

Indicators, domains, and scoring methods for a Canadian Community Sustainability Indicator Framework

by

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## **AUTHOR'S DECLARATION**

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.

I understand that my thesis may be made electronically available to the public.

## **ABSTRACT**

The concept of sustainability has gained traction within Canadian planning efforts in recent years. As such, there is a need to measure progress toward sustainability goals; it was found that sustainability indicators are the recommended tool to perform such measurement. The literature also articulated the potential for core community sustainability indicators. The concept of transferability was produced to describe the ability of indicators, domains, and scoring processes to be relevant between communities (horizontal transferability) and various levels of governance (vertical transferability). Hence, the objectives of this research were to create a set of community sustainability indicators, domains, and a scoring methodology for use in a Canadian Community Sustainability Indicator Framework.

In attempt to achieve these objectives, first a document review of four existing Canadian community sustainability indicator sets and their domains. This review produced a preliminary set of community sustainability indicators and domains, the latter of which were used in the interviews that followed. The document review also introduced a scoring methodology from MMM Group: The Complete Mobility (CM) scoring methodology. Interview communities were chosen from across Canada using criteria to include different geographical areas, community sizes, and economic/population conditions. Interviewees were from academic, government, or non-government organizations. Interviews followed a loose interview guide with the objectives of gaining insight into interviewee perceptions on sustainability indicators, domains, and scoring processes. Specifically they were asked to evaluate the preliminary set of community sustainability indicator domains and CM scoring methodology, both found in the document review.

Synthesis of the results from the document review, the interviews, and the literature review found that there are benefits associated with, and a desire for a transferable community sustainability framework within Canada. The preliminary set of community sustainability indicator domains found complete acceptance in the interviews, and three newly proposed domains. The concept of scoring had varied opinions; however, in those interviewees who desired scoring, the CM methodology was well liked. A proposed framework for a CCSIF as well as other potentially emergent concepts and affirmed academic assertions were also presented in this thesis. Further research into many of these concepts, both emergent and not, was proposed.

## **ACKNOWLEDGEMENTS**

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The other side of this research is the MMM Group, which I would like to thank for supporting this research, both financially and with professionally. Specifically, I would like to thank Clark Gunter, Tyler Plante, and the numerous other members of the MMM Cities Group. The opportunity to work with you all was a truly enlightening experience, and I hope to work with you all in the future in one capacity or another.

Finally, I would like to thank all of the interviewees who took part in this research. The discussions we had were quite stimulating and have provided me with motivation, hope, and of course more questions for the future.

## **DEDICATION**

This thesis is dedicated to Erin for her tireless support, encouragement, and patience. Now we move forward, onto our next adventure.

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## **1.0 INTRODUCTION**

The importance of pursuing sustainability has become more evident in recent years. As such, “the identification, measurement, and application of appropriate indicators remains among the major challenges facing policymakers, bureaucrats, scientists, and citizens tasked with sustainability” (McCool & Stankey, 2004, p. 62). The purpose of this thesis is to develop a second generation set of municipal sustainability indicators, related indicator domains, and a scoring methodology for use in a Canadian Community Sustainability Indicator Framework (CCSIF).

### **1.1 Sustainability Indicators and Assessment**

This first subsection considers the need for indicators for sustainability assessment of municipal planning initiatives, leading with the broad concepts of sustainability and sustainable development, then focusing on sustainability planning and assessment, and finally on sustainability indicators.

#### *1.1.1 Sustainability*

The overarching concept of sustainability centres on the issues we already face, and future issues that are being caused by current actions. Generally, there is a need for current and future generations to respect environmental limitations and each person’s right to an adequate standard of living (Berke & Conroy, 2000). However, the current trends towards growing socio-economic inequity and environmental degradation mean that these seemingly humble goals will require significant change in the way we think and act (Gibson, 2006). Hence, sustainability is achieved by integrating social equity and respect for natural limitations in initiatives to attain and perpetuate a respectable standard of living for all people; current and future generations on a global scale.

#### *1.1.2 Sustainable Development*

Since sustainability is defined as the ultimate goal, sustainable development is defined as the means to achieving these sustainable ends (Cartwright, 1997). The definition most commonly used is from the World Commission on Environment and Development (1987, p. 43):

*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*

- *the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.*

*This definition is very well aligned with the sustainability understanding provided above and reiterates the point that sustainability is achieved through sustainable development.*

#### *1.1.3 Sustainability Planning and Assessment*

General sustainability concepts and theorizing are an important part in the sustainable development process. However, these larger ideas must be refined into implementable strategies in order to realize the benefits (Berke & Conroy, 2000). The sustainability process takes these larger concepts and develops implementation strategies. Implementation is optimally conducted at the local level (Cartwright, 1997; Clarke & Erfan, 2007) and must overcome significant challenges (Colton, 2010). There have been attempts to develop tools and strategies for local level sustainability planning and implementation (Association of Municipalities of Ontario, 2008); however there is currently no standard for assessment of the sustainability planning process (Infrastructure Canada, 2006).

The lack of one system to assess sustainability does not speak to a lack of focus or importance. Quite the opposite in fact, as the literature emphasizes the importance of measuring and reporting on sustainable

development efforts (Devuyst, 2000; V. Maclaren, 1996; Ministry of Municipal Affairs and Housing & Ontario Professional Planning Institute, 2009; Sanchez & Prado-Lorenzo, 2008). Sustainability assessment evaluates options for development towards sustainability, establishes standards, and provides feedback to the sustainability planning process (Dalal-Clayton & Bass, 2002), which assists in selecting the best suited actions (Nicollier, Jollet, Ferrari, & Jemelin, 2003) to progress towards sustainability (L. Shen, Jorge Ochoa, Shah, & Zhang, 2011).

Sustainability assessment is thus an important part of the sustainability planning process. In order to provide tangible results there is a need for specific measures for sustainability assessment (Tanguay, Rajaonson, Lefebvre, & Lanoie, 2010); sustainability assessment is most effectively undertaken using indicators (Dalal-Clayton & Bass, 2002).

#### *1.1.4 Sustainability Indicators*

Indicators are specific measures used to signify a larger trend or set of phenomena (Donnelly, Jones, O'Mahony, & Byrne, 2007). Indicators simplify issues, which means that they must represent those issues as closely as possible (Layne, 2009). Nonetheless, indicators are abstractions of reality and thus can never be perfect (Meadows, 1998). As such, indicators should only be interpreted with understanding of these limitations; they are only one part of the complex system they were selected to represent (V. Maclaren, 1996). So long as the associated limitations are understood, indicators could be very useful to sustainability assessment.

Indicators used for sustainability assessment can provide feedback on the progress, state, and trends of our social and environmental systems (Fehr, Sousa, Pereira, & Pelizer, 2004). This information can help decision makers to monitor changes, and evaluate future decisions and their related consequences (Ramatsteiner, Püchl, Alkan-Olsson, & Frederiksen, 2011). As sustainability indicators are integrated into the decision making process, they can also simplify communication between stakeholders in the sustainability planning process (L. Shen et al., 2011). The importance of developing sustainability indicators is embodied in Chapter 40 of Agenda 21, which calls for all levels of government and non-government agencies to create sustainability indicators to support the decision making process (United Nations Department of Economic and Social Affairs, 2007).

Indicator based sustainability assessment will help to achieve sustainability goals. However, the academic progress on sustainability indicators needs to be linked to real scenarios to benefit decision making and implementation efforts, and thus to realize real progress towards sustainability goals. Several examples of municipal indicators exist; however, there is a need for a common set to use in assessing and comparing municipal sustainable development efforts (L. Shen et al., 2011). Similarly, there is a need for higher level systems to guide sustainable development and to promote communication and comparison among cities (Holden, Roseland, Ferguson, & Perl, 2008). Development of a common set of indicators for use in a ranking system would facilitate communication and comparison between and within cities, while maintaining focus on common sustainability goals.

### **1.2 Research Questions**

In the interest of sustainability, there is a need to improve indicators, integrate indicators into policy making, and develop associated tools (Layne, 2009). Hence, the specific purpose of this thesis is to contribute to the development of community sustainability indicators and scoring methodologies to evaluate and rank municipalities based on the principles of sustainability. This research is undertaken as a collaborative effort between academia and the private sector, through a Mitacs Accelerate internship with MMM Group. Partnering with the private sector allows for input from a practical perspective and the opportunity for the outputs to be applied and have tangible effects.

To fulfill the purpose and goals set out above, two objectives, and related research questions, have been developed:

Research Objective 1: Develop a potential set of core indicator domains and indicators for use in a CCSIF.

Research Question 1a. What core set of sustainability indicator domains are relevant for all Canadian communities?

Research Question 1b. What preliminary set of sustainability indicators exist to populate a CCSIF?

Research Objective 2: Determine community attitudes towards the McCormick Rankin Corporation McLean Hazel (MRCMH, a division of MMM Group) Complete Mobility (CM) scoring methodology.

Research Question 2. Is the MRCMH CM scoring methodology applicable to a CCSIF?

These research objectives and questions follow throughout this thesis and form the core elements. Table 1.1 highlights the specific sections where content related to each research objective and question can be found, along with emergent themes. Transferability is included under Research Objective 1; however, the research questions contain no specific mention of this concept. This is because the concept of transferability relates to both Research Questions 1a and 1b; transferability of community sustainability indicators and domains to other communities (horizontal transferability) and various governance levels (vertical transferability) is vital to the concept of a CCSIF. This concept emerged in the literature review, and follows throughout the sections indicated in the table below. It is important to note this as an important concept that relates to the research questions; however, development of the transferability concept was not an intended outcome. Thus, there is no research question dedicated to this topic.

**Table 1.1: Research Objectives and Research Question Signposting**

		<b>2.0 Literature Review</b>	<b>3.0 Methods</b>	<b>4.0 Document Results</b>	<b>5.0 Interview Results</b>	<b>6.0 Discussion</b>
<b>Research Objective 1</b>	<b>Indicators</b> (Research Question 1a)	2.3, 2.4	3.3.1	4.1, 4.2, 4.3	5.2	
	<b>Domains</b> (Research Question 1b)	2.3, 2.4	3.3.1, 3.4.1	4.1, 4.2, 4.3	5.3	
	<b>Transferability</b>	2.1.2	3.4.1		5.1	
<b>Research Objective 2</b>	<b>Scoring</b> (Research Question 2)	2.5	3.3.2, 3.4.1	4.4	5.4	
<b>Emergent Themes</b>	<b>Creating a CCSIF</b> (Emergent Theme)				5.5	

### **1.3 Methods**

In order to achieve the above research objectives and provide answers to the research questions an academically rigorous set of methods was used. This process was iterative and thus was modified several times during the research stage. An in-depth literature review provided an academic base for the project. This was followed by a practitioner document analysis to determine sustainability indicators, relevant indicator domains, and a potential scoring methodology. Interviews with several participants from selected municipalities were used to assess the relevance of the developed Canadian community sustainability indicator domains and the CM scoring methodology. A complete review of the methods used is included in chapter three of this thesis.

### **1.4 Theoretical and Practical Contributions**

This research will contribute to the academic, public, and private sectors. First, this thesis research, including sustainable development indicators and scoring methodology, will contribute to academic literature. This research will also contribute to a sustainable cities index, which will be linked directly to implementation solutions. This will provide both the private and public sectors with basic understanding of sustainability principles, indicators, and scoring methodology upon which sustainability planning and implementation practices can be based.

### **1.5 Thesis Summary**

The next part of this thesis is an in-depth literature review, including generalized sustainability concepts, sustainability assessment, and sustainability indicator sections. Next the methods followed in conducting the rest of this research are detailed in depth. From this stage it was decided that a practitioner document review was necessary to look for linkages between theory and practice. The products of connecting these two forms of literature are included at the conclusion of the practitioner document analysis section in the form of a set of sustainability indicator categories, and related indicators. These products were then introduced to selected interviewees from municipalities that had been selected based on several criteria. The interviews compared the set of community sustainability indicator domains established through this research and the perceived needs of the communities, and examined the motivations for pursuing certain paths versus others in the sustainability planning, assessment, and indicator creation processes. The results of these interviews are included in the results section. The discussion section then considers similarities and differences found between and within the sections of this research. Finally, conclusions and areas for future consideration are proposed.

## 2.0 LITERATURE REVIEW

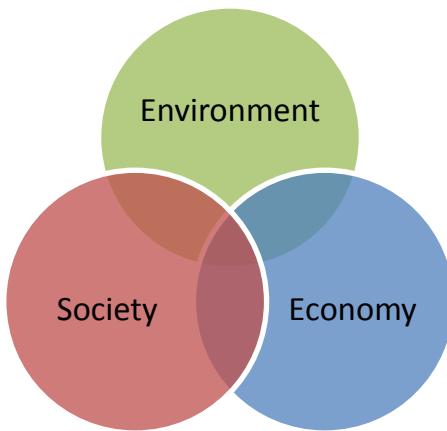
The following chapter considers academic literature pertaining to sustainability indicators. This literature review seeks to establish broad consensus on the definitions of sustainability and sustainable development before moving through the sustainability planning process. One section of this process, sustainability assessment is considered in greater detail, followed by an even more specific final section on sustainability indicators (Research Objective 1) and a final section on scoring sustainability indicators (Research Objective 2).

### 2.1 Sustainability and Sustainable Development

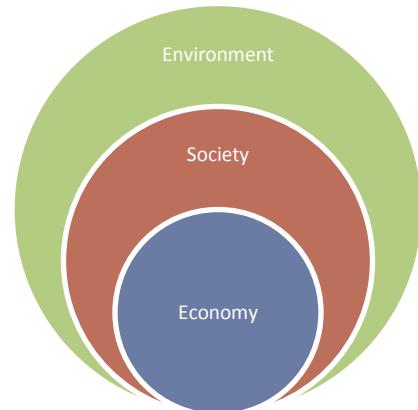
#### 2.1.1 Sustainability

The concept of sustainability developed around problems that current and future generations are already challenged by, and those they will face in coming years. “Current and future generations must strive to achieve a decent standard of living for all people and live within the limits of the natural system” (Berke & Conroy, 2000, p. 22). These simplistic objectives of social equity and respect for the environment prove problematic given the current course of our global society, which is typified by “the spreading gulf between rich and poor and the continued degradation of biospheric conditions” (Gibson, 2006, p. 171). This divergent situation develops from “the evident and fundamental deficiencies of conventional decision-making and it requires significant change in how we think about our choices and how we structure our institutions as well as our processes of evaluation and decision” (Gibson, 2006, p. 178). Hence, in general terms, sustainability must aim to bring current social and environmental actions in line with the basic goals of social equity and natural preservation to provide both current and future generations with access to at least the basic necessities of life and the tools to achieve an adequate standard of living.

With the above general terms in mind, there have been many proposed frameworks and definitions of sustainability. Many of these include representation from three main groups: environment, economy, and society. The most basic illustrations begin with simple representation of the three overlapping groups, which attempts to illustrate either the need for integration (Figure 2.1), or a hierarchical relationship (Figure 2.2) among the systems. The former will be referred to as the ‘Venn diagram model’ and the latter as the ‘concentric circles model’ (Lozano, 2008; Mebratu, 1998).



