Municipality of the County of Richmond:

Municipal Climate Change Action Plan

THE MUNICIPALITY OF THE COUNTY OF RICHMOND

LA MUNICIPALITÉ DU COMTÉ DE RICHMOND

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Prepared for The Municipality of the County of Richmond

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Introduction

The Municipal Climate Change Action Plan (MCCAP) is a blueprint to assist municipalities to address and adapt to the impacts of climate change. The plan seeks to reduce greenhouse gas emissions from municipal operations and prepare the municipality for the anticipated impacts of climate change.

The goal of the MCCAP is to take the municipality to the next step, by compiling both their current and future municipal actions into one cohesive document that lays the foundation for municipal climate action.

This Municipal Climate Change Action Plan is also designed to fit the framework set by the Canada-Nova Scotia Agreement on the Transfer of Federal Gas Tax Funds. In 2008, the federal Government and the Province of Nova Scotia entered into an agreement where funds equivalent to a portion of federal excise tax on municipalities would be transferred back to municipalities to help fund capital projects related to sustainability. As a condition of the Gas Tax Agreement, each municipality is responsible for preparing a Municipal Climate Change Action Plan (MCCAP) which must be submitted to Service Nova Scotia and Municipal Relations by December 31, 2013. This document represents the Municipal Climate Change Action Plan for the Municipality of the County of Richmond.

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Richmond County Community Profile

Location

The Municipality of the County of Richmond (figure 1) is a rural municipality located on the south-eastern corner of Nova Scotia's Cape Breton Island. It is bounded by the Bras D'Or Lakes and Cape Breton Regional Municipality to the north, the Atlantic Ocean to the east, Chedabucto Bay to the south and Inverness County to the west. The land area is divided roughly evenly by the St. Peters' Canal, which connects the Bras d'Or Lake to St. Peters Bay and the Atlantic Ocean. Isle Madame, a large island to the southwest of mainland Richmond County, contains about a third of the County's population and is connected by a bridge to the mainland. The total land area of Richmond County is 1,244 square kilometers.

Figure 1. The Municipality of the County of Richmond.

Geographically, almost all of Richmond County is within 10 kilometres of either the Bras d'Or Lakes water system or the Atlantic coast, a fact which has greatly shaped its landscape and cultural history. The County as a whole is heavily forested, with little agriculture. Topographically, Richmond County is flatter than other municipalities on Cape Breton Island, with most of the County comprised of coastal lowlands with many bays, coves and islands. Nonetheless, there are a few upland regions in Richmond County including Sporting Mountain, facing the Bras d'Or Lakes, as well as the northern part of the County, near Loch Lomond.

Population Demographic

Despite its relatively small population of just under 10,000 (according to the 2006 Census), Richmond County has had a long and varied settlement history. The region was first settled by Europeans in the 1830's when the French built a fort near what is now St. Peters and established a fur trade with the native Mi'kmaq people. Subsequently, French (and Acadian), Scottish, English and Irish settlers moved into the region, and established their own communities. Most of the population was (and still is) concentrated along the coast as many of these villages depended on fishing, boatbuilding and maritime trade.

To this day, roughly one quarter of the residents of Richmond County list French as their mother tongue and over a third are bilingual. This preservation of Acadian, as well as strong First Nations, Irish and Scottish heritage has resulted in a unique cultural mosaic within Richmond County. In recent years, people from many places including Germany, the United States and elsewhere in Canada have moved to Richmond County to take advantage of its natural coastal beauty.

Since the decline of boatbuilding in the 19th Century, the economy of Richmond County has ebbed and flowed with the rise and fall of the fisheries in the North Atlantic. The fishery remains to this day a vital part of the economy of Richmond County, particularly on Isle Madame and in the eastern parts of the County. The completion of the Canso Causeway in 1955 resulted in the creation of a deep ice free harbour. This spurred extensive industrial development at Point Tupper in the western end of the County, an area which still represents a substantial portion of Richmond County's tax base. Tourism development has also emerged as a significant pillar of Richmond County's economy, specifically cultural, eco and adventure based tourism. Government services, such as health (Strait-Richmond Hospital, St. Anne's Nursing Centre) and education (including two school boards and four schools) also employ a large portion of the County's labour force.

The census data for Richmond County in 2006 lists the population as 9,740[1]. The majority of this population is concentrated on the western half of the County, with 3,455 on Isle Madame (whose largest communities are Arichat, West Arichat, Petit de Grat and D'Escousse) and 4,072 living on the mainland, west of the St. Peters Canal (with the largest communities being St. Peters, Louisdale and Evanston-Whiteside). A total of 1,769 residents live east of the St. Peters Canal, with the largest communities being Red Islands, L'Ardoise and Fourchu.

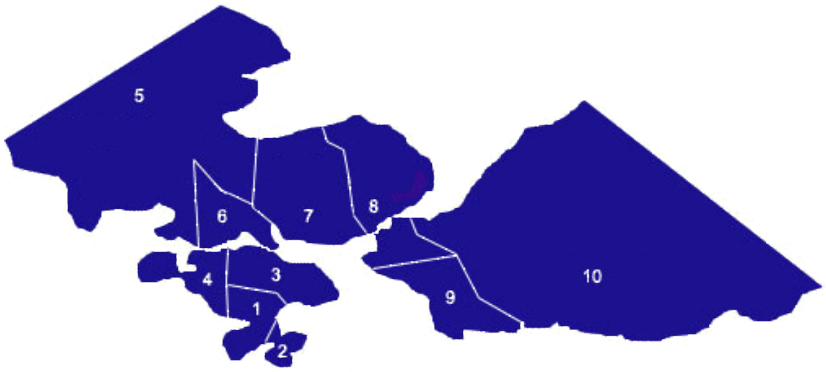
Like many other rural counties in Nova Scotia, Richmond County's population has been declining over the past decades, from a high of over 12,000 in the 1980's. In addition, the median age of the population in the County is also increasing. Median age was 47 years of age in 2006, approximately five years older than the provincial average, and this aging trend is expected to continue. This decline and aging in population partly results from the global trend towards smaller family sizes which has been occurring throughout Canada as well as from the out migration of younger residents for employment and education purposes.

Despite increased subdivision activity and new home construction in some parts of the County (particularly along the Highway 104 corridor between Evanston and St. Peters), continued depopulation in other areas of the County will pose a challenge for the Municipality to continue to provide basic services to residents while maintaining a reasonable tax rate.

[1] http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CD&Code1=1216&Geo2=PR&Code2=24&Data=Count&SearchText=&SearchType=Begins&SearchPR=01&B1=All&Custom=&TABID=1

Municipal governance

At a municipal government level, the County is governed by a Council of 10 members (including the Warden) and provides a wide range of municipal services. Councillors are elected to four year terms and represent different geographical districts. The St. Peters' Village Commission operates as a sub-municipal unit within Richmond County and assumes responsibility for many of its own municipal items. St. Peters' residents are represented by the St. Peters Village Commission and a Municipal Councillor.



District	Area
1	*Arichat, Robins, Cape Auget, Pondville, Lochside, Grandique (South)*
2	*Petit de Grat, Boudreauville, Alderney Point, Gros Nez, Samson's Cove, Little Anse*
3	*D'Escousse, Martinique, Poulamon, Poirierville, Cap la Ronde, Rocky Bay*
4	*West Arichat, St. Mary's, Port Royal, Janvrin's Harbour*
5	*Black River, Cleveland, Dundee, Evanston, Hureauville, Grand Anse, Grantville, Lower River Inhabitants, Walkerville,Port Malcolm, Port Richmond, Point Tupper, Kempt Road, West Bay, Whiteside*

District	Area
6	*Louisdale, Grand Anse, Grandique Ferry,Lennox Passage*
7	*River Bourgeois, St. George's Channel, The Point West Bay, Dundee, Sporting Mountain, Oban, Seaview, River Tillard, Cannes, Hawker*
8	*St. Peter's, French Cove, Sampsonville, Cape George, Roberta*
9	*L'Ardoise, Rockdale, Grand Greve, Lower L'Ardoise, Little Harbour, Point Michaud*
10	*Johnstown, Chapel Island, Barra Head, Lynches River,Soldier's Cove, McNab's Cove, Red Islands, Hay Cove, Loch Lomond, Grand River, L'Archeveque, St. Esprit, Lower St. Esprit, Framboise, Forchu, Stirling, Lake Uist, Irish Cove*

Figure 2. Map of Richmond County depicting geographical location of the ten municipal districts (above) and list of communities included within each district (below).

Planning and Development

Planning and development services for Richmond County are the responsibility of the Eastern District Planning Commission. Land use planning has been established as needed in different sections of the County at various times. At present, the West Richmond, Central Richmond, Shannon Lake, Sporting Mountain, Isle Madame and St. Peters municipal plans regulate development for the majority of the population of the County. There are plans to extend land use planning regulations to the Louisdale area in the future. The Chapel Island First Nation's group has a population of approximately 500 and is located about 10 kilometres northeast of St. Peters. While it is located entirely within the borders of Richmond County, it is governed separately and is not included in municipal land use plans.

MCCAP Adaptation Team

The overall intent of the MCCAP is to build internal capacity within the municipality for dealing with issues related to climate change. The first step in this process was the formation of an Adaptation Team or Committee. Based on the experience of other municipalities, it was decided that this Adaptation Team consist of core municipal staff and representatives with external expertise added, if needed.

The structure of the MCCAP team for Richmond is shown in table 1. The Team consists of the Municipal Director of Public Works and Municipal Engineer, the Director of Economic Development and Tourism, a Council member and two consultants from Université Sainte-Anne.

The consultants were responsible for co-ordinating the committee, organizing and chairing meetings, as well as summarizing and compiling the MCCAP document. The municipal committee members, in turn, were responsible for contributing, reviewing and approving the content of the MCCAP.

Table 1. Adaptation Team Members.

Name	Position
Jeff Stanley	Director of Tourism and Economic Development
Chris Boudreau	Director of Public Works, Municipal Engineer
Shirley McNamara	Councillor
Michelle Theriault **Aleasha Boudreau**	Consultants, Université Sainte-Anne

Additional expertise was available to the MCCAP team and was called upon as needed. This team of external advisors and experts (listed in table 2) included other municipal staff, councillors, consultants, provincial government staff, citizens, and university collaborators.

Table 2. MCCAP Adaptation Team external collaborators.

Name	Position
John Bain	Eastern District Planning Commission
Bryne Butts	Eastern District Planning Commission
John Beaton	Formerly contracted by the Strait Highlands RDA
Dan Lane	University of Ottawa (and other climate change researchers)

The MCCAP Team also incorporated additional climate change work undertaken by the Municipality or other organizations into the MCCAP. This included previous work by the Strait Highlands RDA, a development agency whose mandate was to grow the region by promoting communities, businesses, organizations and citizens in becoming community leaders and agents for their own development[2]. Specifically, the MCCAP incorporated the RDA's 'Partners for Climate Protection', green action Milestone Report which examined greenhouse gas emissions.

[2] Srait-Highlands Regional Development Agency. Annual Report 2011-2012.

Similarly, the Eastern District Planning Commission (EDPC), though not directly represented on the MCCAP committee, provided invaluable assistance to the MCCAP Team. The EDPC assisted with the preparation and interpretation of old map data as well as providing the necessary resources for interpretation of current maps for performing climate change impact assessment.

Additional expertise, scientific information and interpretation were provided to the MCCAP Team by staff and students of the University of Ottawa, ICURA C-Change project. The area of Isle Madame, Richmond County, was chosen to be part of this C-Change community coastal adaptation strategies project.

Through this project, the Municipality of Richmond has participated in numerous climate change workshops, planning studies and research projects. In addition, Richmond County has been used as a model for numerous university research projects and scientific publications. Many of these reports and case studies are referenced in this document.

Adaptation Team Mandate

The first task of the MCCAP Team was to establish the mandate of the Team including roles, responsibilities and authority of the team members. A summary of the MCCAP Team mandate is as follows:

- The Team is responsible for the generation of an MCCAP Plan that is applicable, relevant and attainable.
- The goal of the MCCAP Team is to ensure that climate change awareness and preparedness is integrated into the existing facets of municipality policy and planning.
- The Team should ensure that climate change initiatives can continue on after the MCCAP work is completed.
- The MCCAP Team was established as a working group until the time of MCCAP submission. After which, the Team will meet on an annual basis to review the objectives and deliverables outlined in the plan.
- The Team will report to Warren Olsen, Chief Administration Officer, on a regular basis.
- The Team will provide regular updates to Council and the Final Plan will be presented to Council for approval prior to submission.
- Any changes to existing municipal plans or policies will have to be approved by the appropriate municipal committee or responsible authorities before being implemented.

Impacts and Hazards

The Challenge

There has been a remarkable amount of awareness brought forth about climate change in recent years. Despite common knowledge that changes are occurring, it is important that municipalities understand what these changes will mean for their communities. In the case of the Municipality of the County of Richmond, a largely coastal area, the susceptibility of its communities to serious, immediate and long term threats[3] highlights the need for municipal preparedness.

In order to address potential impacts and hazards, historical evidence[4] and current research being conducted in Isle Madame through the Community-University Research Alliance (ICURA) project, *Managing Adaptation to Environmental Change in Coastal Communities: Canada and the Caribbean,* were examined[5]. Furthermore, a *hazard-matrix* was constructed by the Adaptation Team to assist in the compilation of local knowledge. In addition to these resources, mapping tools were also used to determine the impact of climate change events, such as sea level rise and coastal erosion, on municipal communities.

While there is a lot of existing information available with respect to climate change, there remains few sources for municipalities like Richmond to obtain pragmatic advice or tools available to municipalities. Deal with this issue requires early identification and communication of threats, assessment of vulnerabilities, evaluation of risk and promotion of pro-active, cost-effective strategies to facilitate community adaptation to change[6]. In light of their current partnership with ICURA (C-Change) researchers, Richmond County is well placed to make meaningful strides in the development and implementation of climate changes issues and hazards and to ultimately build resilience and minimize risk to its communities.

This Municipal Climate Change Action Plan is meant to reflect the first step in addressing the climate change hazards and impacts that are expected within the Municipality of the County of Richmond. A list of impacts and hazards was compiled and categorized based on area of impact such as buildings, energy, forest, habitat/ecosystem, mobility and water (table 3).

