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Municipal Climate Change Action Plan Guidebook

Canada-Nova Scotia Agreement on the Transfer of Federal Gas Tax Funds

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Purpose

The purpose of this guide and the accompanying template is to help municipalities prepare Municipal Climate Change Action Plans (MCCAP) that meet the municipal obligation described in the 2010 - 2014 Municipal Funding Agreement. The guide aims to help municipalities reduce greenhouse gas emissions and identify priorities for climate change adaptation.

On December 17, 2008, the extension of the Canada-Nova Scotia Agreement on the Transfer of Federal Gas Tax Revenues was announced by the Governments of Canada and Nova Scotia. The Gas Tax Fund Agreement was originally signed in September 2005. It provided \$145.2 million in federal funding to invest in eligible municipal infrastructure projects from 2005 to 2010.

Additional gas tax funding of more than \$223 million over four years, starting in 2010, will enable municipalities to continue to invest in environmentally sustainable infrastructure projects that contribute to reduced greenhouse gas emissions, cleaner water or cleaner air. The Gas Tax Fund promotes the economic, social, environmental and cultural sustainability of Nova Scotia municipalities.

As a requirement for the 2010 - 2014 Gas Tax Agreement and the Municipal Funding Agreements (MFAs), municipalities will be required to prepare and submit to Service Nova Scotia and Municipal Relations (SNSMR) a Municipal Climate Change Action Plan (MCCAP) by December 31, 2013.

The MCCAP will be an amendment to the Integrated Community Sustainability Plans (ICSP), which were prepared by municipalities and submitted to the province in March 2010. The MCCAP will focus on both climate change adaptation and mitigation and will describe how municipalities plan to respond to climate change.

This handbook has been prepared to serve as a guide and to assist municipalities in the preparation of their Municipal Climate Change Action Plan. In addition, the MCCAP will move Nova Scotia towards honouring commitments made in *Toward a Green Future: Nova Scotia's Climate Change Action Plan*, specifically: **Action 48** - *Amend funding agreements with municipalities by 2010 to require climate change strategies in municipal Integrated Community Sustainability Plans.*

The guide is divided into three parts, with two accompanying appendices:

Part One	General Background
Part Two	Adaptation
Part Three	Mitigation
Appendix A	MCCAP Mandatory Plan Content & Plan Templates
Appendix B	Tools, Guidelines and Resources

The costs associated with the development of the MCCAP may be funded through the Federal Gas Tax Transfer Program, in whole or in part. The costs of engaging in-house resources are limited as per Schedule 2, section 1 of the MFAs.

For more information, refer to the Municipal Funding Agreement located on the infrastructure website:

www.nsinfrastructure.ca

Final MCCAP Report Submission Date: December 31, 2013

Submissions can be sent to:

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Submission Format:

- One copy printed and bound
- One copy on digital compact disc

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PART ONE General Background

Introduction

Climate change refers to both the warming of the earth's atmosphere and oceans, in addition to an increase in the natural variability of the climate. In Nova Scotia climate change poses risks to communities. An increase in the frequency of extreme weather events, changes in water availability and quality, sea level rise and changes to the performance of infrastructure systems, are creating a need for municipalities to change the way they manage their capital assets and operations.

In the past few years there has been a remarkable increase in the level of awareness associated with climate change. From the municipal perspective, this awareness is focused toward understanding how these changes impact communities. It is the combination of historical evidence, anecdotal observations and mounting scientific support that is increasing awareness among municipal administrators and councillors about potential climate change impacts. Concerns about causes and effect have now found their way into municipal council chambers; as evidence and first-hand experience demonstrates that changing climate will cause varied and mostly harmful effects. Damage resulting from climate change creates a financial burden on municipalities, and for those officials in municipal governments who must now plan for an uncertain future, strategies for adapting to climate change and mitigating against climate change are becoming extremely important.

For many municipalities, adaptation to climate change is a challenge that can appear to be complex. This is mainly because managing risk involves uncertain outcomes and debatable probabilities. Moreover, every community within Nova Scotia is unique in its setting and people, and therefore faces environmental and social implications that will differ from those of neighbouring communities. Even when climate change threats are understood, the localized nature of impacts and the seemingly distant timeframes involved can make it hard to design and implement policies designed to address climate change. Identifying a suitable approach to managing climate change is often difficult, however communities across the world now recognize that a planned approach to dealing with the issues helps build resilience and minimize risks.

Understanding Mitigation & Adaptation

There are two main responses to tackling the issues related to climate change: mitigation, and adaptation. This guide presents processes designed to assist municipalities address both of these.

Mitigation

Mitigation is defined as a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to renewable energy (solar energy or wind power), improving the insulation of buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere. The objective of mitigation efforts is to reduce greenhouse gas emissions (GHG), with the result of lowering the volume of carbon that enters the atmosphere on an annual basis.

Mitigation actions over the long-term will reduce GHG levels in the atmosphere and help to reduce the heating trends that are behind many of the climate changes we are currently experiencing. Mitigation is an extremely important aspect of dealing with climate change, and many of the province's municipalities have already undertaken actions, through their ICSP that fall into the category of climate change mitigation. The starting point for most of these actions involves an energy-use and greenhouse gas emissions inventory. The inventory allows municipalities to determine where they consume energy and the amount of GHG they emit. This baseline information is critical for implementing policies to reduce greenhouse gas emissions and develop energy conservation programs.

Energy conservation programs help local governments and citizens manage energy costs and reduce the production of harmful carbon dioxide emissions, which contribute to climate change and affect public health. Conserving energy and reducing overall energy demand is becoming an important part of both daily and long-term municipal management decision-making. The recognition that energy prices will continue to rise into the near future, in addition to the inevitable development of a carbon market, makes energy management an important issue for municipalities, both now and into the future.

Adaptation

Adaptation to climate change is an essential complement to mitigation. Adaptation is viewed as: *an adjustment in natural or human systems in response to actual or expected climatic effects, which moderate harm, or takes advantage of beneficial opportunities.*

The main goals of adaptation usually include: alleviating current and projected future impacts; reducing sensitivity and exposure to climate-related hazards; and increasing resiliency to climatic and non-climatic stressors.

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. Simply put, adaptation is all about understanding climate impacts and effects, in order to undertake substantive actions that make communities and municipal investments more resilient to the harmful effects of weather and climate. In addition, actions undertaken may also capitalize on any positive long-term opportunities that will result from these changes.

Municipalities with adaptive climate change initiatives and actions already described in detail in their ICSP documents will have a head-start in the development of the adaptation requirements of the MCCAP. Work already completed can be transferred directly into the appropriate section of the final plan, and will form the foundation for any additional actions that may be result from working through the adaptation planning framework described in Part Four of this guide.

Be Prepared: The Benefits of Planning for Climate Change

Planning at the municipal and community level presents an important avenue for local adaptation as well as for greenhouse gas mitigation; and there are a number of reasons why municipalities should be actively involved in planning for climate change. The foremost, is that many impacts and hazards associated with climate change translate into issues that are local in nature, and directly affect communities, people and businesses. Other reasons to plan include the protection of municipal investments (such as infrastructure and municipally-owned and operated facilities) because climate change can seriously damage expensive infrastructure and affect the delivery of municipal services. One of the most widely accepted, and effective ways to manage climate change within the context of municipal operations, is to develop a plan or strategy that strives to understand the problems and present realistic approaches to dealing with them.

Municipalities cannot simply rely on the assumption that the prevailing climate will be more or less the same as it was over the past 50 to 100 years. We can expect to live in a climate with different rainfall patterns, warmer temperatures, more frequent storms, and severe weather events. These changes in climate will directly affect municipalities across Nova Scotia. In particular, infrastructure location and design, where and how land is zoned and subdivided for development, how water and wastewater treatment plants, or how local roads and other municipal assets are maintained, renewed and managed.

Estimated Storm Damage Costs
Hurricane Juan, 2003 – 100 million
Meat Cove, Oct. 2010 – 7.2 million
Central Nova, Dec. 2010 – 13 million
Southwest Nova, Nov. 2010 – 5.6 million

Early adoption of policies on climate change will help to develop a strategic approach to determining where to best focus municipal efforts, resources and new infrastructure expenditures. Planning for climate change helps to make decisions more cost-effective and also helps to guard against unforeseen and burdensome costs. This approach is in direct opposition to reactive policies and actions that attempt to minimize consequences after an event that has already occurred. A reactive approach has been shown over and over to be far more costly to municipalities. Hurricane Juan, for example, is estimated to have cost over 100 million dollars in damages.

How Municipalities will be affected:
Rising costs of damaged infrastructure
Protection and repair
Public safety
Drinking water quality
Wastewater and Storm water management
Liability
Public expectation

Like any program, the sooner municipalities begin to plan for climate change, the more likely the behavior will become institutionalized, and integrated into daily practice so that eventually, all decisions will be framed within a context that ensures that climate change criteria are applied.

Public Participation

For the purposes of the MCCAP the public participation component of the plan will be adequately covered through the inclusion of stakeholders in the process (see Part Two, Step One). Municipalities may also expand this part of the process to involve a broader scope of public participation.

Regional Action Plans

Municipalities can work together on a regional level to tackle common impacts, issues and problems associated with climate change, at both the mitigation and adaptation levels. Regional collaboration allows municipalities to pool resources which can be directed towards regional-scale objectives; and wherever possible, municipalities are encouraged to work together in this capacity.

Municipalities that do wish to work with one another should contact SNSMR to understand what the final plan content would entail, and what individual MCCAP, MFA and Gas Tax responsibilities remain, regardless of the inter-municipal adaptation partnership.

Department of Environment Climate Change Portal

During the preparation of the MCCAP, municipalities should contact or visit the website of the Climate Change Directorate with Nova Scotia Environment (NSE). The Climate Change Directorate actively gathers and conducts research relating to climate change as it applies to Nova Scotia.

The Climate Change Directorate also collects and disseminates provincial and local climate data, in addition to providing other types of information and resources which apply to both climate change adaptation and mitigation.

The Directorate also host and administers a Climate Change Adaptation Clearinghouse that houses information that will help your municipality find information about adapting to climate change.

<http://www.gov.ns.ca/nse/climate.change/>

Climate Change Directorate Adaptation Clearinghouse:

<http://climatechange.gov.ns.ca/content/adaptation>

Acronyms and Definitions

Acronyms

AER	Annual Expenditure Report
CIP	Capital Investment Plan
CNSIS	Canada/Nova Scotia Infrastructure Secretariat
GHG	Greenhouse Gases
ICSP	Integrated Community Sustainability Plan
LUB	Land Use Bylaw
MCCAP	Municipal Climate Change Action Plan
MFA	Municipal Funding Agreement
MPS	Municipal Planning Strategy
SNSMR	Service Nova Scotia and Municipal Relations
UNSM	Union of Nova Scotia Municipalities

Definitions (Source IPCC 2007)

Adaptation: Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc.

Anthropogenic: Caused or influenced by humans.

Anthropogenic carbon dioxide is that portion of carbon dioxide in the atmosphere that is produced directly by human activities, such as the burning of fossil fuels, rather than by such processes as respiration and decay.

Adaptive Capacity: The whole of capabilities, resources and institutions of a country or region to implement effective adaptation measures.

Climate Change: Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Note that the United Nations Framework Convention on Climate Change (UNFCCC), defines climate change as: ‘a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

Climate Change Mitigation: Technological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to Climate Change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks.

