Adapting to Climate Change Through Land-Use Planning:
An Investigation of Policy-Making in the Greater Golden Horseshoe

By

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Abstract

Changes to historical climate patterns have significant economic, social and environmental consequences for communities within the Greater Golden Horseshoe (GGH). Recognizing that the effects of climate change are already being experienced and will continue, communities must find ways to adapt in order to mitigate risks and vulnerabilities. In Ontario, the Provincial Government has identified public policy objectives to address climate change through land-use planning through recent amendments to provincial land-use planning policies. Given this new requirement, this research investigates the relationship between land-use planning and climate change adaptation through an examination of policy-making processes, and a targeted review of policy dynamics and instruments, at the local municipal level in the GGH. A review of available literature is used to identify emerging concepts related to policy-making which is applied to a case study analysis of two municipalities in the GGH, the Town of Oakville and the City of Barrie. Based on the analysis, recommendations are made to the Provincial Government to assist local government policy-makers and planners in developing land-use planning policies that address climate change adaptation.

Keywords: climate change adaptation, public policy, policy-making, land-use planning
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Finally, I’d like to dedicate this paper in loving memory of my dear friend, Austin Walker. You encouraged so many of your friends to “live the dream”. So here I am, living my dream and trying to make the world a better place. Even though you’re gone, you continue to have a profound impact on my life and others. You will always live on in our hearts and will never be forgotten.
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<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AMO</td>
<td>Association of Municipalities of Ontario</td>
</tr>
<tr>
<td>AR4</td>
<td>Intergovernmental Panel on Climate Change Fourth Assessment Report</td>
</tr>
<tr>
<td>AR5</td>
<td>Intergovernmental Panel on Climate Change Fifth Assessment Report</td>
</tr>
<tr>
<td>BARC</td>
<td>Building Adaptive and Resilient Communities</td>
</tr>
<tr>
<td>CAs</td>
<td>Conservation Authorities</td>
</tr>
<tr>
<td>CIP</td>
<td>Canadian Institute of Planners</td>
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<tr>
<td>ECCC</td>
<td>Environment and Climate Change Canada</td>
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<tr>
<td>GHG</td>
<td>Greenhouse gas emissions</td>
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<tr>
<td>GGH</td>
<td>Greater Golden Horseshoe</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>ICLEI</td>
<td>International Council for Local Environmental Initiatives</td>
</tr>
<tr>
<td>MMA</td>
<td>Ministry of Municipal Affairs (formerly the Ministry of Municipal Affairs and Housing)</td>
</tr>
<tr>
<td>MMAH</td>
<td>Ministry of Municipal Affairs and Housing</td>
</tr>
<tr>
<td>MRN</td>
<td>Ministry of Natural Resources</td>
</tr>
<tr>
<td>MOECC</td>
<td>Ministry of Environment and Climate Change</td>
</tr>
<tr>
<td>MOECP</td>
<td>Ministry of the Environment, Conservation and Parks (formally the Ministry of Environment and Climate Change)</td>
</tr>
<tr>
<td>NRCan</td>
<td>Natural Resources Canada</td>
</tr>
<tr>
<td>NREE</td>
<td>National Roundtable on the Environment and the Economy</td>
</tr>
<tr>
<td>OPPI</td>
<td>Ontario Professional Planning Institute</td>
</tr>
<tr>
<td>PPS</td>
<td>Provincial Policy Statement</td>
</tr>
<tr>
<td>REB</td>
<td>Research Ethics Board Approval</td>
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Defining Key Terms

**Adaptation** – actions or processes that allow communities and institutions to adapt to uncertainties in future climate projections, reduce potential risks and/or vulnerabilities and identify new opportunities to take advantage of anticipated changes in the climate (Richardson, 2010; Ministry of Environment, 2011; Richardson & Otero, 2012).

**Adaptive Land-Use Planning** – refers to land-use planning policies that can achieve adaptation goals, objectives and processes (Hurlimann & March, 2012).

**Climate Change** – “a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer” (IPCC, 2013, p. 1450).

**Decision-Support Tools** – provides decision makers with relevant information to develop and implement climate change adaptation plans and policies (Richardson & Otero, 2012) and are classified as information-based policy instruments as defined by Howlett (2009) and Henstra (2015).

**Extreme Weather Event** – defined as “a meteorological event that is rare at a place and time of year, such as an intense storm, tornado, hail storm, flood or heat wave, and is beyond the normal range of activity” (Barrie, 2017, p. 8).

**Land-Use Planning Framing Tools** – refers to planning policies that provide strategic direction that can be used to achieve climate change goals (McVey et al., 2016).

**Mainstreaming** – defined as “the integration of adaptation considerations (or climate risks) such that they become part of policies, programs and operations at all levels of decision making” (Richardson, 2010, p. 37).

**Official Plan** – is a land-use planning document that guides the overall development of a community through the identification of long-term land-use planning goals and objectives related to service delivery, development type and location and other community improvements (Ministry of Municipal Affairs and Housing [MMAH], 2018b).

**Policy Instruments** – general term to describe the tools and techniques utilized by policymakers to achieve policy goals and objectives (Howlett, 1991).
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**Provincial Plans** – collectively refers to the recently amended provincial land-use plans including *Growth Plan for the Greater Golden Horseshoe (Growth Plan)*, *Greenbelt Plan*, *Oak Ridges Moraine Conservation Plan* and the *Niagara Escarpment Plan*.

**Resilience** – defined as the capacity of systems (e.g. social, environmental and economic) to respond to extreme events while still being able to maintain primary functions and the ability of such systems to adapt, learn and transform from these occurrences (IPCC, 2014a).

**Vulnerability** – the exposure and lack of ability to respond to harm and adapt (IPCC, 2014a).

**Risk** – relates to the potential adverse affects of climate change on economic, social and environmental systems and the probability of hazardous events and the associated impacts occurring (IPCC, 2014a).
1.0 Introduction

Available literature suggests that land-use planning institutions and interventions are vital in adapting communities to climate change (Hurliman & March, 2012). In Ontario, as of 2017, municipalities located within the Greater Golden Horseshoe (GGH) are now legally-mandated to consider climate change as part of land-use planning documents. Despite this requirement, minimal guidance and support is provided by the Province of Ontario to aid municipalities in developing these policies. This is particularly concerning as failing to adapt to climate change has significant economic, social and environmental costs.

A small number of municipalities in the GGH have made progress in developing climate change policies in advance of the recent Provincial policy changes. Through the development of municipal adaptation strategies, which identify adaptation measures, communities can formulate land-use planning policies to mitigate impacts of climate change. Although there are limited examples of municipalities with existing adaptation strategies to draw upon in the GGH, case studies in other Ontario areas can provide valuable insight that may assist other municipalities in fulfilling new land-use planning policy requirements. In recognition that many municipalities in the GGH have yet to introduce adaptive actions into land-use planning documents, this research study focuses on policy-making rather than policy implementation.

The analysis aims seeks to investigate policy-making as it relates to land-use planning and climate change adaptation in the GGH. In doing so, it aims to contribute to the understanding of public policy-making as it relates to climate change adaptation at the local municipal level. To this end, this paper evaluates existing policy dynamics and policy instrument selection that influence adaptation. Based on a review of existing literature, emerging concepts in relation to developing climate change adaptation policies in the GGH are identified and applied to two municipal case studies, the Town of Oakville and the City of Barrie. The final section of this research provides recommendations to the Province of Ontario to assist local government policy-makers and planners in fulfilling new public policy requirements related to climate change and land-use planning.
2.0 Problem Identification and Background

This section of the paper describes the impacts of climate change in southern Ontario and identifies the need for local governments to implement climate change adaptation measures within land-use planning policies. In particular, policy-making, in relation to policy-instrument selection and policy dynamics is also discussed. This section concludes with a list of research objectives that will be addressed throughout the remainder of this research.

2.1 Consequences of Climate Change in Southern Ontario

Southern Ontario is particularly vulnerable to climate change. Within the Great Lakes River Basin (shown in Figure 1), climate projections prepared by the Ministry of Natural Resources (MNR) indicate the region will experience hotter and dryer summers and milder and wetter winters (McDermind, Fera & Hogg, 2015). By 2080, it is anticipated that the region will experience between a 1.5 to 7°C increase in temperature and 158 mm increase in annual precipitation above historical trends (McDermind, Fera, & Hogg, 2015).

Figure 1: Great Lakes River Basin. Source: ECCC (2017)
According to the Ministry of Environment, Conservation and Parks (MOECP)\(^1\) in the Province of Ontario, climate change has already caused an increase in extreme weather events including heavy rainfall, severe storms, flooding and heat waves resulting in negative impacts on economic, social and environmental systems (MOECP, 2017).

The National Roundtable on the Environment and the Economy (NREE) estimated the economic costs associated with climate change across Canada could increase from “roughly $5 billion per year in 2020” to “between $21 billion and $43 billion per year by 2050” (NREE, 2011, p. 15). The report also commented on the implications to human health, concluding that an increase in average annual temperatures would result in hotter summers and reduce air quality, thereby leading to increased deaths and other illnesses (NREE, 2011).

The MOCEP (2012) identified that increased frequency of extreme weather events arising from climate change has caused significant damages to Ontario’s natural environment. As of 2017, nearly 30% of the Ontario’s evergreen trees had been damaged or lost due to extreme weather events (MOECP, 2017). Moreover, climate change also affects the biodiversity of the Province’s natural systems by altering habitats through temperature changes and creating new climatic conditions that may be conducive to non-native species (MOECP, 2018a).

Moreover, climate change has resulted in multi-billion-dollar damages to private and publicly owned property in Ontario (MOECP, 2017). The significance of these costs suggests that communities in the Province are vulnerable and are inadequately equipped to respond to extreme weather events. The notion of vulnerability is further supported in a recent publication produced by the Intact Centre on Climate Adaptation which concluded that approximately 20% of Canadians are at risk of flooding (Moudak & Fletmate, 2017). This is particularly concerning as the report also noted that many Canadians lack the financial resources to respond to flood related emergencies (Moudak & Fletmate, 2017).

At the local scale, increases in annual precipitation rates, as anticipated by the McDermind, Fera and Hogg (2015), may overburden local stormwater management infrastructure, resulting in flooding and issues with water quality caused by increased stormwater runoff (MOECP, 2018a). Increases in temperature is also problematic as it may result in extreme

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\(^1\) Formerly the Ministry of Environment and Climate Change (MOECC), the Ministry of Environment, Conservation and Parks (MOECP) was renamed by the elected Progressive Conservative government in June 2018
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heat and periods of drought (IPPC, 2014a). This is further supported by the Intergovernmental Panel on Climate Change (IPCC) whose climate models suggest with “very high confidence” that climate change will have negative consequences for human well-being (2014b). Because of these hazards, climate change poses a serious threat to communities.

2.2 The Need for Climate Change Adaptation

There are two primary responses to climate change: mitigation and adaptation. According to Martens (2013), mitigation relates to actions and processes that reduce greenhouse gas (GHG) emissions, which are believed to be the leading cause of climate change. In contrast, available climate change adaptation documents produced by various government agencies in Canada define climate change adaptation as actions or processes that allow communities and institutions to adapt to uncertainties in future climate projections, reduce potential risks and/or vulnerabilities and identify new opportunities to take advantage of anticipated changes in the climate (Richardson, 2010; Ministry of Environment, 2011; Richardson & Otero, 2012).

