Understanding Institutional Change and Resistance to Change Towards Sustainability: An Interdisciplinary Theoretical Framework and Illustrative Application to Provincial-Municipal Aggregates Policy

by

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Environmental Studies
in
Environment and Resource Studies

Waterloo, Ontario, Canada, 2009

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

This study develops an interdisciplinary theoretical framework for understanding institutional change and resistance to change towards sustainability. The research rests on two leading theories of change within the social and ecological sciences: the New Institutionalism and Panarchy theory. A theoretical framework integrating insights from the two theories is applied in an analysis of the development of the Town of Caledon's mineral resources policies. The research suggests that institutional change and inertia are interconnected and interdependent and, depending on the case and context, they may interact with each other across spatial and temporal scales. There may be overlap in the emergence of pressures for institutional inertia and change across temporal and spatial scales, and both institutional change and inertia may be present when opportunities arise for renegotiation of the "rules of the game". Results show that the two theories share many concepts (e.g., thresholds or tipping points, fast and slow moving variables, etc.) to aid in understanding the dynamics of institutional and ecological realms. Moreover, the integrated theoretical framework can help to explain the dynamics of institutional systems in a way that overcomes the limitations in Panarchy and the New Institutionalism theories by themselves. Key concepts within Panarchy theory (e.g., regime shifts, etc.) complement the New Institutionalism's ability to capture important contextual factors influencing institutional change and inertia, and help to overcome the current limitation in its capacity to explain the nonlinear, multi-scalar dynamics of institutional systems. In turn, key concepts within the New Institutionalism (e.g., uncertainty, etc.) complement and enrich Panarchy theory's capacity to illustrate the social and economic dimensions of institutional dynamics. Results of the case analysis demonstrate that a range of overlapping, historic and immediate, local-to-provincial factors (e.g., socioeconomic costs, uncertainty, path dependent effects, etc.) and institutional elements (e.g., interests and values, power and resources, issues of fit, etc.) drove institutional change and inertia in the development of Caledon's mineral resources policies. The slow moving institutional variables in Caledon's case (core Town, industry and provincial government values and interests) were perhaps the greatest determinants of institutional change and resistance to change towards sustainability. The story of the development of Caledon's mineral resources policies, then, is about the resilience and resistance efforts of a small Town committed to maintaining core community values under the constraints of a resilient and resistant, ecologically destructive and inequitable institutional system.

Acknowledgements

I must extend many thanks to Bob Gibson for tricking me into participating in so many wonderful projects over the last few years, and for being such a fair and generous academic advisor. The lessons that I have learned from you continue to influence my thinking and behaviour in positive ways. Every student should be so lucky! Many thanks also go out to Mary-Louise McAllister, who taught me the difference between government and governance, and the importance of structures and processes. Thank you for your ear and wise advice over the last five years! Many thanks to Stephen Murphy, whose comedic approach to metapopulation dynamics made four-hour ecological restoration lectures crazy fun. And thank you, again, to Bob, Mary-Louise, and Steve for their steadfast support and encouragement. I could not have done this Masters degree without you – at least not in the same style! I must also thank the guy or gal who was in charge of designing the Department of Environment and Resource Studies website back in 2005. It was the easiest website to navigate out of all of the university websites that I visited in order to figure out what to study and where. Or was it the description of the BES degree and the "People in ERS" pages that finally convinced me that I was definitely growing old in the wrong profession? Many thanks also go out to my partner, Roy, who taught me the importance of taking breaks – sometimes – and whose steady support is underpinned by a cast-iron faith in me. Many thanks to my dear sister, Anna – a kindred spirit, whose friendship is as vital to me as clean air and clean water. Many thanks to my lovely parents for their unending support and for inviting me over for supper when there is no time for groceries. Finally, thank you to all of the concerned citizens, administrators, planners, mayors, councilors, and aggregates industry representatives who so generously participated in this study. And last but not least, thank you to all of the unknown factors, which have somehow lined up in my favour over the past five years!

Table of Contents

CHAPTER 1: Introduction

Substantive progress towards sustainability requires an understanding of why and how institutions change and resist change. In this study, institutions are defined as "…the rules of the game in a society or, more formally…the humanly devised constraints that shape human interaction" (North, 1990, p. 3). They are comprised of formal constraints (e.g. rules, laws, processes, etc.), informal constraints (e.g. unwritten conventions, norms of behaviour, codes of conduct, values, etc.), and their enforcement mechanisms. They provide the structure and context within which human interaction takes place. Because people create, inherit, and maintain institutions over time, they can become deeply embedded in the socioeconomic and cultural fabric of societies. In this way, they can be very resilient and resistant to change. Resilient and resistant institutions can also be ecologically destructive and inequitable. Reliance on fossil fuels, for example, is ecologically destructive because it contributes to global climate change. A centralized decision-making system, for example, may be inequitable with respect to the distribution of power, costs and benefits, and opportunities across socioeconomic groups and generations.

The purpose of this study is to expand our understanding of institutional change and resistance to change towards sustainability. It aims to strengthen the hands of advocates of sustainability in social-ecological problem solving. Since the rise to prominence of the concept of sustainability, many initiatives have been undertaken in pursuit of sustainability goals. Sustainability advocates assert, however, that the impacts of these initiatives have merely scratched the surface of deepening local-to-global environmental problems. David Runnalls, for example, has observed, "Despite all this progress, the problems that Brundtland and her colleagues warned us we had little time to solve are much worse now…" (Runnalls, 2008, p. 27). This is at least in part because the concept of sustainability fundamentally challenges the status quo and there is considerable resistance to the required transformations. At this juncture, then, it is more important than ever to seek a better understanding of the ways of our institutions. In particular, what can local struggles over natural resource management and land use planning reveal about the behaviour of institutional systems? How can lessons learned from these struggles inform the quest for sustainable societies?

In the quest for sustainable societies, many scholars and practitioners have stressed that conventional approaches to environmental problem solving are too exclusive and fragmented

along disciplinary lines to deal effectively with the complexities of environmental issues (e.g. Dobson, 2000; Dovers, 2001; Paehlke &Torgerson, 2005). In response to these and many other insufficiencies, they have called for more inclusive and integrated approaches to planning, decision-making, and analysis. These approaches are inherently interdisciplinary in that they integrate consideration for the social, economic, and ecological dimensions of environmental problems, and traditional and scientific knowledge (e.g. Wali et al., 2003; Fraser et al., 2006; Gibson, 2006). Moreover, they are based on a conceptualization of "environment" as comprised of interconnected and interdependent social-ecological systems.

Because institutions are among the major determinants of change in social, economic, and ecological spheres, traditional approaches to studying institutions have also been divided along disciplinary lines. Similarly, theories of change in ecological systems have evolved primarily within the natural sciences. Important insights have emerged from these independent branches of inquiry about why and how social and ecological systems change and resist change. Until recently, however, there has been little explicit exchange between them. The call from advocates of sustainability for more substantive recognition of the feedbacks between social-ecological systems in environmental problem solving requires and encourages exchange within and between the social and natural sciences (Bradshaw & Bekoff, 2000; van Kerkhoff, 2005; Lawton, 2007; Macleod et al., 2008). Combining insights from theories of change in social and ecological systems, for example, will lead to more comprehensive frameworks for analysis and so enrich our comprehension of human-institutional-ecological interactions. This integrated approach to analysis should be especially relevant to scholars and practitioners who seek to implement solutions to complex social-ecological problems within resilient and resistant but ecologically destructive and inequitable institutional systems.

This study develops an interdisciplinary theoretical framework for understanding the dynamics of institutional systems. It rests on two leading theories of change, which have emerged independently within the social and ecological sciences: the New Institutionalism and Panarchy theory. Despite the disciplinary divide between these theories, scholars working within them share many common and complementary concepts (e.g., multiple equilibrium orders or stable states, tipping points or thresholds, path dependency, uncertainty or bounded rationality) to understand and explain complex institutional and ecological phenomena (Hall & Taylor, 1996; Gunderson & Holling, 2002; Pierson, 2004). But there has been little deliberate exploration

and/or critical review of the potential strengths and limitations among them for the purpose of exchange and application in analyses of human-institutional-ecological phenomena in social-ecological systems.

This study demonstrates how integrating essential concepts from both theories in empirical analysis can help to generate important insights about institutional change and inertia. Increasing our comprehension of the behaviour of institutions will, in turn, produce critical insights about human-institutional-ecological interactions and so inform the quest for sustainable societies. The research has two key goals. The first is to develop a set of preliminary theoretical propositions based on the New Institutionalism and Panarchy theory. The second is to test the preliminary propositions by applying them in a case analysis of institutional change and resistance to change towards sustainability.

The research employs a deductive, exploratory, qualitative methodological approach. Unlike an inductive approach to analysis, which generates theory based on experience with the phenomenon of interest, a deductive approach is guided from the start by a theoretical framework, the utility of which is determined by applying it in analysis (Palys, 2003, p. 36-39). Exploratory investigations seek to gain new insights into phenomena in order to develop hypotheses and/or refine a research question (see Palys, 2003, p. 72). This stands in contrast to descriptive research, which aims to illustrate the key features of a particular situation or individual; explanatory studies, which investigate causal relationships; and relational inquiries, which reveal how particular variables are related. This study utilises a literature review of the New Institutionalism and Panarchy theory to develop a set of theoretical propositions to guide the analysis. In turn, the analysis informs the refinement of the propositions and contributes to the development of both theories. Case studies provide an appropriate research method for exploratory investigations (Yin, 2003). This study utilises a single case, case study design, which involves multiple methods, including a critical review of academic literature and other relevant documentation, and semi-structured, face-to-face interviews. These methods are discussed in more detail in subsequent chapters.

First, in Chapters 2 and 3, overviews of the New Institutionalism and Panarchy theory are provided. The New Institutionalism represents a sprawling literature within the social sciences. New Institutionalist scholars in several schools have devoted much attention to the role that institutions play in structuring cultural, political and economic spheres. With the renaissance of

the institutional approach to analysis in the late 20th century, the institutional perspective has also extended many valuable insights to the interdisciplinary field of environmental social science (Hotimsky et al., 2006). It has been widely recognized, for example, that human patterns of thinking and behaving can have devastating implications for other people, creatures, and all other forms of matter (Holling & Meffe, 1996; Gunderson & Pritchard, 2002; Young, 2002; Berkes et al., 2003; Connor & Dovers, 2004; Martinez-Ballesté et al., 2006; Hanna, 2008; Waples et al., 2009). It has also been demonstrated that ecologically destructive and inequitable institutional systems can be highly resilient and resistant to change, even in the face of social-ecological degradation and/or collapse (e.g., Berkes & Folke, 2002; Allison & Hobbs, 2004; Brown, 2005; Runnalls, 2008; Finley, 2009; Walker et al., 2009).

Panarchy theory offers an explanation of transformative change based on empirical evidence derived primarily from studies of attempts to manage resources in regional-scale adaptive ecosystems in temperate regions. It asserts that complex adaptive ecological systems are nested within a hierarchical arrangement of adaptive cycles. The basic adaptive cycle consists of four phases, which reflect recurring periods of exploitation, conservation, collapse, and reorganization. It has been applied as a useful metaphor for understanding transformative change in many terrestrial and aquatic ecosystems. More recently, scholars have applied the metaphor to illustrate the interconnections and interdependencies between and among ecological and human systems, especially in the context of natural resource management. Because of the perceived similarities among social and ecological systems, some scholars have asserted that more research is required to determine the generality of the adaptive cycle metaphor, particularly with respect to understanding change in social systems (e.g. Gunderson & Holling, 2002). By incorporating the adaptive cycle and other key concepts from Panarchy theory in the analytical framework, this study begins to answer questions about their applicability to the dynamics of complex adaptive institutional systems.

Aside from the adaptive cycle metaphor, prominent scholars whose work falls within the scope of Panarchy theory have recently adopted concepts (e.g. transaction costs, institutional entrepreneurs), which have long been applied by New Institutionalists to investigate the feedbacks between ecological and social realms (e.g. Berkes & Folke, 1998; Folke et al., 1998; Gunderson & Holling, 2002; Walker & Salt, 2006). This attests to the need within Panarchy theory for useful insights that can elaborate the social-institutional dimensions of ecological

change. Moreover, scholars whose work falls outside of the scope of Panarchy theory have recognized the value of applying an institutional perspective to problems in land use planning and natural resource management (e.g. Healey, 1998; Lowndes, 2001; Motte, 2001; Young, 20002; Hanna, 2008). The comprehensive overview of the New Institutionalism, provided in Chapter 2, defines central concepts that have been utilised by New Institutionalist scholars to understand and explain the dynamics of institutions. These concepts can inform the above areas of inquiry, and Panarchy theory in particular, to help to illuminate the social-institutional dimensions of change in social-ecological systems.

Chapters 2 and 3 lead to the development of two sets of preliminary theoretical propositions, one based on the New Institutionalism and one based on Panarchy theory. Based on a discussion of the strengths and limitations of each, a set of combined preliminary theoretical propositions is developed. Chapter 4 demonstrates the early usefulness of the combined propositions by applying them in an analysis of institutional dynamics in two case studies from the literature, one that demonstrates institutional change in the management of natural resources in the Columbia River Basin in the United States, and one that demonstrates resistance to change towards sustainability in integrated urban stormwater management in Sydney, Australia.

To further test the strengths and limitations of the combined propositions, they are applied in a case study analysis. The research focuses on southern Ontario as a jurisdiction, the aggregates industry as a sector, and the development of the Town of Caledon's new, 2003 mineral resources policies as the focal case (see Chapter 5). These policies reflect a pioneering approach to local control over prime aggregate resources in southern Ontario, and they were met with significant resistance from key members of the aggregates industry and provincial government agencies involved in the development of the mineral resources policies.

Southern Ontario contains the Greater Golden Horseshoe (GGH) region – the most intensely populated and urbanized landscape in Canada. Nowhere is the need for institutional transformation towards sustainability more evident in Canada than in such metropolitan conurbations as the GGH. In this region, local-to-global problems, notably urban and suburban sprawl, loss of farmland, and the degradation of ecosystems, threaten to degrade beyond repair the ecological goods and services upon which millions of people depend.

Since the late 1950s, southern Ontario has been a location of choice for proponents of aggregate extraction operations. Most of the resource has gone into feeding the construction

booms in the Greater Toronto Area (GTA). Many complex land use issues concerning aggregate extraction operations have emerged, therefore, within municipalities across the GGH. Unlike other sectors in Ontario (specifically urban planning, forestry, energy, and waste management), which have undergone significant transformation (though far from complete) towards more sustainable practices, the aggregates sector has been highly resilient and resistant to change. This resistance is evident in the industry's poor record of rehabilitation and largely unfettered access to the resource close to demand. The structure of the current institutional framework guiding aggregate extraction in southern Ontario (i.e., centralized, industry-provincial government control over the resource) positively reinforces this resistance to change.

Industry-provincial government resistance to institutional change towards sustainability in the aggregates sector is especially evident in the story of the Town of Caledon's new 2003 mineral resources policies. This predominantly rural town sits just north of the GTA in the GGH region and contains portions of such provincially protected landforms as the Oak Ridges Moraine and the Niagara Escarpment. The Town also possesses the largest series of contiguous gravel deposits in North America (Chambers & Sandberg, 2007). Over the last 60 years, Caledon has been a major provider of aggregate resources to the GTA. Caledon's mineral resources policies have over the years been influenced by many important contextual factors, notably the Town's rich natural and cultural heritage and legacy of land use battles over aggregate extraction developments; changes in the balance of power among industry, municipal, and provincial players, and the evolving constraints of the provincial legislative framework. Notwithstanding these constraints, Caledon's new 2003 mineral resources policies (Town of Caledon, 2004) are in many ways pioneering. Most significantly, they represent Caledon's capacity to maintain core community values under the constraints of centralized, industry-provincial government control over prime aggregate resources. This institutional system threatens to chip away at the natural and cultural resources around which Caledon's socioeconomic identity has evolved. The story of the Town of Caledon's mineral resources policies, therefore, is a story about the resilience and resistance efforts of a small Town committed to maintaining core community values under the constraints of a resilient and resistant, ecologically destructive and inequitable institutional system.

Key questions in the analyses undertaken in Chapters 6 and 7 include why and how and to what extent the Town of Caledon's new 2003 mineral resources policies reflect progress

towards sustainability objectives. In addition to the analytical framework developed in Chapters 2 and 3, then, this study requires a sustainability assessment framework. The framework chosen by this study is Gibson et al.'s (2005) core decision-making criteria for sustainability. It is described in more detail in Chapter 6. Also, Caledon's older, 1981 policies provide the benchmark against which the new policies are evaluated for evidence of institutional change. Because quarry practice exists within a local-to-provincial legislative framework, this study examines to what extent institutional change occurred at these scales. Transformative change in the aggregates sector in southern Ontario requires local- to provincial-level changes in law, policy, and practice.

The analyses undertaken in Chapters 6 and 7 were informed by semi-structured, face-to-face interviews with the key actors who participated in the development of Caledon's new 2003 mineral resources policies. The information gathered helped to uncover why the key stakeholders involved in the development of Caledon's policies rejected or embraced certain policies over others. The strengths and limitations of the preliminary theoretical propositions (see Chapter 8) were, in part, based on whether they were comprehensive of the major issues and consistent with the story as revealed through the primary and secondary research.

The above-mentioned analyses contribute to knowledge about the dynamics of resilient and resistant but inequitable and/or unproductive social-ecological systems. These types of social and/or ecological systems are resilient and resistant to change in the short and medium terms but their behaviour contributes to the deepening vulnerability of higher and lower level systems, the collapse of which will be catastrophic. With respect to ecological resilience, most scholars who have adopted the adaptive cycle metaphor have devoted much attention to how to maintain social-ecological resilience through adaptive management. Research is also required to better understand how resilient and resistant but ecologically destructive and inequitable social institutions can be nudged towards contributing to sustainability.

It is important to note that the theoretical propositions developed by this study are preliminary at best. They are not based on an exhaustive review of the three major strands (and their sub strands) of the New Institutionalism. Moreover, this study does not undertake a thorough review of the empirical studies that have contributed to the New Institutionalism and Panarchy theory. Rather, it relies on overviews of New Institutionalism and Panarchy theory, as well as seminal works by well-known authors. The study, therefore, does not provide an in-depth

exploration of the debates that exist between and among the strands of the New Institutionalism and around key concepts and other issues within the New Institutionalism and Panarchy theory. Rather, it delineates key concepts in order to develop a theoretical framework that begins to synthesize important insights. A more in-depth review of the New Institutionalism and Panarchy theory would certainly enhance any delineation of key concepts and subsequent theoretical propositions. More research, therefore, is required to refine the preliminary theoretical propositions here developed.

More time and research also are required to determine the long-term impacts of Caledon's new 2003 mineral resources policies on aggregate extraction practice in Caledon and the degree to which they have influenced Official Plan policies in other municipalities. Moreover, application of the propositions to a single sector/case context may not be representative of the strengths and limitations of the framework and institutional dynamics within the aggregates sector and beyond. More casework, therefore, is needed to confirm the results from this study.

CHAPTER 2: The New Institutionalism

2.1 Introduction

This chapter provides an overview of the New Institutionalism, leading to a discussion of the implications of New Institutionalist thought for understanding and explaining institutional resistance and change towards sustainability. As a last step, a set of preliminary theoretical propositions is developed.

2.2 Methods

It is now conventional practice to distinguish among three major varieties of New Institutionalist literature: rational choice, historical, and sociological. The literature review on these three strands was based on seminal works, and well-known overviews and summaries of years of empirical work. A review of academic, peer-reviewed academic articles about the theory and application of the New Institutionalism supplemented these works.

Other relevant bodies of literature, however, could provide the basis for the interdisciplinary theoretical-analytical framework developed in this study. For example, other leading conceptual frameworks that scholars have applied to analyse the dynamics of policy change (e.g., policy windows, policy communities) provide helpful insights into why and how institutional change occurs. The policy windows literature emphasizes how changes in policy can occur when problems, solutions and politics converge to push an issue onto the public policy agenda towards governmental action (Kingdon, 2003). Similarly, the policy communities literature focuses on how public and private stakeholders coalesce around a particular issue and share a common interest in influencing its development (e.g., Pross, 1986; Coleman & Skogstad, 1990).

The New Institutionalist literature was chosen over the above bodies of literature for two key reasons. First, as described in detail, below, the three major varieties of New Institutionalist thought devote much attention to how people create, maintain, and change institutions, and how people are, in turn, influenced and constrained by institutions over time. New Institutionalist scholars, therefore, have developed many concepts to better understand and explain all of the stages in the development of institutions – from creation to maintenance, persistence and change. In contrast, the policy windows and policy communities frameworks focus more narrowly on how policy change might occur. This study seeks to increase our understanding of institutional

change and inertia. Unlike the policy windows and policy communities approaches, New Institutionalist scholars have developed many valuable insights that can enrich our understanding of why and how institutional inertia occurs.

Second, according to Skogstad (2005), critics assert that the policy communities approach is limited in its capacity to explain policy outcomes because, among other reasons, scholars have largely neglected to link policy communities with contextual factors. It has also been criticized for not recognizing the role of agency in policy outcomes. Below, it will be demonstrated that contextual factors (e.g., history, cultural frameworks) and the role of agency or "institutional entrepreneurs" are central components of the New Institutionalist approach to analysis. Scholars working within the policy communities approach, therefore, might benefit from the New Institutionalism's broad analytical scope.

Moreover, with the renaissance of the institutional approach to analysis in the late 20th century, the New Institutionalism has extended many valuable insights to the interdisciplinary field of environmental social science (Hotimsky et al., 2006). It has been widely recognized, for example, that human patterns of thinking and behaving can have devastating implications for other people, creatures, and all other forms of matter (Holling & Meffe, 1996; Gunderson & Pritchard, 2002; Young, 2002; Berkes et al., 2003; Connor & Dovers, 2004; Martinez-Ballesté et al., 2006; Hanna, 2008; Waples et al., 2009). It has also been demonstrated that ecologically destructive and inequitable institutional systems can be highly resilient and resistant to change, even in the face of social-ecological degradation and/or collapse (e.g., Berkes & Folke, 2002; Allison & Hobbs, 2004; Brown, 2005; Runnalls, 2008; Finley, 2009; Walker et al., 2009). This study develops an interdisciplinary theoretical framework for understanding and explaining the dynamics of institutions as major determinants of social-ecological systems. The New Institutionalism is explicitly oriented towards understanding institutions and institutional phenomena. It is appropriate, therefore, for the purpose of this study.

Finally, scholars whose work falls within the scope of Panarchy theory have incorporated insights and concepts from the New Institutionalism in order to understand and explain how ecosystems, people, and institutions behave in relation to each other (e.g., Adger et al., 2005; Abel et al., 2006; Yandle, 2007; Hanna, 2008). This attests to the need within Panarchy theory for useful insights that can elaborate the social-institutional dimensions of ecological change. But there has been little deliberate exploration and/or critical review of potentially useful concepts

within Panarchy theory and the New Institutionalism for the purpose of exchange. This study demonstrates how integrating essential concepts from the New Institutionalism and Panarchy theories in an analytical framework can enhance our comprehension of the dynamics of complex adaptive institutional systems. Increasing our comprehension of the behaviour of institutions will, in turn, generate critical insights about human-institutional-ecological interactions and so inform the quest for sustainable societies.

2.3 Introduction to the New Institutionalism

The New Institutionalism represents a sprawling literature divided along ontological and disciplinary lines. As noted above, it is now conventional to distinguish among three major varieties: rational choice institutionalism, historical institutionalism, and sociological institutionalism. Regardless of the variety, New Institutionalists scholars have devoted much attention to five central and widely debated questions in New Institutionalist thought:

What are institutions?
How and why do institutions emerge?
How and why do institutions persist?
How do institutions affect human behaviour?
How and why do institutions change?

Various overviews of the three major strands of New Institutionalism reveal that there is much overlap at the intersection of the various schools (see Hall & Taylor, 1996; Scott, 1995, 2001; Campbell, 2004; Peters, 2005). March and Olsen (1989), for example, draw from each variety in their examination of how political institutions function, shape political action, and change. Peters (2005) discusses the importance of sociological institutionalism to the study of institutions in political science (see p.107-122). Thelen (1999) highlights the influences that rational choice institutionalism and sociological institutionalism have had on historical institutionalism's understanding of political outcomes (see p. 370-371). According to Hall and Taylor (1998), rational choice new institutionalists are increasingly embracing more sociological explanations of institutional dynamics. Douglas North, for example, a notable theorist in this field, has recognized the value of sociological and historical institutionalist perspectives to analyzing the effects of institutions on economic performance (see North, 1990, 1996a, 1996b; 2005; Schluter, 2007).

Similar to other literatures divided along ontological lines, the New Institutionalism has

been criticized for not providing a unified theory of institutional behaviour: "The problem with much of the 'new' institutionalism literature to date…is that it is unclear on vital questions (e.g. how do institutions develop and how do they change?), is replete with ambiguities and is too discipline bound" (O'Riordan & Jordan, 1999, p. 84). O'Riordan and Jordan argue that a synthesis of the many strands of New Institutionalism will never be possible due to the contradictory interpretations of human behaviour among them. Despite these and other issues, however, many authors assert that the New Institutionalism as a whole would benefit from more exchange among the branches (see Hall & Taylor, 1996; Immergut, 1998; Thelen, 1999; Campbell, 2004; Katznelson & Weingast, 2005). Hall and Taylor (1996), for example, favour as much interchange as possible among the strands, despite their divergences: "None of these literatures appears to be wrong-headed or substantially untrue. More often, each seems to be providing a partial account of the forces at work in a given situation or capturing different dimensions of the human action and institutional impact present there" (p. 955). This study proceeds, therefore, under the assumption that there is much to gain from the erosion of boundaries between various new institutionalist schools.

Sections 2.3.1 to 2.3.5 provide a brief sketch of the three major varieties of the New Institutionalism. They draw primarily from comprehensive overviews in order to describe each strand's particular orientation to the central questions in New Institutional analysis. Because this study rests on the above-described assumption, it does not go into exhaustive detail on the many debates that exist around these central questions. Nor does it compare and contrast the approaches and highlight their strengths and deficiencies. Many potentially relevant debates in the literature are lost in this simplified overview. These debates may indeed be relevant to many analyses of institutional dynamics in social and economic fields. For example, based on the analytical benefits of a particular strand, students may choose one variety of New Institutionalism over another to investigate a specific case and context. This study seeks an inclusive understanding of the dynamics of institutions in order to develop a comprehensive theoretical-analytical framework. Because each variety emphasizes a different but valid dimension of institutional phenomena, the many debates in the literature are not especially relevant to this study. Moreover, the multidimensional implications of sustainability suggest that setting aside ontological differences based on disciplinary boundaries may be more appropriate with respect to understanding and explaining the behaviour of institutions.

2.3.1 What is an institution?

According to Campbell's (2004) overview, rational choice institutionalists define institutions as "formal and informal rules and compliance procedures; strategic equilibrium" (p. 11). Douglas North, a leading scholar in the rational choice stand, has defined institutions as "…formal rules, informal constraints (norms of behavior, conventions, and self-imposed codes of conduct), and the enforcement characteristics of both" (North, 1993, p.36). North's definition, which considers both formal rules and informal constraints, is one of the most widely used definitions of institutions in the literature outside of the New Institutionalism. Following Scott's (1995) typology, this school tends to give prominence to the regulative elements (informal and formal rules, laws, and enforcement mechanisms) of institutions as opposed to the normative (prescriptive values and norms) or cognitive elements (symbolic systems and shared meanings).

Similar to rational choice new institutionalists, historical new institutionalists have tended to define institutions as formal and informal rules, routines, and procedures (see Steinmo et al., 1992; Hall & Taylor, 1996; Campbell, 2004). Historical new institutionalists have tended to emphasize the temporal dimension of the evolution of institutions: "Central to this perspective is the notion that the institutions that guide decision making reflect historical experience" (Campbell, 2004, p. 25).

The sociological strand is concerned with applying an institutional perspective to understanding the structure and behaviour of organizations. They have tended to define institutions as "formal rules and taken-for-granted cultural frameworks, cognitive schema, and routinized processes of reproduction" (Campbell, 2004, p. 11). According to Scott (2001), sociological institutionalists have tended to make more explicit the role of agency and power in their definition of institutions. Arthur Stinchcombe, (1968) for example, has defined institutions as "a structure in which powerful people are committed to some value or interest" (in Scott, 2001, p. 25). Hall and Taylor (1996) stress the importance of the moral dimension in their depiction of the sociological strand: "…not just formal rules, procedures or norms, but the symbol systems, cognitive scripts, and moral templates that provide the 'frames of meaning' guiding human action" (p. 947). Following Scott's (1995) typology, then, this school tends to give prominence to the cognitive elements (symbolic systems and shared meanings) of institutions. The sociological approach to institutions, therefore, is much more encompassing

than other approaches: "Whereas most economists and political scientists focus exclusively on economic or political rules of the game, sociologists find institutions everywhere, from handshakes to marriages to strategic-planning departments" (Powell & DiMaggio, 1991, p. 9).

2.3.2 How do institutions emerge?

Campbell (2004) asserts that rational choice institutionalists have tended to attribute the emergence of institutions to a "logic of instrumentality" (p. 11). Hall and Taylor's (1996) overview elaborates on this logic: "…actors create the institution in order to realize this value, which is most often conceptualized…in terms of gains from cooperation" (p. 945). Institutional emergence, then, depends on the "utility calculations of individuals" (Peters, 2005, p.61). The basis of this approach is to perceive institutions as responses to problems of opportunism, incomplete information, and transaction costs (see Powell & DiMaggio, 1991). Rational choice institutionalists have tended to emphasize such factors as property rights (see North, 1990, p.33), transaction costs (see North, 1990, p.27), and concepts like bounded rationality to explain institutional emergence (see Alston et al., 1996, p.346-347; Campbell, 2004, p. 16). Bounded rationally refers to the limited capacity of actors to make well-informed decisions due to uncertainty and the constraints of the existing institutional environment.

Historical institutionalists present a historically based analytical framework for understanding institutional emergence. Long-term temporal processes are emphasized. Institutions are perceived to be embedded in these temporal processes and as such they are the legacy of these processes: "…the emphasis tends to be on political development as a (structured) process and on the way institutions emerge from particular historical conflicts and constellations" (Thelen, 1999, p. 382). Historical new institutionalists are especially vague when it comes to explaining how institutions emerge. This is perhaps a consequence of their emphasis on history; institutions are understood to be rooted in the past and emerge through path-dependent processes. Moreover, historical new institutionalists have tended to devote much more attention to the persistence of institutions once they are formed (Peters, 2005).

The new institutionalism in sociology is primarily concerned with why organizations adopt certain forms, procedures, etc. over others, and how such forms and procedures, etc. spread through organizational fields or across nations (see Hall & Taylor, 1996, p. 947). According to Peter's (2005) overview, the sociological take on institutional emergence rests, in part, on

explanations of institutionalization. In other words, institutions emerge as symbolic manifestations of the needs of a society. They are institutionalized and legitimized through ongoing participation from actors (p. 118). Hall and Taylor (1996) assert that sociological new institutionalists emphasize social legitimacy over a more instrumental view adopted by some rational choice and historical new institutionalist scholars: "In other words, organizations embrace specific institutional forms or practices because the latter are widely valued within a broader cultural environment" (p. 949). This has been described as a "logic of appropriateness" as opposed to a "logic of instrumentality" (see March & Olsen, 1989, p. 22-23). Powell and DiMaggio (1991) recognize the role played by power in institutional emergence: "…it is clear that elite intervention may play a critical role in institutional formation" (p. 191). An organization may adopt certain rules and practices over others in order to gain needed resources, even if the organization becomes less efficient as a result. This is a more utilitarian assertion, similar to the position taken by rational choice scholars.

2.3.3 How do institutions persist?

Institutions are dynamic in that they are constantly evolving through their interactions with each other and with their participants: "There is a reciprocity between an individual and an institution in the sense that both of them influence and constitute each other" (Sjostrand, 1993, p.10). Institutional "persistence", then, does not denote stasis. Rather, the persistence of a particular institution is dependent on the reproduction or transmission of that institution over time. Reproduction however, is not always simple and complete (see Sjostrand, 1993, p.13). In this way, institutional persistence connotes incremental institutional change, especially in the modern context of continuous technical, economic and other change.

Again, rational choice institutionalists take a functionalist view of persistence, explaining it in terms of the "logic of instrumentality", based on an actor's interest in maximizing his or her interests. Actors will seek to change an institution if it ceases to achieve the ends for which it was originally created. Moreover, according to Hall and Taylor (1996), "Individuals adhere to these patterns of behaviour because deviation will make the individual worse off than will adherence" (p. 940). According to Scott (1995), institutions persist with the help of various "carriers" (culture, social structures, routines) that work to constrain behaviour. Rational choice institutionalists have tended to emphasize rules and laws (culture), governance and power

systems (social structures), and protocols and standard procedures (routines) as the carriers in which institutions are embedded. They have also tended to explain persistence with such concepts as path dependence, positive feedback, increasing returns, transaction costs, and bounded rationality (North, 1990, p. 95-100; Krasner, 1998; Campbell, 2004, p.13). According to Krasner (1988), path-dependence and positive feedbacks are closely related: "Path-dependent patterns are characterized by self-reinforcing positive feedback. Initial choices, often small and random, may determine future historical trajectories" (p. 83). Campbell (2004, p.13) refers to positive feedback as a process whereby certain institutions, once established, generate support from a range of elite players who obtain increasing financial and other benefits from them. North (1990) refers to institutional persistence as "stability" and asserts that stability is accomplished through "…formal rules nested in a hierarchy, where each level is more costly to change than the previous one…" and "…informal constraints, which are extensions, elaborations and qualifications of rules and have tenacious survival ability because they have become part of habitual behavior" (p. 83). North is careful to note that an institution's survival ability is not necessarily an indication of its efficiency. One major concern of rational choice institutionalists is to explain why actors continue to support inefficient institutional arrangements.

Historical new institutionalists emphasize long-term temporal processes in their explanations of institutional persistence. According to Immergut and Anderson (2008), one of the most important tasks for historical new institutionalists is to explain the underlying mechanisms for institutional resilience. A long-term perspective on institutional resilience allows for the consideration of "…feedback links, demographic developments, threshold effects, and the like, which can be more important than short-term political decisions" (p. 354). Mechanisms of reproduction, increasing returns, path dependence, and long-term processes are essential elements of the historical new institutional approach to analysis. Institutions are understood as continually renegotiated and reinterpreted: "Thus…without continual renegotiation and reinterpretation, as well as the support of ancillary institutions, such as customs, beliefs and assumptions, institutions would lose their social embeddedness, and hence cease to function at all" (Immergut & Anderson, 2008, p. 356). Path dependence and increasing returns may work together to fix institutions along a particular trajectory (see Lecours, p. 56-57). Persistence, then, in part, is a product of institutional inertia generated by the mechanisms of path dependence and increasing returns. Similar to rational choice institutionalists, historical new institutionalists also

recognize the paradox of institutional inertia or persistence: "Institutional continuity…should not be interpreted as an indication of efficiency or optimality…Rather, institutional continuity is an indicator of the prohibitive costs of switching to a design that had been presented as an option at an earlier point in time" (p. 58).

According to Hall and Taylor (1996), historical new institutionalists have tended to take either a "calculus approach" or a "cultural approach" to understanding how institutions persist. The calculus approach suggests that a particular institution will persist if it works to solve a collective action problem or of it reaps certain benefits from exchange. Here is the logic of instrumentality espoused by rational choice scholars. In contrast, the cultural approach suggests that institutions persist because they are socially constructed and taken-for-granted. Moreover, because they are collectively constructed, one individual alone cannot transform them. In this way, institutions resist change because they themselves work to define the options and choices that an individual may make in any given situation.

Scott's (2005) overview highlights three different perspectives on institutional stability and persistence within the sociological strand: cognitive, regulative, and normative. Sociological New institutionalists who embrace a cognitive perspective emphasize the taken-for-granted assumptions that define social reality and so ensure the cultural persistence of institutions. These taken-for-granted assumptions are internalized by actors and thus become part of objective reality. The regulative perspective emphasizes power relations, interest, and agency. Powell and Dimaggio (1991), for example, have adopted this view, along with cognitive explanations of persistence: "…once established and in its place, practices and programs are supported and promulgated by those organizations that benefit from prevailing conventions" (p. 191). Here, power plays a leading role in institutional persistence: "power has a great deal to do with the historical preservation of patterns of values" (in Powell & DiMaggio, 1991, p.107). In other words, institutions persist as long as the people who are benefitting from them have the power to preserve them.

Powell and DiMaggio have also recognized the path-dependent nature of institutional persistence: "Organizational procedures and forms may persevere because of path-dependent patterns of development in which initial choices preclude future options…" (p. 192). Similar to rational choice scholars, they have recognized that institutional persistence or inertia is partially caused by increasing transaction costs associated with path-dependence. They have also

highlighted the role played by interdependencies across organizations in institutional inertia: "When interdependencies extend across organizational boundaries to other organizations, particularly in the case of hierarchical relations…then practices become quite resistant to efforts at change" (p. 192). But, again, they prefer to emphasize such cognitive factors as an actor's inability to conceive of appropriate alternative institutional forms: "Institutions do not just constrain options: they establish the very criteria by which people discover their preferences. In other words, some of the most important sunk costs are cognitive" (p. 11).

The normative view emphasizes shared norms as mechanisms for institutional stability. These norms are both internalized and enforced by others. March and Olsen (1989) have embraced a view of persistence that rests somewhat on the normative perspectives: "Institutions preserve themselves, partly by being resistant to many forms of change, partly by developing their own criteria of appropriateness and success, resource distributions, and constitutional rules. Routines are sustained by being embedded in a structure of routines, by socialization…" (p.55). According to Powell and DiMaggio (1991, p. 190) organizations adopt certain institutions because they are mandated by the cultural context within which they are embedded. This, in turn, may lead to inefficiency over the long term. Campbell (2004) asserts that the survival of one organizational structure over another may depend, in part, on how a particular model conforms to the culturally appropriate scripts and other organizational models in their environment.

2.3.4 How do institutions affect human behaviour?

Institutions shape the behaviour of humans and humans, in turn, shape institutions: "…humans design and create institutions but then are constrained by them" (Peters, 2005, p.63). Rational choice institutionalists posit that institutions constrain human and organizational behaviour through rules and constitutions, and bounded rationality (Campbell, 2004, p.11). The concept of bounded rationality has been used to explain how "ideas" (ideology, shared cognitive frames, beliefs, values, etc.) help to define an actor's interests and choices about institutions. Ideas are defined as cognitive constraints. Campbell (2004, p.16) asserts that this concept is not yet well developed within the rational choice strand of New Institutionalism. Nevertheless, Campbell highlights that rational choice scholars have increasingly emphasized how ideas can constrain actors and even lead to inefficient institutions. According to Campbell (2004, p. 15), one influential contribution that sociological and political science scholars have made to the

rational choice strain of New Institutionalism is the "choice-within-constraints" approach to how institutions affect human behaviour. This approach posits that informal norms, etc., formal rules, etc., and enforcement mechanisms affect the range of alternatives available, and information (or lack of information) creates the certainty (or uncertainty) within which actors must pursue particular interests. In this way, an actor's range of choices is limited and this influences his or her capacity to pursue their interests. Hall and Taylor (1996) assert that rational choice institutionalists take a "calculus approach" to explaining how institutions constrain human behaviour: "…an actor's behaviour is likely to be driven, not by impersonal historical forces, but by a strategic calculus and, second, that this calculus will be deeply affected by the actor's expectations about how others are likely to behave as well" (p. 945).

Similar to rational choice institutionalists, historical institutionalists recognize that formal and informal institutions form the context within which actors pursue their interests. Institutions are perceived to offer opportunities for action and to constrain action. Steinmo et al. (1992), however, are quick to note that historical institutionalists place more emphasis on the effects of informal institutions on personal choice: "In short, people don't stop at every choice they make in their lives and think to themselves, 'Now what will maximize my self-interest?' Instead, most of us, most of the time, follow societally defined rules, even when so doing may not be directly in our self-interest" (p. 8). In other words, institutions influence an actor's formation of preferences; norms, ideas, interests, and beliefs act as important informal, societal constraints. Moreover, the goals that actors decide to pursue are in themselves defined by the institutional context. In this way, historical institutionalists assert that interests are socially and politically constructed: "…unless something is known about the context, broad assumptions about 'self-interested behavior' are empty" (p. 9). Also central to historical institutionalism is the assumption that institutions are historically constructed. An actor's choices, therefore, may be greatly influenced by the "logic of institutional development and reproduction" (Lecours, 2005, p.23).

Historical institutionalists also emphasize the roles played by power and the distribution of power across social groups with respect to how institutions affect human behaviour. Certain institutional arrangements, for example, give certain groups more or less influence in the decision making process: "…rather than emphasize the degree to which an outcome makes everyone better off, they tend to stress how some groups lose while others win" (Hall & Taylor,

1996, p. 941). Similar to some rational choice scholars, other historical institutionalists have stressed the importance of cognitive constraints on human behaviour. Campbell (2004) asserts that some historical institutionalists argue that ideas function to constrain an actor's choices as long as they continue to provide answers to collective problems.

Sociological institutionalists have recognized the constraining influence of both normative and cognitive factors on human behaviour. Indeed, Campbell (2004) asserts that this strand stresses an organization's tendency to follow a more cognitive "logic of appropriateness" than a "logic of instrumentality", even if it means choosing a less efficient organizational model. What is deemed most appropriate or legitimate is, in turn, dependent on the habits, routines, taken-for-granted scripts, and schema that influence an actor's perception of the world. These institutionalized scripts, routines, etc. are thought to constrain, enable, and constitute behaviour because, among other things, they guide actors during times of uncertainty, when decisions must be made with incomplete information. According to Powell and DiMaggio (1991), because routines, habits, etc. are taken-for-granted, actors may not choose these routines, habits, etc. freely. Furthermore, an actor's perception of what is appropriate is transmitted through socialization and societal enforcement. In this way, an actor's interests, self-image, identity, and perception of the world are institutionally constructed (see also Hall & Taylor, 1996; Immergut & Anderson, 2008). Broader cultural frames and historical contexts help to define what is appropriate in a given situation.

Sociological institutionalists also emphasize the roles played by power and the distribution of power across social groups with respect to how institutions affect human behaviour. March and Olsen (1989), for example, explored the implications of political equity for the design of political institutions. They define power as the ability of an individual or individuals to persuade others to act in a way that contributes to a particular interest or set of interests. The distribution of power in a society is affected by individual or collective preferences: "…political equality cannot be meaningfully achieved or assessed without a variety of political institutions concerned with the construction, elaboration, and empathic appreciation of individual preferences" (p. 144).

