

KINGS 2050



Municipal Climate Change Action Plan Kings County, N.S.

KINGS 2050 – A Collaborative Project

Kings County 2050

Municipal Climate Change Action Plan

Prepared by The Municipality of Kings County Planning Services with the cooperation and participation of Towns of Kentville, Wolfville, Berwick, Kings County Villages, Province of Nova Scotia, Government of Canada, local groups, agencies and organizations.

November 2013



KINGS 2050

1



CLIMATE CHANGE ACTION PLAN

Note

This document is formatted with consideration for digital reading. Readers should note that hyperlinks have been placed within the document for easy navigation. For example, clicking on a section in the Table of Contents will take the reader to that section in the document.



KINGS 2050

2



CLIMATE CHANGE ACTION PLAN

Executive Summary

The timing of the Municipal Climate Change Action Plan (MCCAP) initiative could not be better for the communities of Kings County. In the fall of 2011, the Municipality of Kings and the Towns of Kentville, Wolfville and Berwick signed a memorandum of understanding to work collaboratively on a project entitled *Kings 2050*. The purpose of this project is to guide the long term sustainable development of the region. By working together, the Municipal units hope to develop the priorities, policies and tools to work towards achieving a common vision.

At the very root of the *Kings 2050* concept is the desire to engage citizens, groups, industry, community leaders, as well as other government agencies, to work towards a sustainable, healthy and productive community.

Climate change adaptation and mitigation impact almost all aspects of *Kings 2050*. We must prepare for change by developing policies that address issues in a proactive way. At the same time we must remain cognizant of the financial realities that face all Nova Scotia Municipalities. Some issues already brought to the forefront in *Kings 2050* discussions are:

- The municipal units in Kings County have made significant infrastructure investments which must be considered. Climate change has the potential to adversely impact this infrastructure and it is vital that, where possible, we make sustainable policy and investment decisions to avoid these impacts and implement appropriate mitigation measures.
- Kings County is the bread basket of Nova Scotia. The land, water and climate are key aspects affecting the continued good health of this industry. Climate change has the potential to have a major impact on agriculture.
- The majority of citizens in Kings County live in relatively close proximity to a water body, river or stream. In many of our older communities, downtown and business uses, as well as residential uses are located at, or very near river floodplains. While it is important to allow and encourage these areas to thrive, we must be cognizant that many of them may be vulnerable to flooding from a severe weather event. This possibility must be taken into account through the Municipal Planning Strategy and Land Use regulations.
- Kings County has almost 200 kilometres of coastline, all subject to the highest tides in the world. Sea level rise, erosion and salt water intrusion are all major factors that will influence Municipal policy development in the future.

Through the *Kings 2050* Project, the municipal partners are exploring a myriad of issues that are directly, or indirectly, related to climate change adaptations. The work being completed through MCCAP initiatives should prove to be invaluable in informing policy decisions that will prepare municipal leaders as they set priorities for climate change adaptation strategies.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

Contents

Contents	4
1. Introduction and Context.....	6
1.1 Municipal Climate Change Action Plan (MCCAP) Format and Terms of Reference.....	6
1.1.1 Historic Events.....	7
1.1.2 Future Events	7
1.2 The Partners and the Process	7
1.2.1 Kings 2050	7
1.2.2 Regional Approach	8
1.2.3 Steering Committee	8
1.3 Stakeholders.....	8
1.3.1 Municipality of Kings.....	8
1.3.2 Town of Berwick	9
1.3.3 Town of Kentville	10
1.3.4 Town of Wolfville	10
1.3.5 Other Stakeholders.....	11
2. Climate Change Impacts and Hazards.....	11
2.1 Identified Issues.....	11
2.1.1 Coastal Flooding.....	11
2.1.2 Severe Weather Events.....	13
2.1.3 Inland Waterways	14
2.1.4 Groundwater.....	16
2.1.5 Agriculture	17
2.1.6 Forests	18
2.2 Potential Climate Benefits.....	19
3. Affected Locations	19
4. Facilities and Infrastructure	20
4.1 Municipal Water Supply	20
4.2 Private Wells.....	20
4.3 Industrial Wells	21
4.4 Sewage Treatment	21



4.5	Transportation Corridors.....	21
4.5.1	Dykes	24
4.5.2	Assets	24
5.	Who and What Will Be Affected	25
5.1	Most Vulnerable.....	25
5.2	EMO's Role	27
5.3	Health and Safety During Extreme Events.....	28
5.4	Economic Implications	29
5.4.1	Negative Implications.....	30
5.4.2	Positive Implications	31
5.5	Environmental Issues	31
5.5.1	Contamination	31
5.5.2	Wetlands and other Sensitive Habitats	32
5.5.3	Hazardous Materials (storage and safety standards).....	32
6.	Priorities for Adaptation.....	33
7.	Mitigation	33
	Appendix A Regional Adaptation Priorities.....	34
	Appendix B Municipality of Kings Adaptation Priorities.....	39
	Appendix C Town of Kentville Adaptation Priorities.....	43
	Appendix D Town of Wolfville Adaptation Priorities.....	45
	Appendix E Town of Berwick Adaptation Priorities.....	46
	Appendix F Kings County Regional Mitigation Priorities.....	49
	Appendix G Municipality of Kings Mitigation Priorities.....	50
	Appendix H Town of Kentville Mitigation Priorities	51
	Appendix I Town of Wolfville Mitigation Priorities	52
	Appendix J Town of Berwick Mitigation Priorities	53



1. Introduction and Context

1.1 Municipal Climate Change Action Plan (MCCAP) Format and Terms of Reference

There is no doubt that the planet's climate is changing; in fact, it has been changing since Earth was formed. However, in recent years scientists have discovered that Earth's climate is changing faster and more dramatically than ever before. The most likely explanation is anthropogenic (human-produced) causes like greenhouse gas emissions. The expected result of this change is an increase in average global temperatures and changes in local weather patterns. Nova Scotia Environment estimates that temperatures in Kings County could be, on average, 3°C warmer by 2050 than in the 1990's. This means milder winters and hotter summers. It is also estimated that precipitation in the area could increase by up to 12 percent by 2050, but that the increase will come in the form of less-frequent, more-violent weather events. There is also likely to be an increase of extreme weather events, such as hurricanes and blizzards. (Pg 8 Kings 2050 Background Paper 1 Environment)

In order for municipalities in Nova Scotia to have access to federal gas tax revenues, they must complete 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.

The four municipalities that make up Kings County, the Towns of Kentville, Wolfville, Berwick and the Municipality of Kings, as well as a number of other partners that include seven Villages, are currently involved in a regional planning initiative entitled *Kings 2050*. The Terms of Reference for *Kings 2050* identifies planning for climate change as a primary goal of the project. To this end, the MCCAP will address regional climate change issues, as well as identify issues specific to each municipality and will inform the *Kings 2050* project as it relates to climate change.

The format of this document generally follows, with slight variations, the one laid out in the Canada-Nova Scotia Infrastructure Secretariat's Municipal Climate Change Action Plan Guidebook. The primary difference is that this MCCAP report is regional and attempts to address regional issues, as well as those specific to individual municipalities.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

1.1.1 Historic Events

The Saxby Gale was a tropical storm that hit the Bay of Fundy region on October 5, 1869. It hit during some of the highest tides of the year and the result was devastating to the region. More than 100 people were killed. A storm surge estimated at 2 metres in height flooded coastal communities, caused rivers to flood their banks, and spilled sea water over the floodplains. Dykes in Kings County were breached, roads washed out and the railway from Windsor to Annapolis saw miles of track destroyed.

This storm has been called a 1 in 150 year event but there have been other significant storms since that time. The Great Gale of 1927 that delivered 4 inches of rain, and gale force winds, to the Annapolis Valley with the community of Harbourville being amongst the hardest hit. More than 20% of rail lines in Nova Scotia were washed out by this storm. The Groundhog Day Gale in 1976, hurricane Juan in 2003, White Juan in 2004 are just some of the named storms that have caused widespread damage and disruption to citizens of Kings County.

1.1.2 Future Events

It is predicted that the strength and frequency of hurricanes in the Atlantic will increase with warming oceans. The predictions suggest that Nova Scotia will see more impacts from hurricanes and their remnants, either through a direct strike or near miss. This will present higher risk of impacts from high winds, precipitation, and storm surge. The potential damage from these storms will challenge local authorities' abilities to respond to infrastructure damage. Municipal infrastructure was designed and built assuming these major storms would be rare, and manageable, events. The new reality of severe weather and climate change has meant that municipalities must adapt infrastructure and try to anticipate future climate related challenges.

1.2 The Partners and the Process

Kings County, Nova Scotia consists of four municipal units. The Municipality of Kings, which also includes seven Villages, has a population of approximately 48,000 and is the third largest municipal unit in Nova Scotia. The three Towns, Kentville, Wolfville and Berwick have respective populations 6100, 4300 and 2400. Climate change has the potential to significantly impact the lives of each of the more than 60,000 people that live in Kings County. Kings County has significant agricultural and ecological resources to protect as we encourage new residential, industrial and commercial development. Kings County is also Nova Scotia's richest agricultural region. Most of the County's agriculture, and its people, are located on the valley floor, a feature that runs east to west, stretching from the Minas Basin to the Annapolis County line.

1.2.1 Kings 2050

Kings 2050 is a partnership initiative intended to guide the long-term sustainable development of Kings County. While the four Municipal units in Kings County each plan for the future, there are many issues, such as climate change, economic development and transportation that can be more effectively addressed collectively. *Kings 2050*, therefore, looks beyond political boundaries by facilitating the



cooperation of all four municipal units, seven villages and a variety of other partners to plan the future of Kings County in a truly comprehensive manner. This initiative, started in late 2011, is expected to take three years to complete.

Forward looking partnerships are central to *Kings 2050's* collaborative and comprehensive planning approach. A collaborative management group coordinates *Kings 2050* initiatives with the support of a variety of 'Implementing Partners' – the local governments that will adopt new policies, bylaws and strategic documents, as well as 'Supporting Partners' – the organizations that will carry out project work and provide valuable information and advice. By working together, these partners are gathering more information, leveraging limited resources, and improving the coordination of a variety of planning, infrastructure and economic development initiatives.

1.2.2 Regional Approach

Using *Kings 2050* as a model, and with the full support of the Provincial Government, the municipalities in Kings County have decided to approach the completion of the MCCAP in a regional manner. Shared geography and infrastructure dictates that the most comprehensive approach to dealing with Climate Change be a regional one. By sharing resources the Municipalities can better address issues of a regional nature, such as flooding and infrastructure planning. Issues that are specific to a particular community will be addressed by the individual community while considering regional impacts.

1.2.3 Steering Committee

The Steering Committee for the MCCAP included staff from each participating Municipality, as well as the Regional Emergency Measures Organization (REMO) Coordinator. This Committee will consult with a wide range of other stakeholders, as the project requires, and is committed to completing the Kings County MCCAP in a timely manner.

David Poole	Kings 2050 Research Coordinator	Municipality of the County of Kings
Monica Beaton	GIS Technician	Municipality of the County of Kings
Gregg Morrison	Director of Planning	Town of Wolfville
Beverly Gentleman	Director of Planning and Development	Town of Kentville
Greg Towne	Director of Finance	Town of Berwick
Ben Sivak	Manager of Planning Services	Municipality of the County of Kings
Fred Whynot	Director of Engineering and Works	Town of Kentville
Scott Quinn	Manager of Engineering and Public Works	Municipality of the County of Kings
Andrew Mitton	Emergency Management Planning Officer	EMO Nova Scotia

1.3 Stakeholders

1.3.1 Municipality of Kings

The Municipality of the County of Kings has a population of approximately 48,000 and is the third largest municipal unit in Nova Scotia. Kings County has significant agricultural and ecological resources to protect as we encourage new residential, industrial and commercial development. The Municipality is

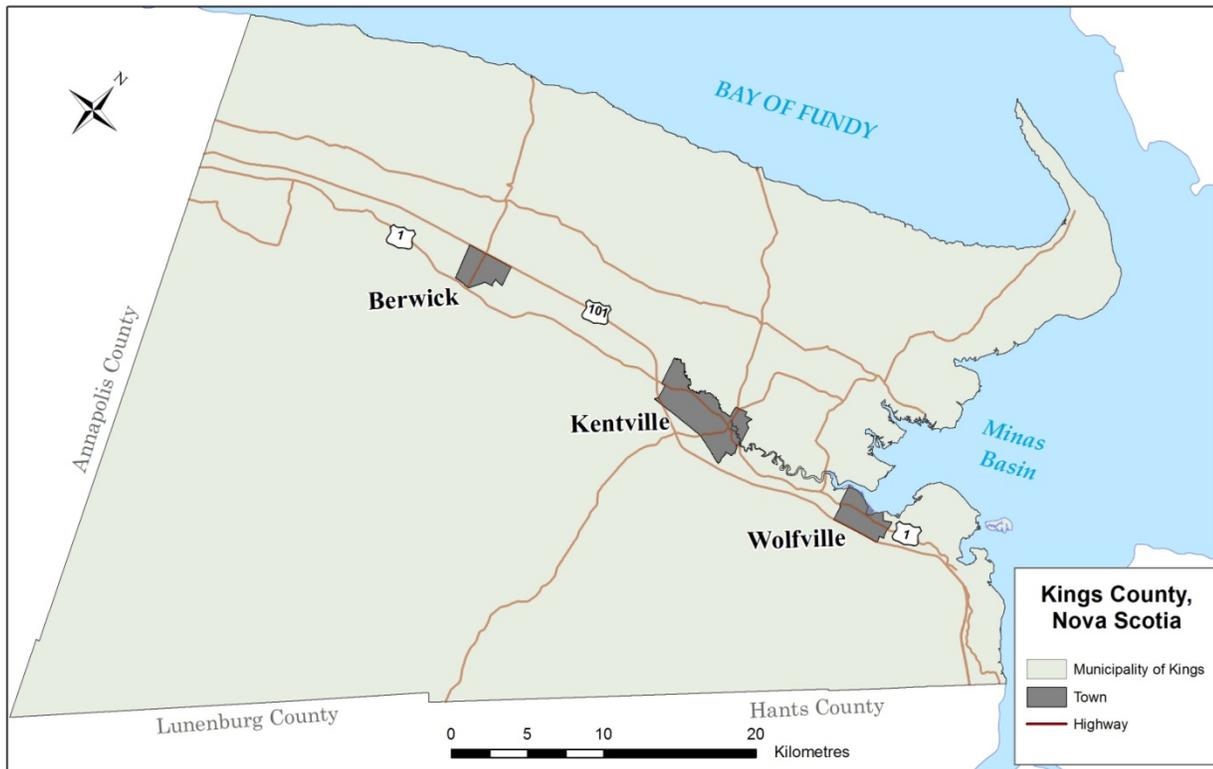


KINGS 2050



CLIMATE CHANGE ACTION PLAN

proud to be a part of the “Land of Orchards, Vineyards and Tides”. It is Nova Scotia’s richest agricultural region and accounts for more than 30% of total agricultural value in the Province.



The nature of the settlement pattern of the county means that the vast majority of its citizens, its infrastructure and industry are located in close proximity to water, either one the many rivers and streams or the Minas Basin. Other pockets of development occur on the North and South Mountain plateaus and the shores of the Bay of Fundy.

Climate change is of particular concern in Kings County due to its reliance on resourced based industries such as agriculture, forestry and fishing, the proximity of most of its residents to water, and dependence on groundwater sources for drinking water. While some parts of these industries may benefit from certain aspects of climate change, such as an increase in frost free growing days, severe weather and potential for flooding could adversely impact everyone. These two phenomena need to be understood, and prepared for, in a Climate Change Adaptation Plan for Kings.