In recognition of the environmental, economic and social impacts that will arise from changes in Canada’s historical climate patterns, available literature suggests that climate change risks can be reduced, and that opportunities can be realized, through adaptative actions (IPCC, 2014a; Ministry of Environment, 2011; Richardson & Otero, 2012). Although mitigation is an important response in reducing the future effects of climate change, recent analysis presented by the IPCC in its Fifth Assessment Report (AR5) suggests that even if mitigation efforts were able to successfully reduce current levels of GHG emissions, adaptation efforts are still required to address climatic changes that have already occurred (IPCC, 2014b).

The notion of resilience is also important to consider in the context of climate change adaptation. According to the IPCC (2014a), resilience is similar to adaptation in that it relates to the capacity of systems (e.g. social, environmental and economic) to adapt, learn and transform from climate change while still maintaining primary functions. In this respect, adapting to climate change can increase the resiliency of systems as well as communities.

2.3 The Importance of Municipalities in Adapting to Climate Change

Evidence suggests that municipalities are becoming increasingly active in developing and implementing adaptation measures (Bulkeley, 2010; Vogel and Henstra, 2015). In Canada, the
importance of local governments in adapting to climate change has been recognized by the Federal Government (Richardson, 2010). As climate change is anticipated to affect every community in Canada, the Federal Government has developed guidelines for municipalities to integrate climate change adaptation into decision-making processes (Richardson, 2010). More recently, Environment and Climate Change Canada (ECCC) released the *Pan Canadian Framework on Clean Growth and Climate Change*, a multi-dimensional strategy developed in collaboration with provincial and territorial levels of government, to identify climate change mitigation and adaptation measures (ECCC, 2016b). The strategy identified climate change adaptation as an important issue for municipalities given the negative impacts on local infrastructure, social and economic systems, as well as built and natural environments (ECCC, 2016b). The responsibilities of local governments arguably demonstrate the need to integrate adaptation policies at the local level. According to Henstra (2012), municipalities play a key role in delivering public amenities, providing infrastructure and regulating land-use planning, all of which are important functions that can be used to adapt to future climate changes.

Recently, the Province of Ontario undertook a coordinated review of existing provincial land-use plans (collectively referred to as the Provincial Plans), which include the *Growth Plan for the Greater Golden Horseshoe* (*Growth Plan*), *Greenbelt Plan*, *Oak Ridges Moraine Conservation Plan* and the *Niagara Escarpment Plan*, resulting in a new requirement for municipalities to include climate change policies in official plans (MOECP, 2018) which are the leading land-use planning document to guide growth at the local community level (MMAH, 2018b). While municipal climate change action is a relatively new approach in Canada, available literature suggests that local level intervention is needed given the “place-based nature of climate adaptation” (Vogel & Henstra, 2015, p. 111).

Although available research acknowledges the importance of municipal governments and achieving climate change actions on a theoretical level (Dannevig, Rauken & Hovelsrud, 2012; Bulkeley, 2010), there remains limited research on the development of adaptation policies (Henstra, 2015; Vogel & Henstra, 2015). That said, in the GGH context, the new Provincial requirement will effectively “mainstream” climate change policies into practice, which as asserted by Kok and Coninck (2007) and Richardson (2010), means adaptation policies are incorporated more broadly into decision-making processes.
The importance of local government agencies in developing adaptation measures is supported by Bulkeley (2010), Henstra (2012) and Vogel and Henstra (2015) who argue that local governments have become increasingly involved in adaptation thereby allowing responses to be tailored to local needs. Drawing on their conclusion, my analysis focuses on adaptation efforts of municipalities rather than other levels of government (e.g. Provincial and Federal). Moreover, I believe that the new Provincial requirement for municipalities to consider climate change in official plans policies further validates the role of local governments in developing adaptation measures.

2.4 Adaptation in the Greater Golden Horseshoe (GGH)

The analysis and findings presented in this research are discussed within the context of the Greater Golden Horseshoe (GGH) region located in southern Ontario. From a land-use planning perspective, the GGH is one of the most populated and fastest growing regions in North America and contains some of the most ecologically significant land in the Province (MMA, 2017a). According to the Growth Plan, the GGH contains a diverse range of land areas including urban, rural and First Nations communities (MMA, 2017a). Several provincial land-use plans and policies (also referred to as the Provincial Plans) guide development in the area through the establishment of overarching policy objectives. This includes the integration of climate change considerations into municipal land-use planning policies to facilitate the development of communities that are resilient to climate change (MMA, 2017a). This policy requirement, coupled with anticipated increases in average annual temperatures and precipitation, illustrates the importance of understanding the relationship between land-use planning and the ability of communities to adapt to climate change.

Figure 2 provides a map of the GGH as defined by the boundaries established in the Growth Plan. Importantly, the GGH encompasses upper and lower-tier municipalities that are located within the Great Lakes Drainage Basin (see Figure 1). In accordance with the projections prepared by the MNR, municipalities located within the GGH are anticipated to experience significant shifts in historic climate patterns (McDermind, Fera & Hogg, 2015).
2.5 Linking Climate Change Adaptation to Land-Use Planning

Land-use planning is vital to facilitate climate change adaptation for two primary reasons. First, land-use planning processes and models have available capacity to integrate adaptive policies. According to Hurlimann and March (2012), planning processes achieve long-term benefits and coordinate across various activities while also simultaneously working within government frameworks. These common processes create capacity to achieve adaptive actions. Examples of such capacities include “the ability to act on and coordinate matters of collective concern or public good” and “thinking and action across various spatial, temporal and governance scales while understanding and acting on local circumstances and particularities” (Hurlimann & March, 2012, p. 480).
Second, government agencies, other organizations and academics have recognized the importance of land-use planning to achieve adaptive measures. For example, adaptation reports prepared by the Federal Government have identified land-use planning processes as a relatively cost-effective approach to reduce future impacts related to climate change (Richardson, 2010). At the provincial level, the Growth Plan requires that climate change mitigation and adaptation be supported through growth management and infrastructure design (MMA, 2017b). In particular, the IPCC (2014b) has identified land-use interventions, such as infrastructure, building design and regulations, as a proactive approach to adapt to future climate risks. Stern (2007) asserts that a range of policy instruments and tools are needed to adapt to climate change. Furthermore, it is argued that integrating climate change into land-use planning will facilitate the development of adaptive infrastructure and also reduce community risks and vulnerability through regulating development (Stern, 2007).

Although there is strong evidence to support land-use planning in addressing climate change, there are also criticisms to this approach. For example, Wilson and Piper (2010) argue that the integration of climate change into land-use planning requires a “reframing” of existing planning methods. This is particularly challenging as planning approaches vary across jurisdictions and developing a new approach to land-use planning requires “conventional planning processes and skills” to be challenged (Wilson & Piper, 2010, p.3). Nonetheless, there exists successful examples of land-use policies that integrate climate change adaptation. A recent case study analysis of local land-use plans in Prince George, British Columbia, found that adaptation measures were successfully mainstreamed into local planning policies (Picketts, Dery & Curry, 2012). Other examples of successful case studies include Rotterdam, The Netherlands, where adaptation policies have been integrated into all levels of decision-making and land-use planning processes (Lu & Stead, 2013) and Queensland, Australia, where despite challenges with competing institutional objectives, land-use planners have overcome political barriers to integrate adaptation measures into planning practices (McClure & Baker, 2018).

Despite known challenges with land-use planning, I argue that it is an important mechanism worth investigating as it can be used to mitigate climate change. This argument is supported by the aforementioned examples which suggests that adaptive measures can be integrated into land-use planning. Moreover, the recent changes to Provincial Plans suggests that
the Government of Ontario also supports the role of land-use planning policy in adapting to climate change.

2.6 Local Level Policy Analysis

Vogel and Henstra (2015) assert that “policy-making is assumed to be a purposive activity spearheaded by governments, which involves choices about whether and how public authority and resources will be used to address problems” (p.111). Governments develop policies through choices. The scope of policy must be determined as well as the intended intervention and/or policy objective (Bardach, 2011; Vogel & Henstra, 2015). To achieve policy objectives, governments must select instruments (e.g. regulation, taxation, information etc.) and embed these choices in the overall policy design. Howlett (1991) (2009) has argued the importance of conceptualizing policy instruments as they are the primary tools utilized to implement public policy.

Public policy is not designed within a vacuum; rather, it is influenced and entrenched within broader institutional and political frameworks (Urwin & Jordan, 2008). Evidence suggests that understanding these broader policy dynamics in relation to policy-making and policy-implementation processes can be used to understand policy change (Bardach, 2011). Although climate change adaptation policies are implemented at all levels of government in Canada, this paper focuses on policy-making by local governments. Additionally, given that many municipalities in the GGH have yet to include adaptive land-use planning policies into official plans, the analysis focuses on policy-making and instrument selection rather than implementation. The need to understand policy-making at the local scale is supported by Vogel and Henstra (2015) and Urwin and Jordan (2008) who assert that public policies related to adaptation are increasingly being developed at this scale and therefore warrant further attention.

2.7 Research Objectives

The goal of my research is to investigate policy-making as it relates to land-use planning and climate change adaptation in the GGH. In total, three key research objectives have been identified in relation to this goal:
1. **Objective 1:** Analyze the relationship between current political and institutional frameworks and policy instruments related to climate change adaptation and land-use planning in the GGH and identify challenges and/or gaps with current practices.

2. **Objective 2:** Evaluate case studies based on emerging concepts from a review of relevant literature that evaluate how climate change adaptation policies are developed and how they are integrated into land-use plans.

3. **Objective 3:** Propose recommendations to improve the formulation of climate change adaptation policies with specific emphasis on policy-making at the local government level.

In achieving these research objectives, I believe this paper will provide insight into policy dynamics and instruments that can aid GGH municipalities in developing land-use policies that integrate adaptive measures. This analysis will contribute to the understanding of policy frameworks and instruments related to land-use planning in the GGH and the relationship to climate change adaptation. While the analysis and research findings apply to municipalities located within the GGH, the findings may also apply to communities outside of this geographic area.

### 2.8 Organization of Research

The analysis presented in this paper is organized into nine sections. Section 1 introduces the reader to the subject matter. Section 2 defines adaptation and identifies the importance of responding to climate change. In addition, Section 2 also describes the importance of local governments and links climate change adaptation to land-use planning and the importance of analyzing policy-making choices (e.g. instrument selection) is also discussed. Following this, Section 3 describes the research methodology and the limitations associated with each of the selected research methods. Section 4 presents a literature review which describes climate change roles and responsibilities and the gaps and limitations of the federal government as well as the provincial and municipal levels of government in the Province of Ontario and the role of Conservation Authorities (CAs). Section 4 also outlines relevant authority and information-based policy instruments (e.g. land-use plans and policies, adaptation programs and decision-support tools) that apply to municipalities in Ontario. Following the literature review, Section 5 presents gaps in the available literature and identifies the need for further research. After establishing the
current state of knowledge in relation to climate change adaptation in Section 4 and 5, Section 6 identifies emerging concepts and observations from the literature review. Section 7 presents an analysis of two case studies as reviewed based on the concepts identified in Section 6. Following this, Section 8 presents the findings from the analysis and offers recommendations to enhance existing climate change adaptation practices. Finally, Section 9 presents concluding thoughts and identifies areas for future research considerations.