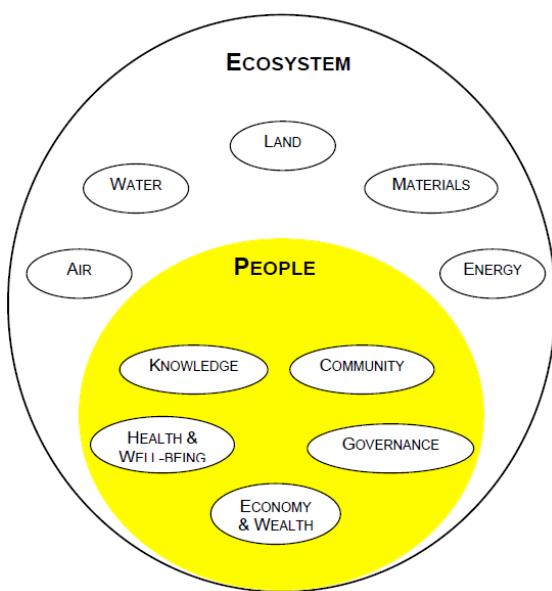
**Figure 2.1: Venn Diagram Model**



**Figure 2.2: Concentric Circles Model**

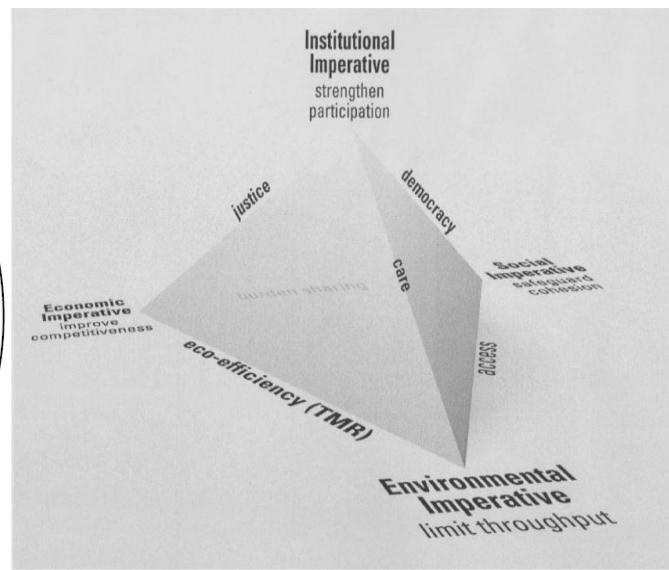
The Venn diagram model provides an illustration of overlapping systems; areas where these three systems intersect are usually best related to policy and thus can highlight important issues or conflicts (Campbell, 1996). The concentric circles model, on the other hand, highlights that all of society operates within the bounds of the environment, and the economy within both social and environmental limitations; this illustrates that smaller circles’ are subsystems of the larger circles (Lozano, 2008).

Both of the above general models have been adapted by authors over time to fit different situations or as an evolution of the model. The concentric circles model was adapted to create the Campus Sustainability Assessment Framework (CSAF) Egg of Sustainability (Figure 2.3) (Cole, 2003). Similar to the concentric circles model, “this schematic shows that the people subsystem lies within the eco-subsystem, representing its supportive function, and that each subsystem needs to be healthy in order for the whole system to be functional and healthy” (Cole, 2003, p. 39). In this case, the model shows a basic representation of the overarching categories, but elaborates using sub-domains. A main difference from the basic concentric circles model is the inclusion of economy as only one of five sub-domains, giving it less significance and highlighting other areas of presumed importance. Similarly, Spangenberg’s prism of sustainability (Figure 2.4) (as seen in Valentin & Spangenberg, 2000) modifies the basic Venn diagram model of sustainability by adding an institutional dimension. Each system is termed as an imperative with a related directive, and each axis of the prism defines interaction among these imperatives. This model is much more elaborate and specific when compared to the counterpart, Venn diagram model. Also, when compared to the CSAF Egg of Sustainability the economic dimension holds a much greater importance, as is the case in comparing the Venn diagram model with the concentric circles model.



**Figure 2.3: CSAF Egg of Sustainability**

Source: (Cole, 2003, p. 40)



**Figure 2.4: Prism of Sustainability**

Source: (Valentin & Spangenberg, 2000, p. 383)

Each of these models shows benefit when considered from various perspectives. For example, the concentric circles model (or variations) provides a good example from a systems perspective, illustrating dependence of people on their surroundings. Despite the variances, these models are all means to describing the same ends from different perspectives. Hence, in attempting to develop a generic definition of sustainability, it may be best to consider only the most basic of goals; the goals that all of these models emphasize are, as stated above, the ability of current and future generations to maintain a decent quality of life. The following section will begin to discuss the movement from goal to action.

### 2.1.2 Sustainability Principles

This section will discuss three complete sets of sustainability principles. These principles are more specific than the above sustainability review, but are still meant to maintain geographical transferability. The three sets in this section are presented as complete lists; hence they are presented here in similar format.

Berke and Conroy (2000) propose the following criteria as sustainability principles:

1. *Harmony with nature.* Land use and development activities should support the essential cycles and life support functions of ecosystems. Whenever possible, these activities should mimic ecosystem processes, rather than modify them to fit urban forms. These activities must respect and preserve biodiversity, as well as protect and restore essential ecosystem services that maintain water quality, reduce flooding, and enhance sustainable resource development.
2. *Livable built environments.* The location, shape, density, mix, proportion, and quality of development should enhance fit between people and urban form by creating physical spaces adapted to desired activities of inhabitants; encourage community cohesion by fostering access among land uses; and support a sense of place to ensure protection of any special physical characteristics of urban forms that support community identity and attachment.
3. *Place-based economy.* A local economy should strive to operate within natural system limits. It should not cause deterioration of the natural resource base, which serves as a capital asset for future economic development. Essential products and processes of nature should be used up no more quickly than nature can renew them. Waste discharges should occur no more quickly than nature can assimilate them. The local economy should also produce built environments that meet locally defined needs and aspirations. It should create diverse housing, and infrastructure that enhances community livability and the efficiency of local economic activities.
4. *Equity.* Land use patterns should recognize and improve the conditions of low-income populations and not deprive them of basic levels of environmental health and human dignity. Equitable access to social and economic resources is essential for eradicating poverty and in accounting for the needs of the least advantaged.
5. *Polluters pay.* Polluters (or culpable interests) that cause adverse communitywide impacts should be required to bear the cost of pollution and other harms, with due regard to the public interest.
6. *Responsible regionalism.* Communities should not act in their own interests to the detriment of the interests of others, and they should be responsible for the consequences of their actions. Just as individual developers should be subject to the principle that polluters (or culpable interests) pay, a local jurisdiction has an obligation to minimize the harm it imposes on other jurisdictions in pursuit of its own objectives.

(Berke & Conroy, 2000, p. 23)

In this set of criteria, the three dimensions of sustainability are refined by integrating relevant local issues. These criteria are fairly vague, but offer principles that are transferable between local settings geographically (horizontal transferability), and through vertical levels of governance (vertical transferability). Hence the generic nature is subjective, but offers flexibility.

Gibson's set of "Core generic criteria for sustainability assessments" (2006, p. 174) provides a different version, but as the title suggests, they are still generic (Box 2.1). These criteria were written for sustainability assessment; however, they are transferable to other aspects of sustainability discussion, and also need to be specified for applications to particular contexts.

**Box 2.1 – Core generic criteria for sustainability assessments**

**Socio-ecological system integrity**

The requirement:

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 and ecological well-being depends.

Illustrative implications:

- need to understand better the complex systemic implications of our own activities; and
- need to reduce indirect and overall as well as direct and specific human threats to system integrity and life support viability.

**Livelihood sufficiency and opportunity**

The requirement:

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.

Illustrative implications:

- need to ensure provision of key prerequisites for a decent life (which, typically, are not now enjoyed by those who have little or no access to basic resources and essential services, who have few if any satisfactory employment opportunities, who are especially vulnerable to disease, or who face physical or economic insecurity); and
- need to appreciate the diversity, and ensure the involvement, of those whose needs are being addressed.

**Intragenerational equity**

The requirement:

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, and so on) between the rich and the poor.

Illustrative implications:

- need to build sustainable livelihoods for all, including practically available livelihood choices and the power to choose; and
- need to emphasize less materially- and energy-intensive approaches to personal satisfactions among the advantaged, to permit material and energy sufficiency for all.

**Intergenerational equity**

The requirement:

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

Illustrative implications:

- need to return current resource exploitation and other pressures on ecological systems and their functions to levels that are safely within the perpetual capacity of those systems to provide resources and services likely to be needed by future generations; and
- need to build the integrity of socio-ecological systems, maintaining the diversity, accountability, broad engagement and other qualities required for long-term adaptive adjustment.

**Resource maintenance and efficiency**

The requirement:

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.

Illustrative implications:

- need to do more with less (optimize production through decreasing material and energy inputs and cutting waste outputs through product and process redesign throughout product lifecycles), to permit continued economic expansion where it is needed, with associated employment and wealth

- generation, while reducing demands on resource stocks and pressures on ecosystems; and
- need to consider purposes and end uses, recognizing that efficiency gains are of no great value if the savings go to more advantages and more consumption by the already affluent.

### **Socio-ecological civility and democratic governance**

The requirement:

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.

Illustrative implications:

- need governance structures capable of integrated responses to complex, intertwined and dynamic conditions; and
- need to mobilize more participants, mechanisms and motivations, including producers, consumers, investors, lenders, insurers, employees, auditors, reporters; and
- need to strengthen individual and collective understanding of ecology and community, foster customary civility and ecological responsibility, and build civil capacity for effective involvement in collective decision-making.

### **Precaution and adaptation**

The requirement:

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.

Illustrative implications:

- need to act on incomplete but suggestive information where social and ecological systems that are crucial for sustainability are at risk; and
- need to design for surprise and adaptation, favouring diversity, flexibility and reversibility; and
- need to prefer safe fail over fail-safe technologies; and
- need to seek broadly comprehensible options rather than those that are dependent on specialized expertise; and
- need to ensure the availability and practicality of back-up alternatives; and
- need to establish mechanisms for effective monitoring and response.

### **Immediate and long term integration**

The requirement:

Apply all principles of sustainability at once, seeking mutually supportive benefits and multiple gains. considerations:

- integration is not the same as balancing; and
- because greater efficiency, equity, ecological integrity and civility are all necessary for sustainability, then positive gains in all areas must be achieved; and
- what happens in any one area affects what happens in all of the others; and
- it is reasonable to expect, but not safe to assume, that positive steps in different areas will be mutually reinforcing.

Illustrative implications:

- need positive steps in all areas, at least in general and at least in the long term; and
- need to resist convenient immediate compromises unless they clearly promise an eventual gain.

Source: adapted from (Gibson, 2006, p. 174)

These criteria fit slightly closer to the sustainability features discussed above, including variations of the three dimensions of sustainability, consideration of current and future generations, multi-time scale integration, and identification of important cross-cutting criteria; the criteria are intentionally designed so that none of them fits into any one of the usual social, economic or ecological categories. These criteria also maintain vertical and horizontal transferability through their generic structure.

The final set is from Infrastructure Canada, and was initially used to evaluate sustainability plans. The criteria to evaluate plans should be very similar to those used to assess overall sustainability. Hence, as is easy to see from the set, they are similar to the other sets presented and offer a third complete example of sustainability principles.

- Future-oriented and cognizant of ecological limits
- Support for local economic development that is mindful of ecological developments
- Integration of the three dimensions of sustainability
- Consideration of the regional context
- Promotion of a liveable and accessible built form
- Encouragement of a place-based economy that considers a community's unique characteristic
- Incorporation of principles of ecological design and ecological infrastructure
- Support for cultural sustainability (Infrastructure Canada, 2006, p. 13)

This third set also fits very well with the sustainability features above, and like the other two examples maintains a generic perspective, but is vertically and horizontally transferable. These criteria consider the three dimensions of sustainability (explicitly) and multi-time horizons, but again, are subjective as is expected with generic sets of sustainability criteria.

Each of these sets of sustainability principles uses a generic, and thus transferable, structure. However, considering them relative to the others and against the sustainability features above, there are some obvious deficiencies in two of the sets. First, Berke and Conroy (2000) are missing one of the main sustainability goals of intergenerational equity; providing the tools for future generations to be successful. Without consideration of different time horizons there can be no assertion of boundaries, and the actions taken are done so intrinsically, without ultimate purpose or goals. Hence, these principles could prove ineffective in promoting long-term sustainability goals and realizing real areas of importance.

The Infrastructure Canada (2006) set of principles simply acknowledges or considers some selected areas of importance to sustainability. The unclear and unspecific wording provides no defined direction and demands no real action or change. In this case, the status quo can continue as long as alternatives are considered, rather than encouraging responsible choices. Again, clear direction that links to real improvements towards sustainability are necessary.

Gibson (2006) provides a comprehensive, clear, and cross-cutting set of principles that consider multi-time horizons. They are effective in communicating areas of importance and look to achieve gains, rather than simple consideration or mitigation of negative impacts. This set even advises precaution and adaption to prevent further 'accidental' damage to the systems upon which we depend. Hence, this set of principles aligns with the features above, and provides good direction for linking actions to sustainability. As such, it will be adopted and used throughout the rest of this research.

### *2.1.3 Sustainable Development*

Sustainability and sustainable development are used interchangeably in many everyday situations. It is important to separate them and define them individually. So, where sustainability is defined as ultimate goals, sustainable development is the process used to achieve sustainability goals (Cartwright, 1997). In the first and most basic form, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs," it contains within it two key concepts:

- the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs" (World Commission on Environment and Development, 1987, p. 43).

This definition aligns very well with the way sustainability was explained above, as it maintains adaptability to different situations. More recently, Berke and Conroy (2000) describe municipal sustainable development as “a dynamic process in which communities anticipate and accommodate the needs of current and future generations in ways that reproduce and balance local social, economic, and ecological systems, and link local actions to global concerns” (p. 23). This definition links the three traditional systems of sustainability to local action and global issues. Focus on local level action to solve larger scale sustainability issues has gained credibility in the years since 1992, when Local Agenda 21 was developed, and is supported as a relevant scale for sustainable development to take place (Eckerberg & Forsberg, 1998; Kitchen, Whitney, & Littlewood, 1997; Nicollier et al., 2003; Peris, Acebillo-Baque, & Calabuig, 2011; Sanchez & Prado-Lorenzo, 2008; Valentin & Spangenberg, 2000). Likewise, promotion of sustainability by international organizations has led to heavy emphasis on environmental and social concerns (L. Shen et al., 2011). These issues appear throughout a great deal of the literature and as such, sustainable development appears to be an initiative that enables local action to achieve larger sustainability goals.

#### 2.1.4 Sustainability Progression

The modern environmental and social rights movements, fuelled by the insights of early visionaries like Leopold, Carson, Gandhi, and Luther King Jr., have contributed to the concept of sustainability. Sustainability and sustainable development were first used in this context in the Brundtland Commission report, *Our Common Future* (World Commission on Environment and Development, 1987). Since then, the United Nations (UN) has been a major force in driving sustainability on an international level through conferences and by facilitating agreements and plans of action. These have punctuated the sustainability progression, beginning with the Brundtland Commission (1983) and Report (1987). The United Nations Conference on Environment and Development in Rio de Janeiro (1992) saw Agenda 21, a document committed to addressing global sustainability issues, adopted by more than 178 countries (United Nations Division for Sustainable Development, 2009). Agenda 21 also refers to the role of local governments in sustainable development. The UN subsequently developed the Programme for the Further Implementation of Agenda 21 (United Nations Department of Economic and Social Affairs, 1997), which was adopted by the general assembly. The year 2000 brought the Millennium Summit and the Millennium Development Goals.

The eight Millennium Development Goals (MDGs) – which range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015 – form a blueprint agreed to by all the world’s countries and all the world’s leading development institutions (United Nations, 2008).