2.3.5 How do institutions change?

Campbell (2004, p.33-35) provides a useful overview of the three basic patterns of

institutional change most frequently discussed by new institutionalists: incremental or evolutionary, punctuated equilibrium, and punctuated evolution.

Incremental or evolutionary change is slow and proceeds in small steps in a particular direction. These small steps build up slowly over time to contribute to an evolutionary process of institutional change. North (1993, p.38) asserts that the direction of incremental change is determined by path dependence. This type of evolutionary change may contribute to the persistence (maintenance or reproduction) of certain institutional forms because it reflects change that does not depart whole-heartedly from yesterday's institutions. Institutional "inertia" and "stickiness" have been used to explain this slow process (see Campbell, 2004, p.33). Inertia and stickiness refer to a process by which choices made in the past constrain future choices by limiting available future options. In some cases, bounded rationality can play a leading role in inertia.

Punctuated equilibrium describes institutional change that is more discontinuous, rapid and profound. These types of changes can represent dramatic shifts from one way of doing things to another. Campbell (2004) gives an example of discontinuous change in Fordist-style industrial production inspired by technological development in the 1970s: "…rapid changes in technologies, energy prices, and market demand sparked a dramatic shift toward post-Fordist institutions based on the principles of decentralized corporate structures…" (p. 34). This model of institutional change is generally known as Krasner's (1984, 1988) model of punctuated equilibrium, which he derived from studies in evolutionary biology, specifically Stephen Jay Gould's and Niles Eldridge's theory of evolution. Krasner's model of punctuated equilibrium distinguishes between short bursts of institutional creation or fundamental reorganization and longer periods of stasis. External and/or internal forces give rise to creation and reorganization.

The third pattern of institutional change, punctuated evolution, incorporates both incremental and punctuated equilibrium conceptions of change. It posits that periods of intuitional stability are evolutionary rather than static. Intuitional stability, then, is characterized by slow and incremental change. Through a process of social learning, self-reflexive actors gradually adjust institutions within the constraints of existing institutional arrangements. During periods of crises, these actors vie for new institutional forms, which can result in the transformation of the previous status quo.

According to Campbell's (2004) overview, rational choice intuitionalists favour path-

dependent evolutionary change as the norm. But some rational choice scholars have recognized the punctuated equilibrium pattern as well. Douglas North (see 1990; 1993; North, 1996b: North, 1996c), has been a staunch defender of the evolutionary model. North distinguishes between fast and slow moving institutions. Formal constraints (rules, etc.), for example, can change overnight, while informal constraints (norms, etc.), change more gradually. According to North (1993, p. 38), even revolutionary (discontinuous) change is not as revolutionary as many scholars would have us believe. This is because it is often the case that formal rules change while informal constraints do not. Because multiple equilibrium options are always possible when it comes to the creation of institutions, one central question for rational choice scholars is why one equilibrium outcome is reached over another (see Thelen, 1999, p. 381). Some rational choice scholars have used the concept of diffusion to explain how certain economic practices are more likely to spread through the market than others in a path-dependent way.

According to Campbell (2004), rational choice scholars have tended to take a functionalist view of why institutional change occurs. In other words, when an institution no longer functions for the reasons for which it was originally created, actors will seek to change it: "…regardless of whether they focus on evolutionary or revolutionary change, rational choice institutionalists find that both norms and more formal institutions emerge and are enforced as a result of self-interested behavior" (p.15). Rational choice scholars have recognized the importance of the concepts of transaction costs and increasing returns when it comes to institutional change and/or persistence: "…even if there are unintended policy consequences from an institution over the long term, actors might have adapted to the institution itself in such a way that it would be too costly to create a new institution" (Lecours, 2005, p. 58). North (1990) also argues that two forces key to the path of institutional change are increasing returns through self-reinforcing feedbacks, and transaction costs. These forces exist at the scale of an individual institution and at the scale of the larger institutional matrix where the interdependencies that exist among institutions generate massive increasing returns.

Historical institutionalists have embraced all three patterns of institutional change outlined above. Institutions, for example, have been perceived to evolve incrementally through path-dependent processes (see Campbell, 2004, p. 26). But historical institutionalists have also been interested in revolutionary institutional change, which represent abrupt breaks from the past. Campbell outlines the tensions between these two views of institutional change:

"According to some critics, this has created problems insofar as their explanations of rapid, revolutionary change do not square well with an analytic framework that talks much about path-dependence" (p. 26). Historical institutionalists who have adopted the pattern of punctuated evolution recognize the validity of both incremental and punctuated equilibrium models of institutional change. The concepts of diffusion, path-dependence, and positive feedback have been central to historical institutionalists' explanations of institutional change. The concept of diffusion, for example, has been used to explain how policy learning can help to spread certain policy models from one country to another (see Campbell, 2004, p. 26). Some historical institutionalists have used the concept of path-dependence in a similar way to rational choice scholars to explain the path-dependent nature of evolutionary and even revolutionary change. The concepts of "tipping points" and "thresholds" have been central to historical new institutionalist understandings of the punctuated equilibrium model of change, whereby a slow accumulation of pressure may eventually reach a critical point where rapid change occurs: "…path-dependent or self-reinforcing processes…are all based on threshold models—relatively small movements can push above some critical level, triggering a process of positive feedback that leads to much more dramatic (nonlinear) change" (see Pierson, 2004, p. 85). The threshold concept is emphasized in punctuated equilibrium and punctuated evolution models of change. The basic idea is that small shifts over the thresholds of individuals can lead to more significant shifts in collective behaviour. Pierson asserts that there are "tipping points" in many social processes and these tipping points can induce nonlinear consequences. Sometimes, these social processes are interconnected. Pierson further emphasizes that changes in one institution can influence and/or undermine others.

Notable historical New Institutionalists, Streeck and Thelen (2005), have provided a typology of various ways that New Institutionalists have perceived institutional change. They criticize views that favour either an incremental or punctuated equilibrium model and offer an alternative view that posits that small adjustments over time can cumulatively amount to transformative change. They dedicate their entire volume to an examination of cases that do not conform to a punctuated equilibrium model of change. Important to this gradualist view of institutional transformation are the concepts of displacement, layering, drift, conversion, and exhaustion (see Streeck & Thelen, 2005, p. 18-30).

Similar to rational choice scholars, historical institutionalists have also recognized the

motivating role that an actor's self-interest plays in institutional change. This refers to the logic of instrumentality, which has been central to the rational choice perspective. But historical institutionalists have also argued that an actor's ideas about the "good" institution may also influence institutional change. A logic of appropriateness, therefore, may be just as important as a logic of instrumentality (see Campbell, 2004, p. 27).

According to Campbell's (2004) overview, sociological institutionalists have emphasized all three patterns of institutional change (punctuated equilibrium, evolution, punctuated evolution) (see p. 20). Like rational choice and historical institutionalists, sociological institutionalists see the concepts of path dependency and diffusion as key to understanding institutional change. Whatever the favoured pattern of change is, the sociological strain is interested in the links between institutions and organizations; therefore, their explanations of change have tended to focus on how certain principles, rules, procedures, etc., diffuse through organizations to become taken-for-granted modes of operation. Hall and Taylor (1996) assert that unlike rational choice institutionalists, who view change as related to means-ends efficiency calculations, sociological institutionalist scholars emphasize the "logic of appropriateness". In other words, organizations will adopt particular rules, procedures, etc., if they increase the social legitimacy of the organization: "…organizations embrace specific institutional forms or practices because the latter are widely valued within a broader cultural environment" (p. 949).

Table 1, below, summarizes the orientation of the three main strands discussed above to the core questions in institutional analysis.

Table 1. Summary of the three major strands of New Institutionalism

	Rational Choice Institutionalism	**Historical Institutionalism**	**Sociological Institutionalism**
Definition of institution	Formal rules and informal norms of behaviour, conventions, etc., compliance procedures (Emphasis on regulative dimension)	Formal and informal rules, routines, and procedures (Emphasis on formal structures, e.g. branches of government)	Formal rules and taken-for-granted cultural frameworks, cognitive schema, routinized processes of reproduction (Emphasis on normative and cognitive dimensions)
How do institutions emerge?	Logic of instrumentality Institutions emerge as responses to problems of opportunism, incomplete information, transaction costs	Institutions are embedded in temporal processes, emerge from particular historical conflicts, constellations, through path-dependent processes	Logic of appropriateness Manifestations of societal needs Institutions emerge from the

	(Transaction costs, bounded rationality are featured concepts)	Recognize role of power (Long-term temporal processes are emphasized)	rubble or from extant institutions The role of power is emphasized (Emphasis on why organizations adopt certain forms, procedures, etc. over others)
How do institutions persist?	Logic of instrumentality Rules, laws, routines, and systems of governance and power act as "carriers" of institutions, constraints Role of horizontal interdependencies is important (Path dependence, positive feedback, increasing returns, transaction costs, bounded rationality are featured concepts) paradox of institutional persistence is recognized	Logic of instrumentality Long-term temporal processes are emphasized as constraints Institutional persistence is related to a constant process of renegotiation and reinterpretation, collective construction Institutions are socially constructed and embedded, (Path dependence, positive feedbacks, threshold effects, transaction costs are featured concepts) paradox of institutional persistence is recognized	Logic of appropriateness Cultural persistence through internalized, taken-for-granted cognitive schema Role of power relations is important (persistence is related to interests and values of elites) Role of horizontal interdependencies is important Role of internalized and enforced shared norms is important (Path dependence, transaction costs (cognitive), positive feedback, socialization are featured concepts)
How do institutions affect human behaviour?	Logic of instrumentality Informal norms, formal rules, laws, constitutions; enforcement mechanisms, bounded rationality, and ideas (beliefs, cognitive schema) constrain human and organizational behaviour	Logic of institutional development and reproduction, path dependency Formal and informal institutions influence human behaviour and political outcomes Role of socialization in formation of actors' interests and preferences Role of power and distribution of power Cognitive constraints (ideas constrain actors' choices)	Logic of appropriateness Institutionalized habits, routines, taken-for-granted cognitive schema (ideas) constrain actors Socialization, societal enforcement, institutionally constructed interests, preferences, identity, etc. Role of power and distribution of power Cultural frames, historical contexts
How do institutions	Logic of instrumentality	Logic of instrumentality, Logic of appropriateness	Logic of appropriateness

change?	Evolutionary, punctuated equilibrium Fast and slow moving institutions Multiple equilibrium orders are possible Featured concepts: diffusion, path dependence, positive feedbacks, transaction costs	Evolutionary, punctuated equilibrium, punctuated evolution Featured concepts: thresholds, diffusion, path dependency, positive feedbacks, increasing returns	Evolutionary, punctuated equilibrium, punctuated evolution Featured concepts: diffusion, path dependency, positive feedbacks

2.3.6 Defining some frequently invoked concepts in institutional analysis

According to Pierson (2004), the concept of path dependence may be of greatest importance to social scientists in their explanations of institutional emergence, persistence, and change. Path dependence has been defined in many different ways (see Pierson, 2004, p. 20; Streeck & Thelen, 2005, p. 6-7). For the purposes of this study, path dependence refers to "…a process whereby contingent events or decisions result in the establishment of institutions that persist over long periods of time and constrain the range of actors' future options, including those that may be more efficient or effective in the long run" (Campbell, 2004, p. 65). It is associated with a positive feedback process, which generates multiple possible outcomes, and which involves high costs of reversal and increasing returns for actors that behave in ways that support previous choices: "In the presence of positive feedback, the probability of further steps along the same path increases with each move down the path" (Pierson, 2004, p. 21).

Campbell argues, however, that without a better explanation of the mechanisms that underpin path dependent evolutionary change, path dependency will remain more suited to describe institutional persistence. One such mechanism is "bricolage". Bricolage refers to a process whereby actors create innovative institutions from previously existing principles and practices: "The key is to recognize that actors often craft new institutional solutions by recombining elements in their repertoire through an innovative process of bricolage whereby new institutions differ from but resemble old ones (Campbell, 2004, p. 69). These elements may be cognitive, normative, and/or regulative. The process of bricolage leads to incremental or path dependent change because the range of options available for actors is limited by the particular elements available to them. In this way, actors are both constrained and empowered by existing

institutions. One important benefit of the concept of bricolage is that it focuses our attention on the importance of agency; "bricoleurs" are central to the process of bricolage.

Bricoleurs is a term coined by Joseph Schumpeter (1934) to describe the creative people who come forward to recombine institutional elements in innovative ways. Understanding their role in bricolage is important because it can explain why one set of institutions is created over another. In particular, an actor's position within the social-institutional environment can impact the effects of bricolage. Campbell asserts, for example, that bricoleurs with extensive ties to people across a range of social networks, including organizations and institutions, enhance the success of a particular innovation, and can lead to more transformative change. An entrepreneur's institutional environment may also constrain his or her choice of innovations, following norms of what is appropriate or legitimate, and regulative constraints: "In other words, the more entrepreneurs can demonstrate that their innovations fit the prevailing institutional situation, the greater will be their capacity for innovation and the greater will be the likelihood that their innovations will stick" (Campbell, 2004, p. 76). This constraining effect determines, in part, the degree to which an innovation is evolutionary or transformative. Campbell notes also that actors' access to resources (e.g. money, political clout, opportunities for participation in decision making) affects the success of innovative ideas: "Thus, while entrepreneurs' social, organizational, and institutional locations affect their capacity for creative innovation, they face institutional and resource constraints that affect their capacity to make their innovations stick" (p. 77).

Another ubiquitous concept in institutional analysis is diffusion. Diffusion refers to how institutional elements spread through a particular environment or population of actors with little alteration. Two important mechanisms that facilitate diffusion are translation and enactment. The more an innovative idea is translated and enacted, the more likely it is that the idea will lead to transformative change. An actor's location within the institutional framework increases the likelihood that a new idea will be introduced in the first place. But once it has been introduced, the process of translation influences its impact: "Institutional entrepreneurs must blend new ideas into local practice. This tends to ensure that implementation of a new idea rarely constitutes a total break with past practice" (Campbell, 2004, p. 80). Success also depends on the degree of political support an idea carries, power struggles, and the capacity (financial, administrative, etc.) of an organization to adopt and implement the new idea. It is important to note too that the way a

particular innovation is translated depends on the actors responsible for translation. Some actors, for example, will be motivated to translate ideas in such a way to fulfill their own interests. Others will be more concerned with cognitive an/or normative goals.

The third common concept to be discussed is ideas. Campbell asserts that it is well recognized that ideas can both inhibit and facilitate incremental and/or transformative institutional change. Here, ideas are defined as socially constructed worldviews, intellectual paradigms, identities, norms, values, culture, interests, beliefs, etc. that influence decision-making. Campbell is careful to note that actors (e.g. decision makers, academics, institutional entrepreneurs, constituents, ideational brokers) play a key role in the emergence and spread of ideas. And the success of an idea is ultimately constrained by the institutional environment. The degree to which a government or organization is centralized, decentralized, and connected to other organizations for example, can influence the success of new programs or policy.

The above overview of the three strands and frequently invoked concepts in the New Institutionalism have important implications for the purposes of this study. These will be discussed below.

2.3.7 The New Institutionalism and institutional change and resistance to change towards sustainability

Hall and Taylor (1996) provide a good critical comparison of the major strands of New Institutionalism, emphasizing strengths and weaknesses. They assert that historical institutionalism is weak in its approach with respect to how institutions influence human behaviour and suggest that it might benefit from some exchange among the schools. Rational choice scholars offer a more precise conception of the relationship between institutions and human behaviour. But, again, rational choice scholars would benefit from a more nuanced explanation of what motivates human behaviour and how interests are formed. For example, they might benefit from the sociological strand's emphasis on the cognitive and cultural dimensions, which go beyond instrumental accounts of human action. Similarly, Hall and Taylor argue that the rational choice perspective on origins and persistence, which emphasizes the logic of instrumentality, may only be appropriate to certain contexts (e.g. legislatures and market competition). Here again, historical and sociological institutionalists have much to offer to fill out the historical and cognitive dimensions of institutional emergence and persistence. In

particular, previously existing institutions play a key role in historical and sociological explanation of origins, persistence, and change. From this standpoint, the more cognitive dimensions of culture and socialization can be elaborated.

For the purpose of this study, insights are drawn from the three major strands in order to better understand and explain institutional change or lack thereof. It argues that each strand has produced a partial understanding of institutions; each captures a different dimension of human-institutional behaviour. Indeed, it can be argued that the particular ingredients of institutional emergence, persistence, and change are context dependent. Moreover, understanding the dynamics of institutions in relation to sustainability requires a comprehensive conceptual approach. As previously mentioned, New Institutionalists have largely ignored the role of the natural environment in institutional analyses. The three major strands of New Institutionalism, however, carry important insights from cultural, economic, and political spheres, which are relevant to understanding institutional behaviour through a sustainability lens.

It is important to note here that the topic of institutional resistance remains poorly understood by New Institutionalist scholars. According to the overview above, scholars in all three strands have attempted to understand and explain why and how institutions persist over time. But institutional persistence and resistance entail different dynamics. Institutional persistence refers to how institutions are maintained by actors over time through various processes (path-dependency, socialization, reproduction through renegotiation and reinterpretation, etc.). The emphasis is on recreating the same institution over time. In contrast, institutional resistance is about how institutions persist in the presence of (sometimes extreme) external and/or internal pressures to change. Nevertheless, the New Institutionalist explanations of persistence provide helpful clues about inertia.

As a whole, the three major strands reveal that institutions are multi-dimensional. They consist of regulative, normative, and cognitive elements. These dimensions may evolve at different speeds. The regulative dimension, for example, may evolve faster than the normative and cognitive dimensions. Investigating institutional behaviour through a sustainability lens, then, requires attention to all three dimensions while recognizing that they do not necessarily evolve simultaneously. This may certainly be the case for institutional change towards sustainability, which is a concept and pursuit that requires integrated attention to multiple dimensions (social, economic, and ecological), a comprehensive suite of interrelated social-

ecological concerns, present and future generations, and local to global scales. Moreover, the concept of sustainability inherently challenges the status quo, which is comprised of formal and informal institutions with regulative (legislative frameworks), normative (values), and cognitive elements (ideas, worldviews). Regulative changes in the aggregates sector, for example, may not induce transformative change towards sustainability without changes in norms of practice, values, and beliefs. Campbell (2004) asserts that institutional change is transformative when change occurs across most or all dimensions.

The above elements represent particular constraints and opportunities for human action. When investigating institutional dimensions of change, then, it is important to devote attention to existing laws, interests and values of powerful groups, norms, etc. as important constraints and opportunities that determine of the choices that individuals make. Historical institutionalists would add that these institutional constraints and opportunities are embedded in long-term historic processes, which may in themselves represent limitations due to the effects of path-dependency (positive feedbacks, increasing returns, transaction costs). Regulative, normative, cognitive factors, therefore, may all be present in certain situations and they may work together to both inhibit and facilitate institutional change towards sustainability. When pursuing institutional change towards sustainability, for example, actors may be limited to a certain degree by the particular range of inherited regulative, normative, and cognitive elements in the institutional environment, especially when institutional entrepreneurs are engaged in creating new institutions. Moreover, as discussed in section 2.3.6, Campbell argues that the degree to which institutional change is incremental or transformative depends on how well actors can demonstrate that a particular innovation "fits" the prevailing institutional environment. Powerful elites, for example, may reject institutional change if the proposed change is not in their best interests. This may explain, in part, why institutional change towards sustainability – a concept that fundamentally challenges the status quo – has been overwhelmingly incremental.

The three strands of the New Institutionalism also suggest that investigations into the dynamics of institutions in relation to progress towards sustainability require consideration of the different types of reasoning or logic that may underpin decision-making. Rational choice institutionalism, for example, stresses the role of a logic of instrumentality in institutional emergence, persistence, and change. Actors will create, recreate, and dismantle certain institutions if the anticipated results will fulfill particular individual or collective interests – even

if the new institutions are less efficient or preclude more efficient alternatives. Actors also think strategically in terms of the transaction costs of change; if the immediate costs of change to the actor(s) are high relative to the costs of maintaining the status quo, resistance to change is likely. Similarly, if the individual and collective gains that result from preserving the status quo are relatively high, the incentive to change is low. In contrast, historical and sociological institutionalists suggest that the logic of appropriateness is equally if not more important. Here, the normative and cognitive elements of decision-making are made explicit. What an actor deems to be appropriate in a given situation, for example, may be underpinned by personal values, shared norms, and taken-for-granted cultural frameworks. These normative and cognitive elements are embedded in the broader cultural environment, which is inherited through long-term historical processes. The historical and cultural embeddedness of these values and shared norms, etc., help to explain why they can be so resistant to change. With respect to progress towards sustainability, then, it is important to consider the influence of both logics and the historical time frame and broader cultural environment in which they are embedded.

The logics of instrumentality and appropriateness both involve certain collective and/or individual gains from cooperation, especially if there are interdependencies among institutions at the scale of the institutional matrix. Gains from cooperation may be increased through path-dependent processes, which involve positive feedbacks, increasing returns, and transaction costs. The particular ideas, norms, laws, etc. that influence the creation, maintenance, and persistence of institutions may be, in part, the effects of long-term path-dependent processes– for better or for worse. Moreover, individual and collective goals underpinned by the logics outlined above may be realized over the long term with the help of path-dependent processes. Sociological institutionalists particularly emphasize the cognitive transaction costs associated with path dependency, whereas rational choice scholars emphasize losses and/or gains in material resources. Analysing institutional progress towards sustainability necessitates integrated consideration of cognitive and material transaction costs. Certain communities, for example, may resist institutional change towards sustainability in certain approaches to natural resource management because of sunk socio-cultural and economic costs. It may be perceived that change is too costly in the short term, even in the face of the long-term benefits of change. In these cases, path dependence, positive feedbacks, increasing returns, and transaction costs work together to maintain the status quo.

The three strands also suggest certain social and other processes may be involved in institutional progress towards sustainability. Sociological institutionalists emphasize cultural persistence through the process of socialization as integral to an actor's definition of his or her interests, values, self-image, worldview, etc. Institutional change towards sustainability, then, may require events where such cognitive elements can be exposed and debated and where certain socially and ecologically destructive and inequitable institutionalized norms, etc., may be "unlearned". Historical institutionalists' emphasize that persistence is associated with a constant process of renegotiation and reinterpretation over the long term. It follows, then, that change and resistance to change may relate back to the different logics, shared norms, taken-for-granted schema, and other such dynamics as bounded rationality, and the distribution of power across social groups. Path dependent processes and the interdependencies across organizations and institutions may further entrench these logics and power dynamics so that renegotiation and reinterpretation result in slow, incremental change or resistance to change. Streeck and Thelen (2005) demonstrate that the process of renegotiation and reinterpretation may sometimes be explicit, for example through decision making around policy reform. Here are opportunities for institutional change towards sustainability through social learning.

Usually, however, as sociological new institutionalists emphasize, certain actors have more access to the political decision making process than others, giving certain groups more influence than others in policy development. Moreover, powerful elites who benefit from certain institutions are inclined to preserve them over time. The persistence of institutions, then, is related to the interests and values of powerful elites. The balance of power among social groups is especially important when considering the impacts of renegotiation and reinterpretation.

Institutional change towards sustainability over the long term also depends on the degree to which institutional change is incremental or transformative. The concept of "tipping points" or thresholds is relevant here. Changes in the beliefs, opinions, etc. of one individual may lead to broader, more collective change. Such mechanisms as bricolage and diffusion many also carry the potential for transformative change towards sustainability – if certain powers, resources and capacities are available to a particular set of actors. Campbell (2004) highlights some of these important resources and capacities (e.g. adequate information, financial, administrative, political support, etc). Uncertainty or lack of information about a particular programme or policy, etc., for example, can stall change and support institutional inertia. Other important resources include

openings for public participation and deliberation, where social learning might occur. A lack of administrative capacity and financial resources may explain why certain natural resource management crises were not met with transformative institutional changes in associated management organizations.

All three strands underscore the centrality of actors as agents who practice and maintain institutions, create new ones and reform old ones. Moreover, actors and institutions are interconnected and interdependent in that they continually interact with each other. The importance of the role of actors is especially evident in Campbell's mechanisms (bricolage, translation and enactment) and other processes for incremental-to-transformative institutional change (see Streeck & Thelen, 2005).

The above discussion highlights the implications of the three main strands of New Institutionalism for understanding and explaining the dynamics of institutional systems. These implications form the basis of the preliminary theoretical propositions based on the New Institutionalism. The theoretical propositions defined in Box 1, below, assume a basic understanding of institutions and human-institutional relationships. They are oriented towards answering questions about why and how institutional change and resistance to change occur and the factors that determine the extent to which they occur. The are underpinned by the following essentials:

- Institutional dynamics (emergence, persistence, change, and resistance to change) occur within and are constrained by a particular set of culturally embedded (norms, habits, etc.), regulative (laws, etc.), normative (values, etc.), and cognitive (beliefs, worldviews, cultural frameworks, etc.) institutional elements, which define a particular institutional system. These institutional elements are interconnected and interdependent across scales and they evolve at different speeds.

- Institutional dynamics occur within and are constrained by the effects of long-term path dependent processes, including positive feedbacks, increasing returns, and transaction costs. Path dependent processes may be reinforced more broadly by the interconnections and interdependencies between and among institutions within the institutional matrix, and the distribution of influence and authority among actors with different interests.

Box 1. Preliminary theoretical propositions based on the three strands of the New Institutionalism.

1. Actors may resist or facilitate institutional change in order to maximize individual and/or collective interests and/or to achieve cultural appropriateness and legitimacy as defined by a particular, culturally embedded institutional environment. Actors' interests are determined, in part, by the institutional system and by long-term historic processes (e.g. socialization).

2. Actors may resist or facilitate institutional change through the process of renegotiation and reinterpretation and/or by creating innovative institutions from previously existing institutional elements. These processes lead to path-dependent change because the range of options available to institutional entrepreneurs is constrained by the particular characteristics (e.g. power relationships, actors' interests, laws and informal norms, etc.) of the existing institutional system.

3. The extent to which institutional change and resistance to change occur is determined, in part, by:

- *the socioeconomic costs associated with change. Path-dependent processes involve high socioeconomic costs of reversal or reorganization, especially when the interconnections and interdependencies among and between the institutions, organizations, and certain socioeconomic groups in a particular institutional arrangement are considered;*

- *the power and resources (esp. financial, ties to people in power, political support, opportunities for participation) held by particular socioeconomic groups to develop, translate and enact innovation(s);*

- *the capacity of actors to translate and enact an innovation (with suitable accommodation but no alterations that undermine the essentials) across a range of organizations or across a population. Translation and enactment occur within and are constrained by a particular institutional context and by a particular set of actors;*

- *the nature of the proposed institutional change. The more that actors can demonstrate that a particular innovation "fits" the existing institutional framework, the more likely that it will be adopted by particular actors (powerful elites, communities, organizations, etc.) and stick;*

- *how much variation occurs in fast and slow moving institutions (regulative, normative, and cognitive) over time. Transformative change occurs when there is change across most or all of these dimensions.*

- *whether a threshold is crossed. Small changes (e.g. changes in the opinion of one individual or a particular group) can trigger a process of positive feedback that leads to more transformative change.*

- *uncertainty: limitations in the quality and quantity of information and knowledge about certain problems; available or potential solutions, and the methods available for evaluating the effectiveness of certain policies and programmes, etc.*

The above propositions incorporate key concepts utilised by New Institutionalist scholars within the three major varieties of New Institutionalism. The propositions have particular strengths and limitations for the purpose of this study. These will be discussed in section 3.4. The next step in the development of the preliminary propositions is to combine them with insights based on Panarchy theory.

CHAPTER 3: Panarchy theory

3.1 Introduction

This section provides an overview of Panarchy theory, which leads to a discussion of the implications of the theory for understanding and explaining institutional behaviour in relation to change towards sustainability. A set of preliminary theoretical propositions is developed based on insights from Panarchy theory. This leads to a discussion of the strengths and limitations of both sets of preliminary theoretical propositions and the development of a combined set of propositions based on the New Institutionalism and Panarchy theory.

3.2 Methods

The review of Panarchy theory included seminal works, well-known compilations of empirical studies, and a review of academic, peer-reviewed articles about the theory and empirical application of key concepts to ecological and social-ecological systems. The review focused on delineating key concepts of the theory to form the foundations of the preliminary theoretical propositions.

Gunderson and Holling's (2002) Panarchy theory was chosen for the purposes of this study for two key reasons. First, Panarchy theory is a theory of transformative change in ecological systems, but it recognizes the feedbacks between and among social and ecological systems. In particular, it emphasizes the implications of ecological collapse for institutional systems and points to the roles of resilient and resistant but destructive institutional systems in the regrettable transformation of ecological systems. This fundamental orientation is appropriate, therefore, for the development of a comprehensive, interdisciplinary theoretical framework for analysis. Secondly, key concepts from Panarchy theory have recently been extended to studies that investigate resilience (and resistance to change) in ecological and/or social-ecological systems. The adaptive cycle metaphor has been especially helpful in investigations into when ecological and/or social-ecological systems are most resilient and when they are most vulnerable to disturbances. This study is especially concerned with resilient and resistant institutional systems for the purpose of understanding why and how institutions change and resist change. Panarchy theory extends important insights about resilience (and resistance) to the theoretical propositions.

3.3 Panarchy theory

The essentials of Panarchy theory include the proposition that ecosystems experience continual adaptive cycles of slow growth and conservation and rapid release and reorganization. During the release and reorganization phases, innovations may emerge to become subsequently embedded, but they are always constrained (and pushed) by existing and historical factors. Adaptive cycles do not exist in isolation. Rather, they are interlinked in a hierarchical structure across temporal and spatial scales; what happens at one scale at one time can influence what happens at higher and lower scales from moments to years into the future. Gunderson and Holling created the term "Panarchy" to describe the hierarchical structure within which adaptive cycles are nested.

Gunderson and Holling and colleagues have developed Panarchy theory with particular objectives in mind. Chief among these objectives is to improve understanding of how and why transformative change occurs within ecological systems. The interconnections and interdependencies between and among social and ecological systems are emphasized. Second, they aim to extend their understanding of transformative change in ecological systems to social systems – to institutional design in particular – to emphasize the implications of nonhuman systems for human systems in order to ameliorate the stubborn mismatches between ecological and social realms.

Key features of the theory will be described, including the metaphor of the four-phase adaptive cycle and the concept of Panarchy. This description will form the basis of the theoretical propositions based on Panarchy theory.

3.3.1 The metaphor of the four-phase adaptive cycle

The four-phase adaptive cycle developed by Gunderson and Holling (2002) is a metaphor for understanding transformative change in complex adaptive ecosystems. It emerged from experience with natural, disturbed, and managed ecosystems in temperate regions, including boreal coniferous forests of the Northern Hemisphere, temperate deciduous forests, and productive grasslands. It was developed to have generality; therefore, Gunderson and Holling are careful to note that the adaptive cycle metaphor is a useful framework and not a theory in itself. Below, the fundamentals of the adaptive cycle heuristic are described.

The adaptive cycle metaphor rests on the proposition that change in most ecosystems occurrs within a four-phase cycle of rapid growth (r), conservation (K), release (Ω) and reorganization (α). Three key ecosystem properties (potential available for other kinds of ecosystems and futures, degree of internal connectedness, and resilience) determine how the ecosystem behaves from one phase to the next. In effect, these properties work to determine the future responses of a particular ecosystem. During the rapid growth phase, pioneer species ("r-strategists") with the ability to reproduce quickly and disperse extensively begin to exploit available resources and create niches for themselves. During this phase, the components of the ecosystem are loosely interconnected and weakly regulated. But connectedness and stability increase slowly as the system moves into the conservation phase. During this slow stage of incremental growth, energy is sequestered and materials slowly accumulate, creating an increase in the potential for other kinds of ecosystems and futures. Potential is high but it is more and more rigidly controlled by a characteristic set of species and processes. Near the end of the conservation phase, the growth rate slows due to an increase in connectedness (rigidity); consequently, resilience declines: "The cost of efficiency is a loss in flexibility. Different ways of performing the same function (redundancy) are eliminated in favor of doing the function in just the most efficient way" (Walker & Salt, 2006, p.77). Although the system is now more stable, it is more vulnerable to internal and/or external disturbances. Finally, internal and/or external disturbances that exceed the system's resilience cause the system to change rapidly. Uncertainty rules. Stability is lost. Sequestered energy and stored materials are suddenly released. But the energy and materials released create the source for reorganization. During this phase, some potential leaks away because some of the previously stored materials leave the system. But by the end of the release phase, the beginning of a new identity for the system emerges as it reorganizes itself once again. This new identity may be similar to the previous system, or it may be an entirely different system, or it may collapse into a degraded state.

The degree to which an ecosystem can maintain a particular identity as it faces disturbances and as it proceeds through the phases of the adaptive cycle depends on the resilience of the ecosystem. Ecosystem resilience is discussed in detail in section 3.3.2, below. Gunderson and Holling assert that an ecosystem's resilience expands and contracts throughout the four-phase cycle as slow variables change. During the reorganization and exploitation phases, connectedness among system variables is low, internal regulation around a particular stable state

is weak, but the potential for various futures is high, and an ecosystem's resilience is consequently high. This is, in part, due to the capacity of pioneer and other types of species to adapt to the stresses and opportunities of a highly variable environment. As connectedness increases from the exploitation to the conservation phase, species that are able to control external variability begin to dominate. Positive feedbacks reinforce established relationships and processes and support their expansion. According to Gunderson and Holling, at this stage more positive gains are achieved by increasing system efficiency in the way energy is used, etc. Newcomers to the system may find it very difficult to penetrate the system. Resilience decreases. Small disturbances from smaller or larger scales can now trigger change, crises and sometimes transformation. From the release to reorganization phases, when connectivity among species is loose, and when a particular stable state is not yet strictly regulated, resilience is high: "This is the time when exotic species of plants and animals can invade and dominate future states, or when two or three entrepreneurs can meet and…turn a novel idea into action" (Gunderson & Holling, 2002, p.46). At this juncture, unpredictable critical events can determine the future trajectory of the ecosystem.

Recently, scholars have applied the metaphor to illustrate the interconnections and interdependencies between and among ecological and social systems, especially in the context of natural resource management. The concept of ecological resilience is highlighted as an integral element of social-ecological sustainability and the adaptive cycle metaphor has helped both scholars and resource management practitioners understand when an ecological system is most vulnerable and most resilient in the face of internal and external disturbances. Because of the perceived similarities and differences among human and ecological systems, some scholars have asserted that more research is required to determine the generality of the adaptive cycles metaphor, especially when it comes to explaining and understanding change in social systems.

3.3.2 Key concepts involved in the metaphor of the adaptive cycle

Multiple stable states

A *"stable state"* (or state of equilibrium, stability domain, basin of attraction, regime) refers to a distinguishable arrangement of a system. A stable state is characterized by a particular set of organisms, structures, processes and feedbacks that work to reinforce that state. Gunderson and Holling (2002) assert that many ecosystems have multiple potential stable states, which

represent different possible states for that ecosystem. Beisner et al. (2003) explore some conceptual frameworks used by ecologists to explain alternative stable states. Peterson (2002) describes the dynamics of alternative stable states in meta-population dynamics, shallow lakes, reefs, kelp forests, sandhill communities in North Florida, and the Serengeti-Mara savanna. Kinzig et al. (2006) describe a savanna system as one that can occupy one of two dominant stable states, a grassy savanna or a woody savanna, depending on pressures on the system. Carpenter et al. (1999) describe two states of many lakes (oligotrophy and eutrophy), which are characterized by the amount of nutrient inputs, plant productivity, turbidity, and the level of the value of ecosystem services.

Thresholds

According to Walker and Meyers (2004), Holling's (1973) seminal paper on resilience inspired an explosion of interest in thresholds in ecosystems with multiple stable states. The Resilience Alliance defines thresholds as points "…between alternate regimes in ecological or social-ecological systems" (Resilience Alliance, 2009). In order for an ecosystem to pass from one stable state to another, a critical threshold of a controlling (slow) variable must be passed. External or internal disturbances can push a system beyond a critical threshold. Once a critical threshold has been passed, the feedbacks that characterized the previous stable state change so that the system shifts from one stable state or basin of attraction to another. The consequences can be dramatic and sudden or more continuous and gradual. Walker and Meyers (2004) provide a useful typology of five classes of thresholds. This typology has been adopted by the Resilience Alliance, whose response to the need for empirical evidence of thresholds has included the development of a database of examples of thresholds and regime shifts from ecological, social, and social-ecological systems (see Resilience Alliance, 2009).

Regime shifts

A regime shift is defined as "a rapid modification of ecosystem organization and dynamics, with prolonged consequences" (Carpenter, 2003). Regime shifts occur when a system crosses a threshold. The system then undergoes rapid reorganization, which represents a flip from one stable state (or regime) to another: "A regime shift, then, initially represents a loss of resilience, in that former functions, structures, feedbacks, and therefore identities…give way to new versions" (Kinzig et al., 2006, p. 1). According to Carpenter (2003), certain regimes are

distinguishable (e.g. clear water, algae blooms, etc.) in that they have somewhat predictable dynamics. But a regime shift involves rapid and large changes in the internal feedbacks and external drivers of a particular regime. This flip from one regime to another is often difficult to predict. Carpenter argues that while ecosystem change is incremental most of the time, rapid and big changes that occur during regime shifts are less frequent. But when they do occur, they may have devastating effects on linked social systems. Karunanithi et al. (2008) provide a good overview of studies undertaken by various scholars to understand regime shifts in ecological systems, social systems, and climate systems.

Cascading effect

Sometimes, whole panarchies can be transformed, either when novelty within the system causes a cascade of changes up the levels, or when harmful catastrophes cause a cascade of collapses down the levels in a system (Gunderson & Holling, 2002). For example, if the potential within a system accumulates beyond a certain threshold, it can cause a cascading effect up the levels in the panarchy until it creates a new panarchical level. Similarly, stochastic events can trigger a collapse at one level, which, in turn, may cause a cascade of collapses down the levels in a panarchy. Kinzig et al. (2006) provide a useful definition of a cascading effect in that it highlights the multiple scales and domains across which a cascading effect may occur: "…crossing a single threshold between alternative regimes often leads to a 'cascading effect' in which multiple thresholds across space, time, and social organization and across ecological, social, and economic domains may be breached". A regime shift in one domain, then, may affect change at other scales and in other domains. For example, a drastic change in climate may have devastating consequences for the conditions for a particular crop and way of farming. This, in turn, may have drastic implications for local cultural identity, and local and regional social and economic stability. Kinzig et al. provide helpful summaries of the dynamics of cascading effects in four different social-ecological systems: Roquefort and Fedou cheese production in the Causse Méjan region of France, the agricultural region of the lower Goulburn-Broken Catchment in Australia, the western Australian Wheatbelt, and the agricultural Androy region in southern Madagascar.

Slow and fast variables

The interplay between fast and slow variables can influence the trajectory of ecological systems. In general, different processes are happening at different speeds throughout the

panarchy. Slow moving processes are often called "controlling variables" or "system drivers" because they strongly influence the location of thresholds within a system. Faster variables include small disturbances that work to generate innovation or collapse, especially if a system is in a vulnerable phase of the adaptive cycle. According to Resilience Alliance (2007), ecological systems are comprised of interconnections and interdependencies between spatial and temporal scales. In general, large-scale components (e.g. a stand of trees) change slowly, while small-scale components (e.g. needles) change more quickly. Walker et al. (2006) assert that social-ecological resilience is determined by the interactions between slow an fast variables at different scales: "In ecosystems, the variables that control regimes shifts, such as soil, sediment concentrations, or long-lived organisms, tend to change slowly…In social systems the controlling variables may change rapidly, e.g., fads or technology, or slowly, e.g., culture" (p. 5).

Path dependency

According to Levin (1998), complex adaptive ecosystems are constrained by history in that there is path dependency in their development: "The colonization history of an island, or of a patch in a forest, will exhibit such path dependency, as early recruitment changes the landscape for future potential colonists" (p. 433). Ecologists have used the concept of path dependency to understand and explain how historic events influence present ecosystem dynamics and, by extension, how present human activities and ecological processes may influence future social-ecological systems (e.g. Carpenter, 2002).

Ecological Resilience

As described in section 3.3.1, ecological resilience is a key concept in Gunderson and Holling's (2002) adaptive cycle metaphor. It is described independently in this section because of its particular double meaning to this study and because of its central role in studies that demonstrate the implications of ecological resilience for the design of institutions for social-ecological sustainability. This study refers to ecological resilience instead of other types of resilience (e.g. engineering resilience), which are based on different assumptions about how nature works (see Gunderson & Holling, 2002, p. 27-29). Moreover, similar to treatment of the adaptive cycle metaphor, the concept of ecological resilience has been extended to encompass social systems and social-ecological systems.

Ecosystem resilience is defined as "…the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure,

identity, and feedbacks – in other words, stay in the same basin of attraction" (Walker et al., 2004, p. 10). Ecosystem resilience is measured by "…the magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control behavior" (Gunderson & Holling, 2002, p. 28). Folke (2006) provides an excellent overview of how the concept of ecological resilience has emerged and how it has been applied in a variety of studies across various disciplines, in particular natural resource management. For the purposes of an examination of institutional change, resilience is significant as a quality to be maintained in some circumstances and overcome in others.

Scholars have devoted much attention to how to maintain social-ecological resilience, especially in the context of ecosystem management (e.g. Anderies et al., 2002; Carpenter, 2003; Janssen et al., 2004; Folke et al., 2004; Kinzig et al., 2006; Lawson & Walker, 2006). These studies have drawn insights from the adaptive cycle metaphor in order to investigate how to maintain social-ecological resilience in the face of internal and/or external disturbances that threaten to push the system beyond a critical threshold. Walker and Salt (2006) have developed a set of criteria for a resilient world: ecological variability, modularity, acknowledging slow variables, tight feedbacks (but not too tight), social capital, innovation, overlap in governance, and attention to the value of ecosystem services in development proposals and assessments (see p. 145-149).