[3] Lane, D. The Gathering Storm : Managing Adaptation to Environmental Change in Coastal Communities and Small Islands.
[4] Boudreau, A. and M. Thériault, 2011. Isle Madame Research Project: Isle Madame Historical Documentation and Storm Monitoring Project (2011-2012).

[5] C-Change: Canada to the Caribbean. http://www.coastalchange.ca/
[6] Lane, D. The Gathering Storm : Managing Adaptation to Environmental Change in Coastal Communities and Small Islands.

Table 3. Summary of Potential Impacts for the Municipality of the County of Richmond.

SYSTEM	SUMMARY OF POTENTIAL IMPACTS
	• Water Damage to buildings and property from sea level rise or increased severity of precipitation. • Increased maintenance; Loss of investments; increased cost for demolition of damaged infrastructure and restoration of lands and coasts due to increased storm activity.
	• More frequent power outages associated with extreme weather events.
	• Migration of species and populations capitalizing on the change in climate. • Change in forest composition due to a combination of impacts.
	• Migration of species and populations capitalizing on the change in climate • Increased risk of species and ecosystem breakdown • Habitat loss due to potential flooding, in particular in low-lying coastal areas
	• Land based transportation route disruption (loss of road network connectivity in coastal areas). • Decreased road safety due to more frequent and severe weather events and coastal instability through barrier stretching (eg. Janvrin's Island).
	• Sewer overflows from stormwater runoff and river flows due to increased number of peak events. • Well contamination.

Hazards and Impacts for the Municipality of Richmond

Sea level Rise and Storm Surge

According to the 2007 Intergovernmental Panel on Climate Change (IPCC) Report, small islands and coastal communities have characteristics that make them very vulnerable to climate change impacts, mainly sea-level rise and storm surges[7]. The frequency of severe storm surges has not only increased, but so too has the intensity and duration[8] of these events. Storm surge, defined as "an increase in the ocean water level above what is expected from the normal tidal level that can be predicted from astronomical observations and is most often caused by winds and low pressure atmospheric storms"[9] are becoming commonplace.

The Municipality of the County of Richmond is designated as a high-risk area for sea level rise and storm surge events (reflected by the 'degree to which the coastline is expected to experience physical changes such as flooding, erosion, beach migration, land subsidence, and coastal dune destabilization)'[10]. It is expected that the County will experience serious, immediate and long term economic, social, environmental and cultural impacts due to these hazards.

[7] IPCC (2007): Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
[8] Mimura et al 2007. 'Small Islands'. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Perry et al., Cambridge University Press, Cambridge, UK, 687-716.
[9] Webster and Stiff, 2008. The prediction and mapping of coastal flood risk associated with storm surge events and long-term sea level changes.WIT Transactions on Information and Communication. Vol 39; 129-138.
[10] Natural resource Canada , 2010.

Anecdotal observations of flooding events from community members highlight the increase in sea level and storm surge events occurring within Richmond County. Collected historical and storm event evidence has supported the impact that these sea level and storm surge events have had within the Municipality[11]. Infrastructure flooding in some communities is becoming more commonplace and certain facilities have been forced to take active measures to reduce ongoing infrastructure damage.

It is important for extremely vulnerable sites within a municipality to be identified so research can be conducted and case studies developed to help ensure appropriate adaptive and mitigation measures are taken to limit the storm damage impacts[12].

Coastal Erosion

Coastal erosion is a natural process that consists of the breakdown of rock and sediments such that these rocks and sediment are taken from one area and placed into another[13]. Coastal erosion is neither good nor bad and erosion problems only occur when structures are located within a coastal erosion zone.

In order to determine the severity coastal erosion will have in a given area, several factors must be evaluated. Exposure, tides, type of shoreline, type of sediment, human activity and changes in climatic conditions all have varying degrees of impact on the rate and extent of coastal erosion.

[11] Boudreau, A. and M. Thériault, 2011. Isle Madame Research Project: Isle Madame Historical Documentation and Storm Monitoring Project (2011-2012)
[12] Hartt-Maxwell, 2012. Coastal Community Adaptation Profiling.
[13] Atlantic Climate Adaptation Solutions Association, 2011. Coastal Erosion and Climate Change. Prepared by the Prince Edward Island Department of Environment, Labour and Justice.

Since several factors influence coastal erosion, each specific situation must be looked at to assess the susceptibility of the Municipality of the County of Richmond as a whole. Within the Municipality, the exposed area on the south coast is highly susceptible to wave action from the Atlantic Ocean. The degree to which these waves, with increased frequency and severity due to increased sea level rise and storm events, will impact the municipality's coastline need to be considered. The effect of coastal erosion has previously been documented in Richmond County in areas like Cape La Ronde on Isle Madame[14].

Increased Frequency of Storm Events and Increasing Storm Intensity

According to the IPCC, storm events and storm intensity are expected to continue to increase. An increase in extreme events increases the risk of flooding and erosion which are already anticipated to be of concern for the Municipality. An increase in the intensity of these storms will affect coastal utilities by exposing them to greater storm surges and flooding events, exacerbating problems due to sea level rise or coastal erosion.

An increase in frequency and intensity of precipitation and storm events will pose problems for water resource managers. Increased risk for both coastal and inland flooding threatens water infrastructure. A more volatile water supply would require the development of new water sources or innovation of storage techniques while changes to both groundwater and surface water quality would necessitate new or upgraded treatment processes. Water resource managers may also have to make greater use of biological monitoring and assessment techniques[15].

[14] Force. E. R., 2012. Coastal erosion and deposition in the Cap-LaRonde-Goulet Beach sector of Isle Madame, Cape Breton Island, Nova Scotia.
[15] Water Research Foundation. The Climate Change Clearing House. http://www.theclimatechangeclearinghouse.org/ClimateChangeImpacts/ChangesStormIntensityFrequency/Pages/default.aspx Accessed March 19th 2013.

Previous Climate Change Impacts

Historical data

Historical photographs can be used to demonstrate some of the changes occurring over time within the municipality. As illustrated in the before and after photos in figure 2, coastal property has been slowly reseeding in several areas due to increased sea level rise and land subsidence. Historical documentation demonstrates past weather and climate related events that are only anticipated to continue to worsen over time.

a) b)

Figure 2. Lower Road in Arichat at present day (a) compared to 80 years ago (b).

Storm damage

Infrastructure flooding has also been experienced within the municipality. Petit de Grat Packers, a seasonal snow crab processing plant within the municipality that employs approximately 90 people, is an example of important infrastructure that has experienced significant impacts from flooding (figure 3). The first level of this processing facility has experienced flooding forcing the company to move equipment to the upper floor to prevent damage from subsequent events.

Figure 3. Petit de Grat Packers facility during a storm in January 2010.

Road connectivity

Road connectivity has been threatened during several past storm events (figure 4) resulting in increased concern about emergency response capabilities, viability of these roadways and costs to repair damaged roadways (figure 5). The frequency and severity of these events has spurred discussions on possible mitigation or adaptation strategies that could take place to avoid a potential disaster in the future.

Figure 4. Loss of road connectivity during a storm in Little Anse, Richmond County.

Figure 5. Road damage to Pondville road, Richmond County after a storm in January 2010.

Breaching of barrier beaches

Barrier beaches in the area have been stretching and breaching under long term relative sea level rise. The similarities between Creighton Island, a once populated peninsula connected to Isle Madame, and Janvrin's island, a populated area off of Isle Madame, are cause for concern as the stretching and breaching is a threat to the road connectivity of Janvrin's Island.

Anticipated Impacts and Hazards

The major impacts anticipated in the Municipality of the County of Richmond concerning climate change include *coastal inundation and erosion*, *storm surge, flooding and saltwater intrusion*. Anticipated hazards to the Municipality of the County of Richmond related to these impacts include:

Transportation and Public Works

a) Potential disruption to transportation and infrastructure due to the impacts of sea level rise, coastal erosion and inundation during extreme events. Loss of connectivity can threaten certain communities (access to food and resources, access to emergency response vehicles)

b) Increased road maintenance due to the impacts of sea level rise, coastal erosion, inundation during extreme storms and freeze thaw cycles. Potential decrease in road safety.

c) Potential disruption in waste collection and treatment with increased potential for discharge of inadequately treated wastewater. Increased sewer and water treatment costs.

d) Potential contamination of drinking water (well water).

Planning and Infrastructure

e) Increased insurance costs due to infrastructure loss and damage.

f) Damage and loss of residential and commercial property and infrastructure.

g) Increased impacts on viable land options.

Emergency Response

h) Increased demands on emergency services. Increased demand for services due to higher number of individuals at risk (high population of seniors in Richmond County) from anticipated increased storm events.

i) Breakdown of services to certain communities during events (power interruption) and the disruption or breakdown of key services required for responders (communication methods).

j) Potential loss of access for service vehicles to community members.

Impact matrix

A summary of the anticipated impacts and hazards in Richmond County can be found in table 3 based on the specific system expected to see the impact. An impact matrix (required for the MCCAP submission) was prepared and can be seen in table 4. The impact matrix summarizes the severity, frequency and extent of the impact that known climate change hazards may have in Richmond County.

Table 4. Climate Change Hazard Impact Matrix

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

Climate Change Preparedness

Overall, the Municipality of the County of Richmond has been fortunate to never have had to experience many severe events. However, it is still important that the municipality begin to implement emergency response criteria to prepare for the impending effects of climate change.

With respect to known areas of concern (i.e. Breaching of breakwater and loss of road connectivity in Little Anse), case studies including cost analysis of potential solutions should be undertaken. Continued support and involvement in research initiatives like the University of Ottawa's C-Change project are important for continuing to document the severity, frequency and impacts of events as well as assisting with the development of solutions.

Capacity/Resources

Despite increased knowledge that the Municipality of Richmond will continue to experience hazards and impacts due to climate change, accurately assessing the direct impact to the Municipality is difficult. To assist with this, the Municipality of Richmond has had access to many resources including academic alliances (University of Ottawa, University of New Brunswick, University Sainte Anne), published case studies for Richmond County, access to knowledgeable GIS technicians (University of New Brunswick), and ArcGIS software from the ICURA project.

Despite this information, it is not possible to project accurate representations of sea level rise, the County's leading climate change concern. Existing digital mapping, used in this report to examine affected locations, is not accurate enough to determine the actual sea level rise impacts. In order to provide these estimates, the area would require LIDAR mapping (remote sensing technology that measures distance by illuminating a target with a laser and analysing the reflected light). This data, collected using aircraft, creates the elevation accuracy required for accurate sea level predictions. Hazard and risk mapping will be important for the municipality to be able to accurately determine its areas of concern.

Climate Change Adaptation Research

As previously mentioned, the Municipality of Richmond has benefited from a unique partnership with the University of Ottawa and the Community-University Research Alliance (ICURA) project, *Managing Adaptation to Environmental Change in Coastal Communities: Canada and the Caribbean.*

Following is a list of some of the various documents and scientific papers that have been have been published through this project:

Water Management Modelling in the Simulation of Water Systems in Coastal Communities
Sara Barghi, a masters recipient at the Univeristy of Ottawa, modelled the Arichat water system (located in Richmond County) during different storm scenarios identifying limitations the system will have with anticipated climate changes.

Multicriteria Decision Evaluation of Adaptation Strategies for Vulnerable Coastal Communities. Hooman Mostofi Camare, a masters recipient at the University of Ottawa, examined adaptation strategies for the Little Anse breakwater in Richmond County.

Spatial-Temporal Modelling for Estimating impacts of Storm Surge and Sea Level Rise on Coastal Communities: The Case of Isle Madame in Cape Breton, Nova Scotia, Canada. Sahar Pakdel, a masters recipient at the University of Ottawa examined the effect storm surge and sea level rise would have on Isle Madame. Using different storm scenarios she was able to examine social, economic, cultural and environmental impacts such storms may have on Isle Madame.

Coastal Community Climate Change Adaptation Framework Development and Implementation. Mingliang Lu, a masters student at the University of Ottawa looked at making the MCCAP 'actionable'. This included developing a Richmond County Action Plan Website with webpages for the following: structure of the Action Plan, links to first responders, a carbon calculator (for household reference and improved efficiency of emissions), local schools' activities and information pages and the Richmond County Emergency Climate Action iPad/IPhone app.

Emergency Management Planning: A Value Based Approach to Preparing Coastal Communities for Sea Level Rise. Alex Chung, a masters student at the University of Ottawa, has been working on measuring preparedness and creating a mock-up exercise of a storm event in Little Anse.

Affected Locations

To identify affected locations, maps of Richmond County were examined for the likelihood of impact in different areas from sea level rise and coastal erosion. Unfortunately, due to a lack of detailed mapping, this impact assessment was difficult to perform.

Accurate digital elevation data does not exist for Richmond County, making it impossible to determine which areas will be affected by sea level rise. Furthermore, despite the existence of geological maps, a geologist would be required to accurately determine what areas within Richmond County are vulnerable to coastal erosion. As a result, areas of concern were identified within this Plan but further examination is required.

Sea Level Rise and Storm Surge Affected Areas

For the purpose of examining the potential threats that sea level rise may cause in Richmond County, Quantum GIS base elevation maps were obtained to map flooding scenarios. A 2 meter increase in sea level was used based on anticipated sea level rise of 1 meter in 100yrs and increases due to past storm surges (1 meter)[16]. An example of a map showing projected 2 meter sea level rise in the St. Peter's area is shown in figure 6.

Figure 6. Map showing projected 2 meter sea level rise, created in quantum GIS software. Areas in pink represent inundated areas.

[16] Pakdel, S. 2011. Spatial-temporal modelling for estimating impacts of storm surge and sea level rise on coastal communities: The Case of Isle Madame in Cape Breton, Nova Scotia, Canada.

It should be noted that sea level rise in the Bras d'Or Lakes is not anticipated to be as high as that of the oceanic coastline, despite what is depicted on projected maps. The Bras D'Or Lakes is a unique system and has been treated as such through various research initiatives that have looked at anticipated impacts due to flooding as well as potential adaptation and mitigation strategies[17][18][19]. Unfortunately, the inaccuracy of these GIS maps re-iterates the importance for the need for better elevation maps and LIDAR for Richmond County.