2.9 Disclaimer

In June 2018, constituents within the Province of Ontario elected a Progressive Conservative Majority Government which replaced the former Liberal Majority Government. Many of the policies and plans discussed in this research paper were developed under the previous Liberal Government and it is currently unclear whether these policies will be supported by the newly elected Premier of Ontario. Notwithstanding this recent political shift, this paper is based on the principle that climate change is a real phenomenon that has severe consequences for communities. Notably, this paper recognizes that land-use planning is an important mechanism in which municipalities can respond and adapt to climate change.

It is currently unknown whether the new requirement for municipalities in the GGH to incorporate climate change policies in their official plans will remain enforced. That said, findings from this research can still be utilized by municipalities that wish to advance climate change adaptation, even without policy direction from the Province.
3.0 Methodology and Limitations

This section of the paper describes the research methods and associated limitations of the employed methods. It is intended to provide a summary of the process used to gather evidence and develop research findings.

3.1 The Research is Based on a Grounded Theory Approach

Grounded theory, supported by a bottom-up inductive approach, was used to develop research outcomes as discussed in Sections 3 to 6. In accordance with the principles of grounded theory as identified by Simons (2009), the research was informed based on general observations of emerging concepts through the identified research methods. As data related to climate change adaptation and land-use planning were gathered and analyzed, observations were noted and theories were developed. In particular, a comparative analysis of case studies in different institutional settings was also employed. This approach has been argued to facilitate the development of assumptions and theory-building (Gupta, 2012).

3.2 Three Research Methods Are Applied

Three qualitative research methods are used to inform the findings of this research: literature review, case study analysis and semi-structured participant interviews. Figure 3 provides a flow chart of the employed research methods and a brief description of how each method informs the analysis. Research was conducted using an integrated and iterative approach meaning that the identified methods were not completed in succession. For example, evidence gathered through the case study analysis and semi-structured interviews prompted further review of available research which informed the literature review.
3.2.1 Literature Review

Section 3 presents a thematic literature review based on peer reviewed and grey literature and identifies current climate change adaptation policies and plans that relate to land-use planning within the GGH. In particular, the literature review describes the roles and responsibilities of various government agencies to better understand the institutional frameworks in which municipalities implement climate change adaptation policies. The second component of the literature review provides a detailed evaluation of land-use planning policy instruments in Ontario, with specific emphasis on the GGH, as well as emerging concepts to be considered in the case study analysis.

Exclusionary criteria were developed to confine the literature reviewed. For example, due to the scope of the research objectives and limited size of this research, the literature review does not address climate change mitigation. Most of the literature reviewed was limited to Canada and the Province of Ontario although some sources from other jurisdictions were relied upon to provide further context. Moreover, literature not available in English was excluded from the analysis.
3.2.2 Case Study Analysis

Section 5 presents a case study analysis of two municipalities within the GGH: City of Barrie and Town of Oakville. Selection criteria were developed in relation to the identified research objectives. For example, municipalities were selected based on their geographic location (e.g. located within the GGH), the existence of adaptation strategies and anticipated risk and vulnerabilities associated with climate change. To limit the number of case studies reviewed, only municipalities enrolled in the Building Adaptive and Resilient Communities (BARC) program were considered. By restricting the case studies to the BARC program, it provides a common framework to compare and analyze the selected municipalities. The BARC program is described in section 4.2.2 of this paper.

The selection criteria resulted in the identification of three potential case studies: City of Barrie, Town of Oakville and the Region of Durham. Although all three jurisdictions were deemed appropriate for examination under the identified criteria, due to the space limitations of the research project, only two case studies were selected: City of Barrie and Town of Oakville.

The selected case studies were then examined using concepts identified through the literature review. Available climate change adaptation plans, staff reports and discussions with municipal staff were also used to inform the case study analysis.

3.2.3 Semi-Structured Interviews

A small sample of four semi-structured interviews were used to identify areas of further research and help inform the case study analysis. The small sample size was intentional given the inductive research approach and limited time and resources available to undertake this project. The employed approach is supported by Neuman and Robson (2009) who argue that although theory is derived from data sources such as participant interviews, it is also limited by the resources available to the researcher. As qualitative interviews require a significant amount of time to locate suitable research participants and disseminate data, semi-structured interviews were not intended to be the primary source of data to inform this research. Rather, semi-

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2 BARC is program managed by the International Council for Local Environmental Initiatives (ICLEI) which assists Canadian municipalities in developing climate change adaptation plans.
structured interviews were intended to ensure that emerging observations were reasonable and to identify areas of further research.

Participants were selected based on municipalities that had existing climate change adaptation plans. Interviews were conducted using the approach outlined by DiCicco-Bloom and Crabtree (2006) whereby questions were structured in an open-ended manner to facilitate further discussion with participants. For example, probing questions such as “What has been your experience with climate change adaptation plans?” and “In your professional experience, do you think there are any challenges with implementing climate change adaptation policies in official plans?” were asked to initiate the discussion. As participants responded to questions, follow-up questions were asked to gather further information based on participant responses to the initial probing questions. Research Ethics Board (REB) approval was obtained to ensure that interviews were conducted in an ethical manner. As well, all participant responses are treated as confidential.

3.3 Research Limitations

There are three primary limitations to the research. First, there are known limitations and fallacies associated with the employed research methods, paradigms and theories. For example, according to Charmaz (2014), grounded theory can be perceived as bias towards the researchers understanding of reality thereby skewing the results. The research is also limited to due to the overall timeframe allotted to collect data resulting in a review of only two case studies and a small sample of semi-structured interviews. This may result in some bias or under representation of the larger population. As well, reliability is challenging to achieve given that data analysis can be knowingly or mistakenly influenced by the personal judgement of the researcher.

Second, environmental elements including the influence of prevailing political, regulatory, economic and other variables may affect or influence the research. As discussed in the literature review, current climate change adaptation policies and practices in the GGH are influenced by prevailing political and institutional frameworks. Recent political party changes in the Provincial Government in Ontario may result in further changes to provincial plans and policies thus influencing the requirement for local municipal governments to implement climate change adaptation policies.
Finally, human elements including inadvertent personal bias and possible influence of the researcher may limit the research findings. In order to mitigate these limitations, I have completed a course on research involving human participants as administered by the Panel on Research Ethics for the Government of Canada and also obtained REB approval.
4.0 Literature Review

This section presents a thematic literature review of current themes and emerging concepts related the climate change adaptation and land-use planning in Ontario. This section also identifies the relevance of existing political and institutional frameworks as well as policy instruments in relation to adaptation and land-use planning.

4.1 Political and Institutional Frameworks Related to Climate Change

Climate change, including adaptation policies and practices, is viewed as a multi-dimensional problem which spans various political and institutional jurisdictions as well as temporal and spatial scales (Urwin & Jordan, 2008; Williams & Mcnutt, 2013). As shown in Figure 4, various federal, provincial and local government agencies as well as other organizations in Canada are responsible for developing and implementing climate change adaptation plans and policies. This paper identifies relevant legislation as well as the roles and responsibilities of organizations to better understand the political and institutional frameworks in which adaptation measures are developed. In doing so, this analysis describes the current context, which relates to government actions and means, that policies are implemented within (Vogel & Henstra, 2015).

Figure 4 is not intended to provide a comprehensive list of all climate change agencies; rather, it identifies key agencies and organizations that influence climate change adaptation and land-use planning decisions. Given that this research is focused at the local municipal level, emphasis is placed on provincial ministries, municipal council and Conservation Authorities (CAs) in Ontario.
4.1.1 Roles and Responsibilities

4.1.1.1 Federal Government

At the federal level, ECCC is responsible for developing national strategies related to adaptation. Recently, ECCC released the Pan-Canadian Framework, a document intended to guide the reduction of GHG emissions across Canada and integrate climate change adaptation policies into practice through the identification of critical actions that support adaptation at federal, provincial and local municipal levels (ECCC, 2016c). In contrast, Natural Resources Canada (NRCan) is responsible for providing scientific climate data (NRCan, 2017b) as well as managing Canada’s Adaptation Platform, which brings together upper levels of government, industry professionals, local and non-profit organizations, academics and Indigenous People to discuss climate adaptation issues (NRCan, 2017a).

4.1.1.2 Provincial Government

In the Province of Ontario, the MOECP is responsible for climate change policies including the development and enforcement of laws and regulations. Under the preceding Liberal Government, the Province announced that a strategy was being developed to further advance adaptation plans and policies through the creation of an organization that would produce a comprehensive province-wide assessment of climate change risk and vulnerabilities (MOECP, 2018). According to the MOECP (2018), the strategy calls for a multi-governmental collaborative approach to climate change adaptation.
From a land-use planning perspective, the Ministry of Municipal Affairs (MMA) is crucial in mainstreaming climate change adaptation measures into land-use planning practices. The Ministry is responsible for a range of legislation including, but not limited to, the *Planning Act*, the *Places to Grow Act*, and the *Building Code*. Each piece of legislation provides rules and guidelines for the development of communities which can be used to ensure that the built environment can withstand future challenges associated with climate change.

### 4.1.1.3 Municipal Government

Municipalities are required to conform with provincial legislation and policies. In this context, municipal councils act as the local governing body that hold decision making powers for a range of activities including service delivery; financing of municipal projects, including the approval of annual capital and operating budgets; and local plans and policies, in accordance with policy goals and objectives identified within overarching provincial policies (Ministry of Municipal Affairs and Housing [MMAH], 2014). Municipal councils are responsible for adopting official plans, which according to the MMA (2018a), guide the development of land within a community through the identification of overarching land-use planning goals and objectives.

### 4.1.1.4 Other Organizations (Conservation Authorities)

CAs “deliver services and programs to protect and manage impacts on water and other natural resources in partnership with all levels of government, landowners and many other organizations” (Conservation Ontario, 2018a). Under the provisions of the *Conservation Authorities Act, 1946*, CAs have the authority to implement watershed management plans that are intended to reduce potential water-related climate change risks such as flooding. Because of the catastrophic flooding events of Hurricane Hazel in 1954, which resulted in the deaths of approximately 80 individuals in southern Ontario, flood management became a primary responsibility of CAs including the implementation of flood-control infrastructure (Worte, 2017).

According to Worte (2017), since the inception of CAs in 1946, their associated roles and responsibilities have continued to broaden. Initially, CAs were created to facilitate flood prevention; however, overtime, their responsibilities have increased to include source water protection, responding to climate change and properly planning for rapidly developing areas. As
CAs often span municipal boundaries, understanding their role in influencing land-use planning decisions may assist in reducing climate change risk and vulnerabilities at the municipal level.

4.1.2 Limitations and Gaps

The assessment of available literature as well as the review of roles and responsibilities of government agencies and other organizations in relation to climate change has identified several limitations and gaps within existing political and institutional frameworks. At the federal level, research conducted by Williams and McNutt (2013) suggests that while there is available capacity to implement climate change policies, competing policy interests may hinder this capacity. In contrast, Snoddon and Wigle (2009) argue that at the provincial level, policy cohesion and collaboration between federal and provincial agencies is a significant challenge, despite that climate change is a shared responsibility between these jurisdictions.

Richardson (2010) asserts that municipalities are vital to the success of climate change mitigation and adaptation and should therefore have an influential role in policy development, including the formation of policies at the federal and provincial level. However, Gore (2010) has argued that this has rarely occurred, as municipalities are subordinate to federal and provincial policy-making therefore, their involvement is not viewed as critical in the policy formulation process.