The Johannesburg Plan of Implementation builds upon the previous Agenda 21 documents in the hopes of furthering progress towards sustainability, focusing on environmental, social, and economic aspects (United Nations, 2002). The UN Conference on Sustainable Development (CSD) 2012 continues this trend, stating that “the objective of the Conference is to secure renewed political commitment for sustainable development, assess the progress to date and the remaining gaps in the implementation of the outcomes of the major summits on sustainable development, and address new and emerging challenges” (United Nations, 2011). The UN efforts listed above show a clear path from recognition to plans of action and implementation, followed by setting goals. They have provided a guiding light through the sustainability journey and maintain the idea of reaching larger goals through implementation, focused on three inter-related areas: environment, society, and economy. However, it is worth noting that there is no indication of the value that has been provided by these UN efforts in terms of actual implementation.

In Canada, public and political pressures caused structural changes to begin slowly within and between communities in the early 1990s, with most initiatives maintaining an environmental focus (V. McLaren, 1992). By 2005, the concept of sustainability had become very popular in Canada, punctuated by the Federal Gas Tax Agreement which provides funding for sustainable infrastructure planning and

implementation projects (Infrastructure Canada, 2011). There were now real pressures to action, and “both citizens and authorities are now increasingly aware of the interconnections among economic, social and ecological considerations” (Gibson, 2006, p. 171). Since then there has been a drastic increase in officially sustainability-based planning in Canada; the Federation of Canadian Municipalities (FCM) has funded the creation of 220 integrated community sustainability plans (ICSPs) (Markvart, 2011).

### *2.1.5 Sustainable Urban Development*

As seen above, the focus of much discussion centres on local level implementation. Hence, the appearance of terms such as sustainable urbanization and sustainable urban development in certain pieces of literature is no surprise. These terms speak to bringing larger sustainability goals into practice in urban environments (V. Maclaren, 1992; L. Shen et al., 2011). Also, “globally, the level of urbanization is expected to rise from 50 per cent in 2008 to 70 percent in 2050” (United Nations Department of Economic and Social Affairs, 2008, p. 4). Given that sustainable development challenges are best articulated at the local level (Cartwright, 1997; L. Shen et al., 2011), and that a majority of the global population now lives in cities, the importance of this area can be easily appreciated.

The importance of focus on urban settings is compounded by assertions that “environmental anxiety in the Third World is most prevalent in metropolitan areas where the sanitary infrastructure does not keep pace with population growth” (Fehr et al., 2004, p. 355), and warnings that “environmental collapse is imminent in many cities and will occur within the next two generations” (Fehr et al., 2004, p. 356). These statements are depressing; however, they highlight the issues that cities are already facing, especially in the third world. There are many practitioner reports that highlight issues in individual cities and collectively in groups (e.g. Ministry of Municipal Affairs and Housing & Ontario Professional Planning Institute, 2009; Siemens AG - Corporate Communications and Government Affairs, 2009; Siemens AG - Corporate Communications and Government Affairs, 2010; Siemens AG - Corporate Communications; Siemens AG - Industry Sector, Mobility Division, 2009; Siemens Canada Limited - Industry Sector, Mobility Division, 2010). Visible, common groups of issues plague all of the largest cities in the world. The Megacities Challenges Report (Siemens AG - Corporate Communications) identifies these common areas in five infrastructure categories: Transportation, Electricity, Water and Wastewater, Healthcare, and Safety and Security. Similarly, other categorizations of relevant issues exist (Ministry of Municipal Affairs and Housing & Ontario Professional Planning Institute, 2009; Siemens AG - Corporate Communications and Government Affairs, 2009; Siemens AG - Corporate Communications and Government Affairs, 2010; Siemens AG - Industry Sector, Mobility Division, 2009; Siemens Canada Limited - Industry Sector, Mobility Division, 2010), showing that there are major issues common across cities globally.

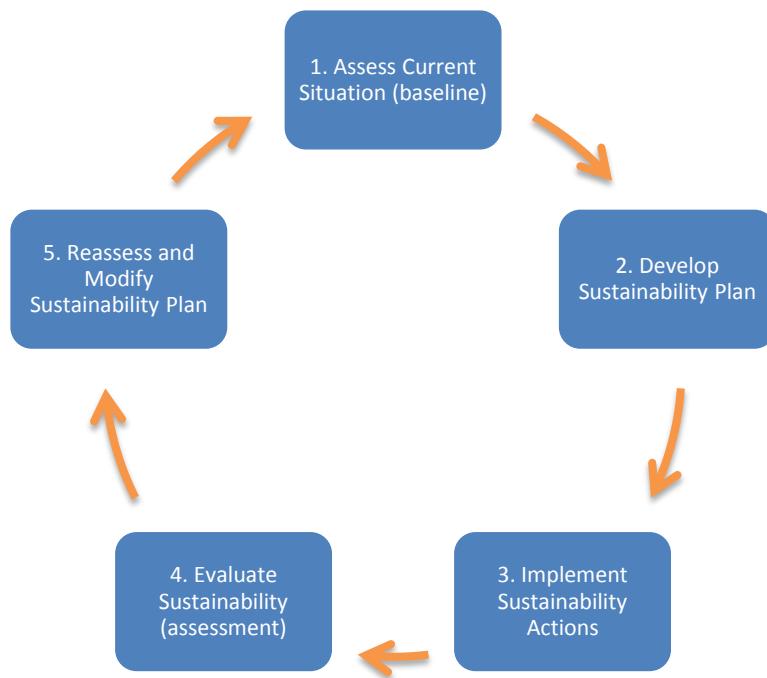
### *2.1.6 Sustainability Planning Process*

A sustainability-based planning process is necessary in order to address current and future sustainability issues. The literature on this topic is mostly aligned, and provides a distinct set of characteristics for a sustainability planning process. Generally, sustainability planning is holistic, and considers limits, connections and relationships (Gibson, 2006; Infrastructure Canada, 2006). This process must be participatory (Cartwright, 1997; Clarke & Erfan, 2007; Gibson, 2006; Kitchen et al., 1997; Ministry of Municipal Affairs and Housing & Ontario Professional Planning Institute, 2009; L. Shen et al., 2011), including all stakeholders (Dalal-Clayton & Bass, 2002). Forging partnerships with specific stakeholders is also important in creating an effective sustainability planning process (Cartwright, 1997; Clarke & Erfan, 2007) and will help to break down the barriers between various sectors and groups within and between organizations (Kitchen et al., 1997). The sustainability planning process should be undertaken considering multiple time periods in the future (Campbell, 1996; Clarke & Erfan, 2007; Fehr et al., 2004; L. Shen et al., 2011), while learning from the past (Gibson, 2006). These broad characteristics can be used as a framework, working local criteria in to address specific issues (Gibson, 2006). Hence, in the

sustainability planning process there is a broad structure that is adaptable to fit particular situations and issues.

Ultimately, planning and theorizing about sustainable development is inadequate to achieve desired results; the benefits of sustainable development come with implementation (Berke & Comroy, 2000). And the local level is an optimal place for sustainable development implementation strategies (Cartwright, 1997; Clarke & Erfan, 2007). Many sustainable development implementation strategies and tools at the local level have been created (Association of Municipalities of Ontario, 2008); however “the possibility for vagueness in community planning may be exacerbated by the fact that no single framework exists to systematically assess sustainable community planning” (Infrastructure Canada, 2006, p. 17). Without an assessment framework, there is no way to determine whether or not goals are being achieved, or if the current path needs to be changed. Sustainability assessment can establish baselines and provide the feedback required for the sustainability planning process to be adaptive in the pursuit of sustainability (Dalal-Clayton & Bass, 2002). The model provided by Johnson, Hays, Center, and Daley shows the basic sustainability planning process discussed in this section, and followed throughout this review (Figure 2.5).

**Figure 2.5: Sustainability Planning Process**



Source: (Johnson, Hays, Center, & Daley, 2004, p. 145)

## 2.2 Sustainability Assessment: Monitoring and evaluation

The literature, and the various UN efforts, have gathered support and highlighted the importance of sustainable practices; now it has become apparent that measuring and reporting on these efforts is very important to the sustainable development process (Devuyst, 2000; V. Maclare, 1996; Ministry of Municipal Affairs and Housing & Ontario Professional Planning Institute, 2009). Evaluation, step four in the sustainability planning cycle shown above (Figure 2.5), is “a way to assess the plan’s implementation and make suggestions as to how it can be improved” (Sanchez & Prado-Lorenzo, 2008, p. 18).

Assessment should be done to establish baselines, and on a regular basis to create feedback for an adaptive planning process (Dalal-Clayton & Bass, 2002). Hence, there is an inherent need to monitor, evaluate, and report on sustainable urbanization efforts as well; feedback will help to get closer to the desired state (L. Shen et al., 2011). Similarly, sustainability assessment can increase administrative

efficiencies by breaking down internal silos; helping with the spread of knowledge and benefits across departmental lines (Gibson, 2006).

A model that already exists for assessment along these lines is environmental assessment. However, since most environmental assessment is project based and lacks a systematic approach, future focus, sustainability principles, and broader geographical context (Gunn & Noble, 2009), there is a need for new tools (Layke, 2009) and the incorporation of sustainability principles into the process (Devuyst, 2000). In light of these deficiencies, the move to regional strategic environmental assessment has been recommended to the Canadian Council of Ministers of the Environment (CCME) Environmental Assessment Task Group (Gunn & Noble, 2009). Regional strategic environmental assessment is “a process designed to systematically assess the potential environmental effects, including cumulative effects, of alternative strategic initiatives, policies, plans, or programs for a particular region” (Noble & Harriman, 2008, p. 260). Considering the similarity in objectives, the incorporation, or at least consideration of regional strategic environmental assessment into sustainability assessment could prove to be very valuable to designing such an assessment system.

### 2.2.1 Evaluation System Design

Given the importance of sustainability assessment, there is a need for a framework within which sustainability assessment can be performed. Within the sustainability assessment literature there are different sets of rules or guidelines available to structure sustainability assessment; they will be considered in this section.

In *Planning by Design: A healthy communities handbook* it states that “in the process of developing your plans and projects, it is important to reflect your:

- vision – what are you doing? why are you doing it? who are you doing it for?
- mission statement – what are your ideal outcomes?
- goals – do they connect to your vision?
- objectives – how are your goals going to be achieved?
- strategies – how can your objectives be accomplished?
- action plans – what will be done? by when? by whom?
- performance indicators – are your goals being met? (Ministry of Municipal Affairs and Housing & Ontario Professional Planning Institute, 2009, p. 11).

Hence, in creating a sustainability assessment framework, it is important to consider the motivations and methods for pursuing sustainability. In order to maintain a systematic approach it would also be valuable to maintain the hierarchical order presented, considering the parts from top to bottom throughout the assessment design process. So, in the process of creating an assessment system, one must be mindful of all parts of the sustainability planning process. However, it is important to remember that the evaluation step of the sustainability planning process, the purpose of this research, should include only actual progress, not planned or expected results; assessing the sustainability planning processes is a separate step and requires separate consideration.

Dalal-Clayton and Bass (2002) believe that a monitoring and evaluation system requires:

- “Measuring and analysing sustainability
- Monitoring implementation of the strategies
- Evaluating the results of the strategy
- Reporting and dissemination of the above findings” (p. 309)

This set of requirements is straightforward and, as above, outlines a sustainability evaluation system that includes assessing the sustainability planning process. Although a system like this provides the necessary feedback and dissemination loops needed for an adaptive planning process, the integration of sustainability assessment findings and adaptation of the sustainability planning process, for the purposes

of this research, will be considered as a separate step (as shown in Figure 2.5). Maintaining independence of steps four and five of the sustainability planning process will allow for more depth in this research. A related assertion from these authors that is very relevant to this research, however, is to consider strategy implementation monitoring as an integral part of a sustainability evaluation system, where “strategy implementation monitoring covers:

- *Inputs*, in terms of monitoring financial, physical and human resources applied to the strategy and to its component activities...
- *Process quality*, in terms of monitoring how strategy principles are adhered to and developed (e.g., people-centred, participation, integration, commitment generation, etc.; see Box 3.1)...
- *Outputs*, in terms of monitoring which specific strategy products are generated by the agencies involved in the strategy...
- *Outcomes*, in terms of monitoring access to, use of, and satisfaction with strategy products. Such outcomes are not necessarily under the control of agencies involved in the strategy...
- *Accountability for implementation* – monitoring the performance of individual strategy actors in implementing the strategy, encouraging them to report to other stakeholders and monitoring related capacity constraints” (Dalal-Clayton & Bass, 2002, p. 321).

Monitoring strategy implementation aspects helps to ensure that a holistic perspective is maintained and taking perspective from all aspects of the process (i.e., knowing what inputs were present can have a large impact on the interpretation of the outputs).

In 1996, an international meeting took place with measurement professionals and researchers from five continents. They developed the Bellagio Principles (Box 2.2) “to serve as guidelines for the whole of the assessment process including the choice and design of indicators, their interpretation and communication of the result. They are interrelated and should be applied as a complete set” (International Institute for Sustainable Development, 2011).

#### **Box 2.2 – The Bellagio Principles**

##### **1. “Guiding Vision and Goals**

Assessment of progress toward sustainable development should be guided by a clear vision of sustainable development and goals that define that vision

##### **2. Holistic Perspective**

Assessment of progress toward sustainable development should:

- include review of the whole system as well as its parts
- consider the well-being of social, ecological, and economic sub-systems, their state as well as the direction and rate of change of that state, of their component parts, and the interaction between parts
- consider both positive and negative consequences of human activity, in a way that reflects the costs and benefits for human and ecological systems, in monetary and non-monetary terms

##### **3. Essential Elements**

Assessment of progress toward sustainable development should:

- consider equity and disparity within the current population and between present and future generations, dealing with such concerns as resource use, over-consumption and poverty, human rights, and access to services, as appropriate
- consider the ecological conditions on which life depends
- consider economic development and other, non-market activities that contribute to human/social well-being

##### **4. Adequate Scope**

Assessment of progress toward sustainable development should:

- adopt a time horizon long enough to capture both human and ecosystem time scales thus responding to needs of future generations as well as those current to short term decision-making

- define the space of study large enough to include not only local but also long distance impacts on people and ecosystems
- build on historic and current conditions to anticipate future conditions - where we want to go, where we could go

### **5. Practical Focus**

Assessment of progress toward sustainable development should be based on:

- an explicit set of categories or an organizing framework that links vision and goals to indicators and assessment criteria
- a limited number of key issues for analysis
- a limited number of indicators or indicator combinations to provide a clearer signal of progress
- standardizing measurement wherever possible to permit comparison
- comparing indicator values to targets, reference values, ranges, thresholds, or direction of trends, as appropriate

### **6. Openness**

Assessment of progress toward sustainable development should:

- make the methods and data that are used accessible to all
- make explicit all judgments, assumptions, and uncertainties in data and interpretations

### **7. Effective Communication**

Assessment of progress toward sustainable development should:

- be designed to address the needs of the audience and set of users
- draw from indicators and other tools that are stimulating and serve to engage decision-makers
- aim, from the outset, for simplicity in structure and use of clear and plain language

### **8. Broad Participation**

Assessment of progress toward sustainable development should:

- obtain broad representation of key grass-roots, professional, technical and social groups , including youth, women, and indigenous people - to ensure recognition of diverse and changing values
- ensure the participation of decision-makers to secure a firm link to adopted policies and resulting action

### **9. Ongoing Assessment**

Assessment of progress toward sustainable development should:

- develop a capacity for repeated measurement to determine trends
- be iterative, adaptive, and responsive to change and uncertainty because systems are complex and change frequently
- adjust goals, frameworks, and indicators as new insights are gained
- promote development of collective learning and feedback to decision-making

### **10. Institutional Capacity**

Continuity of assessing progress toward sustainable development should be assured by:

- clearly assigning responsibility and providing ongoing support in the decision-making process
- providing institutional capacity for data collection, maintenance, and documentation supporting development of local assessment capacity

Source: adapted from (International Institute for Sustainable Development, 2011)

It is worth stating that these principles were endorsed by all members involved, from a wide geographical background. Despite the fact that all participants were from the measurement industry, unanimous agreement speaks to the transferability, quality, and applicability of these principles. The Bellagio Principles are also written in hierarchical order, and should be addressed temporally from top to bottom (International Institute for Sustainable Development, 2011). This list also fits well with the sustainability definition provided above; it addresses current and future generations along with the traditional three sections of sustainability, is adaptable, moves from broader to narrower, is ordered in a way that moves

theoretical assumptions into application, uses simple structure, involves stakeholders, and provides inputs back into the process.