1.3.2 Town of Berwick

Located in the western part of the Annapolis Valley on the Cornwallis River, the Town of Berwick is surrounded by the orchards and farms prevalent on the valley floor. Berwick’s slogan is the “Apple Capital of Nova Scotia”, honouring the importance of the apple industry as a major economic force in developing the town. Its earlier proximity to the Dominion Atlantic Railway and, later, Highway 101 have allowed the town to act as a strong commercial and service centre to the surrounding areas.



With a population of 2,454 (2011 Census data) and area of 6.7 square km's, the geography of the town is relatively flat with gradual elevation changes and few bodies of water or rivers. A large tree canopy covers most of the town.

The town is unique in that it does not have a central water system (meaning residential and commercial properties source their own water individually through private wells) and owns an electric production and distribution system, one of only five municipal utilities in Nova Scotia. Other municipal services include the operation of wastewater and stormwater systems, provision of police and fire protection, transportation infrastructure and parks and recreation services.

1.3.3 Town of Kentville

The Town of Kentville is centrally located in the beautiful Annapolis Valley of Nova Scotia along the scenic Evangeline Trail on Highway #1. Prominent to the geography of Kentville is the Cornwallis River which intersects the community on its meandering easterly course to the Minas Basin in the Bay of Fundy, and is easily accessed from Highway 101. Kentville has a geographic area of 17.35 square km's and is approximately 105 km's from Halifax.

The Town has a rolling topography of hills and valleys attributable to the historical influences of glaciers and the cumulative erosive effects of the Cornwallis River over time.

Geologically, the Town is located between North Mountain (comprised of basalt rock) and South Mountain (comprised of quartzite, granite, limestone and shale). The underlying bedrock of the Town and the valley floor is mainly sandstone. The rich agricultural soils of the Valley region are attributable to the glacial and river influences in the region over the last millennia

The population of the Town of Kentville has increased slightly, though consistently over each Census period since 1991. The total population of the Town (according to the 2011 Census data) was 6,094 up 10% from the 1991 Census total of 5,506. Many changes have taken place in Kentville since the community was first settled. Today, the Town remains an integral part of the overall well being of Kings County and the entire Annapolis Valley region. Kentville currently continues to serve as the administrative and professional centre for the region.

1.3.4 Town of Wolfville

The Town of Wolfville, formerly known as Mud Creek, was incorporated as a Town in 1893. Located adjacent to the Minas Basin, it boasted a busy harbour and home to places of higher learning. While the harbour has evolved from mercantile activity to a place of tourist and recreational interest, the Town continues to be the home of Acadia University which is an important economic and social engine for the Town.

The 2011 census cited a population for Wolfville of 4,269. This 13% increase in population from 2006 to 2011 is a marked increase in growth that had averaged only 0.5% per year for the 15 years prior to 2006. The Town population doubles each fall with the return of approximately 4,200 full and part time students to Acadia University.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

The Town provides a full array of municipal services including sewer and water, roads, recreation, and police and fire protection and acts as a service centre for the surrounding rural and agricultural area. The Town has recently become the hub for an evolving food and wine industry in the surrounding area.

Given the location of Wolfville's downtown business district adjacent to the powerful tides of the Minas Basin, the Town will have a keen interest in adapting to Climate Change.

1.3.5 Other Stakeholders

In addition to the Towns and The Municipality of Kings, there are many other stakeholders in the issue of climate change adaptation and mitigation.

The seven Villages of Aylesford, Canning, Cornwallis Square, Kingston, Greenwood, New Minas, and Port Williams are located within the Municipality of the County of Kings and play an important role in Kings County's identity. All Villages manage a variety of parks, recreation facilities, sidewalks and community centres, and some manage significant water and sewer infrastructure. All of the Villages are located along rivers and have areas that may be susceptible to flooding.

Other stakeholders include a wide range of public services, including Valley Regional Health Board, Annapolis Valley Regional School Board, Emergency Health Services, local First Nations, fire departments, police services and Emergency Measures Organizations.

2. Climate Change Impacts and Hazards

2.1 Identified Issues

It is generally accepted that climate change will affect Atlantic Canada in several significant ways. Sea level rise will most definitely be an issue for, not only the coastal areas of Kings County, but also inland areas that lie near rivers and streams that outflow into the Minas Basin to the east and to the Annapolis Basin to the west. The Nova Scotia Department of Environment estimates that temperatures in Kings County could be, on average, 3°C warmer by 2050 than in the 1990s. This means milder winters and hotter summers. It is also estimated that precipitation in the area could increase by up to 12% by 2050, but that the increase will come in the form of less-frequent, more-violent weather events. Other extreme weather events, such as hurricanes, blizzards and droughts can also be expected.

2.1.1 Coastal Flooding

In 2012, a study commissioned for the *Kings 2050* initiative, examined the effects of ocean rise and storm surge on the coastal areas of Kings County.

The strong tides of the Bay of Fundy affect the Cornwallis River up to 5 km west of the Town of Kentville, making the towns of Kentville and Wolfville, and the villages of Port Williams and New Minas vulnerable to coastal flooding and storm surge. Tidal range in the Minas Basin of the Bay of Fundy,



KINGS 2050



CLIMATE CHANGE ACTION PLAN

Nova Scotia is between 13 and 16 m, the highest in the world. Following a semi-diurnal pattern, there are two high tides and two low tides every 24 hours and 50 minutes in the Bay of Fundy. When a high tide coincides with strong winds and low pressure of a storm, a storm surge can occur. A storm surge is an increase in the ocean water level above what is expected from the normal tidal level that can be predicted from astronomical observations. The strong tidal currents of the Minas Basin cause erosion of the fine glacial till sediments of the coastline at a rapid rate, making the coastal communities in this region ever more vulnerable to storm and flood events.

Dykes provide some protection against coastal flooding due to storm surge, although their primary purpose is to create and protect agricultural land. The salt marshes of the Cornwallis River were dyked by the Acadians in the 1700s to create fertile agriculture lands, as an alternative to clearing forests. The Acadians built one-way culverts called aboiteaux into the dykes to prevent salt water from entering farmland on a flood tide, while still allowing drainage of the land on ebb tides. The dykes in the Minas Basin area are generally between 8 and 9 m above mean sea-level and are maintained by the NS Department of Agriculture. The dykes were brought up to standard in the late 1960s and by 2002 most of the original wooden aboiteaux were replaced or relined with high density polyethylene pipe. In many cases in the Minas Basin region the elevation of the land behind the dykes is lower than the land seaward of the dykes. This is due to the hundreds of years of sediment deposition on the seaward side of the dykes, and has serious implications when considering flood water inundation. (Pg 7 Kings 2050 Floodplain Delineation, Land Use Mapping, Constraint Mapping and Vulnerability Report – Applied Geomatics Research Group)

2.1.1.1 Minas Basin

There are 4,194 hectares of land in Kings County that are protected by dykes. These lands are enshrined in the Nova Scotia Marshlands Conservation Act of 2000. There are twelve incorporated Marsh Bodies that administer the protected lands, while the more than 47 km. of dykes are maintained by the Nova Scotia Department of Agriculture and Marketing.

The ‘soft’ shore of the Minas Basin is made up sandstones, gravel, slate and loamy soils with many sandy and/or muddy beaches. The dykes, and the lands they protect, are probably the most visible and vulnerable pieces of infrastructure in the County. (Pg 5 Municipality of the County of Kings Climate Change Adaptation Case Study Report) Three sewage treatment plants for the most populous parts of Kings County (Kentville, Coldbrook, North Kentville, New Minas, Wolfville and Port Williams) are located within the floodplain of the Cornwallis River. One sewage treatment plant is located on the Habitant River (Canning). Should there be a major break of the dykes, these essential pieces of infrastructure would be at risk.

While almost 50 kms. of shore along the Minas Basin is protected by dykes, there are more than 65 km. of this ‘soft’ shore that are open to the Bay’s tides and are actively eroding. Homes, harbours, farms and woodland line this coast and all are at risk of rising sea level and storm surge. There are also a number of roads and bridges that would be cut off should the dyke system fail, effectively cutting the county in two at its eastern end.



2.1.1.2 Bay of Fundy Shore

There are 90 kms. of the ‘hard’ coast along the Bay of Fundy that, while less susceptible to erosion than the Minas Basin coast, are home to a number of communities that access the Bay through small harbours. These communities are built around the harbours and can be vulnerable during extreme weather events. Wharves, roads, private property and other infrastructure can be particularly vulnerable to storms should there be a confluence of wind, high tide and surge.

2.1.2 Severe Weather Events

Research into climate change effects in Nova Scotia indicates that there will be an increase in severe weather events. These events will likely take the form of extreme wind, rain, snow and ice. Individually any of these events can result in widespread damage but, should several occur in combination, the results have potential to be catastrophic. Hurricanes and blizzards are not new to Kings County but their frequency and magnitude are expected to increase.

2.1.2.1 Wind

Nova Scotia’s location in north eastern North America means that hurricanes, and storms with high winds, are fairly regular weather events. Water temperature plays a major role in the size and magnitude of hurricanes. The relatively cold waters that surround Nova Scotia serve to temper the storms and category 3 or 4 hurricanes with winds of 135km/h to 180 km/h lose intensity and are downgraded to tropical storm or category 1 by the time they make landfall.

The most recent major hurricane to hit our region was a category 2 storm, Hurricane Juan in 2003. This storm, said to be our worst in over 100 years, resulted in 8 fatalities and more than \$300 million in damage through central Nova Scotia and Prince Edward Island. Fortunately, Kings County was not in the direct path of the storm and damage was less than other parts of the region. However, there was major damage to crops and personal property due to high winds and localized flooding.

As oceans warm, it is likely that storms will be stronger and retain their power for much longer periods of time. It is to be expected that more storms will make landfall in Nova Scotia and the impacts of larger storms that make landfall elsewhere on the Atlantic coast will be felt to a greater degree in Kings County.

Nor’easters are another type of storm that brings extreme high winds to Nova Scotia. While generally not as powerful as a hurricane, they are more common and are usually accompanied by heavy snow or rain.

2.1.2.2 Drought

Kings County is an agricultural region, accounting for more than 30% of Nova Scotia farm products. All 60,000 residents rely on groundwater for drinking water and irrigation is commonplace for farms in the county. Climate change predictions are for hotter and drier summers with droughts that may affect agricultural production. When precipitation does occur, it is more likely to be intense rainfall of short duration. Unless captured, most of this water will quickly drain away providing little recharge to groundwater reserves.



KINGS 2050



2.1.2.3 Snow and Ice

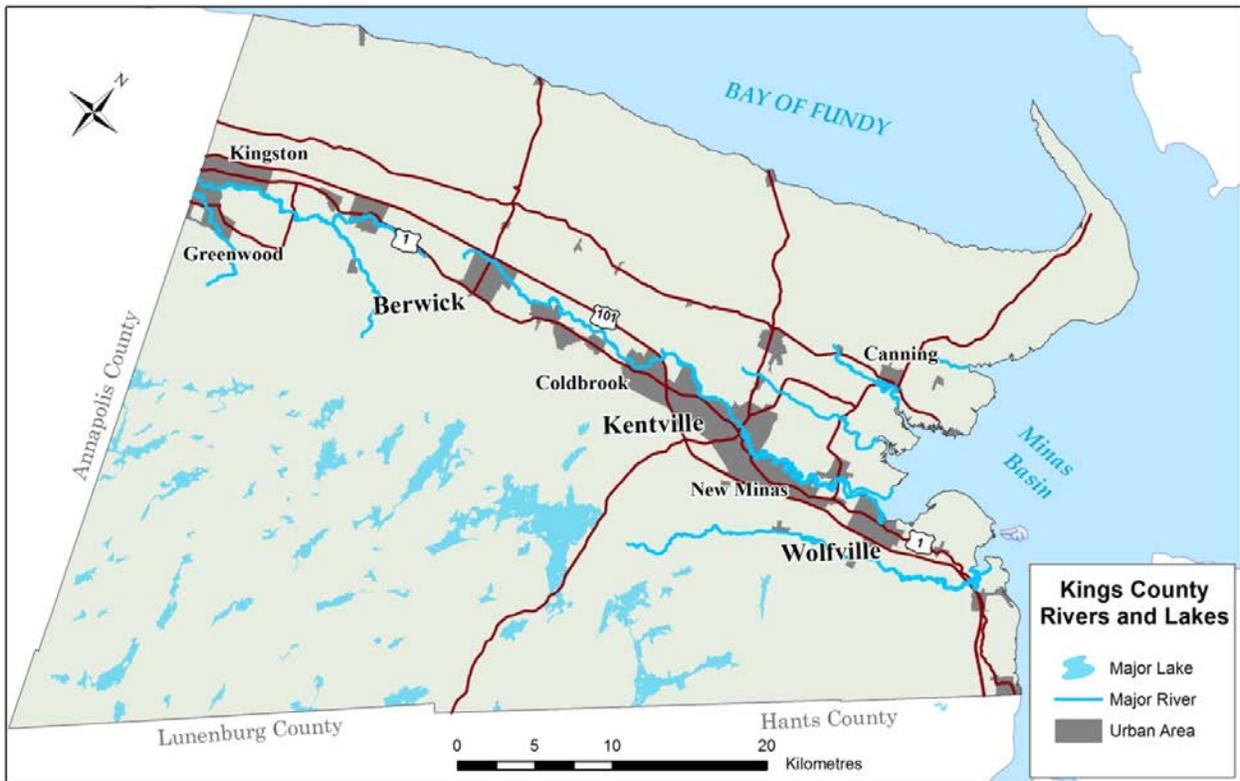
Freezing rain is a common occurrence in Kings County and snow storms are annual events. The ice storm of 1998 that caused massive power outages from Ontario to Nova Scotia and White Juan, a blizzard that hit Nova Scotia in 2004 with as much as 100 cm of snow in some locations, are examples of the types of storms that may become more common as our climate changes. Infrastructure damage and economic disruption from both of these storms was significant and both storms shut down community services for days.

2.1.2.4 Tides and Storm Surge

The Bay of Fundy has the highest tidal range in the world. At extreme high tide, the entire coast is at risk should a major storm hit the region. Storm surges are of particular concern. If a surge were to occur at, or near, an extreme high tide, low lying communities would be at risk of flooding. Because we have many communities along our coast, as well as transportation and electricity corridors, there is a very real possibility of communities being cut off from essential services.

2.1.3 Inland Waterways

While there have been cases of banks being overtopped, and low lying areas being flooded, the watersheds in Kings County are generally seen as being capable of handling normal conditions. However, the ability of the freshwater streams, lakes, ponds and wetlands to accommodate flash floods resulting from extreme rainfall events is still very much an open question.



2.1.3.1 Rivers

Though there are some small rivers that flow into the Bay of Fundy off of the North Mountain, the watersheds of Kings County generally feed six major rivers that flow east or west through the valley floor. The Gaspereau, Cornwallis, Canard, Habitant and Pereau Rivers flow drain east, into the Minas Basin. The Annapolis River flows west through Annapolis County to the Annapolis Basin. The two largest rivers, the Cornwallis and Annapolis have their headwaters in Caribou bog, a large peat formation, to the southwest of the Town of Berwick.

The rivers of Kings County are characterized by expansive flood plains and a meandering nature. Much of the population and infrastructure in Kings County occurs along these rivers. The rivers have been channelled by the construction of dykes and road networks and all are susceptible to flooding their banks. The combination of high tides and high spring runoff regularly leads to localized flooding, washouts and some damage to infrastructure.