Evidence also suggests that CAs struggle to integrate adaptive actions into water management plans (Ludwig, Slobbe & Cofino, 2014). The prevailing integrated watershed management framework used by CAs to develop watershed management plans has been found to ignore future changes in global weather patterns and focus solely on historic climate conditions (Ludwig, Slobbe & Cofino, 2014). As argued by Ludwig, Slobbe and Cofino (2014), this challenge is exasperated by uncertainties in future climate change projections at local scales. Although the Conservation Authorities Act, 1946 was recently amended to modernize the legislation and identify further opportunities to integrate climate change adaptation and mitigation into watershed management plans (Conservation Ontario, 2018b), it is challenging to develop a standardized approach to address climate change and other emerging challenges (e.g. intensification of land, lack of resources, failure to integrate stakeholders etc.) (Shrubsole, Walters, Veale & Mitchelle, 2017).
4.1.3 Policy Context of Local Governments

Despite challenges at the local municipal level, municipalities have acted autonomously to address climate change through voluntary organizations and collaboration with local or international municipal coalitions. For example, municipalities such as the Town of Oakville and City of Barrie (both located within the GGH) have partnered with the International Council for Local Environmental Initiatives (ICLEI) to develop adaptation strategies in response to future climate change projections (ICLEI, 2018). Both strategies were developed in advance of the recent changes to the Provincial Plans.

Comparing policy contexts across government and non-government organizations allows problems to be conceptualized. For example, while available literature suggests that there are limitations and gaps within existing political and institutional frameworks (Gore, 2010; Snoddon & Wigle, 2009; Williams & McNutt, 2013), identifying these challenges generates further knowledge of adaptation policies and can be used to identify areas for improvement. Recognizing that local governments operate within the frameworks of other government agencies and organizations, investigating these frameworks provides insight to policy-making practices at the local scale.

4.2 Identification of Policy Instruments in Ontario

In addition to identifying overarching political and institutional frameworks, this research also investigates how policy instruments achieve public policy objectives. According to Howlett (1991), policy-makers select instruments that they believe can help achieve policy goals. More specifically, policy instruments are defined as “tools by which governments seek to change the behaviour of targets or ameliorate problematic conditions” (Henstra, 2015, p. 497)

Howlett (2009) further argues that policy instruments are inherently linked to successful policy design and that “policy instrument choices can thus be seen to result from a nested or embedded relationship within a larger framework of established governance modes and policy regime logics” (p.1). This notion is also supported by Henstra (2015) who assets that policy instrument selection is crucial in achieving public policy objectives. From an adaptation perspective, there is minimal literature available on the strengths and weaknesses of different policy instruments to help inform policy-making (Henstra, 2015). I believe this to be particularly
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concerning for municipalities located within the GGH, as they are now required to develop policies related to climate change with limited resources. Arguably, both Howlett (2009) and Henstra’s (2015) conclusions emphasize the importance of policy instrument selection in relation to the scale and intended outcomes of policy objectives. However, more research is needed to understand policy instrument selection in relation to climate change adaptation (Henstra, 2015).

Although policy instruments are often classified differently between political and physical jurisdictions, a review of available literature suggests that “information” and “authority” policy instruments are commonly used to formulate and implement climate change adaptation policies within the Province of Ontario. According to Howlett (2009) authority-based instruments, which include legislation, licences and user fees, are intended to modify behaviour by establishing rules and/or regulations and are most commonly used by policy-makers. In contrast, Henstra (2015) describes information-based instruments as “information dissemination, knowledge generation and knowledge mobilization to inform adaptive responses” (p. 500).

This section of the literature review investigates how policy goals related to climate change adaptation in Ontario are achieved through authority and information-based instruments. Land-use planning at the local municipal level in Ontario is guided by authority-based policy instruments including provincial legislation, plans and policies. Legislation provides the regulatory framework, whereas plans and policies such as the Growth Plan provide guidance and further direction on specific policy goals and objectives (e.g. identification of growth areas and related targets, protection of natural heritage features and protection of communities from hazards lands) (MMA, 2017b). In contrast, climate change adaptation programs rely on information-based policy instruments to disseminate knowledge thereby allowing for better informed policy-making.

4.2.1 Identification of Authority-Based Policy Instruments

4.2.1.1 Planning Legislation

The Planning Act is the leading piece of planning legislation in Ontario that guides land-use planning across the province. In 2017 the Planning Act was amended to require that

3 A summary of relevant authority-based policy instruments, including relevant planning legislation and Provincial Plans, is presented in Appendix A.
municipal council have regard to climate change and include related policies within official plans (see section 16(14) of the Planning Act. RSO 1990, c. P13, s 16.). The Provincial Policy Statement (PPS) is another critical document that guides land-use planning in Ontario. The PPS identifies the “governments policies in land-use planning” and applies to all development across the Province, including the GGH (MAH, 2018).

Authority-based policy instruments such as legislation, require compliance established through legal obligation and/or penalties for non-compliance (Henstra, 2015). This is particularly evident in Ontario, as the PPS was amended in 2014 to “require municipalities to consider the effects of climate change in planning for resilient communities” (MOECP, 2018). This change in policy was significant as, in accordance with section 3(5) of the Planning Act, any exercise that affects a planning matter “shall be consistent” with any policy statements issued under the legislation, including the PPS.

4.2.1.2 Provincial Land-Use Plans and Policies

Within the legislative parameters established by the PPS, there are also several provincial plans and policies used to guide land-use planning in the province. As illustrated in Appendix A, the Growth Plan is arguably is the most relevant provincial plan in relation to climate change adaptation. The Growth Plan includes strategic direction to integrate climate change adaptation, particularly in relation to infrastructure and land-use development that may reduce the impacts of climate change risks and vulnerabilities (MMA, 2017b; MMA, 2017c).

Other plans, such as the Greenbelt Plan, Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan, also include strategic direction for climate change adaptation practices in relation to the protection of land. For example, section 1.2 of the Greenbelt Plan identifies guiding vision and policy objectives including the protection of natural heritage features to help reduce climate change flood risks by preserving natural hydrological functions (MMA, 2017c). According to the MMA (2017c), the preservation of natural hydrological functions reduces the amount of stormwater runoff thus reducing flood risk.

4.2.1.3 Provincial Climate Change Adaptation Plans

Climate change adaptation strategies and actions are created at the provincial level in Ontario. For example, in 2011 the Government of Ontario released Climate Ready – Ontario’s
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Adaptation Strategy and Action Plan which included five core policy goals and 37 policy actions intended to increase the resilience of communities in response to climate change, identify risk management tools and disseminate knowledge about future climate projections (Ministry of the Environment, 2011). Of the 37 policy actions, three relate to land-use planning, two of which apply to the GGH.

Table 1 provides a brief description of the land-use planning actions that relate to the GGH. Recognizing the strategy has been in effect since 2011, an analysis of policy outcomes is also provided. As illustrated in the table below, both land-use planning adaptation action items have been achieved through recent amendments to the Provincial Plans and the PPS. Arguably, the achievement of these actions demonstrates the importance of policy instruments in achieving policy goals and objectives.

<table>
<thead>
<tr>
<th>Action Item</th>
<th>Description</th>
<th>Policy Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action 21</strong> – Increase awareness of land-use planning tools (Ministry of the Environment, 2011)</td>
<td>Increase use of municipal site plan control and development permit systems to implement sustainable design of buildings and infrastructure (Ministry of the Environment, 2011). Examples include the use of low impact development and other sustainable building designs (Ministry of the Environment, 2011).</td>
<td>Recent amendments to the Provincial Plans now require that municipalities consider and develop plans in relation to stormwater management and low impact development (MOECP, 2018)</td>
</tr>
<tr>
<td><strong>Action 22</strong> – Integrate adaptation into the PPS (Ministry of the Environment, 2011)</td>
<td>Integrate climate change adaptation into the PPS through the comprehensive review initiated in 2010 (Ministry of the Environment, 2011).</td>
<td>The PPS was amended in 2014 to include climate change policy considerations, including mitigation and adaptation (MOECP, 2018).</td>
</tr>
</tbody>
</table>

Since the release of Climate Ready – Ontario’s Adaptation Strategy and Action Plan, no further climate change plans exclusively dedicated to adaptation have been implemented by the Province. According to a statement released by the MOECP in early 2018 (formally referred to as the MOECC at the time the statement was released), the Province announced that it was developing a new plan related to climate change adaptation which would build on the action
items identified in the *Climate Ready – Ontario’s Adaptation Strategy and Action Plan* (MOECP, 2018). Since the release of the statement, a new political party was elected in the Province of Ontario and it is currently unknown if this strategy is still proposed to be released.

### 4.2.1.4 Local Land-Use Plans

In addition to the Provincial Government, municipalities also rely upon authority-based instruments to achieve adaptation measures through the development and management of land. According to Richardson and Otero (2012), municipalities have a range of authority-based instruments including official plans, zoning by-laws, development guidelines, incentives etc. that control development. These types of regulatory planning instruments are useful in achieving adaptation measures as it provides a framework to apply rules and also coordinates development across an entire community, thus allowing rules to be applied consistently (Hurlimann & March, 2012).

As noted previously, official plans are particularly central in achieving land-use planning policy goals and objectives. According to MAH (2018b), official plans provide a “framework for establishing municipal zoning bylaws to set local regulations and standards, like the size of lots and height of buildings” (p.2). In effect, if a policy goal is identified in an official plan, it is integrated into other land-use planning instruments to achieve the identified goal. For example, if an official plan identifies the intent to adapt to climate change through sustainable design, a municipality may develop design guidelines to help achieve this objective.

The importance of official plans in achieving climate change adaptation policies is further supported through an analysis completed by Davidson and Bowron (2012) for the Canadian Institute of Planners (CIP). Based on an analysis of surveys conducted with municipal planners across Canada in 2008, 2009, 2011 and 2012, official plans were identified as the most important land-use planning tool to implement climate change policy goals and objectives.

In addition, authority-based policy instruments may be used by upper levels of government to ensure local adaptation. Henstra (2015) suggests that “intergovernmental mandates” are a sub-category of authority-based policy instruments. For example, legislation may be enacted at upper levels of government to require municipalities to develop and
implement adaptation policies (Henstrat, 2015). Intergovernmental mandates are evident in the GGH as climate change must now be integrated within official plans.

### 4.2.2 Identification of Information-Based Policy Instruments

#### 4.2.2.1 ICLEI Building Adaptative & Resilient Communities (BARC) program

In Canada, organizations such as ICLEI manage voluntary climate change adaptation programs that provide information, training and support to participating municipalities. In 2011, ICLEI published a report entitled *Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate Change Adaptation* to “assist local governments in the creation of adaptation plans to address the relevant climate change impacts associated with their communities” (ICLEI, 2011, p.4).

Following the release of this guide, the organization developed the BARC program to assist municipalities in developing adaptation plans through expert advice, climate change knowledge and other adaptation tools (ICLEI, 2018). As described by Harvey and Fisher (2013), this program enables “knowledge mobilization” in which relationships are developed between research producers (e.g. ICLEI) and users (e.g. municipalities) to disseminate knowledge. The program relies on the Five Milestone Framework as identified in the *Changing Climate, Changing Communities* guide. As shown in Figure 5 below, the five milestones include “initiate”, “research”, “plan”, “implement” and “monitor/review” and involves an iterative process to help municipalities identify and prioritize adaptation goals and objectives (ICLEI, 2018). As described by Henstra (2015), information-based policy instruments are best used when there is the desire and/or motivation for policy actors to undertake adaptative actions but there lacks sufficient knowledge. Therefore, by disseminating knowledge and educating municipal stakeholders on climate change adaptation, this enables adaptative actions.
Information-based policy instruments, compared to others, are relatively non-resource intensive and maintain low political risk (Henstra, 2015), which makes these policy instruments an attractive option for policy-makers. While BARC has not been implemented widely in the GGH, several municipalities including the cities of Barrie and Hamilton, the Town of Oakville as well as the Region of Durham have participated in the program (ICLEI, 2018). For a fee, participating municipalities are provided with access to information, expertise in relation to climate change science and data, identification and categorization of risks and vulnerabilities and other adaptation strategies based on their climate change adaptation needs (ICLEI, 2018). According to ICLEI (2011), the development of strategies that identify adaptive actions can be used to inform strategic land-use policies and directions, including goals and objectives in official plan documents, as well as identify adaptive actions that can be incorporated into other municipal authority-based instruments such as zoning by-laws and development guidelines. Using tools such as the BARC program, local governments can tailor adaptation plans and strategies to anticipated climate change impacts that may affect their community.