Sea level Rise and storm surge were modelled through a master's thesis as part of the ICURA project[20] to examine flooding in the Isle Madame area. Within this paper, further detailed examination of the social, economic, environmental and cultural impacts were calculated. This project applied various storm scenario assessments to existing maps of the areas assets (social, cultural, economic, and environmental). However, despite the importance of such research, until proper LIDAR work is conducted in the area, results are not a true representation of what will occur.

Coastal Erosion Affected Areas

Assessing the risk of coastal erosion requires the use of various geological mapping data and subsequent analysis of this information by a trained geologist. This data and services were not available for Richmond County. However, advice was obtained from a provincial geologist, as well as university geologist to assist with the completion of the Risk Assessment Matrix (table 4) within this MCCAP. Specifically, this advice was used to determine the susceptibility of these populated areas at either a high, medium or low level of impact from coastal erosion.

[17] Bizikova, L. & B. Hatcher, 2010. Scenario-Based Planning for a Changing Climate in the Bras d'Ors Ecosystem. International Institute for Sustainable Development.
[18] http://brasdorstewardshipsociety.org/drupal/sites/default/files/Sea-level%20and%20the%20Lakes.pdf
[19] Geological Survey of Canada, 2006. Sensitivity of the Coasts of the Bras d'Or Lakes to sea level rise.
[20] Pakdel, S. 2011. Spatial-temporal modelling for estimating impacts of storm surge and sae level rise on coastal communities: The Case of Isle Madame in Cape Breton, Nova Scotia, Canada.

Facilities, Infrastructure and Service Delivery

A list of facilities and infrastructure in the Municipality of the County of Richmond can be found on the municipality's website (http://www.richmondreflections.com/businesses/categories/).

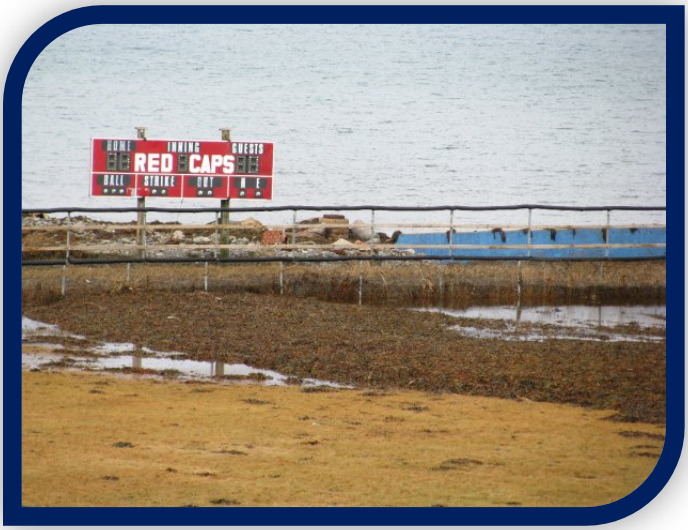
Municipal Facilities and Infrastructure

The Municipality of the County of Richmond is responsible for several facilities in the county. Of these, several are a concern to the municipality in terms of being impacted by climate change. This includes its wastewater collection and treatment facilities, water systems (water distribution systems) and stormwater drainage systems.

Community Facilities and Infrastructure

While municipal facilities and infrastructure have enormous value, other key facilities and service deliveries within the community were examined to determine the impact climate change would have on them. Climate change will impact coastal infrastructure and facilities. Facilities anticipated to experience such impacts include important commercial facilities such as Petit de Grat Packers crab processing facility, Samson's Enterprise boat building and boat shop, NovaCan Seafoods crab storage facility, Premium Seafoods seafood storage and processing facilities, Loberts R Us lobster holding facility, Clearwater Seafoods lobster storage facility, as well as historical and cultural museums and buildings. Infrastructure anticipated to be impacted includes road and bridge damage, loss of road connectivity, and culvert failure.

While the infrastructure and facility impacts anticipated due to the close proximity of the coast are important, several potential fallout impacts within the community were even more concerning to the municipality. Despite the strategic placement of key facilities in the community (hospitals, police stations, fire stations, schools and power utilities) the expected problems with loss of road connectivity make these important service deliveries inaccessible to many areas in the event of increased sea level rise and storm surges (e.g. Little Anse, Boudreauville, Alderney Point, Lower road Arichat, Janvrin's Island).



Social, Economic, Environmental and Cultural Considerations

Social Considerations

Richmond County is committed to the health and well-being of its residents and will work with other levels of government, community groups and residents to ensure the social sustainability of the County. While low population density constrains the efficient provision of social services, there are many ways in which the Municipality can play an engaged and positive role.

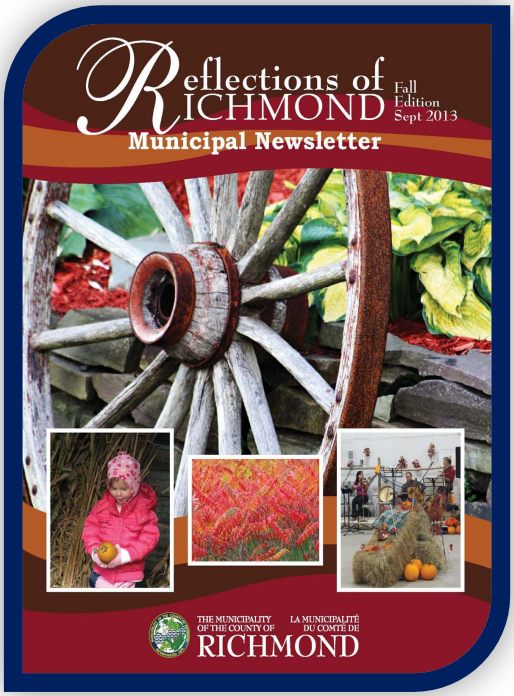
Richmond County strives to provide residents with a comprehensive array of recreation programming opportunities throughout the County for residents of all ages, with the intention of promoting an active healthy lifestyle but also serving to build a sense of community among residents. Richmond County residents will also benefit from an expanded network of trails and the development of passive recreation opportunities.

For the County to remain socially sustainable, actions taken by the Municipality at present and into the future will also need to take into account demographic changes, including a rapidly aging population. While this applies to recreation programs, it also applies to a full range of social issues including healthcare, continuing education, enhanced transportation options and housing. These last issues in particular involve the Municipality taking an active role in working with the provincial government.

Richmond County's many volunteers also take it upon themselves to improve and protect the communities they call home, a valuable asset, and the Municipality intends to continue to support these individuals and groups for the betterment of Richmond County.

Physical Activity and Recreation

Richmond County is dedicated to the promotion of healthy activities for its residents. The County continues to implement a full range of activities and programs to encourage an active lifestyle for its residents, through informal passive recreation opportunities (such as well-maintained trails) and organized programs, including sports, youth and senior programming. Physical activity outside the home promotes community cohesion in bringing people together, and the health benefits to participants are well documented. An abundance of recreational activities also help make Richmond County an attractive place to live while helping reduce greenhouse gases.



In order to continue to provide residents of Richmond County with recreational opportunities, it will be important for the Municipality to consider the impacts of climate change which are occurring and how these changes have or will impact recreational sites (e.g. infrastructure, ball fields, walking trails).

Education

Education is another Provincial responsibility whose influence is very local. The Strait Regional School Board operates three schools in Richmond County and the Conseil scolaire acadien provincial operates one. The ability of a community to sustain a school is essential for its long term viability, as it attracts and keeps young families in the area. Education is also a lifelong venture, however, and it is important that adult education and literacy programs are available to all residents.

CSAP Conseil scolaire acadien provincial

Strait Regional School Board

While health and education are areas of provincial jurisdiction, and the Municipality is not directly involved in the operational aspects of these institutions, the County intends to continue to work with organizations or groups such as health clinics and literacy councils to ensure these measures of community well-being are maintained.

In order to continue to provide residents of Richmond County with appropriate educational requirements, the Municipality will consider impacts of climate change that are occurring and how these changes have or will impact educational facilities as well as transportation to such facilities.

Community Safety

A socially sustainable community is one where residents can live, work and play safely. Richmond County is committed to ensuring that protective services are well supported and accessible to all residents of the County. The Royal Canadian Mounted Police are responsible for policing in the County.

Richmond County is also served by nine volunteer fire departments (Red Islands, Framboise-Fourchu, Grand River, Isle Madame, L'Ardoise, Loch Lomond, Louisdale, St. Peter's and West Bay Road). The Port Hawkesbury Volunteer Fire Department is also under contract to serve the Point Tupper Industrial Park, as required. Large fires or other incidents are often attended to by members of multiple departments. These fire departments are often also designated as first responders in medical emergencies as, due to travel times, their members can often arrive on a scene before an ambulance. The Municipality is committed to working with these departments to ensure their manpower, training and equipment requirements are adequate to protect the residents of Richmond County.

There has been concern raised by residents of more remote locations that telephone services are not available in the event of power outages. This can be very dangerous in the event of an emergency situation, and the Municipality will work with the Emergency Management Office of Nova Scotia to ensure that emergency communications are available to all parts of the County at all times.

Richmond County is also committed to promoting the availability of safe drinking water to all residents of Richmond County. To ensure safe drinking water in Richmond County, the Municipality of the County of Richmond will have to consider impacts of climate change that are occurring and how these changes have or will impact local water supplies (e.g. saltwater intrusion, unsafe mineral run off).

In order to continue to provide residents of Richmond County with a safe community within which to live, work and play, the Municipality of the County of Richmond will have to consider impacts of climate change that are occurring and how these changes have or will impact hospitals, power supply, telephone networks, road connectivity and water supply. Areas susceptible to sea level rise (for example, Little Anse) have already experienced short durations of road disconnect and the safety of some residents in this community is already under threat.

Economic Considerations

Richmond County is a large rural municipality with a relatively small population and a very diverse economy. The County will continue to take advantage of its natural and coastal setting as well as its resourceful people to develop sustainable rural communities, built on local and regional resources, cultural amenities and community initiative. Conflict between sectors will be minimized as the Municipality recognizes that a job gained in one sector should not cost a job in a different sector.

While industry is now the largest single sector of Richmond's economy, tourism is seen as having exceptional growth potential into the future with the potential to benefit communities across the County. The green economy is expected to grow in Richmond County, tapping into the increased local and global market for energy efficient construction, renovation and renewable energy. Existing and longstanding segments of Richmond's economy such as fishing and fish processing as well small scale village commercial, continue to employ many residents and are essential to Richmond's economic sustainability.

New growth will be encouraged by the Municipality and supported by a number of economic development agencies. These agencies provide internet, marketing and other skills to entrepreneurs, be they local shops or cottage industries taking advantage of the spread of broadband internet access throughout the County, enhancing local communities.

To encourage economic growth in Richmond County, the Municipality of the County of Richmond will have to consider impacts of climate change that are occurring and how these changes have or will impact economically significant infrastructure (e.g. buildings, wharves, pipelines) and road connectivity to economically important areas in Richmond County. The Municipality will also work to assist entrepreneurs to consider climate change impacts before new facilities and infrastructure is built to ensure the longevity and resilience of facilities in the county. Municipal infrastructure will also be examined for its vulnerability to sea level rise and sea level rise will be considered in future decisions concerning new infrastructure..

The economic viability of current fishing efforts will also be a concern. Increased sea water temperatures seem to be increasing the prevalence of tropical species in our waters. The impact of these increased temperatures is unknown and could be a concern for locally fished species in the future.

Environmental Considerations

Richmond County is enhanced by its beautiful, natural setting. With a relatively small population, the County features large tracts of clean undeveloped land and a diverse coastal ecosystem including islands, coves, beaches and marshes. In recent years in Canada, protection of the environment has emerged as a public policy priority, and Richmond County is no different as threats both within and outside its control need to be monitored and addressed.

Management of the coastal zone is important, as sea level rise threatens ecosystems and infrastructure. While Richmond County's contribution to the global greenhouse gas emissions believed to cause much of the sea level rise, are minute, there is much the County can do to show municipal leadership in doing its share to reduce its own emissions. The Municipality has greater control over its own water and wastewater treatment systems and recognizes the importance of their working well to the preservation of Richmond's ecological integrity.

While most developers prefer serviced lots, they are becoming sparse, which has an impact on environmental and economic sustainability as incoming residents either move elsewhere or are forced to establish onsite servicing. Richmond County intends to work with residents with private well and septic systems to maximize the efficiency of these systems while protecting the environment. Richmond County strives to do its part to ensure clean air, water and soil for its residents and ecosystems.

Coastal Management Issues

As virtually all of Richmond County lies within 10 kilometres of tidal waters, the entire County fits into the concept of a coastal zone. Richmond County has an extensive coastline on the Strait of Canso, Atlantic Ocean and the Bras d'Or Lakes. As such, management of coastal issues, particularly in light of anticipated sea level increases in coming decades, is very important to Richmond's environmental sustainability.

Richmond County has a variable coastline. While there are sandy beaches, most of the coastline consists of rocky shores, with many bays and coves. Salt marshes are prevalent in the River Inhabitants Basin and western Isle Madame. These are ecologically valuable in that they are highly productive year round and a big component of the food chain. They provide great habitat to many organisms, as well as acting as a natural processor of waste and a buffer against storm surges and floods.

Over the last century, Nova Scotia has been impacted by an increase in the overall sea level (caused by a combination of climate change and general regional land subsidence). The impact of this is currently being studied by the Ocean Management Research Network of the University of Ottawa, working with the Municipality, Université Sainte-Anne's Marine Research Centre and Development Isle Madame Association.

While there remains some debate as to the degree of the human cause of this trend, there is little doubt that sea levels will continue to rise into the foreseeable future. This would have an impact on people, properties, infrastructure, wildlife and ecosystems. The most immediate of these impacts occur during storm surges, usually during extra-tropical storms in the fall and winter, but periodically (and occasionally very destructively) when tropical cyclones in the summer and fall approach shore. A definite challenge to integrated coastal management planning is the complex intergovernmental framework that exists between different municipalities as well as provincial and federal agencies who are each responsible for certain components of the coastal zone.

Water quality has also become an issue in some coastal areas. An increase in the amount of land based effluent discharges, for instance, has resulted in the closure of the entire River Inhabitants Basin for shellfish harvesting. Several other harbour areas in Richmond County are also closed to shellfish harvesting. While there is limited commercial shellfish harvesting in this

part of Nova Scotia, water quality concerns should be addressed in matters of land use planning and other areas where the Municipality has jurisdiction, including wastewater treatment.