2.1.3.2 Lakes

With the exception of several small lakes on the Valley floor and North Mountain, all of the lakes in Kings County are located on the South Mountain plateau. Many of the largest lakes in Kings County are connected through canals and form part of Nova Scotia Power Incorporated's hydroelectricity system. This system drains into the Minas Basin through the Gaspereau River in Kings County and the Avon River in Hants County. Other lakes, and their watersheds, flow south to Lunenburg County, West to Annapolis County or north to drain into the Cornwallis and Annapolis Rivers.

In the 2005 report *Adapting to a Changing Climate in Nova Scotia: Vulnerability Assessment and Adaptation Options*, the authors identified a number of issues specific to lakes. *Water Resources in lakes and reservoirs are becoming increasingly vulnerable to a range of stresses, both natural and human-induced. For example, natural stresses include increased climate variability and extremes that can affect both the magnitude and seasonal cycles of water budget components that influence the availability of clean freshwater. Climate extremes have been shown to significantly affect lake heat storage, temperature and evaporation.* (Pg 45 *Adapting to a Changing Climate in Nova Scotia: Vulnerability Assessment and Adaptation Options*)

2.1.3.3 Hydro Electric Systems

The dams built for the two hydro electricity systems in the county are regularly monitored, and upgraded as required. Nova Scotia Power and Berwick Electric Commission do have emergency plans in place for their respective hydro systems. However, changing precipitation patterns could lead to greater extremes in their water management planning. On one hand, their dams could collect more runoff from the expected short intense rain events. The operators may be more reluctant to release water from their reservoirs if there are going to be longer periods between precipitation events. This could impact water flows in the river systems downstream of the dams. It may also compel the operators to increase the size of their dams to increase storage capacity which could impact water levels on the lakes upstream.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

2.1.3.4 Wetlands

Wetlands, such as freshwater fens and bogs and salt marshes are located throughout Kings County. They provide habitat for wildlife, erosion control and groundwater recharge. The subject of wetlands was addressed in the *Kings 2050* Environment background paper.

The issue of wetland protection is especially relevant in Kings County because the Southern Bight wetland complex on the Minas Basin is designated as a Wetland of International Importance under the Ramsar Convention on Wetlands. This area, which stretches from Medford to Avondale in Hants County, is also listed as an Important Bird Area by Birdlife International. Provincial policy states that the Government will not support nor permit alterations to the Southern Bight wetland complex, as well as other Wetlands of Special Significance such as salt marshes and those supporting species at risk (Wetland Strategy).

The abundance of rivers and lakes in Kings County means that there are a large number of wetlands that are of great local importance. Provincial policy provides some protection for these wetlands by requiring approvals for wetland alterations. The Province also has an objective of no 'net loss of wetland, meaning that the destruction of wetland must be offset by wetland restoration elsewhere, or by the protection of special wetlands. The Nova Scotia Wetland Conservation Policy also includes objectives to promote wetland stewardship, promote the long-term net gain of wetlands, and encourage the use of buffers between development and wetlands. The Municipal Planning Strategies for the Municipality and all three Towns currently include language that greatly restricts development around wetland areas. (Pg 10 Kings 2050 Background Paper 1 Environment)

2.1.4 Groundwater

A stable supply of potable water is essential to life in modern society. For many residents of Kings County this supply comes from groundwater resources, including private wells, small community utilities, and municipal systems. In fact, practically all households in Kings County rely on groundwater sources for their potable water.

Groundwater protection is, accordingly, a critical topic in Kings County. The current Municipal Planning Strategies for the Municipality of Kings and all three Towns include sections dedicated to water resource protection and management. Land use policies for the Municipality of Kings, Wolfville, and Kentville include various wellfield overlay zones that restrict, to varying degrees, the types of development and activities that can occur within the collection and recharge areas of municipal wellheads. In the case of Berwick, which has no central water supply, a blanket restriction on certain activities covers the entire town to protect private wells from contamination.

Planning for groundwater resource protection can be complicated because wellfields rarely follow political boundaries; such is the case with the Kentville West Wellfields. Collaboration between the Municipality, the Towns, and smaller communities will continue to be necessary to effectively plan and manage groundwater resources in Kings County.



2.1.5 Agriculture

Climate change may have downsides for agriculture. Pest insect larvae that are normally killed by cold winter temperatures may survive through the winter as temperatures rise. As the incidences of pests grow, so too could pesticide use. Changes in precipitation could also be a problem. Although there is likely to be a larger volume of rain overall, the occurrence of rain will probably be less frequent. The increased spread between long, dry periods and very wet periods will surely stress crops and challenge farmers. An increase in extreme weather events will also challenge our agricultural system. In 2003 Hurricane Juan caused millions of dollars of damage to agriculture in Nova Scotia. We can expect to see similar costs in the future as the incidences of hurricanes, blizzards, and droughts become more common.

2.1.5.1 Pests

Pest pressures are expected to become more extreme in the future. Some growing years will have more pests to control, and different pests than other years.

New weed species are expected to be encountered in farming activities. There is risk associated with exposure to new weeds as they are often not recognized and overlooked in management decisions. This can result in rapid expansion of weed populations. Fortunately, there are good control strategies available for most weeds. New weeds to our region have likely been a production issue for other farming areas for a long time, thus, control practices are available. Canada has very robust pest control product strategies to enable rapid response to emerging pest issues.

Diseases and insects have the ability to multiply very quickly under the right growing conditions. The inherent variability of climate change means that these “right” conditions will probably occur more frequently than expected. Producers will need to develop more effective pest scouting strategies that provide them with near real-time data to enable proper control measures to be taken.

2.1.5.2 Erosion

The prospect of more extreme and/or more frequent heavy precipitation events will cause increased soil erosion if proper field management practices are not implemented. Soil is the lifeblood of agriculture and erosion is a direct cost to producers. Many erosion control practices that have been viewed as being only marginally profitable in the past may become more common as protecting the investment in soil structure will pay bigger dividends as a risk management tool.

2.1.5.3 Irrigation

Many Nova Scotia farmers are already in the interesting position of having to develop methods to remove excess water from their land at times and add additional water to their same lands at other times. New crops, new markets and a changing climate all point to an increase in the need for agricultural irrigation. The potential for overall drier and longer summers combined with hot extremes and heat waves will force many farmers to have improved access to irrigation equipment and irrigation water to better manage their production risks.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

2.1.5.4 Investment

Climate change is going to force producers to make investments in new equipment, new technology and new knowledge to remain competitive. The biggest challenge will be determining the best investments to make. The variability of future climate change in Nova Scotia has created significant uncertainty. It is not a simple exercise of adapting to an average increase in temperature or a decrease in average summer precipitation; it is an exercise in managing an unknown future risk. The agricultural community must develop strategies to reduce its vulnerability to climate change in order to prosper in the future.

2.1.6 Forests

Although Kings County is widely known for its agriculture, the importance of forestry in the County cannot be overlooked. Over 60 percent of the county is within the Forestry District. This land is designated in the current Municipal Planning Strategy for the primary purpose of resource production and associated industrial development.

In 2010 Kings County accounted for a total of 5 percent of the forestry harvest in Nova Scotia, with the majority of that being softwood harvest for use within the province^[6]. (Pg 5 Kings 2050 Background Paper 1 Environment) A change in biodiversity due to climate change could cause major problems to our forests and our forest industry. New pests arriving from southern climes, as well as an ecology already under stress, will likely result in a period of instability for the sector. As a result, the forest industry may be severely reduced, and timber used in the county may have to more frequently come from outside sources.

2.1.6.1 Species Shift

The subject of wetlands was addressed in the *Kings 2050* Environment background paper.

As the climate warms, and precipitation levels change, there may be an associated change in our forests. A recent study suggests that by mid-century in Kings County the number of growing degree days, amount of solar radiation, and soil water content will be suitable for different tree species than they are now. The study expects these conditions to be poor for spruces and firs, and a few hardwood trees such as birch and aspen, and be good for hardwood species such as red oak, black cherry, and witch hazel^[14]. There are more factors that affect tree species distribution than these three, so changes to Kings County forests are sure to be more complicated than suggested here. However, it is important to recognize that Kings County forests are unlikely to remain static, and that any changes over time could have important implications for the forestry industry, local ecosystems, and Kings County residents in general. (Pg 9 Kings 2050 Background Paper 1 Environment)

2.1.6.2 Pests

Forest pest management may also become more difficult as warmer temperatures lead to reduced winter kill of invasive pest species. Damage to trees from storm events may weaken or kill trees which may, in turn, provide additional habitat to pests.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

2.1.6.3 Fire

A combination of species shift and droughty conditions may very well result in more, and bigger, forest fires. There are species in our forest that are at the extreme southern limit of their range. Climate change will most likely result in some of these species dying off, resulting in an inordinate amount of dry tinder in our forests. With other trees dying due to new pest infestation, it is very likely that there will be an increased occurrence, and magnitude, of forest fires.

2.2 Potential Climate Benefits

The impacts of climate change are many. While most are considered to be negative in nature, there are a few changes that could have a positive impact on the economy of Kings County. Warmer temperatures should translate into energy savings for all facets of the community. The tourist industry, a major economic contributor, could experience a longer tourism season. The shoulder seasons may see a dramatic increase in traffic due to warmer weather. There is near unanimous agreement that we are, and will continue, to experience a longer growing season. This is made up of both a longer frost-free period and the accumulation of more heat units through the growing season. In a recent survey conducted by the Nova Scotia Federation of Agriculture (Power, 2008) over 50% of farmers surveyed felt that NS Agriculture would benefit from warmer temperatures. This benefit may take the form of new varieties, higher yields, earlier planting dates and later harvest dates. A longer frost free period can provide significant benefits to farmers who direct market their products as they can often increase market share and price in the earlier and later “shoulder” seasons.

3. Affected Locations

There are more than 2000 square kilometres of land, 130+ kms of coast and nearly 100 lakes in Kings County. The objective of this section is to identify specific areas and the locations of critical infrastructure that may be affected by climate change. Some locations are large and cross municipal boundaries (most notably tidal flooding), while others are very local in nature. Severe weather events, that may become more common with climate change, have the potential to cause massive property loss, economic disruption and risk to human lives in all areas of the Region. Affected areas, as a result of severe storms, will be largely dictated by the location of critical municipal infrastructure, such as roads and bridges, sewage and water treatment plants, water supplies and buildings. The areas that are most likely to be affected by climate change, as well as critical infrastructure, are shown on the Kings County Regional Climate Change Risk Assessment Inventory Map attached to this report.

It is generally agreed that flooding, either by rivers overflowing their banks, or by seawater inundation from tides and storm surge, has the potential to put large parts of the Municipality at risk. All seven villages in the county are located adjacent to a major river. Some of the Municipality’s larger unincorporated urban areas, such as North Kentville and Coldbrook, also have built up areas adjacent to, or on, river floodplains. The Town of Wolfville is adjacent to the Minas Basin and the Town of



Kentville is adjacent to the tidally influenced Cornwallis River. The Town of Berwick may be affected by possible changes to the drainage character of the Cornwallis River. Compounding the threat, parts of Kentville, Wolfville, Canning, New Minas and Port Williams are located behind dykes and would be at risk in case of a dyke breach.

In addition to the potential for major loss of private property in the event of a flood, a great deal of municipal infrastructure, including sewage treatment plants, pumping stations, water supply wells and municipal buildings are located within these tidal and river floodplains. These rivers and floodplains are shown on the Risk Assessment Inventory Map.

4. Facilities and Infrastructure

4.1 Municipal Water Supply

Municipal water supplies are a critical component of Municipal infrastructure that will be subject to increased risks from climate change. Municipal water supplies in the region are provided by groundwater. Potential climate change impacts for Municipal water supplies include:

- Inundation of wells by seawater where wells are located in floodplain areas.
- Intrusion of salt water into freshwater aquifers due to rising sea levels.
- Contamination of water supplies from severe storm water run-off.
- Flooding or overflow of surface water supplies from severe rain fall events
- Loss of functionality during power outages caused by severe weather.

Specific infrastructure that is at risk, and its location in each municipality, can be seen on the Risk Assessment Inventory Map, attached to this document.

4.2 Private Wells

While many of Kings County residents are served by municipal water supplies, some urban communities, and practically all of the rural residents and businesses get potable water from private wells. Urban communities such as the Town of Berwick and the villages of Kingston, Cornwallis Square and much of Aylesford are serviced by private wells. The unincorporated urban communities of Centreville, Coldbrook and North Kentville are also largely served by private wells.

Private utilities which use wells as the water source also exist in some areas of Kings County. There are approximately a half dozen of these utilities. They have as few as ten, and as many as seventy, connections.

While it is unknown how many private wells exist in Kings County, we do know that many are sand point and dug wells that are particularly susceptible to contamination from surface water. Drilled wells are normally cased to bedrock and are much deeper than sand points, which can be quite shallow.



Drilled wells are the norm for new wells but sand points are very common in areas built on sandy soils, including Kingston, Aylesford, Coldbrook, North Kentville and Grand Pré.

4.3 Industrial Wells

Provincial well log data identifies 58 industrial, 62 commercial and 159 non-irrigation agricultural wells. While this is by no means a complete list, it does give an indication of how many wells could be affected by changes to groundwater quality and quantity. It can be assumed that each of these wells serves an important role to the general economy of Kings County, either through manufacturing, food processing or livestock operations. Many citizens are employed in these industries that rely on the integrity of the wells, and the groundwater. There are also a number of wells that are specifically dedicated to irrigation, not included in the above mentioned data, that are a very important component of the food production industry that is a backbone of the Kings County economy.

4.4 Sewage Treatment

Most urban residents of Kings County are fortunate to be served by central sewer collection, with treatment taking place at a number of sites. The Towns of Wolfville and Berwick operate their own sewage treatment plants while Kentville's effluent is part of the large regional system that serves Coldbrook, Kentville, North Kentville, Greenwich and New Minas. This regional system is operated by the Municipality of Kings and is jointly governed by a regional committee. The Municipality also owns and operates plants in Canning, Aldershot, Waterville, Avonport, Hants Border (also treats Town of Hantsport), Aylesford and Greenwood. The Villages of Port Williams and Kingston own and operate the collection and treatment systems in their respective communities.

With the exception of Aldershot, Greenwood and Waterville, all sewage treatment facilities are located in river flood plains. While all have protective berms, the continued operation of these systems in the event of a major flood event would be a challenge. The MCCAP exercise is designed to identify primary areas for infrastructure adaptation and these plants are very much in the forefront of this discussion.

In addition to the treatment plants, there are many kilometres of sewer pipe, both gravity and force mains, as well as associated manholes and pumping stations. By virtue of their function within the collection systems, pumping stations are generally located in geographically low areas with many being located near watercourses or floodplains. Although the stations themselves were designed to be above the known flood levels, like the treatment plants, accessibility to a number of stations may be an issue. Of greater concern is the increased risk of sewage spills due to stations being overwhelmed from increased storm water infiltration caused by more severe weather events and/or aging infrastructure.

Locations of Sewage Treatment Plants are noted on the Risk Assessment Inventory Map, attached to this report.

4.5 Transportation Corridors

The road transportation networks in Kings County can be generalized into three different categories of priority; arterial roads, collector roads, and local roads.



The only arterial road is the 100 series highway, Highway No. 101. This highway is the main route of land transportation which runs parallel with the Valley floor and connects all communities and adjacent counties through an East-West corridor. This main route receives the highest priority for maintenance and capital improvements.