Less attention has been devoted to understanding and explaining the relationship between resilience and resistance in social-ecological systems, especially in resilient and resistant but inefficient and/or unproductive social-ecological systems. Resistance is a key aspect of ecological resilience and is defined as "…the ease or difficulty of changing the system; how 'resistant' it is to being changed" (Walker et al., 2004, p. 2). It refers to the amount of pressure required to bring about a given amount of change in a particular system. Resilient and resistant but unproductive social-ecological systems may contribute to the deepening vulnerability of higher and lower level systems, the collapse of which may be catastrophic. Kinzig et al. (2006) have demonstrated how cascading thresholds can lead to very resilient but less desirable, alternative states. The new regime is often also highly resistant to rehabilitation management strategies. Other studies have demonstrated the impacts of resilient and resistant but inefficient natural resource management institutions on ecosystem integrity (Brown, 2005; Hodge, 2007; Bradley & Millington, 2008; Bauch et al., 2009; Bottom et al., 2009; Finley, 2009; Guven,

2009). These types of institutions erode the capacity of ecosystems to respond to shocks and surprises and their potential to generate alternatives for the future. Sociopolitical systems too can get locked into supporting unsustainable behaviour. Levin et al. (1998), for example, assert that many low-income countries can get caught in poverty traps, a resilient but destructive state that has been the cause of much environmental degradation. Brock highlights other types of resilient but destructive "traps", including our dependency on hydrocarbon-based technologies, discriminatory class systems, racism, and inflexible institutions that stand as roadblocks to change. These types of "rigidity traps" (see Holling, 2001) exhibit a perverse sort of resilience where an unsustainable system has the capacity to persist in the midst of external disturbances and sometimes intense pressures to change: "Resilience thus makes no distinctions, preserving ecologically or socially undesirable situations as well as desirable ones. It helps maintain our environments… it similarly translates into resistance to change when such change is mandated" (Levin et al. 1998, p. 225).

The institutional framework that underpins the aggregates sector in southern Ontario has since the 1950s, for example, been highly resilient and resistant to change towards sustainability. Panarchy theory's focus on reorganization and transformation in complex adaptive social-ecological systems may be especially appropriate for better understanding of how such institutional frameworks maintain their resilience and how their resilience to change towards greater sustainability may be overcome. Holling (2001), for example, describes how a cascade effect can effect positive rather than destructive change in a system: "A societal version occurs when local activists succeed in their efforts to transform regional organizations and institutions, because the latter have become broadly vulnerable" (p. 398). The metaphors and concepts used to maintain positive resilience, therefore, can also be used to degrade a perverse form of resilience. Transformation of the aggregates sector in southern Ontario towards sustainability, then, requires an identification of a desirable alternative regime and critical thresholds that, once crossed, may cause a cascade of local-to-provincial changes that contribute to progress towards sustainability in pit and quarry law, management, and practice.

3.3.3 Panarchy

As previously described, "Panarchy" is a term used by Gunderson and Holling (2002) and colleagues to describe the interconnections and interdependencies between adaptive cycles

across scales of time and space. The basic idea is that the variables (e.g. needles, foliage, insects, etc.) that comprise ecosystems all experience adaptive cycles at various speeds and scales: "Needles, for example, cycle with a generation time of one year, foliage cycles with a generation time of ten years, and trees cycle with a generation time of one hundred years and more" (p. 71). These cycles are nested across space and time and the speed and size of the variable determines its place in the space-time hierarchy. A landscape, for example, has a slow and large adaptive cycle of centuries. Nested within the landscape are trees, needles, etc., which experience smaller and faster adaptive cycles. Each semi-autonomous level in the hierarchy continually transmits information and material to the next higher level. In this way, slower levels in the panarchy are shaped by faster levels. In turn, larger, slower levels constrain the behaviour of faster levels. These interactions across levels occur through various connections that work to maintain the integrity of the whole structure.

The phases of the adaptive cycle at various scales create opportunities for adaptation and reorganization of the whole structure. For example, the release phase at one level can trigger a release phase at the next larger and slower level, particularly if the next level is experiencing a phase where resilience is low. Faster and smaller levels, then, can overwhelm larger and slower ones: "And that effect could cascade to still higher slower levels if those levels had accumulated vulnerabilities and rigidities" (p. 75-76). In turn, the changes that occur are constrained by the conservation phase of the above larger and slower levels. In some cases, whole panarchies can be transformed by cascading changes up and down the levels.

3.3.4 Panarchy theory and institutional change and resistance to change towards sustainability

This section summarizes the above overview of Panarchy theory, focusing on the implications of key concepts for understanding and explaining institutional behaviour in relation to sustainability objectives. A certain amount of translation was required to place the dynamics of institutional systems in the context of Panarchy theory. The translation was as literal as possible to delineate precisely where more research is required to refine the theory for the purpose of investigating the dynamics of social institutional systems.

When investigating institutional change and resistance to change towards sustainability, it may be useful to place the focal institutional system in the context of the four-phase adaptive

cycle of growth, conservation, release, and reorganization, recognizing multi-scale influences. Following the adaptive cycle metaphor, the degree to which institutional change occurs is determined, in part, by the resilience (and resistance) of a particular institutional system as it progresses through the four phases. According to Gunderson and Holling (2002), during the reorganization and exploitation phases, resilience in certain ecosystems is high because internal regulation around a particular stable state is weak, the potential for alternate stable states is high, and the components of the ecosystem are loosely connected and weakly regulated. Moreover, the pioneer species that emerge during these phases are able to survive in a highly variable environment. Similarly, during the reorganization and growth phases in institutional systems, internal regulation around a particular institutional arrangement may be weak; the interconnections and interdependencies between the players may be loose; and there is a high potential for alternative institutional systems to form. Actors with access to decision-making may exploit opportunities to create alternative institutions and/or reform old ones. Resilience is high.

Gunderson and Holling assert that in certain ecosystems connectedness increases from the rapid growth to the end of the conservation phase as internal regulation around a particular stable state increases. Certain species begin to dominate; path-dependent positive feedbacks reinforce established relationships, and the system becomes increasingly efficient and consequently inflexible. Resilience declines and vulnerability to disturbances is high. With respect to institutional systems, stability increases while actors grow accustomed to the new rules of the game. Certain new and old norms become further entrenched in law and practice. There are pressures for relationships between and among new and old actors to form and solidify around these new and old rules and norms. Path-dependent positive feedback forces reinforce these relationships so that the interdependencies and interconnections between them become increasingly locked in. Concurrently, however, actors gain experience with and learn about the effects of the institutional system. Certain actors (e.g. advocates of sustainability) become aware of required adjustments to achieve desired ends. These actors may begin to act at several scales (e.g. lobbying local, regional and provincial decision makers) to achieve their goals. But the transaction costs (especially for those with the most power in the system) associated with change may be very high due to the locked in interdependencies and interconnections among and between the dominant players at several interlinked scales in the prevailing institutional system; consequently, as with ecological systems, the institutional system becomes inflexible and

resilience declines. As in ecological systems, vulnerability to disturbances increases during this stage in the sense that the costs (economic, political, cultural) of reform are very high. According to Walker and Salt (2006), at this late point in the conservation phase, there is a preoccupation with process and novelty is suppressed.

In certain ecological systems, internal and/or external disturbances may finally exceed the system's resilience, forcing it to cross a critical threshold to a different state or basin of attraction. Uncertainly rules. Stability is lost. Sequestered energy and stored materials are suddenly released. But the energy and materials released create the source for reorganization. With respect to investigating institutional progress towards sustainability, it follows that it may be important to consider where these critical thresholds are in a given institutional system. If a critical threshold is crossed, a period of renegotiation and reinterpretation of the rules of the game may begin. Similar to ecosystems, a certain amount of resilience is lost and uncertainty and instability rule. During this phase, resources (economic, administrative, technological, etc.) are put into adjusting the institutional framework. A diverse range of actors may bring forward ideas from other jurisdictions, the rubble of previous institutions, institutions "waiting in the wings", or from extant institutions. These ideas represent potential alternative equilibrium states for the emerging institutional system.

According to Carpenter (2003), in ecosystems a regime shift can occur when a threshold of a controlling variable is crossed. Regime shifts involve rapid and large changes, often with devastating impacts on linked social systems. When studying the dynamics of institutional systems, the regime change concept is useful because it leads to corollary concepts that, even if a regime change has not occurred within the institutional system, work to describe the potential multiscale impacts of institutional behaviour. Adjusting one part of the institutional infrastructure guiding aggregate extraction, for example, can cause a cascade of changes down or up the levels of the "institutional panarchy". Moreover, a regime shift in one domain (e.g. the management of aggregate resources) may affect change at other scales and in other domains (e.g. land use decision making). Similar to ecosystems, then, institutional systems may also be thought of as nested across scales of time and space. They are interconnected and interdependent; what happens at one scale at one time can drive what happens at scales above and below – from days to years in the future. Slow moving institutions, therefore, may constrain faster moving institutions and vice versa. According to Gunderson and Holling (2002), whole panarchies can

be transformed by cascading changes up and down the levels.

The above discussion highlights the implications of Panarchy theory for understanding and explaining institutional progress, specifically change and resistance to change, towards sustainability. These implications form the basis of the preliminary theoretical propositions, below. A discussion of the complementarities, strengths and limitations of these propositions and the preliminary propositions based on the New Institutionalism will be discussed in section 3.4. Based on this discussion, a combined framework is developed.

Similar to the preliminary theoretical propositions based on the New Institutionalism, the propositions based on Panarchy theory are oriented towards explaining why and how institutional change and resistance to change occur and the factors that may determine the extent to which they occur. They assume an understanding of the following fundamentals:

- Institutional systems are comprised of a hierarchical arrangement of quickly and slowly evolving institutions that are interconnected and interdependent across space and time. Slow moving institutions constrain and influence fast moving institutions and vice versa.

- Institutional systems are influenced by and, in turn, influence complex adaptive ecological systems, which are comprised of a hierarchical arrangement of fast and slow moving variables that are interconnected and interdependent across temporal and spatial scales.

Box 2, below, lists the preliminary theoretical propositions based on Panarchy theory.

Box 2. Preliminary theoretical propositions based on Panarchy theory

1. Institutional change and resistance to change occur within a four-phase adaptive cycle of growth, conservation, release, and reorganization. The degree to which institutional change and resistance to change occurs is determined, in part, by the resilience of the institutional system as it progresses through the four phases of the adaptive cycle:

- *During the reorganization and growth phases, resilience is high. As the system matures and progresses to the end of the conservation phase, resilience declines. Near the end of the conservation phase, internal and/or external stresses may push the institutional system beyond a critical threshold, commencing a period of renegotiation and reinterpretation of the rules of the game. Uncertainty and instability rule. Significant resources are spent to adjust the institutional framework. Actors with access to decision-making bring forward new and/or old ideas, which are sources for reorganization.*

2. The extent to which institutional change occurs is determined, in part, by:

- *whether a regime shift occurs. A regime shift involves rapid and large changes in the internal feedbacks of a particular institutional system. They are less frequent than incremental changes and they may occur when a system crosses a critical threshold, especially when the resilience of a particular institutional system is low*

- *whether change at one scale causes a cascade of changes at other scales. Sometimes, when a single threshold is crossed, a cascading effect can occur in which multiple thresholds across scales are breached. A regime shift in one institutional arrangement in one domain may affect change and/or induce a regime shift in other institutional arrangements in other domains.*

3.4 A combined theoretical framework for understanding and explaining institutional change and resistance to change

Panarchy theory and the three major strands of New Institutionalism offer common and complementary concepts that, when combined, should enhance our understanding of the interconnections and interdependencies between, and among, humans, nonhumans, and institutions.

These common concepts include thresholds, path dependency, self-reinforcing positive feedbacks and increasing returns, multiple equilibrium orders or stable states, and fast and slow moving variables. Scholars' understandings of these concepts are also similar. Both New Institutionalist and Panarchy theorists, for example, have used the concept of path dependency to understand and explain the constraining influences of past and present circumstances. More research is required to explain the subtle differences in interpretation and application of these concepts, however. At this early stage, the commonalities among these theories suggest their basic compatibility for the purpose of developing an interdisciplinary analytical framework. They also provide evidence of the similarities in the dynamics of social and ecological systems.

Panarchy theory's greatest strength is that it offers concepts and metaphors that allow students to consider explicitly the nonlinear, multi-scale dynamics of institutional systems. The New Institutionalism, especially the recent work by Pierson (2004), begins to understand and explain multi-scalar dynamics with such common concepts as path dependency, multiple equilibrium orders, and thresholds, and by emphasizing the interconnections and interdependencies between and among institutions. New Institutionalists have also observed how

both the conflicts between the beliefs of many individuals on the microlevel and the substantive contents of formal laws and procedures on the macrolevel can generate institutional change (see Sjostrand, 1993; Farrell & Haritier, 2003). But Panarchy theory's metaphor of the adaptive cycle, and the concepts of panarchy, thresholds, regime shifts and cascading effects offer highly useful tools for students to explicitly explore the multi-scale dynamics of institutional systems. This is where Panarchy theory complements the New Institutionalism and helps to overcome the current limitation in its capacity to understand and explain multi-scalar interactions.

Another particular strength of Gunderson and Holling's adaptive cycle metaphor is that it is broad enough in its interpretation of change to incorporate all of the models of change developed by the New Institutionalism. It can account for both incremental and more rapid transformative change. The adaptive cycle metaphor for episodic change is most similar to the New Institutionalist conceptualization of change as punctuated evolution, which incorporates both incremental and punctuated equilibrium models. Moreover, following Panarchy theory, even when critical thresholds are crossed, an institutional system may only give way to incremental change. On other words, rapid transformation is rare due to the constraining influences of the past. This is similar to North's (1990) and Streek and Thelen's (2005) assertion that change is overwhelmingly incremental due to the speeds with which different types of institutions evolve and especially due to the embeddedness of institutions in societies. The adaptive cycle metaphor therefore helps to overcome the ongoing debate within the New Institutionalism about which model is most appropriate generally.

With respect to explaining institutional dynamics across a range of different scales, however, the adaptive cycle metaphor may be limited. More research is required to investigate this possibility. It may be that Gunderson and Holling's (2002) illustration of the particular dynamics that occur during the four phases of the adaptive cycle is too limited in scope to incorporate the intricacies of context and multi-scale interactions. This is because it is essentially geared towards explaining transformative change at the regional level and focuses on cases involving only a few key interventions. Gunderson and Holling recognize, however, that the adaptive cycle is just a helpful metaphor and not and theory in itself; therefore, it is limited in its explanatory capacity. Second, they stress that adaptive cycles are nested across space and time and so they are continually happening everywhere at different speeds. But questions remain about whether the particular dynamics of the four phases differ across scales, especially in light

of the possibility that the smaller and faster components of a regional-scale system may not be as complex as the regional system as a whole. Regardless of this potential limitation, however, Panarchy's key concepts of thresholds, multiple stable states, regime shifts, fast and slow variables, and cascading effects remain useful outside of the metaphor and can be applied in any context.

The New Institutionalism's greatest strength is that is fleshes out the social dimensions of institutional dynamics. Panarchy theory is limited in its ability to elaborate on the social dimensions of institutional behaviour because it is fundamentally oriented towards the ecological sciences. In this way, the New Institutionalism complements and enriches Panarchy theory's concepts and metaphor of the adaptive cycle. For example, both the New Institutionalism and Panarchy devote attention to the interactions between fast and slow variables. The New Institutionalism, however, is capable of more precisely defining what slow (e.g. informal institutions) and fast (e.g. formal institutions) variables are in the context of institutional systems. It further distinguishes among regulative, normative, and cognitive dimensions. Moreover, unlike Panarchy theory, the New Institutionalism emphasizes agency and the feedbacks between humans and institutions; people create institutions and are, in turn, constrained by them. Such essential concepts as ideas, worldviews, power, resources, the logics of appropriateness and instrumentality, bricolage, and diffusion complement and enrich Panarchy's key concepts and metaphor of the adaptive cycle.

The concept of path dependency is central to the above-described strength in New Institutionalism. All three strands emphasize the importance of the effects of path dependency (positive feedbacks, increasing returns, transaction costs, etc.) as major determinants of institutional emergence, persistence, and change. The effects of path dependency are also essential to Panarchy theory's adaptive cycle metaphor, which contributes to the compatibilities between the two literatures. The New Institutionalism, however, stresses the importance of transaction costs (economic, political, social, cultural) as one effect of path dependency when it comes to institutional emergence, persistence, and change. Panarchy essentially cannot speak of transaction costs as an effect of path dependence because it is oriented towards the structures and functions of ecological systems (nutrient cycling, energy sequestration, microorganisms, etc.). The economic, political, and cultural costs of change, however, may be major drivers of institutional progress and resistance towards sustainability. The New Institutionalism's

understanding of path dependency complements and enhances Panarchy theory's capacity to explain why a system may change only incrementally.

At the same time, in the business of institutional change towards sustainability, there is a sense that more than incremental change is required – today. This begs the question of how advocates of sustainability can purposefully nudge institutions towards greater sustainability. Here is where Panarchy theory's emphasis on multi-scalar effects, which include the adaptive cycle metaphor and such concepts as thresholds, regime shifts, cascading effects, and panarchy, come in handy. They provide for advocates of sustainability a handbook of sorts for how change might be facilitated. Strategies may be based on an understanding of how linked local-to-global institutions might be transformed, or how a healthy type of institutional resilience may be maintained. The New Institutionalism is highly complementary here, again, because it stresses the social forces that help to determine institutional behaviour. But the New Institutionalism has not incorporated into its research agenda over the years a devotion to figuring out how to achieve social-ecological sustainability. In contrast, scholars whose work falls within the scope of Panarchy theory have extended insights about ecological resilience to natural resource management systems for the purpose of maintaining and enhancing the resilience of social-ecological systems. This lends to Panarchy theory a greater practical purpose, while the New Institutionalism remains a theoretical and conceptual approach to analysis.

As previously noted, with respect to resistance to change, the greatest weakness in both the New Institutionalism and Panarchy is that they devote little attention to understanding and explaining the dynamics of resilient and resistant but inefficient and/or unproductive social and ecological systems. In particular, there is little attempt in either bodies of literature to understand the relationship between resilience and resistance. How does resilience impact resistance and vise versa? Panarchy theory offers the concept of resilience as one determining feature of ecological and, by extension, institutional systems. Moreover, panarchy theory asserts that resistance is one fundamental component of resilience (see Walker et al., 2004 for a discussion of three other key components of resilience: latitude, precariousness, and panarchy). But they are measured in different ways. Resilience is measured by the size of "basins of attraction" or the size of "stable state space" whereas resistance is measured by the amount of pressure required to disturb a given system by a given amount (see Carpenter et al., 2001). One aim of resilience management is to prevent a social-ecological system from shifting to an undesired state in the

face of internal and/or external stresses. Resilience management strategies therefore might focus on enhancing system resistance. According to Walker et al. (2002), however, increasing resistance can lead to increased system rigidity, which, in turn, reduces system resilience and resistance. Most often, studies that investigate ecological resilience focus on how resilience can be maintained and enhanced. Similarly, the New Institutionalism seeks to understand institutional persistence but it does not go far to distinguish among persistence, resilience, and resistance. Nevertheless, both theories offer clues about institutional resilience and resistance.

According to Gunderson and Holling, for example, resilience in ecosystems is highest during the reorganization and growth phases of the adaptive cycle and lowest near the end of the conservation phase. As previously discussed, this may also be true for institutional systems. But institutional systems may be highly resilient and highly resistant to change, or not very resilient and not very resistant to change. Similarly, resilience may be low while resistance to change is high and vice versa. If resilience and resistance to change are both high during the reorganization and growth phases, it may be because the actors with the greatest power to influence decision-making are most interested in maintaining the status quo. Similarly, at the end of the conservation phase when resilience is low, certain actors may resist change in order to avoid significant losses. If resilience is low during this stage, however, certain actors may not be able to resist change for very long, especially if there are significant pressures for change. Long-term path dependent processes (positive feedbacks, increasing returns, transaction costs) may reinforce these dynamics. Resistance to change may be high, for example, if the financial returns for maintaining the status quo are high.

Box 3, below, depicts the combined preliminary theoretical propositions based on the New Institutionalism and Panarchy theory. Again, they are oriented towards explaining why and how and to what extent institutional change and resistance to change occur.

Box 3. Combined preliminary theoretical propositions based on the New Institutionalism and Panarchy theory

1. Actors may resist or facilitate institutional change in order to maximize individual and/or collective interests and/or to achieve cultural appropriateness and legitimacy as defined by a particular, culturally embedded institutional environment. Actors' interests are determined, in part, by the institutional system and by long-term historic processes (e.g. socialization).

2. Actors may resist or facilitate institutional change through the process of renegotiation and reinterpretation and/or by creating innovative institutions from previously existing institutional elements. These processes lead to path-dependent change because the range of options available to institutional entrepreneurs is constrained by the particular characteristics (e.g. power relationships, actors' interests, laws and informal norms, etc.) of the existing institutional system.

3. Institutional change and resistance to change occur within a four-phase adaptive cycle of growth, conservation, release, and reorganization. Long-term path dependent processes (positive feedbacks, increasing returns, and transaction costs) influence change and resistance to change throughout the adaptive cycle. Path dependent processes are reinforced by the cross-scale interconnections and interdependencies between the institutions that comprise the institutional system. The extent to which institutional change and resistance to change occur is determined, in part, by the resilience and resistance of the institutional system as it progresses through the four phases of the adaptive cycle:

- *During the reorganization and growth phases, resilience is high. As the system matures and progresses to the end of the conservation phase, resilience declines. Near the end of the conservation phase, internal and/or external stresses may push the institutional system beyond a critical threshold, commencing a period of renegotiation and reinterpretation of the rules of the game. Uncertainty and instability rule. Significant resources are spent to adjust the institutional framework. Actors with access to decision-making bring forward new and/or old ideas, which create the source for reorganization.*

4. The extent to which institutional change occurs is determined, in part, by:

- *whether a regime shift occurs. A regime shift involves rapid and large changes in the internal feedbacks of a particular institutional system. They are less frequent than incremental changes and they may occur when a system crosses a critical threshold, especially when the resilience of a particular institutional system is low.*

- *whether change at one scale causes a cascade of changes at other scales. Sometimes, when a single threshold is crossed, a cascading effect can occur in which multiple thresholds across scales are breached. A regime shift in one institutional arrangement in one domain may affect change and/or induce a regime shift in other institutional arrangements in other domains.*

5. The extent to which institutional change and resistance to change occur is determined, in part, by:

- *the socioeconomic costs associated with change. Path-dependent processes involve high socioeconomic costs of reversal or reorganization, especially when the interconnections and interdependencies between and among the institutions, organizations, and certain socioeconomic groups in a particular institutional system are tight.*

- *the power and resources (esp. financial, ties to people in power, political support,*

opportunities for participation, ecological) held by particular socioeconomic groups to develop, translate and enact innovation(s).

- *the capacity of actors to translate and enact an innovation (with suitable accommodation but no alterations that undermine the essentials) across a range of organizations or across a population. Translation and enactment occur within and are constrained by a particular institutional context and by a particular set of actors.*

- *the nature of the proposed institutional change. The more the actors can demonstrate that a particular innovation "fits" the existing institutional framework, the more likely that it will be adopted by particular actors (powerful elites, communities, organizations, etc.) and stick.*

- *how much variation occurs in fast and slow moving institutions (regulative, normative, and cognitive) over time. Transformative change occurs when there is change across most or all of these dimensions.*

- *uncertainty: limitations in the quality and quantity of information and knowledge about certain problems; available or potential solutions, and the methods available for evaluating the effectiveness of certain policies and programmes, etc.*

CHAPTER 4: An initial test of the combined theoretical propositions

4.1 Introduction and methods

This chapter explores the strengths and limitations of the combined preliminary theoretical propositions by applying them to two peer-reviewed, academic studies about institutional progress towards sustainability. There are many case studies from which to choose for this purpose (e.g. see Gunderson, Holling & Light, 1995; Connor & Dovers, 2004; Lafferty, 2004; Walker & Salt, 2006; Anderies et al., 2006; Duit, 2007; Stuart, 2007; Hanna, 2008). An in-depth review of a range of case studies across the literature is required to refine the preliminary combined theoretical propositions; however, it is beyond the scope of this study. Two case studies were selected, one focusing on institutional change towards sustainability and one investigating institutional resistance towards sustainability. These studies were selected because they (a) are contemporary examples of institutional phenomena in natural resource management in industrialized countries; (b) explicitly investigate the dynamics of institutions in the context of sustainability objectives; and (c) provide a sufficient amount of detail for analysis. The first case study is about a deliberate effort to achieve progress towards sustainability in the Columbia River Basin in the Pacific Northwest, United States. The second is about institutional resistance to integrated urban stormwater management in Sydney, Australia.

4.1.1 Institutional change towards sustainability in the Columbia River Basin, Pacific Northwest, United States

Lee (1995) investigated institutional change towards sustainability in the institutional system guiding both the salmon population and the hydropower system in the Columbia River Basin in the Pacific Northwest region of the United States. The Columbia River is one of the largest rivers in North America. It rises in the Rocky Mountains in Canada and flows approximately 1900 kilometres through the Pacific Northwest. It drains an area that includes parts of two Canadian provinces and seven U.S. states.

For centuries before European colonization, the Columbia River Basin was an aboriginal cultural landscape, centred on the yearly salmon migrations that brought about 10-16 million salmon back to their native streams to reproduce. The salmon provided trade goods and food for the indigenous people of the river basin. By the mid-nineteenth century, European settlers began to convert the river basin into an industrialized landscape. Between 1930 and the early 1970s,

one of the word's largest hydroelectric power systems was built primarily by the U.S. government. These dams and the inexpensive electricity marketed by the Bonneville Power Administration, a U.S. Department of Energy agency, facilitated the industrialization of the Pacific Northwest. Plantation agriculture was soon to follow. Today, over three million acres of farmland are watered by the Columbia Basin Project irrigation works, which includes the largest dam in the U.S. According to Lee, the Bonneville Power Administration is central to the regional economy: "…the agency's power sales contracts, together with the water rights that control where water flows on croplands, shape the landscapes of the Pacific Northwest about as decisively as does the weather" (p. 216). This engineered landscape also provides for world-class windsurfing facilities and sport and commercial fishing and hunting. According to Lee, the dominant worldview underpinning this development has been one in which economic efficiency and engineering control of nature are paramount: "The inferior position of fish and wildlife is evident in the decline of the annual fish runs of 10-16 million in the preindustrial era to 2.5 million by the late 1970s" (p. 217).

Over the years, three intertwined stressors have shaped the institutional system that presently governs the Columbia River Basin. First, the indigenous peoples of the Pacific Northwest gained legal rights to their treaty title to harvest fish. By 1969, the Columbia River Basin's indigenous tribes had won lawsuits to claim their treaty rights to harvest half of the salmon. This shift in the allocation of shares of the salmon harvest severely impacted the sport and commercial fishing industry, which was already in economic decline. By the late '70s, after decades of competition over harvest shares and Supreme Court affirmations of aboriginal treaty rights, non-aboriginal and aboriginal leaders concluded that the only feasible solution was to rebuild the salmon populations so there would be enough for all. They demanded that the Columbia River's fish migration routes be repaired.

Second, there was a dramatic shift in the price of electric energy largely due to a crisis in the development of nuclear power. The Bonneville Power Administration's response to an increase in demand for power in the 1970s was to pressure utilities to build new nuclear power plants. These projects, however, suffered from cost overruns and high interest rates; consequently, electricity rates increased to pay for the new nuclear power projects. These economic issues intensified during the 1980s when demand for power decreased alongside an economic recession. Only one nuclear generating plant was ever completed. This crisis of

nuclear power generation placed more pressure on the Columbia River system to produce low-cost electricity.

Third, environmental awareness among the Pacific Northwest voters encouraged and supported particular innovations in institutional design. Citizen activism in the 1970s played a major role in convincing authorities that energy conservation could meet a significant portion of the demand for power while being more economically efficient and environmentally friendly. As the rates of electricity increased, energy conservation became a more attractive option.

These changes in fisheries, energy, and environmental awareness culminated in the 1980 federal Northwest Power Act. It established the Northwest Power Planning Council, comprised of two members from each of the four Pacific Northwest states that share the Basin (Idaho, Montana, Oregon, and Washington). This Council, which shares state and federal authority, is responsible for developing and implementing the Northwest Power Plan to guide electric power development. According to Lee, when it comes to power planning, the Council's chief guiding principle is cost effectiveness, including investments in energy conservation. The Northwest Power Act also addresses conflicts that arise over competition among stakeholders for salmon harvest shares. Congress, for example, included in the Act directives that aim to give "equitable treatment" to fish, wildlife and hydropower. The Council also responded with a Columbia River Basin Fish and Wildlife Program, which established the means for the rehabilitation of fish and wildlife. Stakeholders (state, federal, and aboriginal agencies, and the utilities that operate in the Columbia Basin) implement the Program. According to Lee, the revenues of Bonneville Power Administration fund implementation of the Program. In the early 1980s, implementation cost approximately $130 million per year, roughly 1.5% of Bonneville's annual budget of $3 billion. In 1984, the Council adopted an adaptive management approach to the implementation of the Fish and Wildlife Program. In 1987, this approach was expanded to include "system" planning – an experimental, consensus-based approach to program implementation. By 1990, however, the Council discovered that all five salmon stocks were in jeopardy of being listed on the federal Endangered Species Act because their numbers had dwindled so drastically. In response, the Council adopted an amendment to the Fish and Wildlife Program, which provided the basis for a salmon recovery plan formulated under the Endangered Species Act.

According to Lee, the new and more ecologically sustainable institutional framework was able to form because of a combination of conditions:

- regulative change reinforced by broad political support
- explicit recognition of uncertainties (ecological, social, economic)
- adequate funding
- broad acceptance that conflict (e.g. different perspectives) is essential to social learning
- adoption of a systems and adaptive, experimental management style, and
- broad commitment to respond to acquired knowledge.

Lee also asserts that the passage of the Northwest Power Act represents a cognitive shift in the way that the Columbia River Basin was perceived: "The transition beyond industrialism toward a search for sustainability is marked symbolically here by the passage of the Northwest Power Act" (p. 235).

4.1.2 Institutional resistance to integrated urban stormwater management, Metropolitan Sydney, Australia

Brown (2005) investigated institutional resistance to integrated urban stormwater management (IUSM) in Metropolitan Sydney, Australia. The idea of IUSM emerged in Sydney over the last 20 to 30 years as a reaction to standard urban stormwater management techniques. According to Brown, these standard techniques contribute to the deterioration of "urban waterway environments" by altering fluvial corridors, water quality, and aquatic ecosystem habitat. They also perpetuate the waste of a valuable water resource. In contrast, key goals of IUSM include flood reduction, pollution mitigation, stormwater retention (water harvesting and reuse), urban landscape improvement (incorporating stormwater into urban infrastructure), and the reduction of drainage investments (reducing the cost of infrastructure)
(p. 456). IUSM challenges conventional stormwater management because it integrates flood prevention, pollution reduction, water conservation, and infrastructure design in an institutional environment that has historically fragmented these initiatives across a range of administrative departments. Sydney's current system has separate stormwater and wastewater infrastructure.

Brown's analysis traces the institutionalization of urban stormwater management over the last century in Metropolitan Sydney, concentrating on three prominent urban stormwater management discourses that have shaped the prevailing system: stormwater quantity (1900 - 1985), stormwater quality (1980 - 1995), and stormwater sustainability (1995 – ongoing). Brown's account of this history illustrates the influence of previous cognitive ("best practice"

thinking), normative (values), and regulative (administrative organization) institutions on the current system. Briefly, by 1890, a separate stormwater system was constructed to accommodate increasing urban development. Urban stormwater was considered environmentally benign and a nuisance with little social or ecological value. The design and construction of stormwater management systems emphasized economically efficient passage of urban stormwater to avoid flooding. This task was considered to be an incidental engineering job, assigned to junior civil engineers in the local, public engineering department. The low status of urban stormwater, rapid urban development, and construction, design and maintenance practices led to increased flooding. The standard solution was to increase local drainage capacity. Over time, this "economic-risk optimization" approach to the flooding issue required increasingly specialized technical expertise. Eventually, a small number of highly skilled engineers dominated stormwater quantity management at the local level. These engineers belonged to the Institution of Engineers Australia, the primary conduit for developing and sharing urban stormwater management knowledge. Over much of the twentieth century, they focused on technically refining stormwater system design to make it more economically efficient for flood control. By the mid 1970s, the economic-risk optimization approach was enhanced by computer software programs that improved estimations of rainfall-runoff and subsequent stormwater drainage infrastructure design. Eventually, in 1977, 1987, and 1999, the Institution of Engineers Australia codified design specifications for stormwater management best practice.

By the mid-1980s, best practice thinking and community values had started to shift. Water quality, waterway pollution, and the quality of urban stormwater attracted local and international attention, raising disputes about the assumption that stormwater runoff is environmentally benign. In Sydney, public concern over the pollution of Sydney's waterways led to a gathering of approximately 250 000 people on Bondi Beach for a protest rally. Public concern was heightened again in the early 1990s with outbreaks of blue-green algae in Sydney's Hawkesbury-Nepean River system. Finally, in the early 1990s, urban stormwater, as opposed to wastewater, was identified as a major contributor to the pollution of Sydney's waterways. According to Brown, a community volunteer program, the "Clean-up Australia Campaign", was instrumental in this shift in focus. The volunteers collected over 10,000 tons of rubbish from around Sydney Harbor: "It was soon publicly concluded that it was the stormwater drainage system that was transporting this rubbish and polluting Sydney's harbor and waterways" (p.

459). Local awareness and pressure was reinforced by international evidence that urban stormwater quality is associated with the degradation of urban waterways. Soon, Sydney's urban stormwater engineers found that Sydney's urban stormwater contains high concentrations of pollutants. This led to research and development around stormwater infrastructure design and pollution control technologies to augment the existing infrastructure (e.g. "end-of-pipe" solutions). These research and development activities led to the emergence of a private sector industry specializing in designing, constructing and maintaining pollutant control traps. Guidance manuals encouraging local governments to adopt stormwater quality protocols were also produced during this time and were influenced by North American standards.

According to Brown, the implementation of quality control technologies was slow and ad-hoc at best. The resistance came primarily from local governments. Moreover, although the Institution of Engineers Australia and the Local Government Engineers' Association were advocates of stormwater quality, there was competition from other engineering specialists for control over dealing with the stormwater pollution problem. By the mid-1990s, Sydney Water Corporation, a state owned entity, announced that the pollution issue was indeed a local government responsibility. In 1993, a State Inquiry, which brought together relevant stakeholders concluded by consensus that the current management of Sydney's urban stormwater was not sustainable; therefore, many administrative changes were required: "Sustainable development was reported as the agreed framework for future policy development and for implementing solutions to the current urban stormwater issues" (p. 461).

IUSM emerged within the above-mentioned sustainable development discourse. According to Brown, since the mid-1990s, public awareness and concern about local waterways and water conservation have increased, especially in light of Sydney's more recent droughts. Sydney's stormwater environment is now considered an important resource for social-ecological sustainability. The technological insights from the stormwater quality discourse therefore flowed into the improved technologies for sustainable management discourse. According to Brown, a "water sensitive urban design" approach to stormwater management has emerged. This approach is essentially interdisciplinary in that it has particular implications for infrastructure design, land use planning, and catchment management. Brown asserts, however, that despite the burst of new technologies since the mid-1990s, and the recognition for an integrated approach, administration of IUSM has not been widespread. Overall, the extent to which implementation has occurred has

included state position papers, public opinion research, and a few demonstration projects.

According to Brown, the most significant roadblocks to progress towards IUSM include the prevailing administrative arrangements, lack of funding to urban stormwater management, fragmentation of organizational responsibilities, a lack of legal accountability, and insufficient political leadership and support. One major roadblock that Brown highlights is that the cognitive and normative changes that have occurred have not been reinforced by changes in the regulatory framework. Brown asserts that this administrative inertia is one consequence of the technocentric and fragmented structure of the leading governmental organizations. Underlying this fragmented structure is a particular administrative ideology "…where the environment is conceptualized as a machine with technically efficient State departments and organizations representing functionally based services and systems…" (p. 464). It facilitates vertical processes rather than collaborative (horizontal) relationships and decision-making across vertical administrative silos. In contrast, IUSM requires cross-sectoral and cross-organizational governance. The prevailing, technocratic administrative structure, however, favours economic rationalism and technological expertise over an interdisciplinary, more participatory and collaborative alternative.

4.2 Analysis and implications for preliminary combined theoretical propositions

The combined preliminary theoretical propositions developed by this study are comprehensive enough to explain the behaviour of institutions in both cases. In fact, the propositions illuminate some aspects of change and resistance to change that the authors do not consider in depth. The discussion, below, focuses on examples where the propositions clarify some ambiguities.

Both authors acknowledge fast and slow variables, and regulative, normative, and cognitive dimensions. Lee emphasizes the Northwest Power Act as the regulatory innovation that emerged as a consequence of and potential solution to resolve three major, regional stressors that had built up over time. According to Lee, the Northwest Power Act represents a cognitive shift in the way the Columbia River Basin is perceived. Lee, however, does not explain why salmon stocks continued to decline despite the Northwest Power Act and the fish and wildlife program. This may indicate incongruence between the fast and slow moving institutions involved; the regulative dimension changed while the cognitive and normative dimensions lagged. More research is required to determine if the Act and the fish and wildlife program came too late for a

salmon population destined to crash in a heavily dammed watershed, or if the Act was not reinforced by changes in the practices, values, and beliefs that had and continue to have negative consequences for salmon stocks. Some combination of these and other factors may have been involved. While the Northwest Power Act may represent a cognitive shift in the way the Columbia River Basin is perceived, then, this perceptual shift may have been confined to a particular group of actors, the governmental officials and stakeholders who in the early 1980s developed the Act.

Brown focuses on slow moving stormwater management discourses and subsequent changes and/or lack of changes in urban stormwater management. Although Brown does not explicitly acknowledge the importance of variation in fast and slow moving institutions, it is clear that the changes in the discourses did not lead to changes at the administrative level, indicating an even slower moving ideology and other path-dependent effects that reinforce the prevailing, fragmented administrative structure. Brown concludes that the challenges posed by IUSM to the administrative system are major roadblocks to implementation and then leaves the situation as one seemingly hopelessly stuck. The preliminary combined theoretical propositions, however, would add that one reason why implementation has been met with such resistance is that IUSM does not "fit" the prevailing institutional framework. This problem of fit indicates that IUSM in Metropolitan Sydney may require a long-term implementation strategy that allows for incremental adaptation and transformation from one type of administrative structure to another.

Both authors provide historical background to set the context for their analyses. Brown, again, emphasizes the progression of three major urban stormwater management discourses and in particular how the earlier discourses set in motion an approach to infrastructure design underpinned by economic efficiency. Lee focuses on the major social-ecological stressors that led to regulative change. Both authors, however, neglect the importance of path dependent processes. In Brown's case, for example, path dependency in infrastructure design from the early 1900s through to codification of engineering specifications to technological augmentation locked in a high degree of complexity and rigidity, a major roadblock to IUSM. IUSM implementation, for example, has involved only public opinion research, position papers, demonstration projects, and "end of pipe" solutions, as opposed to integrated land use and stormwater management planning. The rigidity of the old infrastructure system is reinforced by a rigid administrative system and engineering and manufacturing industries whose interests may be more vested in

older infrastructure designs. For these interests, the economic, social, cultural, and political costs of change, therefore, are potentially very high, especially in light of the interconnections and interdependencies between the administrative and private spheres. Brown's analysis would have benefitted from a more explicit recognition of these interdependencies and transaction costs.

Similarly, Lee fails to emphasize that one major reason why the Northwest Power Act could emerge and have some success in implementation was that the costs (social, cultural, economic, political) of creating and adhering to the new legislation were relatively low compared to the costs of continuing along as usual. The Act offered a premise for affordable electricity through conservation, and the peaceful resolution of conflicts over salmon shares and use of the water budget to facilitate the migration of salmon versus additional power generation. Low transaction costs, therefore, may have underpinned the broad political support and funding that Lee argues were so important to making the regulative changes. In both cases, transaction costs are closely associated with the resources that various actors may or may not have had at their disposal to enact the required changes. In Lee's case, the Bonneville Power Administration could easily provide the funds to implement the Fish and Wildlife Program. But in Brown's case, one major roadblock to IUSM has been a lack of funding.

Finally, the historical backgrounds provided by both articles could have been placed in the context of the adaptive cycle with the four phases of growth, conservation, release, and reorganization elaborated for each. Lee's article, for example, implies that a threshold was crossed in the old institutional framework, commencing a period of renegotiation and reinterpretation, which led to the Northwest Power Act. Similarly, Brown's article traces the rise of the current infrastructure and administrative system, whose rigidity poses a major barrier to the transition to IUSM. But Brown does not consider any slow moving stressors that might force the system beyond a threshold, perhaps leading to more support for IUSM. Brown considers the influence of global scale attention to the environment as one influence that led to the Bondi Beach protest. But neither article explicitly considers how resistance to change and change were influenced by and influence other domains and regimes across scales. In Lee's case, for example, explicit consideration of scale may have helped to explain the gaps between slow and fast moving variables.

The above cases, then, would have benefitted from more explicit attention to the dynamics of fast and slow moving variables, issues of fit, thresholds, multi-scalar interactions,

and path dependent effects, notably transaction costs. In Brown's case, the transaction costs of change may be especially high in light of the tight interconnections and interdependencies between and among the major players. The adaptive cycle metaphor may have been useful to both cases in that it may have helped to illuminate the interconnections and interdependencies across scales. These two articles, however, cannot provide the basis for any general statements about the strengths and limitations of the combined theoretical propositions. More research is required, therefore, to refine them. Most likely, the propositions would highlight different gaps in analyses in other studies. As an initial test, however, the two cases presented here reveal that the preliminary combined theoretical propositions are comprehensive and potentially quite useful for a range of cases that analyse institutional progress towards sustainability.

CHAPTER 5: The Town of Caledon's new mineral resources policies

5.1 Introduction

This chapter describes the current institutional system guiding aggregate extraction in southern Ontario. It also tells the story of the history of the Town of Caledon's mineral resources policies, from approximately 1980 to 2003. Three different sets of mineral resources policies are described: Caledon's 1981 "Cabinet Corners" policies, the Region of Peel's 1996 Regional Official Plan mineral resources policies, and Caledon's new 2003 Official Plan Amendment 161. The story highlights the significance of multi-scalar dynamics, interests, values, historical, and cultural and natural heritage in influencing why and how institutional change occurred in the development of Caledon's policies. These details are analysed through the lens of the combined preliminary theoretical propositions set out in Chapter 7.

5.2 Methods

As described in Chapter 1, this study utilises a single case, case study design, including a review of academic literature and other relevant documentation (e.g. provincial, regional, and municipal government documents), and semi-structured, face-to-face interviews.