Climate Scenario: A plausible and often simplified representation of the future climate, based on a consistent set of climatological relationships and assumptions, typically constructed for explicit use as input to climate change impact models. A “climate change scenario” is the difference between a climate scenario and the current climate.

Eligible Project: Capital infrastructure projects and capacity-building projects which meet the terms of the Municipal Funding Agreement, and are listed in Schedule 1 of the Agreement.

Extreme Weather Event: An event that is rare at a particular place and time of year. Definitions of “rare” vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of the observed probability density function. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute

sense. Single extreme events cannot be simply and directly attributed to anthropogenic climate change, as there is always a finite chance the event in question might have occurred naturally. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).

Greenhouse Effect: Greenhouse gases effectively absorb thermal infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases, and by clouds. Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus, greenhouse gases trap heat within the surface-troposphere system. This is called the greenhouse effect.

Greenhouse Gases (GHGs): Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and ozone (O₃) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine and bromine containing substances, dealt with under the Montreal Protocol. Beside CO₂, N₂O and CH₄, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

Mitigation: Technological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to Climate Change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks.

Planned Adaptation: Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Resilience: The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

Retrofitting: Retrofitting means to install new or modified parts or equipment, or undertake structural modifications, to existing infrastructure that were either not available or not considered necessary at the time of construction. The purpose of retrofitting in the context of climate change is generally to ensure that existing infrastructure meets new design specifications that may be required under altered climate conditions.

Risk: A combination of the likelihood (probability of occurrence) and the consequences of an adverse event (e.g. climate-related hazard).

Risk management: A systematic approach to setting the best course of action under uncertainty, by applying management policies, procedures and practices to the tasks of analysing, evaluating, controlling and communicating about risk issues.

Salt-water intrusion: Displacement of fresh surface water or groundwater by the advance of salt water due to its greater density. This usually occurs in coastal and estuarine areas due to reducing land-based influence (e.g. either from reduced runoff and associated groundwater recharge, or from excessive water withdrawals from aquifers) or increasing marine influence (e.g. relative sea-level rise).

Storm surge: Generally used to refer to a temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place. Negative storm surges also occur and can present significant problems for navigation.

Vulnerability: The degree to which a system is susceptible to, and unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

PART TWO Climate Change Adaptation

What is Adaptation to Climate Change?

Adapting to climate change involves undertaking actions and activities that are specifically designed to reduce and minimize the harmful consequences of changing climate. Conversely, adaptive actions can also be designed to take advantage of any potential long-term opportunities that come with changes in local and regional climate. For example, a longer growing season in agricultural areas of the province.

Adaptation is built on the premise that appropriate actions are undertaken before major impacts occur or shortly after they take place, so that similar damage in the future is anticipated and minimized. Both of these types of adaptation responses can be planned in advance. In most cases, planned adaptation will incur lower long-term costs and is seen to be far more effective than simply reacting to climate change in an unplanned, ad-hoc manner.

Adaptation at the municipal level also involves new ways of thinking about infrastructure design, renewal and maintenance. It involves adaptive land-use planning and neighbourhood design and also adaptive water and energy management, in addition to other adaptive measures that will help to ensure that our communities are prepared and will be resilient.

Determining Vulnerability & Managing Risk

The measure of how sensitive certain elements of a municipality or community are to climate change impacts is often known as vulnerability. The overall vulnerability of a community to climate change will vary between one community and another. In other words, a variety of factors and variables dictate vulnerability. For example, communities located within close proximity to the coast or watercourses are more susceptible to storm surges than inland communities which are more sheltered. Coastal communities are therefore, more vulnerable (at greater risk) because their location makes them susceptible to shoreline erosion, flooding, and wind damage.

How Can Municipalities Adapt?

Vulnerability can be reduced through the careful implementation of adaptive management practices, actions, policies and initiatives that are specifically designed to limit and minimize negative impacts. For example, identifying vulnerable infrastructure, incorporating adaptive planning into land-use policies, revising emergency response measures, and accounting for sea-level rise when planning and building new infrastructure will serve to protect new developments, private property, municipal capital investments, as well as the environment.

Municipalities can also adapt by considering the vulnerability of their services and the supporting infrastructure. For example, water treatment facilities and water distribution systems provide safe drinking water. Sewage treatment facilities and distribution systems collect and treat waste. Adaptive planning takes these considerations into account by developing measures which ensure that important services continue to operate during, or following extreme weather events.

Other effective adaptation measures include: managing development in coastal areas and flood-prone watercourses; protecting coastlines around significant sites; and restricting or preventing construction in areas of known vulnerability.

There is little doubt that climate change will affect a broad range of municipal assets and local government services, in addition to municipal operations and policy decisions. Climate change adaptation is a matter of risk management and good governance; and at the local government level, there are several key areas of municipal influence where adaptation can begin:

- A. Licensing and Regulation** – Municipalities can use their powers to set the local regulatory environment in conjunction with their ability to enforce regulations, to implement and enforce adaptive policies.
- B. Facilitation, Advocacy, Leadership and Public Education** – Municipalities can use their close contact and relationship with community organizations, businesses, residents and other stakeholders at the local level, to develop a shared understanding of the issues and to develop collaborative responses to climate change.
- C. Service Delivery, Community Development and Civic Engagement** – Many of the services provided by municipalities for businesses and residents can be reviewed in light of adaptive climate change initiatives.

What Are Municipalities Adapting To?

There is now widespread scientific consensus that accelerated climate change is happening and human activities are the principal cause. The ability for communities to adapt and effectively respond to these challenges now ranks alongside other pressing environmental, social and economic imperatives affecting municipalities.

It is now widely accepted that a warming world will be accompanied by changes in the intensity, frequency, duration and geographic extent of weather and climatic extremes. Changes in climate and weather extremes are already observed to be having an impact on communities throughout Nova Scotia. There is little doubt that future changes will present additional challenges to municipalities. In addition to extreme weather, climate change is also linked to sea-level rise, which will have long-term planning implications for coastal areas of the province.

More Frequent Storm Events & Increasing Storm Intensity

Each year, several large storms pass through the Atlantic region and cause damage along the coast. Powerful storm waves increase the risk of erosion on soft sediment shores and storm surges put low-lying coastal areas at risk of flooding.

Major impacts expected from storm surges include an increase in the rate and extent of coastal erosion and coastal inundation. There will also be an increase in flooding in low-lying coastal areas, resulting from high tide events and/or storm surges. This could mean that areas normally flooded once every 100 years could potentially experience floods every 10 years, and areas previously safe from flooding could now be at risk.

In Nova Scotia, rain-on-snow events have led to more than 50 periods of severe floods since the beginning of records in 1759, including recent events in Colchester, Cumberland, Hants and Kings Counties. Regardless of the cause of a flood, human health can be negatively affected and serious injury or death may result. Drowning, hypothermia and electrocution are all risks directly associated with floods (Environment Canada, 2004; Health Canada, 2005). Contamination of floodwater by sewage and wastes, both domestic and industrial, in addition to agricultural chemicals is common; resulting in lengthy and expensive cleaning procedures and delay in reoccupation of communities. Sewage systems and water treatment facilities may be overwhelmed with a sudden influx of contaminated floodwater. Submergence of buildings in floodwaters produces more favourable conditions for the growth of moulds and fungi that, if not removed, can lead to health difficulties when the buildings are reoccupied (Health Canada, 2005).

Research indicates the Atlantic region will experience an increase in extreme weather events and all climate models suggest that storm activity will worsen.

Nova Scotia Coastal Facts
13,300 Km of Coastline
70% of Nova Scotia's population lives on the coast
14% of jobs are coastal and ocean-related sectors
Coastal lot development accounts for a significant portion of all new development
<i>Source: NS State of the Coast Report, 2009.</i>

It is evident that uncertainties exist with respect to the various kinds of hazards and impacts the province will experience from climate change. Often the focus of these uncertainties lies with uncertain future climate conditions. However, past and current climate trends and impacts do give us some indication of what we might anticipate in the future and who and what places might be most vulnerable.

There is a temptation for those faced with issues of climate change at the local level, to focus attention on more pressing matters, however, it is at the municipal and community level where practical knowledge and experience can be drawn from, and where adaptation will begin.

Nova Scotia: Projected Climate Change Trends & Hazards

- More frequent storm events
- Increasing storm intensity
- Changes in precipitation and extreme precipitation events
- Sea level rise
- Storm surges and floods
- Accelerated coastal erosion
- Flooding and flash-floods
- Wetter, warmer winters
- Hotter summers
- Loss of sea ice
- Drier summers with droughts
- Water (availability) constraints
- Greater ultraviolet radiation exposure

Legend:	Climate Event	Impact	Hazard/Issue
Extreme Storms			
Runoff & Drainage Issues	Localized Flooding	Washouts & Erosion	Heavy Precipitation & Strong Winds
Drinking Water Contamination			
Public Safety Concerns			
Damage to Structures, Property & Infrastructure			
Interruptions in Power Supply			
Economic Implications			

Rising Sea Level

Climate change models (reviewed by the Intergovernmental Panel on Climate Change), suggest that the projected increase in the global average surface temperature will likely result in a global sea level rise on of a meter or more by the end of this century. This change in sea level will occur due to the thermal expansion of seawater and the melting of glaciers and ice caps. On a regional level sea level increases will depend on a variety of factors such as the local coastline variations, changes to currents, vertical land movements, and differences in tidal patterns.

According to a report completed by the Geological Survey of Canada in 1998, approximately 80% of the Atlantic Region’s coastline is considered to be highly sensitive to global sea level rise. Areas already vulnerable to erosion and flooding will be at even greater risk as a result of sea-level rise. For example, along the Bay of Fundy, an extensive system of dykes was started in the 1630s and now protects 85% of the former marsh area from flooding and inundation. Since the 1630s, regional sea level has risen by 1.3 metres due to coastal subsidence and although the dykes have been maintained and upgraded to keep them at levels adequate enough to prevent flooding from regular high water events, many are currently 2 metres below the level of an extreme storm surge superimposed on a high tide, and by 2100 they could be as much as 3 metres below. In Halifax sea level has risen about 30 cm over the last century. This means that with climate change, Halifax could potentially experience an increase in sea level of 80 cm by the year 2100.

Sea Level Rise			
Coastal Inundation & Erosion	Storm Surge	Coastal Flooding	Salt Water Intrusion
Erosion of headlands & Shoreline Areas		Drinking Water Contamination	
Damage to Infrastructure			
Damage to Structures & Property			

Storm Surges, Coastal Erosion & Flooding

Increased erosion and flooding will likely mean significant impacts on coastal communities with damage to houses, buildings, roads, bridges, and other types of infrastructure, as well as the risk of contamination to fresh water supplies, damage to drainage systems and sewage treatment facilities. Important coastal resources and sensitive coastal habitats could also be at risk from the impacts of increased erosion and flooding. There are also a host of other areas that may experience impacts from increased erosion and flooding such as human activities, human health and safety, emergency preparedness, insurance, construction, maintenance and repair costs, property ownership, jurisdiction, liability and legal issues.

While some coastal ecosystems may be able to naturally adapt or migrate landwards in response to rising sea levels, those areas backed or fringed by human development, where natural processes of coastal evolution have been disrupted, may be permanently inundated or squeezed out. Coastal wetlands are extremely diverse and productive ecosystems and are critical in the life-cycles of many marine and terrestrial species, so the loss of these ecosystems could have significant implications for biodiversity and coastal resources.