The Bras d'Or Lakes system is different from an open ocean system. As an inland salty sea (although the salt content of 22 parts per thousand is only about two thirds of the 35 parts per thousand in the Atlantic) it is not as susceptible to storm surges and is a more contained ecosystem. As there are only two natural outflows of the Lakes (excluding the St. Peter's Canal), both at the north end and there is a low rate of water circulation (typically between 2 and 40 years, depending on location). As a result, the Lakes are more vulnerable to impacts from development. Due to its unique history and ecology, the Lakes have recently been nominated as a UNESCO Biosphere Reserve.

Currently, the Lakes are fairly clean and the overall human impact is modest. However, some areas close to shore are influenced by pressures related to resource use and shoreline development including coliform pollution, sedimentation and some decrease in biodiversity. Richmond County recognizes the value of the protection of the Lakes and will work to ensure that development in its vicinity does not have a negative impact on the marine and shoreline ecosystem.

Drinking Water Supply and Treatment

Richmond County's drinking water supply is a mix of private wells tapping into aquifers and municipally treated water, tapping into lakes or wells. Standards for drinking water are set by the Province of Nova Scotia and the protection of drinking water supplies, including aquifers, is considered a provincial interest.

Currently in Richmond County, Municipal water distribution systems are available in the communities of Arichat and Petit de Grat (tapping into Babin's Lake just north of Arichat), as well as Louisdale, Evanston and Whiteside (tapping into two wells near Shannon Lake). St. Peter's water distribution system is managed by the St. Peter's Village Commission.

The Municipality is also in the process of reviewing watershed boundaries to ensure that land use planning controls are compatible with water supply areas, to address the Statement of Provincial Interest. Land use planning policies in the County will continue to restrict development in watershed areas to ensure that no development which might pose a hazard to the water supply be permitted.

Richmond County also sits on top of several aquifers, which provide water to residents in rural areas through the use of private wells. The Municipality is interested in maintaining a safe and viable water supply for residents, including investing in capital improvements for water delivery systems in un-serviced areas as well as identifying additional aquifer protection measures.

In order to ensure safe drinking water in Richmond County, the Municipality of the County of Richmond will have to consider impacts of climate change that are occurring and how these changes have or will impact local water supplies (e.g. water usage capacities). Current work within the county includes Stormwater Management Modelling by Sara Barghi (C-Change initiative from the University of Ottawa)[21] on the water system in Arichat, a study that might provide helpful insight on the importance of such modelling for other areas in the county.

Wastewater Management

Clean water is a key component of environmental sustainability, and the Municipality is intent that its water treatment systems are up to date and meet the needs of residents while preserving the integrity of the natural environment, including tidal and fresh water bodies. Wastewater treatment in Richmond County occurs in more densely developed areas through municipal sewers leading to wastewater treatment plants in Arichat, Petit de Grat, Louisdale and Evanston.

The St. Peter's wastewater treatment system is managed by their Village Commission. The more rural parts of the County usually have their wastewater treated on site by septic systems. The efficient use of municipal water supply and wastewater disposal systems are a provincial interest. The Municipality is committed to ensuring that any new development maximizes the use of existing municipal servicing and that any new development requiring the extension of services is done in a way that minimizes servicing costs for the Municipality.

Each of the four wastewater treatment plants was built in the 1970's. There have been complaints in recent years that parts of these systems are failing and in need of costly repairs. In early 2009, CBCL Consulting Engineers evaluated Richmond County's water and wastewater systems (excluding St. Peter's) and identified a number of improvements that should be made to bring the systems up to date and ensure they continue to work effectively. These capital projects include upgrading pumping stations in Arichat, replacing the aging and virtually

[21] Barghi, S., 2013. Stormwater Management Modelling (SWMM) in the Simulation of Water Systems in Arichat, NS.

inoperable wastewater treatment plant in Evanston and various smaller projects to upgrade the piping and distribution systems. These improvements would result in cleaner water at the point of the outflows. This helps to protect the environment and is also beneficial from an environmental perspective given the increased ability to direct new residential development to municipally serviced lots, further reducing the strain on the environment.

Given the urgency and benefits of these recommended projects, they have been identified as funding priorities under the Gas Tax Agreement. To ensure cleaner water outcomes outside the currently municipally serviced areas, the Municipality will continue to work with residents to investigate the implementation and construction of wastewater management systems where feasible.

To ensure appropriate wastewater management in Richmond County, the Municipality of the County of Richmond will have to consider impacts of climate change that are occurring and how these changes will increase the vulnerability and susceptibility of infrastructure as well as the capacity of facilities.

Solid Waste Management

Richmond County provides weekly curbside collection of waste and recyclables from all properties fronting on public roads and private roads which have been incorporated into collection routes. Since 2003, Richmond County has required (the first municipality in Nova Scotia to do so) that all waste placed at the curbside be in a clear transparent bag, to allow collection staff to ensure that compostable material and recyclables were not being directed to the landfill. In 2008, the Municipality contracted out roadside inspection of waste, direct waste diversion education programs and participation in community cleanups.

The Municipality also instituted a backyard composting program. As a result, by 2006-07, 51% of waste produced by residents and within the institutional, commercial and industrial sector was diverted from the landfill, either by way of recycling or composting. This represented the highest rate of waste diversion in the Province. Richmond County intends to continue its waste

management education program through compliance certificates for businesses, continued curbside inspections and school classroom visits and lectures. By continuing to influence and changing behaviour, the Municipality intends to build on its past successes in waste diversion.

Illegal dumping is one challenge faced by the Municipality in its efforts to provide a clean environment. While illegal dumping has occurred throughout Richmond County, most of it is close to secondary highways, with a greater concentration of known sites in the River Inhabitants and Grand River areas. Illegal dumpsites are unsightly and pose contamination risks to the surrounding environment. Municipal Staff intend to continue patrolling for illegal dumping, responding to complaints, cleaning up the sites and, where appropriate, pressing charges against offenders.

In order to ensure effective solid waste management in Richmond County, the Municipality of the County of Richmond will have to consider impacts of climate change that are occurring and how these changes have or will impact it (e.g. infrastructure susceptibility, road connectivity).

Climate Protection and Greenhouse Gas Reduction

Clean air and reduction of greenhouse gas (GHG) emissions are important objectives in the environmental sustainability of Richmond County. The impacts of climate change are already being felt in some coastal areas of the County with increases in sea levels. While Richmond County's impact on overall climate change is small, there is opportunity for the Municipality to show leadership and do its share to improve its environmental practices, both as a corporate entity, and by encouraging its residents to follow suit.

In December 2008, the Strait Highlands Green Action: Partners for Climate Protection report was prepared for the Strait-Highlands Regional Development Agency. This report outlined dozens of recommendations for reducing greenhouse gas emissions in the Counties of Richmond, Inverness and the Town of Port Hawkesbury, as well as implementation strategies to accomplish these. While the environmental recommendations are too numerous to list individually in this MCCAP, it has been recommended that the Municipality investigate which policies are feasible and desirable in Richmond County, and coordinate their implementation.

The ultimate goal is to reduce greenhouse gas emissions in Richmond County by 20% from 2005 levels. Municipal initiatives include refitting and retrofitting municipal buildings, purchasing energy efficient vehicles and incorporating energy efficient policies into planning documents. All

of these are discussed in greater detail in the Mitigation section of this report. The Municipality can also work with communities to encourage residents to retrofit their homes to enhance energy efficiency, encourage carpooling and local food production and to implement an energy efficiency and conservation public education and awareness campaign.

Governments should lead by example through demonstration projects and improving efficiency in their own facilities and infrastructure. As some people can be suspicious of government intervention, where possible, implementation of environmental initiatives in the community should be done while working with community groups and the messaging must emphasize community well-being.

As discussed in the Economic section of this Plan, while actions to reduce greenhouse gas emissions have significant environmental benefits, they also bring obvious economic benefits to the community in the form of green industries. New jobs are created through home and business retrofitting and renovations, initiation of new agricultural practices and local food production and installation and servicing of renewable energy technologies (including biomass as an energy source in the Point Tupper industrial Park).

Federal and provincial government agencies offer many incentives and rebates to residents interested in increasing energy efficiency in their homes or investing in renewable energy. Increased reliance on renewable energy is another key indicator of increased environmental sustainability.

The Government of Nova Scotia has set a goal for Nova Scotia Power to produce 25% of its energy from renewable sources by 2015. While the overwhelming majority of Nova Scotia's electricity today results from coal generation, alternative forms of energy generation such as wind, solar and tidal generators are coming online throughout the Province, including in Richmond County.

Wind mapping done for the Province has indicated that several areas of the County are ideally situated for large scale wind turbine development. These areas include Isle Madame and the sparsely populated Point Tupper area. Richmond County intends to actively tap into this emerging renewable energy market and bring some of this investment into the County for the benefit of residents. Local companies are already building, selling and installing small turbines throughout Cape Breton Island. To ensure wind turbine development is done responsibly and does not negatively impact the quality of life of residents, the Municipality is currently in the

process of developing a comprehensive wind turbine policy for Richmond County. The Municipality will also continue to investigate the potential of other renewable energy sources in Richmond County and enact policies to encourage and, where appropriate, regulate.

In order to ensure effective reductions in greenhouse gas emissions, emission levels were calculated in 2006 to form base levels for later comparison (Appendix A).

Cultural Considerations

The preservation and promotion of Richmond County's cultural heritage is important for ensuring the long term sustainability of the County and its many diverse communities. Richmond County's unique culture is a reflection of the diverse roots of its people, including the Mi'kmaq First Nations, French Acadian settlers, Scottish and Irish Celts, the English and more recently migrants from all over Canada and the world. This culture is expressed in Richmond County's built heritage, cultural heritage (including its museums and cultural centres) and spoken and written traditions. Richmond County is committed to preserving this culture, not only in the context of securing and preserving the historical artifacts, but also for maintaining it as an integral part of the fabric of its communities.

Preserving Richmond's Cultural Heritage

Richmond County's heritage is also expressed through its cultural institutions, languages and performing arts. These components are what make Richmond County unique, and Council is interested in protecting and promoting them so that they continue to be important elements of the day to day life of the County and its residents today and into the future.

There are a variety of museums and cultural institutions throughout Richmond County. Some of them, particularly those in the larger communities and along main transportation routes, are fairly well known and get decent exposure for residents and tourists. These include the Nicolas Denys Museum in St. Peter's and the LeNoir Forge in Arichat. Other museums, in smaller 'out of the way' communities are less known, often staffed by volunteers on a seasonal basis and face significant financial or operational challenges. Some museums tend to operate on a theme (such as music) while others present the history and heritage of an area or a people, and preserve and display artifacts which might otherwise be lost.

The continued operation and promotion of cultural facilities in all parts of the County are important for Richmond's cultural sustainability and there is a need to promote the rich culture

in these outlying areas. These centres present tremendous opportunities for tourism and their mandates can be promoted (and expanded where necessary) to emphasize the cultural and natural heritage of the area.

Aside from the bricks and mortar of museums, Richmond's cultural heritage is also demonstrated through the languages spoken by its residents and the written and performing arts of the community. Historically, the largest settlement groups in Richmond County have been the English, Celts (mostly Scots and Irish), Acadians and Mi'kmaq. While English is spoken as a first language by about two thirds of the population of the County (according to the latest Census figures) followed by French, there is concern that that fewer and fewer young people are becoming fluent in French, as well as Gaelic and Mi'kmaq. The Municipality recognizes the importance of these languages to the cultural sustainability of the County and is very interested in ensuring their legacy continues.

It is important that the Municipality, through its Department of Tourism, Culture and Recreation, develop an inventory of important cultural infrastructure (e.g. museums, cultural centres, libraries, religious sites, cemetery's, community television stations, radio stations). The Municipality must be aware of which ones may be threatened due to climate change in order to determine the viability of protecting infrastructure.

Priorities for Adaptation

Municipal adaptation initiatives were developed based on economic, social, cultural and the environmental priorities. These adaptation initiatives were developed with respect to anticipated hazards and threats including sea level rise, increased storm frequency, increased precipitation and coastal erosion. It should be noted that in order to better identify the impact of these hazards, LIDAR data and appropriate erosion and water supply data should be collected.

The following tables outlines action priorities for adaptation in the areas of; social, economic, environmental, water supply and treatment, climate protection, greenhouse gas reduction and culture.

Economic Priorities	Current Adaptation Initiatives
Land Planning	**Action**: The municipality will work towards informing the public and promoting industrial growth and housing development in areas that will not be threatened by climate change events.
Infrastructure	**Action**: The municipality will lobby the federal government for repairs and maintenance to recreationally and commercially significant harbours.
Renewable energy	**Action:** The Municipality will continue to support the retrofitting of municipal buildings for energy efficiency and the use of renewable energy technology to save money and reduce greenhouse gas emissions.
	Action: The Municipality will investigate the development of district energy or alternate heat recovery systems.
	Action: The Municipality will investigate the implementation of new energy technologies.

Social Priorities	Current Adaptation Initiatives
Physical Activity and Recreation	**Action**: The municipality will help community organizations examine the threat of climate change to existing facilities used for recreation while encouraging new development to occur in areas that are less susceptible to climate change.
Education	**Action**: The Municipality will ensure accessibility to schools for all students and encourage schools to remain in areas not susceptible to sea level rise.
	Action: The Municipality will promote climate change awareness initiatives and will work to enhance community outreach programs
Community Safety	**Action**: When accurate projections are available, the Emergency Measures Operational guidelines will be updated to include climate change impacts. Most notably, operational guidelines will be included in the event of loss of road connectivity or power outages to ensure the safety of residents.
	Action: The Municipality will initiate and develop a strategy to identify vulnerable groups such as seniors, persons with disabilities and the economically challenged, to ensure their safety during hazardous events.
	Action: The Municipality will continue to work with the Royal Canadian Mounted Police to ensure continued police protection for County residents.
	Action: The Municipality will continue to work with and support the operation of the various volunteer fire departments in Richmond County.
	Action: The Municipality will work with and lobby the Emergency Management Office of Nova Scotia to ensure that emergency communications are available in all parts of Richmond County regardless of whether there is a source of power.
	Action: Review Municipal Planning Strategies to take into account sea level rise and concerns over water quality.
	Action: Continue to work with University Researchers and First Nations groups to determine how to address climate change concerns in the community.