Case studies allow investigators to explore real-life circumstances. According to Yin (2003), one rationale for a single case design is when the case represents a unique case. The Town of Caledon is a unique case for three key reasons. First, Caledon was one of the first areas in southern Ontario to undergo aggregate extraction in the 1940s. Since the 1950s, Caledon has been a major supplier of aggregates to the GTA. Unlike other aggregate producing municipalities in Ontario, Caledon has had a long history of experience with the aggregates industry. This history has undoubtedly influenced the Town's aggregate extraction policies. Second, the Town of Caledon is well known for its strong sense of place and culture of stewardship. This strong cultural identity has evolved around the Town's rich cultural and natural resources, which include portions of such provincially protected areas as the Niagara Escarpment, the Greenbelt, and the Oak Ridges Moraine. These valued resources and culture of stewardship have influenced Caledon's mineral resources policies profoundly over the years. Third, Caledon's new 2003, Official Plan Amendment 161 policies are also extraordinary in that they are more comprehensive than the aggregate extraction policies in other municipalities and they introduce

some new requirements for aggregate producers that other municipalities have not yet adopted. Caledon, therefore, is unusually valuable as a leading edge case, better positioned than other municipalities historically and in other ways to confront the recalcitrant aggregates industry and government officials. Other municipalities may be expected to follow Caledon's lead. Consequently, it can be both unique and a source of generalizable findings.

Criteria applied in the selection of the focal case study included the following:

- Case study provides an opportunity to investigate institutional change and resistance to change towards sustainability;
- involves resilient and resistant but ecologically destructive and inequitable institutions;
- involves a range of stakeholders and social-ecological concerns;
- involves an obvious ecological component, where the feedbacks between ecological and institutional systems are evident;
- includes a history sufficient to evaluate institutional progress towards sustainability;
- data is available and easily accessible; and
- interviewees are accessible and willing to participate in the study.

As previously described in Chapter 1, the history of aggregate resources and land use planning law and policy form the context within which Caledon's Official Plan Amendment 161 policies have emerged. This chapter includes a description of the history of aggregate resources and land use planning law and policy in Ontario from 1950 to the present. It illuminates the significance of particular historical events and trends in the evolution of Caledon's policies, which were important in analysis. The historical research drew from two key academic sources, Winfield and Taylor (2005) and Baker, Slanz, and Summerville (2001). These authors provide excellent descriptions of the evolution of aggregate resources legislation in Ontario. Baker et al. analysed the content of 140 Ontario Municipal Board hearings over a twenty-five year period (1971 – 1996) to investigate the role of legislation and policy in decision-making, and to examine the conflict between provincial and municipal governments. Winfield and Taylor examined 30 years (1970 – 2005) of Ontario legislation and policy for trends in the aggregate and land use planning legislative framework. See Appendix A for the detailed description of this history.

This story of the evolution of Caledon's mineral resources policies was drawn from an analysis of secondary and primary sources. Secondary sources included Town of Caledon

meeting minutes, letters from Town Council members and Ministers of Parliament, Official Plans and reports; various types of environmental studies, government and community websites; and articles from *National News, The Globe and Mail*, and a popular Caledon community magazine, *In the Hills*. Interviews were undertaken with eleven interviewees who represent the key stakeholders involved in the development of Caledon's new, controversial Official Plan Amendment 161: Municipal Planners and Councilors, the Mayor of Caledon, staff from the Ministry of Municipal Affairs and Housing, members of environmental nongovernmental organizations (the Coalition of Concerned Citizens and Gravel Watch), and members of the aggregates sector in southern Ontario. The data collected from the interviews complemented and enriched the secondary research. They were oriented towards answering questions about why and how specific policies were rejected or embraced by particular individuals and/or groups. They focused on exploring local and provincial scale influences and why, how, and to what extent institutional change and resistance to change occurred. Interview questions (see Appendix B) were based on the preliminary propositions and story of the evolution of Caledon's mineral resources policies. The questions were adjusted slightly depending on the interviewee.

5.3 Aggregate extraction in the Greater Golden Horseshoe Region, southern Ontario

The GGH region is one of the largest metropolitan conurbations in the world. It consists of over 100 municipalities that form a horseshoe shape around the western tip of Lake Ontario. Many of these municipalities have a population of over 100, 000. As the most populous and most heavily urbanized region in Canada, the GGH is a major consumer of the ecological goods and services provided by ecosystems in southern Ontario and beyond. Most of the prime aggregate produced in southern Ontario, for example, goes to feed the demand in the GTA. Residents rely heavily on the ecological goods and services of such major provincially protected areas within the region, notably the Greenbelt, Niagara Escarpment, and Oak Ridges Moraine. In and adjacent to these areas are watersheds whose rivers and underlying aquifer systems provide drinking water to millions of inhabitants.

The above-mentioned protected areas represent recent growth management planning initiatives that respond to the current and emerging social and ecological problems associated with intense growth in the GGH region. They recognize and anticipate a variety of interconnected problems and stresses that threaten the region's wellbeing. Chief among these

problems are urban and suburban sprawl, loss of farmland for food production, and the degradation of vital ecological goods and services. The demand for aggregate products, extraction of prime aggregate resources, and the institutional system guiding aggregate extraction in southern Ontario sit at the nexus of these issues and stresses. Population growth, for example, contributes to residential housing needs and the building of new subdivisions and municipal roads and other infrastructure in suburban and/or rural areas. In turn, this influences the demand for prime aggregate resources. It is important to note that population growth may not be the most significant driver in the demand for gravel. Provincial highway maintenance and highway construction, for example, which are the leading consumers of prime aggregate resources in Ontario (Winfield & Taylor, 2005), may also be associated with such factors as economic growth and the transportation of trade goods.

Aggregate resources are nonrenewable raw materials, including sand, gravel, clay, earth, shale, mixed stone, limestone, dolostone, sandstone, marble, and granite. When combined in various mixes, they form concrete, cement, asphalt, and other essential building materials. These materials are used in the construction of buildings, infrastructure, glass and glass products, water filtration systems, fertilizers, cosmetics, toothpaste, and even chewing gum (Ontario Stone, Sand & Gravel Association, 2009). The top five prime aggregate producing municipalities in the GGH include the City of Kawartha Lakes, the City of Hamilton, the Municipality of Clarington, the Township of Uxbridge, and the Town of Caledon (The Ontario Aggregate Resources Corporation, 2007). Most aggregate extraction in Ontario, therefore, is concentrated geographically within the Niagara Escarpment and the Oak Ridges Moraine, two of southern Ontario's most significant environmental features. Both provide habitat for many threatened and endangered species and contain vital wetlands, prime agricultural land, and the headwaters of major river systems. The Oak Ridges Moraine has been called the "rain barrel of southern Ontario" because of its massive size and hydrological functions. It provides a vital groundwater recharge role for the GTA and beyond.

Aggregate extraction operations permanently alter the natural environment. Among other reasons, this is because many pits and quarries operate for decades and often reach dozens of meters below the water table. According to Gravel Watch (2006), less than half of the total hectares of land excavated between 1992 and 2001 have been rehabilitated. Winfield and Taylor (2005) provide a good overview of some of the impacts of aggregate extraction. Major concerns

include impacts on the structure and function of hydrological and hydrogeological systems; greenhouse gas emissions from equipment and trucks; contamination of groundwater and surface water; loss of wildlife; and the degradation, loss and fragmentation of natural habitat and prime agricultural land. Because thousands of people rely on regional groundwater and surface water sources, there is concern that the cumulative impacts of aggregate extraction may lead to water quantity and quality issues in some areas. These impacts interact with other environmental problems in the GGH (e.g. urban sprawl) to contribute to such global-scale issues as loss of biodiversity and global warming. Other local-level problems arise from social impacts, including heavy truck traffic, noise, dust, damages to private property and property value losses, loss of cultural identity and sense of place, and costs of road maintenance (Centre for Spatial Economics, 2009). Moreover, aggregate extraction contributes indirectly to the social-ecological impacts of cement manufacturing. According to Huntzinger and Eatmon (2009), approximately 5% of global carbon emissions come from the manufacturing of cement.

For these and other reasons, many complex land use issues related to potential and existing aggregate extraction operations have emerged and continue to surface across the GGH. These land use issues have raised awareness about the above and other aggregate extraction-related social-ecological issues. In recent years, pressure from environmental nongovernmental organizations for "Green Gravel" has emerged out of this context. Priorities for Green Gravel have been set out by some prominent environmental nongovernmental organizations in southern Ontario. These priorities represent some of the local-to-provincial changes that are required to reform the prevailing institutional system guiding aggregate extraction in Ontario. They will be described in more detail in section 6.3.

5.4 The institutional system guiding aggregate extraction in the GGH

Proponents of aggregate extraction operations in the GGH shape and, in turn, are constrained by a complex dynamic institutional system. The effects of this system reach far beyond the process of extraction to influence the demand for the resource in the GGH and beyond. As described above, it also contributes to local-to-global environmental problems. This study focuses on the development of the Town of Caledon's mineral resources policies. These local policies are situated within a particular institutional system. In southern Ontario, proponents of aggregate extraction operations shape and, in turn, are constrained by both natural

resource management laws and practice and land use planning laws and practice. These include the *Aggregate Resources Act* and a host of land use planning laws and policies (Ontario Planning Act, Provincial Policy Statement, Greenbelt Act and Plan, etc.). Similarly, the institutional system is comprised of many local-to-global informal norms and values, etc., many of which have been embedded in law and policy. This study highlights the "shortage of supply" discourse that underpins the now legislated norm of ensuring largely unfettered access to the resource close to demand. This norm ensures the continued supply of affordable gravel for infrastructure and other urban developments. Beyond these local- and provincial-level norms is a global-level worldview that acts as a deep undercurrent in the demand for aggregate resources. Simply put, this worldview is one in which continued economic growth is believed to be integral to the long-term viability of local communities, provinces, and nations. It fuels such trends as global economic integration, and increasing worldwide industrialization and urbanization. Lastly, this institutional system is also comprised of a range of actors (people and organizations) that participate in, shape, and in turn, are constrained by the system. The power to influence the system, however, is not evenly distributed among these actors. It should be noted too that the position of power in this system is dynamic and changes according to the case and context.

Currently, the most powerful actors in this institutional system are multinational corporations, Canadian-owned corporations, associations representing the aggregates industry; and the provincial government (in particular the agencies most responsible for promotion, protection and regulation of the aggregates industry). Traditionally, regional, and municipal governments, and local to global nongovernmental organizations have been less influential. Closely tied to the major industrial players are the multinational and national corporations that provide goods and services for the major players (e.g. engineering and construction consulting firms, export corporations, etc.); other companies in Ontario and the United States that directly or indirectly contribute to the demand for aggregate resources (e.g. construction companies, commercial, industrial and residential developers, etc.) and the companies that provide services to them (e.g. real estate firms, etc.). Less directly involved are the people who use the infrastructure and buy the homes, etc. These players are interconnected and interdependent horizontally across sectors and vertically across local-to-global scales. Changes to one part of the institutional system may impact some or all of these players to varying degrees. Moreover, with respect to demand for the resource, it is difficult to identify one major player as the driver. This

is further complicated by the fact that approximately 6 million tones of the resource are exported to the US annually (Messerschmidt et al., 2008). Multinational corporations have a vested interest in continued demand for the resource. In Southern Ontario, however, most of the resource goes into building municipal and provincial road networks. The need for new roads is driven, in part, by urban and suburban growth, the movement of goods for trade, everyday commuting, etc. Residential developers have a vested interest in building subdivisions, but these are subject to provincial planning legislation, regional and municipal plans and municipal residential needs assessments, which take into account projected population growth. Although there are major players in this supply-demand chain, then, the above described players in southern Ontario and beyond form one gigantic consumer of aggregates.

Multinational corporations (e.g. Holcim Incorporated, Votorantim Cement, and Lafarge Group) own and operate dozens of pits and quarries in Southern Ontario. These companies are vertically integrated in that they specialize in the production and distribution of aggregates, cement, concrete, and asphalt. They may also provide construction services. Holcim, for example, is a Switzerland-based company with offices in over 70 countries. In southern Ontario, Holcim operates as Dufferin Aggregates, which has supplied millions of tonnes per year of aggregates to its sister-companies, Dufferin Concrete and Dufferin Construction. A few Canadian companies, Walker Industries Holdings Limited and James Dick Construction Limited have managed to survive among the above-mentioned giants in Southern Ontario. James Dick Construction has been operating in the Town of Caledon since the mid-1960s.

Key provincial governmental departments that participate in this institutional system include the Ministry of Natural Resources, the Ministry of Northern Development and Mines, the Ministry of Transportation, the Ministry of Municipal Affairs and Housing, and the Ministry of Energy and Infrastructure. The Ministry of Natural Resource's policy staff administers the *Aggregate Resources Act*. Ministry of Natural Resources Inspectors process applications for licences and permits, conduct inspections, enforce infractions of the *Aggregate Resources Act*, and participate in Ontario Municipal Board hearings. Ministry of Natural Resources Planners participate in the municipal planning process through the Ministry of Municipal Affairs and Housing to ensure that Official Plans give proper regard to the *Aggregate Resources Act* and other provincial policies. The Ministry of Municipal Affairs and Housing and Ministry of Energy and Infrastructure are directly involved in land use planning in that they administer key

provincial land use planning laws and policies. These will be discussed in more detail below. The Ministry of Municipal Affairs and Housing approves or rejects Regional and Municipal Official Plan policies based on whether or not they are consistent with provincial interests. In this way, the Ministry of Municipal Affairs and Housing can influence local mineral aggregate policies. It also participates in Ontario Municipal Board hearings. The Ontario Municipal Board sits at the centre of land use planning in Ontario in that it provides a public forum for resolving land use disagreements. Operating under the Ontario Municipal Board Act, the Board is an independent tribunal that hears appeals from individuals, public agencies, or corporations with respect to land use decisions made by a particular approval authority. Many disputes over pit and quarry licences are referred to the Ontario Municipal Board. The Ministry of Northern Development and Mines geologists prepare *Aggregate Resource Inventory Papers* and resource maps for various regions of Ontario. These papers form the basis for the Ministry of Natural Resource's *High Potential Mineral Aggregate Resource Areas* mapping, which are adopted at the Regional and Municipal levels. The Ministry of Transportation processes applications for aggregate extraction permits for provincial road projects, and conducts its own inspections and enforcement of these projects. It is also responsible for planning and maintaining Ontario's provincial highways. It develops standards for pavement, which impact the quality and quantity of aggregates required for highway construction. Through law and policy development, mapping, licensing, and enforcement, these Provincial departments, including the independent Ontario Municipal Board, influence the amount of aggregate that is extracted and consumed, as well as the nature of extraction and consumption.

Regional and municipal governments develop Official Plan policies for mineral aggregate resources and many other local and provincial interests. Similarly, Conservation Authorities develop environmental and watershed policies that affect aggregate extraction operations. These policies, however, are significantly constrained by provincial law and policy. This will be discussed in more detail, below. Here, it is important to note that under the *Aggregate Resources Act* and the *Planning Act,* regional and municipal councils and planning departments may establish zoning by-laws and develop policies that define for proponents of aggregate operations the requirements for zoning by-law and Official Plan amendments to permit aggregate extraction.

Local-to-global environmental nongovernmental organizations act as watchdogs of the

industry and pressure governments and corporate players to make certain changes in the mineral aggregate supply-demand chain. In southern Ontario, the desired alternative is Green Gravel. As previously described, priorities for Green Gravel represent some of the local-to-provincial changes that are required to reform the prevailing institutional system guiding aggregate extraction in Ontario. Some key provincial-level environmental nongovernmental organizations in the institutional system include the Ontario Greenbelt Alliance, which has been vocal about priorities for aggregate reform in Ontario; and Toronto Environmental Alliance, whose "Dig Conservation, Not Holes" campaign calls for the production of sustainable aggregate centered on initiatives to reduce, reuse, and recycle. With respect to change in the institutional system guiding aggregate extraction in Ontario, some of the most instrumental players are community-level groups that have formed around local quarry land use issues. Some of these include Protected Escarpment Rural Land in Burlington, Friends of Rural Communities and the Environment in Hamilton, and the Coalition of Concerned Citizens in Caledon.

There is much overlap and divergence among the interests and concerns of the above-described players. Moreover, as previously described, the power to influence the institutional system is not equally distributed among them. The multinational and national corporations have the greatest financial base for influence in decision-making. They can afford to maintain sophisticated lobbying efforts and to hire the best lawyers and consultants for the municipal and provincial application review process and Ontario Municipal Board hearings. The relationships between these players reinforce the balance of power among them. For example, the above-described global players often work closely with the Ministry of Transportation and Ministry of Energy and Infrastructure on major energy and infrastructure projects. Dufferin Construction, for example, had been awarded many provincial highway construction contracts. The economic interests of construction and development industries and the provincial government are also closely aligned in that the provincial government and other infrastructure providers have an interest in low aggregates prices that depend on the proximity of aggregate extraction operations to demand and consequently low transportation costs. At the local level, then, regional and municipal governments too have an interest in low aggregates costs for local infrastructure projects. At the same time, however, they have a political interest in defending their voters and ratepayers and roads, water supplies and other valued natural and cultural heritage against aggregate extraction operations.

The formal institutional framework governing aggregate extraction in southern Ontario reinforces the above distribution of power among the players. Baker et al. assert that the evolution of aggregate resources legislation and policy in Ontario "…reflects a power struggle between provincial and municipal interests" (p.464). The overall trend has been for provincial governments to push municipalities through legislation from the centre to the periphery of the policy process dedicated to aggregate mining. This has allowed the province to give greater consideration to the demands of the aggregate industry and less consideration to the social-ecological impacts of aggregate mining. It has also eroded the capacity of municipalities to protect the interests of local citizens and anti-aggregate groups. Winfield and Taylor (2005) underscore that the protection of aggregate resources over the years has been reinforced by Ontario's land use planning laws and policies, which give priority to aggregates over other potential land uses. They assert that this provincial priority will likely contribute to increasingly intense land use issues, especially in southern Ontario, where growing awareness of the social-ecological impacts of aggregate extraction compete with the desire of the aggregate industry to access resources close to demand. Baker et al. also highlight conflicts due to tensions between the provincial need to control the supply of aggregates and the municipal need to control land use and respond to concerned citizens and environmental groups about the impacts of mining.

A handful of laws and policies sit at the top of the hierarchy of land use planning law in Ontario. Individually and as a package, they constrain Municipal and Regional Official Plans and local-to-provincial land use planning and decision-making. The above described and other players shape these laws and policies. This description focuses on the land use planning laws and policies that reinforce the current situation of centralized, industry-provincial government control over prime aggregate resources. Key among these laws is the Ontario Planning Act. It aims to provide for a land use system led by provincial policy and gives the Minister of Municipal Affairs and Housing the authority to issue policy statements on matters relating to municipal planning. Ontario's current Planning Act requires Regional and Municipal Official Plans and planning decisions to be "consistent with" Provincial Policy Statements and "conform with" or "not conflict with" Provincial Plans.

Ontario's Provincial Policy Statement, which is administered by the Ministry of Municipal Affairs and Housing, is closely tied to the Ontario Planning Act. It provides direction to planning authorities with respect to land use planning by setting out policies on a range of

economic, social, and environmental matters. With respect to mineral aggregate resources, the Provincial Policy Statement stipulates that, among other things, "As much of the resource as is realistically possible shall be made available as close to market as possible" (Ministry of Municipal Affairs and Housing, 2005, p. 23). It explicitly rejects the requirement for demonstration of need for the resource, and it sets out a requirement for progressive and final rehabilitation. It points to Official Plans as the most important vehicle for implementing the Provincial Policy Statement.

Current provincial plans in effect in southern Ontario include the Growth Plan for the Greater Golden Horseshoe under the Places to Grow Act, 2005, administered by the Ministry of Energy and Infrastructure. Other Plans include the Greenbelt Plan under the Greenbelt Act, 2005; the Oak Ridges Moraine Conservation Plan under the Oak Ridges Moraine Act, 2001; and the Niagara Escarpment Plan under the Niagara Escarpment Planning and Development Act, administered under the Ministry of Municipal Affairs and Housing. The Growth Plan for the GGH guides local decisions on a range of issues (transportation, infrastructure, housing, resource and natural heritage protection, etc.). With respect to mineral aggregate resources, the Minister works with the Ministry of Natural Resources, municipalities, aggregate producers, and other stakeholders to identify, protect, and manage the resource.

The objectives of the Greenbelt Plan, Oak Ridges Moraine Conservation Plan, and Niagara Escarpment Plan seek to contribute to the viability of agricultural communities, protect and enhance ecological goods and services, control urban sprawl, and promote the sustainable use of natural resources. They pursue these goals through such mechanisms as land use designations and policies aimed at guiding municipal planning and development. The Plans, however, contain policies that may facilitate sprawl, the degradation of ecological goods and services, and an unsustainable use of natural resources. All three Plans, for example, contain policies for the development of infrastructure. Moreover, all three Plans allow for aggregate extraction operations in key areas (e.g. Protected Countryside Areas, Natural Linkage Areas, Rural Areas, etc.), subject to particular criteria and applicable legislation. Because Municipal and Regional Official Plans must be consistent with and/or conform to these laws, policies, and plans, they embody a particular institutional context. With respect to mineral aggregate resources, the above formal institutions both shape and are shaped by a particular set of informal institutions, which may evolve more slowly than the formal ones.

The above-described provincial institutional framework governing aggregate extraction in Ontario reflects an institutional system that is exceptionally strong in its commitment to aggregate extraction as the priority land use. According to Winfield and Taylor (2005), this policy framework maximizes access to prime aggregate resources as close to market as possible in order to ensure an abundance of inexpensive gravel by keeping the costs of transporting the resource (e.g., from extraction sites to markets) as low as possible. This policy approach stands in stark contrast to that of other jurisdictions (e.g., the United Kingdom, Sweden, Denmark), which have adopted policies to, among other goals, increase aggregate recycling and reduce demand (see Winfield & Taylor, 2005, p. 29-32). The institutional arrangements operating in these jurisdictions provide excellent examples of potential alternative institutional frameworks for aggregate extraction in Ontario. The United Kingdom's policy approach to aggregate resources, for example, is underpinned by such sustainable development objectives as, among others, the maximization of conservation of prime aggregate resources; the minimization of waste and waste recycling; and the complete prohibition of extraction in designated areas. These and other sustainable development objectives for aggregates are encouraged through such mechanisms as an aggregates levy of £1.60 ($3.73 CAD) per tonne; a sustainability fund oriented towards reducing the social-ecological impacts of extraction; and guidelines for the recycling of aggregates. A portion of the sustainability fund, for example, goes towards increasing the use of recycled aggregates. The 2001-2016 guidelines for recycling aim to increase the use of alternative materials to meet 23% of demand by 2016.

The above description of the provincial institutional framework guiding aggregate extraction in Ontario also begins to sketch out the feedbacks that exist between institutions, organizations, people, and the natural environment. People produce and reproduce the institutional system by which they are, in turn, constrained. This institutional system has implications for social-ecological systems. Changes in social and/or ecological systems can, in turn, induce institutional change. Many New Institutionalists (e.g. North, 1990; Streeck & Thelen, 2005), assert that institutional change is overwhelmingly incremental, especially due to the differences between fast and slow moving variables. Even ecological catastrophes, then, may induce changes in local or provincial laws and policies, while putting only a small dent in the worldviews that contributed to the crisis.

5.5 The aggregate extraction application process

Proponents of aggregate extraction operations must file an application with the Ministry of Natural Resources for a licence, permit, or wayside permit. If the extraction operation will be on private land, a licence is required. If the extraction operation will be on Crown land, lands under water, or if the Crown owns the aggregate, an aggregate permit is required. Licence and permit applications are categorized according to how much aggregate will be removed form the site, whether the extraction will be below or above the water table, and whether the site will be a pit or a quarry. Unconsolidated materials (e.g. sand and gravel) come from a pit whereas consolidated bedrock (limestone, granite, etc.) comes from a quarry and usually involves blasting. As previously described, the Ministry of Transportation has the authority to issue and administer wayside permits for its own Provincial highway projects. All other wayside permits (e.g. to municipalities) are issued and administered by the Ministry of Natural Resources.

Proponents must also submit applications with the appropriate local authority for a Zoning By-Law Amendment and, if required, an Official Plan Amendment. Under the *Aggregate Resources Act*, the Ministry of Natural Resources cannot issue a licence or permit for aggregate extraction unless the proponent has demonstrated that the appropriate land use changes have been made at the local level. The requirements for Official Plan Amendments and Zoning By-Law Amendments vary in detail depending on upper and lower-tier regional and/or municipal policy; some municipalities have more stringent requirements than others. This inconsistency, in part, is a consequence of different interpretations of the Provincial Policy Statement, different local cultures, and different historically based relationships between local communities and the aggregates industry. On the other hand, standards for licence and permit applications with the Ministry of Natural Resources are the same across Ontario, although they vary according to the application category.

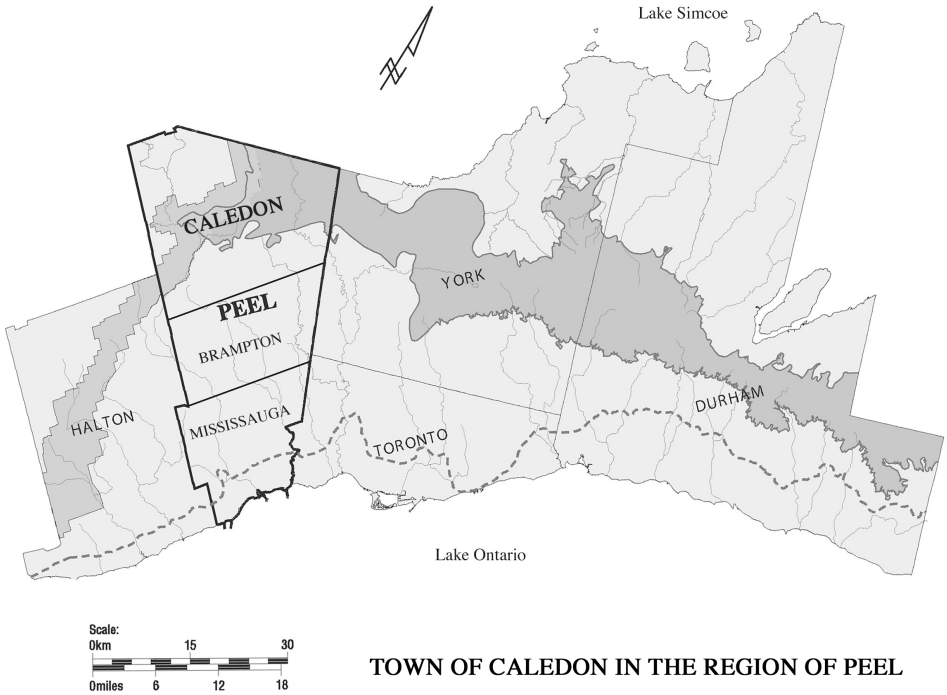
Regardless of the type of permit or licence, all applicants must submit to the Ministry of Natural Resources a site plan and technical reports as part of their application package, following provincial standards. The Ministry then has 20 days to determine if the application meets the requirements of the *Aggregate Resources Act*. If the Ministry determines that the application is complete, the applicant must proceed with the notification and consultation process. Under the *Aggregate Resources Act*, the applicant must provide a 45-day public notification period to allow the public to comment on the application package. The applicant must provide an information

session to the public sometime within this 45-day window. The public must have at least 10 days for comment after the information session. The applicant must try to resolve all objections and submit documentation of all resolved and unresolved issues to the Ministry. At this stage, the Minister may refer the application to the Ontario Municipal Board for a hearing. If the applicant does not submit all required documentation to the Ministry within 2 years of the notification period, the application will be considered to be withdrawn. Recent changes to the Ontario Planning Act allow municipalities to develop by-laws that require applicants to consult with the municipality before they submit Official Plan and Zoning By-Law Amendment applications.

5.6 The Town of Caledon in the Region of Peel

The Town of Caledon is the northernmost lower-tier municipality in the Regional Municipality of Peel. The Region of Peel extends northward from Lake Ontario in the west GTA, in the southwestern corner of the GGH (see Figure 1).

Figure 1. The Town of Caledon in the Region of Peel



The Town of Caledon is the largest of Peel's three lower-tier municipalities. Brampton and Mississauga constitute the southern half of the Region, with Brampton situated between the Town of Caledon to the north and Mississauga to the south. The Town's population is approximately 57,000 and it is expected to grow to approximately 84,000 by 2021 (Town of Caledon, 2004, p. 4-2).

Caledon's Official Plan describes the Town as "…characterized by its rolling hills and valleys, rivers and streams, natural landscapes, agricultural lands, rural residential areas, historic hamlets/villages, parks and conservation areas, hiking trails, the Niagara Escarpment, and the Bruce Trail" (Town of Caledon, 2004b, p. 5-105). The Iroquois and Algonkian Nations inhabited the area for hundreds of years. By the early 19th century, European settlers began to survey the land and establish farms. Today, these historical settlements represent a valued heritage unique to Caledon (see Town of Caledon, 2004c, p.1-1). The Town was created in 1974 through the amalgamation of some old area townships and the dissolution of other historic village governments under the Regional Municipality of Peel Act, 1973. It is primarily rural in character and contains some major natural and cultural heritage features, including parts of the Oak Ridges Moraine, the Niagara Escarpment, the Peel Plain, and the Credit and Humber river systems. The Town of Caledon is situated within the Credit River Watershed, which drains into Lake Ontario.

Local residents of Caledon take pride in the Town's picturesque countryside, rural character, and sense of community (see Planning & Engineering Initiatives Ltd. & Associates, 1998, p.32). In 2008, a Caledon Countryside Alliance survey found that most residents want municipal officials to resist development pressures in order to keep Caledon a small town (Caledon Enterprise, 2008). Over the years, a culture of stewardship has become a notable aspect of the Town's character. In 2003, Caledon was co-recipient of the "TV Ontario Greenest Town in Ontario" award, which recognized the Town's progressive environmental initiatives (Town of Caledon, 2009). These progressive initiatives are reinforced by Caledon's strong environmental civil society, which is comprised of a variety of groups that are active on a range of local issues broadly present across the GGH (loss of farmland, degradation of ecological goods and services, and sprawl). The Caledon Countryside Alliance, for example, works to ensure that the Town maintains its rural nature. Similarly, the Coalition of Concerned Citizens is committed to sustainable land use planning. The activities of this latter group are centered on defeating the Rockfort Quarry application. This group will be discussed in more detail in section 5.7. Because

the Town of Caledon contains portions of the above-mentioned major natural and cultural heritage features, Caledon's environmental civil society also includes larger organizations whose presence may be felt in many communities. Among others, these organizations include the Niagara Escarpment Coalition and Save the Oak Ridges Moraine.

Caledon's picturesque countryside has also attracted a community of well-to-do ex-urban retirees and commuting professionals: "…over the past two decades ex-urbanites have sought out this area for reasons of natural aesthetics, real estate value, small town appeal, and small 'c' conservative values" (Chambers & Sandberg, 2007, p. 332). This community is comprised of many households with annual incomes in excess of Can$100,000 and high levels of education. The recent trend in demographics has been that people who can afford the increasing cost of real estate have replaced lower income families (p. 332). These ex-urban residents have formed a solid base for activism against aggregate extraction in Caledon. It is important to note that this demographic shift has occurred alongside the emergence of land use legislation (e.g. Niagara Escarpment Act and Plan, Oak Ridges Moraine Act and Plan, and Greenbelt Act and Plan) that restricts residential, commercial, recreational and industrial development in the Niagara Escarpment Plan, Oak Ridges Moraine Plan, and Greenbelt Plan areas. As previously described in section 5.4, these Acts and Plans seek to contribute to the viability of agricultural communities, protect and enhance ecological goods and services, control urban sprawl, and promote the sustainable use of natural resources.

The Town of Caledon possesses the largest series of contiguous gravel pits in North America (Chambers & Sandberg, 2007). Caledon, therefore, has been a major provider of sand, gravel, and limestone to the construction booms in the GTA. According to Chambers and Sandberg (2007), Caledon's reliance on this single industry has made the Town prone to attracting more aggregate extraction operations. Moreover, the horizontally and vertically integrated multinational corporations that dominate the cement market in Canada have over the years shaped Caledon's natural and cultural landscape. According to the *Caledon Community Resources Study* (Planning & Engineering Initiatives Ltd. & Associates, 1998), by 1970, the areas that later became the Town of Caledon included a significant amount of land disturbed by aggregate extraction operations.

Chambers and Sandberg (2007) emphasize the socially constructed nature of Caledon's identity as an aggregates town. The aggregate industry, for example, has constructed several

narratives that support certain norms in practice. One such narrative is that aggregate operations must be sited close to demand in order to avoid high transportation costs. The industry rightly argues that lower transportation costs reduce the cost of cement, government-funded infrastructure, and private home building. Plus, lower trucking kilometers will reduce carbon emissions and so contribute to minimizing Canada's contribution to climate change. Another narrative is the industry's repeated insistence that there is a scarcity of aggregate resources relative to anticipated demand. Chambers and Sandberg note that the industry's demand projections are also socially constructed in that an elite group whose interests are vested in a paradigm that promotes highway construction and urban development determines them. Community narratives too have typically described Caledon as "predestined for aggregate production" (p. 331) by highlighting the rich deposits and their proximity to the GTA. Other path-dependent, positive feedback processes may also be at play. Chambers and Sandberg, for example, highlight that traditional patterns of employment and income (e.g. local farmers supplement their income with wayside pits for road maintenance) contribute to the persistence of Caledon's identity as an aggregates Town. These norms are reinforced by the Province: "The provincial state is keenly keyed into and complicit in the aggregate industry's scaled narrative with respect to resource protection and the distance/cost relationship…" (p. 331). This has been demonstrated over the years in the shift that occurred from the 1960s to the mid-1990s in the legislative framework guiding aggregate extraction operations in southern Ontario.

Caledon's culture of stewardship and the desire felt by many residents for Caledon to remain a small town stand in stark contrast with the economic growth and urban development pressures broadly present in the GGH region and locally evident in Caledon. These pressures may be magnified by Caledon's rich deposit of the aggregate resource and its position just north of such intensely populated and urbanized municipalities as Brampton and Mississauga. Moreover, the tensions between social groups, values and interests representing small town advocacy and growth pressures ultimately influence municipal and regional land use planning. These tensions, coupled with the complex web of legislative constraints that guide land use planning and decision making in the Town, generate complex land use issues. One such complex land use issue in Caledon centres on is the Rockfort Quarry project, which will be discussed in more detail in section 5.7. The Rockfort Quarry project is like many other quarry projects in the GGH in that it involves a diverse range of stakeholders and community concerns, notably loss

and degradation of water quality and quantity, and cultural and natural heritage.

5.7 The evolution of Caledon's mineral resources policies

According to Chambers and Sandberg (2007), Caledon's aggregate deposits were one of the first in Ontario to undergo extraction in the 1940s. During this time and up to approximately 1970, Municipalities had primary control over the location and operation of pits and quarries. The *Ontario Planning Act* and the *Municipal Act* gave municipalities land use planning tools to restrict the location of extraction operations. There was limited provincial control in that the regulation of the resource was decentralized over a range of statutes and provincial regulating agencies. Demand for the resource was low and based on local needs. Municipal control over the resource was not necessarily more sustainable, however. According to one interviewee who is a long-time resident of Caledon, these were the "wild west" days of aggregate extraction; a proponent could literally drive up to a source of aggregate, blow it up with dynamite, and drive away with a truck full of gravel.

By the mid-1950s, demand for aggregates began to increase with economic growth and urban and suburban development in the GTA. Larger companies began to form to supply the increasing demand and it became more common for aggregates to be hauled beyond the rural boundaries within which the pits were located. By the late 1960s, the aggregates industry began to lobby the provincial government for remedial action against a perceived shortage of resources. According to Baker et al. (2001), this "shortage of supply" discourse emerged out of a lack of understanding of the amount of sand, gravel and bedrock resources available for extraction; rising conflict between public concern for the environmental impacts of aggregate extraction and increasing public demand for aggregate resources; and increasing competition between the aggregates industry and municipalities for land for aggregate mining versus other land uses.

In 1969, the Province created the Mineral Resources Committee to examine the industry's concerns and make recommendations that would guarantee the ongoing availability of aggregates close to demand. The Committee's 1969 report recommended increased provincial control over the aggregates industry. This was the beginning of the loss of municipal control over aggregate extraction: "…the industry, realizing the growing 'crisis' for aggregate producers, 'captured' the provincial government and began to dominate policy-making" (Baker et al., 2001, p. 468). Chambers and Sandberg (2007) assert that the aggregate industry was successful in its

demands partly because both the provincial government and the industry were profiting from increasing urbanization.

The *Pits and Quarries Control Act* came into effect in 1971, transferring control of aggregate resources from municipal governments to the Province through the establishment of a licensing and site plan procedure system enforced by the Ministry of Natural Resources. The Ministry became the central planning agency, with power to licence, regulate, and rehabilitate pits and quarries. Municipalities, however, were allowed to maintain control over the location of future pits and quarries through land use planning tools. In a significant step, the Act also required the rehabilitation of pits and quarries. It recognized the growing conflicts between the aggregates sector and the interests of private citizens: "…while there is a general acceptance within the Province that aggregate extraction is necessary, there is also a very real concern by the citizens involved to see that their interests are protected" (Baker et al., 2001, p. 470). According to one interviewee who is a long time resident of Caledon, citizens of the Town have always been concerned with protecting the tranquility and rural aesthetic of Caledon's countryside, as these are valued components of a particular quality of life.

By the early 1970s, Caledon had been well established as a town with an ample supply of prime aggregate to feed the needs of the GTA. According to the *Caledon Community Resources Study* (Planning & Engineering Initiatives Ltd. & Associates, 1998), by 1970, Caledon was surrounded by a significant amount of land disturbed by aggregate extraction operations. Indeed, many of these pits and quarries were opened before the *Pits and Quarries Control Act* came into effect; therefore, they were not subjected to rehabilitation obligations. For residents of Caledon, the Province made a significant move in 1979 when the Ministry of Natural Resources released the *Mineral Aggregate Policy for Official Plans*, which directed municipalities to protect lands identified as having significant aggregate deposits from being allocated to any other land use. Then, in the early 1980s, the new *Planning Act* allowed the provincial government to issue policy statements to guide municipal authorities in land use planning. The *Mineral Aggregate Resources Policy Statement* was the first of these provincial policy statements. It was based on an inventory of aggregates in Ontario, projected demands, and estimated volumes to be produced by local jurisdictions (Chambers & Sandberg, 2007). Like the 1979 policy, the objectives of the *Mineral Aggregate Resources Policy Statement* ensured that official plans identify and protect existing pits and quarries and future aggregate reserves from incompatible land uses.

Municipalities did not have to zone the identified areas for extraction but the *Mineral Aggregate Resources Policy Statement* prevented such lands from being used for any other purpose.

These legislative changes are evidence of the institutionalization of the norm of unfettered access to the resource close to demand, driven by the industry's shortage of supply discourse and the provincial need for affordable aggregate to feed urban development in the GGH region. It also represents the establishment of a land use planning and natural resource management system that gives priority to aggregate extraction over other land uses. Prior to this policy, municipalities could control the location of pits and quarries through Official Plan zoning by-laws. According to one citizen who lived in Caledon during this time, Town Council was pressured by the Ministry of Natural Resources to adopt an aggregate resources area map in Caledon's Official Plan to designate certain parts of the Town for extraction. This caused an immediate uproar among concerned citizens who were accustomed to having more control over the location of pits and quarries, and who wanted to protect the cultural and natural heritage that defines their rural quality of life. Some of these citizens formed the Caledon Ratepayer's Association to defeat the aggregate resources area map proposal and associated municipal policies. After about two years of lobbying, Town Council sided with the Ratepayer's Association. Eventually, negotiations between the Town, Ratepayers, and the Ministry of Natural Resources led to a decision popularly known as "Cabinet Corners", the nickname for the area of Town described in Caledon's 1981 mineral resources policies as an area to which the Town would "have regard to" preserving for future aggregate extraction. Indeed, Caledon was no stranger to quarry land use battles by the early 1980s.

Caledon's 1981 Cabinet Corners policies set out particular requirements for proponents of new aggregate operations or extensions to existing operations in applying for a zoning by-law change and an amendment to the Plan. The policies provided a list of criteria upon which amendment applications would be evaluated. Among other evaluation criteria was the *need* for the operation. Little detail was set out with respect to the assessment of biophysical and social impacts. Moreover, "environment" was defined narrowly along biophysical lines (air, water quality and quantity, noise, hydrology). Assessment of social impacts was not elaborated beyond the requirement to consider public concerns and impacts on residents adjacent to the project. The nature of the proposed rehabilitation was to be considered in the amendment approval process and progressive rehabilitation was to be promoted. The Town also laid out an intention to

develop a rehabilitation program and prepare an inventory of abandoned and rehabilitated pits and quarries with the assistance of the Ministry of Natural Resources. With respect to land use priorities, Caledon's Cabinet Corners policies explicitly stated that, when considering Official Plan Amendments, it would "…consider the goals and objectives of this plan to preserve and encourage agricultural activity and maintain the scenic and rural character of the Municipality in maintaining a land use balance between competing land uses…" (Town of Caledon, 1983, p. 95). Moreover, it stated that priority would be given to "…the protection of existing and approved residential development from undue adverse impact of the new extractive industrial use" (Town of Caledon, 1983, p. 95). These Cabinet Corners policies were in effect in Caledon until 1996.

By the early 1980s, Caledon's identity had been defined, in part, by the aggregates industry and the demands of urban development in the GTA and beyond. Chambers and Sandberg (2007), for example, highlight the powerful role of corporate narratives that construct particular locations as "predestined producers of aggregate" (p. 328). Caledon's position within the Region of Peel and just north of the GTA meant that it was an easy target as an area that could be pegged as a major supplier of aggregates. Moreover, Caledon's farming community has traditionally welcomed aggregate extraction: "From using wayside pits for road upgrades to supplement their income in the past, farmers now seek to sell their land as aggregate resources, while young men from farm backgrounds seek employment as heavy equipment operators or labourers at the local pits" (p. 331). Moreover, between the early and late '80s, aggregate production increased dramatically, contributing to Caledon's identity as an aggregates town. But such factors as the influx of well-to-do, ex-urban retirees and commuting professionals, Caledon's commitment to protect its rural and scenic character, and a rise in environmental awareness and activism also contributed to Caledon's identity. According to one interviewee, historically, the Town's attitude has always been to go to the Ontario Municipal Board to oppose applications for aggregate extraction in order to protect citizens from the adverse social and environmental impacts.

In 1989, the *Aggregate Resource Act* replaced the *Pits and Quarries Control Act*, handing more responsibility to the aggregates industry for the mitigation of the biophysical and social impacts of extraction. This may have been, in part, a response to the significant increase in the rate of aggregate extraction in southern Ontario. Between 1979 and 1989, aggregate production increased from 131 million tonnes to 197 tonnes annually: "With this dramatic rise in mining

activity came heightened awareness of the overall costs of the industry and weaknesses in the policy framework" (Baker et al., 2001, p. 471).