Coastal communities and their infrastructure and industries, including fisheries and tourism, are vulnerable to these changes. Impacts on coastal infrastructure, such as bridges, roads and energy facilities have already affected trade and tourism in the region, and some coastal communities have started experiencing saltwater intrusion in their groundwater supply. Future disruptions to transportation, electricity transmission and communications will have widespread implications, including increasing the susceptibility of some communities to isolation.

Storm Surges			
Runoff & Drainage Issues	Localized Flooding	Coastal Erosion & Washouts	Heavy Precipitation & Strong Winds
Drinking Water Contamination			
Public Safety Concerns			
Damage to Structures, Property & Infrastructure			
Interruptions in Power Supply			
Economic Implications			

Wetter Winters and Drier Summers

Climate projections indicate that Atlantic Canada will experience drier summers, with an accompanying increase in summer-time droughts. Nova Scotia is projected to experience increases in mean annual temperature and precipitation. By 2050, there trends indicate a 2 to 4 C° increase in summer temperature, depending on geographic location, and drier summer months will characterize inland regions of the province. Future warming of 1.5 to 6 C° during winter can also be anticipated (*From Impacts to Adaptation: Canada in a Changing Climate, 2007*).

Wetter Winters			
Decrease in Snow Cover	Localized Flooding	Erosion & Washouts	Landslides
Damage to Property			
Damage to Infrastructure			
Economic Implications			

Drier Summers		
Reduced Water Recharge	Heat & Drought	Forest Fires
Decreased Water Quality		Damage to Property
Public Health Implications		Damage to Infrastructure
Economic Implications		

Water Resources

Changes in water resources can have far reaching effects. Reductions in summer stream flow, which is predicted for all of Atlantic Canada's provinces, could impact tourism and recreation, freshwater fisheries, hydroelectric power generation, municipal water supplies and agriculture. Lowered water levels or decreased river flows could also lead to poor drinking water quality in some parts of the province. Many municipalities across nova scotia rely on surface water supplies, leaving them exposed to declines in water levels, and the increased risk from contamination; resulting in the need for a greater level of water treatment. Changes in snow cover are also expected to further impact the water supply, by reducing recharge to aquifers (*From Impacts to Adaptation: Canada in a Changing Climate, 2007*).

Water Resources: Issues
Drinking water degradation and contamination
Reduced groundwater flows and stream recharge
Saltwater intrusion, salinization and contamination of wells

Groundwater reserves will also be affected by climate change. If water is withdrawn at rates in excess of recharge by precipitation, the result is a drop in the water table. One of the areas of Atlantic Canada that is most dependent on groundwater is southern Nova Scotia. Reductions in water tables would result from decreased infiltration of seasonal precipitation, caused by a combination of reduced summer rainfall, and increased surface runoff of winter rain (*From Impacts to Adaptation: Canada in a Changing Climate, 2007*). Sea level rise may also increase the risk of salinization to groundwater in low-lying coastal regions or threaten the viability of freshwater coastal aquifers (*The Road Ahead – Adapting to Climate Change in Atlantic Canada, 2003*).

Adaptation: Six-Step Planning Framework

The next part of the guide will assist in the preparation of a Climate Change Adaptation Plan. It presents a six-step planning process. Each step begins by outlining key objectives. The objectives summarize what will be achieved upon completion of the step. Each step will take you through a series of 'self-assessment' questions, designed to probe more deeply into climate change impacts, affects and accompanying municipal issues. More specifically, the steps will help you to understand where impacts are already being felt, where you might expect them to occur in the future, what parts of your municipality are vulnerable, who might be affected, what kinds of actions are required, and where they will be applied.

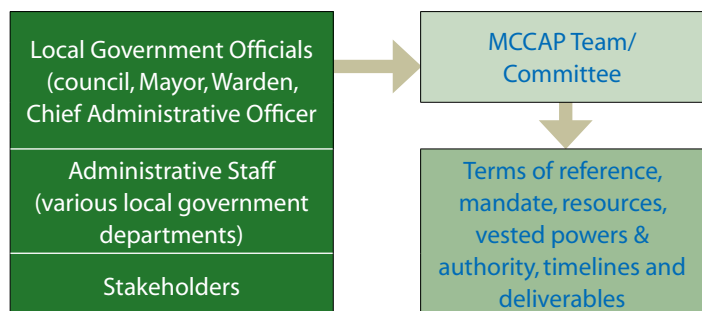
Preparing careful and thoughtful responses to the questions listed in each step will contribute to a flow of gained knowledge and new information. The overall intention is to help your municipality determine where to focus adaptation efforts. Many questions are designed to lead to additional questions and new avenues of analysis that are directly applicable to the circumstances characterizing your municipality. The accompanying research and analysis required to answer these questions, will over time, help to build internal capacity. Questions which require your team to develop deeper analysis, or follow-up with subsequent research, will form the basis for a broader understanding of the issues.



Step One: Adaptation Team/Committee

Step One: Objectives

- Assemble a climate change adaptation team consisting of local government officials, staff and stakeholders.
- Establish a mandate and terms of reference for preparing the plan.
- Identify limits of the committee's authority and level of resourcing.



Committee Composition

The first step in this process is compulsory, and involves the formation of a climate change adaptation team consisting of local government staff, officials, council members, and where applicable, stakeholders. The final composition of the team will be important because members will be fully responsible for preparing the plan, and will remain in this capacity as it moves into implementation. Moreover, the members of this team will be accountable to SNSMR in regard to any elements of the plan, which require explanation, elaboration for Gas Tax purposes, revisions, or requirements regarding its development or implementation.

Consequently, when forming your adaptation team, it is important to ensure a diversity of expertise which draws on all relevant municipal departments or programs.

Potential Membership - Climate Change Adaptation Team Committee Members	
Economic Development	Parks & Recreation
Tourism & Culture	Planning & Zoning
Energy	Public Health
Engineering	Transportation
Environment	Water & Wastewater
Emergency Management	Solid Waste
Finance & Administration	Port & Harbour Authorities
Fire & Police Services	Emergency Measures (EMO)
Legal Services	

Stakeholder Involvement

Public consultation is not a mandatory part of preparing the climate change adaptation plan. Instead, municipalities should consider contacting and consulting with stakeholders affected by climate change issues, where appropriate. The committee may want to consult with developers responsible for building new subdivisions and neighbourhoods in coastal areas, or contact academics in your community who can contribute knowledge and experience to the process of planning for adaptation. How and where in the process municipalities engage stakeholders will be determined at the discretion of each municipality.

Stakeholders can be an inclusive part of the team, or brought in only when necessary to provide specific advice and input. It is important to remember that involving a variety of stakeholders will help to secure widespread support for any initiatives that are undertaken during the process of MCCAP implementation.

Facilitation of stakeholder sessions is an eligible project, under the capacity-building category of projects listed in the 2010/2014 Municipal Funding Agreement.

Preparing a Mandate

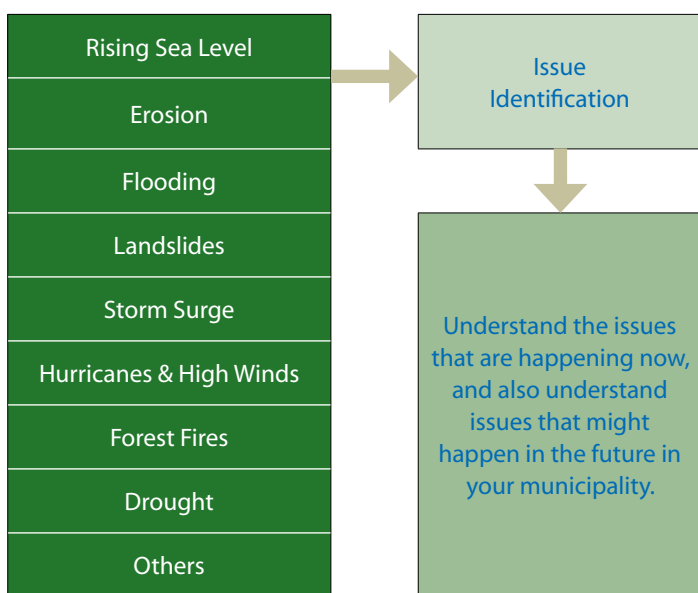
Working with your team, each municipality will develop a mandate. Its purpose is to clearly establish and record the roles, responsibilities, authority, etc. of the team. The following questions are intended to help guide the development of the mandate:

- Is your adaptation team being established as a permanent working group?
- What is the ultimate deliverable the team is responsible for?
- How much time does the group have to accomplish their tasks?
- What resources are available for the team to accomplish their work?
- What authority does the team have?
- To whom is the team accountable?
- Who does the team report to, and how often?
- What level of support can be expected from council?
- What is your schedule for completing the work?

Step Two: Impacts & Hazards

Step Two: Objectives

- Develop a deeper understanding of the types of weather-related and climate related changes the municipality has experienced in the past.
- Look at what climate changes are expected and how these changes may exacerbate or cause new hazards in your municipality: (a) today and (b) in the future.
- Identify any opportunities which may result from future changes in the climate.



Climate changes range in scope, from a slow but continual rise in sea level, to an increase in the frequency and severity of extreme storms. In general, the range of potential impacts and hazards associated with climate and weather varies on a local and regional scale, and in turn, will vary from municipality to municipality.

Climate change becomes an issue for the municipality when it directly impacts the community. For example, a storm surge along undeveloped portions of a coastline is for the most part, not a pressing issue for the municipality. However, when a storm surge damages buildings or impacts infrastructure or other vital elements of the community, it becomes an issue for the municipality that requires attention, and management through adaptation. Particularly if it becomes evident that another similar event will take place in the future.

Coastal erosion, for example, will affect some municipalities more than others, due to variability in factors like the underlying bedrock and surficial geology, wave energy and direction and the

location of development and infrastructure. Municipalities that are directly affected by coastal erosion will be concerned with finding ways to adapt, especially those places where erosion has the potential to harm public safety, infrastructure or economic elements that are important to the long-term viability of the community.

Extreme storm events provide another good example that demonstrates how climate impacts can vary between municipalities. Increased runoff resulting from heavy rainfall can impact municipalities with extensive wastewater treatment infrastructure. Unforeseen consequences can occur when an increase in water volume exceeds the design capacity of the facility. Operating at full capacity can cause a number of issues such as: increased wear-and-tear on moving parts, the discharge of inadequately treated wastewater in receiving waters, the potential contamination of nearby drinking water supplies, or the closure of downstream shellfish beds, to list a few. Adaptation for municipalities with this type of infrastructure will involve reviewing the design capacity of the existing system and integrating changes which accommodate the new weather regime, during maintenance and infrastructure renewal.

Municipalities without wastewater and drinking water infrastructure do not have to worry about these kinds of issues; however, other issues of concern might result from heavy rainfall. For example, heavy rain can cause flooding which can impact communities by limiting or restricting access to local roads. This in turn can affect residents and businesses and hamper emergency response procedures.

The following questions will help your team identify impacts and hazards:

- What hazards or impacts resulting from the changing climate and the weather have become issues for your municipality in the past?
- What kinds of events caused these issues (ex: extreme weather, flooding, hurricane)
- What kind of actions or measures (if any) were undertaken in order to address or respond to these issues?
- How well prepared is your municipality if such events occur again; especially if such an event becomes more frequent or severe as a result of climate change?
- Does your municipality have the capacity/resources to manage the next event?
- How often do these events occur; are they occasional or frequent; do they affect a large or small part of your municipality; was the impact level severe or minimal?