Gibson (2006), on the other hand, takes a different approach to addressing what should be included in sustainability assessment. Rather than a hierarchical layout, a set of guidelines to follow the entire process is provided (Box 2.3).

#### Box 2.3 – Gibson (2006) Sustainability Assessment Guidelines

- Sustainability considerations are comprehensive, including socio-economic as well as biophysical matters, and their interrelations and interdependency over the long term as well as the short term.
- Precaution is needed because human and ecological effects must be addressed as factors in open, dynamic, multi-scalar systems, which are so complex that full description is impossible, prediction of changes uncertain, and surprise likely.
- Minimization of negative effects is not enough; assessment requirements must encourage positive steps towards greater community and ecological sustainability, towards a future that is more viable, pleasant and secure.
- Corrective actions must be woven together to serve multiple objectives and to seek positive feedback in complex systems.
- Sustainability requires recognition both of inviolable limits and of endless opportunities for creative innovation.
- Sustainability is not about balancing, which presumes a focus on compromises and trade-offs. Instead the aim is multiple reinforcing gains. Trade-offs are acceptable only as a last resort when all the other options have been found to be worse.
- The notion and pursuit of sustainability are both universal and context-dependent. While a limited set of fundamental, broadly applicable requirements for progress towards sustainability may be identified, many key considerations will be location-specific, dependent on the particulars of local ecosystems, institutional capacities and public preferences.
- In the pursuit of sustainability, the means and ends are intertwined and the process is open-ended. There is no end state to be achieved.

Source: adapted from (Gibson, 2006, p. 172).

These sustainability assessment guidelines are intended to be adaptable to different situations and maintain a high level of dedication to furthering positive progress towards sustainability, rather than simply reducing impacts. While these may not deliver a hierarchical set of rules to follow, they maintain a very progressive stance towards achieving sustainability and provide a high set of standards to measure sustainable development against. And still, realistic expectations are maintained with the understanding that trade-offs are inevitable, but should be addressed openly and directly through the use of rules and/or processes (Gibson, 2006). While this set provides generalized guidance to pursue sustainability assessment in many different situations and on multiple scales, the Bellagio Principles are more systematic in presentation, and thus will be easier to incorporate into a sustainability evaluation system. Still, The Bellagio Principles are slightly dated and could be improved by incorporating some of Gibson's more broad-minded ideas; it is also worthwhile to note that these two sets could work in unison, as the Bellagio Principles are centred on process while Gibson's Guidelines focus on the substantive criteria for evaluating different options.

Another example slightly different from the rest is the Campus Sustainability Assessment Framework (CSAF). It is specific to campuses; however, most of the principles appear to be adaptable to fit other

situations, and the general sustainability assessment discussion. The framework is based around what the community desired (participatory process) and should:

- identify important issues;
- be calculable and comparable;
- move beyond eco-efficiency;
- measure processes and motivations; and
- stress comprehensibility (Cole, 2003, p. 11).

Along with these, Cole identified some other useful aspects of the sustainability assessment process. Benchmarks are important to measure performance and effectiveness, and assessment should provide valuable information to policy makers about wider scale implications (Cole, 2003). Sustainability assessment should identify challenges, weaknesses, and biases in an effort to be transparent and understandable (Cole, 2003). As is apparent when reading these insights, they are all transferable to broader sustainability assessment.

Aside from the guidelines provided in the above frameworks, there are some other relevant observations about sustainability assessment. A major point is that sustainability assessment frameworks need to be evolving rather than static and must revolve around the current state of society (Cole, 2003; Devuyst, 2000). This means that the sustainability assessment framework must be evaluated over time. Next, the sustainability assessment process should be participative (Cole, 2003; Gibson, 2006; V. Maclarens, 1996), just like the rest of the sustainability planning process. Finally, “sustainability assessment is most of all a communicative process, improving communication in relation to sustainability issues. Sustainability Assessment should be designed to initiate creative and innovative thought processes, which lead to solving current problems of sustainable development” (Devuyst, 2000, p. 77).

Ultimately, these frameworks provide similar guidance, as they all align with the sustainability features above. However, these frameworks define different parts of the sustainability assessment process. Dalal-Clayton and Bass (2002) provide an overarching idea of what sustainability assessment should generally include. The Bellagio Principles (International Institute for Sustainable Development, 2011) define how to design sustainability assessment, and specifically what to include and consider. Gibson (2006) offers insight on conducting sustainability assessment that is closely tied to the set of principles assumed above. The CSAF guidelines (Cole, 2003) cut across each of these stages, but offer realistic perspective, making sure that the assessment is possible. It links assessment to real issues, and ensures that the results are clear and thus able to be effectively disseminated to the public. Hence, in developing an assessment framework, each version can provide a distinct guidance that will assist in directing the sustainability assessment process towards ultimate sustainability goals. The other side to these frameworks is to decide what is important to measure; ensuring that the sustainability principles above are incorporated into the assessment design.

Larger sustainability assumptions are visible through the sustainability assessment frameworks provided. That being said, the generic nature makes these frameworks subjective and as such, more specific measures will be required in order to provide accurate and reliable assessment. It has been demonstrated that sustainability is an important concept and provides necessary goals for current and future generations. And, sustainability assessment is an important part of the sustainability planning process, but in order to provide more concrete results there is a need for more specific and less subjective results than the generic frameworks provided above; “the most productive way to approach this is to undertake an indicator-based sustainability assessment” (Dalal-Clayton & Bass, 2002, p. 309).

### **2.3 Sustainability Indicators**

Indicators are specific measures used to signify a larger trend or phenomena (Donnelly et al., 2007). Relevant issues are simplified through indicators and used to inform policy; hence in order to effectively inform policy, indicators must identify issues as accurately as possible (Layne, 2009). Since indicators are

abstract, simplified views of the world, they are imperfect (Meadows, 1998) and should be taken only for what they are: an indication of one part of a complex system (V. Maclaren, 1996). Indicators, in their ability to represent large issues, could be very useful to sustainability assessment. However, those using or interpreting indicators must be aware of their limitations.

Indicators of sustainability can help us to determine current state, direction, and progress relative to sustainability and our complex environmental and social systems (Fehr et al., 2004; McCool & Stankey, 2004). They are useful for setting multi-time horizon goals, as is done in the CSAF (Cole, 2003). As sustainability has been growing in importance, the status of these systems has become more important; these types of indicators are seen as a way to monitor the achievement of sustainable development (Wilson, Tyedmers, & Pelot, 2007). “Indicators are consequently meant to support scientists, politicians, citizens, and decision-makers to monitor status and changes in key sustainability dimensions and to more clearly foresee the consequences of action or inaction” (Ramatsteiner et al., 2011, p. 62). Thus indicators are integrated and facilitate communication across all stakeholders in the sustainability assessment process (L. Shen et al., 2011). As such, “Chapter 40 of Agenda 21 calls on countries as well as international, governmental and non-governmental organizations to develop indicators on sustainable development that can provide a solid basis for decision-making at all levels” (United Nations Department of Economic and Social Affairs, 2007, p. 5).

### 2.3.1 Sustainability Indicator Selection Process

Indicators are valuable to the sustainability assessment process, and since “the choice of an indicator will reflect how progress (or success) is defined” (Association of Municipalities of Ontario, 2008, p. 62), attention to the indicator selection process is important. “The selection process is the place where legitimacy and comprehension are built, as people see their values and worldviews incorporated into the indicators” (Meadows, 1998, p. 25). Thus indicator acceptance lies in the selection process and its ties to current issues and ideals; maintaining connection to sustainability goals and principles can ensure the relevance to, and integration into society.

During the selection process, as with the rest of the sustainability planning process, it is important to maintain inclusivity of all relevant stakeholders (V. Maclaren, 1996). Based on the sustainability assumptions presented above, this should also include representation and protection of the interests of future generations. Not only does citizen monitoring and consultation offer helpful insight into the issues that are of actual importance, but as above, involvement in the selection process can help with the internalization, acceptance, and understanding of indicators and subsequent actions (Fehr et al., 2004). Indicators should therefore be chosen and used in a transparent, participatory way to maintain relevance (Cartwright, 1997; Rametsteiner et al., 2011; Valentin & Spangenberg, 2000). Communication of progress and necessary action can then be easily communicated to the public and policy-makers through the use of these indicators (Valentin & Spangenberg, 2000). Along with public involvement, indicator development needs to include science and policy perspectives (McCool & Stankey, 2004; Rametsteiner et al., 2011; Valentin & Spangenberg, 2000). Indicators should be simple, relevant to sustainable development issues and policy, and should indicate clearly whether or not actions or outcomes are sustainable (Valentin & Spangenberg, 2000). Inter-agency cooperation is necessary to align interests (United Nations Department of Economic and Social Affairs, 2007), and a multidisciplinary approach can help to reduce biases and bring a wider variety of stakeholder views and criteria to the process (Donnelly et al., 2007). As the entire sustainability assessment process is dependent on inclusivity, one must be aware of this necessary component from the outset and throughout (Ramatsteiner et al., 2011). This inclusive process means that “new kinds of methodological choices regarding participation and representation need to guide development processes in order to achieve credibility and legitimacy within society” (Ramatsteiner et al., 2011, p. 69). In order to achieve this, “the public and policy-makers must participate in the process of defining *what* should be sustained, for *whom*, and over what *time* and *spatial* scale. Science has important roles in applying these tests and selecting indicators, but those roles are

directed at informing, rather than determining, what indicators are ‘best’” (McCool & Stankey, 2004, p. 299).

Adaptability is another theme that has been apparent throughout the sustainability assessment process, and is important in indicator selection. It is widely understood that indicator development is, and will continue to be a learning process. The process will need to be continuously iterative to adapt to changing norms and values (Ramatsteiner et al., 2011). Learning and flexibility will refine indicators continuously over time, producing a better and better system (Meadows, 1998). A major aspect of this is adapting to data availability (Association of Municipalities of Ontario, 2008); we often measure what can be measured with available date sets rather than what should be measured (McCool & Stankey, 2004). Adaptability in this sense means that over time there will be a move from measuring with what is available to making available what should be measured.

Part of the process of improvement comes through comparison – communities learning from and competing with each other. In order for this to be possible, there is a need for the creation of collective municipal sustainability goals across the geographic region where comparison is desired. In this case “each community has to develop its individual set of indicators within this common structure. This approach (common structure, different indicators) provides a possibility to compare communities without ignoring their specific needs and situations” (Valentin & Spangenberg, 2000, p. 382). Hence, the adoption of larger sustainability frameworks can provide vertical and horizontal linkages that will help with sustainable development on all scales, and thus further overall progress towards sustainability. In this case, the community’s indicators would reflect larger sustainability goals and based on progress made towards these goals, could be compared using a set of higher level, less situational indicators.

One final area of consideration in the sustainability indicator selection process is the number of indicators to choose. The CSAF initially kept a large number of indicators (170) to maintain depth and respect the diversity and breadth of the issues measured (Cole, 2003). However in 2009, due to requests from the campus sustainability community, a smaller set of CSAF core indicators was released (Sierra Youth Coalition, 2009). Valentin and Spangenburg (2000) state that indicators should be low in number (12-15), and should include simply a broad balance of all sustainable development aspects. This seems to be a focus of ongoing debate between those who advocate comprehensive indicator sets and those who focus on the practical aspects of actual measurement and reporting of the indicator findings. Also, the United Nations sustainability indicator program found that 134 indicators were too many to manage, which comes from the evaluation of their first set of indicators used in 22 countries (United Nations Department of Economic and Social Affairs, 2007). When presented with practical limitations like this, there seem to be two choices: 1) maintain the maximum number of indicators possible, constantly refining those indicators to maintain the best possible set, and look for ways to increase capital/time to expand the set, or 2) maintain the smallest possible set that is still comprehensive enough to encompass all relevant issues. The following sections will provide insight into these options, considering different types of sustainability indicators and how sustainability indicators should be chosen.

### *2.3.2 Sets of Sustainability Indicator Selection Criteria*

There are different perspectives throughout the literature pertaining to how sustainability indicators should be selected. This section will consider several, and evaluate them based on the features of sustainability and sustainability assessment provided in earlier sections.

Meadows (1998) recommends that indicators should monitor usage levels of natural capital, monitor efficiency levels of built capital, monitor the structure (education, health, demographics, etc.) of human capital, measure human relationships for social capital, and ultimately measure well-being. Flows that increase, decrease, and connect these capital stocks should also be measured (Meadows, 1998). In this case, the indicators are interconnected and focused on the well-being of those people within the system. Qualitative and quantitative measures are seen as equally valuable (Meadows, 1998).

Donnelly, Jones, O'Mahony, and Byrne (2007) consider only environmental indicators, but believe they “should be measurable, scientifically valid and capable of providing information for management decision making” (p. 162). This position emphasizes the need for indicators to be policy relevant and based on available information. They also state that “clear definitions should accompany each [indicator]” (Donnelly et al., 2007, p. 174) to ensure that what is being measured, and the ties it has to policy and related initiatives, will be unmistakable. These authors also created a list of criteria for indicator selection:

- Be policy relevant...
- Cover a range of environmental receptors...
- Be relevant to the plan in question...
- Show trends...
- Be easily understandable to decision makers and the public...
- Be well founded in technical and scientific terms...
- Prioritize key issues and provide early warning...
- Be adaptable...
- Identify conflict between plan objectives and SEA objectives (Donnelly et al., 2007, p. 168)

This list fits well into the sustainability assumptions detailed in this literature review; however it is missing a few key issues, namely social and intergenerational focus. However, relevance to current plans and adaptability are very important and could allow the future development of different areas of focus into this set.

Next is the set of criteria that Cole (2003) developed for use in selecting the CSAF indicators. “The set of criteria that the co-research team agreed to use in determining a ‘good indicator’ was that it is:

- *Based on accurate, available and accessible data of known quality.* Can high-quality data be found and accessed?
- *Representative of the phenomena being measured.* Does the indicator actually represent the larger phenomenon that it is attempting to paint a picture about?
- *Relevant to users, decision-makers, local and global sustainability challenges.* Does the indicator help decision-makers to take action? Does it clearly and succinctly describe a phenomenon? Does it make sense in terms of making progress towards local and global sustainability? Does it inspire action?
- *Understandable to the university and broader communities.* Does the indicator clearly describe a particular phenomenon in a language that is accessible to the communities that will use the results?
- *Geographically and temporally comparable.* Does this indicator take into account both short and long-term time scale effects, and both local- and global geographic effects into account?
- *Attached to a clear and ambitious goal.* Does the indicator let the user know which direction to head when aiming for improvement towards a more sustainable state?
- *Reflective of the university’s capacity to effect change.* Is the university able to take action on improving indicator performance without relying on other people to make decisions?” (Cole, 2003, p. 34).