Environmental Priorities	Current Adaptation Initiatives
Coastal Management	**Action**: The municipality will work with other governmental and non -governmental agencies to identify environmentally sensitive areas in Richmond County, particularly in relation to the coastal zone.
	Action: The Municipality will support development standards for the Bras d'Or Lakes watershed recognizing its sensitive ecological position.
	Action: In planned areas of Richmond County, the proximity to and protection of coastlines will be considered by the Municipality in evaluating developments (for example the Cape Auget Eco trail).
	Action: The Municipality will work with Eastern District Planning Commission to review local municipal planning strategies to take into account coastal issues including sea level rise and concerns about water quality.

	Current Adaptation Initiatives	
Wastewater Management	**Action**: The Municipality will work to upgrade or replace the sewage pumping stations in the Arichat Sewage Collection System to increase pumping capacity and reduce sewage outflow.	*
	Action: The Municipality will conduct an inflow/infiltration study in the Petit de Grat Sewage Collection System to assess condition of piping, manholes and pumping stations.	*
	Action: The Municipality will replace the Evanston Wastewater Treatment Plant because it has reached the end of its useful life.	*
	Action: The Municipality will continue to conduct a manhole inspection and rehabilitation program to reduce levels of extraneous water entering all four municipal wastewater collection systems.	
	Action: The Municipality will continue to support land use planning policies that maximize the use of existing infrastructure and where new municipal servicing is required, that such extensions are directed to areas where servicing costs are minimized.	
	Action: The Municipality will proceed with pre-design work for the District 4 Wastewater Collection and Treatment System.	
	Action: The Municipality will work to assist with a Wastewater Control Study for the communities of District 3 (D'escousse and Area).	*
	Action: The Municipality will continue to support the development of proper wastewater management systems for un-serviced areas of Richmond. These funds should support feasibility and pre-design work as well as capital construction.	

NOTE: '' indicates action items that have been completed between 2010 and 2013.*

	Current Adaptation Initiatives	
Water Supply and Treatment	**Action**: The municipality will proceed with pre-design work related to construction of a water treatment plant for the Lousidale/ Evanston/ Whiteside Water System to address high levels of iron and manganese in the water.	*
	Action: The municipality will work to implement the key recommendations contained in the Source Water Protection Plan for Richmond including purchase of land in Lousidale/Evanston/Whiteside water supply area, re-establishing the boundaries of the Water Supply Zone O-3 for the Arichat/Petit de Grat Water supply and pursuit of Public Water Supply Designations for both water supplies.	*
	Action: The municipality will conduct an inventory of underground aquifers within the County with an aim to developing appropriate protection measures.	
	Action: The municipality will continue to work towards the development of proper drinking water supply and delivery systems for un-serviced areas of Richmond.	

	Current Adaptation Initiatives
Cultural	**Action**: The Municipality will conduct an inventory of heritage properties in Richmond County to better plan their protection.

NOTE: '' indicates action items that have been completed between 2010 and 2013.*

	Current Adaptation Initiatives	
Climate protection and greenhouse gas reduction[22]	**Action**: An assessment of the need and cost of acquiring LIDAR for Richmond County will be examined to determine the feasibility of this data in addressing sea level rise concerns in Richmond County.	
	Action: The Municipality will encourage energy efficient land use planning policies or development guidelines where feasible. These would address the issues such as lot road design, and incorporating passive solar design or alternative construction material.	
	Action: The Municipality will continue to support public transit initiatives to encourage more people to find transportation options other than personal vehicles, which will ultimately reduce greenhouse gas emissions.	
	Action: The Municipality will develop a county-wide policy addressing wind turbine development for small and large scale turbines recognizing the benefits they bring to the community and establishing regulations to protect neighbouring properties.	*
	Action: On an ongoing basis, the municipality will assess the need for policies to encourage or regulate other forms of renewable energy within the municipality with the intention of setting a benchmark for local energy production.	

NOTE: '' indicates action items that have been completed between 2010 and 2013.*

[22] Details for greenhouse gas reductions can be found in the Mitigation section of this report.

Climate Change Mitigation

While adaptation described how people can prepare for, and respond to, the effects of climate change, mitigation focuses on the causes of climate change. Mitigation efforts can reduce greenhouse gas (GHG) emissions and slow the rate of climate change, thus reducing the impacts.

The first step toward reducing GHG emissions involves estimating the County's baseline emissions. This baseline data provides a benchmark for monitoring the County's performance going into the future.

Summary of Energy and Emissions information

The inventory collected and presented in this section provides a record of corporate energy use and emissions for the Municipality of the County of Richmond corporate operations. It includes data for 2006 in the following categories: buildings, vehicle fleet, street and area lights, and water and sewage. A summary of results from the greenhouse gas inventory are also included in this report.

Energy and Emissions Information

Energy and Emissions information was collected by Nova Dynamics Limited. The Municipality of Richmond County's energy audit report with its accompanying greenhouse gas inventory can be found in Appendix A. This inventory was conducted using the Union of Nova Scotia Municipalities (UNSM) Corporate Energy and Emissions Inventory Toolkit. The Toolkit was developed by Jacques Whitford and is based on the Inventory Quantification Support Spreadsheet developed by the International Council for Local Environmental Initiatives (ICLEI). Corporate Operations categories included in the UNSM toolkit are buildings, vehicle fleet, street and area lights, water and sewage, and waste.

In order to calculate emissions, the inventory tool requires the input of energy use data for all categories. The tool also allows for the input of additional data, such as cost of fuel and electricity, and indicators such as building area and occupancy, which are recommended to provide a more detailed assessment of energy use. For this inventory, both required and recommended data were included whenever possible to give the most complete picture of energy use and emissions for all categories.

Measures for energy use and emissions included in the inventory are kilowatt hour (kWh) of electricity, litres of fuel (oil, gas, and diesel) and eCO2-equivalent (eCO2) of greenhouse gas emissions. Air pollutants include Carbon Monoxide (CO), Sulphur Dioxide (SO2), Nitrogen Oxides (NO2), Volatile Organic Compounds (VOCs) and Particulate Matter (PM).

Base Year

A base year must be established from which to monitor energy use, emissions and to set reductions targets. The Kyoto Protocol established 1990 as the base year for emissions reductions, the PCP program recommends either 1990 or 1994, and the province of Nova Scotia established 1990 as the base year.

In practice, municipal greenhouse gas emission reduction policies and programs vary in the base years selected. Municipalities must chose a base year for which a complete and accurate data is available and for many communities data from the 1990s is not readily available. Alternatively, it is advisable to select a base year for which a complete data set is available, one which presents a picture of energy use and emissions prior to the implementation of energy reductions programs, and one in which emissions coefficients specific to the province are available. This allows for a comparison to future years to assess the effectiveness of strategies aimed at reducing energy usage and emissions.

For the Municipality of the County of Richmond, 2006 was selected as the base year. It was determined that complete records were likely to be available.

Coefficients

Equivalent CO2 calculations (eCO2) were made using the UNSM toolkit spreadsheet developed to calculate emissions based on energy consumption (i.e. fuel and electricity use). Coefficients for electricity generation used in the inventories were provided by Nova Scotia Power Inc. for 2007. Full details on calculations and emissions can be found in the UNSM toolkit available from the Union of Nova Scotia.

Climate Change Mitigation Research

Partners for Climate Protection Milestone reports have been prepared for the Strait Highland Regional Development Agency. Reports were aimed at examining current emissions and emission targets for the future.

A detailed audit report for the Municipality of the County of Richmond with an inventory and analysis of energy consumed by the various assets of the municipality was also completed in 2010 by Mike Jenkins and Ron Addison, Nova Dynamics Limited

Energy and Emissions Inventory Summary Table for the Municipality of Richmond

Emission Category	Energy Type	Energy Consumption	Cost ($)	Units	Emission Factor (tCO2/units)	Emissions (tCO2e)
Buildings	Electricity Fuel Oil Propane	651845.00 48212.00 6310.30	75187.15 43340.75 5936.24	kWh L l	0.868kgeCO2/Kwh 2.83kgeCO2/L 50.79kgeCO2/GJ	565.80 (t) 129.21(t) 9.59
Water and Wastewater	Electricity Propane	982922 17800	101271.81 13350	kWh l	0.868kgeCO2/Kwh 50.79kgeCO2/GJ	853.18 (t) 27.06 (t)
Streetlights	Electricity	1735852	335151	kWh	0.868kgeCO2/Kwh	1507 (t)
Vehicles	Reg. Gasoline Diesel	15000 8380	15000 8380	L L	2.34kgCO2/L 2.63kgCO2/L	35(t) 22 (t)

Setting Goals and Actions for Mitigation

Corporate and Community Initiatives

The Municipality of Richmond's corporate and community greenhouse gas reduction initiatives have been described in 'Partners for Climate Protection Milestone', a report prepared by CBCL limited for the Strait Highlands Regional Development Agency (December 2008). The Richmond Integrated Sustainability Plan re-evaluated the municipalities goals and initiatives in March 2010.

A detailed audit report for the Municipality of the County of Richmond with an inventory and analysis of energy consumed by the various assets of the municipality was also completed in 2010 by Mike Jenkins and Ron Addison, Nova Dynamics Limited. A summary of actions can be found below. Full details of these initiatives as well as potential greenhouse gas reductions can be found in the 'Partners for Climate Change Milestone 2 Final Report'.

Goal 1: Improve the Energy Efficiency of Buildings (Time Frame: 2010-2015)	
	Community Actions
Action 1	Reduce infiltration in residential dwellings through weather stripping, caulking, etc.
Action 2	Retrofit commercial and institutional buildings for energy efficiency and conservation
Action 3	Explore alternative uses of the local biomass resource (i.e. wood pellets, wood chips, gasification, etc.). *Mutually exclusive with Goal #6, Community Action #3.*
Action 4	Develop utility size wind turbines independently or in cluster approach
Action 5	Assess feasibility for installation of solar thermal DHW (i.e. for residential, commercial & small industrial, institutional users, etc.). A high number of installations can obtain bulk pricing (i.e. DSM measures).

Goal 1: Improve the Energy Efficiency of Buildings (Time Frame: 2010-2015)	
	Corporate Actions
Action 1	Retrofit existing municipal buildings for energy efficiency/ conservation improvements and the use of renewable energy technologies
Action 2	Utilise demand side management (DSM) programmes (such as NSPI's) as a resource tool to reduce energy consumption.
Action 3	Create a capital reserve fund for energy efficiency projects, replenished in part by savings from energy efficiency/conservation initiatives.
Action 4	Encourage municipalities to enroll in Nova Scotia Power's SEIS (Smart Energy Information Service), which will assist them in managing their energy demand, or use a wireless energy monitor that provides real-time energy consumption information.
Action 5	Monitor energy use at the water/wastewater treatment plants and pumping stations and perform regularly scheduled maintenance, end of motor life upgrades to high efficiency units and variable frequency drives on pumps with high flow variability.
Action 6	Explore the option of seawater cooling in municipal buildings near water.
Action 7	Utilise solar thermal air heating for suitable municipal buildings where feasible (i.e. solar wall for large buildings, modular units such as Cansolair for smaller buildings).
Action 8	Utilise solar thermal heating for suitable municipal domestic hot water (DHW) and pools where feasible.
Action 9	Utilise solar thermal energy for hydronic space heating in municipal buildings where feasible.
Action 10	Explore the potential of utilising wind energy to power municipal infrastructure.

Goal 2: Increase Transportation Choice and Efficiency (Time frame: 2010-2015)	
Corporate Actions	
Action 1	Provide incentives for municipal workers to take public transit (such as a 20% rebate on passes).
Action 2	Provide (or support the acquisition of) carpooling parking lots in order to encourage ride sharing and transit rider-ship.
Action 3	Determine the current usage patterns and best practices for municipal vehicles, and then incorporate these practices into operation of fleet. Incentives and/or bonuses may be offered for staying within fuel usage limits.
Action 4	Purchase and showcase more fuel-efficient and/or alternative fuel municipal vehicles (i.e. hybrid, CNG, propane).
Action 5	Support the Strait Area Transit Cooperative initiative by providing annual municipal operating subsidies to ensure its continued operation.
Community Actions[23]	
Action 1	Promote local food production on the most productive lands that are currently not being utilised for food production or that would require minimal energy investment (i.e. even community gardens). Work on expanding Farmer's Markets and promoting efforts to share costs or establish cooperatives for food preparation and/or storage.
Action 2	Support the Strait Area Transit Cooperative initiative through community membership of the co-op and regular usage of the system.

Goal 3: Encourage Energy Efficient Land Use Planning and Neighbourhood Site Planning	
Action 1	Incorporate solar access into community planning (layout of both roads and lots)
Action 2	Allow planning departments to provide preferential or accelerated review for the development permit process for projects meeting energy efficient criteria (i.e. through the use of a checklist) for developments and/or other green criteria.
Action 3	Develop a county-wide policy addressing wind turbine development for small and large scale turbines recognizing the benefits they bring to the community and encouraging the development of small scale green industries in the County.

[23] ***In the PCP framework, Transportation emissions fall under Community***

Goal 4: Educate and Engage the Community	
Corporate Actions	
Action 1:	Day long coalition building session (via invite) organised by mayors and CAOs from the three regions involving CEOs and top managers of large energy users to build momentum to get projects off the ground.
Community Actions	
Action 1	Implement a public education and awareness campaign on energy efficiency, conservation and renewable energy as well as available incentives/programs. Several forms of media should be used to ensure outreach to all citizens. This campaign can include tours of local RE systems and/or passive solar design, etc. Addressing concerns such as lower quality of life and unemployment would be beneficial.
Action 2	Explore funding options to conduct feasibility studies on the use of heat pumps for buildings (e.g. water source on the coast and ground or air source inland).
Action 3	Seek funding for prizes, speakers and educational aids etc. on energy efficiency/conservation and renewable energy at schools.
Action 4	Using a broad-based approach that involves multi-community partners and organisations in order to increase community participations, conduct a well-planned and timed CEP launch campaign and promotion blitz that utilises local festivals, exhibitions, workshops and other carefully selected social events.
Action 5	Determine the interest in bulk purchase (to achieve a lower cost) of rain barrels to be available at a nominal fee and provide information on operation and maintenance in order to decrease energy and resources used for water pumping and treatment.
Action 6	Partner with local and/or provincial NGOs to provide input and deliver education and outreach activities as well as organise school events such as energy challenges.
Action 7	Work with the NS Community College to develop training programs to enhance the skills of existing trades persons to implement energy efficiency/conservation and renewable energy measures.
Action 8	Develop and deliver an information and education campaign for developers and the Builders Owners and Managers Association (BOMA) that emphasises the

	benefits of energy efficient neighbourhood and building design.
Action 9	Create a carpool culture with a large ad campaign, or through a newsletter and/or call- in show and offer to provide a centralised car-pooling registration system to allow interested participants to contact one another.
Action 10	Conduct a focussed neighbourhood canvassing program to promote the EnerGuide for Houses Programme.
Action 11	Use demonstration projects of renewable energy technologies and energy efficiency/conservation measures. Once installed, organise tours to promote them via the public education and awareness programme.