Collector roads for the purposes of this report are essentially numbered highways either running North-South or East-West. Collector roads running East West are Highway No. 221, Highway No. 201, Highway No. 1, and Highway No. 341. Collector roads running North-South are Highway No. 358, Highway No. 359, Highway No. 360, and Highway No. 12. These roads would receive secondary levels of funding for maintenance and capital improvements based on traffic volume.

All remaining roads are considered local roads. Although they have different daily volumes when compared to each other, their traffic volumes are much smaller in comparison to the arterial and collector roads. As such their funding levels would generally be less than that of collector roads which would vary by traffic volume and location.

Although traffic volume is a key variable when prioritizing funding allocation, other factors can take precedence, especially when considered against the potential effects of climate change. With climate change, the potential high water mark can be a valuable tool in prioritizing future maintenance planning for all road networks. Recently, a high water mark of 10.5 metres was calculated to be a reasonable level for future water elevations in Kentville. This elevation was transferred to a map of Kings County so a review of the transportation system of Kings County could be analysed for water at this level.

Arterial Road Analysis

Highway No. 101 – Running West to East, the first area where water elevations are close to the travelled surface is Exit 15, north of Berwick. This is the general headwaters area of the Cornwallis River which would naturally be affected by high water elevations. At the elevation of 10.5 m, the travelled surface of Highway No. 101 does not appear to be compromised. The second area of consideration is just West of Exit 14. Although the land in this area shows a large floodplain, the elevation of 10.5 m should not encroach on the travelled surface of Highway No. 101. The third and final area where water elevations may be of concern would be the twin bridges crossing the Gaspereau River, just West of Avonport. An elevation of 10.5 metres may very well compromise the bridges at this location. Further field investigations will be required.

Collector Road Analysis

Highway No. 221 – Running West to East, areas of concern are not encountered until Sheffield Mills, Canning, and just West of Kingsport. However, the effect of a water level of 10.5 m may be severe and will likely overtop the travelled surface in most of these areas, especially near Kingsport where present day storms often overtop the road. Further field investigations will be required.

Highway No. 201 – This collector road is located in the Western end of Kings County and serves as a connector to Greenwood from Highway No. 1 and also Greenwood to Annapolis County. This does not



appear to be affected by a 10.5 m water elevation. This is fortunate as other local roads connecting to Greenwood, namely Rocknotch Road and Bridge Street will likely be affected.

Highway No. 1 – This is the main collector road through Kings County and essentially runs parallel to Highway No. 101. Traffic volumes in certain sections of Highway No. 1 are actually higher than some sections of Highway No. 101, especially west of the Kings County border. Running West-East, potential problems are evident in Aylesford, Kentville, Greenwich, Wolfville and Avonport. Aylesford would likely be compromised by the Annapolis River, however further investigation will be required. Two section of Highway No. 1 are compromised in Kentville but could be protected by earth berms or similar infrastructure. The same is likely for Wolfville, however Highway No. 1 in Avonport appears to require substantial means of protection to prevent its loss. Further field investigations will be required.

Highway No. 341 - This collector road is located in the Eastern end of Kings County and serves mainly as a connector from Kentville to Highway No. 358, even though Highway No. 341 does continue eastwards toward the Minas Basin. This collector appears to be severely affected by a 10.5 m water elevation. Further field investigations will be required.

Highway No. 358 – This is a major collector road that runs north from Exit 11 through the communities of Greenwich, Port Williams, Canning, and Scots Bay and is also the closest access to Highway No. 101 for the Town of Wolfville. This collector road appears to be the most compromised and may become unmaintainable between the communities of Canning and Greenwich. Further field investigations will be required.

Highway No. 359 - This is a major collector road that runs North from within the Town of Kentville (aka Cornwallis Street) through the communities of North Kentville, Steam Mill, Centreville, and Halls Harbour. This collector road appears to be compromised near the Cornwallis River in Kentville and Canard River in Steam Mill. Although earth berms or similar infrastructure may address the 10.5 m elevation, further field investigations will be required.

Highway No. 360 – This collector road appears to be largely unaffected except for a small section North of the Town of Berwick at Exit 15. Raising the road profile may be a possibility here. Further field investigations will be required.

Highway No. 12 - This collector road appears to be unaffected.

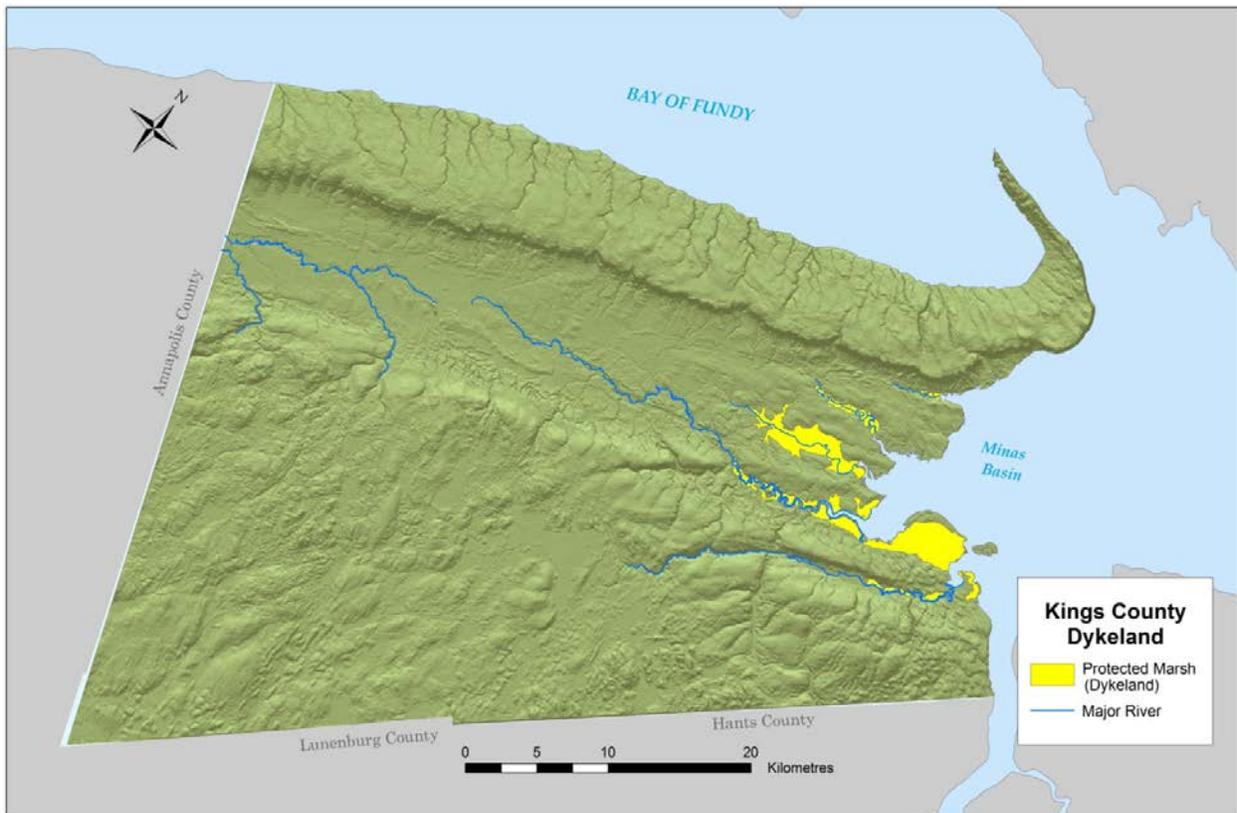
Local Road Analysis

Numerous local transportation systems are severely compromised by a 10.5 m water elevation. This is especially true of communities East of Kentville along the Valley floor, namely Steam Mill, Sheffield Mills, Canning, Port Williams, Wolfville, Grand Pre' and Avonport to name a few. Some areas could possibly mitigate water levels with earth berms or similar infrastructure but others would be very challenged to do so with the amount of coastline affected by the Minas Basin. Further field investigations of these areas are required with local “Fight or Flight” adaptation strategies developed with local stake holders.



4.5.1 Dykes

There are almost 50 kilometres of dykes in Kings County that protect over 3,500 hectares of farmland and developed areas. The purpose of these dykes was initially focused on the creation and protection of farmland as initiated by the Acadians in the late 1600's. Over time, and with urban settlement, the dykes have also come to protect a significant number of buildings and municipal infrastructure. While occasional flooding of farmland from failure of the dykes is tolerable, the risks to costly infrastructure poses a larger concern. Climate change will heighten this risk to that infrastructure as the dykes become more likely to fail with sea level rise and severe weather events.



The Nova Scotia Department of Agriculture is actively exploring priorities and developing a schedule for reinforcing and raising dykes to adapt to expected sea level rise.

4.5.2 Assets

Community assets can be identified as land and buildings owned or managed by government and community organizations. These assets cover a wide spectrum and include town halls, community



KINGS 2050



CLIMATE CHANGE ACTION PLAN

centres, sports facilities, libraries, schools, hospitals, church, library, police and fire departments, even a community landmark or symbol. Or it may be a public place that already belongs to the community- a park, a wetland, or other open space. For the sake of this report only those essential assets at risk due to a drastic storm surge have been identified. The Kings County Regional Climate Change Risk Assessment Inventory Map, that accompanies this report, identifies these assets.

5. Who and What Will Be Affected

5.1 Most Vulnerable

Sections 2 and 3 of this document describe the likely impacts which will be felt as a result of climate change. There is little information available regarding who will be most vulnerable in developed countries; the research focus appears to have been primarily on developing countries. However, there is some information available on the impact of climate change on those living in poverty or near-poverty in developed countries, and there is now considerable information regarding the present problems of those experiencing homelessness in Kings County (*Taking Steps Together to Establish Safe Affordable Housing by Engaging Communities in Kings County, Nova Scotia, July 2013, Penni Burrell*).

Everyone will be affected in some manner by climate change: the impact will vary by degree from one income bracket to another and one physical location to another. Each impact will have a wide-rippling effect on others.

Gradual Changes

All aspects of both the agriculture and forestry industries will become more uncertain as earlier noted. The impact on employment in these fields will be similar to the impacts on tourism.

Households which exist on the income provided by tourism and the agriculture and forestry industries are often those which do not have the skills, education, information, and capital to adapt to change and seek other employment.

Warmer winters may also have a number of negative effects on health: the number of days for relatively inexpensive outdoor winter activities such as skating and cross-country skiing will decrease and may result in negative impact on the health of those who would now participate in these activities.

Many jobs which involve physical outdoor labour are paid at or near minimum wage; those in these jobs will be affected by increased summer temperatures. *Heat illnesses can lead to long-term health problems and even death* (Health Canada http://www.hc-sc.gc.ca/ewh-semt/pubs/climat/heat-active_chaleur-actif/index-eng.php) Employers will need to watch for indicators of heat illness and modify expectations of those working in extreme heat – once again increasing the costs of necessary infrastructure such as roads, with these costs being borne by the taxpayer. As noted in Subsection



KINGS 2050

25



CLIMATE CHANGE ACTION PLAN

4.1.7 above, many of the structural assets of the municipal units will be at risk during a flood, again increasing costs to all taxpayers.

With agriculture affected, the cost of food will rise, including the local produce on which we are encouraging more dependence.

Housing which is affordable to those who work in Kings County has been the focus of the Housing First Association of Kings County since its inception in early 2012. More stringent requirements for climate control and for flood proofing for new buildings, including houses, will increase the costs of those buildings affected, and may gradually increase development pressure in areas where flood proofing is not required.

If the area where development is possible is further restricted, as is likely with increasing floodplains, and if the preservation of agricultural land remains a focus of the county, there will be a need for increased development density. Since a net population decline over the next 40 years appears to be the *trend* (Pg 5, Background Paper 2, Demographics, Development Activity and Land Use), any increase in density can be gradual. However, it is likely that any existing structures within the present or future “open space” designations will not be able to increase the number of dwelling units within existing structures, reducing the potential value of these properties and the number of dwelling units created within existing housing stock.

(Since 1991), the proportion of senior citizens has increased dramatically ...and will continue to grow as the baby boomer generation ages.

(Pg 4 Kings 2050 Background Paper 2, Demographics, Development Activity and Land Use).

Seniors and children are more at risk of harm from increases in heat and heat waves; those on a fixed income may have no way personally to avoid the heat, a responsibility which may fall to private agencies and government.

The impact of the more gradual climate change effects will be an increase to all existing vulnerabilities, as the following changes are experienced:

- increased power costs
- increased utility costs and taxation as cost of maintaining the infrastructure rise
- increased food costs
- increased costs and decreased supply of potable water
- decreased employment in tourism, agriculture and forestry sectors
- increased stress on outdoor labourers and increased costs to employers during summer seasons
- decrease in “inexpensive” outdoor winter recreation (skating, snow shoeing, cross-country skiing)



Psychological Harm

Psychological harm has been observed to increase after storms and other disasters. (Pg 150-157 Gasper, R, Blohm, A, Ruth, M. Social and Economic Impacts of Climate Change on the Urban Environment 2011. 3) Post-traumatic stress disorder, depression, anxiety and other psychological disorders can often be completely debilitating, which could have a very negative effect on the workforce.

There may be an increased reliance on social programs such as unemployment insurance, welfare, and social security pensions. Unemployment may become a chronic issue in the region.

Catastrophic Events

People with limited financial means are the least likely to have personal alternate accommodation available during or following a catastrophic event. Those with means can pay for short or longer-term alternate accommodation either personally or through their insurance companies.

Those who live on First Nations reserves within the county may be particularly affected by catastrophic events associated with climate change – not only will they experience the impacts, but they are within physical boundaries which may restrict their ability to relocate to avoid flooding, for example.

In short, those with limited financial means will not have the resources to protect themselves day-to-day from the more extreme heat and cold or to buy nutritious food and gain access to clean water, and will not be able, in case of catastrophic events, to relocate to avoid flooding or other consequences. Those with greater financial means will be stressed by increasing costs and the need to provide more support to those in need. Some living on some reserves may experience all of these impacts and also be least able to move to avoid the impacts.

The opportunity to lessen these impacts still exists:

“By making public institutions responsive, participative, and accountable to those they serve, decision making process and implementation activities can be robust enough to deal with the challenge of climate change.”

(Pg 24; Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation; The World Bank et al).

5.2 EMO's Role

The Emergency Management Organization within Kings County is regional in its scope and responsibility. The four municipal units have partnered in the creation of one comprehensive Regional Emergency Management Plan. This work is undertaken by a Regional Emergency Planning Committee with over-site by an Emergency Advisory Committee composed of councillors from each of the municipal units. The Plan is specific in identifying and mapping risks and mitigation strategies, along with identification, management, and support to those agencies expected to respond. The Municipality of the County of Kings has also partnered with those services and agencies responsible for providing



KINGS 2050



CLIMATE CHANGE ACTION PLAN

the basic needs of life, medical, food, and shelter to comfort and temporarily house those without means to support themselves during an emergency.

The Kings Regional Emergency Management Organization (REMO) has established alert systems and specific criteria to initiate a response utilizing local resources for the entire length of time necessary to mitigate the effects of an emergency.. In the event that any one municipality's resources are not adequate, the Kings REMO can provide additional resources through the local school board for mass evacuation transportation and mass sheltering and feeding through resources available at the local university and community college campuses.

Should the resources of the four municipal units working under the Kings REMO plan become exhausted, we have access to the provincial Emergency Management Organization in Halifax for additional assistance. The benefits of the provincial EMO would be the immediate activation of the Department of National Defence which has two very large facilities, 14 Wing Greenwood, and Military Training Centre, Aldershot , both within Kings County boundaries. Both facilities are capable of responding with military personnel as well as providing mass evacuation, sheltering, and feeding of those who cannot provide for themselves.