This set reflects the situation for which the CSAF was created: university campuses. These indicators are meant for the public and decision makers for whom they are carefully chosen to be relevant and understandable. Allowing more people to access and appreciate the information presented through these indicators, and tying the package to larger sustainability issues and goals could have the effect of attracting more interest and support not only to the campus sustainability movement, but also to all sustainability movements. Attention to these details could prove very helpful to growing sustainability initiatives of all levels.

The Association of Municipalities of Ontario provides a very concise list that, for its length, provides some of the most important insights. “The three main criteria for good sustainability indicators are: 1) issue relevance (scientific validity, soundness, representativeness, etc.); 2) user relevance (understandable, unambiguous, useful and integrates social, economic and environmental factors); and, 3) data reliability (data availability and cost-effectiveness)” (Association of Municipalities of Ontario, 2008, p. 63). These simple criteria, without specifying specific areas of focus, such as the three dimensions of sustainability, can be effective in creating successful indicators. The indicators will be relevant, will adapt to current situations and issues, and relatable to the general public. However, without sustainability direction and substance, the direction these indicators take, and the interpretation they receive, will not necessarily be focussed on sustainability, and thus the actions taken as a result may not reflect sustainable development.

The United Nations also created a concise set of criteria for indicator selection. In their opinion, indicators should be SMART: Specific, Measurable, Achievable, Relevant, and Time-related (United Nations Statistical Institute for Asia and Pacific, 2007). Again, this is a small list that is easy to satisfy. However, as above, the lack of a focus on sustainability could cause indicator direction to stray. If these are placed within a wider sustainability framework or context that also provided criteria, such as the criteria provided in the sustainability assessment section above, they could be very effective. In the analysis of the above lists, there are similarities such as adaptability, inclusivity, and relevance to policy that fit within the sustainability model that has developed throughout this review.

The set of sustainability indicator selection criteria put forth by Cole (2003) will be adopted for use throughout this research because of the similarity in research objectives between the CSAF and this research, their comprehensive nature, the fit with the established conclusions from the rest of the literature review, and finally because of the success that the CSAF has experienced. This set will be adapted slightly however, to move to focus from campus sustainability to community sustainability.

### 2.3.3 Sustainability Indicator Types

Sustainability indicators have also been divided into various types. The literature on sustainability indicator typologies has produced various sets to use in categorizing indicators during the selection process. The first, and arguably the most popular, is the Pressure-State-Response (PSR) model, where “sustainability indicators are selected, based on variables, which signal pressure, state, and response” as follows:

- The *pressure* that society puts on the environment; for example in the form of demands on resources (leading to resource depletion) and demands on ecological processes (leading to pollution). Pressure indicators are based on measurements or on model-based estimates of actual behaviour. Consequently, they are particularly useful in formulating policy targets and in evaluating policy performance. They can also be used prospectively to evaluate potential environmental impacts of socio-economic scenarios or proposed policy measures.
- The resulting *state* of the environment (especially the incurred changes) compared with desirable (sustainable) states. State indicators cover the major characteristics of natural, physical, financial, social and human capital assets, individually or in a combined manner. They can be obtained variously from national accounts, poverty monitoring, natural resource inventories and remote sensing, sector information systems and demographic monitoring – although it is not always the case that variables pertinent to sustainability are currently collected.
- The *response* mainly in the form of political and societal decisions, measures and policies. Response indicators measure progress towards regulatory compliance or other governmental efforts, but don’t directly tell what is happening to the environment. Response indicators need to be able to ascertain the most relevant policy or programme in

relation to any given driving force or state indicators. Further investigation of any given response, of course, leads into the territory of impact assessment.

(Dalal-Clayton & Bass, 2002, p. 318)

The above pressure-state-response system is effective for biophysical environmental monitoring, but is maybe not so well suited for sustainability assessment since human actions are seen only as pressures or environmental problems (Dalal-Clayton & Bass, 2002) and not also as benefits. However, human actions that have negative effects for environmental and social systems should arguably be seen as pressures in a sustainability model, and alternatives should be pursued. Hence, the pressure-state-response system could be useful for evaluating progress towards sustainability.

Maclarens proposes a somewhat different approach that does not divide indicators into categories, but instead discusses characteristics they should all hold. In this system, indicators should be integrating, forward-looking, and distributional (looking to intergenerational and intragenerational equity). Integrating indicators “attempt to portray linkages among the economic, environmental, and social dimensions of sustainability” (V. Maclarens, 1996, p. 186). In this role, some integrating indicators can represent more than one theme (e.g. salmon stocks represent environmental and economic conditions for a community with a fishing industry) (V. Maclarens, 1996). Forward looking indicators address intergenerational equity and come in three types:

- A trend indicator describes historical trends and provides indirect information about future sustainability...
- Predictive sustainability indicators rely on mathematical models for the future state and development of variables describing the environment, the economy, and society, or the linkages among them...
- Conditional Indicators depend on a form of scenario development; they answer the question: ‘If a given indicator achieves or is set at a certain level, what will the level of an associated indicator be in the future?’ (V. Maclarens, 1996, p. 187).

And finally, distributional indicators deal with intragenerational equity. They measure social, environmental, and economic equity within and between areas and at different scales (community, region, national, global) (V. Maclarens, 1996). These characteristics fit very well with the sustainability process from above, and thus would provide a good framework for developing sustainability indicators.

From a different perspective, Meadows (1998) believes that indicators should measure both stocks and flows (state indicators), and “must be more than environmental; they must be about time and/or thresholds” (p. 12). Thus we must know the limits of all of our impacts (not just ecologically speaking), and how quickly we are reaching them. This will help to make the indicators more understandable and the impacts more real (i.e. “tons of nutrient per year released into waterways means nothing to people. Amount released relative to the amount the waterways can absorb without becoming toxic or clogged begins to carry a message” (Meadows, 1998, p. 14)).

Indicators can also be ‘attached’ to political commitments to increase their political relevance (Rametsteiner et al., 2011). Giving policy makers measures of what is pertinent makes the indicators more useful; “outcome-oriented indicators ultimately provide policy and management relevant information needed to assess progress toward sustainability” (McCool & Stankey, 2004, p. 304). Furthermore, the United Nations have found that indicators in line with development policy and goals seem most successful (United Nations Department of Economic and Social Affairs, 2007). However, ecosystem service indicators need improvement in conveying information to the policymakers, comprehensiveness, sufficiency of data, and in the area of cultural services (Layne, 2009). So, improvement towards “well designed indicators [that] suggest implications of alternative policies, providing decision makers with salient information when making choices” (McCool & Stankey, 2004, p. 301) will benefit the relevance of the indicators and thus their effectiveness in affecting policy and related change.

The literature on indicator types includes variations of the above mentioned systems (McCool & Stankey, 2004; Nicollier et al., 2003). These sets of indicator classifications can help to ensure all aspects of the system are addressed, and that the indicators form the optimal set based on sustainability principles; thus increasing their effectiveness. The sets considered above are not mutually exclusive and thus could be used together, highlighting the benefits of each. This would mean looking for indicators that fit Maclaren's (1996) guidelines, use primarily stock and flow (state) indicators as recommended by Meadows (1998), but using pressure and response indicators where no state indicators exist.

#### 2.3.4 Indicator Sets

The previous sections look at how to select and organize sustainability indicators. This section will examine measurement frameworks that correspond to the sustainability assessment criteria, adding the missing sustainability dimension needed in some of the above indicator criteria. Most are presented as indicator categories (some of which come from complete indicator lists) and are indicative of current trends and issues.

Wilson et al. (2007) conducted an evaluation of various sustainable development indicator (SDI) metrics, all of which have been questioned on their effectiveness, and whether they are all directing action in a similar direction. The research highlights certain issues common to such frameworks and determines where and why inconsistencies occur (Wilson et al., 2007). These metrics include:

- Ecological Footprint (EF): Calculates demands put on nature by humans (sources and sinks). Maintained by the global footprint network.
- Surplus Biocapacity (SB): Shows the difference between a nation's ecological capacity and their ecological footprint.
- Environmental Sustainability Index (ESI): Measures "environmental, socio-economic, and institutional indicators... to assess sustainability" (Wilson et al., 2007, p. 302).
- Well-being Index (WI): Combines human well-being and ecosystem well-being as a composite to assess sustainability.
- U.N. Human Development Index (HDI): "Measuring three basic dimensions of human development: a long and healthy life, knowledge, and a decent standard of living (UNDP, 2004)... used as a proxy of sustainability" (Wilson et al., 2007, p. 302).
- GDP: economic growth. (Wilson et al., 2007).

A major problem found was that these metrics were divergent, in part because they apparently rest on different definitions of sustainability (Wilson et al., 2007). Moving in different directions is not only inefficient, but can lead actions in counterproductive directions. Part of the larger problem in creating theoretically consistent metrics is that "most SDI metrics tend to reflect more strongly one of the standard dimensions of sustainability—economic, social, or environmental" (Wilson et al., 2007, p. 311).

Consequently, these measurement tools, although not consistent, can still be effective as long as the process and assumptions are understood (Wilson et al., 2007). However, until they are aligned with larger sustainability goals, reporting will be inconsistent based on the individual focus of the specific metrics. For example, Canada could be rated very highly on socio-political, economic, and resource basis, but has the second highest energy consumption per capita in the world (Wilson et al., 2007). A focus on all of these levels offers a real indication of areas requiring attention and holds those responsible accountable, rather than allowing such areas to go unnoticed in an otherwise stated 'sustainable' area.

Another article (Niemeijer, 2002) looks at three reporting systems that are based on different indicators and assessment frameworks. These reporting systems, while not specific to the municipal level, offer insights into other levels and forms of evaluation that could be useful in developing a standardized set of indicators for use across geographical boundaries. The three systems are the State of the Nation's Ecosystem Report (the Heinz Report), the Ecological Indicators for the Nation Report (NRC Report), and the Environmental Sustainability Index (ESI). The Heinz report is more theoretical, looks at only the United States, and uses only state type indicators (Niemeijer, 2002). Core indicators are supported by

ecosystem type specific indicators (e.g. alpine, lake, desert, etc.), which raise issues when aggregating indicators (Niemeijer, 2002). Raw data are published and not made to be compared at all, even to benchmarks; this makes it hard to interpret significance and implications (Niemeijer, 2002). Ultimately, overall assessment is unavailable because of the aggregation difficulties, but it is argued that integrity of the measure is maintained (Niemeijer, 2002). Hence from this report there is an abundance of technical data that are not comparable or understandable to the general public. In terms of reporting or informing policy decisions, this system on its own seems inadequate. However, providing interpretation of these results could be very helpful as the report provides a very comprehensive analysis of the health of all types of ecosystems in the United States. Other similar reports would thus be helpful in other regions if interpretation was available. This ‘state’ type of report could be of great value when evaluating environmental sustainability on various other levels, such as the municipal level, and also to learn from the downfalls discussed here.

The NRC Report is also focused on the United States, and on state type indicators; however in this case a small number of indicators (13) was chosen so that each indicator would have a more significant individual impact (Niemeijer, 2002). With few indicators, aggregation becomes almost irrelevant, and these indicators were designed to measure across different ecosystems, so geographical aggregation is unnecessary as well (Niemeijer, 2002). This type of report, provided the indicator system was adaptable to changing conditions, could be very helpful in conveying important information to the public and decision makers; there would not be a lot of information to sort through, and the importance would be evident as the small number would mean that the indicators would be centered on large issues. Worth noting is the national level of this report, allowing it to maintain a broad focus on large scale issues; however, these issues still need to be tied to smaller, more localized issues so that local steps to implement the necessary change can happen. This example shows that at least environmental trends can be evaluated effectively at a high level, while maintaining a small number of indicators.

The ESI was created based on data availability and it inexplicably uses a PSR indicator model (Niemeijer, 2002). For scoring this proves somewhat problematic, as the PSR categories are related and influence each of the others (i.e. a good state of water quality requires no response; hence the region with this situation would be punished in the response section when in reality they have accomplished the goal); this could be solved by weighting indicators in a cross country format (Niemeijer, 2002). Hence, when selecting indicators, availability of measures is a key issue. Likewise, scoring is complicated by the choice of indicators.

Each of these reports is brought together in a different way. The ESI reports based on PSR, the Heinz Report brings industry, academia, and politics together, and the NRC Report puts a core set of theoretically grounded indicators together (Niemeijer, 2002). The problems faced include data availability, specificity of indicators vs. aggregation (conceptual and geographic), and baseline figures and comparisons are subjective (Niemeijer, 2002). Data availability can be improved through awareness and acceptance of sustainability principles; however it needs to be clear what indicators need improvement. The other two issues are more fundamental; however, by maintaining links to sustainability goals, higher and lower level indicators could be incorporated and aggregated based on the required scope. This would also help support the subjective nature of certain aspects of sustainability assessment and help to validate the outcomes. A good example of this is the CSAF, which maintains a hierarchical layout throughout and is able to provide linkages between lower level measurements and higher level sustainability goals (Cole, 2003). Comparison between campuses is also possible because of the standardized layout and ties to common larger issues.

There have been many other sets developed, which correspond to a certain level of the sustainable development front (Meadows, 1998; L. Shen et al., 2011; United Nations Department of Economic and Social Affairs, 2007). Divergent paths, however, can be inefficient and the maintenance of communication paths throughout the vertical levels can help to link these different levels and create a more efficient system.

Different people in different areas of the world hold different views and objectives; thus one global system for local level indicators might be impractical (Meadows, 1998). However, basic human needs and natural laws are common across all cultures and continents, so Meadows (1998) suggests it is possible to create a system of overarching, basic local-level indicators. Different worldviews produce different questions, yet indicators of our reality and conflicting answers can help to highlight, and promote learning about underlying issues (Meadows, 1998).

## **2.4 Selecting a set of Criteria for Canadian Municipal Sustainability Assessment**

The purpose of this thesis is to create a set of indicators for use in a Canadian municipal sustainability audit. Having established the current academic thought on municipal sustainability indicators, there is a need to now explicitly define the criteria (sustainability goals and sustainability indicator selection criteria) that will be used for the rest of this study. A similar study, conducted by Maclaren (1996), will be discussed first and will serve as a guide in this section and throughout other parts of this thesis. Then sustainability goals and sustainability indicator selection criteria will be selected for use in the rest of this research.

### *2.4.1 Maclaren (1996)*

Despite Maclaren conducting this research over a decade and a half ago, the process used and conclusions drawn parallel those of the literature review conducted above: sustainability is an important goal that many communities are adopting, and as such, there is a need to measure progress using urban sustainability indicators (1996). In an attempt to aid in the development of urban sustainability indicators Maclaren proposes the following six steps:

- Step 1. Define and conceptualize the nature of urban sustainability and the urban sustainability goals for which indicators are needed.
- Step 2. Identify the target audience, the associated purpose for which indicators will be used, and the relative number of indicators needed.
- Step 3. Choose an appropriate indicator framework
- Step 4. Define indicator selection criteria.
- Step 5. Identify a set of potential indicators and evaluate them against the selection criteria.
- Step 6. Choose a final set of indicators and test their effectiveness.