- Describe and record the range of issues which occurred as a result of past climate events. Document as much specific detail as possible regarding the effects on your municipality.

Preparing a matrix, such as the one illustrated below will help the committee to assign a relative degree of impact to the change events affecting your municipality. Filling in the matrix is a subjective ‘best-estimate’ exercise, and will be based on collective experience of the committee members and stakeholders. It enables the team to summarize information derived from answering the questions. Hazards with a severe impact will obviously require closer attention and more adaptive planning.

- Do you think these types of events and associated hazards will continue into the future and become more problematic unless actions are taken to minimize their effects?

- Describe how and why you think climate impacts will become more of a problem for your municipality over time (ex: expansion of development into affected areas, more paved surfaces, aging infrastructure, etc.)
- Do you think your municipality will experience other kinds of climate related issues in the future, which have not affected you in the past – what are they?
- What new information do you need to know to be able to plan effectively for the future of your municipality, with respect to the impacts and issues you have identified?
- Do you have this information, and/or do you know where it can be obtained?
- Do you see any new opportunities for your community in the future as the climate changes?

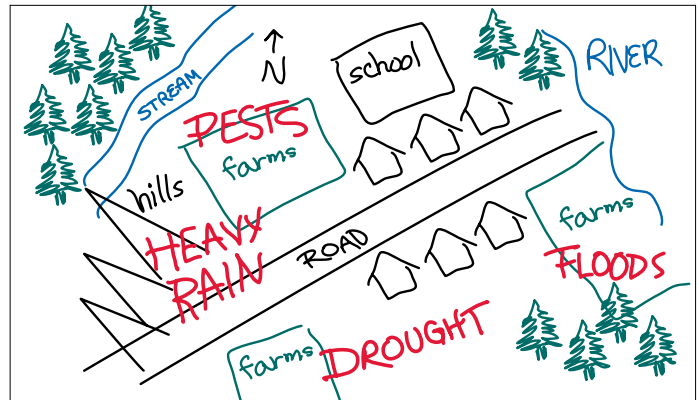
Example: Climate Change Hazard Impact Matrix

Hazard	Severity			Frequency			Area		
	Severe	Moderate	Minor	Often	Sometimes	Rarely	Large	Medium	Small
Sea Level Rise		X			NA			X	
Erosion		X		X				X	
Flooding		X			X		X		
Landslides	X					X			X
Storm Surge	X				X		X		
Hurricanes & Wind	X					X	X		
Forest Fires	X					X	X		
Drought		X			X				X

Step Three: Affected Locations

Step Three: Objectives

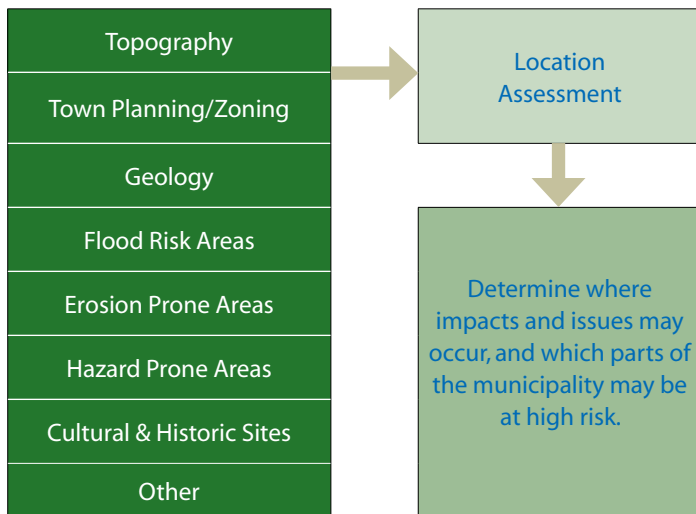
- Identify locations within your municipality where these issues have occurred; and where are they likely to occur in the future.
- To determine where within your municipality, these impacts will become an issue that should be addressed through adaptation.



An effective way to get your adaptation team thinking about this question is to create a map (see above) illustrating those places and locations within the municipality, community or town which have been subject to climate change impacts that have caused issues in the past. This undertaking will be largely based on anecdotal recounts and historical events that have been recorded and archived, in addition to events that have taken place within living memory.



Preparing a simple map like above will help the committee compile information on vulnerable parts of the municipality, in addition to the type and geographical extent of the impact. Gathering information and transferring it to community maps is an effective way to build-up layers of data that will inform the preparation of the adaptation plan and help the committee make decisions regarding an appropriate approach to managing the issues.



There are several factors that can significantly influence which locations within your municipality will most likely be affected by climate change. For example, the local geography and geology, topography, and proximity to the ocean, play a role in determining what parts of the municipality are affected and to what degree.

The objective of Step Three is to develop a deeper understanding of the locations within the municipality where climate change impacts could, or will become a considerable issue that requires management. As discussed in Step Two, an impact becomes an issue when it intersects with the management and operation of the municipality, or where it affects people and property.

The following questions will help your team to understand where climate change could present issues for your municipality:

- Do the climate changes related hazards you identified in Step Two, impact your entire municipality or only certain portions or geographic areas?
- If there is variation, can you identify and map areas where impacts and issues are most likely?

The same technique can be used to answer some of the following questions. By combining topographic, geological, soils and drainage maps (among others) with municipal maps showing for example: (a) the location of major infrastructure; (b) areas with existing development; (c) areas zoned for new development; (d) roads, bridges and utility corridors; (e) the location of seniors

homes; (f) emergency response routes; and (g) areas that are critical to the local and regional economies (such as important agricultural areas or business parks) the committee will get a far better indication of where within the municipality climate impacts and hazards may become significant issues which warrant action.

3. Will the issue cause more of a problem (or benefit) in certain areas of the municipality?
4. If issues are specific to certain areas, which parts of the municipality are most greatly affected?
5. Do you think this pattern will change in the future: will these issues become more problematic with predicted changes in weather and climate?
6. What resources and tools can your municipality use in order to map-out and determine which parts of your municipality are at higher risk?

It is recommended that municipalities look first to internal resources before deciding upon what additional tools are required to develop greater understanding of impacts and issues. The latest digital mapping and modeling may provide exceptional levels of detail, but in many cases, this level of detail may only be necessary under specific circumstances. For example, in the case of built areas that are located in close proximity to the coast, detailed modeling that helps the committee to understand risk and vulnerability may be warranted. This level of modeling may be both appropriate and necessary to make informed decisions, especially where people and property are concerned. However, it may not be necessary for parts of the municipality with a low potential for development, or places with minimal infrastructure and urbanization.

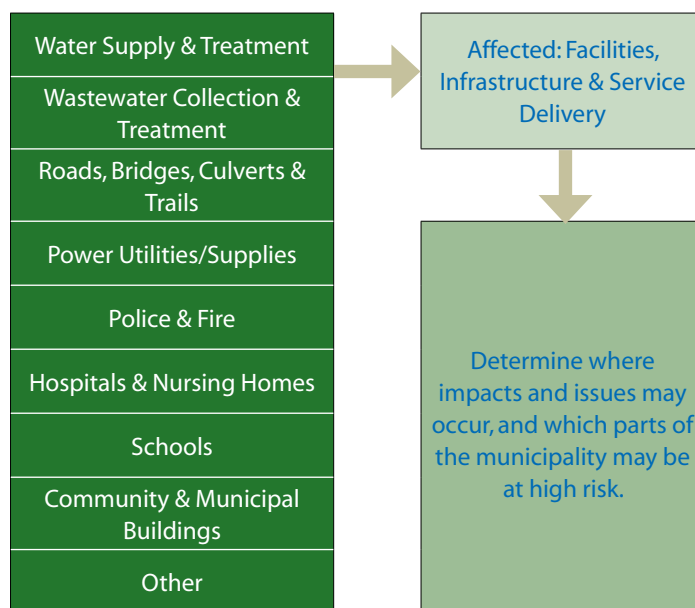
7. What additional information, skills, expertise or resources do you need to make proper decisions?

There are going to be instances where municipalities will require resources and/or expertise that cannot be provided internally. Capacity building projects related to understanding climate change, are generally eligible under the terms of the MFA, and can be paid for using Gas Tax funds. Questions regarding capacity building projects should be directed to Canada/Nova Scotia Infrastructure Secretariat branch of SNSMR to confirm project eligibility.

Step Four: Facilities, Infrastructure & Service Delivery

Step Four: Objectives

- a) Identify key facilities and infrastructure in your municipality.
- b) Identify where they are located and determine if some facilities and infrastructure will be more affected by climate change than others.
- c) Evaluate the impact of climate change on the delivery of municipal services.



Municipal infrastructure has enormous value, both directly as a capital asset and indirectly as an essential element contributing to a productive local and regional economy. The objective of Step Four is to look at the key facilities and infrastructure to ensure the services they support and the people they affect are taken into consideration when setting priorities for adaptive actions.

Climate change hazards include (among others): damage or destruction resulting from extreme events (rain, wind and snow), flooding of facilities and equipment, inundation from sea level rise; changes in patterns of water availability; and the overall effects of climate change on operating costs.

It is evident that an increase in the frequency of extreme storms, flooding, storm surges and other events associated with climate change will place additional challenges on the management of municipal infrastructure, beyond the need for regular maintenance, refits and renewal.

Essentially, all infrastructure systems are located in natural and engineered environments affected by climate change. Climate change, for example, can and will affect water, wastewater, and storm water utility infrastructure today and well into the future. Moreover, infrastructure located in coastal zones is particularly vulnerable, because it is subject to sea level rise and heightened storm surges and in consequence municipal infrastructure must be designed and managed in order to operate even in case of sea level rise.

Simple infrastructure failures, for example municipal infrastructure such as culverts failing due to heavy rain, can lead to a domino effect that in-turn leads to road washouts, the geographic isolation of communities, public safety issues, in addition to potential health and economic ramifications. The challenge, therefore, is to identify those parts of the municipal infrastructure network that are at greatest risk from changing climate and ensure that adequate measures are taken, in order to prevent more dire consequences.

The following questions will help you to examine your infrastructure and facilities:

1. What are the key facilities in your community?
2. How will the impacts and issues identified in Step Two affect these facilities?

The first concern is proximity of public infrastructure to the coast. Municipalities with infrastructure located in the coastal zone should immediately be alerted to potential issues. The second major concern is the ability of the infrastructure to handle additional capacity over and above design specifications. This analysis will involve recommendations and input from engineers and other specialists. Other factors, such as the age of the facility, will help to inform and guide this discussion. Your team should also consider what types of impacts would have a high, medium or low effect on the municipality; with regard to the delivery of services.

3. Are there any facilities or infrastructure that you are concerned about in an emergency?

This question is aimed at helping you to determine if potentially impacted infrastructure is also crucial to the short-term wellbeing of your municipality. For example: roads interconnecting communities or leading to hospitals.

4. Are any of your facilities in need of repair, replacement or upgrades?

This discussion should be lead by the engineering department and the people responsible for the day-to-day operations of municipal infrastructure.

5. Do you have the types of information to answer these questions?

Where existing information is insufficient, Gas Tax funds can be used to build capacity in this area, or to hire experts where necessary.

6. In light of goals and actions in your ICSP that specifically address infrastructure, are there any places where climate change needs to be taken into consideration?

All projects described within the ICSP that are related in any way to infrastructure, should be examined in this context.