According to Carmin, Dodman, Harvey and Romero-lankao (2011) government action and strategies are needed to achieve climate change adaptation measures. This can be realized
through the pooling of resources, interaction with various stakeholders or through community-based adaptation whereby local communities are empowered to adapt to climate change through local knowledge and skills (Carmin et al., 2011). The actions identified by Carmin et al. (2011) are embodied within the BARC program. The program provides local governments with knowledge as well as access to various resources in order to develop solutions to climate change through policy development.

4.2.2.2 Other Climate Change Adaptation Programs and Frameworks

In addition to the BARC program, other adaptation programs and guidelines are available to municipalities in the GGH. For example, the Great Lakes Canada Climate Change Adaptation Project, also managed by ICLEI, provides training to municipalities on climate change data and establishes collaborative stakeholder groups to help implement adaptation policies into practice through funding, knowledge support and investment in local climate change initiatives (ICLEI, 2016). However, this program is only available to a select number of communities in the GGH that border the Great Lakes (ICLEI, 2016).

Other adaptation frameworks are available to municipalities within the GGH, including the *Climate Change Adaptation Planning: A Handbook for Small Canadian Communities*, developed by the Canadian Institute of Planners (CIP) (2011). However, both the Great Lakes Canada Climate Change Adaptation Project and the adaptation handbook are limited to specific types of communities, whereas the BARC program can be used by any municipality in Canada and tailored to meet the unique political, social and environmental contexts of each community.

There is also some evidence to suggest that site-specific adaptation programs and partnerships are being utilized by municipalities in Ontario. For example, the City of Vaughan has partnered with the Ontario Climate Consortium to undertake a vulnerability and risk assessment of climate change impacts on stormwater management assets (Ontario Climate Consortium, 2017). Although the project is currently underway, the Ontario Climate Consortium, who is leading the project, expects that the project will result in a greater understanding of stormwater vulnerability using geospatial data, climate projections, mapping and risk assessments based on workshops with private and public stakeholders (Ontario Climate Consortium, 2017).
4.3 Summary of Embedded Policy Dynamics

Table 2 provides a summary of the various political and institutional frameworks and the related policy instruments embedded within the broader policy dynamics related to climate change adaptation in Ontario. As defined by Howlett (2009), the green boxes represent authority-based policy instruments whereby the government creates legislation and regulation to influence behaviour. In contrast, the blue boxes denote information-based policy instruments which provides information to stakeholders to achieve desired policy outcomes (Henstra, 2015). As illustrated in the table, all levels of government utilize both authority and information-based policy instruments to achieve desired policy outcomes. This suggests that policy-makers rely on a range of instruments to achieve public policy objectives.

<table>
<thead>
<tr>
<th>Policy Instruments</th>
<th>Federal</th>
<th>Provincial</th>
<th>Municipal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislation</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Provincial Plans and Policies</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Local Land-Use Plans</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Programs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
5.0 Identification of Policy-Making and Further Research Needs

The analysis of policy frameworks and instruments provide a high-level synopsis of climate change adaptation policy dynamics within the Province of Ontario. Based on the review of available literature, the following identifies the need for additional research.

5.1 The Need for Decision-Support Tools

As identified by Harvey and Fisher (2013), knowledge mobilization relates to the dissemination of climate change information amongst policy actors. The Federal Government report produced by Richardson and Otero (2012) entitled *Land-use Planning Tools for Local Adaptation to Climate Change*, arguably attempts to disseminate knowledge on climate change adaptation by identifying “decision-support tools” that provide policy-makers and planners with relevant information to develop and implement climate change adaptation policies. Examples of such tools include “assessment of community vulnerability and risk”, “climate projections”, “scenario planning”, “visualizing climate change impacts” and “adaptation planning guidebooks” (Richardson & Otero, 2012).

According to Henstra (2015), tools such as climate change projections, scenarios and visualization are categorized as information-based policy instruments. Recognizing the risks associated with climate change and the importance of land-use planning to build community resilience, I assert that information-based policy instruments should be made available to help local governments develop adaptation policies. This is supported by Richardson and Otero (2012) who argue that decision-support tools help integrate climate change into land-use planning policy and decision-making processes, and the importance of policy instrument selection as described by Howlett (2009) and Henstra (2015). Moreover, I argue that the Province should provide more resources to municipalities. According to Henstra (2015), government organizations have access and often maintain ownership of important data that is needed during early stages of policy-making. Despite that reports developed by the Federal Government have acknowledged the importance of decision-support tools (Richardson & Otero, 2012), the responsibility to disseminate this information into a format that is meaningful for local level policy-making has remained largely with independent organizations such as ICLEI rather than Federal or Provincial agencies. Although ICLEI offers an important service to municipalities, I believe that the Provincial Government should have a more active role in
providing information-based policy instruments. I also argue that the lack of support by the Province demonstrates a disconnect between the Provincial Government’s expectations related to climate change and land-use planning and the ability of municipalities to deliver intergovernmental-mandated public policy objectives.

5.2 Further Research Is Needed

The schematic shown in Figure 6 provides a visual representation of the relationship between political and institutional frameworks, land-use planning and climate change adaptation as analyzed through a review of existing literature. Based on this review, three conclusions have been made.

First, municipalities have an important role in adapting to climate change through land-use planning. Although land-use planning is not the only mechanism to respond to climate change, government and non-government agencies including the IPCC (2014), MMA (2017a) and ICLEI (2016) as well as academics (Hurlimann & March, 2012; Stern, 2007) have recognized land-use planning as critical mechanism in reducing climate change related risk and vulnerabilities. Recognizing that municipalities have been legally-mandated to consider climate
change in land-use planning and given that municipal planners also identify official plans as important tools, I argue that official plans are the primary authority-based policy instrument to achieve adaptive response in land-use planning at the local municipal level.

Second, municipalities utilize both authority and information-based policy instruments to achieve climate change adaptation policy objectives; however, in review of current policy frameworks and policy instruments, there is some uncertainty concerning how adaptive land-use planning policies are developed. For example, as official plans are authority-based policy instruments that alter behaviour to achieve policy objectives, decision-support tools (e.g. information-based policy instruments) are needed to make informed land-use planning decisions related to climate change (Henstra, 2015; Richardson & Otero, 2012). While programs such as BARC provide municipalities with climate change information to help inform official plan policies, participation in the program is voluntary, thus the application of decision-support tools is not consistent between jurisdictions.

Finally, there is no provincially-mandated program or framework to guide municipalities in developing climate change policies for official plans. As municipalities are now legislatively required to develop these policies, I draw upon Howlett’s (2009) and Henstra’s (2015) conclusions that policy instruments are imperative when developing public policy. Recommendations developed by McVey et al. (2016) as input to the coordinated review of the Provincial Plans on behalf of the MOECC, argue that frameworks, performance and evolution measures are needed to aid policy-makers in land-use planning decisions. This finding is validated through semi-structured interviews with participants from surveyed municipalities. Participants without climate change policies in their official plan documents indicated that developing these policies would be challenging without proper guidance.
6.0 Identification of Emerging Concepts

Based on the review of existing literature, two concepts emerged in relation to climate change adaptation and land-use planning at the municipal level in the GGH:

1. Decision-Support Tools
2. Land-Use Planning Framing Tools

These emerging concepts are discussed further below and are used to evaluate the identified case studies in Section 5. By reviewing the case studies in the context of emerging concepts, lessons learned can be disseminated and applied conceptually to other municipalities within the GGH.

6.1 Decision-Support Tools

As identified through the literature review, Richardson and Otero (2012) and Henstra (2015) argue that information-based policy instruments are crucial in developing climate change land-use planning policies. Notably, this theory has been validated by municipal planning professionals across Canada. As identified by Davidson and Bowron (2012) through multiyear surveys of municipal planning professionals in Canada, the majority of planners surveyed noted they were uncertain of the data required to develop climate change policies. More specifically, planners suggested that data on “local information on climate change threats” would aid in formulating climate change policies (Davidson & Bowron, 2012). The lack of data related to climate change has been recognized as a challenge for planners in available literature. As asserted by Hurlimann and March (2012), while the discipline of planning arguably has the capacity to facilitate climate change response, there is a lack of relevant climate change data at local scales. The findings from Davidson and Bowron’s (2012) further supports the need to provide municipalities with decision-support tools to make adaptive land-use planning policies.

Table 3 below summarizes the various decision-support tools as identified by Richardson and Otero (2012) and the relationship to adaptive land-use planning. According to Araosa, Berrang-Forda, Forda, Austin, Biesbroekb and Lesnikowskia (2013), groundwork adaptation initiatives are used to identify and create enabling conditions that support the implementation of adaptive actions. Groundwork adaptation initiatives are supported through information-based policy instruments identified by Richardson and Otero (2012). For example, the scenario
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A planning decision-support tool allows land-use planners to examine different climate conditions. Therefore, I believe that an assessment of these conditions may lead to specific adaptive actions such as the development of additional stormwater infrastructure to accommodate increases in annual precipitation identified under climate change scenarios.

<table>
<thead>
<tr>
<th>Table 3: Decision Support-Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tool</strong></td>
</tr>
<tr>
<td>Assessment of community vulnerability and risk</td>
</tr>
<tr>
<td>Climate projections</td>
</tr>
<tr>
<td>Scenario planning</td>
</tr>
<tr>
<td>Visualizing climate change impacts</td>
</tr>
<tr>
<td>Adaptation planning guidebooks</td>
</tr>
</tbody>
</table>
6.2 Land-Use Planning Framing Tools

In addition to decision-support tools, Richardson and Otero (2012) suggest land-use planning tools allow municipalities to “more effectively adapt to climate change” (p. 3). Examples of land-use planning tools include “official plans”, “local plans on special matters”, “zoning”, “land subdivisions and development controls”, “covenants and easements”, “design guidelines” and “environmental review of development projects” (Richardson and Otero, 2012, p. 3).

The significance of land-use planning tools is further supported by McVey et al. (2016). Drawing on the decision-support tools identified by Richardson and Otero (2012), McVey et al. (2016) identified several planning related tools and instruments in their report to the MOECC, which categorized the various types of land-use planning tools. For example, “official plans” and “local plans on special matters” were categorized as “framing” instruments to reflect the strategic policy goals and objectives these documents provide in relation to climate change (McVey et al., 2016).