(V. W. Maclaren, 1996, p. 55)

To add a real-world perspective to the research, Maclaren (1996) provides three case studies that reveal the process of creating sustainability indicators. This research shows the importance of multiple stakeholder perspectives, a community focussed approach, and cross-cutting, forward looking indicators. Ultimately, the need is to create effective urban sustainability indicators to use in evaluating progress (V. W. Maclaren, 1996).

It is easy to see the similarities between Maclaren's (1996) research and this thesis, with the exception that this project will develop indicator domains and related community sustainability indicators for use in a CCSIF. Thus, throughout this thesis, Maclaren's (1996) process will be elaborated upon and modified where necessary to serve as a guide. Using this approach the following section will decide on sustainability goals and sustainability indicator selection criteria to use during the course of this thesis.

### *2.4.2 Selecting Criteria for this Research*

In order to create a structure for evaluating and selecting urban sustainability indicators, steps one through four will be completed using the ideas presented in the literature review, and any relevant assertions from Maclaren's (1996) document. Steps five and six will be addressed in a later section after selected complete indicator sets have been reviewed. Since these steps were made for individual municipalities to

use in creating sustainability indicators some of the developments made here may be somewhat unspecific in order to maintain generalizability across Canadian municipalities.

Individual municipalities will hold certain issues above others and face greater challenges with particular aspects of sustainability; however, it was established above that there are common goals globally and nationally that urban sustainable development should reflect in order to maintain a collective front in the pursuit of sustainability. Therefore, for the first step of defining sustainability goals, the broad objectives for sustainability and sustainable development provided in the literature review will be maintained. The sustainability principles provided in Box 1 (Gibson, 2006) will serve as the generic sustainability assumptions for the rest of this research. They are comprehensive, cross-cutting, include the three elements of sustainability (environmental, social, and economic well-being), take a multi-time perspective, and are also the most progressive and recent of the principles evaluated. Also, they are directed towards sustainability assessment, making these principles an excellent, generic fit for the purposes of this thesis.

The target audience for the indicators that will be selected is policy-makers and ultimately the public for use in a sustainability ranking index. Thus, based on the Target Audience Pyramid (V. W. Maclaren, 1996, p. 56) there will need to be a moderate number of indicators that relate to policy issues (the Target Audience Pyramid does not provide specific numbers as guidance, only relative quantities of indicators based on audience type). From these indicators, selected ‘core’ indicators could be used to satisfy the public audience (V. W. Maclaren, 1996). Limiting the number of indicators in this initial set also makes it more likely that the indicators will relate to communities across Canada.

Since the primary target audience for the indicators selected here are policy-makers, and the end product is a CCSIF, there are certain factors that must be included. Policy most often focuses on traditional sectors; however a sectoral framework would not fit with the cross-cutting sustainability principles chosen above. Alternatively, a causal framework (like the PSR model described in the literature review) “has the significant advantage of being able to suggest why certain indicators are rising or falling” (V. W. Maclaren, 1996, p. 47). The PSR model would therefore be very appealing to policy-makers. From the perspective of being able to rank performance on an index, a goal-based framework would be the most valuable as it allows progress scored very easily relative to the determined goals or benchmarks. Thus, a combination causal-goal-based framework will be used to satisfy the target audience and to align with the end-use of the indicators.

The sets of indicator criteria discussed in the literature review are all very similar; however the criteria used in the CSAF are not only the most comprehensive, but also relate strongly to the objectives of this research: developing indicators for a CCSIF. Thus, the criteria presented in the CSAF will be adapted, by shifting from university focus to municipal focus, and used to evaluate and choose indicators for this research.

Defining these first four steps creates a replicable and reliable structure for selecting indicators based on established goals and criteria. To further aid throughout this development process, Maclaren (1996) provides a matrix to evaluate indicators, which includes all these assumptions on one axis and potential indicators on the other. The indicators can then be compared based on how many criteria and goals each meet, as well as by framework and indicator categories. Table 2.1 is an adapted version of this table that includes the goals, criteria, and framework selected above. The indicator categories in this preliminary matrix are maintained from Maclaren’s (1996) original are maintained because they fit with the sustainability process identified above, however are subject to change depending on the findings from analysing various sustainability indicator sets (i.e., if better categories are identified then they will be replaced). Table 2.1 provides a very concise understanding of the choices made in steps one through four, and of how the indicator selection will proceed. Steps five and six will be completed at a later point in the research, after the analysis of different complete indicator sets, and will result in the selection of a preliminary set of indicators for use in a local level sustainability rating system. This will form a

completed set to use in discussions with various municipalities. The methods used are detailed in the following section.

**Table 2.1: Urban Sustainability Indicator Evaluation Matrix**

Type of Indicator (Subject to change)	Potential Indicator	Sustainability Goals								Indicator Selection Criteria							Pressure	State	Response
		1	2	3	4	5	6	7	8	A	B	C	D	E	F	G			
Environmental																			
Social																			
Economic																			
Environmental-Social																			
Environmental-Economic																			
Social-Economic																			
Environmental-Social-Economic																			

Adapted from (V. W. Maclaren, 1996, p. 79)

Notes for Table 2.1:

**Sustainability Goals:**

1. Socio-ecological system integrity
2. Livelihood sufficiency and opportunity
3. Intragenerational equity
4. Intergenerational equity
5. Resource maintenance and efficiency
6. Socio-ecological civility and democratic governance
7. Precaution and adaptation
8. Immediate and long term integration

Adapted from (Gibson, 2006, p. 174)

**Indicator Selection Criteria:**

- A. Based on accurate, available and accessible data of known quality
- B. Representative of the phenomena being measured
- C. Relevant to users, decision-makers, local and global sustainability challenges
- D. Understandable to the local and broader communities
- E. Geographically and temporally comparable
- F. Attached to a clear and ambitious goal
- G. Reflective of the community's capacity to effect change

Adapted from (Cole, 2003, p. 34)

## 2.5 Scoring Sustainability Indicators

This section looks into the concept of scoring community sustainability indicators to provide an academic basis for Research Question 2. Several academic and practitioner scoring mechanisms have been created all over the world (Hu, Chen, Hsu, & Ao, 2011) including frameworks for scoring sustainable communities (Bobbitt, Green, Candura, & Morgan, 2005; Choon et al., 2011; Kondyli, 2010), urban renewal and regeneration projects (Hemphill, Berry, & McGreal, 2004; Lee & Chan, 2009), and corporate actions (Hu et al., 2011; L. -. Shen, Lu, Yao, & Wu, 2005). Examples of scoring frameworks worldwide were easy to come by in the academic literature, which speaks to the benefits of scoring processes for sustainability. Skouloudis (2009, p. 300) provides a synopsis of these benefits in the context of corporate sustainability:

*It informs stakeholders in a simple but systematic manner about the efforts that have been made by the reporting organizations in order to provide adequate and meaningful information on their operation and impacts.*

While this summation is specific to corporate sustainability, it is easy to see the transferable benefits to community sustainability indicator scoring; scoring allows comparison between communities and provides comparable and simplified information to the community. This being said, the processes are not always so straightforward. While some frameworks use fairly basic mathematical or statistical exercises (Bobbitt et al., 2005; Choon et al., 2011; Hemphill et al., 2004; Lee & Chan, 2009), certain others include complex mathematical models (Hu et al., 2011; L. -. Shen et al., 2005; Yu & Wen, 2010). The more complex models include weighting parameters, meaning that one indicator is given more significance in the final score, which could prove problematic considering the above generic sets of sustainability criteria that involve overlapping considerations. Kondyli (2010) provides perspective on these differences in complexity due to weighting, stating that there are three ways to weight: “a) to use statistical models, b) to adopt participatory methods and c) to assign equal weights to the indicators” (p. 348). Hence, the more complex models attempt to determine ultimate scores with more complex mathematics that use different weights for each indicator, while the more simple frameworks use techniques that involve Likert scales and maximum/minimum scores to normalize the scores so that each indicator is given an equal weighting. For example, Choon’s (2011) Sustainable Cities Index in Malaysia normalizes indicator scores in proportion to the maximum and minimum values found for that indicator across the communities being scored. The equation used to calculate each score is:

$$\text{Index} = \frac{(\text{Actual X Value} - \text{Minimum X Value})}{(\text{Maximum X Value} - \text{Minimum X Value})}$$

Other frameworks look to expert opinions or established benchmarks to determine baseline scores for each indicator (Hemphill et al., 2004; Lee & Chan, 2009). Each of the scoring frameworks found was different from the others in one way or another, which underscores the assertion that “there is a lack of consensus in the literature about what indicators should be used to measure sustainability and ultimately how these indicators should be weighted and scored” (Hemphill et al., 2004, p. 726).

## 2.6 Summary

The above review shows the importance of pursuing sustainability, and doing so using a systematic process. Overarching goals need to be tied to local level implementation in sustainable development. In order to ensure progress towards sustainability, sustainability assessment must take place. Sustainability assessment would use indicators that tie different aspects of sustainability together, creating vertical linkages among scales and horizontal linkages among key substantive considerations. “The identification, measurement, and application of appropriate indicators remains among the major challenges facing policymakers, bureaucrats, scientists, and citizens tasked with sustainability” (McCool & Stankey, 2004, p. 62). Thus, there is a need to bridge the gap between the academic progress made in indicator

development and the practical application of sustainability indicators to realize the potential benefits. Furthermore,

Whilst there are various lists of urban sustainability indicators there is no single set of indicators that suits equally to all cities or communities. It is therefore appreciated that the use of common indicators is essential for monitoring and comparing the process of sustainable urbanization in order that this does not remain as an abstract concept (L. Shen et al., 2011, p. 19).

Hence there is a need for further development in sustainability indicators that measure progress towards sustainability in order to communicate the essence of sustainability to all stakeholders and to see real improvements towards common sustainability goals. Basically, a set of geographically transferable indicators that are tied to common sustainability goals is needed. This set will need to be framed within the real world, respecting differences in context, to ensure its practicality. Understanding the current trends and best practices could help to ground the indicators in reality and establish performance benchmarks. A set of indicators with these properties will help inform municipalities so they can direct and refine their sustainability actions to reach individual and common sustainability goals. It is hoped that, using the process and criteria outlined in section 2.4, this thesis will be able to provide such a set of indicators. The scoring discussion in section 2.5 is also expected to provide the basis for discussing the need for a scoring process in a CCSIF.

Several assumptions were also established from this literature review that are used throughout the rest of this research, they are presented here in point form in order to be concise:

- Collaboration in sustainable development efforts, including indicator development, is necessary.
- The local level is optimal for sustainable development implementation; however, sustainable development should link global and local issues and actions.
- The concept of transferability will be used to describe the ability of sustainability indicators and domains to be applicable in various communities (horizontal transferability) and throughout different governance levels (vertical transferability). The benefits of horizontally and vertically transferable sustainability indicators are in the creation of a unified local level movement toward established sustainability goals and to help provide guidance on relevant areas of sustainability and indicator development.
- It is expected that, because of the availability of transferable sets of sustainability principles, the creation of transferable sustainability indicators and domains is feasible. Gibson's (2006) set of sustainability principles are adopted as the optimal sustainability goals for this research (Table 2.1) as they are seen as the most progressive, they were developed for sustainability assessment, and they fit well with the sustainability conclusions drawn here.
- Indicators are the optimal method for conducting sustainability assessment. For selecting indicators the set of criteria adapted from Cole (2003) found in Table 2.1 was selected. This set was chosen because of the similarity in research objectives, their comprehensive nature, their fit with these literature conclusions, and the success that the CSAF has experienced.
- Maclaren's (1996) Urban Sustainability Indicator Evaluation Matrix provides an effective tool for selecting community sustainability indicators.
- The number of sustainability indicators to use depends on the intended audience; public audiences require a low amount of indicators, decision makers require a moderate amount of indicators, and scientists require a high amount of indicators.

## **3.0 METHODS**

This chapter describes the approach that was taken in completing this thesis. Specific methods of research are discussed to explain how and why certain municipalities were included, how data were collected, and how the data were analyzed. This chapter answers first why, and then how, this research was completed.

The research was undertaken to assist communities in pursuing sustainable development. Specifically, this thesis aims to create a second generation set of sustainability indicators and domains to be used in a CCSIF (Research Objective 1 and Research Questions 1a and 1b) – indicators that are not only feasible, but also tied to all aspects of a sustainable future (i.e., not only those that are most convenient within the current socio-economic and political systems). In terms of domains, the expectation is to provide a set of established sustainability indicator categories that are relevant to different communities, upon which evaluation could be based. These domains and indicators are also anticipated to act as examples to help with future sustainability planning. Also, this thesis endeavours to provide insight into opinions of the CM scoring methodology (Research Objective 2 and Research Question 2).

### **3.1 Research Design**

In pursuing answers to the research questions, a critical social science methodological approach was taken. Critical social science explores the contradictions between theory and practice in individuals and society, looking to influence changes in practice (Schwandt, 1997). “Critical social science is thus practical and normative and not merely descriptive. It rejects the idea of a disinterested social scientist and is oriented toward social and individual transformation” (Schwandt, 1997, p. 24). Hence, the approach was to look critically at the actions taken in, and the social perspectives affecting, pursuit of sustainability, ultimately to stimulate positive change towards sustainable ends. Using this methodology, “the issue of research results feeding back into social life is not a ‘problem’ for researchers. On the contrary, the adequacy of critical research lies in its value for informing political actions” (Lewis-Beck, Bryman, & Liao, 2004, p. 224). This methodology could thus facilitate connections between the Canadian communities involved and the results of the research, promoting social transformation towards sustainable values and actions.

It is worth noting that in order to influence change, critical social science requires interactive, qualitative methods, which allow the researcher to use individual perceptions to explore social phenomena (Allan, 1991). Consequently, qualitative document analysis and interviews were chosen for this research. The following sections elaborate on these methods.

### **3.2 Preliminary Indicator and Scoring Methodology Development**

#### *3.2.1 Indicators and Indicator Category Development - Document Analysis*

The first part of this study was to conduct document analysis of practitioner literature. Documents to answer Research Questions 1a and 1b were selected based on the work of Anielski and Winfield (2002), which presents various sustainability indicator sets and frameworks. This approach was taken because online (Google) searches turned up uncertain and inconsistent results, where Anielski and Winfield (2002) chose what they believed was “a good summary of the ‘best-practices’ or ‘best-in-class’ at measuring sustainability at the community and municipal level” (p. 17). Thus it was assumed that these frameworks would be well established (10 years old) now, and would thus provide exemplary examples from within the current sustainability indicator field. Sustainability frameworks from Anielski and Winfield’s (2002) work were included in this research provided they:

- included indicators;
- maintained a municipal, city, or community focus;
- were intended for use in comparison across a larger region (i.e., provincial or national) in Canada.

Hence, the Federation of Canadian Municipalities (FCM) Quality of Life Reporting System (QOLRS), the Alberta Genuine Progress Indicators (GPI), and the Statistics Canada (StatsCan) Trends in Cities (TIC) frameworks were chosen to be included. For the FCM QOLRS and the GPI, recent iterations were found and were used for analysis; however, there were no more recent data available for the StatsCan TIC. This should have precluded inclusion in this research; however, since StatsCan is the primary statistical data collection and interpretation agency in Canada, it was decided that the indicators provided within the framework could be extremely valuable. One other framework outside the above criteria was also included: the Siemens US and Canada Green Cities Index (SUCGCI). The SUCGCI was included because of the relationship that exists between certain MMM Group divisions and because of the similar format to the MMM Group motivations for this research (i.e., a corporation creating a rating system).