Requirements for Existing Infrastructure Risk Evaluation

The following section is a mandatory part of the MCCAP. To complete this part of the MCCAP use the spreadsheets available on-line at: <http://www.nsinfrastructure.ca/>

A. Preliminary Risk Assessment

Reducing the vulnerability of existing infrastructure to climate change risks will require a comprehensive evaluation of each infrastructure and facility asset. First priority must be given to essential services and potential for interruption or destruction of each utility. Evaluation would include the individual elements that comprise the utility and risks to the overall operation of the system.

Each asset should be assessed for risks associated with sea level rise, precipitation (snow, rain), extreme wind, flooding, temperature change (high, low), erosion and earthquake.

The spreadsheets provide a list of the various infrastructure and facility asset categories (others can be added) with potential risks from climate change. Each assessment should include adaptive measures to eliminate or minimize risk. The list includes water systems, sanitary sewer systems, storm sewer systems, municipal buildings, landfill/solid waste facilities, dams and roads.

B. Prioritizing the Asset Risks

The spreadsheets provide a method for ranking adaptation measures required for each asset and associated costs. Adaptation measures may be classified as high, medium or low risk and municipalities can establish priorities by ranking their assets according to the assigned risks.

C. Estimating Costs of Adaptation Measures

High Risk priorities should be evaluated in detail and cost-estimates determined.

D. Cost Benefit

Each suggested adaptation measure should be evaluated for the degree of magnitude as well as the significance of the desired adaptation. This may be expressed as a cost benefit comparison. Measures may be again re-prioritized.

E. Financing Adaptation

Municipalities must integrate the adaptation project(s) into their regular Capital Investment Planning process.

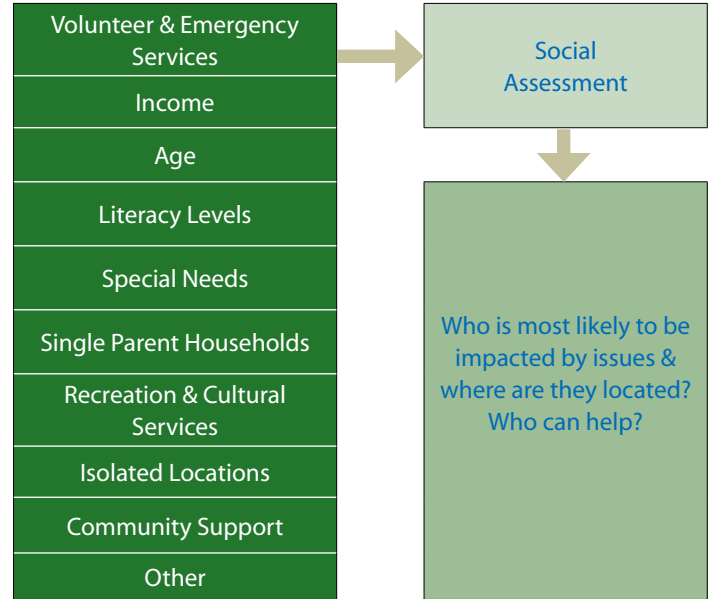
F. New Infrastructure

For new infrastructure projects climate change risk assessment should be included in the 'Request for Proposal' (RFP) for the design engineer to consider. Appendix C can be used as a checklist to insure that climate change risks are considered in the design of any new facilities. Decisions must be made as to the degree of adaptation measures required.

Step Five (a): Social Considerations

Step Five (a): Objectives

- Determine which residents will be most affected.
- Identify which residents, local groups and agencies can help.



Changes in the climate can affect the people. Power outages, flooded homes and businesses, road washouts, compromised bridges, contaminated drinking water, and wildfires (among others) are hazards resulting from with climate change, which have the potential to directly impact people.

In the event of climate-related emergencies there is a strong likelihood some residents living in the municipality may be more vulnerable than others. Seniors and people with special needs are particularly vulnerable. Getting a better understanding of those people that could be most affected, will help the municipality to update emergency response procedures and identify volunteer support mechanisms that can be employed in the event of these kinds of emergencies.

Many of the elements covered in this step may have already been addressed in your municipality's Emergency Measures Plan; however, it is prudent to review any municipal emergency response or contingency plans, in light of the climate change issues your team has identified so far.

The following questions will help your team to understand the social implications of climate change issues affecting your municipality:

1. Have you reviewed your ICSP’s social pillar’s goals and actions in order to identify key priorities?
2. Are there any goals or actions under the social pillar which warrant special attention when examined within the context of climate change?

Reviewing your ICSP will enable you to re-visit your municipality’s priorities around its social agenda. If for example, you have major initiatives involving the long-term wellbeing of seniors, you should consider taking another look at your goals and actions in light of climate change issues.

3. Can you identify who in your municipality will be most affected by climate related emergency events?

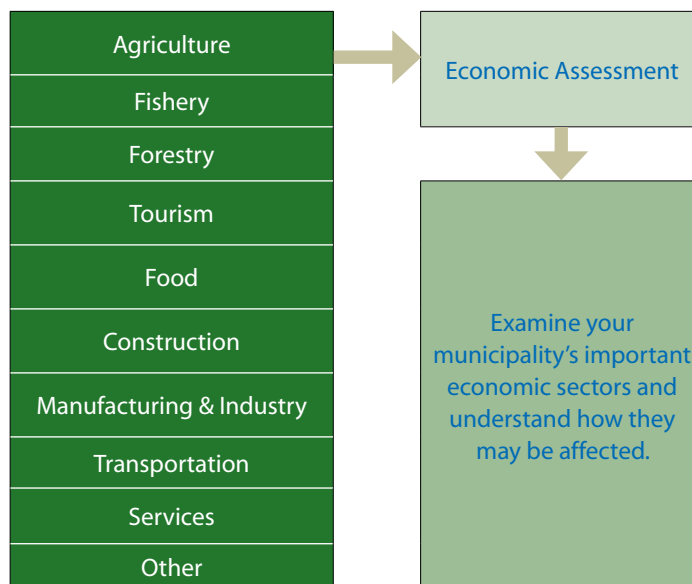
In Step Three you determined what parts of your municipality are likely to be at greater risk from climate issues. Based on information collected in Step Three, you will be able to get a good sense of any groups of people who may be put at risk, because they reside in vulnerable parts of the municipality.

4. What are the main barriers for at-risk people to receive adequate help during an emergency in your municipality?
5. Does your municipality have an emergency plan?
6. Does the plan address barriers for at-risk people?
7. Does the plan take into consideration the location and characteristics of the at-risk people and work their needs into the plan?
8. Are there heritage or cultural elements of your municipality that could be affected?
9. How will these issues affect the quality of life, health and safety in your community?
10. Are their groups or organizations in your community that can help?

Step Five (b): Economic Considerations

Step Five (b): Objectives

- a) Identify the most important economic sectors in your municipality and determine how these issues impact these sectors and, in addition, identify the most important economic goals the municipality has identified in the ICSP.
- b) Understand how climate change will affect the financial resources of your municipality.



Step Five (b) involves determining how climate change issues will affect the local and regional economy. Although climate change is seen to have mostly damaging effects on the management and operations of municipalities, there may also be a number of benefits which can help your municipality to prosper in the future.

Because climate change is directly linked to the ‘business as usual’ fossil-fuel economy that has predominated for the past century, many municipal administrators view climate change adaptation as good opportunity to move towards creating a greener future for their municipality. Local government investments in renewable energy, and green technologies, particularly if coupled with adaptation and sustainability goals and actions, will help local governments to become more competitive in the twenty-first century. The integration of green practices with adaptation, presents a chance for municipalities to be both adaptive and competitive. Climate change adaptation may also benefit municipalities in other ways. For example, a warmer climate may help the agricultural sector and allow new types of crops, fruits and vegetables to be grown.

Conversely, many climate change issues, for example the flooding of homes and businesses, or damage to critical municipal infrastructure, can have severe and far-reaching consequences for local and regional economies. It is important for your team to develop a good understanding regarding these issues, so that adequate measures can be undertaken to minimize negative impacts and advance positive ones.

The following questions will help you to understand how the local and regional economy in your area may be affected by climate change:

1. What are the most important industries in your community today and where are they located?

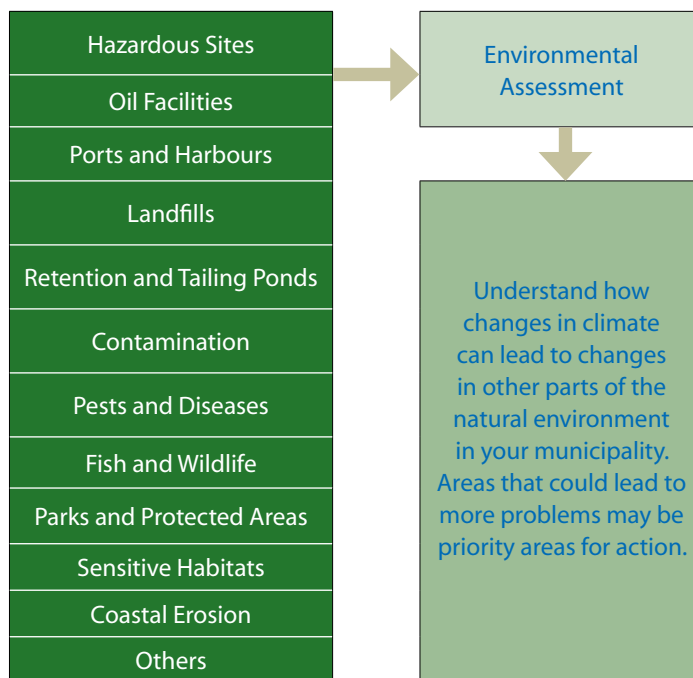
Preparing a map illustrating the most important economic elements of your municipality will, when combined with the information and knowledge gathered so far; help you to determine threats and benefits to the local and regional economy.

2. How important is the municipal/community economy to the economy of the province? For example, is it strategically important to other economies (i.e., suppliers, manufacturers)
3. What parts of the economy are expected to be the most important in the future?
4. How could changes in the weather and climate affect these industries?
5. Could any of the climate issues identified so far result in the loss of an industry in your municipality? If so, describe how.
6. What are the top weaknesses in your municipality's economic sectors related to the current and future issues discussed in previous steps?
7. What are your options for reducing potential harm to the economy: (a) in the short-term, (b) in the long-term?
8. Is dealing with the economic ramifications of climate change a priority for your municipality?
9. Are there any potential economic opportunities that you see that may result for your municipality as consequence in changing climate?
10. In light of goals and actions in your ICSP that address the economy, are there any places where climate change needs to be taken into consideration?

Step Five (c): Environmental Considerations

Step Five (c): Objectives

- a) Evaluate how the natural environment will be affected and identify potential environmental problems resulting from climate change issues.
- b) Understand how climate change may help or harm important species or natural areas found within your municipality.



The main purpose of Step Five (c) is to help the committee identify and locate key sites in your municipality where climate issues or weather events may cause dangerous environmental impacts. For example: a severe storm can lead to the back-up of a sewage treatment facility, causing sewage to breach its containment and cause pollution and health hazards. Other potential dangers, such as the storage of hazardous materials, should also be evaluated in light of climate change because of their potential to cause serious problems if they spill and contaminate the local environment.