Goal 5: Demonstrate Local Government Leadership	
Corporate Actions	
Action 1	Use demonstration projects (i.e. heat pumps, solar thermal, green roofs, wind, biofuels, etc.) to prove technology and reduce (perceived) risk. Once installed, organise tours to promote them through the public education and awareness programme.
Action 2	Develop a long-term sustainable municipal energy vision that focuses on local, renewable, low or no carbon resources for the next 50 years.
Action 3	Officially endorse the GHG emission reduction target and the resulting implementation plan.
Action 4	Incorporate energy efficiency principles into municipal planning documents through regular review cycles (i.e. roundabouts and yield signs).
Action 5	Maintain the Green Action brand presence in all incentive programs and promotions developed through Green Action and the CEP.
Action 6	Develop a programme to exchange information related to sustainable development projects (i.e. share lessons learned, or cooperate on the launch of a capacity building programme).

Capital Projects

Specific capital projects which address sustainable goals covered in this MCCAP are listed in this section. Capital projects require substantial long term planning to make the best use of Municipal resources. As part of the requirements relating to the Gas Tax Agreement, this list will be required to be updated on an annual basis to include new capital projects ready for construction upon the completion of current ones.

Capital project	Sustainability Benefit	Estimated Cost	Status
Source Water Supply and Treatment			
Pre-design work for construction of water treatment plant for Louisdale/ Evanston/ Whiteside (addressing elevated manganese and iron).	Cleaner water for communities	$25,000	*Completed*
Implement key recommendations in Source Water Protection Plan for Richmond County, including land acquisition and re-designating Water Supply areas	Protects environment by improving efficiency of system	$175,000	*Completed*
Comprehensive leak detection and repair program for Richmond Water Utility	Enhances efficiency of water system	$150,000	
Waste Water Treatment			
Risk assessment studies for wastewater treatment to ensure compliance with Canadian Guidelines for Wastewater Effluent	Protects environment by improving efficiency of system	$200,000	*In Progress*
Upgrade or replace pumping stations in Arichat system to increase capacity and reduce sewage overflow	Protects environment by reduced sewage outflow into waterbodies	$750,000	*Completed*

Pre-design work for District 4 Wastewater Collection and Treatment System	Safer drinking water, reduced health risk and protects environment	$35,000	*In progress*
Replace inoperable Evanston Wastewater Treatment Plant	Protects watercourses by ensuring wastewater is treated	$2,250,000	*Completed*
Manhole inspection and rehabilitation program to reduce level of extraneous water entering system	Protects environment by ensuring efficiency of system	$250,000	*Completed*
Inflow/infiltration study in Petit de Grat system to assess condition of infrastructure	Protects environment by ensuring efficiency of system	$90,000	*Completed*
Wastewater Treatment Control Study for District 3 (D'Escousse and area)	Safer drinking water, reduced health risk and protects environment	$40,000	*Completed*
Wastewater Treatment Project for District 3 and 4, including installation of up to 20 onsite pilot sewage treatment (cluster) systems	Safer drinking water, reduced health risk and protects environment	$200,000	*In Progress*
Upgrades to lift station in Louisdale to prevent risk of failed operation resulting in overflow of raw sewage.	Protects watercourses, residents and homes	$300,000	*In Progress*
Repairs and upgrades to aging lift station in Petit de Grat to prevent risk of failed operation and overflow of raw sewage.	Protects watercourses, residents and homes	$50,000	*In Progress*
Repairs and upgrades to aging lift station in Evanston to prevent risk of failed	Protects watercourses, residents and homes	$50,000	*In Progress*

operation and overflow of raw sewage.			
Upgrade of Public Works utility vehicle to a larger capacity truck and purchase of an additional vehicle.	Maintain efficiency of Public Works Water utility services	$105,000	*In Progress*
Solid Waste Management			
New construction and demolition (C&D) debris cell. Existing cell at capacity and must be closed.	Protect environment through continued landfill waste diversion and composting	$100,000	*Completed*
New construction and demolition (C&D) debris cell. Existing cell at capacity and must be closed.	Protect environment through continued landfill waste diversion and composting	$100,000	
Expansion of Compost pad at waste management facility to accommodate projected increased volume of organics	Protect environment through continued landfill waste diversion and composting	$200,000	*In progress*
Loader for handling and managing projected increased volume of organic material and wood bark at compost facility	Protect environment through continued landfill waste diversion and composting	$190,000	*Completed*
Screener for size sorting and sifting finished compost prior to distribution or sale.	Improve efficiency and increase capacity of composting operation	$90,000	*Completed*
Increase size of Solid Waste Management facility garage to accommodate additional equipment required for expansion.	Improve efficiency and increase capacity of waste management facility	$350,000	*In Progress*

Replacement of old weigh scale and construction of new scale house at waste management facility.	Improve efficiency and increase capacity of waste management facility	$200,000	*In Progress*
Construction of a designated Solid waste drop off site for residents to improve safety and access at facility.	Improve safety and access to waste management facility for residents	$50,000	
Upgrades to security system at waste management facility.	Improve safety and efficiency of facility and services	$25,000	
Purchase of various heavy equipment accessories for waste management facility.	Improve safety and efficiency of facility and services	$25,000	

Conclusions

Climate change is a critical challenge facing the Municipality of the County of Richmond, with its impacts becoming more evident over time. Characterised by small islands and rural coastal communities, Richmond County is very vulnerable to the following effects of climate change:

- The Municipality is designated as a high risk area to sea level rise and storm surge events, with potential for impact and damage to infrastructure from flooding
- Within the Municipality, sections of the coastline exposed to the Atlantic Ocean are also at risk for effects of coastal erosion
- Increases in storm events and storm intensity increase the risk of flooding and coastal erosion which are already anticipated to be of concern for the Municipality.

Despite this knowledge, it is not possible to accurately project how sea level rise, the County's leading climate change concern, will impact Richmond County. Existing digital mapping is not accurate enough to determine actual sea level rise impacts. Richmond County would require LIDAR mapping to create the elevation accuracy and sea level predictions necessary for subsequent identification of areas of concern.

This Municipal Climate Change Action Plan was viewed as an opportunity to develop key adaptation strategies and actions for the Municipality of Richmond. This report identifies a total of 37 action priorities for adaptation in the areas of social, economic, cultural, environmental, water supply and treatment, climate change protection and greenhouse gas reduction.

This report also presents a detailed summary of the energy use and emissions for the Municipality of Richmond, a valuable tool for assessing the effectiveness of future energy and emissions reduction strategies and initiatives. In this report, a total of 5 community and corporate goals for mitigation were identified. Within these goals, a total of 43 action items were identified. A list of specific capital projects addressing these adaptations and mitigation action items are also presented and including projects in the areas of source water treatment and supply, waste water treatment and solid waste management.

While climate change is already occurring, the way in which the municipality of Richmond and its residents will be affected is not completely understood. It is the hope of the MCCAP Adaptation Team that the priority actions identified in this report form the basis for the Municipality's ongoing response to Climate Change. Incorporating climate change into regular planning now is important to help ensure that the communities of the Municipality of Richmond continue to be sustainable and resilient in the face of future change.

Appendix :

Summary of Corporate Energy Usage, Costs and Greenhouse Gas Emissions

Buildings 2006: Energy and Emissions

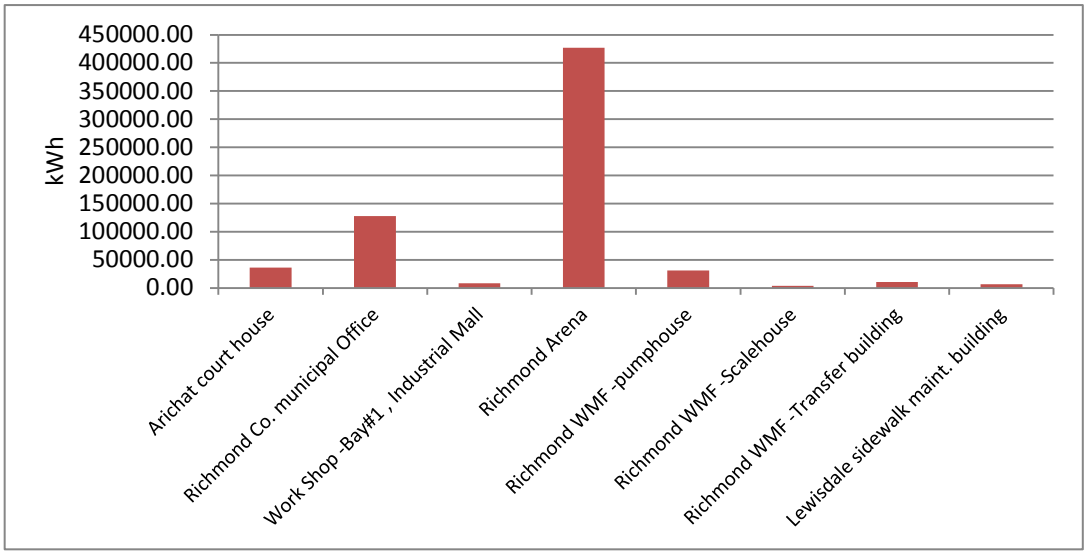
		Court house	Municipal Office	Industrial Mall Shop	Richmond Arena	WMF - pumphouse	WMF - Scalehouse	WMF -Transfer building	Louisdale sidewalk, shop	Totals
Indicators	Occupants	6	18	1	5					**30**
	Operating Hours	2080	2080		2800					**6 960**
	Total Floor Area (m^2)	500	1 005	370	3 394					**5 269**
Electricity	Total Use (kWh)	36420	127620	8595	426858	31218	3898	10520	6716	**651845**
	Cost ($)	5083	15223	1184	46954	3900	601	1177	1066	**75187**
	Total eCO_2 (t)	31,61	110,77	7,46	370,51	27,1	3,38	9,13	5,83	**565,8**
	Total $SO_{2\,(KG)}$	65,56	229,72	15,47	768,34	56,19	7,02	18,94	12,09	**1173,32**
Fuel	Total Use (L)	12215	16000	3500	16497					**48212**
	Cost ($)	10383	13600	2975	16383					**43341**
	Total eCO_2 (t)	32,74	42,88	9,38	44,21	0	0	0	0	**129,21**
	Total $SO_{2\,(KG)}$	104,07	136,32	29,82	140,55	0	0	0	0	
Propane	Total Use (l)				3510,3			2800		**6310,3**
	Cost ($)				3136,24			2800		**5936,24**
	Total eCO_2 (t)	0	0	0	5,34	0	0	4,26	0	**9,59**
	Total $NO_{x\,(KG)}$	0	0	0	147,8	0	0	117,89	0	
TOTALS	Total Cost ($)	15465	28823	4159	66473	3900	601	3977	1066	**124464**
	Total eCO2 (t)	64,35	153,65	16,84	420,06	27,1	3,38	13,39	5,83	**704,6**
	Cost ($) /Operating Hr	7,44	13,86		23,74					**17,88**
	Total Cost ($) /Occupant	2578	1601	4159	13295					**4149**
	Cost ($) / m^2	30,93	28,68	11,24	19,59					**23,62**
	eCO_2 (t) /Operating Hr	0,03	0,07		0,15					**0,1**
	eCO_2 (t) / Occupant	10,72	8,54	16,84	84,01					**23,49**
	eCO_2 (t) / m^2	0,13	0,15	0,05	0,12					**0,13**

Air Pollutants

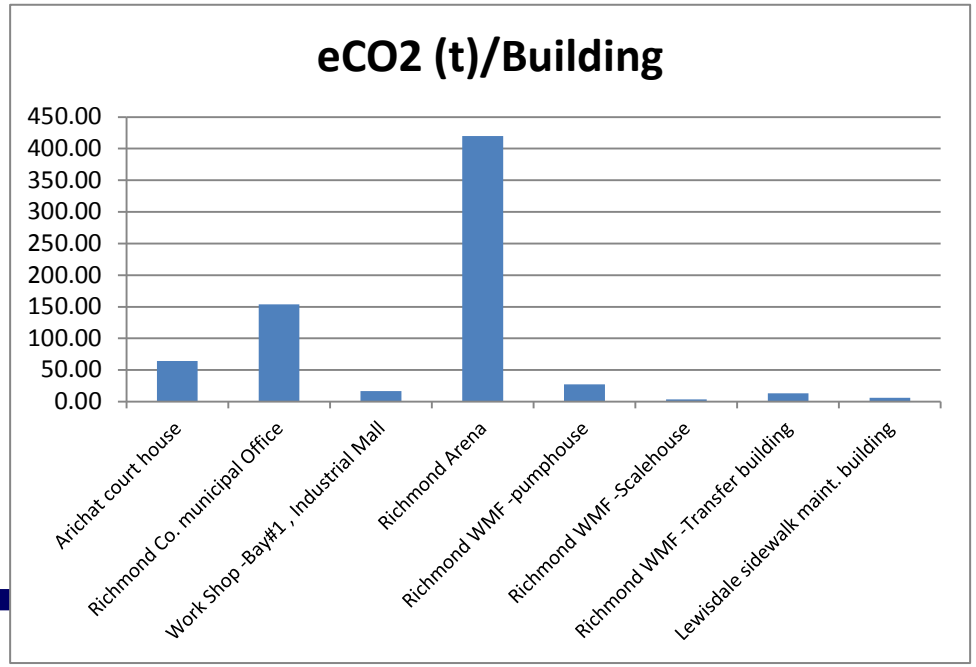
	2. Electricity - Air Pollutants			3. Fuel Oil (L)			4. Natural Gas		
	Total Use (kWH)	**AP Coefficient**	**Total AP (KG)**	**Total Use (L)**	**AP Coefficient**	**Total AP (KG)**	**Total Use (GJ)**	**AP Coefficient**	**Total AP (KG)**
Carbon Monoxide (CO)	651845,00	N/A	N/A	48212,00	0,000600	28,927200	6310,30	0,035368	223,185347
Sulphur Dioxide (SO2)		0,001800	1173,321000		0,008520	410,766240		0,000253	1,594181
Oxides of Nitrogen, expressed as NO2 (NOx)		0,000750	488,883750		0,002400	115,708800		0,042105	265,696842
Volatile Organic Compounds (VOCs)		N/A	N/A		0,000024	1,157088		N/A	N/A
Total Particulate Matter (TPM)		N/A	N/A		0,000240	11,570880		0,000800	5,048240
Particulate Matter less than or equal to 10 microns (PM10)		N/A	N/A		0,000120	5,785440		0,000800	5,048240
Particulate Matter less than or equal to 2.5 microns (PM2.5)		N/A	N/A		0,000030	1,446360		0,000800	5,048240