Although each of the identified planning tools by McVey et al. (2016) and Richardson and Otero (2012) achieve adaptation goals and objectives, I argue that official plans are one of the most important tools to address climate change. This argument is supported based on the importance of official plans in achieving policy objectives (MMA, 2018a), the perception of its importance by land-use planners (Davidson & Bowron, 2012) and the presence of intergovernmental mandates (e.g. Provincial requirement to integrate climate change into land-use plans) (Henstra, 2015). As discussed in Section 3, municipal councils approve official plans under the requirements of the Planning Act and related provincial plans and policies to identify strategic goals and objectives related to the development of communities. Other planning tools, such as regulatory and zoning instruments, voluntary contributions and design guidelines, are used to achieve the overarching goals and objectives identified in official plans. Therefore, I further argue that incorporating adaptive actions into official plans will likely result in climate change actions being incorporated into other planning tools.

Other specialized plans and policies such as climate change strategies also provide direction and guidance to inform land-use planning decisions. These strategies identify future climate conditions as well as strategic vision and objectives to promote the resiliency of
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communities in response to climate change. As identified by Hurlimann and March (2012), the development of vision statements is “useful as a starting point for stating intent, organizing and finding common ground between large sets of differing views or stakeholders” (p. 482). In effect, these strategies are similar to official plans in that they provide a framework and identify objectives that are actioned through other tools and instruments. For the purposes of this research, land-use planning “framing” tools relies on the categorization developed by McVey et al. (2016) and includes both official plans and climate change adaptation strategies which are defined as other specialized plans and policies.

Table 4 below provides a brief description of official plans and other specialized plans and policies and the application to adaptive land-use planning.

<table>
<thead>
<tr>
<th>Planning Tool</th>
<th>Description</th>
<th>Relationship to Adaptive Land-Use Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Official Plans</strong></td>
<td>Provides policies that guide the overall development of land within a municipality (MAH, 2018b)</td>
<td>• Identifies goals and objectives to adapt and mitigate climate change risks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provides a framework to establish regulatory and policies (e.g. zoning by-law, design guidelines, sustainable building guidelines)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Enhances the development of policies in collaboration with other agencies (e.g. CAs)</td>
</tr>
<tr>
<td><strong>Specialized Plans and Policies (e.g. Climate Change Adaptation Plans and Policies)</strong></td>
<td>Identifies future climate change projections, risks and vulnerabilities associated with climate change and prioritizes actions (Richardson &amp; Otero, 2012)</td>
<td>• Identifies future climate change projections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identifies risks and vulnerabilities of climate change within social, economic and environment contexts</td>
</tr>
</tbody>
</table>
7.0 Case Study Analysis

Drawing on the review of adaptation programs identified in Section 3, two municipalities, the Town of Oakville and the City of Barrie, were selected as case studies. The two case studies provide an interesting comparison for the following reasons. First, both municipalities are subject to the same land-use planning regime as they are located within the GGH. Second, the municipalities are at different stages in developing adaptation policies for their official plans. As discussed in Section 2, the case studies were selected based on their participation in ICLEI’s BARC program. The two case studies provide a small sample of GGH municipalities and are not necessarily indicative of economic, social and political contexts of all communities.

The information presented as part of this case study analysis provides an important comparison and investigation of climate change adaptation policies and land-use planning in the GGH as municipalities located within this geographic area are subject to the same land-use planning frameworks and policy dynamics. This notion is further supported by Vogel and Henstra (2015) who assert that local level municipalities “is an optimal site for policy experimentation, in that innovative practices can be tested on a smaller scale and then replicated in other communities” (p. 111).

7.1 Town of Oakville

The Town of Oakville is an interesting case study given its relatively long history in developing climate change adaptation policies. For example, the Town has incorporated climate change policies into its official plan since the The Liveable Oakville Plan was adopted in 2009. In contrast, the City of Barrie has no climate change policies in its official plan. The Town has demonstrated its commitment to mainstreaming climate change into its decision-making process by adopting an adaptation initiative and disseminating knowledge to local constituents through a Climate Change Primer which provides information on climate projections and related impacts to the Town (Oakville, 2018b)

7.1.1 Description of Case Study Area

The Town of Oakville is a lower-tier municipality within Halton Region located adjacent to Lake Ontario in the central area of the GGH. According to Statistics Canada (2017b), as of 2016, the population of the Town was approximately 193,800 persons. The Town is located
within the Great Lakes River Basin, an area which is anticipated to experience significant changes in annual temperature and precipitation. Climate projections prepared as part of the Town’s Climate Change Strategy anticipate that average annual temperatures and precipitation will increase by approximately 2.6°C and 5%, respectively by 2050 (Oakville, 2014). As a result of these changes, it is anticipated that the number of storms, freezing rain occurrences and number of extreme heat warning days per annum will increase (Oakville, 2014).

7.1.2 Analysis of Climate Change Adaptation Strategies

The Town of Oakville has been actively engaged with ICLEI since 2004 (Oakville, 2018). In 2014 the Town adopted a formal Climate Change Strategy in accordance with the Five Milestone Framework established under the BARC program; as of 2016, the Town had achieved the fifth milestone (Oakville, 2018).

Section 10.2. of the Town’s 2009 The Liveable Oakville Plan (as consolidated in April 2017) provides specific direction to reduce the risk of infrastructure damage associated with extreme weather events (Oakville, 2017). This is reflected in the guiding vision of the Town’s Climate Change Adaptation Strategy to “build the Town’s resiliency to the impact of climate change” (Oakville, 2014, p. 4). Several decision-support tools, as described by Henstra (2015) and Richardson and Otero (2012), were used to inform the actions identified in the adaptation strategy. For example, climate projections were prepared to identify future conditions that may negatively affect the Town. In accordance with the findings of Richardson and Otero (2012), the Town utilized climate projections to help inform the assessment of community risk and vulnerabilities (Oakville, 2014).

Two climate change scenarios based on high and low emissions were presented in the Town’s adaptation strategy and were informed based in factors such as “population, GDP growth, energy use, land-use change, oil/gas resource availability, technological change and change favoring” (Oakville, 2014, p. 15). According to Richardson and Otero (2012), scenario testing allows policy-makers and planners to develop strategies and responses under different scenarios. While the Town examined changes under both scenarios, adaptation goals and actions were developed under the assumption of the high emissions scenario as it was indicative of historical emission trends at the time the strategy was developed (Oakville, 2014). This scenario
was applied in the assessment of climate related risk and vulnerabilities which prioritized adaptive responses (Oakville, 2014).

A vulnerability assessment of climate change impacts was based on a ranking of sensitivity and adaptive capacity (Oakville, 2014). In an effort to prioritize adaptive actions, a detailed risk assessment was prepared for the highest-ranking climate change vulnerabilities. For each identified risk, the Town identified the department and stakeholders impacted as well as the relevant master plan, strategy or planning document that could be used to address the identified risk through adaptive actions (Oakville, 2014). The Town identified risks based on “themed impacts” including the “Built Environment – Buildings, Planning and Lane Use” (Oakville, 2014, p. 76). For example, the impact of “increased urban heat island effect due to extreme heat events and increase development” was identified as a high-ranking vulnerability (Oakville, 2014). In response to this, the Town’s strategy called for “preparing proactive planning, zoning and land-use decisions” to reduce the urban heat island effect (Oakville, 2014, p. 77). This action has since been incorporated into the Town’s Official Plan. In accordance with Section 10.6. “Green Buildings”, the Town encourages sustainable building designs such as “green roofs” and “high albedo roofs” to reduce urban heat island effects (Oakville, 2017, p.C-55).

7.2 City of Barrie

In contrast to the Town of Oakville, the City of Barrie has recently developed a formal climate change adaptation strategy using ICLEI’s Five Milestone Framework and is currently in the process of developing an implementation plan. Prior to the formal adoption of an adaptation strategy, the City had taken efforts to identify climate change impacts and possible vulnerabilities to community infrastructure as well as the health and safety of inhabitants within the City. In 2010, the City hosted a series of workshops in collaboration with Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) to identify climate change related concerns (OCCIAR, 2010). Given Barrie’s current status in adaptation policy-making, available literature suggests the City is in the early stages of adapting to climate change (Araos et al., 2016).
7.2.1 Description of Case Study Area

The City of Barrie is a single-tier municipality located in the northern area of the GGH west of Lake Simcoe. As of 2016, Statistics Canada reported the City’s population was approximately 141,400 people (Statistics Canada, 2017). The City is located within the Great Lakes River Basin, which as discussed in Section 1, is anticipated to experience a significant increase in annual temperature and precipitation (McDermind, Fera & Hogg, 2015). As part of the City’s recent Climate Change Adaptation Strategy, local climate projections based on IPCC’s AR4 and AR5 documents further support these anticipated climatic changes (Barrie, 2017). Under a high emissions scenario, the adaptation strategy suggests that the City is projected to experience an average annual temperature increase of 4.7°C and 106.3 mm of precipitation by 2080 from existing conditions in 2017 (Barrie, 2017). These changes are anticipated to increase the number of extreme heat days (described as days with temperatures over 35°C) and the frequency of extreme weather events (Barrie, 2017).

7.2.2 Analysis of Climate Change Adaptation Strategies

The City’s current Climate Change Adaptation Strategy was developed in accordance with ICLEI’s Five Milestone Framework as implemented under the BARC program (see description of program in Section 3). To date, the City has achieved the fourth milestone of the Five Milestone Framework (ICLEI, 2018). To initiate the creation of an adaptation strategy, the City completed a Framework for a Climate Change Strategy in 2015 (Barrie, 2015). The framework was informed through a series of workshops that provided insight to public perceptions about climate change and identified key policy objectives that were incorporated into the recent Climate Change Adaptation Strategy (Barrie, 2015).

Following the development of this framework, the City of Barrie published a Climate Change Adaptation Strategy in 2017. The strategy was developed to “help coordinate decision-making and planning efforts to reduce vulnerabilities to climate change, while building resilience across City” (Barrie, 2017, p. 13). To achieve this, climate change adaptation goals and actions were developed in response to anticipated physical, social, environmental and economic impacts arising from changes in the climate. In review of the strategy, several decision-support tools were utilized to develop policy goals and objectives. For example, climate change projections were
used to estimate impacts associated with changes in temperature, precipitation and extreme weather events (Barrie, 2017). Three scenarios were presented in the analysis including a base line scenario (scenario 1), a high emissions scenario (scenario 2) and a low emissions scenario (scenario 3) (Barrie, 2017). For the purposes of developing adaptive policies and actions, the City relied on the high emissions scenario (scenario 2), which has more severe impacts in comparison to the other scenarios.

According to Richardson and Otero (2012), there are multiple approaches to undertake climate change risk and vulnerability assessments. Under the BARC program, the assessment of risk and vulnerability is based on sensitivity (the impact of climate change on the function of a municipal service areas) and adaptive capacity (the ability of the service areas to respond to impacts). As part of the City’s strategy, vulnerabilities were scored based on a matrix of low to high sensitivity and adaptive capacity. Once vulnerabilities were ranked, risks were assessed based on the likelihood of the event and the significance of the associated consequences (e.g. negligible to catastrophic) (Barrie, 2017). This assessment resulted in the identification of priority areas and adaptive actions to mitigate anticipated climate change impacts (Barrie, 2017). Of particular relevance, one of the key actions identified was to “incorporate climate change into the City’s Official Plan” (Barrie, 2017, p. 39). However, the City’s Official Plan review is underway, and it is currently unknown whether these actions will be incorporated.

Since developing the Climate Change Adaptation Strategy, the City has developed an implementation plan to achieve the identified objectives. This is achieved through a series of Action-Specific Action Plans (ASAPs) for each of the priority areas identified in the strategy (Barrie, 2018). Once finalized, the ASAPs will be used to achieve policy objectives and climate actions identified in the adaptation strategy. While ASAPs are not directly mentioned in the Five Milestone Framework, the City’s implementation plan and identification of ASAPs were developed in collaboration with representatives from ICLEI (Barrie, 2018).