Meanwhile, control over the aggregates industry was shifting again – from provincial to joint provincial-industry control. Ontario's land use planning and natural resource management legislative framework reinforced this shift. In December 1994, the province adopted a comprehensive set of provincial policy statements, which came into effect in 1995. These statements were based on the work of the Commission on Planning and Development Reform. Among these statements was the *Mineral Aggregate and Mineral Petroleum Resources Policy Statement*, the chief objective of which was to "…ensure mineral aggregates are available at a reasonable cost and as close to markets as possible to meet future local, regional and provincial needs" (Winfield & Taylor, 2005, p. 13). The goals of 1979 *Mineral Aggregate Resources Policy Statement* were carried over in this policy statement. Other types of land uses were permissible only in areas where mineral extraction was not feasible, if development would not preclude aggregate extraction, and if the proposed land use or development was in the greater interest of the general public. Under the Planning Act, municipal planning authorities had to adhere to this policy in their Official Plans. The trend to reinforce aggregate law with land use planning policy continued, therefore, with the new Provincial Policy Statement, which came into effect in March 1995.

A further shift in responsibilities from the Ministry of Natural Resources to the aggregate industry occurred later in 1995, when the Ministry of Natural Resources experienced a dramatic reduction in funding for their aggregates program. In response to the reductions, the *Aggregate and Petroleum Resources Statute Law Amendment Act* was passed in 1996 and proclaimed in force in June 1997. It amended the Aggregate Resources Act. Notably, it handed compliance inspection and reporting, management of rehabilitation funds and the Management of Abandoned Aggregate Properties Program, and operational accountability responsibilities to the industry, while the province retained responsibility for conducting enforcement, setting standards, and issuing approvals. Under this amendment, the Minister created the Aggregate Resources Trust and appointed The Ontario Aggregate Resources Corporation as trustee. The sole shareholder of The Ontario Aggregate Resources Corporation is the Ontario Stone, Sand & Gravel Association, formerly called the Aggregate Producers' Association of Ontario.

In 1995, when Mike Harris became Premier of Ontario, the Planning Act was amended to

weaken the Provincial Policy Statement, especially by requiring planning decisions only to "have regard to" provincial policies rather than to be consistent with the policies. But the new Provincial Policy Statement strengthened the priority given to aggregate resources over other land uses. By the mid 1990s, a partnership had solidified between the Province and the aggregates industry in the management of the industry and mitigation of its environmental impacts. Unfettered access to the resource, based on the "shortage of supply" discourse, was firmly institutionalized and implemented to varying degrees at the local level across southern Ontario.

According to one interviewee who was a Town Councilor during this time, it was around 1996 when the Town became aware that the 1981 Cabinet Corners policies were antique. Moreover, by 1996, the Town had spent millions of dollars on aggregate extraction related Ontario Municipal Board hearings. If the aggregate producers did not win at the Board, they would appeal the Board's decision to Cabinet. Most often, Cabinet would overturn the Board's decision. The Town, therefore, was not gaining ground from these battles. Still, according to one interviewee who was a Town planner around this time, the Town's willingness to go to the Ontario Municipal Board was underpinned by its desire to have more control over the industry, and to achieve a balance between the interests of the aggregates industry and community concerns. In response to these local, industry, and provincial stresses, the Town initiated the *Caledon Community Resources Study*: "As a result of the number of local Ontario Municipal Board referrals to the Regional and Town Official Plans, the need for a study was recognized…" (Planning & Engineering Initiatives Ltd. & Associates, 1999, p. 1). It was to be completed in three phases. The overall objective of the study was to "…develop a sustainable community model for the management of the aggregate resource that will enable the Caledon ecosystem and community to be maintained over the long term" (Planning & Engineering Initiatives Ltd. & Associates, 1998, p. 1). A Community Advisory Group was established to assist the Study Team during the *Caledon Community Resources Study* process. The Community Advisory Group consisted of residents, representatives of the aggregate industry, and municipal and regional officials. According to one Town official interviewee, this collaborative approach was groundbreaking for Caledon, a Town that had experienced decades of precarious relations between the aggregates industry and residents and local politicians. The above stakeholders, however, had reached a point where they realized that the time and money that they were

spending on Ontario Municipal Board hearings were not contributing to a solution to the essential problem – a land use planning issue. Town officials realized that it was unlikely that the provincial legislative framework would change to their advantage in the foreseeable future. Caledon would continue to receive more applications for aggregate extraction; somehow, pits and quarries had to be accommodated. Everyone wanted some certainty. The Town, certain concerned citizens and representatives from the aggregates industry were willing, therefore, to negotiate a transition to a local institutional system that would help to avoid costly Ontario Municipal Board hearings.

Meanwhile, the Region of Peel was experiencing a lot of pressure from certain Ministry of Municipal Affairs and Housing staff to adopt a Regional Official Plan. Up until this point, the Region did not have one. According to one interviewee who was a Councilor during this time, this was because Peel's lower-tier Municipalities (Brampton, Mississauga, and Caledon) were historically accustomed to and wanted to maintain the custom of having primary control over local concerns. The Regional planners were content with merely delivering services. In order to force the Region's hand, certain staff within the Ministry of Municipal Affairs and Housing decided to stop the approval process for municipal plans in Peel Region. The Minister, for example, refused to review Caledon's 1991 Growth Management Plan until Peel developed an ROP. Although the *Caledon Community Resource Study* had already been initiated, Town and Regional officials and staff temporarily shifted their focus to developing Peel's first Regional Official Plan.

On July 11, 1996, the Region of Peel adopted its first Official Plan. With respect to mineral aggregate resources, the new Plan built on Caledon's 1981 Cabinet Corners policies. According to one interviewee who was a Town Councilor during this time, the Town of Caledon simply uploaded many of its policies to the ROP. The new Plan, therefore, retained the old 1981 requirement to "have regard to" preserving lands within a defined area of Caledon for future extraction of mineral resources. But it refined toughened this policy to prohibit new aggregate operations outside of that area of the Town. It also retained the requirement for proponents to demonstrate need. The 1996 Regional Official Plan also adopted more of the language of the 1996 Provincial Policy Statement. For example, it directed area municipalities to identify and protect pits and quarries from incompatible land uses and permit aggregate uses in Prime Agricultural Areas with policies in their Official Plans. As required by the Provincial Policy

Statement, the new Plan directed area municipalities to permit the establishment, operation, expansion and rehabilitation of pits and quarries with policies in their Official Plans. It allowed for municipal consideration of environmental and social impacts. Concern for community, social and biophysical impacts was explicit, as was consideration for the cumulative effects of aggregate extraction on Peel's communities, cultural features, and environmental integrity. Progressive rehabilitation was required and the Region set out an objective to "actively promote" rehabilitation of abandoned pits and quarries. Rehabilitation requirements, however, were somewhat diminished in that the old 1981 intention to develop an inventory of abandoned and rehabilitated pits and quarries was removed. This may have been due to a lack of capacity on the part of the Ministry of Natural Resources and the Town to collect and maintain inventory data. The Regional Official Plan prohibited new aggregate operations within Peel's entire Greenlands system. Plus, it retained the requirement for the town to, when considering applications for new aggregate developments, give priority to protecting existing communities from the impacts of aggregate operations, and "preserve and encourage agricultural activity and maintain the scenic and rural character and land use balance between competing land uses" (Region of Peel, 1996, p.37). Overall, Peel's new Regional Official Plan maintained the above-described orientation of Caledon's 1981 mineral extraction policies. One important detail is that the new Plan directed the Town of Caledon to continue the *Caledon Community Resource Study* in order to recommend new policy and management directions for the Region and for the Town of Caledon in particular.

In the summer of 1996, the Region forwarded the new Plan to the Ministry of Municipal Affairs and Housing for approval. Near the end of the summer, Regional Council was notified that the Minister intended to modify Peel's new aggregate resources policies because, according to the Minister, they did not properly address provincial policy. Negotiations were held between the Ministry and the Region around key issues in the proposed modifications. According to one interviewee who was a municipal planner during this time, the Town refused to attend these negotiations because it wanted to maintain control over the aggregate policies and the management of the resource. Among the key negotiated issues was the incorporation of a *High Potential Mineral Aggregate Resource Area* (HPMARA) map prepared by the Ministry of Natural Resources and Ministry of Municipal Affairs and Housing, based on the Ministry of Northern Development and Mines' aggregate resources geological inventory for the Region of Peel. The HPMARA map identified areas of significant mineral resources in Caledon. In keeping

with ensuring unfettered access to the resource close to demand, the Minister wanted the map to be used to *designate* lands for extraction. The Region and Town, however, insisted that the map should be used to *identify* mineral resources only – as a basis for further refinement at the local level through the *Caledon Community Resource Study*. Also at stake was the Region's *Greenlands* system, within which extraction was prohibited in Peel's Regional Official Plan. The Minister wanted to modify this restriction by prohibiting extraction within the core areas of the Greenlands system only, opening ecologically sensitive areas for extraction. The Region and Town further rejected the HPMARA map on the grounds that it included settlement areas and residential estate communities. Moreover, the map would designate significant portions of the Town's rural system for aggregate protection with few other uses. Municipal and Regional Councils strongly recommended that the modifications be deferred until the completion of the *Caledon Community Resource Study* or replaced with policies that required the *Caledon Community Resource Study*. On October 22, 1996, however, the Minister approved Peel's modified Regional Official Plan. The requirement for the *Caledon Community Resource Study* was retained and it continued under its original purpose.

Around this time, the Rockfort Quarry land use issue appeared on the Town of Caledon's horizon. Nestled within the western reaches of the Town, the Rockfort lands are a well-known remnant of Caledon's early-nineteenth century farming community. The Scottish pioneers who settled the land built the stone barn, which remains on the site, and the farmhouse was at one time the Post Office for the old village. According to more recent history, the previous owners who had maintained the heritage property for over thirty years sold the Rockfort lands to a "lovely young couple" who showed great admiration for the historic farmhouse, stone barn, and surrounding landscape. It turned out that the young couple represented James Dick Construction Limited (JDCL), an aggregate production and processing company that had been operating in the Caledon area since 1964. To the dismay of the local residents, the property had been purchased with the intent to quarry.

In reaction to the Rockfort Quarry proposal, the Coalition of Concerned Citizens was formed, a nongovernmental organization comprised of citizens primarily from Caledon and the neighbouring Town of Erin. Defeating JDCL's quarry proposal was and remains its main raison d'être. Their broader mandate is to encourage all levels of government to adopt sustainable land use planning policies.

The Minister's modifications to Peel's aggregate extraction policies prompted dozens of appeals to the Ontario Municipal Board. Key appellants included the Town, Region, Niagara Escarpment Commission, Credit Valley Conservation Authority, Metro Toronto Conservation Authority, and private landowners. Key reasons for the appeals were that the modifications (i) were made without any notification or input by the public, whose property interests would be affected; (ii) undermined the recommendations of the *Caledon Community Resource Study*; (iii) involved a level of detail that the Town asserted was inappropriate for a Plan that must be high-level and strategic; and (iv) failed to provide a balanced approach to future land use planning. The Town appealed the policies that would (i) allow for extraction operations within the Greenlands System; (ii) limit the ability of area municipalities to require that aggregate operations minimize negative biophysical, community, and social impacts, and limit their ability to undertake studies to consider cumulative effects; (iii) be unclear with respect to whether a Regional Plan Amendment would be required within the HPMARA for a use that would be in accordance with the policies of the Plan; (iv) protect existing and future aggregate operations from other land uses while not providing protection for other landowners from the effects of aggregate operations; and (v) eliminate the Town's 1981 Cabinet Corners policy to "preserve and encourage agricultural activity and maintain the scenic and rural character and land use balance between competing land uses" (Manning, 1996, p. 13). The modifications were perceived to demonstrate a preference for the aggregate industry over the interests of the residents of Caledon: "As a result of these changes, and an overall lack of balance, as supported through Provincial Policy, the Mineral Aggregate policies, as modified, do not provide a balanced approach to planning and fail to give adequate recognition to interests other than aggregate extraction" (Manning, 1996, p.3).

An Ontario Municipal Board pre-hearing on the Minister's modified version of Peel's Regional Official Plan was held on April 2, 1997. During this time, the Region and the Town were under pressure from the aggregates industry and the Ministry of Municipal Affairs and Housing to proceed with the Ontario Municipal Board hearing before the completion of the *Caledon Community Resource Study*, i.e. before Caledon's aggregate policies could be revised. The Region, Town, Coalition, and Niagara Escarpment Commission, however, pushed to have the hearing after the *Caledon Community Resource Study* was completed and following the amendments to the Municipal Official Plan. In June 1997, the Ontario Municipal Board decided

to concur with the Ministry of Municipal Affairs and Housing to not delay in the hopes that the *Caledon Community Resources Study* would be completed by the fall of 1998. In February 1998, the appeals to the Minister's modifications were resolved in a settlement agreement between all parties and finally approved by the Ontario Municipal Board. Meanwhile, the Town and the Region continued with the *Caledon Community Resource Study* with its original objectives.

For the key appellants, the revised new Regional Official Plan represented some wins and some losses. It was decided in the negotiations the HPMARA map would be a tool to identify aggregate resources as opposed to a designation tool, and it would require further refinement by local municipalities. The Regional Plan incorporated policies to permit joint regional-municipal studies that would address the social, cultural, environmental, and cumulative effects of aggregate developments. It also gave area municipalities some control over aggregate developments by directing them to develop policies regarding the location, operation, and expansion of pits and quarries; Official Plan Amendment criteria for new and/or expanded operations; and rehabilitation policies. The new Regional Official Plan, however, prohibits aggregate operations within the Core Areas of the Greenlands System only, as opposed to the entire system. Perhaps the most significant loss was that it diluted previous policies that explicitly sought to maintain a balance between competing land uses and give priority to the protection of existing and approved residential developments from the adverse impacts of aggregate operations. The new Plan retained a regional-level requirement that aggregate developments should be located, designated and operated in such a way that biophysical and social impacts would be minimized. And it incorporated in the *Objectives* section the goal to achieve a balance between the demand for and economic benefits of aggregates and the protection of Peel's communities and natural environment. But the previous policies that explicitly sought to "preserve and encourage agricultural activity and maintain the scenic and rural character and land use balance between competing land uses" were not carried over. Instead, greater attention was devoted to Provincial interests with respect to aggregate resources as expressed in the Provincial Policy Statement.

In March 1998, JDCL submitted an application to the Town of Caledon for an Official Plan Amendment and Zoning By-Law Amendment. The company also applied to the Ministry of Natural Resources for a Category 2 licence to quarry below the water table. Town Official Plan and Zoning By-Law Amendments were required to designate the Rockfort lands from "Rural

Area" to "Extractive Industrial" to permit the establishment of the quarry. Because the Town's *Caledon Community Resource Study* was not yet complete at the time of JDCL's application, the Town's 1981 aggregate policies remained in force.

In April and September 1998, Phase 1 and Phase 2 of the *Caledon Community Resource Study* were completed and approved by Caledon Council. Around this time, the Coalition continued to work with local citizens, the Credit Valley Conservation Authority, the Town, and the Region to raise awareness of the potential impacts of the Rockfort Quarry. The Coalition's key concerns were for property values, the water table, the aquifer system and other sensitive features (including cultural heritage) of the rural countryside around the Rockfort site. Their activities included fundraising through garage sales, dinner theatre, and golf tournaments. By 2002, the Coalition's membership had reached approximately 3600 individuals. Fundraising was especially important to the Coalition because its strategy included hiring legal, environmental, and engineering consultants to review JDCL's quarry proposal and associated reports. By 2003, the Coalition had spent over $600, 000 in direct costs and over $1 million in indirect costs.

By the spring of 1999, Phase 3 of the *Caledon Community Resource Study* was complete. It culminated in the preparation of recommendations by hired consultants for a new set of mineral resources policies for the Town, popularly known as Official Plan Amendment 161 (OPA 161). Council finally adopted OPA 161 in March 2000, after meetings with key stakeholders (Town, Region, Ministry of Municipal Affairs and Housing, Ministry of Natural Resources, Ministry of the Environment, Ministry of Transportation, Niagara Escarpment Commission, Credit Valley Conservation Authority, Aggregate Producers' Association of Ontario, and the Coalition of Concerned Citizens), and numerous revisions of the policy by planning staff. Thirteen parties promptly appealed OPA 161 to the Ontario Municipal Board, including JDCL, other individual citizens and aggregate producers, the Ontario Producers' Association of Ontario, Ministry of Municipal Affairs and Housing, Ministry of Natural Resources, Niagara Escarpment Commission, and the Coalition of Concerned Citizens. In June 2000, the Ministry of Natural Resources referred JDCL's licence application to the Ontario Municipal Board at the request of JDCL and because of the outcry against the quarry from the public and other agencies, including the Town, Region, Niagara Escarpment Commission, Credit Valley Conservation Authority, and the Coalition of Concerned Citizens. In September 2000, JDCL also appealed its Official Plan and Zoning By-Law Amendment applications on the

grounds that the Town had failed to adopt the proposed amendments within the legislated timeframe. Also in September, JDCL filed a motion with the Ontario Municipal Board for an order based on the "Clergy Principle" that OPA 161 was not applicable to its quarry application. JDCL wanted its application to be assessed under Caledon's 1981 mineral extraction policies. The Clergy Principle will be discussed in more detail later, below.

From about the winter of 2000 to the fall of 2003, settlement discussions on OPA 161 were undertaken among all parties. A settlement agreement was finally reached and the Ontario Municipal Board approved OPA 161 on April 28, 2003. The status of the Rockfort lands was deferred to a February 2004 hearing. The most controversial issues that were negotiated by the parties to the Ontario Municipal Board settlement included the following:

- prioritization of aggregate resource lands for extraction operations
- requirement for a comprehensive broader scale environmental impact study
- requirement for an independent social impact study, and
- demonstration of need for extraction.

OPA 161 incorporated a *Caledon High Potential Mineral Aggregate Resource Area* map, which refined the Regional HPMARA map. The municipal map eliminated portions of the HPMARA in order to be consistent with Caledon's environmental policies and to exclude residential clusters and parcels of land that were determined to be too small for extraction operations. Certain Environmental Policy Areas, therefore, were removed from HPMARA. This was underpinned by the town's desire to protect Caledon's cultural and natural heritage as an integral part of its unique identity and character (Town of Caledon 2004b, p. 5-105). In a bold move by the town, the map incorporated an aggregate extraction prioritization strategy in that it divided the resource lands into ten resource areas. According to one interviewee who was a planner during this time, this was the first time at an attempt to prioritize aggregate extraction in southern Ontario. Before OPA 161 was appealed to the Ontario Municipal Board, these ten resource areas were categorized according to certain criteria as "Priority 1" and "Priority 2" lands. Extraction would be encouraged in Priority 1 areas and prohibited in Priority 2 areas. Town planners would examine the Plan every five years and adjust the restricted area policies according to certain criteria. According to five interviewees, two Town Planners and three Councilors, for the town, prioritization was essential to its capacity to maintain some control over the timing and location of pits and quarries, and to ensure that an acceptable level of

rehabilitation was underway before extraction could occur in Priority 2 lands. The town was especially devoted to ensuring that Priority 1 areas were near appropriate haul routs in order to avoid paving over rural roads, which are a valued component of Caledon's cultural heritage. Many old rural roads in Caledon, for example, are lined with the original stone fences erected by the European settlers who farmed the land during the early 19^{h} century. According to one interviewee who was a Town Councilor during this time, the prioritization idea was underpinned by the Town's acceptance that it would have to obey the Provincial legislative framework. But the Town was determined to deal with the Provincial framework in a way that was somehow favourable to them. According to Konefat (2000), the Aggregate Producers' Association of Ontario, individual aggregate producers, Ministry of Municipal Affairs and Housing, and Ministry of Natural Resources were "…fundamentally opposed to the concept of prioritization" (p. 3). They wanted policies that ensured unfettered access to the resource, fair competition, and low prices for aggregate. These interest are is evident in the Aggregate Producers' Association's comments on the draft Official Plan Amendment: "The proposed prioritization has the effect of limiting resource availability and further, serves to potentially constrain competition in the market place. This would have a negative effect on aggregate prices…" (Aggregate Producers' Association of Ontario, 1999, p.1). Another interviewee who was a Town Official during this time asserts that the industry players resisted this policy because they were afraid that it might become the norm across southern Ontario. Finally, the Town's lawyer threatened to take the negotiations to a full-blown Ontario Municipal Board hearing if the industry could not agree to a compromise on the prioritization issue. Eventually, the industry players agreed to some prioritization policies and the Town agreed to provide more flexibility. In the end, the "Priority 1" and "Priority 2" wording was changed to "Resource Area" and "Reserve Area". New pits and quarries would be encouraged in Resource Lands but would also be considered in Reserve Lands, subject to more onerous study requirements and informally higher standards for approval. JDCL's Rockfort Quarry lands were identified as being located within Aggregate Reserve (Priority 2) lands.

Among these additional study requirements is one that calls for a Comprehensive Broader Scale Environmental Study (CBSES), equivalent to a Subwatershed Study if one had not been undertaken prior to the extraction application. Applications for extraction in Reserve (Priority 2) areas must complete a CBSES and many other studies as part of their application for an Official

Plan and Zoning By-Law Amendment to permit extraction in CHPMARA lands. The Town of Caledon, Ministry of Municipal Affairs and Housing, Niagara Escarpment Coalition, and Coalition of Concerned Citizens supported this additional CBSES study because it requires proponents to evaluate how extraction will impact any areas identified as having functional linkages to the Resource Area, including hydrologic features, wetlands, woodlots, riparian communities, aquatic communities, groundwater recharge areas, etc. Prior to the settlement negotiations, proponents only had to investigate their individual sites, which provided only an incremental understanding of potential impacts. According to an interviewee who was a Town Planner during this time, industry stakeholders resisted this new policy because they felt it was unfair to ask them so study lands they may not own. They also felt that the study would be too expensive to undertake. The Aggregate Producers' Association of Ontario argued that the CBSES requirement is redundant and would only cause unwarranted delay (Ontario Aggregate Producers' Association, 1999, p. 4).

According to Konefat (2000), the Aggregate Producers' Association of Ontario and individual aggregate producers were generally concerned with the number of reports that OPA 161 requires to be submitted for an Official Plan and Zoning By-Law Amendment. OPA 161, for example, requires for all extraction applications a Traffic Impact Study, an assessment of social impacts (noise, dust, traffic levels and vibration), a Visual Impact Report, a Cultural Heritage Survey, a Water Resources Study, and a land use planning analysis. Moreover, OPA 161 requires the applicant to pay for the costs of an independent peer review of these reports. All of these studies have to demonstrate that there will be no unacceptable impacts. With respect to the Water Resources Studies, OPA 161 further requires applicants to demonstrate that "…water resources will be protected, maintained and, where applicable, enhanced…" (Town of Caledon, 2004b, p. 5-119). Subsequent sections provide details on what these reports and assessments must address, including specifics on what information must be provided. OPA 161 also requires a pre-submission consultation meeting with the applicant, Town, Region, Ministry of Natural Resources, Conservation Authorities, and other relevant agencies before these reports be submitted to the Town as part of an application package. These reports, along with the detailed site plans required for submission to the Ministry of Natural Resources under the *Aggregate Resources Act* must be delivered to the Town in order to be made available to the public. The Town and other approval agencies may reject an application on the basis of these reports. The

"unacceptable impacts" wording had to be negotiated during the settlement talks. According to one interviewee who was a Town planner and present during the negotiations, the "unacceptable impact" wording was one of the last remaining controversial issues settled between the Town's lawyer and the aggregates industry representatives. According to another interviewee who is a Town planner, one reason for the industry's resistance towards the study requirements is that the general trend in the aggregates industry is to submit the bare minimum studies in order to maximize profits.

The original OPA 161 also included the requirement for an independent social impact study. An independent social impact study was very important to the Town because they wanted to protect communities from the negative social impacts of pit and quarries. According to one interviewee who was involved in the negotiations, the Town's demand for an independent social impact study and the CBSES was due to their view that the Provincial framework was tilted in the direction of the aggregates industry. The stand-alone social impact study and CBSES became part of the planners' aim to achieve a fair and balanced approach to land use decision-making. Truck traffic, noise, dust, and contamination of well water were especially stressed as significant negative social impacts. According to one interviewee, however, industry stakeholders argued that social impacts are too precarious to measure because of their subjectivity. They felt that any independent social impact study would result in a negative reaction towards a particular extraction project and threaten the success of the application. The independent social impact study was a major issue on the Ontario Municipal Board negotiation table. Eventually, the Town conceded. The Ministry of Municipal Affairs and Housing/Ministry of Natural Resources, Aggregate Producers' Association of Ontario, and independent aggregate producers fought hard to avoid the stand-alone study. Instead, they agreed to assess social impacts, where appropriate, "based on predictable, measurable, significant, objective effects on people caused by such factors as noise, dust, traffic levels and vibration…based on Provincial standards, regulations and guidelines…" (Town of Caledon, 2004b, p. 5-123).

The original official plan amendment also included a requirement to demonstrate need for an extraction operation. This was negotiated out of OPA 161 during the Ontario Municipal Board settlement process. According to one interviewee, the Town wanted the requirement to consider need because, based on its previous experience with the aggregates industry, pits and quarries were being opened and closed without proper regard to rehabilitation. From the Town's

point of view, a requirement to consider need would help to curb the rehabilitation problem. The industry and the Province, however, argued that there is always a need for aggregate, especially in light of the Province's population growth forecasts and urban densification targets. According to one interviewee representing the aggregates industry, more and higher quality aggregates are required for the Province's aim to grow up instead of out. Moreover, need is closely tied to demand. The aggregates industry, then, is merely responding to the demand from Municipalities and developers for roads and homes, etc. Thirdly, according to this industry representative, sources for high quality aggregate close to demand are disappearing quickly. Producers are starting to have to go farther and farther from the demand to access the resource. There is, therefore, a need to excavate the remaining resources close to demand. Plus, the foundation for the rejection of the requirement to demonstrate need was well established over fifteen years earlier. In 1986, the Ontario Municipal Board made a precedent setting decision in an aggregate extraction related Ontario Municipal Board hearing in the Township of Puslinch. The Board decided that the Planning Act prohibits any concept of "need" for aggregate resources (Planning & Engineering Initiatives Ltd. & Associates, 1998, page 59).

Aside from these contentious issues, Caledon's Ontario Municipal Board approved OPA 161 met the Provincial Policy Statement's core requirements for aggregate policies to protect aggregate resources from incompatible land uses, to allow as much of the resource as is realistically possible to be made available for use, and to require progressive and final rehabilitation. The thirty-three-page amendment is divided into sections that set out policies in a level of detail and complexity that was not present before OPA 161. The "balance" and "preservation" ideas were carried over to OPA 161, although they were not translated to the same degree. In 1981, these ideas had been present as considerations in the approval of Official Plan Amendments to permit new aggregate operations. In OPA 161, however, *preservation* was deleted and *balance* is present only as an objective in the *Town-Wide Aggregate Management Objectives* section: the Town seeks to "ensure that the extraction of aggregate resources is undertaken in a balanced manner…which will recognize Caledon's community character and social values over the short and long term" (Town of Caledon, 2004b, p. 5-105). *Rural* character was replaced with *community* character, indicating a change in Caledon's identity and/or an attempt to broaden the interpretation of Caledon's *character* beyond rural features. According to Konefat (2000), the Aggregate Producers' Association of Ontario argued that the objectives

should be modified to ensure that community/social values were not given priority over the provincial interest in aggregate extraction.

OPA 161 worked around the Regional Official Plan policies that allow aggregate operations within parts of the Greenlands system by stipulating that aggregate extraction would be prohibited in certain Environmental Policy Areas, some of which are located outside of the Core Greenlands area. But policies that allow extraction within some types of Environmental Policy Areas, subject to additional studies and informally higher standards of approval, have also been incorporated. Extraction is prohibited in kettle lakes and their catchments to protect surface and groundwater, and ecological functions and features. The Amendment also requires two different Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) and a requirement to amend the plan to change an extraction operation from "A" to "B". Konefat (2000) notes that the aggregate producers objected to this approach. Town planning staff, however, fought for this approach on the grounds that it would allow for appropriate assessment of impacts. Cumulative impacts are also considered by OPA 161, which sets out a requirement for the Town to conduct studies and address when appropriate the cumulative effects of new and expanded pits and quarries on Caledon's communities and natural and cultural heritage.

OPA 161 also requires the preparation of Rehabilitation Master Plans for the ten aggregate resources areas. The Town will request that consideration for area Rehabilitation Master Plans be included in the Ministry of Natural Resources' conditions of licence and the Town will not approve an Official Plan Amendment to permit extraction until the applicant has shown that the application meets the intent of the Rehabilitation Master Plan. The rehabilitation policies state that the Town will assess existing extraction sites to determine the extent to which progressive rehabilitation is taking place, a function normally undertaken by Ministry of Natural Resources inspectors; and develop and maintain a database of existing and abandoned pits and quarries. The database will keep track of the progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, and effects on water resources and ecosystem integrity. According to one interviewee who is a Town planner, there is much resistance on the ground with respect to monitoring dust and noise. First, it is difficult to determine an acceptable level of dust. Second, there are technical difficulties in setting up monitoring systems on site. Third, there is a general attitude among operators that they

should not have to adhere to Caledon's requirements because they are not required in other municipalities and because operators have never before had to adhere to them.

According to one interviewee who was a planner for the Town of Caledon during this time, the potential social-ecological impacts of the Rockfort Quarry land use issue profoundly influenced the development of OPA 161. As the planners revised the policies, one eye was always kept on the implications that the policies would have on the Rockfort Quarry application. The Rockfort Quarry site, for example, is situated within a Reserve area, in the middle of the Credit River watershed. The site is nestled between the base of the Paris Moraine to the north and the Niagara Escarpment to the south. Adjacent to the site are two Areas of Natural and Scientific Interest and two Provincially Significant Wetlands are in the immediate vicinity. The Jefferson salamander, Western Chorus Frog, Blandings Turtle, and Butternut trees are among the species at risk living in the area. The proposal is for extraction to a depth of 23 to 39 meters (128 feet) below the water table. One especially controversial aspect of the proposal includes the use of a grout curtain to reduce the flow of groundwater during extraction. Installation of the grout curtain involves drilling holes into the rock and then filling them with grout. The grout fills the holes and the natural fractures of the rock and then hardens to a solid, reducing water flow by reducing the hydraulic conductivity of the rock mass. According to one interviewee who lives in Caledon, residents who live near the site fear that the carcinogens in the grout will contaminate their well water. At a March 2009 public Town Council meeting, one Councilor argued that JDCL's extraction proposal is a "Walkerton" crisis begging to happen. Moreover, there is also a high level of uncertainty associated with how the Rockfort site is connected to adjacent cold-water fishery streams, wetlands and surface water features. During the development of OPA 161, then, the planners continually asked themselves, "Are we going to be able to achieve a proper evaluation of Rockfort with these policies?" They aimed to develop policies that would allow the Town to reject an application like Rockfort.

In November 2003, the Ontario Municipal Board hearing commenced about whether JDCL's quarry application should be assessed under Caledon's 1981 policies or the new policies enacted under OPA 161. The key appellants were JDCL, the Town of Caledon, the Region of Peel, the Niagara Escarpment Commission, and the Coalition. JDCL wanted the Ontario Municipal Board to enact the "Clergy Principle", which is based on a long-standing interpretation of fairness at the Ontario Municipal Board. It rests on the notion that "every

applicant is entitled to have their application evaluated on the basis of the laws and policies that existed on the date that the application was made" (Ontario Municipal Board, 2003, p.1). According to JDCL, the Board should consider the new policies but not evaluate the application under the new policies. JDCL sought relief from the new, more stringent, study requirements, prioritization scheme, and transportation policies set out by OPA 161. The Town, Region, Niagara Escarpment Coalition, and Coalition of Concerned Citizens, however, insisted that the new policies should be determinative. They explicitly challenged the *Clergy* institution by arguing that it is a kind of procedural policy or practice as opposed to an absolute rule. Second, they argued that the formulation of OPA 161, in which JDCL was a participant, had started with the *Caledon Community Resource Study*, in which JDCL was also a participant. OPA 161 was a continuation of the *Caledon Community Resource Study*, which represented a new regime for aggregate management in Caledon. JDCL, therefore, was well aware of the changing local policy framework. But instead of embracing it, they resisted it. Third, they recognized the duty of the Board to balance private interests with public interests and so appealed to the Board's "logic of appropriateness":

> …Applying the most recent, more stringent policies would simply represent good planning as it is now known, understood and practiced…It will not be sufficient, in order to achieve an acceptable standard of planning and environmental management, to comply with the study requirement provided in the Town's 1981 Official Plan (Ontario Municipal Board, 2003, p. 7-10).

In the end, the Board sided with the Town, agreeing that the *Clergy* principle is not a law or inviolate rule. Moreover, the Board decided for the Town that applying the *Clergy* principle in the Rockfort case would effectively ignore the appropriateness of current practices and policies in favour of 20-year-old policies.

The Ontario Municipal Board's November 2003 decision for the Town was a major milestone in the community's campaign against the Rockfort quarry. As per the directives laid out in OPA 161 for aggregate extraction proposals in Reserve Areas, JDCL was required to update its site-specific studies and undertake a Comprehensive Broader Scale Environmental Study (CBSES). The company agreed to begin preparing the CBSES even though the status of the lands was still deferred. Major deficiencies have since been found in JDCL's reports, especially with respect to hydrological studies and the Adaptive Water Management Plan. Overall, the predicted impacts of JDCL's proposed project on water quality and quantity,

surrounding natural habitat, and hydrogeology have been determined to be unacceptable. As per the permission of OPA 161, then, the Niagara Escarpment Commission, Credit Valley Conservation Authority, Wellington County, Region of Peel, and the Town of Caledon have taken formal positions against JDCL's application.

The full Ontario Municipal Board hearing on the status of JDCL's Official Plan and Zoning By-Law Amendments is scheduled to begin on September 15, 2009 and will take place over six weeks. Although many variables will undoubtedly contribute to the final outcome of the Ontario Municipal Board hearing, in many ways JDCL's Rockfort Quarry application has been a good test of OPA 161. The proof with respect to OPA 161's capacity to protect community interests from such applications in Reserve Areas is in the fact that the major local players were able to reject the Rockfort application based on their dissatisfaction with the CBSES and other studies. Because the *Provincial Policy Statement* and the *Ontario Planning Act* favour aggregate extraction over other land uses, however, Caledon's policies are vulnerable to Ontario Municipal Board decisions.

According to interviewees representing the Ministry of Municipal Affairs and Housing and Caledon planning staff, OPA 161 has affected and continues to impact the aggregate resources policies of other Municipalities in the GGH Region. One of the key planners involved in developing OPA 161, for example, now works in Woolwich Township in the Region of Waterloo. This planner has incorporated Caledon's OPA 161 policies that distinguish between above and below water table extraction and associated study requirements into Woolwich's Official Plan. Because the Region of Waterloo is currently undertaking a review of its ROP, this planner is attempting to influence the Regional-level aggregate extraction policies, especially with respect to ensuring that the Region's HPMARA map is clearly an identification tool as opposed to a designation tool. According to a planner for the Town of Caledon, the County of Wellington Planning Committee has asked Caledon's planners to do a presentation on OPA 161 to explain the policies to them. According to one interviewee who represents the Province, other such major aggregate supplying municipalities as Clarington in the Region of Durham, and the Township of Oro-Medonte in Grey County are currently reviewing Caledon's approach. Any diffusion of Caledon's mineral resources policies may contribute to progress towards sustainability across local to provincial scales. OPA 161 is examined in light of requirements for progress towards local, regional, and provincial sustainability, below.

CHAPTER 6: OPA 161 and progress towards sustainability

6.1 Introduction and methods

This chapter analyses Caledon's OPA 161 for steps towards local-to-provincial sustainability. Since the rise to popularity of the concept of sustainability in the mid 1980s, many governments, businesses, and civil society organizations around the world have officially embraced it, though not clearly on the basis of a widely shared understanding of the concept or its implications. There are many theoretical and practical approaches to understanding and pursuing sustainability. Dobson's (1996) review and typology, for example, found more than 300 definitions of the concept, ranging from "weak" to "eco-centric" views. This has led some scholars to argue that the concept is still dangerously vague (eg. Mebratu, 1998; Faber et al., 2005). Gibson et al. (2005), however, argue that after two decades of deliberation and experience common concerns and principles are now discernible.

This study adopts Gibson et al.'s (2005) essentials of the concept of sustainability. They were derived from a thorough review of the theoretical literature. The essentials that Gibson et al. chose for their understanding are underpinned by their intention to delineate "…those that lie at the core of the idea and that should inform its application anywhere" (p. 59). They are rooted in the origins of the concept and are apparent in a variety of interpretations. Box 4, below, depicts Gibson et al.'s essentials of the concept of sustainability.

Box 4. The essential elements of the concept of sustainability

(Gibson et al., 2005, p. 62)

The concept of sustainability is:

- a challenge to conventional thinking and practice;
- about long- as well as short-term well-being;
- comprehensive, covering all the core issues of decision making;
- a recognition of links and interdependencies, especially between humans and the biophysical foundations for life;
- embedded in a world of complexity and surprise, in which precautionary approaches are necessary;
- a recognition of both inviolable limits and endless opportunities for creative innovation;
- about an open-ended process, not a state;
- about intertwined means and ends – culture and governance as well as ecology, society and economy;
- both universal and context dependent.

Based on these essential elements and an examination of various applications of sustainability around the world, Gibson et al. (2005) developed a set of core decision-making criteria for sustainability. Individually and as a whole, these criteria describe what is required for progress towards sustainability. They represent the full range of social, economic, political, and ecological concerns that influence the long-term well being of social-ecological systems. Box 5, below, depicts Gibson et al.'s core decision-making criteria for sustainability.

Box 5. Core decision-making criteria for sustainability

(Gibson et al., 2005, p.116)

Socio-ecological system integrity:
Build human-ecological relations to establish and maintain the long-term integrity of socio-biophysical systems and protect the irreplaceable life support functions upon which human as well as ecological well-being depends.

Livelihood sufficiency and opportunity:
Ensure that everyone and every community has enough for a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity.

Intragenerational equity:
Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor.

Intergenerational equity:
Favour present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.

Resource maintenance and efficiency:
Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.

Socio-ecological civility and democratic governance:
Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision making practices.

Precaution and adaptation:
Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise and manage for adaptation.

Immediate and long-term integration:
Apply all principles of sustainability at once, seeking mutually supportive benefits and multiple gains.

For practical applications, Gibson et al.'s criteria need to be specified for the particular context, in this case the current institutional system guiding aggregate extraction in southern Ontario. For this purpose, context-specific factors were drawn from the broadly felt impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system. These factors were categorized appropriately under the sustainability criteria. Caledon's OPA 161 was then evaluated against this context specific set of sustainability requirements. The results illustrate the strengths and insufficiencies of OPA 161 with respect to progress towards sustainability at the local and provincial scales. OPA 161 was then compared with Caledon's older, 1981 Cabinet Corners policies in order to investigate the extent to which the Amendment represents institutional change towards sustainability.

6.2 Broadly felt benefits and negative impacts of the current institutional system guiding aggregate extraction in southern Ontario

Box 6, below, summarizes a specification of the criteria in light of the major, broadly felt, benefits and negative impacts of the current institutional system guiding aggregate extraction in southern Ontario. The points below each criterion were derived mainly from secondary sources, including peer reviewed, academic journal articles, and reports published by nongovernmental environmental organizations, and provincial, municipal, and regional governments. Interviews with the key players involved in the development of OPA 161 also revealed many of the benefits and negative impacts listed below.

Box 6. Broadly felt benefits and negative impacts of aggregate extraction under the current regime

Socio-ecological system integrity:
- Loss and degradation of natural habitat (Winfield & Taylor, 20005)
- Loss and degradation of form and function of hydrological and hydrogeological systems (Winfield & Taylor, 20005)
- Loss and degradation of surface and groundwater quality and quantity (Winfield & Taylor, 2005)
- Inadequacy of progressive and final rehabilitation (Gravel Watch, 2006)
- Air pollution (especially dust and CO_2 emissions from trucks) (Huntzinger & Eatmon, 2009)
- Higher cumulative effects due to lack of phasing in of extraction operations (e.g. many pits are allowed to operate at once, before others close and before rehabilitation is finished)
- Rehabilitation of pits and quarries to other productive land uses, with social and ecological benefits (Ontario Stone, Sand & Gravel Association, 2006)

Livelihood sufficiency and opportunity:
- Costs of road construction and maintenance of haul routes (Dorfman, 2009)
- Costs of damage to cultural and natural heritage (e.g. hydrological and hydrogeological systems, surface water quality and quantity) (Centre for Spatial Economics, 2009)
- Costs of damage to private property and property values (Centre for Spatial Economics, 2009)
- Costs of administration and conflict resolution (e.g. legal and consultant fees)
- Loss of use of prime agricultural land for food production (K. Smart Associates, 2008)
- Priority given to aggregate extraction over other land uses (Winfield & Taylor, 2005)
- Local employment opportunities (Ontario Stone, Sand & Gravel Association, 2006b)
- More affordable building and infrastructure construction (Ontario Stone, Sand & Gravel Association, 2006b)
- Tax revenues and economic multiplier effects from the industry and its employees (Ontario Stone, Sand & Gravel Association, 2006b)

Intragenerational equity:
- Local communities must deal with all immediate and cumulative effects (noise, vibrations, dust, truck traffic, safety and health issues)
- Insufficient licence and permit fees (Toronto Environmental Alliance, 2009)
- Centralized regulation of the industry by the industry and the provincial government (Baker et al., 2001)

Intergenerational equity:
- Inadequacy of progressive and final rehabilitation
- Higher cumulative effects due to lack of phasing in of extraction operations (e.g. many pits are allowed to operate at once, before others close and before rehabilitation is finished)
- Loss of natural and cultural heritage resources
- Loss of use of prime agricultural land for food production
- Depletion of a valuable resource (aggregates near urban demand)

Resource maintenance and efficiency:
- Inadequacy of progressive and final rehabilitation
- Absence of aggregates demand management (Toronto Environmental Alliance, 2009)
- Facilitation of urban and suburban sprawl
- Lower GHG emissions with short fun aggregates transportation
- Rehabilitation of pits and quarries to other productive land uses, with social and ecological benefits

Socio-ecological civility and democratic governance:
- Lack of funding for individual intervenors in Ontario Municipal Board hearings (Ontario Greenbelt Alliance, 2007)
- Insufficient time allotted for public comment on site plans and reports (Ontario Greenbelt Alliance, 2007)
- Lack of transparency with respect to the amount of aggregate produced/pit or quarry (Toronto Environmental Alliance, 2009)
- Centralized regulation of the industry by the industry and the provincial government
- Lack of public participation in decision making
- Priority to aggregate extraction land uses reinforced by Provincial Policy Statement and Planning Act (Winfield & Taylor, 2005)
- Insufficient Ministry of Natural Resources staffing and expertise to inspect sites (Environmental Commissioner of Ontario, 2007)
- Insufficient funding for the Ministry of Natural Resources to administer the aggregate resources program (e.g. site inspection) (Environmental Commissioner of Ontario, 2007)

Precaution and adaptation:
- Use of unproven technologies to mitigate negative impacts of extraction (e.g. grout curtain)
- Insufficient understanding of the complex biophysical systems affected by aggregate extraction and the long-term cumulative impacts of aggregate extraction

Immediate and long-term integration:
- Little integration of aggregates sustainability considerations in overall growth management planning
- Limited explicit attention to trade-offs

The vision for "Green Gravel" advanced by many advocates of sustainability has emerged out of the context of the above, broadly felt benefits and negative impacts of the prevailing institutional system guiding aggregate extraction in southern Ontario.