The following questions will help in your analysis of environmental issues:

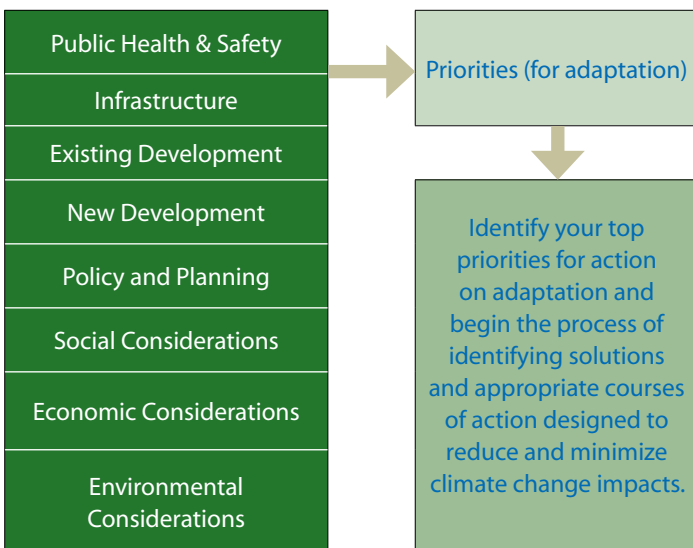
1. What have been the main environmental problems you have experienced as a result of weather or climate related issues in the past?
2. How might this change in the future?
3. Are there any concentrations of hazardous materials of waste in your municipality?
4. Are they stored safely?
5. Have you undertaken any actions in the past that have helped to reduce the impacts of any of these problems or issues?
6. Are you prepared in the event of an environmental emergency?
7. Do you think these same strategies will work in the future?

8. Do you have an environmental protection or emergency preparedness plans?
9. In light of goals and actions in your ICSP that address the environment, are there any additional areas where climate change needs to be taken into consideration?

Step Six: Priorities for Action

Step Six: Objectives

- a) Prioritize the climate change adaptation issues considered by the committee to pose the greatest risks to the municipality, both now and in the future.
- b) Identification of potential courses of action for the priority adaptation issues.
- c) Develop an approach to integrate adaptation priorities into municipal planning documents.



Setting Priorities for Adaptive Action

The main objective of Step Six is for the municipality to establish key priorities for taking action on climate related hazards and impacts considered by the committee to be issues which require management through adaptation. These are issues, which if left unmanaged, could cause problems (over the short to long-term) for public safety, municipal infrastructure, or harm other aspects of the community. Step Six is a starting point for taking action. During Step Six, the committee will establish priorities for municipal action, and start the process of determining what methods (actions) might be undertaken by the municipality to reduce risk.

Generally, more immediate concerns will have a higher priority, while long-term changes and concerns often take a lower priority. Issues or hazards impacting public safety or the delivery of services should be high on the list of priorities, while those which are less-immediate (and can be dealt with over time) will tend to have a lower priority. The ways and means by which your committee determines priorities will be based on a number of variables which will be unique to each municipality. Prioritization should be supported by sound reasoning that is documented in the plan. The committee is encouraged to include stakeholders in the decision-making process, regarding setting priorities for adaptive action.

Step Six is important because it will serve as a roadmap for both staff and council, with regard to adaptive planning. In particular the role adaptation will play with respect to the development of land. Consequently, the information recorded in this step is instrumental in planning for the future of the municipality.

Once priorities are established, the committee is also required (in this step) to investigate and report on the range of potential actions which might be considered by the committee, in order to address each priority. The requirement is not for a detailed action plan for each item. Rather, the goal is for the municipality to explore viable options for each issue and record the options.

Adaptation Priorities: Municipal Planning Strategies, Land Use Bylaws

This section of the MCCAP will outline how climate change concerns and adaptation will be integrated into the municipality's approach to the planning and regulation of development.

Municipal Planning Strategies (MPS) are the primary vehicle for articulating a community's vision on sustainability and overall planning policy direction. Municipalities with a Municipal Planning Strategy and Land Use Bylaw (LUB) are required to provide information in Step Six of the MCCAP guide outlining council's adaptation priorities with respect to land-use planning and, in particular for new development.

At the time of the adoption of the MCCAP time municipalities are not required to have detailed policies and provisions in place in their MPS and LUB. Rather, municipalities will outline in the MCCAP the general policy direction to be taken with respect to adaptation. Policies and regulations specific to the circumstances that characterize adaptation issues for individual municipalities will take time to prepare properly, and will be part of a phased approach to implementation.

Municipalities with formal planning documents can begin the process, by developing an understanding of how adaptation can be integrated into:

- Statements of Provincial Interest
- Zoning Bylaws (i.e., setbacks)
- Site Plan Control
- Setbacks
- Storm Water Management
- Parkland Dedication
- Plans of Subdivision

Municipalities without Formal Planning Documents

Municipalities without formal land-use planning documents, i.e., Municipal Planning Strategy and Land Use Bylaw, are required to explain and document how they plan to address new development within the context of climate change adaptation.

The following questions will help you prioritize issues:

1. Of all of the issues discussed by your team so far, what are the most significant, and why?

Determining the significance, in terms of priority, of the various climate change hazards facing your municipality can be a difficult task, influenced by numerous factors. When discussing the ranking of priorities and potential courses of action with your team, you should keep in mind the following fundamental principles:

- The protection of public safety
- The protection of structures, buildings, and infrastructure
- The protection of public drinking water supplies.

The committee may want to consider developing a series of tables to help you to summarize and organize information gathered during Steps One to Five. Tables can be particularly useful when capturing information that influences decisions on priorities and potential courses of adaptive action. A few examples of the types of tables that can be generated the committee are outlined below. The information and approaches provided in the examples are presented as illustrations.

Example 1: Storm Surge - Impacts, Issues & Hazards

Storm Surge	
Concern 1	Residential cottages and properties located in Shellfish Bay are vulnerable to erosion, flooding, wind and water damage during severe storms and storm surges.
Concern 2	The unpaved road leading to the campground is prone to flooding and washouts and undermining in several places along its route, and may become impassable due to damage from storm surges.
Concern 3	Several economically important wharfs, and harbours are at risk during extreme wind, flooding and wave damage, and boats and fishing equipment are also at risk from severe storm damage
Concern 4	Along route 1 there is an increased risk of damage to power lines and poles due to their close proximity to the shore. This risk for damage is increased if snow and ice are a factor.

Example 2: Storm Surge – Special Considerations & Priorities for Action

Effects on the Municipality	Special Considerations	Action Priority Ranking*
Social	A large number of the residents in vulnerable parts of the community are elderly. Flooding and road washouts would prohibit the use of emergency and other vehicles in these places if assistance is required.	High
Economic	Local fishing industry could be severely affected by storm surge damage to wharves, harbours and associated infrastructure.	High
Environmental	Contamination from fuel and other petroleum products used by fishermen and stored in accessory buildings located near to the shore could occur during floods and extreme storms.	High
Infrastructure	Culvert outlets may become blocked with debris and exasperate localized flooding, and cause road washouts.	Medium
Other	Sea wall will require modifications and maintenance to accommodate rising sea level.	Low

**rank determined by committee members based on municipal circumstances*

- Have you done anything in the past that has helped reduce the impacts of these issues?

Moving Towards Adaptation

- Based on your research and discussions, what options are there for dealing with these issues?

There are a variety of factors that will affect the type of actions your municipality may take into consideration. These include local circumstances, overall practicality, the resources available for implementation, the timing of consequences (immediate or long-term) and the level of risk you are willing to incur with respect to limiting damage, to list a few. As you consider adaptive actions, keep in mind that these should not only address climate change issues; but should do so in a sustainable way that does not hinder any wider sustainability efforts.

Example 3: Storm Surge: Options for Taking Action

Adaptation Options Under Consideration	
Action 1	Educate residential property owners regarding potential dangers and damages; ensure EMO is aware of vulnerable residents; pass land use regulations that ensure future development is set-back from vulnerable locations.
Action 2	Take efforts to protect dunes and other ecosystems that buffer the shoreline; consider re-locating the road; ensure road has adequately sized culverts and drainage structures, reinforce elements of the road that are particularly vulnerable.
Action 3	Meet with local fishermen and other vested stakeholders to discuss the issue; develop emergency procedures for boats and property; look for solutions based on local knowledge of the fishermen.
Action 4	Contact NSPC to develop response plan and repair scenarios; consider burying power lines; develop emergency procedures for affected residents.

- Which of your department's responsibilities/roles would these issues and impacts likely influence?

PART THREE Climate Change Mitigation

Background

Greenhouse gases (GHGs) generated by human activity, primarily carbon dioxide, as well as methane, ozone and several others, have risen sharply as the world's population expands, industrialization spreads and the consumption of resources accelerates. The inevitable consequence of all this growth is an increase in greenhouse gas emissions, leading to a rise in average global temperature, the disruption of climate patterns and the irreversible alteration of the ecological balance of our planet. The effects of climate change are pervasive, and left unchecked, could have both severe and indiscriminate impacts on our social and economic systems.

Many Canadian cities have already taken the first step toward reducing carbon emissions by conducting an inventory of GHG emissions. This work has shown that electrical generation, transportation and the combustion of heating fuels, account for up to 95 per cent of a community's direct GHG emissions. The remainder comes from the management and disposal of municipal waste and the emissions from certain industrial processes, such as cement production, steel making and chemical processing. This statistical breakdown varies from one municipality to the next, depending on a number of factors including the mix of heating fuels, the availability of public transit, and the source of their electrical power.

A well-designed mitigation plan will help to reduce GHG emissions and also has the potential to spur technological advances, create new sources of employment and stimulate the economic growth needed to propel communities forward into a more sustainable future.

Building on Existing Mitigation Efforts

SNSMR recognizes that many of the province's municipalities will have already completed some of the required elements for the mitigation component of the MCCAP. Although this work has been completed your municipality will be asked to supply this information to SNSMR in the format outlined in the Mitigation Plan Template, found in Appendix A.

Municipal Requirements for Mitigation

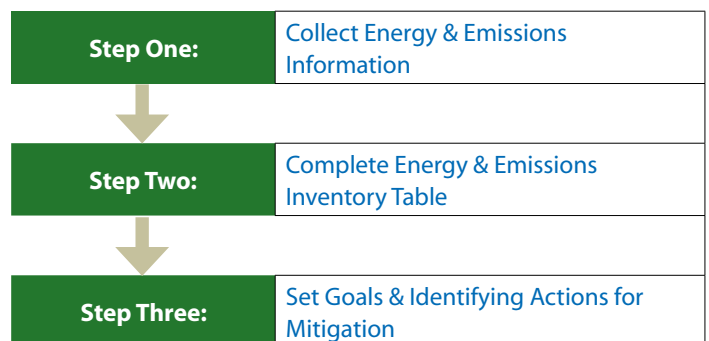
The purpose of developing a municipal mitigation plan is to start the process of identifying where and how municipal facilities, infrastructure and operations produce emissions, and to develop an approach to reducing emissions over time. Ultimately this will result in cleaner air for all Nova Scotians. To achieve this purpose the mitigation component will focus only on corporate (municipal) greenhouse gas emissions.

In order to assist municipalities prepare their mitigation action plan SNSMR has partnered with the UNSM and Stantec, and have developed a Municipal Climate Change Mitigation Plan Workbook that will also be of assistance when undertaking this part of the MCCAP. The workbook provides all the information necessary to prepare a comprehensive mitigation plan, complete with reduction targets and detailed actions, and can be used as such by municipalities. Those municipalities wishing to develop a comprehensive mitigation plan are strongly encouraged to work through the workbook which is available on-line and can be downloaded from the UNSM webpage.

It should be noted that the mandatory requirement for the mitigation component of the MCCAP is described in Steps One to Three (see below) and also in the submission template in Appendix A.