7.3 Findings and Discussion

Table 5 summarizes the various decision-support tools and land-use planning policies employed within the identified case studies. Based on this review, the following provides a discussion of the observations and uncertainties of the Town of Oakville and City of Barrie’s existing adaptation plans in relation to the decision-support tools and land-use planning policies
identified in Section 4. Appendix B provides further analysis and discussion on the observations and uncertainties related to the identified case studies.

<table>
<thead>
<tr>
<th>Table 5: Summary of Case Study Analysis</th>
<th>City of Barrie</th>
<th>Town of Oakville</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision-Support Tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of community vulnerability and risk</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Climate projections</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Scenario planning</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Visualizing climate change impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptation planning guidebooks</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Land-Use Planning Policies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Official Plan</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Specialized Plans</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

7.3.1 Decision-Support Tools

In review of the two case studies, almost all decision support tools identified by Richardson and Otero (2012) were utilized in the climate change adaptation strategies. As part of the BARC program, ICLEI provides municipalities with access to various decision-support tools and relevant climate change data. As noted by Henstra (2015), this information-based policy instruments can disseminate knowledge and provide policy-makers with information to identify strategic objectives and create adaptive planning policies related to climate change.

7.3.1.1 Observations

In both the City of Barrie and the Town of Oakville, an assessment of vulnerabilities was used to prioritize risks through an analysis of sensitivity (i.e. the impact of climate change on the delivery of municipal services) and adaptive capacity (i.e. the ability of departments to cope with changes in the climate and the ability to implement policies into practice) (Barrie, 2017; Oakville, 2014). By identifying risks and vulnerabilities this helps to frame problems that will be addressed through public policy (Vogel & Henstra, 2015). For example, risk-based problems imply that climate change issues can be addressed by understanding probability whereas vulnerability-based problems frames climate change as a stress on a community (Vogel & Henstra, 2015).
In total the City of Barrie identified 68 climate change impacts (Barrie, 2017) and the Town of Oakville identified 39 (Oakville, 2014). These impacts were then further categorized into “consequence criteria” (Barrie, 2017) and “themed impacts” (Oakville, 2014). This allowed for the municipalities to categorize adaptive responses while also assessing broader economic, environmental and social impacts through scenario planning. Vogel and Henstra (2015) suggests that framing climate change as one type of problem (e.g. environmental) can result in bias in policy-instrument selection. Both the Town of Oakville and City of Barrie recognized climate change as a multi-sectoral issue rather than framing the problem within a single sector. As such, I believe that ICLEI’s Five Milestone Framework provides municipalities with a good foundation to identify climate change risk and vulnerabilities while recognizing that it is a multi-sectoral problem.

Three of the identified decision-support tools by Richardson and Otero (2012), assessment of risk and vulnerabilities, climate projections and scenario planning, were used to inform the actions identified in the Town Oakville and City of Barrie’s adaptation strategies. By participating in the BARC program, both municipalities were provided with access to various tools and climate data sources such as the “Canadian Climate Change Data and Scenarios tool” (Barrie, 2017) and data from the “Climate Change Scenarios Network (CCCSN) Localizer Reports” (Oakville, 2015). Access to such data are important as Henstra (2015) argues that it can be used in policy-making as well as policy evaluation.

7.1.3.2 Uncertainties

In review of the case studies, neither the City of Barrie or the Town of Oakville’s adaptation strategies used the visualizing climate change impacts decision-support tool. It is uncertain why this tool was not included within the adaptation strategy; however, it is recognized that other organizations, such as CAs, are responsible for flood mapping, a form of visualizing climate change risks. That said, there may be opportunities to incorporate visualizations of anticipated climate change impacts into municipal adaptation strategies. In particular, I believe that visualizing climate change impacts may help stakeholders understand the implications of climate change and the need for adaptation strategies as supported by Henstra (2015) and Sheppard (2005) who argue that visualizations can motivate behavioural change.
7.3.2 Land-Use Planning Framing Policies

Land-use planning policies were reviewed in relation to existing official plans and adaptation strategies in the case study municipalities. The two case studies were particularly interesting given that the Town of Oakville has included climate change related objectives since the inception of *The Liveable Oakville Official Plan* in 2009, whereas the City of Barrie has yet to incorporate climate change policies in its current Official Plan. In both case studies, it was determined that both municipalities are undertaking official plan reviews and that forthcoming updates will reflect the new climate change requirements arising from the recent amendment to the Provincial Plans.

7.3.2.1 Observations

To understand the relevance of Oakville and Barrie’s current stage of adaptation policy making, “adaptation classifications” as identified by Araosa et al. (2016) are used to assess the case studies. As stated previously, the presence of adaptation strategies without actions incorporated into other land-use plans suggest that governments are in the early stages of policy-making, which are referred to as “early stage adaptors” (Araosa et al., 2016). Based on this definition and recognizing that Barrie has yet to incorporate adaptive actions into land-use planning policies, it suggests that the City is in the preliminary stages of developing these plans. However, Barrie is also in the process of developing an implementation plan that will achieve identified adaptive actions.

In contrast, Araosa et al. (2016) defines “extensive adaptors” as municipalities that frequently undertake adaptation initiatives that are reflected in dedicated policy documents, whereas “moderate adaptors” are defined as municipalities that integrate climate change policies into land-use planning on an ad-hoc basis. Drawing on Araosa et al (2016) description, the Town of Oakville demonstrates characteristics of an “extensive adaptor” as the Town has formally adopted a climate change adaptation strategy and has integrated adaptive actions into its Official Plan.

Although the assessment of adaptation classifications provides context to the policy stages of the Town of Oakville and City of Barrie, there remains uncertainty whether the existing policy frameworks and selected policy-instruments will achieve identified policy outcomes.
However, the actions of both Oakville and Barrie demonstrate that they have reached the stage where adaptation measures have or can be integrated into land-use planning policies. Vogel and Henstra (2015) define the policy integration stage as the identification of specific actions that put public policy objectives into effect and/or mainstream an issue into practice. As available literature by Kok and Coninck (2007) argue that mainstreaming adaptation into the decision-making process allows for more effective climate change policies as it results in “policy coherence”, I believe that both municipalities have taken significant steps to integrate climate change policies into land-use planning in an effort to achieve broader public policy goals.

### 7.3.2.2 Uncertainties

Both municipalities are currently undertaking official plan reviews; as such, there is some uncertainty regarding the use of climate change adaptation strategies in developing land-use planning policies. However, recognizing that both municipalities have existing adaptation strategies, arguably they are better suited to incorporate climate change adaptation policies into official plan updates than municipalities without adaptation strategies.

Discussions with other municipalities who participated in the semi-structured phone interviews noted that the lack of framework and direction in relation to the new official plan requirements was a concern. However, given that some of the surveyed municipalities were in the early stages of the process, it is not well understood if municipalities will seek assistance from other programs such as BARC in order to meet these new requirements.
8.0 Recommendations

In recognition that municipalities are in the initial stages of developing climate change policies for incorporation into official plans, there is opportunity to identify recommendations to help facilitate policy-making processes. Based on the review of the existing literature and two case studies, three recommendations were developed. The identified recommendations are directed towards the Provincial Government of Ontario due to its role in legally-mandated public policy considerations related to climate change. In an ideal world, the identified recommendations would be implemented without hesitation and would result in better policy-making practices of adaptation measures and land-use planning in the GGH. Although the full implementation of these recommendations is not a realistic expectation, they provide general considerations and valuable insight which may advance climate change adaptation policy-making.

8.1 Recommendation #1: Develop a Formal Adaptation Framework

The analysis suggests that municipalities in the GGH lack a framework to assist in policy formulation and policy instrument selection. The literature review and case study analysis demonstrate the need for municipalities to employ a process and rely on decision-support tools to inform land-use planning policies that address adaptation. For example, ICLEI’s Five Milestone Framework provided the case study municipalities with access to range of information-based policy instruments as well as a framework to identify and prioritize climate change vulnerabilities and risks to ensure that resources were used effectively.

If the Province developed a similar framework, this would provide municipalities with increased strategic direction and guidance. Arguably, the development of a framework would be mutually beneficial to both upper and lower levels of government as municipalities in the GGH would have greater certainty about how to assess “infrastructure risks and vulnerabilities and identifying actions and investments to address these challenges” – a new requirement of section 4.2.10 of the Growth Plan. However, the framework should be flexible enough to allow communities to address regional and site-specific risks and pressures arising from future changes in the climate. In recognition that municipalities have limited human and financial resources, identifying and prioritizing climate change risks would allow for a more effective response.
8.2 Recommendation #2: Create an Accessible Climate Change Adaptation Portal

In review of the two case studies, information-based policy instruments including data sets and information were relied upon to develop the climate change adaptation strategies. While municipalities who participate in the BARC program gain access to a range of climate change adaptation tools, they are required to pay for this service. The Province should consider developing an accessible (free) online adaptation portal that provides a comprehensive “tool kit” of policies, framework guidelines and scientific data that municipalities could access to develop informed policies and plans. Moreover, the creation of a portal supports the principle of developing “knowledge-sharing” networks that allow relevant actors to share ideas regarding common challenges (Harvey & Fisher, 2013). The relevance of these networks is supported by Henstra (2015) who argues that governments can help facilitate these networks through funding, political leadership and recruitment during initial phases.

A similar portal has been developed for European counties and is referred to as the “European Climate Adaptation Platform (Climate-ADAPT)” (European Environment Agency, 2018). The platform includes a range of tools including a climate change database, a catalogue of climate change adaptation policies, information for upper and lower levels of government and various climate modelling instruments (European Environment Agency, 2018). The platform also connects governments agencies and other organizations with vested interests in climate change adaptation.

8.3 Recommendation #3: Recognize the Different Policy Needs Between Communities

The Changing Climate Changing Communities document developed by ICLEI identified the importance of understanding differences between urban and rural communities, specifically in relation to adaptive capacity (ICLEI, 2011). Changes in the climate may impact urban and rural communities differently and should therefore be considered through this lens when developing climate change strategies in official plans.

In developing frameworks to develop climate change adaptation strategies, consideration should also be given to the strengths and limitations of different communities. This is further supported by the adaptation planning handbook that was developed by the CIP for small rural communities (CIP, 2011). Many rural communities lack in-house land-use planning expertise as
well as resources to gather scientific knowledge. The creation of an accessible climate change adaptation portal would likely aid rural and smaller communities in developing adaptation strategies.
9.0 Conclusions

Climate change is anticipated to have serious implications on social, economic and environmental systems as well as the built environment. In recognition of these challenges, land-use planning is an important method to increase a community’s ability to adapt to climate change, thereby ensuring its resiliency. At a high level, the analysis in this research reveals the authority and information-based policy instruments currently used in Ontario and GGH to achieve policy goals and objectives related to climate change. At the local level, the development of land-use planning policies that address climate change require the framing of policy problems through the identification of risk and vulnerabilities. Adaptation strategies, as informed by decision-support tools, are useful in framing complex public policy problems such as climate change.

Local governments play an important role in adapting to climate change through the development of public policies. In this respect, increased access to policy instruments that facilitate policy-making will, in theory, ensure desired outcomes will be achieved. From a local land-use planning perspective, official plans are important authority-based policy instruments that provide strategic planning direction for a community. However, information-based policy instruments, such as decision support tools, are needed to help policy-makers and planners disseminate data so climate change can be integrated into official plans.