6.3 Green Gravel: An alternative vision for aggregate extraction in Ontario

As previously described in section 5.4, other jurisdictions (e.g., United Kingdom, Sweden, Denmark) provide excellent illustrations of alternative institutional frameworks for

aggregate resources (see Winfield & Taylor, 2005). This study focuses on priorities for Green Gravel in Ontario, which have been set out by the Ontario Greenbelt Alliance (2007) and Toronto Environmental Alliance (2009). Winfield and Taylor's recommendations for an aggregate conservation strategy in Ontario are also considered here. As previously described, Green Gravel objectives represent some of the local-to-provincial changes that are required to reform the prevailing institutional system guiding aggregate extraction in Ontario. The vision for Green Gravel essentially seeks a reorientation of the current legislative framework away from its current position of allowing unfettered access to the resource close to market. Among other things, it would reduce the demand for the resource, maximize the use of recycled materials, extend broader participation in the management of the resource, and increase the transparency of and access to production data and demand forecasts. The vision for Green Gravel proposes the following:

- lift regulatory barriers to the use of recycled materials;
- develop and implement Provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates;
- implement Provincial policies and guidelines, strategies, etc. for the use of recycled materials for Provincial and Municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and Municipal highway specifications);
- modify the *Provincial Policy Statement* to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas;
- amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them;
- strengthen the *Aggregate Resources Act* to require at least 50% of rehabilitation in one licenced area before the expansion of an existing operation or a new operation by the same owner in a particular Municipality can occur;
- phase in new extraction operations so that existing licences are optimized before new licences are granted;
- allow more time in addition to the 45 days provided by the *Aggregate Resources Act* for public review of licence and permit applications;

- provide intervenor funding for the application review process;
- increase public access to application documents (site plans, technical reports, background studies, etc.);
- impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)
- eliminate perpetual licences and permits and unlimited annual tonnage allowances;
- increase capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections;
- require greener modes of transport of the resource (boat, barge, rail);
- introduce mandatory standards and monitoring for dust and carbon dioxide; and
- create an independent Provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply.

The extent to which institutional change towards sustainability has occurred in Caledon's OPA 161 policies depends, in part, on the extent to which they help to achieve this vision for Green Gravel. The above Green Gravel priorities represent progress towards sustainability in many areas. Box 7, below, summarizes a specification of the criteria in light of the contributions of Green Gravel to Gibson et al.'s sustainability requirements.

Box 7. Contributions of Green Gravel to progress towards sustainability

Socio-ecological system integrity:

- Modify the Provincial Policy Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas
- Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them
- Strengthen the *Aggregate Resources Act* to require at least 50% of rehabilitation in one licenced area before the expansion of an existing operation or a new operation by the same owner in a particular Municipality can occur
- Require greener modes of transport of the resource (boat, barge, rail)
- Introduce mandatory standards and monitoring for dust and carbon dioxide

Livelihood sufficiency and opportunity:

- Impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)

Intragenerational equity:

- Allow more time in addition to the 45 days provided by the *Aggregate Resources Act* for public review of licence and permit applications
- Provide intervenor funding for the application review process
- Impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)

Intergenerational equity:

- Modify the Provincial Policy Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas
- Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them
- Impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)

Resource maintenance and efficiency:

- Develop and implement provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates
- Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and municipal highway specifications)
- Strengthen the *Aggregate Resources Act* to require at least 50% of rehabilitation in one licenced area before the expansion of an existing operation or a new operation by the same owner in a particular Municipality can occur
- Eliminate perpetual licences and permits and unlimited annual tonnage allowances
- Phase in new extraction operations so that existing licences are optimized before new licences are granted
- Impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)
- Require greener modes of transport of the resource (boat, barge, rail)

Socio-ecological civility and democratic governance:

- Allow more time in addition to the 45 days provided by the *Aggregate Resources Act* for public review of licence and permit applications
- Provide intervenor funding for the application review process
- Increase public access to application documents (site plans, technical reports, background studies, etc.)
- Increase capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections
- Create an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply

Precaution and adaptation:

- Create an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply
- Introduce mandatory standards and monitoring for dust and carbon dioxide

Immediate and long-term integration:

- Lift regulatory barriers to the use of recycled materials
- Develop and implement provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates
- Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and Municipal highway specifications)
- Create an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply
- Increase capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections

An in-depth sustainability assessment of Green Gravel priorities is beyond the scope of this study. Briefly, as illustrated above, Green Gravel priorities take significant steps towards sustainability at the local and provincial scales. In particular, the objectives to amend the Aggregate Resources Act and the Provincial Policy Statement, etc., and implement higher fees for extraction take steps towards protecting and enhancing *Socio-Ecological System Integrity, Livelihood Sufficiency and Opportunity,* and *Inter-* and *Intragenerational Equity*. Also, many Green Gravel objectives (e.g. regulated use of recycled aggregates, increase in extraction fees, conservation strategy, infrastructure and building design standards, greener modes of transport, more stringent rehabilitation requirements) take immediate steps towards *Resource Maintenance and Efficiency*. Intervenor funding, more time for public review, increased public accessibility to application documents, increased capacity of the Ministry of Natural Resources to conduct inspections, and the creation of an independent provincial authority to collect and maintain publicly accessible production statistics address most of the broadly felt impacts under the *Social-Ecological Civility and Democratic Governance* criterion. Green Gravel objectives, however, do not take significant steps towards fulfilling the *Precaution and Adaptation* sustainability requirement. The vision for Green Gravel, for example, does not consider the risks associated with some of the technologies that proponents of extraction propose to use to mitigate certain environmental impacts. Many of these technologies (e.g. grout curtain) are unproven and/or have no long-term performance track record. Additionally, although they require more

transparency with respect to publicly accessible application documents, they do not fully address the need for a better understanding of the complex biophysical systems affected by aggregate extraction and the long-term cumulative impacts of aggregate extraction. Funded research on immediate, long term, and cumulative impacts would address this need.

Regardless of these weaknesses, realization of the above Green Gravel priorities would cause a "cascading effect" through the prevailing institutional system. Among other effects, the proposed changes to the Greenbelt Act and Plan, and consultation process would force a change in the Aggregate Resources Act, Provincial Policy Statement and Regional and Municipal Official Plans. Relationships between stakeholders and the balance of power would shift from the industry and the provincial government to the province and the general public. Pressure for alternative transportation methods and to prohibit extraction in the Greenbelt, Niagara Escarpment, and Oak Ridges Moraine areas would chip away at the "unfettered access to the resource close to demand" norm that has existed since the 1960s. Changes in building standards would impact sectors beyond the aggregates industry, notably developers. For major aggregate producing Towns like Caledon, these changes would decrease the number of pits and quarries operating within their jurisdiction at one time and reduce the pressure that extraction operations exert on surrounding social-ecological systems.

6.4 OPA 161 and progress towards local to provincial sustainability

Caledon's OPA 161 was evaluated against a set of context specific evaluation criteria. They integrate attention to Gibson et al.'s (2005) basic generic sustainability objectives, the above-described broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system. Box 8, below, summarizes the context specific criteria. Some overlap among the categories has been retained to illustrate the interconnected nature of sustainability requirements. Intervenor funding for the application review process for extraction operations, for example, would take steps towards multiple sustainability objectives. An asterisk (*) marks the Green Gravel priorities for reform of the provincial institutional system. They are marked in order to emphasize the criteria that, if addressed by OPA 161, represent steps towards sustainability at the provincial scale.

Box 8. Sustainability assessment criteria specified for the case and context of the institutional system guiding aggregate extraction in southern Ontario

Socio-ecological system integrity

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Loss and degradation of natural habitat (Winfield & Taylor, 20005)
- Loss and degradation of form and function of hydrological and hydrogeological systems (Winfield & Taylor, 20005)
- Loss and degradation of surface and groundwater quality and quantity (Winfield & Taylor, 2005)
- Air pollution (especially dust and CO_2 emissions from trucks)
- Loss of farmland for food production (K. Smart Associates, 2008)
- Inadequacy of progressive and final rehabilitation (Gravel Watch, 2006)
- Higher cumulative effects due to lack of phasing in of extraction operations (e.g. many pits are allowed to operate at once, before others close and before rehabilitation is finished)
- Rehabilitation of pits and quarries to other productive land uses, with social and ecological benefits (Ontario Stone, Sand & Gravel Association, 2006)
- *Modify the Provincial Policy Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas
- *Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them
- *Introduce mandatory standards and monitoring for dust and carbon dioxide
- *Strengthen the *Aggregate Resources Act* to require at least 50% of rehabilitation in one licenced area before the expansion of an existing operation or a new operation by the same owner in a particular Municipality can occur
- *Require greener modes of transport of the resource (boat, barge, rail)

Livelihood sufficiency and opportunity

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Costs of road construction and maintenance of haul routes (Dorfman, 2009)
- Costs of damage to cultural and natural heritage (e.g. hydrological and hydrogeological systems, surface water quality and quantity) (Centre for Spatial Economics, 2009)
- Costs of damage to private property and property values (Centre for Spatial Economics, 2009)

- Costs of administration and conflict resolution (e.g. legal and consultant fees)
- Loss of use of prime agricultural land for food production (K. Smart Associates, 2008)
- Priority given to aggregate extraction over other land uses (Winfield & Taylor, 2005)
- Insufficient licence and permit fees
- Local employment opportunities (Ontario Stone, Sand & Gravel Association, 2006b)
- More affordable building and infrastructure construction (Ontario Stone, Sand & Gravel Association, 2006b)
- Tax revenues and economic multiplier effects from the industry and its employees (Ontario Stone, Sand & Gravel Association, 2006b)
- *Impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)
- *Provide intervenor funding for the application review process

Intragenerational equity

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Local communities must deal with all immediate and cumulative effects (noise, vibrations, dust, truck traffic, safety and health issues)
- Insufficient licence and permit fees (Toronto Environmental Alliance, 2009)
- *Provide intervenor funding for the application review process

Intergenerational equity

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Inadequacy of progressive and final rehabilitation
- Higher cumulative effects due to lack of phasing in of extraction operations (e.g. many pits are allowed to operate at once, before others close and before rehabilitation is finished)
- Loss of natural and cultural heritage resources
- Loss of use of prime agricultural land for food production
- Depletion of a valuable resource (aggregates near urban demand)
- *Modify the Provincial Policy Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas
- *Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them
- *Impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)

Resource maintenance and efficiency

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Inadequacy of progressive and final rehabilitation
- Absence of aggregates demand management (Toronto Environmental Alliance, 2009)
- Facilitation of urban and suburban sprawl
- Lower GHG emissions with short run aggregates transportation
- Rehabilitation of pits and quarries to other productive land uses, with social and ecological benefits
- *Develop and implement provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates
- *Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and municipal highway specifications)
- *Strengthen the *Aggregate Resources Act* to require at least 50% of rehabilitation in one licenced area before the expansion of an existing operation or a new operation by the same owner in a particular Municipality can occur
- *Eliminate perpetual licences and permits and unlimited annual tonnage allowances
- *Phase in new extraction operations so that existing licences are optimized before new licences are granted
- *Impose higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)
- *Require greener modes of transport of the resource

Socio-ecological civility and democratic governance

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Lack of transparency with respect to the amount of aggregate produced/pit or quarry (Toronto Environmental Alliance, 2009)
- Centralized regulation of the industry by the industry and the provincial government
- Lack of public participation in decision making
- Priority to aggregate extraction land uses reinforced by Provincial Policy Statement and Planning Act (Winfield & Taylor, 2005)
- Insufficient Ministry of Natural Resources staffing and expertise to inspect sites (Environmental Commissioner of Ontario, 2007)
- Insufficient funding for the Ministry of Natural Resources to administer the aggregate resources program (e.g. site inspection) (Environmental Commissioner of Ontario, 2007)
- *Allow more time in addition to the 45 days provided by the *Aggregate Resources Act* for

public review of licence and permit applications
- *Intervenor funding for the application review process
- *Increased public accessibility to application documents (site plans, technical reports, background studies, etc.)
- *Increased capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections
- *Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply

Precaution and adaptation

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Use of unproven technologies to mitigate negative impacts of extraction (e.g. grout curtain)
- Insufficient understanding of the complex biophysical systems affected by aggregate extraction and the long-term cumulative impacts of aggregate extraction
- *Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply
- *Introduce mandatory standards and monitoring for dust and carbon dioxide

Immediate and long-term integration

How does OPA 161 address the following broadly felt, negative social-ecological impacts of the institutional system; current provincial and industry claims about the benefits of the institutional system; and Green Gravel priorities for reform of the provincial institutional system?

- Little integration of aggregates sustainability considerations in overall growth management planning
- Limited explicit attention to trade-offs
- *Lift regulatory barriers to the use of recycled materials
- *Develop and implement provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates
- *Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and Municipal highway specifications)
- *Create an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply
- *Increase capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections

Results indicate that OPA 161's greatest steps towards local sustainability are in protecting and enhancing *Social-Ecological System Integrity* (see Appendix C, Table 2). This reflects the Town's intention to develop policies that would protect the natural and cultural heritage resources that are so vital to its socioeconomic and cultural identity. Key policies in this regard include the prioritization policies, policies that allow approval authorities to reject an application based on unacceptable impacts, comprehensive study requirements for applications in Resource and Reserve areas and other Environmental Policy Areas, two Extractive Industrial designations, prohibition of extraction in Core Areas of Peel's Greenlands system, kettle lakes and their catchments; monitoring requirements, and Rehabilitation Master Plan requirements. These policies addressed many of the locally felt negative impacts of pits and quarries in this category (e.g. loss and degradation of natural habitat, hydrological and hydrogeological systems, groundwater quality). However, they did not address most of the provincial-scale sustainability objectives in this category, notably modification of the Provincial Policy Statement and other such land use planning laws and policies as the Greenbelt Act and Plan, etc., and mandatory standards and monitoring of carbon dioxide. Current provincial legislative constraints and a lack of direction from the province on certain sustainability priorities for aggregate extraction and consumption stand as major roadblocks to more substantive progress towards local-to-provincial sustainability in this category. Moreover, in developing OPA 161, key stakeholders were understandably most concerned with the local social-ecological impacts of aggregate extraction operations.

It should be noted too that the strength of OPA 161's prioritization scheme in the above-mentioned and other sustainability requirements is more informal than formal. OPA 161 allows for extraction in both Resource and Reserve areas and in other Environmental Policy Areas. However, applications for extraction in Reserve areas and other Environmental Policy Areas are subject to additional, more onerous and costly study requirements, and informally higher standards for approval. The prioritization scheme and additional study requirements, then, may help to establish an unwritten code of conduct among Town and industry players based on the understanding that if a proponent of an aggregate development applies for a license to quarry in a Resource area, he or she will have a far easier time in getting approval than if the proponent applies for a license in a Reserve area or Environmental Policy Area. Moreover, if prioritization is successful, many existing and new pits and quarries located in resource areas will have had

more time to undergo progressive and final rehabilitation before extraction occurs in Reserve areas.

By extension, the above-mentioned key policies take some steps towards protecting and enhancing local livelihood sufficiency and opportunity and intra- and intergenerational equity. Notably, if the above policies are successful, some of the external costs of aggregate extraction operations will be reduced in Caledon (costs of road construction, damage to private property). Also, the requirement for proponents to pay for the costs of an independent peer review of reports reduces the administrative costs associated with the review process, and by extension, protects and enhances these sustainability requirements in Caledon. Many broadly felt negative impacts and provincial-scale sustainability objectives in these categories, however, remain unaddressed by OPA 161. Notably, OPA 161 did not address the loss of use of prime agricultural land for food production, insufficient licence and permit fees, lack of intervenor funding for the application review process, and the need for higher charges for extraction. Moreover, the above policies do not change the nature of aggregate extraction operations. The predicted and unpredicted impacts of a pit below the water table, for example, will exist regardless of the quality and quantity of required studies. In this way, the above policies can only reduce the negative impacts of extraction by avoiding them. The benefits of extraction in these sustainability categories (e.g. local employment opportunities) were also unaddressed. Again, current provincial legislative constraints and a lack of direction from the province on sustainability priorities for the management of prime aggregate resources stand as roadblocks to more substantive progress towards local-to-provincial sustainability in these categories. Moreover, OPA 161's lack of progress towards sustainability beyond Caledon reveals the Town's preoccupation with local concerns, especially to protect valued natural and cultural heritage. It may also reveal a lack of awareness of broader social equity issues. Indeed, the concept of *sustainability*, as it is defined by this study, did not explicitly guide the development of OPA 161.

For similar reasons, again, OPA 161 did not contribute significantly to Gibson et al.'s *Resource Maintenance and Efficiency,* and *Social-Ecological Civility and Democratic Governance* sustainability criteria. Notably, with respect to efficient use of aggregates, OPA 161 does not facilitate the development of an aggregates demand management strategy for Caledon. Nor does it develop policies that encourage infrastructure and building design standards that

reduce the need for aggregates. If successful, the prioritization policies, however, may enhance resource maintenance and efficiency by phasing in extraction operations and allowing more time for rehabilitation.

OPA 161 takes some steps towards facilitating more public participation in the application review process. One key policy in this regard is the requirement for a pre-submission consultation meeting with the proponent and other relevant approval agencies. Prior to OPA 161, proponents could submit their Official Plan and Zoning By-Law amendment application packages without first consulting with the municipality about potentially important community concerns. Now, there will presumably be more direct communication between the Town and the aggregates industry with respect to unacceptable impacts, study requirements and standards. This pre-consultation requirement is underpinned by the Town's desire to maintain some control over the management of the resource, protect valued natural and cultural heritage, and maintain a balanced approach to land use planning and natural resource management.

Another key policy that takes steps towards facilitating more public participation in the application review process is the requirement to make all reports and detailed site plans available to the public. One interviewee who is a member of the Coalition of Concerned Citizens asserts that access to site plans and reports is essential in that it helps to educate the public about the impacts of extraction and the biophysical systems that will be affected by a particular extraction operation. The Coalition, for example, has borrowed information from JDCL's reports in order to highlight unacceptable impacts through peer reviews. One effect of publicly accessible site plans and reports, then, is to empower concerned citizens in their efforts to protect valued community assets. Again, due to provincial legislative constraints, OPA 161 cannot take steps towards provincial-scale objectives to extend broader participation in the centralized regulation of the industry, empowering the Ministry of Natural Resources to better administer the Aggregate Resources Program through increased funding for site inspections and enforcement, and increasing the transparency in the amount of aggregate produced per pit or quarry. The Ontario Aggregate Resources Corporation, for example, publishes yearly production statistics but municipalities cannot ask individual site operators for monthly production records due to corporate privacy laws.

OPA 161's comprehensive study requirements may over the long-term take steps towards a better understanding of the immediate and cumulative social and biophysical impacts of pits

and quarries. This understanding may help to facilitate a more precautionary and adaptive approach in the management of aggregate resources. The requirement for two Extractive Industrial designations, one for above the water table and one for below the water table, encourages a more adaptive approach to management. If an operator, for example, applies for an extension of an existing pit to below the water table, an additional Zoning By-Law amendment and additional studies are required. Depending on the information provided by the studies, under OPA 161 the extension may not be approved. Also, OPA 161's approval policies allow for the rejection of projects that involve high levels of uncertainty and/or the use of unproven technologies. In JDCL's case, for example, two major issues that led local approval authorities to reject the application included uncertainty surrounding the quarry's impacts on immediate and surrounding hydrological and hydrogeological systems. This is an area where groundwater from the Paris Moraine flows rapidly down a steep slope towards JDCL's site. There is fear that the amount of pressure from groundwater flow in this area would exceed JDCL's capacity to pump and to mitigate any impacts to the water table. Secondly, there is a high level of uncertainty about the grout curtain technology. As previously noted, many Town Councilors fear the grout curtain will not hold for very long against the groundwater pressure, and contaminate nearby wells.

Finally, OPA 161 did not address any of the factors listed under the *Immediate and Long-Term Integration* criterion. Notably, OPA 161 does not incorporate the integration of aggregates sustainability considerations in overall growth management planning. It does not begin to lift institutional barriers to the use of recycled materials, and it does not develop and implement provincial guidelines, etc. to reduce the need for aggregates and promote the efficient use of the resource. The insufficiencies of OPA 161 in this category are, again, understandable. The above-described provincial constraints, preoccupation with immediate, local concerns and issues, and lack of awareness of sustainability objectives, as defined by this study, contributed to the weaknesses of OPA 161 in this regard.

6.5 Institutional change towards sustainability? Evaluation of Caledon's 2003 OPA 161 against Caledon's 1981 Cabinet Corners policies

An evaluation of OPA 161's policies against the Town of Caledon's 1981 Cabinet Corners policies reveals that in some ways Caledon's Cabinet Corners policies represent, at least

potentially, more substantive steps towards sustainability objectives (see Appendix C, Table 3). For example, Caledon's Cabinet Corners policies are stronger than the OPA 161 policies in that they did not have to incorporate the provincial HPMARA map for Peel Region. Rather, the Town in the early 80s fought to draw strict boundaries around a particular area where the Town would "have regard to" the necessity to preserve lands for future extraction. This area was much smaller than the 1996 HPMARA map area and it ensured that extraction operations would be located near appropriate haul routes, where most extraction was already occurring, and away from sensitive lands and settlement areas. Second, under the Cabinet Corners policies, in considering Official Plan Amendments for extraction purposes, the Town could consider the need for extraction and whether a particular project would interfere with the Town's objective to "preserve and encourage agricultural activity and maintain the scenic and rural character of the Municipality in maintaining a land use balance between competing land uses including extractive uses" (Town of Caledon, 1983, p.95). Third, the 1981 policies explicitly stated that, in considering Official Plan Amendments, the Town would give priority to existing and approved residential development from the negative impacts of new extraction operations. Whether the 1981 policies were effectively authoritative is, however, open to debate. The industry consistently appealed to the Ontario Municipal Board when it received unfavourable decisions from the Town based on the 1981 policies, and typically the Ontario Municipal Board sided with the industry in its rulings in these cases. The negotiations leading the OPA 161 were initiated, in part, to reduce uncertainties and Ontario Municipal Board appeal costs by establishing actually authoritative aggregates policies.

The above Cabinet Corners policies were significantly diluted and/or eliminated completely through the Ontario Municipal Board settlement negotiations for Peel's 1996 ROP and, later, OPA 161. The demonstration of need requirement, for example, was eliminated from Peel's 1996 ROP and, later, the original draft of OPA 161 due to resistance from the province and the industry. The objective to preserve and encourage agricultural activity and maintain the scenic and rural character of the municipality in maintaining a land use balance between competing land uses was diluted in OPA 161 in two ways. First, the wording changed to "ensure that the extraction of aggregate resources is undertaken in a balanced manner…which will recognize Caledon's community character and social values over the short and long term" (Town of Caledon, 2004, 5-105). The language in OPA 161 is more flexible in that is allows for a

broader range of interpretations of "community character" and "social values". Second, in contrast to the Cabinet Corners policies, the objective was not presented as something the Town could consider when reviewing applications for Official Plan Amendments for extraction. Rather, it is presented in OPA 161 merely as a Town-wide objective. Additionally, the objective to give priority to existing and approved residential development from the negative impacts of new extraction operations was not carried over from Cabinet Corners to OPA 161.

The Town fought throughout the OPA 161 Ontario Municipal Board negotiations to maintain some control over management of the local resource, protect Caledon's cultural and natural heritage, and maintain a balanced approach to aggregate management and land use planning. The Town, for example, pursued these core community values through the refinement of the HPMARA map, the protection of Core Areas of Peel's Greenlands system, kettle lakes and their catchments, and especially by developing the Resource versus Reserve area prioritization strategy. These policies, however, are more a reflection of the Town's responses to the changing provincial legislative framework, subsequent imposition by the province of the HPMARA map, and provincial rejection of Caledon's Cabinet Corners policies. The above policies therefore do not represent a significant change towards sustainability when compared to Caledon's Cabinet Corners policies. Nor do they reflect a significant change in the values of the Town. Local control over and a balanced approach to land use planning and natural resource management have persisted in the Town for generations, and have underpinned the Town's readiness to go to the Ontario Municipal Board over aggregate extraction issues. While the above policies do take steps towards the previously described sustainability requirements, then, they are more a reflection of the ingenuity of the Town to find creative ways to maintain core community values under new, increasingly unfriendly provincial constraints.

OPA 161 does represent incremental institutional change towards sustainability, at least potentially, in its requirements for proponents to pay for independent peer reviews of site plans and reports, undertake pre-consultations with the Town and other approval agencies before submitting an application, and ensuring site plans and reports are publicly accessible through the Town. OPA 161 also takes further steps towards ensuring progressive and final rehabilitation through the requirement for proponents to consider Rehabilitation Master Plans in their applications to the Town and the Ministry of Natural Resources. The intent to develop a database to keep track of all existing and abandoned aggregate operations, however, is not a significant

change from Caledon's 1981 policies, which set out the same aim. Unlike the Cabinet Corners policies, however, OPA 161 incorporates monitoring of truck traffic, noise, dust, and the effects on water resources and ecosystem integrity. The requirement for two different Extractive Industrial Area zoning designations also represents incremental change towards sustainability. Previously, for example, if a site operator wanted to extend a site from above the water table to below the water table, he or she did not have to apply for rezoning at the Municipal level. The level of detail present in OPA 161 with respect to study requirements also represents incremental change towards sustainability in that they empower the Town to take a more precautionary approach to decision-making and raise awareness in the community about the impacts of pits and quarries. OPA 161, then, represents incremental change towards sustainability particularly with respect to protecting and enhancing *Social-Ecological System Integrity, Civility and Democratic Governance,* and *Precaution and Adaptation.*

The above incremental changes are underpinned by the Town's desire to maintain control over the management of the resource. They also reflect a respect for community participation in aggregate-related land use issues. According to one interviewee who was present during the Ontario Municipal Board negotiations for OPA 161, Town Officials and planners have always held community participation in land use issues in high regard. In this way, then, OPA 161 has formally caught up to persistent Town and community values, which were present long before OPA 161 was developed. Transferring of the costs of peer reviews of reports to the industry is underpinned by the Town's knowledge that it will continue to receive applications for extraction as long as it possesses plenty of the prime resource and the Town's experiences in having to pay for expensive application review processes. The detailed study requirements and Rehabilitation Master Plans reflect an increase in knowledge and awareness about the impacts of pits and quarries since the 1981 policies were in place and an increased valuing of vital ecological goods and services. OPA 161 policies also reflect industry-provincial interests in that they allow for extraction to occur in reserve areas, other locally significant areas, and in prime agricultural lands. These policies are underpinned by the "shortage of supply" discourse created by the industry in order to ensure unfettered access to the resource and maintain resource affordability.

Although the above policies represent incremental institutional change towards sustainability, real progress towards sustainability will require the successful implementation of OPA 161 "on the ground". According to the preliminary theoretical propositions, successful

implementation will involve, among other things, sufficient resources, and broad support from private and public sectors. Some aspects of OPA 161 were highly contested by the industry during the Ontario Municipal Board negotiations; therefore, there might be some resistance towards implementing OPA 161 on the ground. With respect to "fit", most of the above mentioned policies (publicly accessible reports, pre-consultations, peer review fees, zoning changes) could be incorporated in the existing local administrative context. But changes in practice, particularly requirements for pre-consultation meetings, monitoring of individual pits and quarries by the Town and the industry, and progressive rehabilitation, require changes in everyday behaviour. Well-established norms of behaviour in the aggregates industry, then, stand as significant challenges to successful implementation of OPA 161.

Institutional change towards sustainability in the prevailing institutional system guiding aggregate extraction in southern Ontario may occur through mechanisms beyond and in addition to implementation of Green Gravel objectives. OPA 161 has and continues to influence the aggregate resources policies of other municipalities in the GGH Region. The diffusion of some of OPA 161's policies, then, may also contribute to institutional change towards sustainability across local to provincial scales. More research is required to determine the extent to which diffusion is occurring.

Finally, the positive changes in OPA 161 are a reflection of the strong commitment and growing sophistication and innovation on the part of the Town to protect and maintain core community values under new, increasingly unfriendly provincial constraints. They also reflect continuing quite effective resistance to change on the part of the industry, Ministry of Natural Resources and Ministry of Municipal Affairs and Housing. OPA 161 could have taken greater steps towards sustainability if industry and provincial stakeholders had accepted the Town's original prioritization strategy, independent social impact study, and demonstration of need policies. Through the lens of the theoretical framework developed by this study, Chapter 7, below, discusses why these and other policies were rejected and/or embraced.

CHAPTER 7: Understanding and explaining institutional change and resistance to change

7.1 Introduction and methods

This section analyses institutional change and resistance to change towards sustainability in the development of OPA 161 through the lens of the combined preliminary theoretical propositions. Informal, semi-structured, face-to-face interviews, Ontario Municipal Board rulings, Town and Regional planning documents, community websites and newsletters, newspaper articles and articles from *In the Hills: A Magazine of Country Living in Erin, Caledon, Mono and Mulmur* informed this discussion. The discussion centers on the original, more substantive OPA 161 policies that were the subjects of negotiation during the 2000-2003 Ontario Municipal Board hearings: the prioritization of lands for extraction, the requirements for a Comprehensive Broader Scale Environmental Study for applications for extraction in Reserve areas, an independent social impact study, and demonstration of need for extraction. It also considers the Ontario Municipal Board settlement negotiations for Peel's first ROP and the Ontario Municipal Board's decision for the Town to allow OPA 161 to be applied in the Town's evaluation of JDCL's application. This discussion will lead to an analysis of the strengths and limitations of the preliminary theoretical propositions, recommendations for refinement of the propositions, and future research directions. Each of the theoretical propositions is discussed in turn.

7.2 Interests, appropriateness and legitimacy

Proposition: *Actors may resist or facilitate institutional change in order to maximize individual and/or collective interests and/or to achieve cultural appropriateness and legitimacy as defined by a particular, culturally embedded institutional environment. An actor's interests are determined, in part, by the institutional system and by long-term historic processes (e.g. socialization).*

Economic interests clearly played a determinative role in the development of OPA 161. In 1996, the Town initiated the *Caledon Community Resources Study* because, among other reasons, the major players that had historically been involved in and/or affected by aggregate extraction in Caledon (Town Officials, concerned citizens, members of the aggregates industry) had reached a point where they were willing to come to a consensus on local policies that they

believed would help to avoid costly Ontario Municipal Board hearings.

Additionally, throughout the development of OPA 161, the major argument used by the key provincial agencies (Ministry of Municipal Affairs and Housing and the Ministry of Natural Resources) and key individuals representing the aggregates industry to oppose the original, more substantive policies was that they have the effect of limiting resource availability. Many government agencies (e.g., Ministry of Transportation), the aggregates industry, and other private sector groups (e.g. developers) profit from unfettered access to prime aggregate resources close to demand. It is in their best interests, therefore, to ensure that as much of the resource as possible is available to the industry, especially to keep the costs of gravel low. This economic interest has been reinforced by the industry's "shortage of supply" discourse and institutionalized over the years in land use planning and natural resource management law. The aggregates industry and key provincial ministries also profit from a system of centralized control over the management of the resource. Their opposition to the original, more substantive policies of OPA 161, therefore, was essentially political as well as economic. These economic and political interests reflect core industry and provincial values, which are rooted in the intertwined histories of economic growth, profit seeking, urbanization, demand for prime aggregates, and provincial land use planning and natural resource management legislation.

Aside from wanting to avoid costly Ontario Municipal Board hearings, Town planners and officials were concerned with gaining or maintaining local control over aggregate extraction operations, protecting Caledon's natural and cultural heritage (notably Caledon's countryside aesthetic, quality of life, and rural character), serving the interests of ratepayers and residents, and maintaining a balanced approach to land use planning and natural resource management. These economic, political, cultural and ecological interests reflect core Town values, which are rooted in Caledon's custom of having primary control over land use planning and management of natural resources, culture of stewardship and sense of place, and long history of disputes over aggregate extraction related land use issues. Protection and maintenance of these core values underpinned the Town's rejection of the Minister's modifications to Peel's 1996 ROP and the institutional change reflected in OPA 161.

A sense of what is "fair" (or appropriate) also played a role in the development of OPA 161. One interviewee who was a Town planner involved in writing OPA 161 recalls that the planners wanted to develop mineral resources policies that were fair in that they would work to

level the "playing field" between citizens' interests and the interests of the aggregates industry. This Town planner believes that the provincial policy framework unfairly favours the interests of the aggregates industry. This interviewee also asserted that the Town planners also wanted to develop policies that were appropriately robust enough to allow the Town to reject such controversial quarry applications as JDCL's, which propose to undertake extraction in a highly sensitive Reserve area. This latter point demonstrates that concern for protection of Caledon's natural and cultural heritage played a major role in the development of OPA 161. It also demonstrates the role played by Caledon's rich natural heritage in the development of the amendment.

Appropriateness and legitimacy were also considerations in the Ontario Municipal Board case that ended in the Board's ruling for the Town to apply OPA 161 policies in its review of JDCL's application. JDCL rejected the idea that OPA 161 should be determinative because the company did not want to be subjected to new, more onerous and costly study requirements. The Board, however, asserted that the public would not have confidence in an evaluation process that ignored policies and adopted standards that are not current and modern: "The Board considers it appropriate and necessary that the application should satisfy most recent available policies and the best standards of planning and environmental management…This approach represents the best expression of the public's interest in good planning principles and sound planning practice" (Ontario Municipal Board, 2003, p.14). This ruling was based on the Board's interpretation of the *Clergy Principle* as a "…practice meant to promote fairness in the planning process" (p. 11), in stark contrast to a law or inviolate rule to be applied in every circumstance.

7.3 Renegotiation and reinterpretation

Proposition: *Actors may resist or facilitate institutional change through the process of renegotiation and reinterpretation and/or by creating innovative institutions from previously existing institutional elements. These processes lead to path-dependent change because the range of options available to institutional entrepreneurs is constrained by the particular factors (e.g. power relationships, actors' interests, laws and informal norms, etc.) of the existing institutional system.*

Periods of renegotiation and reinterpretation occurred throughout the evolution of Caledon's mineral resources policies. The development of Peel's ROP, for example, involved

resistance on the part of Town planners and officials to the new provincial legislative framework and in particular to the HPMARA map and the Minister's modifications. The mineral resources policies in Peel's original ROP were based on Caledon's 1981 Cabinet Corners policies. The Ministry of Municipal Affairs and Housing, however, rejected these policies on the grounds that they did not give proper regard to provincial interests. Eventually, Peel's modified ROP was appealed to the Ontario Municipal Board where the Ministry of Municipal Affairs and Housing, Region, and Town could negotiate various versions of the Region's original and modified policies. The Region and the Town fought to maintain and protect core community values while the Ministry of Municipal Affairs and Housing fought to protect industry-provincial interests by enforcing the legislated norm of unfettered access to aggregate resources close to demand. As previously described in section 5.7, the Region's most significant loss was that the approved ROP diluted previous policies that explicitly sought to maintain a balance between competing land uses and give priority to the protection of existing and approved residential developments from the adverse impacts of aggregate operations.

The Town's collaborative approach to the development of OPA 161 and the Ontario Municipal Board settlement negotiations were integral to the Town's capacity to push back against powerful industry-provincial government interests. These opportunities for collaboration and negotiation provided the venue for renegotiation and reinterpretation of both Peel's ROP and, later, the Town's OPA 161. In both cases, however, the actors involved in the negotiations were constrained and/or empowered by the provincial legislative framework and the power relationship between the industry and the provincial government. The Town planners involved in developing OPA 161, for example, had a limited range of land use planning tools upon which policies could be based that could protect core community values and stand up against aggregate extraction applications in sensitive Reserve areas. These land use planning tools (zoning by-laws and Official Plan Amendment and zoning-by law amendment criteria) are granted to municipalities under the Ontario Planning Act but the municipalities' independent authoritative power is diminished or constrained by the Provincial Policy Statement and other such provincial policies. As previously noted, Ontario's land use planning laws and policies have been significantly influenced by powerful industry-provincial interests to favour aggregate extraction operations over all other land uses. The returns of this legislative framework empower industry and provincial players and represent attractive incentives for them to maintain and protect these

interests and, by extension, the existing legislative framework. Even under this oppressive balance of power, however, the existing legislative framework provided the source for creativity in the development of the Town's local polices. Caledon's original and more substantive prioritization policies, for example, reflect an ingenious interpretation of the Provincial Policy Statement's requirement for Official Plans to protect existing and future aggregate resources from incompatible land uses. The Town estimated that it has enough undeveloped gravel deposits to supply the demand well beyond the lifetime of the Official Plan. Town planners and officials argued that they would protect all of these deposits from incompatible land uses but they would not make all of these deposits available all at once. As previously described, industry and provincial resistance to the prioritization policies resulted in a watering down of the more substantive, original version. The industry and the province cited the Provincial Policy Statement in order to ensure that as much of the resource as possible would be available under OPA 161. In response, under the Ontario Planning Act, the Town planners devised the more onerous and costly study requirements for Official Plan and Zoning By-Law amendment approval for aggregate extraction applications in Reserve areas, sending an informal but explicit message to the industry to avoid these sensitive areas. In this case, then, the most powerful players fought to maintain the institutions that they require to protect and maintain their core values, while the Town planners pushed back against these powerful players by creatively interpreting the legislative framework to their advantage in order to maintain and protect core community values. Despite the Town's ingenious interpretation of the legislative framework, however, the more substantial policies of OPA 161 with respect to institutional change towards sustainability were rejected and/or watered down through the Ontario Municipal Board negotiations. Provincial constraints and the industry-provincial power relationship undoubtedly contributed to path-dependent change in the final version of the Amendment. This is also evident in the results of the evaluation of OPA 161 against Caledon's 1981 Cabinet Corners policies; altogether, only incremental change towards sustainability was accomplished.

7.4 Adaptive cycle

Proposition: *Institutional change and resistance to change occur within a four-phase adaptive cycle of growth, conservation, release, and reorganization. Long-term path dependent processes (positive feedbacks, increasing returns, and transaction costs) influence change and resistance*

to change throughout the adaptive cycle. Path dependent processes are reinforced by the cross-scale interconnections and interdependencies between the institutions that comprise the institutional system. The extent to which institutional change and resistance to change occur is determined, in part, by the resilience and resistance of the institution(s) and/or institutional system as it progresses through the four phases of the adaptive cycle.

In Caledon's case, the 1940s and '50s mark the beginning of the growth and conservation phases in the institutional system guiding aggregate extraction in southern Ontario. During these decades, municipalities had primary control over the location and operation of pits and quarries. The Ontario Planning Act and the Municipal Act gave municipalities land use planning tools to restrict the location of extraction operations. The regulation of the resource was decentralized over a range of statutes and provincial regulating agencies. Demand for the resource was low and based on local needs.

The conservation phase was well underway by the mid-1950s and has extended to today. During these decades, the aggregates industry and the Ministry of Natural Resources forged a reciprocal power relationship that has culminated in centralized industry-provincial control over prime aggregate resources. The evolution of this partnership was concurrent with increasing economic growth and urbanization in the GTA, and a subsequent increase in the demand for aggregates. Moreover, as the system became more influenced by the aligned interests of the province and the aggregates industry, provincial land use planning law and policy began to reinforce aggregate resources law. From about 1997 to present, industry-provincial control has maintained the mutually reinforcing nature of land use planning and aggregate resources management law; consequently, as previously discussed, it is conceivable that the short and medium term transactional costs of significant institutional change for industry and provincial players (e.g. towards Green Gravel objectives) would be high. According to the theoretical propositions, as long as the industry and the province continue to profit from centralized control, resistance may also continue to be high. The resilience of the present institutional system, however, may be low due to the tight interconnections and interdependencies between industry and provincial governmental players, the high costs of change, and the limited room for adapting and accommodating institutional change.

Meanwhile, during this conservation phase, Caledon became well known as a Town with plenty of aggregate to feed the needs of the GTA. As described in section 7.5, below, the above-

described regime shift was a major driver in Caledon's shift from the 1981 Cabinet Corners policies to the 2003 OPA 161 policies. A threshold in Caledon's Cabinet Corners rule system was crossed in 1996-97, when Town officials came to realize that (a) the Town had no choice under the existing provincial legislative framework but to somehow accommodate the aggregates industry, but that (b) it was nevertheless of paramount importance for the Town to develop policies that would protect and maintain Caledon's natural and cultural heritage and local control over aggregate extraction operations. Moreover, members of the aggregates industry and Town officials reached a point where they were willing to negotiate a local policy framework that would help to avoid future disputes at the Ontario Municipal Board. Thus, a period of renewal and reorganization began in Caledon with the 1996 *Caledon Community Resources Study* and ended with the Ontario Municipal Board's approval of OPA 161 in 2003. Institutional change towards sustainability through OPA 161 was incremental, in part, because of the continued constraining influence of the industry-provincial power relationship and the provincial legislative framework. Although in the OPA 161 negotiations the aggregates industry was moved to accept some changes enhancing authority at the local level in Caledon, the provincial-scale institutional system remained dominant. Arguably, however, the dominant system continued somewhere in the latter half of the conservation phase with perhaps declining ability to accommodate further adjustments.