These frameworks were then analyzed based on their respective indicator sets and indicator domains using the Maclaren (1996) Urban Sustainability Indicator Evaluation Matrix. This analysis is documented in further detail in Chapter 4. In relation to the research questions for this research, this document analysis provided only one part of the answers desired: indicator categories and a preliminary set of indicators to be used in a community sustainability assessment system. The second part, which revolves around Research Question 2, is explored in the next chapter (section 4.4) and discussed briefly in the next section.

### *3.2.2 Scoring Procedures*

In Chapter 4 the CM scoring methodology is presented, as it is showcased through practitioner literature in Siemens' mobility audits (Siemens AG - Industry Sector, Mobility Division, 2009; Siemens Canada Limited - Industry Sector, Mobility Division, 2010). In these CM audits both qualitative and quantitative indicators are paired with scoring rubrics that provide scores between one and six based on either qualitative or quantitative criteria (respective of the type of indicator). In this sense, all indicator scores are normalized (i.e., made to be consistent with the others), allowing the average of all the indicators to indicate the overall CM score. This method of normalizing indicator scores is also used in the GPI, the FCM QOLRS, and the SUCGCI. The main difference is that the CM methodology uses rubrics to base scores upon. Using this type of system provides transparency to the audit, and the opportunity for indicators to be attached to goals. Hence it was decided that the CM scoring methodology would provide the preliminary structure to use in discussions with interviewees; to investigate Research Question 2 in the interview part of this research.

## **3.3 Interviews**

### *3.3.1 Selecting Study Sites*

Interviews were conducted based on Research Question 1a and Research Question 2; Research Question 1b was seen to be too extensive to include in the interviews. It was also expected that these interviews will provide insight into the transferability of indicators and domains, as they discuss the above research questions within the context of a CCSIF. Since these research questions seek to create community sustainability indicator domains and to investigate perceptions around the CM scoring process for use in a CCSIF, cities were chosen based on geographic location, their experience developing sustainability indicators, and different economic and population circumstances. These criteria are provided in more explicit detail here:

- Geographic Distribution:
  - o One community from Western Canada (British Columbia and the Rocky Mountains in Alberta);
  - o One community from the Prairies (Alberta, excluding the Rocky Mountains, Saskatchewan, and Manitoba);
  - o One community from Ontario;

- One community from Quebec;
- One community from Atlantic Canada (New Brunswick, Nova Scotia, PEI, and Newfoundland and Labrador), and;
- One community from northern Canada (Yukon, Northwest Territory, Nunavut).
- Decline vs. Growth:
  - At least one community experiencing decline (economic and/or population).
- Size variance:
  - At least one small, one medium, and one large size community, defined using Corporate Knights *Most Sustainable Cities in Canada* population divisions (small: 250,000 or less, med: 250,000-750,000, large: 750,000+) (Marchington, 2011). The size of each community was defined by the level of the organization that created the indicators (i.e., Fraser Basin will include the population of the entire Fraser Basin area).
- Indicator experience:
  - Communities that have created a community level set of sustainability indicators were selected above others where possible. If not available, communities with a corporate level set of indicators will be sought. Where these criteria could still not be satisfied, communities with a community level sustainability plan were considered.

From these criteria, a list of potential communities was assembled (Appendix A). Included below (Table 3.1) are the communities that were selected for the interview process. These communities were selected in attempt to optimally suit the criteria above and are listed according to the geographic distribution categories above. Other criteria met or not met are listed with each community.

**Table 3.1: Selected Interview Communities**

Geographic Region	Community Selected	Other Criteria
West	Fraser Basin, BC	Large community, experiencing population and economic growth, sustainability indicator report: Sustainability Snapshots
Prairies	Calgary, AB	Large community, experiencing population and economic growth, sustainability indicator reports: State of the Environment, Sustainable Calgary State of Our City, Vital Signs, FCM QoLRS
Ontario	Sault Ste Marie, ON	Small community, experiencing declining population and recovering economy, indicator report: Community Quality Institute Community Performance Reports
Quebec	Montreal, QC	Large community, experiencing growth, indicator reports:

		Montreal Community Sustainable Development Plan
Atlantic	Halifax, NS	Medium community, experiencing growth, indicator reports: Atlantic GPI, FCM QoLRS, City is in the process of developing community sustainability indicators
North	Yellowknife, NWT	Small community, experiencing growth, no indicator reports, have a sustainability plan, placed 4 <sup>th</sup> in 2011 and 1 <sup>st</sup> in 2010 and 2009 in Corporate Knights ‘Most Sustainable Cities in Canada’ ranking

Individual participants were selected using online resources available from each community as well as connections made through the researcher’s networks (a complete list of interviewees who agreed to be identified is included in Appendix B). Referrals from these potential candidates were also included where necessary or in the case that a participant more experienced in indicator development was available.

### 3.3.2 Data Collection

Once the cities had been selected, email requests (Appendix C) were sent, or an outreach phone call was conducted (Appendix D), to each potential participant. A second email (Appendix E) was sent to those participants who were interested in engaging in the study to provide them with more information. The second email outlined in more detail the study and contained a scheduling request.

Preparation for the interviews involved creating a consent letter (Appendix F), making an interview guide (Appendix G), obtaining ethics clearance (Appendix I), and coordinating travel.

Conducting the interviews was done in person to align with the methodology above; interviews were only conducted on the phone where no other option was available (As in the case of interviewee E from Montreal). Each interview was audio recorded and transcribed. The researcher also took hand-written notes during the interviews to provide situational depth and highlight areas of importance. As is shown in Appendix G, the questions asked were open-ended and offered a guide for the interview rather than a set of specific questions. This is because less structured interviewing techniques allow for a broader range of data to be gathered (Fontana & Frey, 2000; Northey, Tepperman, & Russel, 2002). The lack of structure also allowed the researcher to explore motivations and opinions of the participants, providing an understanding of the interviewee’s social reality. Understanding this reality is beneficial when creating solutions to use within that society (Lewis-Beck et al., 2004).

After the interviews were complete, a thank you email (Appendix H) was sent to each participant. Also, upon completion, an executive summary of the results was sent to each participant, with the option of receiving a copy of the full thesis. This allowed them to see the results of their participation, and, hopefully, influenced positive change towards sustainability.

### 3.3.3 Data Analysis

The transcribed interview data were analyzed by coding responses that fell into similar conceptual categories (Allan, 1991). Once the coding was complete, data reduction was performed to make the data easier to analyze. The coded responses were then compared with the responses of other participants from

the same city to contrast perspectives of the same situations. Larger conceptual lines were drawn by adding the researcher's hand written notes and comparing similar codes across all cities involved.

Conflicts between theory and practice were highlighted, maintaining the critical social science methodology. These gaps presented major areas for improvement, and combined with the best practices reviews provide a structure that encourages improvement in indicator and scoring methodology development as well as sustainable development implementation.

### *3.3.4 Validity and Reliability*

The methods discussed here maintain credibility by following the critical social science approach; constantly looking between theory and fact (Lewis-Beck et al., 2004). In qualitative research there is debate about whether or not the subjective nature precludes these methods from being valid and reliable (Janesick, 2000; Lewis-Beck et al., 2004). However, since the methods are clearly outlined, this study is replicable, which lends to the credibility (Lewis-Beck et al., 2004). And, the perspectives and insights gained are from various third party participants, in numerous cities, to verify the applicability of the initial findings. These methods add to the validity of the research outcomes by increasing the accuracy (Lewis-Beck et al., 2004) and credibility (Janesick, 2000) of the findings(). Ultimately, the research questions were answered effectively, thus enabling the research objectives to be achieved in a successful manner that is valid and reliable enough for the purposes of the research.

## **4.0 DOCUMENT RESULTS - GENERIC COMMUNITY LEVEL SUSTAINABILITY INDICATOR SETS**

The purpose of this chapter is to create a preliminary set of community sustainability indicators (Research Question 1b), related domains (Research Question 1a), and to discuss the CM scoring methodology.

### **4.1 Community Level Indicator Sets**

This first part of this chapter aims to create a preliminary set of community-level indicators and domains to be used across Canada. Since generic community-level sustainability sets have already been created by various entities, this section will first consider the following four indicator sets that fit with the interests of this research:

- The Federation of Canadian Municipalities Quality of Life Reporting System
- Statistics Canada's Trends in Cities Project
- Alberta's Genuine Progress Indicators
- Siemen's US and Canada Green City Index

The chosen sets of indicators are generic and focused at the community level, but have slightly different characteristics that are in themselves advantageous for the analysis and ultimately useful background for designing the initial set of indicators that will emerge from this analysis. Each of the following sections begins by outlining the respective set of indicators, and then discusses the advantages of that particular indicator set to this research. This is followed by a summary of the results of analysis, which was conducted using the Urban Sustainability Indicator Evaluation Matrix (Appendix J), adapted from Maclaren (1996). The matrix compared the indicators based on their satisfaction of the sustainability goals and indicator selection criteria selected in section 2.4. The chapter concludes with a discussion of the combined results and the selection of a preliminary set of indicators to be used in discussion with both the MMM Cities Group and in the interviews later in this thesis.

#### *4.1.1 The Federation of Canadian Municipalities Quality of Life Reporting System*

The Federation of Canadian Municipalities (FCM) Quality of Life Reporting System (QOLRS), which is maintained by an organization that represents municipalities across Canada and promotes sustainable development within those municipalities, is expected to provide a set of sustainability indicators that are very relevant to communities across Canada. The QOLRS has been used to perform measurement in the three domains of sustainability (social, economic, and environmental) since 2002, when environmental indicators were added to the reporting system domains (Anielski & Winfield, 2002). Currently in use by 24 member municipalities, “the Quality of Life Reporting System (QOLRS) measures, monitors and reports on social, economic and environmental trends in Canada’s largest cities and communities” (Federation of Canadian Municipalities, 2010).

Analysis of the FCM QOLRS indicators using the Urban Sustainability Evaluation Matrix (Appendix 4.1) is summarized in the following results:

- The set was broken into 10 domains with a total of 86 indicators.
- Low satisfaction of sustainability goal 5 (Resource maintenance and efficiency) and goal 6 (Socio-ecological civility and democratic governance), no satisfaction of goal 7 (Precaution and adaptation) or goal 8 (Immediate and long term integration). This indicates a lack of focus on socio-environmental and long-term considerations.
- Low satisfaction of sustainability indicator criterion F (Attached to a clear and ambitious goal); all of the other criteria were met in the majority of the indicators. These indicators are thus lacking specific direction for the future.
- Most indicators were State type indicators; a few were Pressure type, and none was Response type. Combined with a lack of appropriate goals, this further indicates a set of indicators focused on determining the current state without consideration of the future.

#### *4.1.2 Statistics Canada's Trends in Cities Project*

This indicator set was compiled by Statistics Canada, the government agency responsible for statistics. It was assumed that this organization should be the most aware of the data available and the measures used to collect that data. Furthermore, “the focus of the Cities project is identifying all statistical information (environmental and non-environmental) that can be reported for cities” (Anielski & Winfield, 2002, p. 37). The Trends in Cities project was only a pilot project in 2002 and no subsequent data have been found; however, it is expected that the measures provided through such a project would still be of value to this project. The measures presented come from various sources, including self-rated information from the community level (Anielski & Winfield, 2002). Hence, it is expected that this document will specifically highlight easily accessible indicators, as the required data should all be publicly available.

Analysis of the Statistics Canada Trends in Cities Project indicators using the Urban Sustainability Evaluation Matrix (Appendix 4.1) is summarized in the following results:

- The set was broken into 10 domains with a total of 25 indicators.
- Low satisfaction of sustainability goal 2 (Livelihood sufficiency and opportunity) and goal 6 (Socio-ecological civility and democratic governance); no satisfaction of goal 3 (Intragenerational equity), goal 7 (Precaution and adaptation) or goal 8 (Immediate and long term integration). This indicates a lack of focus on equality and long-term considerations.
- Low satisfaction of sustainability indicator criterion F (Attached to a clear and ambitious goal); all of the other criteria were met in the majority of the indicators. These indicators are thus lacking specific direction for the future.
- There was a mix of Pressure, State, and Response types of indicators.

#### *4.1.3 Alberta's Genuine Progress Indicators*

The Genuine Progress Indicators (GPI) system is different from others considered. Where other indicator sets consider domains or categories, the GPI has accounts (environmental, social, and economic) and sub-accounts that hold ‘balances’ and the GPI considers inflows, outflows, pressures, states and responses (Anielski & Winfield, 2002). Hence it operates similarly to a traditional financial accounting system with a more holistic perspective. The values for each measure are normalized based on best and worst scores then plotted on a spider-graph, which provides a visual depiction that is easily interpreted. The overall intention of the GPI is to provide a more holistic alternative to community-level GDP as the primary indication of Canada’s ‘progress’.

Analysis of the Alberta GPI indicators using the Urban Sustainability Evaluation Matrix (Appendix 4.1) is summarized in the following results:

- The set was broken into 3 domains with a total of 51 indicators.
- Low satisfaction of sustainability goal 6 (Socio-ecological civility and democratic governance), and no satisfaction of goal 7 (Precaution and adaptation) or goal 8 (Immediate and long term integration). This indicates a lack of focus on long-term and social capacity considerations. The latter of these two is interesting considering the nature of the GPI is to account for the social and environmental capacity that is usually not given value in traditional well-being indexes.
- Low satisfaction of sustainability indicator criterion F (Attached to a clear and ambitious goal); all of the other criteria were met in the majority of the indicators. These indicators are thus lacking specific direction for the future.
- Most indicators were State type indicators, a few were Pressure type, and none were Response type. Combined with a lack of appropriate goals this further indicates a set of indicators that are focused on determining the current state without consideration of the future.

#### *4.1.4 Siemens US and Canada Green City Index*

Siemens has created five different Green City Indexes spanning four continents with the fifth coming soon. The benefits of such a widespread monitoring system are numerous, and fit very well with the conclusions from the academic literature review above. Hence the US and Canada Green City Index (USCGCI), although it is not uniquely Canadian and considers only environmental indicators, is expected to provide a unique perspective.

The USCGCI used publicly available data where possible (Statistics Canada, Environment Canada, and the Conference board of Canada) supplemented with data collected directly from cities. National level data were preferred because they ensured a consistent collection method. The indicators are split into 9 categories totalling 16 quantitative and 15 qualitative measures. The data were ultimately normalized for presentation as best and worst practices on a scale of one to ten to provide comparable results.

Analysis of the Siemens US and Canada Green City Index Indicators using the Urban Sustainability Evaluation Matrix (Appendix 4.1) is summarized in the following results:

- The set was broken into 9 domains with a total of 31 indicators.
- Low satisfaction of sustainability goal 2 (Livelihood sufficiency and opportunity), goal 4 (Intergenerational equity) and goal 7 (Precaution and adaptation). This indicates a lack of focus on socio-economic and long-term considerations.
- Low satisfaction of sustainability indicator criterion F (Attached to a clear and ambitious goal); all of the other criteria were met in the majority of the indicators. These indicators are thus lacking specific direction for the future.
- There was a mix of Pressure, State, and Response types of indicators.

#### **4.2 Evaluation of Community Level Sustainability Indicator Sets**

Considering the individual analyses of these four indicator sets together it is easy to highlight the common gaps. Primarily, there is a major gap in terms of long-term consideration. The indicators, for the most part, do not respect future implications or needs, potential future issues, and are not tied to future goals. Similarly, the indicators are mostly focussed on determining the current state and rarely consider the effect of pressures or responses, which are very helpful in decision making. In terms of forward looking measures, policy based indicators made up the majority throughout the indicator sets, and are a good example of forward looking indicators. Other forms of forward looking indicators should be pursued in order to evaluate their value to the indicator set being developed for this research. The lack of attachment to goals is easily fixed by attaching indicators to already established national level goals where possible, or establishing goals based on current performance, future need, or best practices.