Building Summary

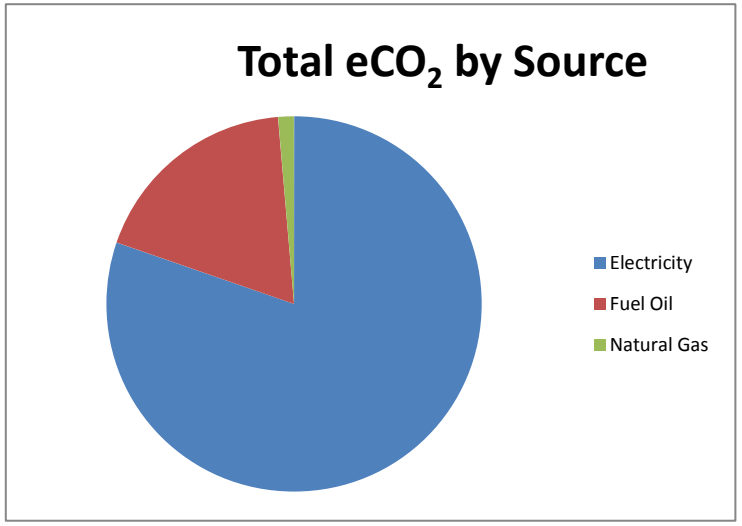
kWh Use / Building	
Arichat court house	36420,00
Richmond Co. municipal Office	127620,00
Work Shop -Bay#1 , Industrial Mall	8595,00
Richmond Arena	426858,00
Richmond WMF -pumphouse	31218,00
Richmond WMF -Scalehouse	3898,00
Richmond WMF -Transfer building	10520,00
Lewisdale sidewalk maint. building	6716,00



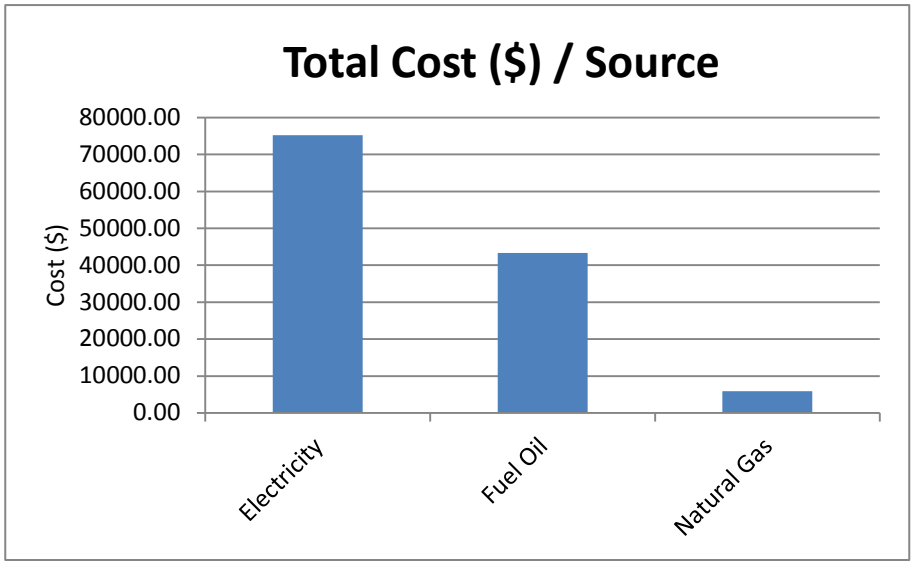
Building or Building Group Name	**Total eCO2 (t)**
Arichat court house	64,35
Richmond Co. municipal Office	153,65
Work Shop -Bay#1 , Industrial Mall	16,84
Richmond Arena	420,06
Richmond WMF -pumphouse	27,10
Richmond WMF -Scalehouse	3,38
Richmond WMF -Transfer building	13,39
Lewisdale sidewalk maint. building	5,83



Total eCO_2 by source	
Electricity	565,80
Fuel Oil	129,21
Natural Gas	9,59



Total Cost ($) / Source	
Electricity	75187,15
Fuel Oil	43340,75
Natural Gas	5936,24



Vehicle Fleet

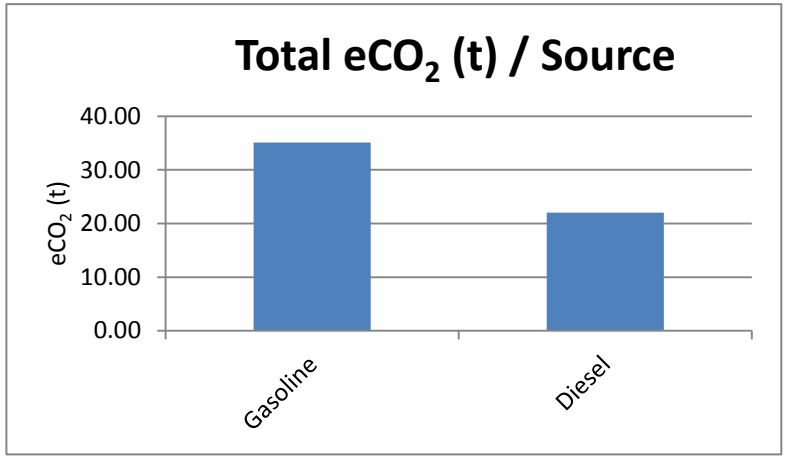
	2. Indicators		3. Gasoline (L)			4. Diesel (L)								
	Total Vehicle KM's	**#**	**Total Use (L)**	**Cost ($)**	**Total eCO_2 (t)**	**Total Use (L)**	**Cost ($)**	**Total eCO_2 (t)**	**Total Cost ($)**	**Total eCO_2 (t)**	**Total Cost ($) / Km**	**Total Cost ($) / # of Vehicles**	**Total eCO_2 (t) / Km**	**Total eCO_2 (t) / # of Vehicles**
Backhoe &Tractor-(solid waste facility)					0	5380	5380	14,15	5380	14,15				
light trucks, 4x1/2ton , 1x1/4 ton, 1x3/4ton	100 000	6	15000	15000	35,1	3000	3000	7,89	18000	42,99	0,18	3000	0	7,17
Totals	**100 000**	**6**	**15 000**	**15 000**	**35**	**8 380**	**8 380**	**22**	**23 380**	**57**	**0**	**3 897**	**0**	**10**

Air Pollutant

Representative vehicle Selected											
Make/Model	Class	Eng Size/ # Cyl	Trans #gears	Fuel			Consumption		Rank		CO_2 kg per year
				Type	$/yr	L/yr	L/100km		Class	All	
							City	Hwy			
Chevrolet C1500 Avalanche	PU	5.3 / 8	E4E	X	$1 960	2839	16,4	11,5	88	864	6814

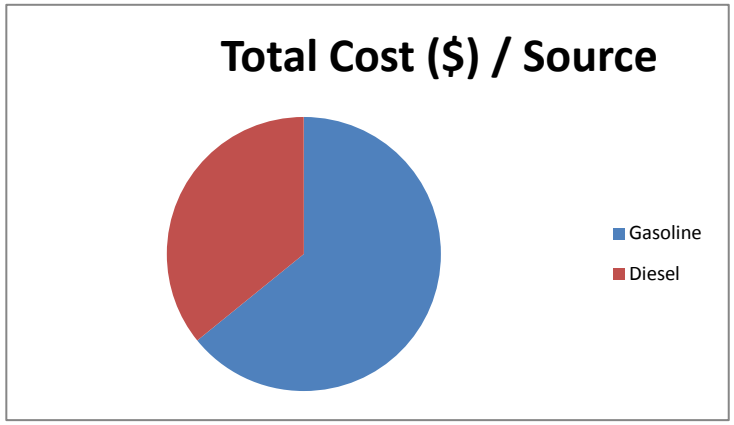
Vehicle Fleet Summary

Total eCO2 (t) / Source	
Gasoline	35,10
Diesel	22,04



Vehicle Fleet Summary

Total Cost ($) / Source	
Gasoline	15000,00
Diesel	8380,00



Street and Area Lights

Energy and Emissions

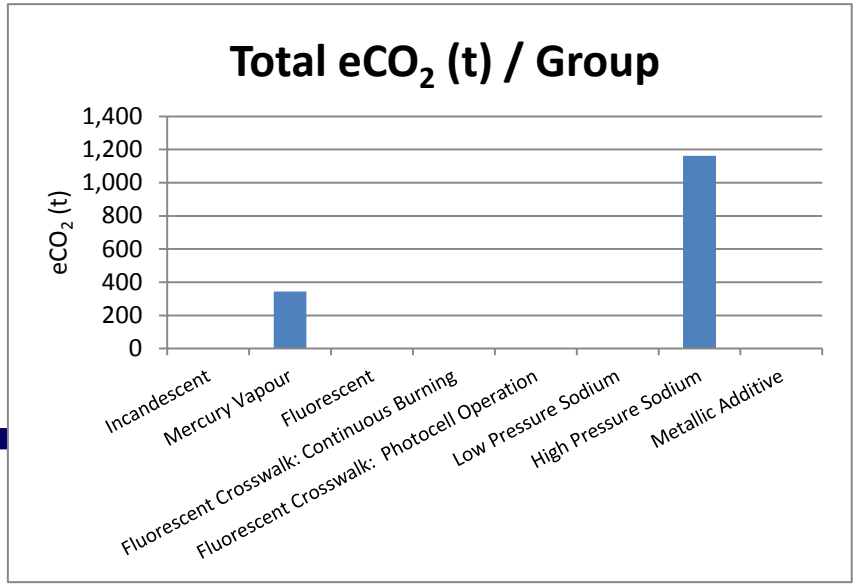
		2. Indicators	3. Electricity (kWh)			4. Total
Description		# of Lights	Total Use (kWh)	Cost ($)	Total eCO_2 (t) / Group	Total eCO_2 (t) / Streetlight
Mercury Vapour						
LOW WATT:	362x125w,34x175w,2x250w	398	396 408	72 176	344	0,864528
HIGH WATT:			0		0	
High Pressure Sodium						
LOW WATT:	1671x70w,137x100w,4x150w	1 812	1 310 076	258 033	1 137	0,627564
HIGH WATT:	17x250w,2x400w	19	28 500	4 643	25	1,302
Metallic Additive						
LOW WATT:	1x250w	1	868	298	1	0,753424
HIGH WATT:			0		0	
Totals		**2 230**	**1 735 852**	**335 151**	**1 507**	**0,675658985**

Street and Area Lights - Air Pollutants

	2. Electricity - Air Pollutants		
	Total Use (kWH)	**AP Coefficient**	**Total AP (KG)**
Carbon Monoxide (CO)	1735852,00	N/A	N/A
Sulphur Dioxide (SO2)		0,001800	3124,533600
Oxides of Nitrogen, expressed as NO2 (NOx)		0,000750	1301,889000
Volatile Organic Compounds (VOCs)		N/A	N/A
Total Particulate Matter (TPM)		N/A	N/A
Particulate Matter less than or equal to 10 microns (PM10)		N/A	N/A
Particulate Matter less than or equal to 2.5 microns (PM2.5)		N/A	N/A

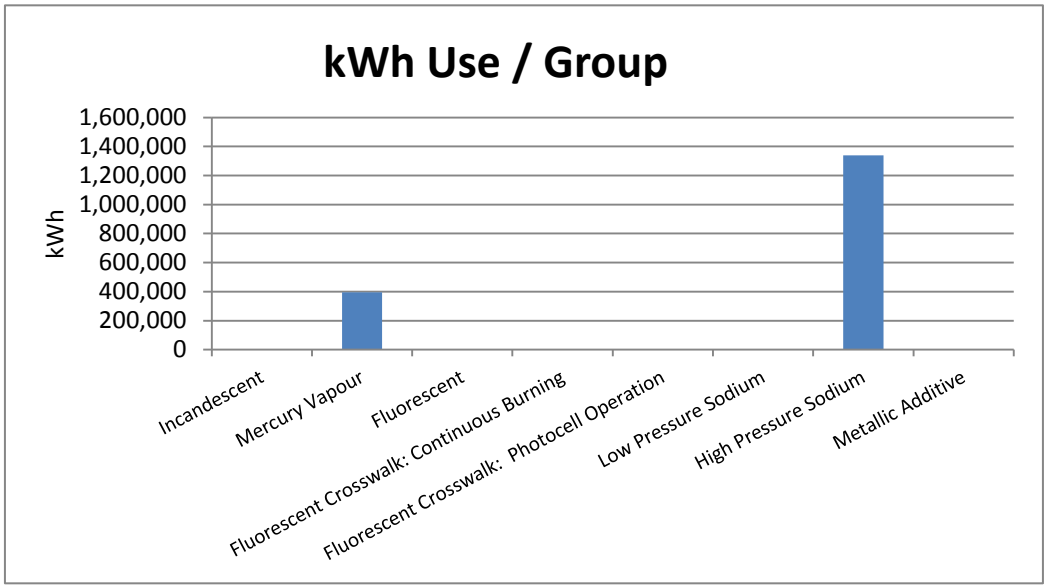
Street and Area Lights Summary

Total $eCO_{2\ (t)}$ / Group	
Mercury Vapour	344
High Pressure Sodium	1 162
Metallic Additive	1