Also, during this conservation phase, awareness about the environmental and social impacts of aggregate extraction increased. Baker et al. (2001), for example, describe how the *Pits and Quarries Control Act* and the *Aggregate Resources Act* both responded to demands for consideration of local social and biophysical impacts and especially improved rehabilitation practices. The industry's rehabilitation records remain dismal (see Gravel Watch, 2006), however, indicating a high level of resistance towards progressive and final rehabilitation among key players. According to one interviewee who represents the aggregates industry, there are many local challenges to rehabilitation (e.g. land use changes over the lifetime of a licence) that influence the successful rehabilitation of a particular site. Priorities for Green Gravel have emerged out of the above-described institutional context of centralized industry-provincial control over aggregate resources.

As previously demonstrated, sustainability priorities are essentially subversive and would cause a cascading effect in the prevailing institutional system for aggregates. A number of

scenarios or new equilibrium orders (stable states) may result from increasing pressure from nongovernmental organizations and community groups for institutional change – if the provincial system crosses a critical threshold and well-established norms begin to unravel. Indeed, it may take more than pressures from nongovernmental and community groups to force a change at the provincial scale. Increasing competition over land use for aggregate extraction versus other uses and changes in local-to-provincial water quality and quantity, etc., are other potential pressures for institutional change in the prevailing institutional system. As long as a critical threshold is not crossed, however, it is likely that institutional change at the provincial scale will continue to be incremental. The Ministry of Natural Resources and the industry, for example, may choose to adopt certain Green Gravel priorities that would satisfy certain pressure groups while maintaining core industry-provincial values, notably centralized control over prime aggregate resources and largely unfettered access close to demand.

Whatever might happen, the provincial-scale institutional system remains tightly locked in a position of centralized control where, according to theory, system resilience is low. It should be noted, however, that it is difficult to determine the exact position of the institutional system within the conservation phase. This demonstrates a need within Panarchy theory for threshold indicators that help to more precisely reveal the position of a particular system in the conservation phase of the adaptive cycle.

7.5 Regime shifts

Proposition: *The extent to which institutional change occurs is determined, in part, by whether a regime shift occurs. A regime shift involves rapid and large changes in the internal feedbacks of a particular institutional system. They are less frequent than incremental changes and they may occur when a system crosses a critical threshold, especially when the resilience of a particular institutional system is low.*

Clearly, a regime shift did not occur as a result of OPA 161. Indeed, key features of the institutional system guiding aggregate extraction in southern Ontario remain intact, notably centralized control of the industry by the industry and the Ministry of Natural Resources. A slow, provincial-scale regime shift did occur, however, from the late 1940s to the late 1990s (see Baker et al., 2001). Over the course of approximately 50 years, the institutional framework guiding aggregate extraction in southern Ontario evolved from decentralized provincial responsibility

over aggregate extraction, which gave municipalities primary control over aggregate extraction operations through land use planning tools, to provincial control in the 1970s with the *Pits and Quarries Control Act,* to the institutionalization of industry-provincial control by the mid 1990s with the *Aggregate and Petroleum Resources Statute Law Amendment Act*. This institutionalization included, from the late 1970s to the mid 1990s, evolution of Ontario's land use planning laws and policies to reinforce the *Aggregate Resources Act* and the objective of unfettered access to the resource (see Winfield & Taylor, 2005). Increasing urbanization and economic growth in the GTA and a subsequent increase in the demand for aggregate resources were key drivers of these changes. In southern Ontario, for example, consumption of aggregate increased from 3.86 tonnes/person in 1950 to 14.33 tonnes/person in 1996 (Baker et al., 2001, p. 467). The effects of this regime shift are discussed in section 7.6, below.

7.6 Cascading effects

Proposition: *The extent to which institutional change occurs is determined, in part, by whether change at one scale causes a cascade of changes at other scales. Sometimes, when a single threshold is crossed, a cascading effect can occur in which multiple thresholds across scales are breached. A regime shift in one institutional arrangement in one domain may affect change and/or induce a regime shift in other institutional arrangements in other domains.*

The above described regime shift profoundly influenced regional and municipal mineral resources policies across southern Ontario and the balance of power among industry, provincial, and municipal stakeholders. Caledon's 1981 Cabinet Corners policies, for example, were a response to Ontario's first provincial policy statement, the *Mineral Aggregate Resources Policy Statement*, which ensured that official plans identify and protect existing pits and quarries and future aggregate reserves from incompatible land uses. Under this provincial policy, municipalities did not have to zone the identified areas for extraction but were prevented them allocating aggregates areas for any other purpose. Moreover, the *Caledon Community Resources Study* was initiated, in part, because Town officials realized in 1996 that the Cabinet Corners policies were continually being appealed and overturned at the Ontario Municipal Board.

Baker et al. (2001) assert that the above described regime shift has effectively pushed municipalities through legislation from the centre to the periphery of the policy process dedicated to aggregate mining. This allowed the province to give greater consideration to the

demands of the aggregates industry despite rising awareness of the social-ecological impacts of aggregate mining. It also eroded the capacity of municipalities to protect the interests of local citizens and anti-aggregate groups. This trend to move the municipality to the periphery of the policy process occurred alongside a demand from aggregate producers to have access to resources close to markets to minimize transportation costs, and for guaranteed access to stocks in order to avoid perceived supply shortages.

7.7 Socioeconomic costs

Proposition: *The extent to which institutional change and resistance to change occur is determined, in part, by the socioeconomic costs associated with change. Path-dependent processes involve high socio-economic costs of reversal or reorganization, especially when the interconnections and interdependencies between and among the institutions, organizations, and certain socioeconomic groups in a particular institutional system are tight.*

As urbanization increased in the GTA during the 50s and 60s, the demand for aggregate increased and it became more common for prime aggregate to be transported outside the local areas within which it was extracted. Large companies soon formed to supply the increasing demand. Crying "shortage of supply" in the early 1970s, the aggregates industry began to dominate provincial policy making in the management of aggregate resources. Today, the industry and the province profit from a system of centralized control over the management of the resource, which protects prime aggregate resources from incompatible land uses and keeps aggregate prices relatively low. OPA 161's original, more substantive policies (e.g. demonstration of need, prioritization, stand alone social impact study, etc.) threatened to unravel this centralized control and the legislated *modus operandi* of unfettered access to prime aggregate resources close to demand. According to one interviewee who was a Town Councilor during the Ontario Municipal Board settlement negotiations for OPA 161, one reason why the province and the aggregates industry representatives resisted the original prioritization strategy was that they were concerned that if they accepted, prioritization would soon become the norm across southern Ontario.

In contrast, the Town stood to lose vital components of its cultural identity, which are important to the Town's social and economic well-being. The potential social-ecological impacts of JDCL's quarry application exemplified for the Town and community the risks associated with

the OPA 161 Ontario Municipal Board settlement negotiations. Caledon enjoyed primary control over land use planning and natural resource management up until 1996, when, among other important events, the Ministry of Municipal Affairs and Housing demanded from Peel a Regional Official Plan. Local control over local resources was by 1996 a deeply ingrained feature of the Town's character. According to one interviewee who was a Town planner during the development of OPA 161, it has also been historically customary for Peel's southern municipalities, Brampton and Mississauga, to assert local control over land use planning and the management of natural resources. Additionally, for generations, residents of Caledon have valued the Town's rural aesthetic, tranquility, and cultural heritage as components of the Town's identity. Many long time residents of Caledon have a strong sense of place based on these qualities. Moreover, Caledon's culture of stewardship has been built on the Town's valued cultural and natural recourses, which include portions of such provincially significant landforms as the Niagara Escarpment, Peel Plain, and Oak Ridges Moraine. The socio-economic fabric of the Town has evolved around these valued natural and cultural resources. The Town's rural aesthetic and natural and cultural heritage, for example, have been and continue to be attractive to newcomers who choose to reside or establish businesses (e.g. golf courses, inns and spas) in Caledon. The Town therefore rejected the Minister's modifications to Peel's ROP, initiated the *Caledon Community Resources Study* (as the basis for local mineral resources policies), and subsequently argued *for* the original, more substantive policies in the proposed OPA 161 in order to protect these valued components of its identity.

7.8 Power and resources (financial, political, administrative, ecological, etc.)

Proposition: *The extent to which institutional change and resistance to change occur is determined, in part, by the power and resources (esp. financial, ties to people in power, political support, opportunities for participation, ecological) held by particular socioeconomic groups to translate and enact the innovation(s).*

According to interviewees who were Town Councilors in 1996 and during the settlement negotiations for OPA 161, the Town has historically been willing to front the costs of Ontario Municipal Board hearings to protect citizens from the negative impacts of pits and quarries. Caledon's community of well-to-do, educated landowners has reinforced the Town's willingness in this regard. Enjoyment of property and protection of the Town's cultural and natural heritage

have been and continue to be chief among their local political concerns.

Aside from financial resources, the Town had wide political and community support for the *Caledon Community Resources Study*. Certain community champions were also integral to the development of OPA 161. According to interviewees, these champions included Mayor Carol Seglins and Mayor Marolyn Morrison, who stood as major supporters of OPA 161 in the face of adversity from the aggregates industry. Other champions included key Town planners, Dan Kennaley and Heather Konefat. According to interviewees who are long time residents of Caledon, the integrity of these planners was influential in the development of OPA 161. Also, according to interviewees who were Town planners during the settlement negotiations for OPA 161, the Town's lawyer, for example, was instrumental in arguing for OPA 161's prioritization policies, social impact study requirements, and additional study requirements. Certain members of the Coalition of Concerned Citizens also emerged as community heroes who were instrumental in the Ontario Municipal Board hearing that allowed OPA 161 to be determinative in the review of JDCL's quarry application.

It should be noted too that Caledon's cultural and natural heritage resources played a profound role in the development of OPA 161. According to interviewees who are long time residents of Caledon and members of the Coalition of Concerned Citizens, OPA 161 could transpire in a Town like Caledon because, among other reasons, Caledon has a rich inheritance of natural and cultural heritage. Again, the socio-economic fabric of the Town has evolved around this rich legacy and so many citizens and Town officials aim to protect it. Moreover, the integrity of the Town's ecological systems is a form of capital from which Caledon's residents draw vital sustenance for such political struggles as OPA 161.

Clearly, then, there was sufficient economic, political (municipal, regional, provincial and community), administrative, and ecological support for the development of the proposed OPA 161 and negotiating with the Province and industry to strengthen the Town's hand in promoting its interests in management of the aggregates industry in Caledon. Implementation, however, will also require these supportive resources. According to one interviewee who is a Town planner, the Town has not yet developed the Rehabilitation Master Plans because they are short staffed and therefore have not found the time to dedicate to it. There has also been some resistance from individual extraction operators to OPA 161's requirements for, pre-consultation meetings, on-site monitoring of dust and progressive rehabilitation. Negotiations among Town

planners and the aggregates industry are ongoing with respect to the site-by-site implementation of OPA 161.

The Town's efforts were, however, were only partly successful, in part because of the constraining influence of the power relationship that has over the years been established between the aggregates industry and key provincial ministries. As Baker et al. (2001) and Winfield and Taylor (2005) emphasize, this power relationship has pushed municipalities to the periphery of the provincial policy making process and is currently reinforced by provincial land use planning and natural resource management law and policy. The constraining influence of the existing provincial legislation during the development of OPA 161 and the subsequent Ontario Municipal Board settlement negotiations is supported by this infrastructure of power. Moreover, the industry-provincial government power relationship has been and continues to be reinforced by considerable financial, legal, political, etc. resources available to the Province and the aggregates industry. As previously noted in section 5.4, they can afford to maintain sophisticated lobbying efforts and to hire the best lawyers and consultants for the municipal and provincial application review process and Ontario Municipal Board hearings. As noted, above, OPA 161's incremental progress towards sustainability, therefore, is partly a consequence of the constraints of the industry-provincial government power relationship, which is manifest in their centralized control over prime aggregate resources. According to theory, however, the rigidity of the current centralized system and the high transaction costs associated with institutional change are signs of decreasing resilience. The current centralized system, then, is somewhat self-destructive on its own and vulnerable to internal and external disturbances.

7.9 Diffusion

Proposition: *The extent to which institutional change and resistance to change occur is determined, in part, by the capacity of actors to translate and enact an innovation (with suitable accommodation but no alterations that undermine the essentials) across a range of organizations or across a population. Translation and enactment occur within and are constrained by a particular institutional context and by a particular set of actors.*

The stakeholders involved in the development of OPA 161 did not set out to translate and enact Caledon's mineral resources policies in other municipal jurisdictions. As described in section 5.7, however, OPA 161 has influenced other local mineral resources policies through

word of mouth and because the Town planners involved in writing OPA 161 have since been hired by other municipalities. One planner who worked for Caledon during the settlement negotiations for OPA 161 is now a planner in another Township where aggregate extraction related land use issues are not uncommon. This planner has incorporated Caledon's approach to above and below water table extraction designations and study requirements in this Township's Official Plan. Approval of these Caledon-based policies is currently before the Ontario Municipal Board. Clearly, this planner is faced with similar local-to-provincial constraints as Caledon faced in the development of OPA 161. At best then, even if some diffusion of Caledon's policies occurs, it will constitute incremental institutional change.

7.10 Fit

Proposition: *The extent to which institutional change and resistance to change occur is determined, in part, by the nature of the proposed new institution. The more the actors can demonstrate that a particular innovation "fits" the prevailing institutional framework, the more likely that it will be adopted by particular actors (powerful elites, communities, organizations, etc.) and stick.*

The Town of Caledon took a collaborative approach in the development of OPA 161 by forming the Community Advisory Group for the *Caledon Community Resources Study*, which included powerful industry representatives, for the purpose of stakeholder input. Additionally, before Council adopted the original OPA 161, it was subjected to meetings for feedback from key stakeholders (Town, Region, Ministry of Municipal Affairs and Housing/Ministry of Natural Resources, Aggregate Producers' Association of Ontario, Niagara Escarpment Commission, Credit Valley Conservation Authority, and the Coalition of Concerned Citizens). These key stakeholders scrutinized the controversial details of OPA 161 again during the Ontario Municipal Board settlement negotiations, which resulted in an approved set of significantly revised policies. Evidently, the most powerful players at the negotiating table (industry and provincial government representatives) were persuaded that the contents of the revised and approved OPA 161 "fit" well enough to be accommodated within the prevailing provincial legislative framework for aggregate resources. After all, the negotiations resulted in a local rule system that accommodates the core values of industry and provincial players, namely centralized control and unfettered access to the resource.

The practical implementation implications of some OPA 161 policies, however, are uncertain and potentially significant. Some practicalities (e.g. pre-consultation meetings, monitoring of dust and on progressive rehabilitation, additional study requirements, two Extractive Industrial designations) challenge well-established norms of operation in the aggregates industry. As a result, OPA 161's substance may not "fit" as well as expected, and the resulting conflicts may present further tensions for the new rule system.

7.11 Variation in fast and slow moving institutions

Proposition: *The extent to which institutional change and resistance to change occur is determined, in part, by how much variation occurs in fast and slow moving institutions (regulative, normative, and cognitive) over time. Transformative change occurs when there is change across most or all of these dimensions.*

It was demonstrated in section 6.4 that OPA 161 does not reflect or require transformative change because it does not contribute significantly to objectives for sustainability contributions through aggregates management. Although regulatory changes have occurred at the local level in Caledon, many key normative and cognitive institutional elements in the institutional system guiding aggregate extraction in southern Ontario remain. While some have been undermined by the OPA 161 policies, others have been somewhat reinforced. For example, the norm of unfettered access close to demand, which is underpinned by the aggregate industry's shortage of supply discourse and need for affordable gravel, was formally maintained in the policies that allow for extraction in Reserve areas, albeit pending more onerous and costly studies and informally higher standards for approval.

Secondly, persistence in the Town's core values (local control over land use planning and management of natural resources, protection of natural and cultural heritage resources, and a balanced approach to land use planning) indicates that change at the local level was also restricted to the regulative dimension. Certain key policies (e.g. allowing extraction to occur in Reserve areas and other sensitive areas), which are reinforced by provincial land use planning policies, appear to trump the Town's capacity to determine the timing and location of pits and quarries. But the Town's core values have persisted regardless of changes in the local and provincial legal framework. This persistence is evident in the Amendment policies that enhance local control over land use planning and natural resource management process components and

some matters of substance (e.g. publicly accessible site plans and reports, pre-consultation requirements, prohibition of extraction in Core Areas of Peel's Greenlands system, etc., and more onerous study requirements for applications for extraction in Reserve areas).

According to this proposition, then, OPA 161 reflects and will play a role in incremental institutional change. This is consistent with the findings of the comparison of OPA 161 with Caledon's 1981 Cabinet Corners policies.

7.12 Uncertainty

Proposition: *The extent to which institutional change and resistance to change occurs is determined, in part, by uncertainty: limitations in the quality and quantity of information and knowledge about certain problems, available or potential solutions, and the methods available for evaluating the effectiveness of certain policies and programmes.*

There is one example in which uncertainty clearly played a role in resistance to institutional change towards sustainability in this case. The Ministry of Municipal Affairs and Housing and the aggregate industry players involved in the settlement negotiations for OPA 161 rejected the stand-alone social impact study on the basis that social impacts were too precarious to measure because of their subjectivity. According to one interviewee who was a Town planner involved in writing OPA 161, the planners were uncertain about the methodology that would be used to measure the social impacts of extraction operations in Caledon; therefore, they could not present a clear framework for the study to the industry during the Ontario Municipal Board settlement negotiations. The stand-alone social impact study may have been easier to reject because it was still a vague idea and not presented in such a level of detail to facilitate negotiations over the particular approach and methods to be applied. The rejection of the study was significant because acceptance would have made OPA 161 more substantive in taking steps towards sustainability objectives, albeit incremental steps.

7.13 Summary

Economic interests clearly played a role in both institutional change and inertia in Caledon's case. For example, Caledon officials, planners, individual aggregate producers, and the Ministry of Natural Resources and the Ministry of Municipal Affairs and Housing were willing to collaborate in the development of OPA 161 in order to avoid costly Ontario Municipal

Board hearings related to aggregate extraction land use issues. Industry and provincial government resistance to the more substantive policies in the original Amendment, however, was underpinned by their interest in maintaining core industry-provincial government values (centralized control over and unfettered access to prime aggregate resources close to demand) to ensure a continued supply of affordable gravel to provincial infrastructure and other public and private projects in the GGH region and beyond. These core values are rooted in the intertwined histories of economic growth, profit seeking, urbanization, demand for prime aggregates, and provincial land use planning and natural resource management legislation.

Core values held by Town officials, planners, and individual citizens (local control over local issues, protection of natural and cultural resources, and a balanced approach to land use planning) also played a role in inertia and change in the development of OPA 161. These core values, for example, underpinned the Town's rejection of the Minister's modification to Peel's 1996 Regional Official Plan and the incremental change reflected in the final version of the Amendment.

Aside from these core values and interests, a sense of what is "fair" (or appropriate) played a role in incremental institutional change Caledon's case. Town planners, for example, aimed to develop mineral resources policies that were fair in that they would work to level the "playing field" between citizens' interests and the interests of the aggregates industry. They also wanted to develop policies that were appropriately robust to allow Town officials to reject controversial quarry applications in sensitive Reserve areas. This latter point also demonstrates that the planners' concern for protection of Caledon's natural and cultural heritage resources played a significant role in the development of OPA 161. By extension, it demonstrates the essential role played by Caledon's rich natural and cultural heritage resources.

Periods of collaboration and negotiation provided the venue through which institutional change and inertia occurred in Caledon's case. The Ontario Municipal Board settlement negotiations for Peel's modified Regional Official Plan and OPA 161, for example, provided vital opportunities for the renegotiation and reinterpretation of Caledon's mineral resources policies. During both hearings, the Town fought to maintain and protect core community values while individuals representing the aggregates industry, the Ministry of Natural Resources, and the Ministry of Municipal Affairs and Housing fought to protect industry-provincial government interests by enforcing the legislated norms of centralized control over and unfettered access to

aggregate resources close to demand.

It is important to note too that in both Ontario Municipal Board settlement negotiations, the actors involved were both constrained and empowered by the existing provincial legislative framework and the industry-provincial government power relationship. The Town planners involved in developing OPA 161, for example, had a limited range of land use planning tools upon which policies could be based that could protect core community values and stand up against aggregate extraction applications in sensitive Reserve areas. The returns of this legislative framework (notably, affordable gravel for infrastructure and other public and private projects) empower industry and provincial players and represent attractive incentives for them to maintain and protect the existing legislative framework. Even under this oppressive balance of power, however, the existing provincial legislative framework provided the source for creativity in the development of the Town's local polices. Caledon's original and more substantive prioritization policies, for example, reflect an ingenious interpretation of the Provincial Policy Statement's requirement for official plans to protect existing and future aggregate resources from incompatible land uses. Despite the Town's ingenious interpretation of the legislative framework, however, the more substantial policies of OPA 161 with respect to institutional change towards sustainability were rejected and/or watered down through the Ontario Municipal Board negotiations. In response, the Town planners devised the more onerous and costly study requirements for approval for aggregate extraction operations in Reserve areas. These policies were eventually adopted, thereby contributing to incremental institutional change towards sustainability. The path dependent effects of the existing provincial legislative framework and the industry-provincial power relationship undoubtedly contributed to incremental change in the final version of the Amendment.

The socioeconomic costs of change were also important pressures for institutional change and inertia in the development of OPA 161. For example, OPA 161's original, more substantive policies (e.g. demonstration of need, prioritization strategy, stand alone social impact study, etc.) threatened to unravel the *modus operandi* of unfettered access to prime aggregate resources close to demand, which work to keep the costs of gravel low. One reason why the province and the aggregates industry representatives resisted the original prioritization strategy was that they were concerned that if they accepted, prioritization would soon become the norm across southern Ontario. In contrast, the Town stood to lose vital components of its cultural identity, which are

important to the Town's social and economic well-being. The potential social-ecological impacts of JDCL's quarry application exemplified for the Town and community the risks associated with the outcome of the Ontario Municipal Board settlement negotiations for OPA 161. The Town therefore rejected the Minister's modifications to Peel's ROP, initiated the *Caledon Community Resources Study* (as the basis for local mineral resources policies), and subsequently argued *for* the original, more substantive policies in the proposed OPA 161, which resulted in incremental institutional change towards sustainability.

Additionally, throughout the development of OPA 161, power and resources (ecological, economic, political, administrative, community support, etc.) were major enablers for institutional change and resistance to change. The Town, for example, had sufficient economic resources to participate in the Ontario Municipal Board hearings; and wide political and community support for the *Caledon Community Resources Study* and the development of OPA 161. The Town's lawyer, for example, was instrumental in arguing for OPA 161's prioritization policies, and additional study requirements, which contributed to incremental institutional change. The Town's efforts were, however, only partly successful, in part because of the constraining influence of the power relationship that has over the years been established between the aggregates industry and key provincial ministries. This power relationship has been and continues to be reinforced by considerable financial, legal, political, etc. resources available to the aggregates industry and provincial government ministries.

Issues of fit with respect to how Caledon's OPA 161 policies could be accommodated by key industry and provincial government players also influenced inertia and incremental institutional change in this case. For example, the industry and provincial government players at the negotiating table were finally persuaded that the revised and approved OPA 161 policies "fit" well enough within the prevailing provincial legislative framework for aggregate resources. After all, the negotiations resulted in a local rule system that, although contributing to incremental institutional change, accommodates the core values of industry and provincial players. The practical implementation implications of some OPA 161 policies, however, are uncertain and potentially significant. Some practicalities (e.g. pre-consultation meetings, monitoring of dust and on progressive rehabilitation, additional study requirements, two Extractive Industrial designations) challenge well-established norms of operation in the aggregates industry. As a result, OPA 161's substance may not "fit" as well as expected on the ground, and the resulting

conflicts may present further tensions for the new rule system.

Another pressure for institutional change and inertia at the local level was the provincial-scale regime shift that occurred from the late 1940s to the late 1990s, which profoundly influenced regional and municipal mineral resources policies across southern Ontario. Caledon's 1981 Cabinet Corners policies, for example, were a response to Ontario's first Provincial Policy Statement, the *Mineral Aggregate Resources Policy Statement*, which ensured that official plans identify and protect existing pits and quarries and future aggregate reserves from incompatible land uses. Moreover, the *Caledon Community Resources Study* was initiated, in part, because Town officials realized in 1996 that the Cabinet Corners policies were continually being appealed and overturned at the Ontario Municipal Board due to the changes in the provincial legislative framework and the industry-provincial government power relationship. It is important to note too that the *Caledon Community Resources Study* was also an attempt by Town officials and planners to resist the implications of the new provincial legislative framework for the socioeconomic identity of the Town.

One other key force for institutional change that emerged in this case is the diffusion of Caledon's OPA 161 policies in other municipal jurisdictions. According to interviewees representing the Ministry of Municipal Affairs and Housing and Caledon planning staff, OPA 161 has affected and continues to impact the aggregate resources policies of other Municipalities in the GGH Region. This diffusion may contribute to incremental institutional change over the long term.

Two other pressures that drove institutional inertia in this case include the tensions between fast and slow moving elements in the institutional system guiding aggregate extraction in southern Ontario, and uncertainty. Although regulatory changes have occurred at the local level in Caledon, many key normative and cognitive institutional elements in the institutional system remain. For example, the norm of unfettered access close to demand was formally maintained in the policies that allow for extraction in Reserve areas, albeit pending more onerous and costly studies and informally higher standards for approval. Secondly, persistence in the Town's core values indicates that change at the local level was also restricted to the regulative dimension. Institutional change, then, was confined to the regulative dimension; therefore, it was only incremental. According to Campbell (2005), institutional change is transformative when change occurs in most or all dimensions.

With respect to uncertainty, the Town planners involved in writing OPA 161 were unclear about the methodology that would be used to measure the social impacts of extraction operations in Caledon; therefore, they could not present a credible framework for the study to the industry during the Ontario Municipal Board settlement negotiations. The stand-alone social impact study may have been easier to reject because it was still a vague idea and not presented in such a level of detail to facilitate negotiations over the particular approach and methods to be applied. The rejection of the study was significant because acceptance would have made OPA 161 more substantive in taking steps towards sustainability objectives, albeit incremental steps.

Additionally, the above analysis suggests that the resilience of the existing institutional system governing aggregate extraction in southern Ontario is low due to the tight interconnections and interdependencies between key industry and provincial government players, the high costs associated with change, and the limited room for adaptive and accommodating institutional change. These features of the institutional system suggest that it is positioned somewhere in the late conservation phase of the adaptive cycle. The above analysis also suggests, however, that resistance is high, perhaps due to the resources to which these players have access for the purpose of maintaining the existing provincial legislative framework. As long as a critical threshold is not crossed, it is likely that institutional change at the provincial scale will continue to be incremental. Indeed, it may take more than pressures from nongovernmental and community groups to force a change at the provincial scale. Increasing competition over land use for aggregate extraction versus other uses and changes in local-to-provincial water quality and quantity, etc., are other potential pressures for institutional change in the prevailing institutional system. It is difficult to determine the exact position of the institutional system within the conservation phase, however. This demonstrates a need within Panarchy theory for threshold indicators that help to more precisely reveal the position of a particular system in the conservation phase of the adaptive cycle.

CHAPTER 8: Analysis

8.1. Introduction

This chapter discusses the strengths and limitations of the preliminary theoretical propositions. General conclusions about the effectiveness of the propositions may not be made based on the above application to Caledon's case alone. This section discusses some initial observations and recommendations for potential refinements. These observations and recommendations are based on whether and how well the propositions answered some of the central questions of this study: Why and how and to what extent have institutional change and resistance to change towards sustainability occurred in the development of Caledon's OPA 161 policies?

8.2. Strengths and limitations of the preliminary theoretical propositions

The preliminary theoretical propositions assisted elaboration of why and how and to what extent institutional progress towards sustainability occurred in a manner comprehensive of the details of the story of Caledon's mineral resources policies and consistent with the previous evaluations of OPA 161 undertaken by this study. The propositions captured the major social-ecological issues and pressures in the case of OPA 161. In some respects, the propositions produced insights about the extent to which institutional change occurred that were not illuminated by the previous evaluations of OPA 161.

The *Interests, Appropriateness and Legitimacy* and *Socio-Economic Costs* propositions captured the important reasons why certain policies were embraced and/or rejected in Caledon's case. Stakeholder interests and values, for example were among the greatest determinants of institutional change and inertia. Also, as demonstrated in section 5.7, history and context mattered in Caledon's case. Because these propositions devote attention to long-term historic processes and the constraining influence of the existing institutional environment, they captured the foundations and existing supportive structures (e.g. law and policy) of stakeholder power relationships and core interests and values. This helped in understanding and explaining the high socioeconomic costs associated with change for all stakeholders. Moreover, these propositions, especially their attention to the actors' consideration of *appropriateness*, also captured the integral role played by the planners' sense of fairness, policy robustness, and the natural environment in this case. The potential negative social-ecological impacts of JDCL's quarry

application, for example, profoundly influenced OPA 161's policies and standards of approval for aggregate extraction operations.

The above propositions were mainly based on insights from the New Institutionalism. Again, New Institutionalism's strength is that it emphasizes the social, economic, and political dimensions of institutional dynamics. In this case, the New Institutionalism's attention to the logic of appropriateness also captured the role played the natural environment, which complements Panarchy theory's attention to the interconnections and interdependencies between and among human and ecological systems. As previously discussed, the preliminary combined theoretical propositions are based on an understanding of certain fundamentals. One of these fundamentals is the linked nature of social and ecological systems, where the dynamics of one influence and constrain the other. In this case, then, the significance of concern for natural and cultural heritage resources in JDCL's case was explicitly brought to light by the New Institutionalism's logic of appropriateness and Panarchy theory's perception of social and ecological systems as inextricably linked.

Also, with respect to why institutional change occurred, the *Adaptive Cycle, Cascading Effects,* and *Regime Shifts* propositions captured the interconnections and interdependencies between the provincial and local scales, in particular the implications of the provincial-scale regime shift on the Town's local policies, changes in the relationships between and among local municipalities, the aggregates industry and key provincial ministries, and the major interconnected, external drivers of this regime shift (economic growth and urbanization in the GTA). The history of aggregate extraction in southern Ontario and the evolution of the provincial legislative framework were captured by the *Adaptive Cycle* proposition, demonstrating the potential generalizability of Panarchy's adaptive cycle metaphor. Additionally, the *Adaptive Cycle* proposition contributed important insights about potential system resilience and resistance. These insights inspired consideration for the position of critical thresholds in the institutional system, threats to the existing system (e.g. land use disputes, changes in water quantity and quality), and possible future scenarios. Here, again, Panarchy theory has contributed to the explanatory strength of the propositions with respect to devoting attention to multi-scalar dynamics. More research is required, however, to uncover the relationship between resilience and resistance and to develop threshold indicators in order to more precisely determine where a particular system is positioned in the conservation phase of the

adaptive cycle.

With respect to how institutional change and inertia occurred, the *Renegotiation and Reinterpretation* and *Power and Resources* theoretical propositions captured the importance of power and resources (financial, political, administrative, ecological, community heroes), collaboration, and opportunities for participation in Ontario Municipal Board settlement negotiations in this case. The constraining influence of the power relationship between the industry and the provincial government, for example, was a significant determinant of incremental change in this case. The resources and opportunities for negotiation were integral to the Town's capacity to adapt to provincial legislative constraints while developing policies that would protect core community values. These propositions, then, help to explain why the Town officials and planners were able to adapt to the new provincial institutional framework and undergo policy changes at the local level while protecting and maintaining core community values. New Institutionalism's emphasis on the constraining influences of the particular characteristics of the existing institutional system contributed to the strength of the *Renegotiation and Reinterpretation* propositions. The New Institutionalism highlighted the importance of power, financial, political, and administrative and community support in this case.

With respect to the extent to which institutional change occurred, the theoretical propositions support the findings of Chapter 6, which demonstrate that OPA 161 represents incremental institutional change towards sustainability. The propositions that were the most helpful in this regard were *Renegotiation and Reinterpretation*, *Regime Shifts, Cascading Effects, Socio-Economic Costs, Variation in Fast and Slow Moving Institutions, Uncertainty, Fit,* and *Diffusion*. The *Renegotiation and Reinterpretation*, *Regime Shifts,* and *Cascading Effects* propositions captured the impacts of cross-scale path-dependent effects, especially provincial legislative constraints and the constraints of the industry-Provincial power relationship, which were paramount in determining the final nature OPA 161. Here, the complementarities of the New Institutionalism and Panarchy are especially evident in that both bodies of literature emphasize path dependency, while Panarchy theory emphasizes cross-scale dynamics. The *Socio-Economic Costs* proposition captured that resistance to institutional change occurred, in part, because the Town's socioeconomic and cultural identity was threatened by changes in the provincial legislative framework. Similarly, socioeconomic costs were involved when core provincial-industry interests and values were threatened by the original, more substantive

policies in OPA 161. The *Variation in Fast and Slow Moving Institutions* proposition illuminated the importance of change across all institutional dimensions (regulative, normative, and cognitive) in understanding the extent to which institutional change occurred in Caledon's case. Identifying a point missing from previous evaluations of OPA 161, this proposition suggests that institutional change was incremental because it was mainly confined to the regulative dimension. The *Uncertainty* proposition captured one reason why the independent social impact study was rejected and thus why OPA 161 was not more substantive in its contributions to sustainability. The *Fit* proposition captured the significance of potential gaps between policy and implementation in progress towards sustainability. Conflicts resulting from discrepancies between policy and practice, for example, reflect long-standing norms of operation in the aggregates industry and present further tensions for the new rule system. Finally, the *Diffusion* proposition captured the significance of the informal translation of some OPA 161 policies in other municipalities' policies. These latter four propositions were based on insights from the New Institutionalism.

Despite the above-mentioned strengths of the preliminary theoretical propositions, there are some early limitations and redundancies. The *Interests, Appropriateness and Legitimacy* proposition, for example, did not explicitly address the role played by core values in Caledon's case. Rather, industry, provincial, and community core values had to be inferred from interests. The incorporation of interests in this proposition is based on the tendency within rational choice New Institutionalism to favour the logic of instrumentality over the logic of appropriateness in institutional analysis. Because the rational choice school has mainly been associated with studies that investigate the performance of economies, the word "interests" in this proposition has a distinct economic flavour. In Caledon's case, the Town's core values are tied not just to conventional economic interests but also to Caledon's more complex socioeconomic and cultural identity. While these core values are closely associated with the Town's economic interests and this proposition addresses these, Caledon's socioeconomic identity is a particular identity based on valued cultural and natural heritage. Moreover, protection of this identity underpinned the Town's resistance to institutional change. The "logic of appropriateness" does incorporate consideration for values but students who do not have an in-depth understanding of the New Institutionalism could easily overlook this. The *Interests, Appropriateness and Legitimacy* proposition was modified to incorporate attention to core values.

The *Renegotiation and Reinterpretation* proposition captured the constraining influence of the provincial legislative framework and power on Caledon's local policies as major determinants of change in Caledon's case. These major reasons for incremental change may not have been captured if Caledon's case had not involved periods of negotiation. The constraining influences of the particulars of prevailing institutional systems should be incorporated in other propositions beyond this one in order to ensure that they are captured in other cases.

The *Fit* proposition assumes that the institutional system within which institutional entrepreneurs are participating has wide support, not in the sense that everyone likes the system, just in the sense that many established interests are dependent on it or have other reasons to worry about what will happen if the system collapses. However, when a particular institutional arrangement collapses, it may become broadly discredited or vice versa. In these cases where the prevailing institutional system does not have broad public support, *Fit* may not be as great a concern as having a plausible and credible alternative at hand, supported by individuals with actual or potential power. The propositions were adjusted to reflect this consideration.

Additionally, despite the explanatory power of the theoretical framework, important questions about institutional change and inertia remain. For example, beyond the above-described pressures for institutional change and inertia, how have the aggregates industry and key provincial ministries been able to maintain the norms of unfettered access close to demand, and centralized control over aggregate resources for so long in southern Ontario? What factor was most influential in determining incremental institutional change in this case? This study focuses on one case study, where Caledon pushed back against powerful political and economic interests in order to protect core community values. But many other, similar cases exist in southern Ontario. Why has the cumulative pushback from many stakeholders involved in aggregate extraction-related complex land use issues in southern Ontario not had a profound impact on the norms that characterize the provincial legislative framework? One clue is that aggregate extraction in southern Ontario is relatively concentrated geographically in a few key areas. The scale of the resistance to the current provincial institutional framework, then, has not been province wide; therefore, opposition may not be significant enough to be perceived as a political threat that requires governmental action. While the theoretical propositions based on Panarchy theory do consider multi-scalar effects, scale was not incorporated in the *Power and Resources* proposition. Scale and its implications for power, institutional change and resistance

to chance, then, were not captured. The propositions were adjusted to incorporate consideration for scale.

Also, the central role played by the industry-provincial government power relationship in this case suggests that the theoretical propositions should devote more attention to the dynamics of power in cases of institutional change and inertia. The propositions that consider power are based on insights from the New Institutionalism. However, according to the overview provided in Chapter 2, the three major strands of New Institutionalist thought do not explain the implications of power for institutional change and inertia beyond suggesting that powerful elites will seek to protect their values and interests and certain actors will have more influence over others in policy development. More research is required to determine if this is an essential limitation of the New Institutionalism as a whole, or if the propositions do not accurately reflect various New Institutionalist explanations of the determinative effects of power dynamics in institutional systems.

Finally, there is some perhaps unnecessary overlap among the *Adaptive Cycle, Regime Shift,* and *Cascading Effects* propositions. Because adaptive cycles are depicted as hierarchically nested in space and time, where smaller and larger scales constrain and influence each other, the metaphor incorporates room for discussion on regime shifts and cascading effects. These three propositions, however, are oriented towards answering different questions about institutional change. Briefly, *Regime Shifts* and *Cascading Effects* answer questions about the extent to which institutional change occurs while the *Adaptive Cycle* proposition devotes more attention to how and why institutional change and resistance to change occurs. The redundancies among these propositions, therefore, may enhance their explanatory capacity. More experience in application is required to refine this early redundancy.

Based on the above discussion, the preliminary theoretical propositions were adjusted. Box 9, below, presents the modified combined preliminary theoretical propositions.

Box 9. Modified combined preliminary theoretical propositions

1. Actors may resist or facilitate institutional change in order to maximize individual and/or collective interests, protect and maintain core values, and/or to achieve cultural appropriateness and legitimacy as defined by a particular, culturally embedded institutional environment. Actors' interests and values are determined, in part, by the institutional system and by long-term historic processes (e.g. socialization).

2. Actors may resist or facilitate institutional change through the process of renegotiation and reinterpretation and/or by creating innovative institutions from previously existing institutional elements. These processes lead to path-dependent change because the range of options available to institutional entrepreneurs is constrained by the particular characteristics (e.g. power relationships, actors' interests and values, laws and informal norms, etc.) of the existing institutional system.

3. Institutional change and resistance to change occur within a four-phase adaptive cycle of growth, conservation, release, and reorganization. Long-term path dependent processes (positive feedbacks, increasing returns, and transaction costs) influence change and resistance to change throughout the adaptive cycle. Path dependent processes are reinforced by the cross-scale interconnections and interdependencies between the institutions that comprise the institutional system. The extent to which institutional change and resistance to change occur is determined, in part, by the resilience and resistance of the institutional system as it progresses through the four phases of the adaptive cycle:

- *During the reorganization and growth phases, resilience is high. As the system matures and progresses to the end of the conservation phase, resilience declines. Near the end of the conservation phase, internal and/or external stresses may push the institutional system beyond a critical threshold, commencing a period of renegotiation and reinterpretation of the rules of the game. Uncertainty and instability rule. Significant resources are spent to adjust the institutional framework. Actors with access to decision-making bring forward new and/or old ideas, which create the source for reorganization.*

4. The extent to which institutional change occurs is determined, in part, by:

- *whether a regime shift occurs. A regime shift involves rapid and large changes in the internal feedbacks of a particular institutional system. They are less frequent than incremental changes and they may occur when a system crosses a critical threshold, especially when the resilience of a particular institutional system is low.*

- *whether change at one scale causes a cascade of changes at other scales. Sometimes, when a single threshold is crossed, a cascading effect can occur in which multiple thresholds across scales are breached. A regime shift in one institutional arrangement in one domain may affect change and/or induce a regime shift in other institutional arrangements in other domains.*

5. The extent to which institutional change and resistance to change occur is determined, in part, by:

- *the socio-economic costs associated with change. Path-dependent processes involve high socio-economic costs of reversal or reorganization, especially when the interconnections and interdependencies between and among the institutions, organizations, and certain socioeconomic groups in the institutional system are tight.*

- *the power and resources (esp. financial, ties to people in power, political support, opportunities for participation, ecological) held by particular socioeconomic groups to develop, translate and enact innovation(s).*

- *the scale(s) at which pressures for change and inertia occur. Province-wide pressures for change, for example, may be more influential with respect to inducing institutional change than pressures from isolated groups or groups concentrated in one geographic location.*

- *the capacity of actors to translate and enact an innovation (with suitable accommodation but no alterations that undermine the essentials) across a range of organizations or across a population. Translation and enactment occur within and are constrained by a particular institutional context and by a particular set of actors.*

- *the nature of the proposed new institution. The more the actors can demonstrate that a particular innovation "fits" the existing institutional framework, the more likely that it will be adopted by particular actors (powerful elites, communities, organizations, etc). If the existing institutional system has been discredited, however, alternative solutions may be welcomed.*

- *how much variations occurs in fast and slow moving institutions (regulative, normative, and cognitive) over time. Transformative change occurs when there is change across most or all of these dimensions.*

- *uncertainty: limitations in the quality and quantity of information and knowledge about certain problems; available or potential solutions, and the methods available for evaluating the effectiveness of certain policies and programmes.*

CHAPTER 9: Conclusions

The theoretical propositions developed by this study are preliminary and require further refinement based on application to many other cases. Regardless of this limitation, the research demonstrates the advantages of developing and applying an interdisciplinary theoretical framework in analyses of the dynamics of institutional systems. Integrating key concepts from the New Institutionalism and Panarchy theory in analysis should enhance our understanding of such phenomena in social-ecological systems and, by extension, enrich our comprehensions of human-institutional-ecological interactions. As such, the research contributes insights to the New Institutionalism and Panarchy theory about the positive implications of exchange between and among these theories. The research has also contributes to knowledge about how and why and to what extent institutional change and inertia towards sustainability might occur in a given context. The academic and practical contributions of the research are discussed, below.

9.1 Contributions to the literature

The preliminary theoretical propositions developed by this study assisted elaboration of why and how and to what extent institutional progress and inertia towards sustainability occurred in a manner comprehensive of the social-ecological issues and pressures in the story of the development of Caledon's OPA 161. Moreover, the propositions were able to assist explanation of institutional change and resistance to change in a way that overcame the limitations of Panarchy theory and the New Institutionalism individually.