Preparing a Corporate Mitigation Plan

There are three mandatory steps required for the mitigation component of the MCCAP.



Step One: Energy & Emissions Information

Step One: Objective

- Completion of Corporate Energy and Emissions Spreadsheet

Corporate Energy & Emissions Spreadsheet

Municipalities that have not already conducted an energy and emissions inventory must use the Corporate and Emissions Spreadsheet and User Guide, developed by the UNSM and downloadable at:

<http://www.sustainability-unsm.ca/our-work.html>

It is recommended that you also download the instruction manual and additional information provided in order to assist you in completing the spreadsheet. For Step One, municipalities are required to collect the relevant information and complete the Corporate Energy and Emissions Spreadsheet.

Step Two: Energy & Emissions Inventory Table

Step Two: Objective

- Completion of Energy and Emissions Inventory Table

Step Two involves transferring information from the spreadsheet to the Inventory Summary Table (see below). The UNSM/ Stantec Workbook provides additional information on this procedure.

Municipalities that have already conducted an Energy Audit and Emissions Inventory can use existing data to populate the Summary Inventory Table. The original energy and emissions spreadsheet (with the detailed data) must also be submitted along with the summary table.

Step Three: Setting Goals and Actions for Mitigation

Step Three: Objectives

- Identify the municipality's goals for reducing greenhouse gas emissions.
- Determine appropriate actions to be undertaken in order to achieve mitigation goals.

Step Three involves setting goals for reducing emissions and establishing actions that will carry-out the intent of each goal. Actions must be linked with a specific time frame, responsibility, and where possible costs. Step Three will serve as the roadmap for the implementation the municipality's mitigation efforts. Typically, goals and actions are viewed as a living element of the mitigation plan, and at times will be updated, adjusted and adapted as circumstances change with the municipality.

Goals

Goals are a precise and realistic articulation of the desired end-state. Goals are required for each emission category listed in the Inventory table.

Example: improved energy efficiency and annual cost savings for the municipality's building stock.

Energy & Emissions Inventory Summary Table

Emission Category	Energy Type	Energy Consumption	Cost (\$)	Units	Emission Factor (tCO ₂ /units)	Emissions (tCO ₂ e)	Notes
Buildings	Electricity Nat. Gas Fuel Oil			kWh M3 L			
Water & Wastewater	Electricity			kWh			
Streetlights	Electricity			kWh			
Vehicles	Reg. Gasoline Diesel			L L			
Solid Waste	n/a						
Others				tonnes			

Actions

Actions are specific priority items which must be achieved to fully realize the stated goals. Actions must accompany the goals established for each emission category.

Example: complete a detailed, professional energy audit on the town hall and other municipal buildings, and act on any recommendations resulting from the findings which will improve energy efficiency and reduce energy costs.

Time Frame

The time frame is an articulation of the timing of the specific action. Wherever reasonably possible, time frames should accompany each goal and action.

Example: Short-Term (Year 1 and Year 2); Medium-Term (Year 3 and Year 4); Long-Term (Year 5 and beyond)

Accountability

Accountability describes the department or person responsible for carrying-out the actions. Wherever reasonably possible, there should be accountability for each action item.

Document References

1. Environment Canada (1998) The Canada Country Study (CCS) – Climate change impacts and adaptation measures; in Canada: highlights for Canadians. Environment Canada, 8 Volumes.
2. Environment Canada (2004) Greenhouse Gas inventories and Climate Change: Executive Summary.
3. Environment Canada (2005) Canada's Top Ten Weather Stories for 2005. Environment Canada
4. Environment Canada (2006) Vulnerability assessment, climate change impacts and adaptation measures; in Canada's Fourth National Report on Climate Change, Environment Canada, p. 153-168.
5. Environment Canada (2007) From Impacts to Adaptation: Canada in a Changing Climate. Chapter 4, Atlantic Canada.
6. Geological Survey of Canada (1998) Climate Change in Canada – Impacts and Adaptation
7. Government of Canada (2010) Adapting to Climate Change: An Introduction for Canadian Municipalities.
8. Health Canada (2004) Your Health and Changing Climate: Newsletter – Volume 1
9. Health Canada (2005) Your Health and Changing Climate: Newsletter – Volume 2
10. ICLEI (2011) Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate Adaptation.
11. ICLEI (2008) Five Milestone Framework for Reducing Greenhouse Gas Emissions. FCM Centre for Sustainable Community Development.
12. Natural Resources Canada (2005). An Overview of the Risk Management Approach to Adaptation to Climate Change in Canada. Global Strategies International. Ottawa, Ontario.
13. MacKenzie, Kyle. and Parlee, Kathryn. (2003) The Road Ahead: Adapting to Climate Change in Atlantic Canada. Canadian Climate Impacts and Adaptation Research Network.
14. Public Safety Canada (2005) Canadian Disaster Database. Public Safety Canada

APPENDIX A Submission Template - Mandatory Plan Content

The following information is mandatory and is a requirement of the final Municipal Climate Change Action Plan Submission to Service Nova Scotia & Municipal Relations.

MCCAP (ADAPTATION) – TEMPLATE

Step One: Adaptation Committee

This section of the MCCAP will:

- List the members of the adaptation committee and their role within the organization, or stakeholder group.
- Present the mandate and terms of reference under which the committee will operate.

Checklist & Deliverables:

- An accounting of the members of your adaptation committee, and description of their present role in your organization or as a member of a stakeholder group.
- List of potential stakeholders to be consulted during preparation of the plan.
- Mandate or Terms of Reference which clarifies team member's roles, responsibilities, and deliverables.
- Description of your committee's process for accountability.

Step Two: Climate Change Issues & Hazards

This section of the MCCAP will:

- Provide information on significant climate change issues and hazards affecting your municipality and why they have been flagged as being important.

Checklist & Deliverables:

- Description of the types of issues and hazards climate changes have caused or exacerbated within your municipality.

- A summary of the level of preparedness which characterized your municipality with respect to the above.
- Description of climate related issues or hazards that could cause problems in the future, and which of these your committee acknowledges will require future action on the part of the municipality.
- Analysis of how they might affect the future of your municipality.
- Any maps which geographically illustrate where climate change hazards are likely to occur and where they have occurred in the past.
- Any information summarizing potential climate benefits for your municipality, if you believe there are any.
- A description of any additional information your team may require in order to fill-in information gaps related to hazards caused by climate change.
- A description of any stakeholder involvement during this step.

Step Three: Affected Locations

This section of the MCCAP will:

- Provide information that describes those parts of the municipality that your committee has identified as being subject to climate change issues. Affected locations may range in scale from an entire region, to specific sites and structures.

Checklist & Deliverables:

- Description of specific places where problems have occurred in the past and are highly likely to occur again.
- Information describing where within your municipality future climate hazards are likely to occur and how your committee came to identify these areas/sites.
- Where possible, an analysis of the level of degree of impact associated with vulnerable sites (for example, moderate to severe effects anticipated in low-lying areas near the coastline).

- An account or map showing municipal and community assets located on vulnerable or at-risk areas of your municipality, including specific sites and locations expected to be affected, as well as structures, buildings, existing and new development expected to be affected
- Description of the kinds of additional information that is necessary to complete this analysis.
- A description of any stakeholder involvement during this step.

Step Four: Facilities and Infrastructure

This section of the MCCAP will:

- Identify and describe how existing (and proposed new) municipally-owned and operated facilities and infrastructure are vulnerable to climate change.

Checklist & Deliverables:

- A description of key facilities and infrastructure.
- A map overlay that indicates whether or not these facilities fall into areas identified in Step Three as being at risk due to their location with the municipality.
- A section describing specific issues that your committee acknowledges will affect your infrastructure and key facilities.
- Identification of those facilities and infrastructure considered to be important during an emergency.
- Completion of the requirements for infrastructure and facilities.
- A description of any stakeholder involvement during this step.

Step Five (a): Who will be Affected

This section of the MCCAP will:

- Provide information about whom within the municipality might be most adversely affected by climate change issues.

Checklist & Deliverables:

- An account of whom (communities, individuals, groups) within your municipality may be particularly vulnerable to climate change hazards, either because of their location, or due to other factors, and why they are at greater risk.
- Any maps which help to convey this information.
- Any information regarding how EMO plans will be incorporated into this analysis.
- General information regarding any climate hazards with the potential to affect the health and safety of residents.
- A compilation of individuals, organizations, agencies or groups that may be able to help in the event of a weather-related emergency.
- A description of any stakeholder involvement during this step.

Step Five (b): Economic Implications

This section of the MCCAP will:

- Provide information on the potential economic implications of climate change on the municipality, at both the local and regional levels.

Checklist & Deliverables:

- Information regarding how your committee anticipates climate change could potentially impact local and regional economies, with information relating to areas within the local economy that may be particularly vulnerable to, or exasperated by climate change.
- A list of ideas and/or options for dealing with potential threats to the local economy.
- A description of any areas within the local economy where climate change may prove to be beneficial.
- A description of any stakeholder involvement during this step.

Step Five (c): Environmental Issues

This section of the MCCAP will:

- Report on any potential environmental issues of which the municipality is aware, which could result from climate change impacts.

Checklist & Deliverables:

- A summary of any environmental problems experienced in your municipality in the past; caused by weather and/or climate change.
- A section outlining how your committee anticipates these problems may increase, become exacerbated or change with future changes in the weather (based on information gained during the completion of Steps One to Five).
- Any information and/or maps describing sensitive habitats, ecosystems, wildlife and endangered species in your municipality which may be impacted by changes in the weather or by climate change.
- Any maps showing the location of sites with dangerous and/or hazardous materials stored within your municipality.
- Any information which describes storage conditions and overall safety standards in place for hazardous materials.
- A summary of how your municipality's Emergency Preparedness Plan fits into Step Five.

Step Six: Priorities for Adaptation

This section of the MCCAP will:

- Outline the priorities for adaptive action acknowledged by your committee to be important to the overall wellbeing of your municipality.

Checklist & Deliverables:

- An accounting of the adaptation issues and hazards (with implications for the future well-being of your municipality) considered by the committee to warrant future action, with a description of why they were identified as being significant.
- A level of priority assigned to each issue (high, medium, low).
- A description of any adaptive actions that are already being undertaken by the municipality to address issues.

- Information on the range of potential actions which may be under consideration for addressing priority issues. Please note that: municipalities will be asked to provide progress reports on adaptive actions undertaken in the years subsequent to the submission of the final MCCAP in 2013.
- A list of tasks or additional information necessary to develop deeper analysis and understanding of the priority issues (for example detailed mapping or professional risk analysis for infrastructure).
- For municipalities with a MPS and LUB (refer to Step Six):
- A section explaining how climate change adaptation will influence, and be integrated into, land-use policy and (future) land-use regulation.
- A discussion on potential planning approaches or tools which might be used to facilitate adaptation.
- For municipalities without formal land use documents: a section outlining how you plan to address new development within the context of climate change adaptation.

MCCAP (MITIGATION) - TEMPLATE

The following information is a requirement of the MCCAP and must be included as part of the final plan submission to SNSMR.

Introduction

- A short section describing key areas in which the municipality intends to reduce energy demand and energy use with the overall objective of reducing greenhouse gas emissions (buildings, operations, vehicles, etc.).

Energy & Emissions Information

- Completion and submission of the UNSM corporate energy and emissions spreadsheet.
- Completion and submission of an energy and emissions inventory table.