The Kings REMO stands ready to activate its well equipped emergency operations centre to respond and recover from an emergency.

5.3 Health and Safety During Extreme Events

A significant part of the Kings REMO Emergency Plan is its communications with the provincial EMO and the Hurricane and Extreme Weather Centre in Dartmouth Nova Scotia. As soon as predictions can forecast a potentially damaging weather event, the centres' staff initiate weather forecast updates every six hours, advising the Kings REMO Emergency Management Coordinator of pending weather emergencies. Municipal staff are assigned to the EOC based on the intensity and severity of the event. As advisories are received, the Kings REMO sends pertinent information bulletins to all emergency responders as well as those who might be called upon to provide food and shelter. At the same time, the Kings REMO issues advisories to local media providing information and instructions for the security of person and property. As necessary, advisories would provide instructions for evacuation of those living or working within flood plains. Staff are prepared 24/7 to open the Emergency Operations Centre and staffing it appropriately to ensure the provision of emergency services.

Efforts are focused on public notification of a pending weather event, appropriate actions for sheltering in-place or evacuation before the storm, and response during an emergency appropriate the needs of those affected. Once the response efforts are complete, personnel are assigned to recovery efforts.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

5.4 Economic Implications

Planning for long-term recovery that could occur with a significant event, such as a major flood within the County, seems like a difficult task when there are cleanup and rebuilding needs to address. The Municipality of Kings, and the three Towns, will need to develop a vision for how it will rebuild the economy. It takes time, leadership, and resources to develop an economic recovery plan with buy-in from community stakeholders. However, a post-disaster strategic plan will provide the opportunity to re-evaluate economic objectives and establish strategies and action steps to make progress toward long-term recovery.

Actions steps would include:

Step 1: Conduct an economic impact study

The regional partners should conduct an independent economic impact assessment, even though external agencies will perform their own assessments, after an event such as a flood. The impact study would assess both the physical damage (properties, inventory, etc.) and the economic damage to industry and the local economy.

Accessing this information will have its challenges. Where possible, the study should measure the following economic impacts:

- Tax revenue loss (sales, property, employment)
- Job loss
- Loss of wages
- Business closures and interruption (loss of productivity)
- Damage to infrastructure
- Damage to property (commercial, industrial, residential)
- Damage to natural resources (which have an impact on local industries)

Step 2: Initiate an economic recovery planning process.

Within the process, topics such as business retention, business assistance and redevelopment of downtown areas should be covered. The analysis would include a detailed look at key industries and anchors and specific quantitative and qualitative data on how they would be impacted. This analysis would additionally provide insight into the 'current' state of the County, including whether economic development targets should be re-evaluated; a better understanding of competitive positioning; and could possibly lay the foundation for a re-evaluation of the overall long-term economic development strategy for Kings County.

It may be beneficial to have a third party conduct this economic analysis due to:

- limited local capacity issues
- assurance of a speedy planning process



- the need for a fresh perspective on the situation

The following steps will assist with the economic analysis:

- Review existing strategic plans and studies for relevancy, evaluate existing business development targets, and revisit economic issues
- Hold an economic redevelopment charrette with various stakeholders (planners, local government, businesses, citizens, etc.) with a focus on geographic areas, such as the downtown cores or neighborhoods of the affected area(s)

Step 3: Create a plan with action strategies

Create specific actions and tactics to provide direction on economic ‘recovery’ priorities. Understand the economic analysis that has been done, before any actions are proposed or implemented. A thorough understanding of the current situation will provide critical insight on how the local government should move forward.

Implement a phased approach to economic recovery where clear goals and objectives are set for the short-, medium- and long-term. Source out the appropriate organizations to take ownership of and carry out defined tasks.

1. Ensure these organizations have the resources to carry out each task, in terms of capacity, ability and financial means.
2. Ensure that business retention and expansion is addressed before any recruitment efforts take place. Existing businesses are the ones that are most likely to rebuild the economy.
3. Ensure that strategies and actions are specific, with measurable outcomes, to provide a basis for monitoring progress.

Coordinate the action plan with the development of an effective communications strategy as the public should be aware of this planning effort and how time, resources and funds will be prioritized.

5.4.1 Negative Implications

Climate change could have negative implications on certain sectors more than others. Depending on the weather patterns, the length of the tourist season, the events which are planned during particular seasons and the overall attraction to the Valley from out of province tourist will all be impacted. Festival planners will have to re-evaluate the profitability of their event if there is a prediction of continuous poor weather during the month when the event is held. Decisions on whether to continue, change the timing, or no longer have the event would be required. Accommodators will have to look for additional revenue sources such as conferences that could be held indoors and the overall numbers of participants in the agri-tourism business could see a decline in participation.

Agriculture is a major economic driver in the County and could be negatively impacted by climate change. With an unstable ecosystem there is a more likely chance of species invasion, such as the codling moth in apple trees. As well, erratic weather such as drought and heavy rains could cause crop



KINGS 2050



CLIMATE CHANGE ACTION PLAN

damage by way of mold, slug infestation, and withering. An early summer or winter could mean too much or not enough microbiological die off. Early or late frosts could completely destroy an entire season. As such, the ability to rely on farming for income could be compromised.

5.4.2 Positive Implications

It is also important to keep in mind that there might be long-term positive implications for growth in the county due to a dramatic change in the weather. It is quite likely that authorities in the province would put forward infrastructure projects to avoid, or at least minimize the impact of such terrible events in the future. As such, employment opportunities in trades and technology related fields could increase. There certainly will be education opportunities resulting from climate change and man's attempt at adapting to it. More companies may be looking for engineering or science graduates. There may also be more funding coming from industry for programs focused on climate change and ecology research. This could mean an increase in students going to Acadia University or Kingstec Community College who exit their program with a job waiting for them in the region.

In addition, independent research in the region may see an increase in industrial/commercial interest in the effects of climate change. More scientific job opportunities could bring rise to an entirely different source of economic growth.

5.5 Environmental Issues

5.5.1 Contamination

Significant weather events, including tidal storm surges and hurricanes, can create the potential for contamination, through:

- Inundation of sewage treatment plants by high tides,
- Damage to fuel storage infrastructure , and
- Damage to pesticide and herbicide storage facilities.

Tidal inundation is a significant consideration in developing an emergency response to an environmental contaminant events. Kings has a significant coast line that reaches well into the heart of Kings County by a river estuary. Emergency response plans will need to consider flooding by tidal inundation and heavy rainfalls.

The regional municipal sewage treatment plant, located in New Minas, is within the original flood plain of the Cornwallis River, and near the mouth of the Minas Basin Estuary. Any breach of the dyke at the treatment plant would see an inundation of the treatment cells with a flushing out to sea of untreated sewage. That event could impact occupancies on the Cornwallis River and within the Estuary, including the downtown cores of Kentville and Wolfville. As a measure of precaution, the treatment plant operators have an emergency plan to mitigate the effects of most weather events. In preparation for a pending event, operators ensure fuel is on hand for emergency power generation, along with performing equipment checks. During the storm, operators remain at the plant to ensure all of the



systems and electrical back-up are working to properly control inputs and outputs within each cell prior to and during a storm.

5.5.2 Wetlands and other Sensitive Habitats

Wetlands such as bogs, swamps and fens are very important to the overall health of our ecology. In addition to providing for a diverse range of flora and fauna, they are also a key factor in groundwater recharge. Should predictions of droughty periods, followed by intense precipitation events, become the new norm, the overall health of the wetlands and our groundwater will be affected. Wetlands are technically the responsibility of the Province. In light of new stresses on these key ecosystems, it is imperative that the NS Department of Environment take a more active position in wetland protection and preservation. Municipalities, including those in Kings County can restrict development in these areas and contribute to their protection.

Other sensitive areas, such as steep ravines, shorelines and river floodplains are also subject to development restrictions by municipalities. Through research completed for the *Kings 2050* project, some of these areas have been identified, particularly floodplains and steep slopes.

5.5.3 Hazardous Materials (storage and safety standards)

The Municipality of the County of Kings and the Towns of Wolfville, Kentville and Berwick house one of the five Provincial Hazardous Materials Teams. This team is made up of technically trained firefighters from the Wolfville, New Minas and Kentville Fire Departments. The overall risk within in the municipality is moderate to high. Although the potential is high, there are not a large number of responses to events in the farming community. Of greater concern is the presence of Highway 101 where hundreds of thousands of gallons fuel and other chemicals travel through our communities on a daily basis. This introduces a great risk of accidental spills on our roadways.

The last flood in the Town of Kentville in 2001 resulted in many residential oil tanks being ripped from their bases and some sent adrift downstream on the Cornwallis River. Given a larger flood area, this could spread to our industrial and farming areas throughout the region, and lead to a more significant area of contamination.

Some of our higher risk areas include:

- Air Force Base (Greenwood)
- University and High School Labs
- Farms
- Pharmaceutical Labs
- Transportation (Hwy 101)
- Manufacturing Facilities
- Large amounts of propane in commercial districts



6. Priorities for Adaptation

The four municipal units of Kings County, in taking a regional approach to climate change adaptation, have worked cooperatively towards identifying issues and priorities for the region. The adaptation priority tables contained in this report are the result of each municipal unit completing detailed analysis as per the Municipal Climate Change Action Plan Guidebook provided by the Nova Scotia Department of Municipal Affairs. Summary tables have been created in an attempt to reduce repetition and simplify presentation of the information.

Priorities of a regional nature appear separately from those that are municipal jurisdiction specific, though there may be some duplication. The Regional Adaptation Priority Summary Table can be found in Appendix A of this report. Appendices B through E are comprised of data specific to the individual municipal units. The Municipality of Kings data can be found in Appendix B, Appendix C is the Town of Kentville, Appendix D is the Town of Wolfville and Appendix E identifies the Town of Berwick's priorities. Information pertaining to the seven Villages located in Kings County can be found in the Municipality of Kings tables.

7. Mitigation

The Municipal partners in this project have each been working towards reducing their energy use through a variety of means. The mitigation tables, Appendices F- K identify the mitigation efforts to date and, where practical, future actions or direction. Each of the municipal units in Kings County is aware of the importance of mitigating greenhouse gas emissions and fully expect to continue down the road to energy efficiency.



KINGS 2050



CLIMATE CHANGE ACTION PLAN

Appendix A Regional Adaptation Priorities

SEWAGE TREATMENT PLANTS				
There are 10 sewage treatment plants in the Kings Region and several are vulnerable to climate change, sea level rise and flooding in particular. These treatment plants represent millions of dollars in Municipal infrastructure and damage or loss to any of the systems could result in serious environmental and economic challenges. There are multiple areas for regional cooperation, including mutual aid agreements and working together with the Dept. of Agriculture to strengthen key dykes.				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Regional STP Port Williams STP Wolfville STP	<ul style="list-style-type: none"> High Temperature Erosion High winds Extreme rain Extreme snow Sea level rise Flooding 	<ul style="list-style-type: none"> Damage or destruction of earthen lagoon berms, buildings Impaired biological treatment functions, more algae blooms in summer, which affects effluent quality Odor issues Loss of power Impaired access to STPs Seawater/river intrusion STP capacity overload 	<ul style="list-style-type: none"> Maintenance of vegetative cover on earthen berms Strengthened and increase maintenance of access roads Retrofit aeration systems at some STPs Ongoing review of influent and effluent makeup Partial review of processes at STP to ensure optimized for current and projected future flows Dedicated maintenance vehicles with off-road, all weather capacity Back-up generator Risk assessment of each STP Initial Business Continuity Review AGRG flood/sea level report Installed backflow valve to keep river water out of system Increase height of lagoon berms 	<ul style="list-style-type: none"> Algae management plans Complete review of STPs to ensure optimum operations Review to identify if any additional erosion controls are feasible Regular review and update Business Continuity Plans Reduce storm water infiltration into collection system Work with NS Dept of Agriculture to strengthen dykes surrounding STP Review access road design to ensure long term access Review lagoon berm height Mutual Aid Agreements
Waterville STP	<ul style="list-style-type: none"> Extreme rain event Extreme snow event Low temperature Flooding High Temperature 	<ul style="list-style-type: none"> Partial or complete loss of access to STP and Septage facility Damage or destruction of access road and bridge due to flooding or ice jam River intrusion Impaired biological treatment functions, more algae blooms in summer, which affects effluent quality Odor issues 	<ul style="list-style-type: none"> Installed Infiltration ditch which provides overflow discharge for STP and additional effluent treatment Some modifications to access road and bridge for flood conditions 	<ul style="list-style-type: none"> Review access road and bridge design to ensure long term access Develop contingency plan for either alternate access route to septage facility or alternate disposal site Develop contingency plan for ice control in river Algae management plans Complete review of STPs to ensure optimum operations
Berwick STP	<ul style="list-style-type: none"> Flooding Earthquake 	<ul style="list-style-type: none"> Damage or destruction of earthen lagoon berms, buildings Impaired biological treatment functions, more algae blooms in summer, which affects effluent quality Odor issues Loss of power Impaired access to STP STP capacity overload 	<ul style="list-style-type: none"> Maintenance of vegetative cover on earthen berms Strengthened and increase maintenance of access roads Back-up generator Risk assessment of STP Initial Business Continuity Review Increase height of lagoon berms 	<ul style="list-style-type: none"> Algae management plans Complete review of STPs to ensure optimum operations Review to identify if any additional erosion controls are feasible Regular review and update Business Continuity Plans Reduce storm water infiltration into collection system Work with NS Dept of Agriculture to strengthen dykes surrounding STP Review access road design to ensure long term access

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

				<ul style="list-style-type: none"> • Review lagoon berm height • Mutual Aid Agreements • Relocate facilities
--	--	--	--	---

LIFT STATIONS

There are numerous sewage lift stations in the Kings Region and many are vulnerable to climate change, flooding and high winds in particular. These stations represent millions of dollars in Municipal infrastructure and damage or loss to any of the systems could result in serious environmental and economic challenges. The individual municipal units can retrofit their respective stations to account for the effects of climate change or longer term assess the feasibility of relocating certain stations. There are multiple areas for regional cooperation, including mutual aid agreements and working together with the Dept. of Agriculture to strength key dykes.

Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
All	<ul style="list-style-type: none"> • Erosion • High winds • Extreme rain • Extreme snow • Sea level rise • Flooding 	<ul style="list-style-type: none"> • Release of raw sewage into the environment • Backup of sewage into homes/businesses • Damage or destruction of equipment, buildings • Odor issues • Loss of power • Partial or complete loss of access to station • Overload of downstream lift stations and sewage treatment facilities 	<ul style="list-style-type: none"> • Upsized some wells for extra storage capacity • Require all service laterals to be equipped with backflow preventions valves • Dedicated maintenance vehicles with off-road, all weather capacity • Capacity to connect back-up generator to station • Risk assessment of each Collection system • Initial Business Continuity Review 	<ul style="list-style-type: none"> • Retrofit or relocate Retrofit stations to adapt to site conditions certain stations when time for life cycle renewal • Review to identify if any additional erosion controls or flood are feasible • Regular review and update Business Continuity Plans

VULNERABLE COMMUNITIES/DRAINAGE SYSTEMS

The Minas Basin shoreline and the lower reaches of the rivers that flow into the Basin will be particularly affected by sea level rise and flooding. Many residents, businesses, and critical infrastructure are in close proximity to these water bodies. There is potential risk to human health and safety due to resulting damage or loss of public and private infrastructure in addition to serious environmental and economic challenges. There are multiple areas for regional cooperation, including mutual aid agreements and working together with the Dept. of Agriculture to strength key dykes.

Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Port Williams, Canning, Wolfville, Kentville	<ul style="list-style-type: none"> • Extreme rain event • Extreme snow event • Flooding • Low temperatures • Sea Level Rise 	<ul style="list-style-type: none"> • Damage to homes, businesses • Partial or total loss of access to road network which will limit access to other areas north of the Region • Clogging of drainage systems by ice, snow • Overflow of ditches onto existing properties, roads 	<ul style="list-style-type: none"> • Land Use Planning and Secondary Planning Strategy identified flood prone areas, zoning requirements 	<ul style="list-style-type: none"> • Ongoing winter maintenance to keep storm drains free of ice and snow • Share information with REMO and DTIR • Review land use and development regulations to improve flood requirements

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

WELLHEADS/WATER UTILITIES

Many communities get their drinking water from public utilities that utilize groundwater sources for their supply. Climate change impacts may affect the quality and quantity of water within the source aquifers that these utilities rely upon. The loss or contamination of these systems could compromise human health and lead to sanitation issues. Individual utilities can evaluate the feasibility of securing alternate sources or further backup systems. There are multiple areas for regional cooperation, including mutual aid agreements and working together with the Dept. of Agriculture to strength key dykes.

Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Greenwood Water Utility Wellfields	<ul style="list-style-type: none"> • Extreme rain event • Flooding • Erosion • High temperatures • Low temperatures 	<ul style="list-style-type: none"> • Washout of natural/manmade contaminants into wellfield • Increase in “cosmetic” water use • Decrease in aquifer recharge due to extra runoff from higher intensity rain events • Increased chemical use, storage requirements due to changes in water temperatures • Impaired access to production wells, treatment facility • Loss of power 	<ul style="list-style-type: none"> • Wellhead Protection Zones to limit certain types of development with most vulnerable areas • Source Protection Committee formed to advise Council on protective measures for wellfield • Public education programming • Study for backup water supply • Redundant UV treatment systems • Extended chlorine disinfection within reservoirs • Improvements to access roads • Perimeter fencing near wellheads • Dedicated maintenance vehicles with off-road, all weather capacity • Back-up generator • Initial Business Continuity Review 	<ul style="list-style-type: none"> • Water conservation bylaw • Programs or bylaws to enhance spill prevention within wellhead areas • Install backup water production well • Long term capital program to add further treatment redundancies • Ongoing public education programs • Review to identify if any additional erosion controls are feasible • Regular review and update Business Continuity Plans
Kentville <ul style="list-style-type: none"> • East End Pumphouse • Bonavista Pumphouse • West End Pumphouse • Mitchell Avenue Pumphouse and Treatment Plant 	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Saltwater Intrusion 	<ul style="list-style-type: none"> • Each of these pump houses contain two wellheads which collectively supply the Kentville drinking water distribution system. These locations are close to or in the floodplain. If significant enough erosion occurs, this could leave the wellfields vulnerable to saltwater intrusion, spoiling the water supply. • Potential loss of water supply if equipment is damaged in flood. 	<ul style="list-style-type: none"> • A contour map showing potential flood levels has been produced. • Wellhead protection zones limiting certain types of uses with potential to contaminate ground water. 	<ul style="list-style-type: none"> • Update Source Water Protection Plan beginning December 2013.
Berwick	<ul style="list-style-type: none"> • Extreme rain event • Flooding • Erosion • High temperatures • Low temperatures 	<ul style="list-style-type: none"> • Washout of natural/manmade contaminants into wellfield • Decrease in aquifer recharge due to extra runoff from higher intensity rain events • Increased chemical use, storage requirements due to changes in water temperatures • Impaired access to production wells, treatment facility • Loss of power 	<ul style="list-style-type: none"> • Wellhead Protection Zones to limit certain types of development with most vulnerable areas • Source Protection Committee formed to advise Council on protective measures for wellfield • Public education programming • Perimeter fencing near wellheads 	<ul style="list-style-type: none"> • Programs or bylaws to enhance spill prevention within wellhead areas • Long term capital program to add further treatment redundancies • Ongoing public education programs • Review to identify if any additional controls are feasible • Regular review and update Business Continuity Plans
Wolfville	<ul style="list-style-type: none"> • Extreme rain event • Flooding 	<ul style="list-style-type: none"> • Contamination of water supply by run-off 	<ul style="list-style-type: none"> • Source Water Protection Plan adopted • Implementation of the SWPP is ongoing 	<ul style="list-style-type: none"> • Consider Provincial Designation for well head areas • Adopt Land Use regulations for well head areas.

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

	<ul style="list-style-type: none"> Erosion Salt water intrusion 	<ul style="list-style-type: none"> Contamination of water supply by salt water intrusion Limited access to well heads 	<ul style="list-style-type: none"> Wellhead protection criteria implemented in development agreements 	
--	---	---	--	--

MUNICIPAL BUILDINGS/PROPERTY				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
MoK Municipal Complex Wolfville Town Hall Kentville Fire Station Kentville Police Station	<ul style="list-style-type: none"> Sea level rise Erosion High winds Extreme rain Extreme snow 	<ul style="list-style-type: none"> Damage or destruction of buildings Loss of power Seawater/river intrusion Partial or complete loss of access to building Loss of REMO Operations Centre 	<ul style="list-style-type: none"> Backup generator Improvements to dykes around property Dillon Building Assessment 2006 Catalyst Building Assessment 2011 HVAC, control system retrofit Replacement of two roof sections New chiller for building Repairs to brick façade and chimney 	<ul style="list-style-type: none"> Work with Town of Kentville to address/reinforce flood control measures Emergency exit from Justice Way LED Lights when time for life cycle renewal Confirm location of alternate REMO Operations Centre
Berwick Hydroelectric Dam	<ul style="list-style-type: none"> Extreme rain event Flooding Erosion High temperatures Earthquake 	<ul style="list-style-type: none"> Damage or destruction of dam Downstream properties damaged or destroyed due to loss of dam Loss of power generation by facility Impacts to aquatic life 	<ul style="list-style-type: none"> Emergency evacuation, communication plans 	<ul style="list-style-type: none"> Increase dam height Increase emergency spillway capacity Review to identify if any additional erosion controls are feasible Review access road design and upgrade as needed Remote access and controls for control gates Access for other modes of transport Improve monitoring and access for aquatic life Review emergency plans

ROAD NETWORKS				
Many sections of the road network in the Kings Region are vulnerable to sea level rises, flooding, and resulting erosion. The loss of access to many areas of the Kings Region could be severely disruptive to emergency services, the general public. Economic losses could be significant by restricting access to key agricultural resources and assets, disruption of tourism activities, and limiting local workforce mobility. There are multiple areas for regional cooperation, including mutual aid agreements and working together with the Dept. of Agriculture to strength key dykes.				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Highway 101 @ Gaspereau River Highway 221 @ <ul style="list-style-type: none"> Sheffield Mills Canning West of Kingsport Highway 1	<ul style="list-style-type: none"> Sea/river level rise Erosion High winds Extreme rain Flooding 	<ul style="list-style-type: none"> Road rendered partial or completely impassible to flood and high tidal conditions Damage or destruction of the two bridges and approaches Highway 358 between Canning and Greenwich is considered particularly vulnerable and may be a total loss 	<ul style="list-style-type: none"> CBCL Flood study AGRG report Town of Kentville Dyke report Information provided to NSDTIR and NSEMO <i>Kings 2050</i> road Network Study 	<ul style="list-style-type: none"> Work with NSDTIR to improve flood resiliency of bridges roads, culverts, etc. Identify alternate access routes to impacted communities and critical facilities Review mutual aid agreements with other municipal units, provincial/federal agencies

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

<ul style="list-style-type: none"> • Aylesford • Kentville • Greenwich • Wolfville • Avonport <p>Highways 341 & 358</p> <ul style="list-style-type: none"> • Zone between Canning, Greenwich, and North Kentville <p>Highway 359 @</p> <ul style="list-style-type: none"> • Cornwallis River (Kentville) • Canard River (Steam Mill) • Halls Harbour <p>Highway 360 Between Berwick and Exit 15 interchange</p>				
East Main Street at Elderkin Brook (Kentville)	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	<ul style="list-style-type: none"> • East Main Street connects Kentville to New Minas, and losing this connection would force commuters and visitors to take the 101 highway. • Loss of primary access route to Valley Regional Hospital 	A contour map showing potential flood levels has been produced.	<ul style="list-style-type: none"> • Work with the Department of Transportation and Infrastructure Renewal to decide on a strategy involving either relocation of the road or the installation of a culvert/bridge/berms in this area. • Prepare a protocol for redirecting traffic in this area in the event of flooding in this area. • Develop floodplain development standards; or prohibit further development within the floodplain
Cornwallis Bridge (Kentville)	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	<ul style="list-style-type: none"> • The bridge could wash out, cutting the northern part of Kentville off from the downtown. • Loss of primary access route to Valley Regional Hospital • Loss of critical power and communications links 	Communication and planning with the DTIR, NSP, and Valley Communications on the upcoming bridge repair tentatively scheduled for 2015.	<ul style="list-style-type: none"> • Ensure the rearrangement of water/sewer/storm mains in preparation for the bridge renewal. • Contact NSP to coordinate the required alterations to their assets in this area.
Belcher St (Meadowview)	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	<ul style="list-style-type: none"> • Overflow of watercourse, storm system onto existing properties, roads • Roads rendered partial or completely impassible due to overflow conditions • Loss of primary access route to 	<ul style="list-style-type: none"> • CBCL Flood study • AGRG report • Town of Kentville Dyke report • Information provided to NSDTIR and NSEMO 	<ul style="list-style-type: none"> • Work with the Department of Transportation and Infrastructure Renewal to decide on a strategy involving either relocation of the road or the installation of a culvert/bridge/berms in this area. • Prepare a protocol for redirecting traffic in this area in the event of flooding in this area. • Develop floodplain development standards; or

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

		Valley Regional Hospital		prohibit further development within the floodplain
Valley View Rd (New Minas)	<ul style="list-style-type: none"> • Extreme rain event • Flooding 	<ul style="list-style-type: none"> • Overflow of watercourse, storm system onto existing properties, roads • Area next to Valley View rendered partial or completely impassible due to overflow conditions 	<ul style="list-style-type: none"> • Replaced storm sewer and grates, removed accumulated debris 	<ul style="list-style-type: none"> • Ongoing inspection and maintenance to limit debris buildup in future • Work with Valley Waste to find ways to limit illegal dumping within watershed

Appendix B Municipality of Kings Adaptation Priorities

SEWAGE TREATMENT PLANTS				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
All (except Avonport)	<ul style="list-style-type: none"> • High Temperature • Erosion • High winds • Extreme rain • Extreme snow 	<ul style="list-style-type: none"> • Damage or destruction of earthen lagoon berms, buildings • Impaired biological treatment functions, more algae blooms in summer, which affects effluent quality • Odor issues • Loss of power • Impaired access to STPs 	<ul style="list-style-type: none"> • Maintenance of vegetative cover on earthen berms • Strengthened and increase maintenance of access roads • Retrofit aeration systems at some STPs • Ongoing review of influent and effluent makeup • Partial review of processes at STP to ensure optimized for current and projected future flows • Dedicated maintenance vehicles with off-road, all weather capacity • Back-up generator • Risk assessment of each STP • Initial Business Continuity Review 	<ul style="list-style-type: none"> • Algae management plans • Complete review of STPs to ensure optimum operations • Review to identify if any additional erosion controls are feasible • Regular review and update Business Continuity Plans
Regional STP	<ul style="list-style-type: none"> • Sea level rise • Extreme rain event • Flooding 	<ul style="list-style-type: none"> • Seawater/river intrusion • STP capacity overload • Partial or complete loss of access to STP 	<ul style="list-style-type: none"> • AGRG flood/sea level report • Installed backflow valve to keep river water out of system • Increase height of lagoon berms 	<ul style="list-style-type: none"> • Reduce storm water infiltration into collection system • Work with NS Dept of Agriculture to strengthen dykes surrounding STP • Review access road design to ensure long term access
Canning STP	<ul style="list-style-type: none"> • Sea level rise • Extreme rain event • Flooding 	<ul style="list-style-type: none"> • Seawater/river intrusion • Partial or complete loss of access to STP 	<ul style="list-style-type: none"> • AGRG flood/sea level report 	<ul style="list-style-type: none"> • Reduce storm water infiltration into collection system • Work with NS Dept of Agriculture to strengthen dykes surrounding STP • Review access road design to ensure long term access • Review lagoon berm height
Avonport STP	<ul style="list-style-type: none"> • Sea level rise • Extreme rain event • Flooding 	<ul style="list-style-type: none"> • Access to STP via Highway 101 may be compromised • Excess water into STP • Loss of power • STP capacity overload 	<ul style="list-style-type: none"> • Back-up generator • Risk assessment of each STP • AGRG flood/sea level report • Initial Business Continuity Review • Added equalization tank to Increase treatment capacity 	<ul style="list-style-type: none"> • Reduce storm water infiltration into collection system • Mutual Aid Agreement with Town of Hantsport

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

			<ul style="list-style-type: none"> • Changes to STP process controls 	
Waterville STP	<ul style="list-style-type: none"> • Extreme rain event • Extreme snow event • Low temperature • Flooding 	<ul style="list-style-type: none"> • Partial or complete loss of access to STP and Septage facility • Damage or destruction of access road and bridge due to flooding or ice jam • River intrusion 	<ul style="list-style-type: none"> • Installed Infiltration ditch which provides overflow discharge for STP • Some modifications to access road and bridge for flood conditions 	<ul style="list-style-type: none"> • Review access road and bridge design to ensure long term access • Develop contingency plan for either alternate access route to septage facility or alternate disposal site • Develop contingency plan for ice control in river

LIFT STATIONS				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
All	<ul style="list-style-type: none"> • Erosion • High winds • Extreme rain • Extreme snow • Sea level rise • Flooding 	<ul style="list-style-type: none"> • Release of raw sewage into the environment • Backup of sewage into homes/businesses • Damage or destruction of equipment, buildings • Odor issues • Loss of power • Partial or complete loss of access to station 	<ul style="list-style-type: none"> • Upsized some wells for extra storage capacity • Require all service laterals to be equipped with backflow preventions valves • Dedicated maintenance vehicles with off-road, all weather capacity • Capacity to connect back-up generator to station • Risk assessment of each Collection system • Initial Business Continuity Review 	<ul style="list-style-type: none"> • Retrofit orrrRelocate certain stations when time for life cycle renewal • Review to identify if any additional erosion controls are feasible • Regular review and update Business Continuity Plans

VULNERABLE COMMUNITIES/DRAINAGE SYSTEMS				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Port Williams, Canning	<ul style="list-style-type: none"> • Extreme rain event • Extreme snow event • Flooding • Low temperatures • Sea Level Rise 	<ul style="list-style-type: none"> • Damage to homes, businesses • Partial or total loss of access to road network which will limit access to other areas of the County • Clogging of drainage systems by ice, snow • Overflow of ditches onto existing properties, roads 	<ul style="list-style-type: none"> • Land Use Planning and Secondary Planning Strategy identified flood prone areas, zoning requirements 	<ul style="list-style-type: none"> • Ongoing winter maintenance to keep storm drains free of ice and snow • Share information with REMO and DTIR • Review land use and development regulations to improve flood requirements •
Kingsport, Medford, Minas Basin shoreline	<ul style="list-style-type: none"> • Erosion • Sea Level Rise 	<ul style="list-style-type: none"> • Damage or destruction of homes, businesses, infrastructure due to shoreline erosion • Partial or total loss of access to road network 	<ul style="list-style-type: none"> • Land Use Planning identified shoreline areas prone to erosion, zoning requirements • Some monitoring of shoreline erosion 	<ul style="list-style-type: none"> • Share information with REMO and DTIR • Update MPS and LUB in response to issues • Continue shoreline monitoring • Work with other stakeholders to explore potential erosion control measure
Coldbrook – Pinewood/Royal	<ul style="list-style-type: none"> • Extreme rain event • Extreme snow 	<ul style="list-style-type: none"> • System capacity overload • Clogging of drainage systems by ice, 	<ul style="list-style-type: none"> • Increased capacity of existing ditches and culverts • Constructed new in-line ponds and flow control 	<ul style="list-style-type: none"> • Ongoing winter maintenance to keep storm drains free of ice and snow