First, the research found that Panarchy theory and the New Institutionalism share many concepts (e.g., thresholds or tipping points, path dependency and path dependent effects, multiple equilibrium orders or multiple stable states, and fast and slow moving variables) to aid in understanding and explaining the dynamics of institutional and ecological realms. More research is required to investigate both theories for other shared concepts and to explore the subtle yet enlightening differences in interpretation and application. At this early stage, the commonalities among these theories attest to their compatibility for the purposes of investigating the dynamics of institutional systems. They also provide evidence of the similarities in the dynamics of social and ecological worlds.

Early New Institutionalist investigations into the nonlinear effects of institutional dynamics (e.g. Pierson, 2004) would especially benefit from exchange with Panarchy theory. For

example, the research found that key concepts and metaphors (adaptive cycle, panarchy, regime shifts, cascading effects, thresholds), which have been developed by Panarchy theorists to devote attention to scale and vertical and horizontal feedback loops, complement the New Institutionalism's ability to capture important contextual factors affecting institutional change and inertia, and help to overcome the current limitation in its capacity to understand and explain the nonlinear, multi-scalar dynamics of institutional systems. Notably, Panarchy theory's attention to scale could capture one reason why institutional change towards sustainability in the institutional system governing aggregate extraction in southern Ontario has not been more profound over the years, and why resistance to change has been the norm: the pushback against powerful industry-provincial players has been relatively concentrated geographically in a few key areas in southern Ontario. The scale of the resistance to the current provincial institutional framework, then, has not been province wide; therefore, opposition may not be significant enough to be perceived as a political threat that requires governmental action. Also, in this study, Panarchy theory's understanding of social and ecological systems as inextricably linked complemented key concepts from the New Institutionalism (e.g., logic of appropriateness) with respect to capturing the determinative role played by Caledon's rich natural and cultural heritage in the development of the Amendment.

In turn, Panarchy theorists would benefit from exchange with New Institutionalists with respect to understanding and explaining the social dimensions of institutional change and inertia in social-ecological systems. For example, the research found that key concepts and insights from the New Institutionalism complement and enrich the explanatory power of Panarchy theory's key concepts and adaptive cycle metaphor. For example, while both theories emphasize the implications of fast and slow moving variables for social and ecological change, the New Institutionalism is capable of defining precisely what slow (e.g. informal institutions) and fast (e.g. formal institutions) variables are in the context of institutional systems; it distinguishes between regulative, normative, and cognitive institutional dimensions and emphasizes the implications of the tensions between them for institutional change and inertia. Moreover, in contrast to Panarchy theory, the New Institutionalism emphasizes agency and the feedbacks between people and institutions. Such essential concepts as uncertainty, bounded rationality, diffusion, socioeconomic costs, institutional fit, renegotiation and reinterpretation, power and resources, and the logics of appropriateness and instrumentality complement and enhance

Panarchy theory's explanatory strengths

With respect to inquiries from scholars into the generalizability of the adaptive cycle metaphor, the research found that the four-phase depiction of change in ecological systems could be applied to Caledon's case. It was able to capture and contribute to an understanding of the history and evolution of the provincial institutional system guiding aggregate extraction in southern Ontario. For example, it provided a useful perspective on the regime shift that occurred from the late 1940s to the mid-1990s. It also highlighted the critical threshold that was crossed in Caledon's case and the local-to-provincial pressures that helped to induce a period of renegotiation and reinterpretation of Caledon's local mineral resources policies. Notably, the adaptive cycle's attention to connectedness and rigidity versus flexibility could provide clues about the resilience of the institutional system, which, according to theory, is low. Resistance to institutional change, however, remains strong. Here, the New Institutionalism's attention to power and resources began to explain why industry-provincial resistance has been and continues to be so significant.

More research is required to explore how the adaptive cycle metaphor might be applied to the emergence, persistence, and resilience and resistance of institutions and institutional systems. Secondly, although the adaptive cycle metaphor contributed insights about the potential resilience of the institutional system, neither theory devotes significant attention to understanding the dynamics of resilient and resistant but inefficient and/or unproductive institutional and ecological systems. Overall, more research is required to better our understanding of the relationship between resilience and resistance, and how a negative type of resilience might be overcome. Also, although the adaptive cycle metaphor provided clues about the location of the institutional system in the conservation phase, more research is required to develop threshold indicators that help to more precisely determine the position of a particular system within the conservation phase of the adaptive cycle.

Given the centrality of the constraining influence of path dependent effects in Caledon's case, more research in both New Institutionalists and Panarchy theories should be devoted to investigating mechanisms (e.g., social learning, adaptive management, etc.) that help to counteract destructive path dependent effects, especially when they work to prevent institutional progress towards sustainability. Additionally, given the significant role played by power in this case, more research is required to determine if the theoretical propositions accurately reflect New

Institutionalist explanations of power dynamics in institutional change and inertia, or if the New Institutionalism is essentially limited in its ability to elaborate the implications of power dynamics for institutional emergence, persistence, change and resistance to change.

Overall, the research demonstrates that integrating central concepts and insights from the New Institutionalism and Panarchy theory will increase our comprehension of human-institutional-ecological interactions. In Caledon's case for example, the theoretical propositions captured, among other important factors, that the Town's natural and cultural heritage resources, concern for the integrity of these resources, uncertainty, and the socioeconomic costs associated with change played profound roles in institutional inertia and incremental institutional change towards sustainability.

9.2 Lessons learned about institutional change and resistance to change towards sustainability

Institutional change towards sustainability in Caledon's case was incremental in some sustainability requirements, notably *Social-Ecological System Integrity, Social-Ecological Civility and Democratic Governance,* and *Precaution and Adaptation.* More substantive progress would have been made in all sustainability requirements if key provincial and industry players had accepted the Town's original Amendment policies.

The theoretical propositions revealed that both institutional change and inertia in the development of OPA 161 were underpinned by core socioeconomic interests and values held by key Town officials and planners, individuals representing the aggregates industry, and staff from key provincial ministries, notably the Ministry of Natural Resources and the Ministry of Municipal Affairs and Housing. For example, the Town, provincial government ministries, and individuals representing the aggregates industry were willing to negotiate new local mineral resources policies in order to avoid costly Ontario Municipal Board hearings. But industry and provincial government resistance to the more substantive policies in the original Amendment was underpinned by their interest in maintaining centralized control over and unfettered access to prime aggregate resources close to demand. These core values are rooted in the intertwined histories of economic growth, demand for affordable prime aggregates for urban development, and provincial land use planning and natural resource management legislation. In contrast, Town officials, planners, and individual citizens fought to maintain core community values (local

control over local issues, protection of natural and cultural heritage, and a balanced approach to land use planning) integral to the socioeconomic identity of the Town. These community values are rooted in the history of the Town, including the Town's identity as a major supplier of aggregates to the GTA and beyond, dealings with the aggregates industry, strong culture of stewardship, and long standing tradition of local control over local issues and interests.

The significant role played by core values and interests in Caledon's case highlights the implications of the tensions between fast and slow moving elements in the institutional system for institutional change and resistance to change. In Caledon's case, for example, legislative changes occurred at the provincial and local levels, but key normative (e.g., unfettered access to aggregate resources close to demand) and cognitive (e.g., core values of key Town official, planners, and citizens) institutional elements prevail. Institutional change towards sustainability, therefore, was incremental.

The propositions revealed that other pressures for institutional change and inertia in Caledon's case included (a) the provincial regime shift that occurred from the late 1940s to the late 1990s, which induced the period of renegotiation and reinterpretation of Caledon's mineral resources policies; (b) the socioeconomic costs of change for the Town of Caledon and key aggregates industry and provincial government players; and (c) the path dependent constraints of the provincial legislative framework governing aggregate extraction in southern Ontario, and the industry-provincial government power relationship. The path dependent effects of these latter formal and informal elements of the institutional system were central determinants of the trajectory of change in the development of OPA 161. For example, the existing provincial legislative framework provided the source for creativity and imposed significant institutional constraints in the development of the Amendment.

Factors that enabled institutional change and resistance to change included the periods of renegotiation and reinterpretation of Caledon's mineral resources policies during the Ontario Municipal Board settlement negotiations, and the power and resources (economic, political, administrative, community support, etc.) possessed by key stakeholders involved in development the Amendment. The Town, for example, had sufficient economic resources to participate in the Ontario Municipal Board hearings, and wide political and community support for the *Caledon Community Resources Study*. Similarly, the industry-provincial government power relationship has been and continues to be reinforced by considerable financial, legal, political, etc. resources

available to the aggregates industry and key provincial government ministries.

Other pressures for institutional change in Caledon's case include the diffusion of OPA 161 policies to other municipalities, which may contribute to incremental provincial-scale institutional change towards sustainability over the long term. More research is required to determine the extent to which diffusion is occurring. The propositions also revealed that the Town planners' aim to develop appropriately robust policies in order to protect valued natural and cultural resources was a significant driver for institutional change. Additionally, such local-to-provincial pressures as changes in water quality and quantity, and increasing competition over land uses may combine with pressures from environmental nongovernmental organizations to push the current institutional system beyond a critical threshold, which may provide an opening for institutional change and continues resistance to change.

Other pressures for institutional inertia in Caledon's case include issues of fit with respect to how the Amendment is implemented on the ground. Certain OPA 161 policies, for example, challenge the *modus operandi* of aggregate extraction operations, which may exacerbate resistance to change. More research is required to determine how these issues of fit might influence the effectiveness of the policies and the future development of the Amendment. Uncertainty presented another influential force for inertia in that the Town planners' ideas for an independent social impact study requirement were too vague to be discussed in detail during the Ontario Municipal Board settlement negotiations for the Amendment.

The implications of uncertainty in Caledon's case emphasize the importance of developing credible alternatives when pursuing institutional change towards sustainability. In fact, the theoretical propositions and lessons learned from Caledon's case carry many other practical insights for advocates of sustainability who seek institutional change. For example, the research demonstrates the importance of considering broad contextual factors (e.g., interconnections and interdependencies within and between institutional elements across various scales, issues of fit, thresholds, resilience, etc.) in efforts to facilitate and/or implement institutional change towards sustainability.

Overall, the theoretical propositions and case study findings suggest that institutional change and inertia are interconnected and interdependent and, depending on the case and context, they may interact with each other across multiple spatial and temporal scales. Moreover, there may be significant overlap in the emergence of pressures for institutional inertia and

change across temporal and spatial scales, and both institutional change and resistance to change may be present when opportunities arise for renegotiation and reinterpretation of the "rules of the game". For example, a range of interconnected and overlapping, historic and immediate, local-to-provincial factors (e.g., the provincial regime shift, socioeconomic costs, path dependent effects, uncertainty, etc.) and institutional elements (interests and values, power and resources, existing provincial legislative framework, fit, etc.), contributed to institutional change and inertia in Caledon's case. Moreover, both institutional change and resistance to change were enabled by the Ontario Municipal Board settlement negotiations for OPA 161. The slow moving institutional variables in Caledon's case (core Town, industry and provincial government values and interests), which have endured under the Amendment, were perhaps the greatest determinants of change and resistance to change towards sustainability. These core values persisted under the provincial and local regime shifts and underpinned both incremental change and resistance to change throughout the development of OPA 161. The story of Caledon's mineral resources policies, then, is about the resilience and resistance efforts of a small Town committed to maintaining core community values under the constraints of a resilient and resistant, ecologically destructive and inequitable institutional system.

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Appendix A: History of aggregate resources law in Ontario, 1950 – present

Winfield and Taylor (2005) and Baker, Slanz, and Summerville (2001) provide excellent descriptions of the evolution of aggregate resources legislation in Ontario. Baker et al. analysed the content of 140 Ontario Municipal Board hearings over a twenty-five year period (1971 – 1996) to investigate the role of legislation and policy in decision-making, and to examine the conflict between provincial and municipal governments. Winfield and Taylor examined 30 years (1970 – 2005) of Ontario legislation and policy for trends in the aggregate and land use legislative framework.

1950s to early 1970s

Prior to the 1950s, there was limited regulation of the aggregate industry. Demand for aggregate was relatively low and the need for aggregate was centered primarily on local road and construction projects. This began to change by the mid-1950s with economic growth and increasing suburban development. Larger corporations soon formed to supply the demand. This meant that sand and gravel was increasingly being hauled beyond the rural boundaries within which the pits were situated. The aggregates industry grew rapidly during the 1950-70 period. In southern Ontario, for example, where urbanization was concentrated, consumption of aggregate increased from 3.86 tonnes/person in 1950 to 14.33 tonnes/person in 1996 (Baker et al., 2001, p. 467). During this period, regulation of aggregate extraction was decentralized across a range of statutes and provincial regulating agencies. Municipalities had primary control over the establishment, operation, and location of new pits and quarries. Under the provincial Planning Act and Municipal Act, Municipal-level planning tools consisted of Official Plan regulatory by-laws, and restricted-area zoning by-laws. These planning tools allowed Municipalities to establish by-laws that prohibited pits and quarries. A 1959 Planning Act Amendment closed this loophole so that municipalities could only control aggregate extraction with zoning by-laws. As concern for environmental protection intensified in the mid-1960s, municipalities throughout the province used the powers invested in them to control aggregate developments.

By the late 1960s, the informal “shortage of supply” discourse had emerged. The aggregate industry began to lobby the provincial government for remedial action against a perceived shortage of resources. According to Baker et al., this perceived shortage was the result

of a lack of understanding of the amount of sand, gravel and bedrock resources available for extraction; rising conflict between public concern for the environmental impacts of aggregate extraction and increasing public demand for aggregate resources; and increasing competition between the aggregates industry and municipalities for land for aggregate mining versus other land uses. The industry wanted continued unrestrained access to the resource. Municipalities were interested in protecting local communities from the negative impacts of aggregate mining, and the Province's interests were aligned with the industry. According to Baker et al., this was when the industry began to dominate policy-making. In 1969, the Province created the Mineral Resources Committee to examine the industry's concerns and make recommendations that would guarantee the ongoing availability of aggregates close to demand. The Committee was comprised of provincial government and industry representatives and no Municipal or Regional governmental representation. The Committee's 1969 report recommended increased provincial control over the aggregates industry. This was the beginning of the loss of municipal control over aggregate extraction: "…the industry, realizing the growing 'crisis' for aggregate producers, 'captured' the provincial government and began to dominate policy-making" (p. 468). Chambers and Sandberg (2007) assert that the aggregate industry was successful in its demands partly because both the provincial government and the industry were profiting from increasing urbanization.

Early 1970s to early 1980s

In 1971, the *Pits and Quarries Control Act* came into effect. Significantly influenced by the recommendations of the Mineral Resources Committee, this new law transferred control of aggregate resources to the province. Responsibility for approvals of aggregate developments shifted from Municipalities to the Province. This was accomplished through the establishment of a licensing and site plan procedure system enforced by the Ministry of Natural Resources. The numerous agencies and regulations that had comprised the former institutional framework were streamlined so that the Ministry of Natural Resources became the central planning agency, with power to licence, regulate, and rehabilitate pits and quarries. Municipalities were allowed to maintain control over the location of future pits and quarries through land use planning but the new Act essentially shifted the relatively decentralized system to a centralized one with the province at the helm. In a significant step, the Act also required the rehabilitation of pits and

quarries.

In 1976, the Ministry of Natural Resources established the Ontario Mineral Aggregate Working Party to review the *Pits and Quarries Control Act* and make further recommendations to the Ontario government on mineral aggregate policy. This Working Party was comprised of representatives from the public, municipalities, the aggregates industry, and government. It recognized the growing conflicts between the aggregates sector and the interests of private citizens: "…while there is a general acceptance within the Province that aggregate extraction is necessary, there is also a very real concern by the citizens involved to see that their interests are protected" (Baker et al., 2001, p. 470). It recognized other pervasive issues in the industry also, including a lack of consistency in the administration of the Pits and Quarry Control Act; a failure of enforcement of the Act; deficiencies in the Act; inequities in the supply system within the Province; and a severe lack of any rehabilitation. The Working Party's final report, *A Policy for Mineral Aggregate Management in Ontario*, made many recommendations for improvements in policy and legislation and endorsed municipal involvement in the decision-making process: "Provincial-municipal shared control was seen as the best way to ensure environmental protection, regulatory control, and industry needs" (p. 470). This, however, was not reflected in subsequent changes in aggregate policy. For example, the Ministry of Natural Resources' 1979 *Mineral Aggregate Resources Policy Statement*, the "Mineral Aggregate Policy for Official Plans," protected lands identified as having significant aggregate deposits from all other land uses until aggregates had first been removed. Aggregate extraction, then, had priority over all other land uses.

Section 3 of the new Planning Act, adopted in 1983, allowed the provincial government to issue policy statements to guide municipal authorities in land use planning. The "Mineral Aggregate Resources Policy Statement" (MARPS) was the first of these provincial policy statements. It was based on an inventory of aggregates in Ontario, projected demands, and estimated volumes to be produced by local jurisdictions (see Chambers & Sandberg, 2007). Like the 1979 policy, the objectives of MARPS ensured that official plans identify and protect existing pits and quarries and future aggregate reserves from incompatible land uses. Municipalities did not have to zone the identified areas for extraction but it prevented them from being used for any other purpose.

1985 – mid 1990s

The (1989) Aggregate Resources Act (ARA) replaced the Pits and Quarries Control Act. It received first reading in 1979 but was not adopted until 1989. The ARA was at this time largely based on the recommendations of the Ontario Mineral Aggregate Working Party's final report. According to Baker et al., the ARA was unpopular with the industry. This may have been because the ARA placed more responsibility on the aggregate industry for the mitigation of the environmental and social impacts of extraction. Municipalities also disliked the new bill because it did nothing to reverse the trend to diminish the ability of the municipalities to restrict aggregate operations. The move to give more responsibility to the aggregate industry for the environmental impacts of aggregate extraction may have been, in part, a response to the significant increase in the rate of aggregate extraction in southern Ontario. Between 1979 and 1989, aggregate production increased from 131 million tonnes to 197 tonnes (Baker et al., 2001, p.471): "With this dramatic rise in mining activity came heightened awareness of the overall costs of the industry and weaknesses in the policy framework" (p. 471). In December 1994, the province adopted a comprehensive set of provincial policy statements, which came into effect in 1995. These statements were based on the work of the Commission on Planning and Development Reform. Among these statements was the *Mineral Aggregate and Mineral Petroleum Resources Policy Statement*, the chief objective of which was to ensure that aggregates resources were available at a reasonable cost and as close to markets as possible to meet local, regional and provincial needs. The goals of 1979 MARPS policy were carried over in this policy statement. Other types of land uses were permissible only in areas where mineral extraction was not feasible, if development would not preclude aggregate extraction, and if the proposed land use or development was in the greater interest of the general public. Under the Planning Act, Municipal planning authorities had to adhere to this policy in their Official Plans. The trend to reinforce aggregate law with land use planning policy continued, therefore, with the new Provincial Policy Statement, which came into effect in March 1995.

A further shift in responsibilities from the Ministry of Natural Resources to the aggregate industry occurred in 1995, when the Ministry of Natural Resources experienced a dramatic reduction in funding for their aggregates program. In response to the reductions, the *Aggregate and Petroleum Resources Statute Law Amendment Act* was passed in 1996 and proclaimed in force in June 1997. It amended the ARA. Notably, it handed compliance inspection and

reporting, management of rehabilitation funds and the Management of Abandoned Aggregate Properties Program (MAAP), and operational accountability responsibilities to the industry, while the province retained responsibility for conducting enforcement, setting standards, and issuing approvals. Under this amendment, the Minister created the Aggregate Resources Trust and appointed the Ontario Aggregate Resources Corporation (TOARC) as trustee. TOARC's sole shareholder is the Ontario Stone, Sand & Gravel Association, formerly called the Aggregate Producers' Association of Ontario. The purposes of the Trust include, among others, the rehabilitation of abandoned pits and quarries, the collection and disbursement of aggregate fees to the Crown, regional and local municipalities, and research on aggregate resources management. According to Winfield and Taylor, this shift in responsibilities solidified a partnership between the provincial government and the aggregate industry in the management of the industry and mitigation of its environmental impacts. It also changed the powers of the Ministry of Natural Resources relative to the Ontario Municipal Board. The Ministry of Natural Resources, for example, was now responsible for deciding whether a licence application would be referred to the Ontario Municipal Board and the issues to be examined at the Ontario Municipal Board. And the Minister could also refuse a condition specified by the Ontario Municipal Board for a particular licence if he or she determined that the condition was not consistent with the purpose of the ARA: "The effect of these amendments was to allow the minister to decide, one, whether appeals of applications for aggregate licences under the ARA by individuals or municipalities are allowed to proceed before the Ontario Municipal Board and, two, the scope of any case referred to the Ontario Municipal Board" (Winfield and Taylor, 2005, p. 13). Also in 1996, the 1995 Provincial Policy Statement was rewritten to further ensure that as much aggregate resources as possible be made available as close to market as possible to supply market needs without consideration of other land uses.

1996 to present

The above trend in the evolution of legislation and policy that govern aggregate resources prevails. Today, Ontario's current Planning Act (1990) requires planning decisions and Official Plans to be "consistent with" provincial policy statements and to "conform with" or "not conflict with" provincial plans. This is an amendment to the 1996 version of the Act, which required planning decisions "to have regard to" provincial policy statements. Ontario's Provincial Policy

Statement (2005) continues to protect aggregate resources for long-term use by ensuring that "as much of the mineral aggregate resources as is realistically possible shall be made available as close to markets as possible" (Ministry of Municipal Affairs and Housing, 2005, p. 23). Subsections 2.5.2.4 and 2.5.2.5 give priority to aggregate operations and areas identified as having deposits of mineral aggregate resources over other potential land uses. Section 2.5.4 lays out a particular stipulation to permit aggregate extraction in prime agricultural areas, on prime agricultural land. A demonstration of need, including any type of supply/demand analysis, is not required. Social and environmental impacts are laid out in subsection 2.5.2.2, and require aggregate extraction undertakings to proceed in a manner that minimizes social and environmental impacts. But no direction is provided that elaborates on the interpretation of this clause. Section 2.5.3 lays out in scant detail requirements for rehabilitation, the funds for which, as previously described, are administered by TOARC.

From 2003 to 2006, the Office of the Environmental Commissioner of Ontario undertook a review of Ministry of Natural Resources' Aggregate Resources Program. The report released in 2006 confirms that the Program lacks the capacity to fulfill its responsibilities due to inadequate staffing, funds, and expertise: "In addition to overall cuts in funding and staffing, inadequate capacity is hindering Ministry of Natural Resources' aggregates program in the areas of approvals and compliance, the oversight of rehabilitation activities, and long-term planning" (Environmental Commissioner of Ontario, 2007, p. 52). For example, since 1995/1996 budget for the program was reduced from $5.2 million to $1.7 million and the number of staff inspectors was slashed from 41 in 1997 to 20 in 2006. Inspectors are expected to report on as many as 600 aggregate operations. According to Environmental Commissioner of Ontario (2007), staff inspectors can effectively report on approximately 150 sites: "Actual audit rates in the last four years have hovered between 10 ad 13 percent, and an average pit or quarry might only be inspected only every 6 to 10 years" (p. 52). The study also found that compliance problems and complaints have increased: "Ministry of Natural Resources surveyed licencee compliance with the ARA within the Oak Ridges Moraine, and found that 100 sites out of 121 had compliance problems: "Lack of staff and visibility in the field by inspectors has resulted in an increase in illegal operations and numerous complaints to the Ministry of Natural Resources field staff" (p. 53). As a result, many municipalities have asked for the power to enforce rules on site operations. According to the review, the Ministry of Natural Resources and TOARC do not have

an adequate database for evaluating rehabilitation activities across the province (p. 53). The Ministry of Natural Resources has also lost much of its expertise in hydrogeology, making it difficult to assess potential impacts on water resources. Inadequate staffing has affected the Ministry of Natural Resources' aggregate resource inventorying activities. Every 10 years, an evaluation of the state of the resource should be undertaken. But the most recent inventory dates back to 1992.

In response to some of the above issues, the ARA was amended in 2006 to require aggregate operators to keep a record of the amount of aggregate removed from a site. Also, aggregate inspectors now have the power to issue a "stop work order" for violations of the ARA provisions and regulations. Licence and permit fees were also increased for the first time in 30 years to 11.5 cents/tonne from 6 cents/tonne.

In February 2009, the Ministry of Natural Resources commenced a *State of Aggregate Resource in Ontario Study* as an attempt to update the 1992 study. Among other objectives, the Study aims to develop a methodology to forecast future aggregate demand and analyse alternative sources of aggregate.

Appendix B: Interview questions

A.) Questions and prompts to all interviewees (Mayor of Caledon, Town Councilors, Town Planners, Ministry of Municipal Affairs and Housing staff, and members of the Caledon Coalition of Concerned Citizens, Ontario Stone, Sand & Gravel Association):

1. Why did the Town and the Region initiate the *Caledon Community Resources* study?
   - Why was it needed?
   - Who was involved in the study?

2. Why did the Region of Peel not have a Regional Official Plan in 1996?
   - Were the Region and the Town under a lot of pressure from the Ministry of Municipal Affairs and Housing to develop a Regional Official Plan?

3. How could Caledon get away with using the Cabinet Corners policies for so long?
   - How did the Cabinet Corners policies come about?

4. What were the key controversial policies in the Region's 1996 Official Plan?
   - HPMARA map, protection of Peel's Greenlands system, demonstration of need, policies about providing balance and priority to protect settlement areas, rural character, cultural heritage

5. What were the key controversial policies in OPA 161?
   - Prioritization, two extraction designations, demonstration of need, independent social impact study, protection of Greenlands system, monitoring of dust and rehabilitation, Comprehensive Broader Scale Environmental Study requirement

6. In your opinion, why did the players involved in OPA 161 support or reject the more controversial policies?
   - Town Council, Regional Council, Town Planners, Ministry of Municipal Affairs and Housing/ Ministry of Natural Resources, Coalition of Concerned Citizens, Niagara Escarpment Commission, Credit Valley Conservation Authority, Ontario Stone, Sand & Gravel Association, individual quarry owners, James Dick Construction

7. In your opinion, how significant is OPA 161 when it comes to aggregate extraction operations in Caledon?

8. In your opinion, how will OPA 161 influence future aggregate extraction operations in Caledon?

9. In your opinion, will OPA 161 have an effect beyond Caledon? Why?

10. In your opinion, what contributed to the success of OPA 161, especially with regards to its incorporation in Caledon's OP and the Ontario Municipal Board hearing where it was decided that OPA 161 would be applied to JDCL's case?

B.) Additional questions posed to members of the Ontario Stone, Sand & Gravel Association and Gravel Watch:

1. Interviewees were asked to speak to the following trends that have emerged or disappeared over the years in aggregate extraction law and practice:

- Rehabilitation problems
- Demonstration of need
- Recognition and mitigation of environmental and social impacts
- Shortage of supply, close to demand discourse
- Recycling of aggregate
- Attitudes of corporate versus local owners of extraction operations

Appendix C: Evaluations of OPA 161

Table 2 Evaluation of OPA 161 against a consolidated set of context specific sustainability criteria

OPA 161 policies were evaluated against a set of context specific sustainability criteria in order to determine the extent to which OPA 161 may contribute to progress towards sustainability across local to provincial scales. Section 6.4 discusses the results of this evaluation.

Table 2. Evaluation of OPA 161 against a consolidated set of context specific sustainability criteria

(The asterisk (*) marks the Green Gravel priorities for reform of the provincial institutional system.)

Requirements for progress towards sustainability	Green Gravel priorities and broadly felt benefits and negative impacts of pits and quarries	Contributions of OPA 161 policies to progress towards local to provincial sustainability

Social-ecological system integrity	• Loss and degradation of natural habitat
	• Loss and degradation of form and function of hydrological and hydrogeological systems
	• Loss and degradation of surface and groundwater quality and quantity
	• Loss of farmland for food production
	• Inadequacy of progressive and final rehabilitation
	• Air pollution (especially dust and CO_2 emissions from trucks)
	• Higher cumulative effects due to lack of phasing in of extraction operations
	  • *Modify the Provincial Policy Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas
	  • *Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these
		• Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas
		• Requirement for CBSES in Reserve areas
		• Other study requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis)
		• Approval agencies may reject an application based on the technical and scientific information in the required reports
		• Prohibition of extraction in Core Areas of Peel's Greenlands system, some Environmental Policy Areas, kettle lakes and their catchments
		• Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B)
		• Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence
		• Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation,

	designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them • *Greener modes of transport of the resource • *Mandatory standards and monitoring for dust and carbon dioxide	noise, dust, truck traffic, effects on water resources and ecosystem integrity
Livelihood sufficiency and opportunity	• Costs of road construction and maintenance of haul routes • Costs of damage to cultural and natural heritage • Costs of damage to private property and property values • Costs of administration and conflict resolution (e.g. legal and consultant fees) • Loss of use of prime agricultural land for food production • Priority given to aggregate extraction over other land uses • Local employment opportunities • More affordable building and infrastructure construction • Tax revenues and economic multiplier effects from the industry and its employees • Higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)	• Requirement for Applicants to pay for the costs of an independent peer review of reports • Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Prohibition of extraction in Core Areas of Peel's Greenlands system, some Environmental Policy Areas, kettle lakes and their catchments • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity
Intra-generational equity	• Local communities must deal with all immediate and cumulative effects • Insufficient licence and permit fees • Centralized regulation of the industry by the industry and	• Approval agencies may reject an application based on the technical and scientific information in the required reports • Requirement for Applicants to pay for the costs of an independent peer review of reports

	the provincial government • *More time in addition to the 45 days provided by the ARA for public review of licence and permit applications • *Intervenor funding for the application review process	
Inter-generational equity	• Inadequacy of progressive and final rehabilitation • Higher cumulative effects due to lack of phasing in of extraction operations • Loss of natural and cultural heritage resources • Loss of use of prime agricultural land for food production • Depletion of a valuable resource (aggregates near urban demand) • *Modify the Provincial Policy Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas • *Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them • *Higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)	• Requirement for Applicants to pay for the costs of an independent peer review of reports • Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Prohibition of extraction in Core Areas of Peel's Greenlands system, some Environmental Policy Areas, kettle lakes and their catchments • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity
Resource maintenance and efficiency	• Inadequacy of progressive and final rehabilitation • Absence of aggregates demand management • Facilitation of urban and suburban sprawl • Lower GHG emissions with	• Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural

	short fun aggregates transportation • *Development and implementation of provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates • *Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and municipal highway specifications) • *Strengthen the ARA to require at least 50% of rehabilitation in one licenced area before the expansion of an existing operation or a new operation by the same owner in a particular Municipality can occur • *Elimination of perpetual licences and permits and unlimited annual tonnage allowances • *A phasing in of new extraction operations so that existing licences are optimized before new licences are granted • *Higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)	heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Prohibition of extraction in Core Areas of Peel's Greenlands system, some Environmental Policy Areas, kettle lakes and their catchments • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity
Social-ecological civility and democratic governance	• Lack of funding for individual intervenors in Ontario Municipal Board hearings • Insufficient time allotted for public comment on site plans and reports	• Requirement for a pre-submission consultation meeting with the Applicant, Town, Region, Ministry of Natural Resources, Conservation Authorities, and other relevant agencies before submission of application

	• Lack of transparency with respect to the amount of aggregate produced/pit or quarry
	• Centralized regulation of the industry by the industry and the provincial government
	• Lack of public participation in decision making
	• Priority to aggregate extraction land uses reinforced by Provincial Policy Statement and Planning Act
	• Insufficient Ministry of Natural Resources staffing and expertise to inspect sites
	  • Insufficient funding for the Ministry of Natural Resources to administer the aggregate resources program (e.g. site inspection)
	  • *More time in addition to the 45 days provided by the ARA for public review of licence and permit applications
	  • *Intervenor funding for the application review process
	  • *Increased public accessibility to application documents (site plans, technical reports, background studies, etc.)
	  • *Increased capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections
	• *Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply
		package to the Town
		• Requirement to make all Reports and detailed site plans available to the public by submitting them to the Town Clerk
		• Other study requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis)
		• Approval agencies may reject an application based on the technical and scientific information in the required reports

Precaution and adaptation	• Use of unproven technologies to mitigate negative impacts of extraction (e.g. grout curtain) • Insufficient understanding of the complex biophysical systems affected by aggregate extraction and the long-term cumulative	• Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural

	impacts of aggregate extraction • *Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply	heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity
Immediate and long-term integration	• Little integration of aggregates sustainability considerations in overall growth management planning • Limited explicit attention to trade-offs • *Lift regulatory barriers to the use of recycled materials • *Development and implementation of provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates • *Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and Municipal highway specifications) • *Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply • *Increased capacity of the Ministry of Natural	

	Resources to conduct inspections and increase the frequency of inspections	

Table 3: Evaluation of OPA 161 against Caledon's 1981 Cabinet Corners policies

OPA 161 was evaluated against Caledon's 1981 Cabinet Corners policies in order to determine the extent to which OPA 161 represents institutional change. Section 6.5 discusses the results of this evaluation.

Table 3. Evaluation of OPA 161 against Caledon's 1981 Cabinet Corners policies

Requirements for progress towards sustainability (Gibson et al., 2005)	Broadly felt benefits and negative social-ecological impacts of pits and quarries	Caledon's 1981 Cabinet Corners Policies	Contributions of OPA 161 policies to progress towards local, regional sustainability
Social-ecological system integrity	• Loss and degradation of natural habitat • Loss and degradation of form and function of hydrological and hydrogeological systems • Loss and degradation of surface and groundwater quality and quantity • Loss of farmland for food production • Inadequacy of progressive and final rehabilitation • Air pollution (especially dust and CO_2 emissions from trucks) • Higher cumulative effects due to lack of phasing in of extraction operations • Modify the Provincial Policy	• "Have regard" to preserving land in a particular area known as Cabinet Corners • In considering OPAs, Town will consider goals to preserve and encourage agricultural activity, maintain the scenic and rural character of the Mun, land use balance as an amendment consideration • Priority given to existing and future residential dev • Official Plan amendment criteria	• Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Prohibition of extraction in Core Areas of Peel's Greenlands system,

	Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas • Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them • Greener modes of transport of the resource • Mandatory standards and monitoring for dust and carbon dioxide	included *need* for the operation & impact on the environment (air, water, noise, water table, surface drainage on and off site) & nature of proposed rehab • Little detail with respect to assessment of envt'l impacts and social impacts • Assmnt of Social impacts not elaborated beyond consideration of public concerns and impacts on residents adjacent to project • Progressive rehab promoted • Intent to dev rehab program and inventory of abandoned and rehab-ilitated pits and quarries	some Environmental Policy Areas, kettle lakes and their catchments • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity
Livelihood sufficiency and opportunity	• Costs of road construction and maintenance of haul routes • Costs of damage to cultural and natural heritage • Costs of damage to private property and property values • Costs of administration and conflict resolution (e.g. legal and consultant fees) • Loss of use of prime	• "Have regard" to preserving land in a particular area known as Cabinet Corners • In considering OPAs, Town will consider goals to preserve and encourage agricultural activity, maintain the scenic and rural character of the Mun, land use balance as an amendment consideration	• Requirement for Applicants to pay for the costs of an independent peer review of reports • Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study requirements (noise,

	agricultural land for food production • Priority given to aggregate extraction over other land uses • Local employment opportunities • More affordable building and infrastructure construction • Tax revenues and economic multiplier effects from the industry and its employees • Higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)	• Priority given to existing and future residential dev • Official Plan amendment criteria included *need* for the operation & impact on the environment (air, water, noise, water table, surface drainage on and off site) & nature of proposed rehab • Little detail with respect to assessment of envt'l impacts and social impacts • Assmnt of Social impacts not elaborated beyond consideration of public concerns and impacts on residents adjacent to project • Progressive rehab promoted • Intent to dev rehab program and inventory of abandoned and rehab-ilitated pits and quarries	dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Prohibition of extraction in Core Areas of Peel's Greenlands system, some Environmental Policy Areas, kettle lakes and their catchments • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity
Intra-generational equity	• Local communities must deal with all immediate and cumulative effects • Insufficient licence and permit fees	• "Have regard" to preserving land in a particular area known as Cabinet Corners • In considering OPAs,	• Approval agencies may reject an application based on the technical and scientific information in the required reports

	• Centralized regulation of the industry by the industry and the provincial government • More time in addition to the 45 days provided by the ARA for public review of licence and permit applications Intervenor funding for the application review process	Town will consider goals to preserve and encourage agricultural activity, maintain the scenic and rural character of the Mun, land use balance as an amendment consideration • Priority given to existing and future residential dev • Official Plan amendment criteria included *need* for the operation & impact on the environment (air, water, noise, water table, surface drainage on and off site) & nature of proposed rehab • Assmnt of Social impacts not elaborated beyond consideration of public concerns and impacts on residents adjacent to project	• Requirement for Applicants to pay for the costs of an independent peer review of reports
Inter-generational equity	• Inadequacy of progressive and final rehabilitation • Higher cumulative effects due to lack of phasing in of extraction operations • Loss of natural and cultural heritage resources • Loss of use of prime agricultural land for food production • Depletion of a valuable resource (aggregates near urban demand) • Modify the	• "Have regard" to preserving land in a particular area known as Cabinet Corners • In considering OPAs, Town will consider goals to preserve and encourage agricultural activity, maintain the scenic and rural character of the Mun, land use balance as an amendment consideration • Priority given to existing and future	• Requirement for Applicants to pay for the costs of an independent peer review of reports • Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural

	Provincial Policy Statement to prohibit aggregate extraction in prime agricultural lands, natural heritage, and source water areas • Amend the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment Acts and Plans to prohibit new aggregate extraction in these designated areas, and the Class I, II, and III agricultural lands adjacent or contiguous to them • Higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts)	residential dev • Official Plan amendment criteria included *need* for the operation & impact on the environment (air, water, noise, water table, surface drainage on and off site) & nature of proposed rehab • Little detail with respect to assessment of envt'l impacts and social impacts • Assmnt of Social impacts not elaborated beyond consideration of public concerns and impacts on residents adjacent to project • Progressive rehab promoted • Intent to dev rehab program and inventory of abandoned and rehab-ilitated pits and quarries	heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Prohibition of extraction in Core Areas of Peel's Greenlands system, some Environmental Policy Areas, kettle lakes and their catchments • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity
Resource maintenance and efficiency	• Inadequacy of progressive and final rehabilitation • Absence of aggregates demand management • Facilitation of urban and suburban sprawl • Lower GHG	• "Have regard" to preserving land in a particular area known as Cabinet Corners • In considering OPAs, Town will consider goals to preserve and	• Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve

	emissions with short fun aggregates transportation • Development and implementation of provincial laws, policies, strategies, etc. that encourage infrastructure and building design standards that reduce the need for aggregates • Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and municipal highway specifications) • Strengthen the ARA to require at least 50% of rehabilitation in one licenced area before the expansion of an existing operation or a new operation by the same owner in a particular Municipality can occur • A phasing in of new extraction operations so that existing licences are optimized before new	encourage agricultural activity, maintain the scenic and rural character of the Mun, land use balance as an amendment consideration • Priority given to existing and future residential dev • Official Plan amendment criteria included *need* for the operation & impact on the environment (air, water, noise, water table, surface drainage on and off site) & nature of proposed rehab • Little detail with respect to assessment of envt'l impacts and social impacts • Assmnt of Social impacts not elaborated beyond consideration of public concerns and impacts on residents adjacent to project • Progressive rehab promoted • Intent to dev rehab program and inventory of abandoned and rehab-ilitated pits and quarries	areas • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Prohibition of extraction in Core Areas of Peel's Greenlands system, some Environmental Policy Areas, kettle lakes and their catchments • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Requirement for Rehabilitation Master Plans, included in Ministry of Natural Resources' conditions of licence • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity

	licences are granted • Higher charges for extraction (to promote efficient use of the resource, fund the implementation of a conservation strategy, and to help to internalize the costs of impacts) • Greener modes of transport of the resource (boat, barge, rail)		
Social-ecological civility and democratic governance	• Lack of funding for individual intervenors in Ontario Municipal Board hearings • Insufficient time allotted for public comment on site plans and reports • Lack of transparency with respect to the amount of aggregate produced/pit or quarry • Centralized regulation of the industry by the industry and the provincial government • Lack of public participation in decision making • Priority to aggregate extraction land uses reinforced by Provincial Policy Statement and Planning Act • Insufficient Ministry of Natural Resources staffing and expertise to inspect sites • Insufficient funding for the Ministry of Natural Resources	•	• Requirement for a pre-submission consultation meeting with the Applicant, Town, Region, Ministry of Natural Resources, Conservation Authorities, and other relevant agencies before submission of application package to the Town • Requirement to make all Reports and detailed site plans available to the public by submitting them to the Town Clerk • Other study requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports

	to administer the aggregate resources program (e.g. site inspection) • More time in addition to the 45 days provided by the ARA for public review of licence and permit applications • Intervenor funding for the application review process • Increased public accessibility to application documents (site plans, technical reports, background studies, etc.) • Increased capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections • Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply		
Precaution and adaptation	• Use of unproven technologies to mitigate negative impacts of extraction (e.g. grout curtain) • Insufficient understanding of the complex biophysical systems affected by aggregate extraction	•	• Prioritization of aggregate resource lands to phase in extraction and discourage extraction in Reserve areas • Requirement for CBSES in Reserve areas • Other study

	and the long-term cumulative impacts of aggregate extraction • Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply		requirements (noise, dust, traffic, vibration, visual impact, cultural heritage, water recourses, land use analysis) • Approval agencies may reject an application based on the technical and scientific information in the required reports • Two Extractive Industrial designations, one for above the water table (Extractive Industrial A) and one for below the water table (Extractive Industrial B) • Monitoring: progress of extraction, licence conditions compliance, extent of disturbed area, extent of rehabilitation, noise, dust, truck traffic, effects on water resources and ecosystem integrity

Immediate and long-term integration	• Little integration of aggregates sustainability considerations in overall growth management planning
	• Limited explicit attention to trade-offs
	  • Lift regulatory barriers to the use of recycled materials
	  • Development and implementation of provincial laws, policies, strategies, etc. that encourage infrastructure and		

	building design standards that reduce the need for aggregates • Implement provincial policies and guidelines, strategies, etc. for the use of recycled materials for provincial and municipal projects (e.g. a comprehensive conservation strategy based on the 3Rs, including changes in MTO and Municipal highway specifications) • Creation of an independent provincial authority to collect and maintain publicly accessible production statistics and forecasts of future demand and supply • Increased capacity of the Ministry of Natural Resources to conduct inspections and increase the frequency of inspections		