While official plans are important to provide guidance and direction in relation to land-use planning, other planning tools such as zoning and developing standards provide site-specific requirements that must be legally adhered to when developing land. While evidence suggests that the development of guiding policies and objectives is important (Hurlimann & March, 2012; MMH, 2018b), policy-makers should also understand how these policies translate into development interventions. Although other land-use planning mechanisms (e.g. zoning and development standards) are not the focus of this research, further research on the tools may also provide valuable insight to land-use planning interventions that address climate change.
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References


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Intergovernmental Panel on Climate Change [IPCC]. (2014b). *Summary for policymakers climate change 2014: Impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. contribution of working group ii to the fifth assessment report of the*


### Appendix A

Hierarchy of Planning Legislation and Policies in Ontario and the GGH

<table>
<thead>
<tr>
<th>Legislation, Plans or Policies</th>
<th>Purpose</th>
<th>Relationship to Municipal Climate Change Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning Legislation</strong></td>
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</table>
| *Planning Act, 1990*                          | Sets out rule and provisions for land-use planning in Ontario (MMA, 2018). | • Subsection 2(s) requires that different governing bodies including municipal council “shall have regard to” matters of provincial interest including climate change adaptation.  
• In accordance with section 16(14) an official plan shall contain policies that provide for adapting to climate change. |
| *Places to Grow Act, 2005*                    | Provides the province with authority to guide growth and develop growth plans for any region in Ontario (MMA, 2013). | • There is no direct mention of climate change in the *Places to Grow Act*.  
• However, the *Growth Plan for the Greater Golden Horseshoe*, is implemented under the legislative requirements of the *Places to Grow Act*. |
| **Provincial Plans and Policies – Key Provincial Land-Use Plans** |                                                                         |                                                                                                                    |
| *Provincial Policy Statement (PPS), 2014*     | Provides “clear policy direction on land-use planning to promote strong communities, a strong economy, and a clean and healthy environment” (MMA, 2015). | • Section 1.8 requires that land-use planning shall support climate change adaptation.  
• Under the requirements of section 3(5) of the *Planning Act 1990*, any exercise that affects a planning matter “shall be consistent” with any policy statements issued under the legislation, including the PPS. |
| *Growth Plan for the Greater Golden Horseshoe, 2017* | Provides a growth management framework that guides land-use development throughout the Greater Golden Horseshoe (GGH). Importantly, the framework identifies specific requirements for climate change mitigation and adaptation (MMA, 2017b). | • In accordance with section 4.2.10(1) municipal official plans must include adaptation objectives consistent with the Ontario Climate Change Strategy, 2015 and the Climate Change Action Plan, 2016 (MMA, 2017a). |
### Legislation, Plans or Policies

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Relationship to Municipal Climate Change Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.10(2) requires that vulnerabilities to climate change be identified and that strategies be developed to help mitigate impacts through land-use planning, green infrastructure, low impact development, etc. (MMA, 2017a).</td>
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</table>

### Provincial Plans and Policies – Other Relevant Provincial Land-Use Plans

<table>
<thead>
<tr>
<th>Plan</th>
<th>Purpose</th>
<th>Relationship to Municipal Climate Change Adaptation</th>
</tr>
</thead>
</table>
| **Greenbelt Plan, 2017**                | Protects areas that have ecological and hydrological significance as well as prime agricultural land. The plan “builds upon the ecological protections provided by, the Niagara Escarpment Plan (NEP) and the Oak Ridges Moraine Conservation Plan (ORMCP)” (MMA, 2017c). | • The vision and goals for Greenbelt Plan protect land to “build resilience to and mitigate climate change” (section 1.2.1).  
• Several other “geographic-specific policies in the protected countryside” were also identified including agricultural systems (section 3.1); natural systems (section 3.2); parkland, open space and trails (section 3.3).  
• Climate change adaptation policies also relate to “general policies for the protected countryside” including non-agricultural uses (section 4.1) and infrastructure (section 4.2). |
<p>| <strong>Oak Ridges Moraine Conservation Plan, 2017</strong> | “The Oak Ridges Moraine Conservation Plan is an ecologically based plan that provides land-use and resource management direction for the 190,000 hectares of land and water within the Moraine” (MMA, 2017d) | • The negative impacts of climate change are to be reduced through the planning of various areas such as Natural Core Areas (section 11), Natural Linkage Areas (section 12), Countryside Areas (section 13) |
| <strong>Niagara Escarpment Plan, 2017</strong>       | “The Niagara Escarpment Plan builds upon the policy foundation provided by the Provincial Policy Statement and provides additional land-use planning policies for the maintenance of the Niagara Escarpment and | • General policies aimed to protect and enhance resources of the escarpment that can help achieve greater resiliency to climate change (section 1.3) |</p>
<table>
<thead>
<tr>
<th>Legislation, Plans or Policies</th>
<th>Purpose</th>
<th>Relationship to Municipal Climate Change Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>land in its vicinity substantially as a continuous natural environment and to ensure that only such development occurs as is compatible with that natural environment” (MMA, 2017e, p. 4)</td>
<td></td>
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</tbody>
</table>
## Appendix B
### Summary Table of Emerging Concepts Across Case Studies

<table>
<thead>
<tr>
<th>Decision-Support Tools</th>
<th>Town of Oakville</th>
<th>Uncertainties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observations</strong></td>
<td><strong>Uncertainties</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Assessment of community vulnerability and risk</strong></td>
<td><strong>2014 Climate Change Adaptation Strategy</strong></td>
<td><strong>Vulnerability Assessment</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Vulnerability Assessment</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Used to rank identified climate change impacts on a scale of 1-5 to help prioritize actions and resources.</td>
<td>- Frequency of identified high vulnerabilities were unknown.</td>
</tr>
<tr>
<td></td>
<td>- Frequency of identified high vulnerabilities were unknown.</td>
<td>- Requires that a separate integrated risk management (IRM) assessment be undertaken separately.</td>
</tr>
<tr>
<td><strong>Climate projections</strong></td>
<td><strong>2014 Climate Change Adaptation Strategy</strong></td>
<td><strong>Climate projections</strong></td>
</tr>
<tr>
<td></td>
<td>- Climate projections were prepared to 2050 with specific emphasis on two indicators: “increase in annual averages”, “increase in annual precipitation” and “increase in frequency of extreme events”.</td>
<td>- Climate change modelling is complex and influenced by an infinite number of variables.</td>
</tr>
<tr>
<td></td>
<td>- Identified changes in temperature in winter months would have the most significant impact on built and natural systems.</td>
<td>- Climate projections are difficult to estimate at a localized scale.</td>
</tr>
<tr>
<td><strong>Scenario planning</strong></td>
<td><strong>2014 Climate Change Adaptation Strategy</strong></td>
<td><strong>Scenario planning</strong></td>
</tr>
<tr>
<td></td>
<td>- Available data from CCCSN Localizer Reports and the IPCC were used to develop “high emissions” and “low emissions” scenarios.</td>
<td></td>
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<tr>
<td></td>
<td>- The analysis also examined the implications to social, economic and other conditions including “population growth”, “GDP growth”, “energy use”, “land-use change” etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Visualizing climate change impacts</strong></td>
<td></td>
<td><strong>Visualizing climate change impacts</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- No mapping or other visualizations of climate change impacts were included in the adaptation strategy.</td>
</tr>
</tbody>
</table>
### Town of Oakville

| Adaptation planning guidebooks | **2014 Climate Change Adaptation Strategy**  
- Informed based on the Five-Milestone Framework developed by ICLEI.  
- Adaptation strategies were implemented using the BARC program framework. |  |

| Land-Use Planning Policy | **The Liveable Oakville Official Plan**  
- Section 10.2 identifies mitigation and adaptation goals and objectives | **Uncertainties**  
- An Official Plan Review is currently underway and will be developed within the framework of the updated Provincial Plans.  
- The integration of new climate change considerations, as required by the recent amendments to the Growth Plan, is currently unknown. |

| Specialized Plans | **2014 Climate Change Adaptation Strategy**  
- Provides an assessment of climate change vulnerabilities.  
- Identified specific plans and policies (e.g. Official Plans, Assessment Studies, Water Sustainability Plans etc.) that can mitigate and adapt to climate change.  
- For each identified plan and/or policy, related “adaptation actions” were identified in order to achieve the overall goals and objectives of the strategy. |  |
<table>
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<th>Decision-Support Tools</th>
<th>Observations</th>
<th>Uncertainties</th>
</tr>
</thead>
</table>
| Assessment of community vulnerability and risk | **2017 Climate Change Adaptation Strategy**  
Vulnerability Assessment  
• Used to identify specific services vulnerable to climate change.  
• Provides as assessment of adaptive capacity. | • Assessment of vulnerability and risk can evolve and change over time. This will likely require ongoing resources and expertise from the City. |
| Risk Assessment         | • Risk was identified and defined based on the vulnerability assessment.  
• Risk was determined based on likelihood and consequence of the related actions.  
• Risks were classified into three categories: social, economic and environmental. |                                                                                  |
| Climate projections     | **2017 Climate Change Adaptation Strategy**  
• The strategy identified changes in temperature, precipitation and increases in extreme weather events over within the City until 2080.  
• The City relied on available climate change data tools (e.g. the Canadian Climate Change Data and Scenarios tool) as well as data and expertise from other organizations Institute for Catastrophic Loss Reduction (ICLR) regarding changes in precipitation. | • Coordinating with various organizations and climate change experts requires resources (e.g. human and financial). |
| Scenario planning       | **2017 Climate Change Adaptation Strategy**  
• Climate change impacts were analyzed within the context of physical, social and ecological implications. Various scenarios were also examined in relation to precipitation, temperatures and water levels. | • Multiple scenarios were produced for each of the identified climate change variables. As such, identified priorities and actions may change over time. |
<table>
<thead>
<tr>
<th>City of Barrie</th>
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</thead>
<tbody>
<tr>
<td><strong>Observations</strong></td>
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<tr>
<td>Visualizing climate change impacts</td>
</tr>
</tbody>
</table>
| Adaptation planning guidebooks | **2017 Climate Change Adaptation Strategy**  
• Informed based on the Five-Milestone Framework developed by ICLEI.  
• Adaptation strategies were implemented using the BARC program framework.  
• This framework is voluntary and not widely used across the Province. |

<table>
<thead>
<tr>
<th>Land-Use Planning Policies</th>
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<tr>
<td><strong>Official Plan</strong></td>
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</table>
| **2017 Climate Change Adaptation Strategy**  
• Action CC.1 of the strategy recommended that climate change be incorporated into the City’s Official Plan.  
• The Official Plan review is currently underway. The influence and integration of actions identified in the adaptation strategy are currently unknown. |
| **Specialized Plans** |
| **2017 Climate Change Adaptation Strategy**  
• Ranked identified actions based on a prioritization matrix (e.g. investigate further, monitor and must do).  
• Provided strategic direction to integrate climate change into the City’s Official Plan.  
• Identified adaptation requirements for various departments.  
• The plans and policies were recently implemented, the outcomes of these plans are currently unknown. |
| **2018 Adaptation Strategy Implement Plan**  
• Identified required resources for implementation of identified climate change actions and priorities.  
• Used to achieve Milestone 4 and Milestone 5 of the BARC program.  
• Allowed for the development of Action-Specific Action Plans (ASAPs) to implement each priority action. |