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Estates Subdivision	<ul style="list-style-type: none"> event Flooding Low temperatures 	<ul style="list-style-type: none"> snow Overflow of ditches onto existing properties, roads Damage to homes, roads Icing of roads due to excess storm water and cold temperatures 	<ul style="list-style-type: none"> systems near Hwy 101 to help regulate peak flow into subdivision Upgraded portions of discharge drainageway and obtained new easement to allow for easier access for maintenance 	<ul style="list-style-type: none"> Share information with REMO and DTIR Update MPS and LUB in response to issues
Greenwood – Fales Subdivision	<ul style="list-style-type: none"> Extreme rain event Flooding 	<ul style="list-style-type: none"> Flooding of some homes due to flood stage of Fales River 	<ul style="list-style-type: none"> CBCL Flood study Construction of dyke and clear water pumping facilities Clearing of ditches and culverts within subdivision (DTIR) 	<ul style="list-style-type: none"> Ongoing maintenance to keep storm drains free of ice and snow Share information with REMO and DTIR
Meadowview	<ul style="list-style-type: none"> Extreme rain event Flooding 	<ul style="list-style-type: none"> Loss of access into parts of area due to flooded roads Flooding of some homes due to flood stage of Cornwallis River, creek Clogging of drainage systems by ice, snow Damage to homes, roads Icing of roads due to excess storm water and cold temperatures 	<ul style="list-style-type: none"> CBCL Flood study AGRG report Town of Kentville Dyke report 	<ul style="list-style-type: none"> Develop capital improvement plan from CBCL study to implement some recommendations Work with DTIR on potential improvements to storm drains along Brooklyn St for help situation Share information with REMO and Dept of Ag

WELLHEADS/WATER UTILITIES				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Greenwood Water Utility; New Minas Water Utility	<ul style="list-style-type: none"> Extreme rain event Flooding Erosion High temperatures Low temperatures 	<ul style="list-style-type: none"> Washout of natural/manmade contaminants into wellfield Increase in “cosmetic” water use Decrease in aquifer recharge due to extra runoff from higher intensity rain events Increased chemical use, storage requirements due to changes in water temperatures Impaired access to production wells, treatment facility Loss of power 	<ul style="list-style-type: none"> Wellhead Protection Zones to limit certain types of development with most vulnerable areas Source Protection Committee formed to advise Council on protective measures for wellfield Public education programming Study for backup water supply Redundant UV treatment systems Extended chlorine disinfection within reservoirs Improvements to access roads Perimeter fencing near wellheads Dedicated maintenance vehicles with off-road, all weather capacity Back-up generator Risk assessment of each STP Initial Business Continuity Review 	<ul style="list-style-type: none"> Water conservation bylaw Programs or bylaws to enhance spill prevention within wellhead areas Install backup water production well Long term capital program to add further treatment redundancies Ongoing public education programs Review to identify if any additional erosion controls are feasible Regular review and update Business Continuity Plans
Sandy Ct Water Supply	<ul style="list-style-type: none"> Extreme rain event Flooding 	<ul style="list-style-type: none"> Washout of natural/manmade contaminants into wellfield 	<ul style="list-style-type: none"> Wellhead Protection Zones to limit certain types of development with most vulnerable areas 	<ul style="list-style-type: none"> Water conservation bylaw Programs or bylaws to enhance spill prevention

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

	<ul style="list-style-type: none"> Erosion High temperatures Low temperatures 	<ul style="list-style-type: none"> Increase in “cosmetic” water use Decrease in aquifer recharge due to extra runoff from higher intensity rain events Increased chemical use, storage requirements due to changes in water temperatures Impaired access to production wells, treatment facility Loss of power 	<ul style="list-style-type: none"> Source Protection Committee formed to advise Council on protective measures for wellfield Public education programming Study for backup water supply Redundant UV treatment systems Extended chlorine disinfection within reservoirs Improvements to access roads Perimeter fencing near wellheads Dedicated maintenance vehicles with off-road, all weather capacity Back-up generator Risk assessment of each STP Initial Business Continuity Review 	<ul style="list-style-type: none"> within wellhead areas Install backup water production well Long term capital program to add further treatment redundancies Ongoing public education programs Review to identify if any additional erosion controls are feasible Regular review and update Business Continuity Plans
--	--	---	--	--

ROAD NETWORKS

Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Valley View Rd – New Minas	<ul style="list-style-type: none"> Extreme rain event Flooding 	<ul style="list-style-type: none"> Overflow of watercourse, storm system onto existing properties, roads 	<ul style="list-style-type: none"> Replaced storm sewer and grates, removed accumulated debris Clearing of ditches and culverts within subdivision (DTIR) 	<ul style="list-style-type: none"> Ongoing inspection and maintenance to limit debris buildup in future Work with Valley Waste to find ways to limit illegal dumping within watershed

MUNICIPAL BUILDINGS/PROPERTY

Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Municipal Complex	<ul style="list-style-type: none"> Sea level rise Erosion High winds Extreme rain Extreme snow 	<ul style="list-style-type: none"> Damage or destruction of buildings Loss of power Seawater/river intrusion Partial or complete loss of access to building Loss of REMO Operations Centre 	<ul style="list-style-type: none"> Backup generator Improvements to dykes around property Dillon Building Assessment 2006 Catalyst Building Assessment 2011 HVAC, control system retrofit Replacement of two roof sections New chiller for building Repairs to brick façade and chimney 	<ul style="list-style-type: none"> Work with Town of Kentville to address/reinforce flood control measures Emergency exit from Justice Way LED Lights when time for life cycle renewal Confirm location of alternate REMO Operations Centre

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix C Town of Kentville Adaptation Priorities

ROAD NETWORKS				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
East Main Street at Elderkin Brook	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	East Main Street connects Kentville to New Minas, and losing this connection would force commuters and visitors to take the 101 highway.	A contour map showing potential flood levels has been produced.	<ul style="list-style-type: none"> • Work with the Department of Transportation and Infrastructure Renewal to decide on a strategy involving either relocation of the road or the installation of a culvert/bridge/berms in this area. • Prepare a protocol for redirecting traffic in this area in the event of flooding in this area. • Develop floodplain development standards; or prohibit further development within the floodplain
Crescent Avenue and Main Street Section	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	This subdivision could become flooded out in the event of an extreme occurrence of one of these risk factors.	A contour map showing potential flood levels has been produced.	<ul style="list-style-type: none"> • A consultant will be hired to conduct a study on the comparative cost of raising and or relocation of the dykes and berms in that area to the cost of buying the potentially affected properties to determine the most effective adaptation strategy. • Develop floodplain development standards; or prohibit further development within the floodplain
Cornwallis Bridge	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	The bridge could wash out, cutting the northern part of Kentville off from the downtown.	Communication and planning with the DOTIR on the upcoming bridge repair tentatively scheduled for 2015.	<ul style="list-style-type: none"> • Ensure the rearrangement of water/sewer/storm mains in preparation for the bridge renewal. • Contact NSP to coordinate the required alterations to their assets in this area.
Klondyke Street/Leverett Avenue	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	This subdivision could become flooded out in the event of an extreme occurrence of one of these risk factors.	A contour map showing potential flood levels has been produced.	<ul style="list-style-type: none"> • A consultant will be hired to conduct a study on the comparative cost of raising and or relocation of the dykes and berms in that area to the cost of buying the potentially affected properties to determine the most effective adaptation strategy. • Develop floodplain development standards; or prohibit further development within the floodplain

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

WELLHEADS/WATER UTILITY				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
East End Pumphouse	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Saltwater Intrusion 	Each of these pump houses contain two wellheads which collectively supply the Kentville drinking water distribution system. These locations are close to or in the floodplain. If significant enough erosion occurs, this could leave the wellfields vulnerable to saltwater intrusion, spoiling the water supply.	A contour map showing potential flood levels has been produced.	<ul style="list-style-type: none"> • Update Source Water Protection Plan beginning December 2013.
Bonavista Pumphouse	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Saltwater Intrusion 			
West End Pumphouse	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Saltwater Intrusion 			
Mitchell Avenue Pumphouse and Treatment Plant	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Saltwater Intrusion 			
PROPERTIES WITHIN TOWN				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
King's County Municipal Building	<ul style="list-style-type: none"> • Flooding/Erosion • Sea Level Rise • Heavy Precipitation 	This building is located in one of the most vulnerable areas in the Town. This building could become completely compromised by flooding.	<p>The Municipality of the County of Kings is looking into relocation.</p> <p>A berm complete with outfalls and back water valves was placed within the last decade. Raising the berms and general maintenance is likely required, however.</p>	<ul style="list-style-type: none"> • A consultant will be hired to conduct a study on the comparative cost of raising and or relocation of the dykes and berms in that area to the cost of buying the potentially affected properties to determine the most effective adaptation strategy.
STORM SEWER				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Storm Sewer Outfalls	<ul style="list-style-type: none"> • Sea level rise • Flooding/Erosion • Heavy Precipitation 	Outfalls could allow water from the Cornwallis River to rise up or block the pipes, causing catchbasins to overflow.	Installation of duck bills on outfall pipes.	<ul style="list-style-type: none"> • Order and install duck bills where they are missing, or replace duck bills which are no longer functioning. • Investigate vulnerable outfalls and relocate them as necessary.

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix D Town of Wolfville Adaptation Priorities

SEWAGE TREATMENT PLANTS				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Town of Wolfville STP	<ul style="list-style-type: none"> • Sea level rise • Extreme rain event • Flooding 	<ul style="list-style-type: none"> • Seawater/river intrusion • Loss of access to facility • Damage or destruction of lagoons and buildings • Loss of power • STP capacity overload 	<ul style="list-style-type: none"> • Back-up generator • AGRG flood/sea level report 	<ul style="list-style-type: none"> • Reduce storm water infiltration into collection system • Work with NS Dept of Agriculture to strengthen dykes surrounding STP • Review access road design to ensure long term access • Business Continuity Review • Increase height of lagoon berms

VULNERABLE AREAS				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Dykeland Street	Tidal flooding	<ul style="list-style-type: none"> • Loss of power • Damage to buildings • Damage to sewage pumping stations • Isolation of Public Works department 	<ul style="list-style-type: none"> • Requirement for minimum first floor elevation for new buildings. • Back-up generators acquired • Dykes upgraded by Province. 	<ul style="list-style-type: none"> • Continued upgrading and monitoring of dyke conditions •
Business District	Tidal Flooding	<ul style="list-style-type: none"> • Damage to commercial buildings • Cut off of Main Street transportation corridor 	<ul style="list-style-type: none"> • Some limited flood mitigation criteria provided in planning documents 	<ul style="list-style-type: none"> • Introduction of flood mitigation criteria in planning documents

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix E Town of Berwick Adaptation Priorities

WATER SYSTEM				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Water source	<ul style="list-style-type: none"> • Extreme Rain • Flooding • Erosion 	<ul style="list-style-type: none"> • Contamination of ground water source 	<ul style="list-style-type: none"> • Water protection study done 	

SEWAGE TREATMENT PLANT				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Wastewater Treatment Plant	<ul style="list-style-type: none"> • Flooding • Earthquake 	<ul style="list-style-type: none"> • River intrusion • Loss of access to facility • Damage or destruction of lagoons and buildings • Loss of power • STP capacity overload • Environmental impacts 	<ul style="list-style-type: none"> • Site assessment • Building improvements and siting • Back up generator installed • Installed backwater value to keep river water out of system 	<ul style="list-style-type: none"> • Reduce storm water infiltration into collection system • Increase height of lagoon berms • Work with NS Dept of Agriculture to strengthen dykes surrounding STP • Risk assessment study • Improved monitoring system
Buildings	<ul style="list-style-type: none"> • Flooding 	<ul style="list-style-type: none"> • Damage to buildings and equipment 	<ul style="list-style-type: none"> • Building sited on higher grounds 	<ul style="list-style-type: none"> • Increase height of berms • Relocate buildings
Wastewater Gravity Sewer	<ul style="list-style-type: none"> • Earthquake 	<ul style="list-style-type: none"> • Loss of system at certain points • General damage to system • Potential property damage • Environmental impacts 	<ul style="list-style-type: none"> • Keep to good condition by replacing aging components • Improve condition rating measurements 	<ul style="list-style-type: none"> • Improve preventative maintenance
Forcemains	<ul style="list-style-type: none"> • Earthquake 	<ul style="list-style-type: none"> • Loss of system at certain points • General damage to system • Potential property damage • Environmental impacts 	<ul style="list-style-type: none"> • Keep to good condition by replacing aging components • Improve condition rating measurements 	<ul style="list-style-type: none"> • Improved monitoring system • Improve flooding protocols
Pumping Stations	<ul style="list-style-type: none"> • Flooding • Earthquake 	<ul style="list-style-type: none"> • General damage to system • Potential property damage • Spread of sewage to general public areas 	<ul style="list-style-type: none"> • Keep to good condition by replacing aging components • Improve condition rating measurements 	<ul style="list-style-type: none"> • Improved monitoring system • Improve flooding protocols

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

STORM SEWER SYSTEM				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Catchbasins	<ul style="list-style-type: none"> • Extreme Rain • Flooding 	<ul style="list-style-type: none"> • System may become overloaded • Clogging of system with solid materials • Destruction of system components • Potential property damage 	<ul style="list-style-type: none"> • Keep to good condition by replacing aging components • Improve condition rating measurements • Improved preparation for weather events 	<ul style="list-style-type: none"> • Improve preventive maintenance • Review municipal specifications, specific to drainage requirements
Manholes	<ul style="list-style-type: none"> • Extreme Rain • Flooding 	<ul style="list-style-type: none"> • System may become overloaded • Clogging of system with solid materials • Destruction of system components • Potential property damage 	<ul style="list-style-type: none"> • Keep to good condition by replacing aging components • Improve condition rating measurements • Improved preparation for weather events 	<ul style="list-style-type: none"> • Improve preventive maintenance • Review municipal specifications, specific to drainage requirements
Pipes	<ul style="list-style-type: none"> • Flooding 	<ul style="list-style-type: none"> • System may become overloaded • Clogging of system with solid materials • Destruction of system components • Potential property damage 	<ul style="list-style-type: none"> • Keep to good condition by replacing aging components • Improve condition rating measurements • Improved preparation for weather events 	<ul style="list-style-type: none"> • Improve preventive maintenance • Review municipal specifications, specific to drainage requirements