Goals & Actions

- A description of emission reduction efforts to-date and/or targets for GHG reduction set by the municipality.
- A description of any progress made towards meeting the guiding principles outlined in the Memorandum of Understanding on Climate Change, made between the UNSM and the Province of Nova Scotia.

- A description of any significant projects related to reducing emissions already undertaken by the municipality, and any guiding principles or strategic approach already in use with respect to municipal mitigation efforts.
- A section that describes the goals established by the municipality for reducing energy demand and greenhouse gas emissions over the short, medium and long-term.
- Any contextual notes required for understanding the goals.
- A description of the actions established for the plan, and an indication of the goals that each action is associated with.
- Any contextual notes required to understand the actions.

Implementation

This section of the mitigation plan will include:

- The time frame, responsibility and estimated cost information associated with each action which links to a goal.
- Any contextual notes required for understanding this content.

APPENDIX B Adaptation Tools, Guidelines & Helpful Resources

Step Two: Identify the Issues

- Climate change models
- Historical data
- Local knowledge
- Newspaper and municipal records
- Risk rating indices
- Integrated Community Sustainability Plan
- Peer-reviewed, published and non-published articles on biophysical and socio-economic impacts of climate change
- Findings from technical assessments
- Results of climate change risk assessments
- Technical expertise – local, provincial, national
- UNDP's Adaptation Learning Mechanism <http://www.adaptationlearning.net>
- UNFCCC http://unfccc.int/national_reports/items/1408.php
- National Capacity Self-Assessment <http://ncsa.undp.org>
- IPCC Climate Data & Models <http://www.ipcc.ch>

Step Three: Affected Locations

- Maps (e.g. flood, topographic, hazard, zoning, geology, soils, watershed)
- Local knowledge
- Google Earth
- Arial photographs
- Integrated Community Sustainability Plan
- HRM Climate Change: Developer's Risk Management Guide
<http://www.halifax.ca/climate/documents/DevelopersGuidetoRiskManagment.pdf>
- Atlantic Canada Adaptation Solutions http://adaptation.nrcan.gc.ca/collab/index_e.php

- Intergovernmental Panel on Climate Change http://www.ipcc.ch/publications_and/data/publications_and_data_reports.htm#1
- Natural Resources Canada <http://www.nrc.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/995.asp>

Step Four: Facilities and Infrastructure

- Community Accounts infrastructure maps
- Municipal planning strategy and land use bylaw
- Public Sector Accounting Board (PSAB) reporting
- Municipal infrastructure maps
- Capital works plans
- Engineering studies and drawings
- Arial photographs
- Integrated Community Sustainability Plan
- Infrastructure Climate Risk Protocols (Engineers Canada) www.pievca.ca
- Guide to Considering Climate Change in Project Development in Nova Scotia
<http://www.gov.ns.ca/nse/ea/docs/Development.Climate.Change.Guide.pdf>
- Adapting Infrastructure to Climate Change in Canada's Cities and Communities – A Literature Review http://www.csa.ca/climatechange/downloads/pdf/Impacts_of_Climate_Change_2006.pdf
- HRM Climate Change: Developer's Risk Management Guide
<http://www.halifax.ca/climate/documents/DevelopersGuidetoRiskManagment.pdf>

- The Role of Standards in Adapting Canada's Infrastructure to the Impacts of Climate Change
http://www.csa.ca/climatechange/downloads/pdf/Impacts_of_Climate_Change_2006.pdf
- Canadian Institute of Planners <http://www.cip-icu.ca>
- Engineers Canada <http://engineerscanada.ca>
- Environmental Systems Research Institute Canada <http://www.esricanada.com/english/955.asp>
- Federation of Canadian Municipalities <http://www.fcm.ca>
- Public Infrastructure Engineering Vulnerability Committee (PIEVC): Adapting Infrastructure to a Changing Climate http://www.pievcc.ca/e/index_.cfm
- Natural Disaster Mitigation in Drinking Water and Sewerage Systems: Guidelines for Vulnerability Analysis <http://www.paho.org/English/DD/PED/natureng.htm>

Step Five: Socioeconomic & Environmental

- Community Accounts Statistics
- Municipal planning strategy and land use bylaw
- Integrated Community Sustainability Plan
- Social Services Agencies
- Emergency Plans
- Archeological, Heritage & Cultural Studies
- Population and Demographic Assessments
- Community Development Grants
- Municipal planning strategy and land use bylaw
- Integrated Community Sustainability Plan
- Community Maps, Reports and Statistics
- Environmental Plans
- Local Knowledge
- Local Environmental Groups
- Maps (ex. Habitat, soils, geology, zoning)
- Guide to Considering Climate Change in Environmental Assessments in Nova Scotia
<http://www.gov.ns.ca/nse/ea/docs/EA.Climate.Change.Guide.pdf>

Step Six: Setting Priorities & Taking Action

- Municipal planning strategy and land use bylaw
- Integrated Community Sustainability Plan
- Community Maps, Reports and Statistics
- Local Knowledge
- Case Studies
Adapting to Climate Change: A Risk-based Guide for Local Governments (Black et al., 2010)
http://adaptation.nrcan.gc.ca/tools/abosuj_e.php
- Municipal Resources for Adapting to Climate Change (Federation of Canadian Municipalities)
www.sustainablecommunities.ca/files/Capacity_Building_-_PCP/PCP_Resources/Mun-Re-_Adapting-Climate-Change-e.pdf
- Adapting to Climate Change: An Introduction for Canadian Municipalities
http://adaptation.nrcan.gc.ca/mun/pdf/mun_e.pdf
- Guide to Considering Climate Change in Project Development in Nova Scotia
<http://www.gov.ns.ca/nse/ea/docs/Development.Climate.Change.Guide.pdf>
- HRM Climate Change: Developer's Risk Management Guide
<http://www.halifax.ca/climate/documents/DevelopersGuidetoRiskManagment.pdf>
- Community Climate Change Adaptation Handbook
<http://www.clean.ns.ca/files/01/59/CCAdaptBooklet.pdf>
- FCM's Model Climate Change Action Plan, from their Partners for Climate Protection program:
http://fmv.fcm.ca/files/Capacity_Building_-_PCP/model-climate-change-action-plan-En.pdf
- Vancouver's Corporate Climate Change Action Plan:
http://vancouver.ca/sustainability/documents/corp_climatechangeAP-1.pdf
- Vancouver's Community Climate Change Action Plan (Climate-friendly City):
<http://vancouver.ca/sustainability/documents/CommunityClimateChangeActionPlan2005coverandreport.pdf>

- Climate Change Adaptation Framework Manual (Ministry of Sustainable Resource Development, Alberta)
www.srd.alberta.ca/MapsFormsPublications/Publications/ClimateChangeAdaptationFramework.aspx
- Alberta Association of Municipal Districts and Counties (AAMDC) and Alberta Urban Municipalities Association's Model Climate Change Action Plan
mccac.ca
- EPA's guide to developing a climate change action plan:
<http://www.epa.gov/statelocalclimate/local/activities/action-plan.html>
- International examples of Climate Change Action Plans from C40 cities:
<http://www.c40cities.org/ccap/>
- United Nations Conference on Climate Change: Local Coping Strategies Database
<http://maindb.unfccc.int/public/adaptation/>
- Climate Change Scenarios: New Brunswick Municipalities
<http://www.unb.ca/enviro/documents/Finalreport-March30.pdf>
- Partners for Climate Protection: Municipal Resources for Adapting to Climate Change
http://fmv.fcm.ca/files/Capacity_Building_-_PCP/PCP_Resources/Mun-Re-_Adapting-Climate-Change-e.pdf
- Climate Change: Changing Communities A Guide and Workbook for Municipal Climate Change Adaptation
http://www.iclei.org/fileadmin/user_upload/documents/Canada/Changing_Climate/ICLE076_-_NRCan_Guide.pdf
- Canadian Communities' Guidebook for Adaptation to Climate Change.
cbtadaptation.squarespace.com/guidebooks-papers-methologie/
- Institute for Local Government – Best Management Practices
<http://www.ca-ilg.org/ClimatePractices>
- IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations
http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm
- UNDP Adaptation Policy Framework
http://www.undp.org/climatechange_adapt/apf.html
- Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors
http://unfccc.int/files/cooperation_and_support/Idc/application/pdf/annguide.pdf
- Tool for Environmental Assessment and Management (TEAM)
<http://www.epa.gov/eims/global/team1.pdf>
- Adaptation Actions
http://www.ukcip.org.uk/index.php?option=com_content&task=view

Mitigation Tools, Guidelines & Helpful Resources

Report Title	Organization	Access
Climate Change 101	PEW Center for Global Climate Change	Available online: http://www.pewclimate.org/global-warming-basics/climate_change_101
Climate Change 101	Government of Canada	Available online: http://www.climatechange.gc.ca/default.asp?lang=En&n=65CD73F4-1
Climate Change Basic Information	United States Environmental Protection Agency	Available online: http://www.epa.gov/climatechange/basicinfo.html
Climate Change in Nova Scotia: A Background Paper to Guide Nova Scotia's Climate Change Action Plan	Nova Scotia Department of Energy	Available online: http://oee.nrcan.gc.ca/Publications/statistics/trends06/pdf/trends06.pdf
From Impacts to Adaptation: Canada in a Changing Climate 2007	Government of Canada	Available online: http://adaptation.nrcan.gc.ca/assess/2007/pdf/full-complet_e.pdf
Our Coast Live. Work. Play. Protect. The 2009 State of Nova Scotia's Coast Technical Report	Province of Nova Scotia	Available online: http://www.gov.ns.ca/coast/documents/report/Coastal-Tech-Report-Nov-09.pdf . Chapters 5 and 7.
Submission for Nova Scotia Department of Energy's Energy Strategy and Climate Change Action Plan	Clean Nova Scotia	Available online: http://www.clean.ns.ca/files/30/CNS27s20submission20for20DOE.pdf
Toward a Greener Future: Nova Scotia's Climate Change Action Plan	Nova Scotia Department of Environment	Available online: http://climatechange.gov.ns.ca/doc/ccap.pdf
Energy Efficiency Trends in Canada 1990-2004	Natural Resources Canada	Available online: http://oee.nrcan.gc.ca/Publications/statistics/trends06/pdf/trends06.pdf
Greenhouse Gas Emissions Forecasting: Learning from International Best Practices	National Round Table on the Environment and the Economy	Available online: http://www.ec.gc.ca/Content/6/3/A/63A6D41E-8017-4826-A40C-6C940BF71BC5/nrtee-ghg-emissions-forecasting-eng.pdf
Halifax Regional Municipality Community Local Action Plan to Reduce Greenhouse Gas Emissions	Naturally Green Halifax Regional Municipality Dillon Consulting Limited	
Improving Energy Performance in Canada. Report to Parliament Under the Energy Efficiency Act for the Fiscal Year 2007-2008	Natural Resources Canada ecoENERGY	Available online: http://oee.nrcan.gc.ca/publications/statistics/parliament07-08/pdf/parliament07-08.pdf
National Inventory Report 1990-2008: Greenhouse Gas Sources and Sinks in Canada	The Canadian Government's Submission to the UN Framework Convention on Climate Change	Available online: http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=492D914C-2EAB-47AB-A045-C62B2CDACC29
Act Locally. The Municipal Role in Fighting Climate Change	Federation of Canadian Municipalities	Available online: http://www.fcm.ca//CMFiles/FCM_Climate_En_Final1RSG-1272009-2598.pdf

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