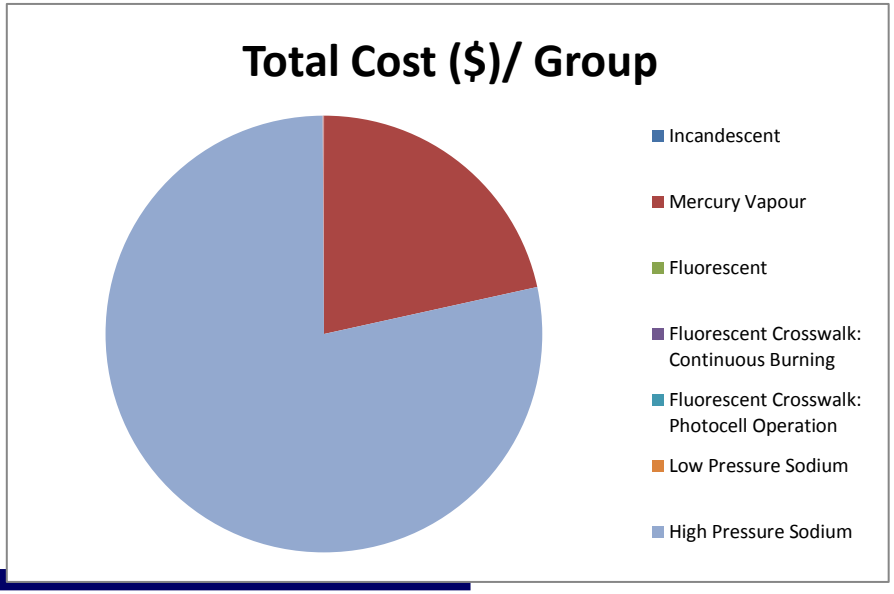


Street and Area Lights Summary

kWh Use / Group	
Incandescent	0
Mercury Vapour	396 408
High Pressure Sodium	1 338 576
Metallic Additive	868



Total Cost ($) / Group	
Incandescent	0
Mercury Vapour	72 176
Fluorescent	0
Fluorescent Crosswalk: Continuous Burning	0
Fluorescent Crosswalk: Photocell Operation	0
Low Pressure Sodium	0
High Pressure Sodium	262 676
Metallic Additive	298



Water and Sewage - Energy and Emissions

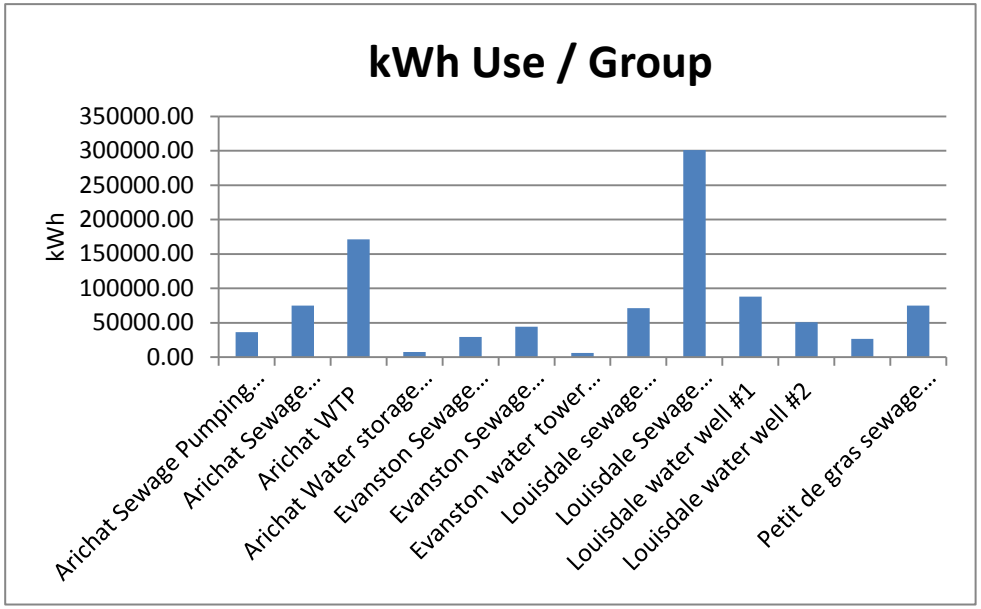
	Electricty (kWh)				4. Propane				TOTALS	
Facility or Facility Group Name	**Total Use (kWh)**	**Cost ($)**	**Total eCO_2 (t)**	**Total SO_2 (KG)**	**Total Use (L)**	**Cost ($)**	**Total eCO_2 (t)**	**Total NO_x (KG)**	**Total Cost ($)**	**Total eCO_2 (t)**
Arichat 5 Sewage Pump Stations	36360	5718,85	31,56	65,45			0	0	5719	31,56
Arichat Sewage Treatment Plant	74880	6369,62	65	134,78			0	0	6370	65
Arichat WTP	171375	16007,66	148,75	308,48	17800	13350	27,06	749,47	29358	175,81
Arichat Water storage tank	7457	1043,98	6,47	13,42			0	0	1044	6,47
Evanston 2 Sewage pump stations	29411	5174,09	25,53	52,94			0	0	5174	25,53
Evanston Sewage treatment plant	44460	3653,58	38,59	80,03			0	0	3654	38,59
Evanston water tower valve building	6144	1583,86	5,33	11,06			0	0	1584	5,33
Louisdale 7 sewage pumping stations	71040	11336	61,66	127,87			0	0	11336	61,66
Louisdale Sewage treatment plant	301200	25221,52	261,44	542,16			0	0	25222	261,44
Louisdale water well #1	88155	10156,91	76,52	158,68			0	0	10157	76,52
Louisdale water well #2	50700	5289,8	44,01	91,26			0	0	5290	44,01
Petit de Grat 4 sewage pump stns	26590	3338,31	23,08	47,86			0	0	3338	23,08
Petit de Grat sewage treatment plant	75150	6377,63	65,23	135,27			0	0	6378	65,23
Totals	982922	101271,81	853,18		17800	13350	27,06		114622	880,23

Air Pollutants

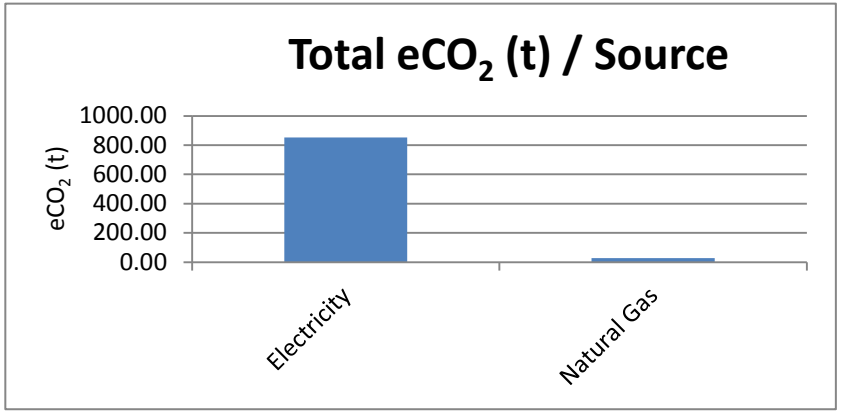
	2. Electricity			4. Natural Gas		
	Total Use (kWH)	**AP Coefficient**	**Total AP (KG)**	**Total Use (GJ)**	**AP Coefficient**	**Total AP (KG)**
Carbon Monoxide (CO)		N/A	N/A		0,035368	#########
Sulphur Dioxide (SO2)		0,001800	1769,259600		0,000253	4,496842
Oxides of Nitrogen, expressed as NO2 (NOx)		0,000750	737,191500		0,042105	#########
Volatile Organic Compounds (VOCs)		N/A	N/A		N/A	N/A
Total Particulate Matter (TPM)	982922,00	N/A	N/A	17800,00	0,000800	14,240000
Particulate Matter less than or equal to 10 microns (PM10)		N/A	N/A		0,000800	14,240000
Particulate Matter less than or equal to 2.5 microns (PM2.5)		N/A	N/A		0,000800	14,240000

Water and Sewage Summary

kWh Use / Group	
Arichat Sewage Pumping Stations (5 in total)	36360,00
Arichat Sewage Treatment Plant	74880,00
Arichat WTP	171375,00
Arichat Water storage tank	7457,00
Evanston Sewage pumping stations (2 in total)	29411,00
Evanston Sewage treatment plant	44460,00
Evanston water tower valve building	6144,00
Louisdale sewage pumping stations (7 in total)	71040,00
Louisdale Sewage treatment plant	301200,00
Louisdale water well #1	88155,00
Louisdale water well #2	50700,00
Petit de grat sewage pumping stations (4 in total)	26590,00
Petit de gras sewage treatment plant	75150,00

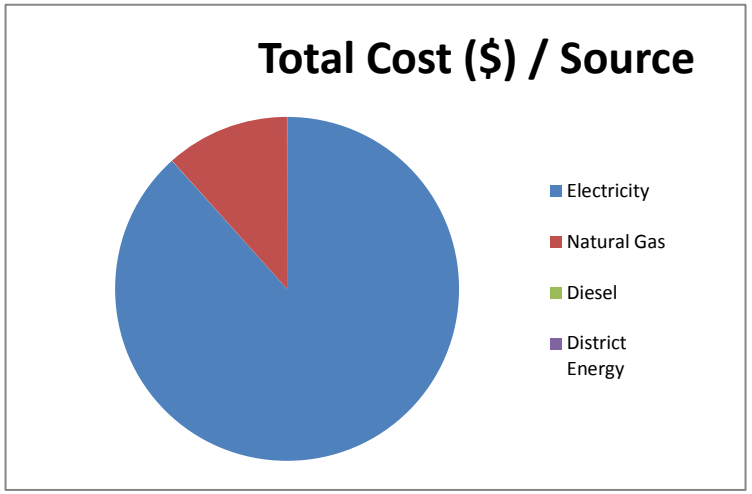


Total eCO_2 / Source	
Electricity	853,18
Natural Gas	27,06



Water and Sewage Summary

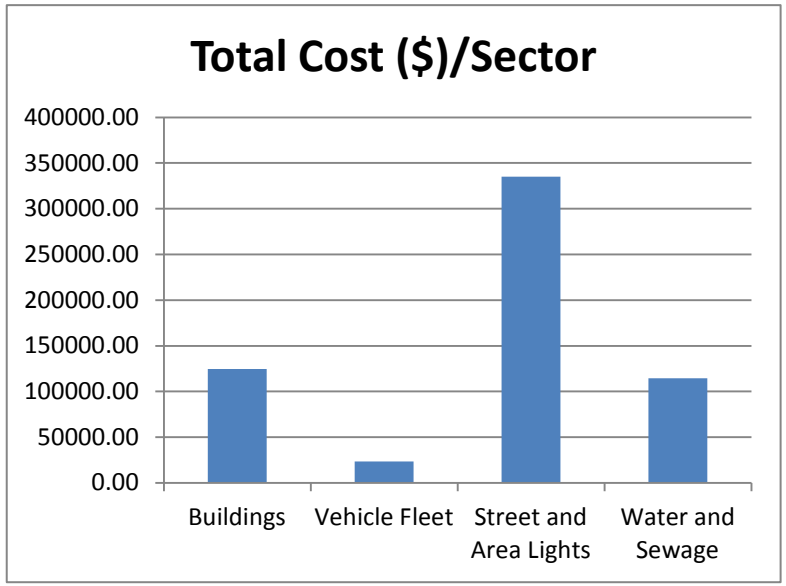
Total Cost ($) / Source	
Electricity	101271,81
Natural Gas	13350,00

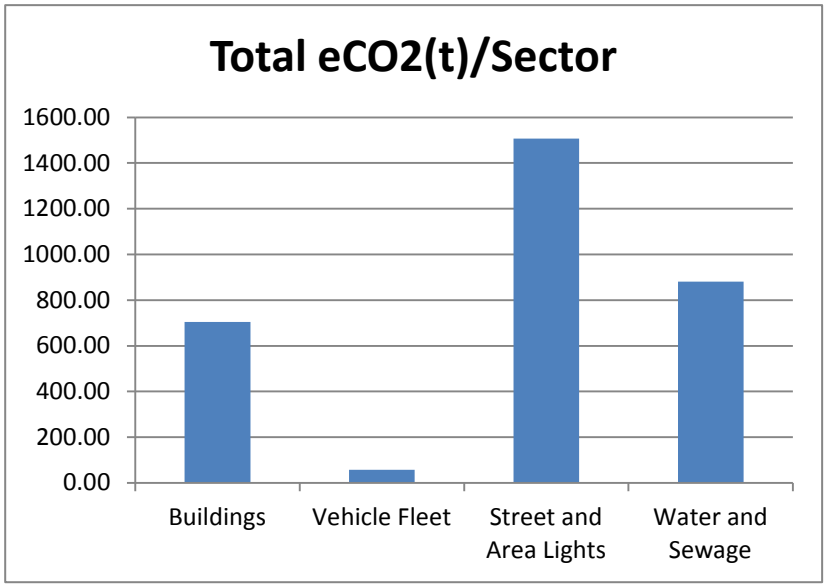


Corporate Inventory Summary

Cost and Tonnes of eCO2 / Sector

Sector	Total Cost	Total eCO2
Buildings	124464,14	704,60
Vehicle Fleet	23380,00	57,14
Street and Area Lights	335150,72	1506,72
Water and Sewage	114621,81	880,23
Waste	0,00	0,00
Totals:	597616,67	3148,69





Energy Type	Total Cost	Total eCO2
Electricity	511609,68	2925,70
Natural Gas	19286,24	36,65
Compressed Natural Gas	0,00	0,00
Diesel	8380,00	22,04
District Energy	0,00	0,00
Ethanol Blend	0,00	0,00
Fuel Oil	43340,75	129,21
Gasoline	15000,00	35,10
Propane	0,00	0,00
Waste	-	0,00
Totals	597616,67	3148,69