DAMS (Factorydale Hydroelectric Facility)				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Flooding	<ul style="list-style-type: none"> • Extreme Rain • Flooding • Earthquake 	<ul style="list-style-type: none"> • Dam could be overtopped • Dam could be damaged • Properties downstream could be affected • Power generation could be affected 	<ul style="list-style-type: none"> • Inundation study done • Remediation done to adhere to Canadian Dam Association standards • Installed water level monitoring systems 	<ul style="list-style-type: none"> • Further improve remote monitoring • Assessment to determine adequacy of spillways
Control Gates	<ul style="list-style-type: none"> • Earthquake 	<ul style="list-style-type: none"> • Damage to control gates • Damage to assets downstream • Potential property damage 	<ul style="list-style-type: none"> • Gate reinforcement 	<ul style="list-style-type: none"> • Consider remote operation of assets • Improve monitoring and alarm functions •
Access Roads	<ul style="list-style-type: none"> • Extreme Rain • Flooding • Erosion 	<ul style="list-style-type: none"> • Loss of use or access to assets • Potential damage to other assets 	<ul style="list-style-type: none"> • Maintain to good condition 	<ul style="list-style-type: none"> • Condition ratings to current roads • Improve road maintenance • Identify secondary access •
Fish Passage	<ul style="list-style-type: none"> • High Temperature 	<ul style="list-style-type: none"> • Aquatic life affected 	<ul style="list-style-type: none"> • Maintain minimum stream flows (as per agreement with Department of Environment) • Cutting passages within control gates 	

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

ROADS				
Priority	Risk Factor	Potential Impacts	Adaptation Actions	
			Actions Taken to Date	Required Action Items
Bridges	<ul style="list-style-type: none"> • Flooding 	<ul style="list-style-type: none"> • Loss of use • Damage to bridge • Evacuation route/general access blocked 	<ul style="list-style-type: none"> • Work with province to identify concerns 	<ul style="list-style-type: none"> • Improve/reinforce structures • Alter waterways
Traffic Signals	<ul style="list-style-type: none"> • Extreme Wind 	<ul style="list-style-type: none"> • Damage to asset • Chance or personal or property damage 		<ul style="list-style-type: none"> • Improve protocols prior to weather events • Improve preventative maintenance
Street Lighting	<ul style="list-style-type: none"> • Extreme Wind 	<ul style="list-style-type: none"> • Damage to asset • Chance or personal or property damage 		<ul style="list-style-type: none"> • Improve protocols prior to weather events • Improve preventative maintenance
Signs	<ul style="list-style-type: none"> • Extreme Wind 	<ul style="list-style-type: none"> • Damage to asset • Chance or personal or property damage 		<ul style="list-style-type: none"> • Improve protocols prior to weather events • Improve preventative maintenance
Culverts	<ul style="list-style-type: none"> • Extreme Rain • Flooding 	<ul style="list-style-type: none"> • Damage to asset • Chance or personal or property damage • May become blocked 		<ul style="list-style-type: none"> • Improve protocols prior to weather events • Improve preventative maintenance
Sidewalks	<ul style="list-style-type: none"> • Erosion 	<ul style="list-style-type: none"> • Damage to asset 		<ul style="list-style-type: none"> • Improve sidewalk base/foundation • Improve surrounding areas • Improve preventative maintenance
Local Roads	<ul style="list-style-type: none"> • Flooding • Erosion 	<ul style="list-style-type: none"> • Damage to asset • Loss of access • Interruption to services 	<ul style="list-style-type: none"> • Road condition ratings done 	<ul style="list-style-type: none"> • Improve base/foundation • Improve preventative maintenance
Collectors	<ul style="list-style-type: none"> • Flooding • Erosion 	<ul style="list-style-type: none"> • Damage to asset • Loss of access • Interruption to services 	<ul style="list-style-type: none"> • Road condition ratings done 	<ul style="list-style-type: none"> • Improve base/foundation • Improve preventative maintenance

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix F Kings County Regional Mitigation Priorities

Category	Mitigation Actions	
	Actions Taken to Date	Required Action Items
Water/Sewage Treatment Plants	<ul style="list-style-type: none"> • Inventory of water/sewer systems is nearing completion. • Older equipment has been replaced with more energy efficient options. 	<ul style="list-style-type: none"> • Continue upgrading or replacement of older equipment • Retain consultant to examine options for onsite energy generation • Complete strategic review of water/sewer operations to evaluate: <ul style="list-style-type: none"> ○ Establish energy efficiency standards for future equipment procurement ○ Use of more energy efficient processes ○ Process shift in treatment, collection, distribution to utilize either more natural based processes (i.e., bioswales, infiltration ditches) or technologies that are less energy dependent ○ Review of long term system requirements to assess whether systems are properly sized for projected future demands
Wellfields	<ul style="list-style-type: none"> • Identified wellfields in vulnerable locations • Installed some additional backup wells in less vulnerable areas 	<ul style="list-style-type: none"> • Provide backup systems to ensure operability during extreme events • Identify locations to install additional backup wells and treatment systems
Sanitary Sewer Collection Systems	<ul style="list-style-type: none"> • Identify location of lift stations and sewer mains in vulnerable locations • Equipping lift stations with either backup generators or equipment to allow portable generators to be connected • Some manholes covers replaced with watertight covers 	<ul style="list-style-type: none"> • As budget permits, relocate vulnerable lift stations and sewer mains when due for replacement • Where practical, replace existing sewer system with alternate system which is flood and storm resistant • As budget permits, replace or upgrade equipment to increase energy efficiency • As budget permits, separate combined storm/sanitary sewers to reduce energy consumption from pumping and treatment • Equip all effluent outfalls are equipped with backflow prevention valves to reduce pumping and reduce damage to treatment systems
Roads	<ul style="list-style-type: none"> • Annual inventory of roads has been undertaken 	<ul style="list-style-type: none"> • Consider recycled asphalt opportunities for future paving. • Plan infrastructure renewals to minimize pavement waste. • Investigate whether the replacement of a thin lift of asphalt is more effective than a complete replacement.
Vehicle Fleet	<ul style="list-style-type: none"> • An emphasis has been placed on fuel economy during the procurement of new vehicles. • Specifying smaller vehicles with smaller, more fuel efficient engines where practical. • Greater coordination of routine vehicle maintenance to ensure vehicles are operating optimally. 	<ul style="list-style-type: none"> • Carpooling to meetings. • Policy to purchase alternate fuel vehicles or require minimum certification or fuel efficiency. • Install recharging stations at Municipal Complex. • Review vehicle size requirements, life cycle planning for vehicles.
Municipal buildings	<ul style="list-style-type: none"> • Main municipal buildings have had assessments which had led to various refits to such systems as: HVAC, heating plants, lighting. 	<ul style="list-style-type: none"> • New Municipal structures to be constructed to minimum LEED Silver certification standard or similar requirements. • Encourage energy saving measures with all staff. • Protocols for procurement which consider energy efficiency options.
Lighting	<ul style="list-style-type: none"> • Undertaking a lighting inventory • Traffic lights set to “flashing red” overnight to reduce greenhouse gases from idling cars 	<ul style="list-style-type: none"> • Where practical, replace existing ornamental street lights and crosswalk signals with more efficient lighting. • Replace street lights with LED fixtures. • Replace exterior light fixtures at municipal buildings with LED or solar power fixtures.

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix G Municipality of Kings Mitigation Priorities

Category	Mitigation Actions	
	Actions Taken to Date	Required Action Items
Water/Sewage Treatment Plants	<ul style="list-style-type: none"> • An energy audit was performed by CBCL Limited to assess energy usage in the County's sewage treatment plants. • Efficiency NS and the County of Kings are currently collaborating on energy-reducing solutions identified in the energy audit. • Older equipment has been replaced with more energy efficient options. • Variable frequency drives which allow equipment to match demand have been installed on pumps and other equipment. 	<ul style="list-style-type: none"> • Implement recommendations of Energy Audit and Efficiency NS review such as new blowers, blower variable frequency drives, aeration system improvements. • Continue upgrading or replacement of older equipment • Retain consultant to examine options for onsite energy generation • Complete strategic review for 2014/15 budget process of water/sewer operations to evaluate: <ul style="list-style-type: none"> ○ Use of more energy efficient processes ○ Process shift in treatment, collection, distribution to utilize either more natural based processes (i.e., bioswales, infiltration ditches) or technologies that are less energy dependent ○ Review of long term system requirements to assess where reductions in treatment systems may be implemented
Vehicle Fleet	<ul style="list-style-type: none"> • An emphasis has been placed on fuel economy during the procurement of new vehicles for the County fleet. • Specifying smaller vehicles with smaller, more fuel efficient engines where practical • Greater coordination of routine vehicle maintenance to ensure vehicles are operating optimally 	<ul style="list-style-type: none"> • Carpooling to meetings • Policy to purchase hybrid/electric vehicles • Install recharging stations at Municipal Complex • Review vehicle size requirements, life cycle planning for vehicles
Municipal Complex, other properties	<ul style="list-style-type: none"> • The assessment of the existing Municipal Complex has led to several changes: <ul style="list-style-type: none"> ○ Upgrades to HVAC system, with computerized digital control system throughout the building, reduces energy consumption by measures such as individualized temperature control, integrated system management software tied into all control features, reduced off-hour service, better air "balancing" thru system, repairs to duct work to improve air tightness and insulation, reduced using more fresh air for heating/cooling ○ The replacement of sections of roof with new insulation reduces heating cost in the building. ○ Repairs to exterior façade, reducing water and air penetration which could contribute to air quality issues, thermal loss thru the façade contributing to extra heating/cooling. ○ Maintenance workers use environmentally friendly cleaning products. ○ T12 Energy efficient light bulbs have been used to replace older fluorescent bulbs in most light fixtures in the building. 	<ul style="list-style-type: none"> • New Municipal structures to be constructed to minimum LEED Silver certification standard or similar requirements. • LED or solar lighting to be installed at all Municipal facilities when time for life cycle renewal. • NSP to replace street lights with LED fixtures by 2018.

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix H Town of Kentville Mitigation Priorities

Category	Mitigation Actions	
	Actions Taken to Date	Required Action Items
Town Buildings	<p>Enerplan was hired to complete an Energy Audit for all of the Town buildings, with the following results:</p> <ul style="list-style-type: none"> • The lights in the Town Hall were retrofitted, and hot water pipes were installed. • The Arena had a plant room retrofit, and the lights were also retrofitted. • The Police Station has had a solar panel demonstration by NSPI. 	<ul style="list-style-type: none"> • Encouragement of routine energy-saving measures to be performed by maintenance workers and Town of Kentville Staff. • Protocols will be put in place for procurement of upgrades to the buildings to ensure the Town is putting its best efforts toward reducing our energy consumption.
Town Fleet	The procurement of new vehicles involves the consideration of fuel efficiency.	<ul style="list-style-type: none"> • Protocols will be put in place for the procurement of Town Vehicles which will require a minimum certification/classification or fuel efficiency.
Sanitary Sewer	An inventory of the pumps was taken. Pump curves are being compiled by Xylem.	<ul style="list-style-type: none"> • Determine whether each pump is sized properly. • When planning the purchase of new pumps, an energy efficiency standard will be set by the Town.
Combined Sewer	An inventory of Town combined sewers was taken.	<ul style="list-style-type: none"> • As budgets permit, separate sewers to reduce the energy use associated with pumping and treatment. • When planning the purchase of new pumps, an energy efficiency standard will be set by the Town.
Storm Sewer	An inventory of sewers and pumps has been undertaken.	<ul style="list-style-type: none"> • As budgets permit, separate sewers to reduce the energy use associated with pumping and treatment. • Place backflow valves as budgets permit to reduce pumping and environmental damage. • When planning the purchase of new pumps, an energy efficiency standard will be set by the Town.
Central Water	A system inventory has been taken.	<ul style="list-style-type: none"> • Determine whether each pump is sized properly. • When planning the purchase of new pumps, an energy efficiency standard will be set by the Town.
Road System	An annual system inventory has been undertaken.	<ul style="list-style-type: none"> • Consider recycled asphalt opportunities for future paving. • Plan infrastructure renewals to minimize pavement waste. • Investigate whether the replacement of a thin lift of asphalt is more effective than a complete replacement.
Lighting	<p>A lighting inventory is currently being undertaken.</p> <p>Traffic lights have been set to flashing red through the night to minimize greenhouse gases from idling cars.</p>	<ul style="list-style-type: none"> • Determine whether downtown ornamental lights are operating efficiently. Investigate options for improving efficiency, such as an LED replacement strategy. • Replace Belcher Street/Cornwallis Street traffic light system with a roundabout to reduce idling and power requirements. • Look into the energy efficiency of the Town's crosswalk lights. Consider alternatives.

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix I Town of Wolfville Mitigation Priorities

Category	Mitigation Actions	
	Actions Taken to Date	Required Action Items
Water/Sewage Treatment Plants	<ul style="list-style-type: none"> • Energy audit completed • 	<ul style="list-style-type: none"> • Implement recommendations of Energy Audit • Continue replacement of older equipment • Examine options for onsite energy generation
Vehicle Fleet	<ul style="list-style-type: none"> • Corporate Energy audit completed • Smaller more fuel efficient vehicles selected for replacements • Anti-idling policy adopted • Trial use of bicycle for parks department crew members. 	<ul style="list-style-type: none"> • Review vehicle size requirements, life cycle planning for vehicles
Municipal Buildings	<ul style="list-style-type: none"> • Energy audit completed • Upgrading of light fixtures and bulbs to more energy efficient models • Improvement to heating systems in Town Hall and Public Works buildings 	<ul style="list-style-type: none"> • Upgrading of insulation in all buildings • Replacement of windows in selected buildings • Implement recommendations from Energy Audit
Street lighting	<ul style="list-style-type: none"> • Energy audit completed • Partial replacement of downtown street lighting with LED lights 	<ul style="list-style-type: none"> • Complete conversion to LED street lighting

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)

Appendix J Town of Berwick Mitigation Priorities

Category	Mitigation Actions	
	Actions Taken to Date	Required Action Items
Sewage Treatment Plant	<ul style="list-style-type: none"> Corporate Energy audit completed (2007) Assessment and condition study on sewer infrastructure done Back up emergency generation in place 	<ul style="list-style-type: none"> Implement recommendations of Energy Audit Continue replacement of older equipment Improve mapping and identification of system components Increase berms around plant to protect from flood risk Install remote monitoring and warning systems Improve planning for upcoming weather events
Vehicle Fleet	<ul style="list-style-type: none"> Corporate Energy audit completed (2007) Anti-idling protocols enacted 	<ul style="list-style-type: none"> Improve regular maintenance to improve mileage and reduce emissions Review vehicle size requirements, life cycle planning for vehicles
Municipal Buildings	<ul style="list-style-type: none"> Corporate Energy audit completed (2007) Upgraded fixtures and bulbs to more energy efficient models 	<ul style="list-style-type: none"> Continue to implement recommendations from Energy Audit Replace heating and cooling system in Town Hall Install improved lighting and heating controls in municipal buildings Refurbish Town Hall roof and insulation Upgrade insulation in all buildings Replacement of windows in selected buildings
Dams	<ul style="list-style-type: none"> Dam Inspection & Flood Inundation Assessment done (2006) Remediation done to adhere to Canadian Dam Association standards Installed water level monitoring systems 	<ul style="list-style-type: none"> Improve remote monitoring capabilities Consider remote access and controls of dam functions Improve preventative maintenance of hydro infrastructure
Street lighting	<ul style="list-style-type: none"> Replacement of standard street lighting to LED lights completed 	<ul style="list-style-type: none"> Convert pole-top lights in downtown core to LED street lighting
General		<ul style="list-style-type: none"> Share Climate Change Action Plan locally and advocate climate change issues with ratepayers and businesses Distribute to service providers and partners Review Municipal Planning Strategy, Land Use By-Law and other policies to reflect potential climate change impacts Install vehicle recharging stations within town Update Emergency Management plans and protocols based on findings

*Summary table developed by the Kings County Regional MCCAP Committee using data gathered through the course of completing the MCCAP report, including the asset adaptation spreadsheets as prescribed in the Municipal Climate Change Action Plan Guidebook (Canada – Nova Scotia Infrastructure handbook)