Each of the indicator sets, apart from these common issues, had unique issues and features. This develops from the fact that each set is focused in slightly different directions (e.g. Quality of Life vs. Genuine Progress). In the next step of selecting the preliminary set of sustainability indicators for this research, there will be an attempt to transfer these advantages and minimize the negative qualities using the outcomes of the Sustainability Indicator Evaluation Matrix.

#### **4.3 Preliminary Set of Generalized Community Level Sustainability Indicators**

In order to begin paring down the list of indicators, all indicators that satisfied none of the sustainability goals and less than five of the indicator criteria were eliminated. Then an exercise was undertaken to merge the lists. Sub-domains were selected and refined through this organization process, ensuring that all remaining indicators fit into one or more categories. Those indicators that fit more than one sub-domain were listed in one of the categories and labelled as ‘cross-cutting’ with the other sub-domain. Similar indicators were grouped together for future consideration. From this exercise emerged the preliminary set of indicators for this research complete with sub-domains that fit into one of the three domains of sustainability (Appendix K). Appendix L shows this preliminary indicator list reorganized back into the

Sustainability Indicator Evaluation Matrix to help with future evaluation of these indicators against each other, new indicators, or additional criteria.

#### **4.4 Complete Mobility (CM) Scoring Methodology**

The CM scoring methodology, which comes from the practitioner literature, was used in the interview stage to incite discussion around scoring processes for sustainability indicators. This particular scoring methodology, the CM scoring methodology, was chosen because of the partnership in this research with the MMM Group; the CM methodology was developed by an MMM subsidiary, MRC Mclean Hazel (MRCMH). Below is a brief description of the CM scoring methodology.

The CM methodology was developed by MRC McLean Hazel for use in Siemens transportation audits worldwide. Within the CM concept is a scoring methodology that allows indicators with different measurement types to be compared and (assuming equal weighting) combined to create a composite index to measure and compare mobility within and between cities (Siemens Canada Limited - Industry Sector, Mobility Division, 2010). To do this, indicators were scored on a scale of 1 to 6 using scoring rubrics (e.g., for qualitative indicators the rubric would describe the scores 1 to 6 and for quantitative indicators the rubric would provide numerical ranges for each score 1 to 6) (Siemens Canada Limited - Industry Sector, Mobility Division, 2010).

This type of scoring methodology also allows for goals to be attached to each indicator score, and thus provides a sustainability index that seeks defined sustainable ends and promotes positive improvement while highlighting areas requiring improvement across Canada and within each community. Perceptions on this scoring methodology can be found in the Results chapter.

#### **4.4 Summary**

The indicator sets presented and evaluated in this section individually contained benefits and drawbacks. Through combining these lists and removing those indicators that did not satisfy sufficient sustainability goals or indicator criteria, a preliminary list of indicators has been created. Reformatting this list provides a tool for easy future appraisal. This will be valuable as this preliminary list of indicators and sub-domains, along with the CM scoring process, will become a focus of the rest of this research project; this set is the starting point in creating a set of indicators and potential scoring process for use in a CCSIF.

## **5.0 INTERVIEW RESULTS – CONVERSATIONS ABOUT A CANADIAN COMMUNITY SUSTAINABILITY INDICATOR FRAMEWORK**

The aim of this chapter is to convey the contents of the interviews, grouped by theme according the objectives of this research (5.1, 5.2, and 5.3 relate to Research Objective 1; 5.4 relates to Research Objective 2; and 5.5 contains emergent themes). Interviewees came from three distinct sectors: public, non-governmental organizations, and academia. There were 19 interviewees and 15 interviews conducted in communities across Canada; the selection criteria can be found in Chapter 3. The communities involved were Sault Ste Marie, Calgary, Yellowknife, Fraser River Basin, Montreal, and Halifax. The chapter follows the major themes that emerged in these interviews: transferability, information sources and indicators, Canadian core indicator domains, progress management, and discussion of the real world context in which a Canadian community sustainability indicator framework would function. It will be evident throughout the following sections that these divisions are not absolute, however, and there is overlap between them. The objective of these interviews was to gain real world insight into the three research questions of this thesis. The theme divisions provide clear connection to the development of a standardized set of community sustainability indicators for Canada, a potential scoring framework, and the creation of a CCSIF.

### **5.1 Transferable Community Sustainability Indicators**

The most noticeable theme that emerged from the interviews was the conflict around horizontally and vertically transferable indicators. Transferability was defined in Chapter 2 as the ability of indicators to be relevant and comparable between different communities (horizontal transferability) and between community, provincial, and national levels (vertical transferability). This theme speaks directly to the feasibility of Canadian community sustainability indicators and domains, and thus Research Questions 1a and 1b. The interviews produced five distinct themes around the creation of transferable community sustainability indicators: uniqueness of community, core indicators, grassroots vs. top-down process, government participation in indicator development, and collaboration. These results are divided accordingly in this section.

#### *5.1.1 Uniqueness of Community*

The need to consider unique community context when measuring sustainability has the capacity to present difficulties in attempting to deliver a comparable set of core sustainability indicators. Interviewee D from Montreal illustrated this point, saying:

*It's one thing to create indicators, but comparing cities is different altogether. There has to be some context; judicial systems are not the same... Cities in Quebec don't have the same responsibilities as Ontarian ones.*

Interviewee A from Sault Ste Marie used a personal health metaphor to highlight the perceived issues of community comparison, concluding that:

*When you undertake a weight-loss program do you compare your weight-loss rate with a guy next to you? It's probably not a good idea; he has different health issues, different metabolism, may be able to lose weight easier or maybe not so easily. And you can also find any community to compare yourself against that, it may not be fair but you want to look better I'll find you a dozen communities that we could benchmark ourselves against unfairly, not properly, not in a scientific way, but still you can find communities that appear on the surface very similar where we would win. How does that help us? I get benchmarking, we benchmark all the time in government against other jurisdictions, because there is in kind of a standardized approach to delivery of government services and policy development. But at the micro level, the community level, there are such big differences. People say northern Ontario is... But the key stakeholders in Thunder Bay would dispute that they have anything*

*in common whatsoever with Sault Ste. Marie and Sudbury. Their issues are different; they have more in common with Winnipeg than they do with Toronto.*

An example of such a community specific issue was provided by interviewee B from Sault Ste Marie. This particular example underlined the potential measurement issues of their geographic location on the border between Canada and the United States:

*Some of our indicators get skewed because of our cross-border situation. We have things that happen here that wouldn't happen in Sudbury where people do so much of their shopping across the river. I mean how much gas is being bought in Sault Ste. Marie? Well it doesn't seem to make much sense, that's because half the people buy it across the river. Some of the indicators just don't make sense to try to compare them to other communities without really trying to into account the situation.*

These excerpts exemplify the belief of these interviewees that community context must be taken into account in order to select and interpret indicators. Furthermore, interviewee B from Montreal emphasizes the difficulties they have faced in searching for indicators that suit large cities, concluding that an indicator set that represents all communities across Canada would be even more difficult to compile. Similarly, interviewees B and C from Yellowknife concluded that the characteristics of a sustainable community differ between regions and therefore generalized measurements would be very difficult to define for Canada as a whole. Interviewees A and B from Montreal highlighted the result of these contextual differences as follows:

*Interviewee A, Montreal: Another problem is when you take a specific objective and you apply it to two different communities, what you will have to do to reach that objective is not necessarily the same. It won't have the same scope, or costs, and it won't require the same level of investment. The same political, administrative and regulatory structures won't exist, and so it can lead to unequal difficulties.*

*Interviewee B, Montreal: For example the ease of increasing the number of trees is not necessarily equal in Montreal as in Calgary.*

Another key example, used in four of the six communities, was differences in energy use between communities, epitomized in the following statement from interviewee A from Fraser River Basin:

*If you look at household energy consumption in colder and more northern climates, they're going to burn more energy to keep themselves from freezing. So it's not appropriate to say that, well Prince George uses way more energy per capita than Vancouver.*

Throughout the interviews there was also a consensus that despite these challenges, sustainability comparisons are valued and should be pursued. Interviewee B from Yellowknife pointed out that while communities want to maintain uniqueness, they also desire comparison. In fact, according to interviewee B from Halifax and interviewee C from Yellowknife, comparability informs decision makers of their community's relative position. And, as interviewees B and C from Sault Ste Marie point out, comparisons are necessary in certain circumstances to determine the allocation of provincial and federal funding. Moreover, interviewee D from Yellowknife stated that comparisons between communities can spur positive personal as well as political action towards goals.

Two of the interviewees from Montreal found advantage in comparability from a slightly different angle:

*Interviewee B, Montreal: It could be helpful, instead of always saying "Look at us, we're so great!" to have a way of comparing ourselves to other cities. It was interesting, for example, to hear that Calgary is a leader on something, whereas our paradigm on that region tends to tell us otherwise.*

*Interviewee A, Montreal: If it would allow the exchange of methodologies, for example methods of measuring things that we are unable to as of yet, as we were discussing earlier, then it could become interesting for everyone involved.*

Interviewee A from Fraser River Basin supported this assertion; however, in order to provide these benefits, interviewee A from Calgary declared a need to provide better measurement and interviewee A from Fraser River Basin argued that any deficiencies or imperfections in current measurement protocols should not discourage efforts at improvement. Reflecting on attempts to improve, interviewee C provided a possible solution to the popular issue of comparing energy usage levels across communities:

*The degree per day calculation can create a level platform to look at my house in Yellowknife compared to the efficiency of the same house in Edmonton or Toronto.*

Two interviewees, interviewee C from Calgary and interviewee B from Halifax, also asserted that there are certain core issues relevant to all communities despite differences and unique qualities, as shown in the statement by interviewee C from Calgary:

*Looking at the big picture we all want to move toward the same place and contribute to the same thing... but you have to see where your piece of the pie or the puzzle fits in... you can see that there is an overarching framework for it, and then you can go about and say, well there are things that matter in our community that might not matter in others.*

### 5.1.2 Core Indicators

This section presents assertions about potential challenges in creating a core set of community sustainability indicators. Interviewee A from Calgary, in discussing the potential for a set of transferable community sustainability indicators stated that it would be possible to have a core set of up to 36 indicators, but also maintained the importance of supporting unique local indicators that speak to specific community issues. Interviewee C from Montreal and interviewee D from Yellowknife echoed this point, characterized in the following statement from the latter:

*I think a lot of this is common to communities because it is still a question of measuring how people live and we do all kind of live the same way. Clearly there are unique attributes to northern communities that don't exist elsewhere, but in terms of something like water quality, it's drinkable or it's not, it needs to be boiled five times a year or not. I mean there are common denominators no matter which community you are in.*

Interviewee B from Calgary, described a vertically transferable method of determining nationally relevant themes, used by the Community Foundations of Canada in their Vital Signs publications. This process is collaborative (all participant communities have input), and it maintains local uniqueness by encouraging the addition of locally relevant indicators within each of the local reports.

This concept was also mentioned by interviewee B from Halifax and interviewee D from Montreal, asserting the need for a national set of community sustainability indicators to maintain relevance at the community level. An example of provincial level indicator development failing to do so comes from interviewee D in Montreal:

*Our comment when we presented in a parliamentary commission was that, to be useful, national [here, provincial] level indicators must be relevant at a local scale. Their indicator development was very theoretical, perhaps too much so to be very useful for us. There is a question of scale in the development of indicators. The ideal would be that local scale data would be the same at provincial scale and at the national scale, and that we would see a logical and coherent flow... it would be easier for everyone if upper level thinking on data could have an immediate impact at the local scale.*

The dialogue with interviewee A from Fraser River Basin provided several important insights on challenges faced and actions taken by the Fraser Basin Council in developing an effective set of

sustainability indicators at the river basin level, which includes several different communities of different sizes and circumstance:

*I think at the community scale you are more likely to more accurately attribute trends to causes and improvements to specific actions. On the scale of the Fraser River basin, very difficult, so I'll use salmon stocks as an example. So we have dozens of different stocks of species throughout the Fraser River basin and many of the populations are declining over time and some are going up. Those trends are a result of freshwater habitat, whether through degradation or restoration, forest practices, urban development, agriculture, low river flows, warm fresh water temperatures, and a whole bunch of dynamics in the marine environment around food webs and predators and climate change, and then there are questions around harvest rate. So it's very difficult for us, with most of these trends to say salmon stocks are going down because of X. More typically you will list out the range of stresses that we believe to be significantly influencing these trends, but not go as far as saying that this process is causing X, because it's so large and diverse, and there are different drivers in different regions... because the basin is so diverse it's hard to make those attributions and statements, but at a community scale there is a more homogeneous situation. It might be easier to tell that this policy is implemented and it directly led to an improvement in housing.*

Thus, determining causality at the river basin level can be difficult; however, the Fraser Basin Council indicators are seen to contribute to the community level pool of data, stating that:

*For a community that [wants] to develop an action plan, they'll need some combination of provincial, regional, and community scale data.*

Still, interviewee A from Fraser River Basin also detailed the difficulties associated with trying to provide different communities with relevant and useful data:

*I've had a number of discussions with folks, different indicator people, and to meet and all agree on a common set of indicators is one approach. And that would be way more efficient and demand less resources and everyone would get their work done. But you quickly realize that... we're doing this work for different perspectives. So we look at it through the lens of sustainability, for others it might be healthy communities, or community well-being, or [they might] stick with the state of the environment. So there are those different lenses that we look at, different geographies of interest, different data that are available for different geographies, and so I guess the way I see it working is, there ought to be potential to agree on a core set of indicators that are of relevance to the vast majority of agencies, organizations and geographies. And then you supplement that with those that might be of unique interest at a different scale or within a particular community.*

Thus, Fraser River Basin provides an example of the challenges and successes in creating a multi-community sustainability indicator system. All of the interviewees from Sault Ste Marie came to similar conclusions, stating the value of a vertically transferable community sustainability indicator framework, including that there will be certain community dimensions that are not scalable to the provincial or national level. Interviewee C from Calgary also reflects the value in such a system, emphasizing the potential to align provincial and national sustainability vision and goals.

### *5.1.3 Grassroots vs. Top-down Process*

Throughout the interviews, there were proponents of the idea that the community level should inform the provincial and national sustainability agenda, as well as those that believed the opposite – that the national level should define the relevant core sustainability issues. Interviewee A from Sault Ste Marie was particularly passionate in this regard and epitomizes the grassroots side of the debate:

*I really firmly believe, and I would debate it with anyone, the notion that real value in terms of the development of sustainability indicators will be found at the grassroots level and these larger macro exercises will be informed from the grassroots, from the micro level exercises that are occurring. It shouldn't go the other way. If communities are looking to inform their exercises based on the Canadian index of well-being work, they are going to be disappointed I believe, and I really think it should go the other way.*

These sentiments are supported by interviewee C in Calgary, asserting that the process of determining core issue areas and sustainability indicators needs to be a true participatory process that promotes transparency and accountability within the community. Interviewee B from Yellowknife also provides encouragement for community involvement with the following statement:

*I think there needs to be enough consultation... at the municipal level so that the federal level can define what is really practical... I think they're going to have to meet in the middle.*

On the other hand, interviewee A from Yellowknife challenges the statements, arguing:

*I think as far as core indicators go, it would be nice to be able to have sort of a set that's provided by a national organization to say, here is a set we can now measure each of these communities against.*

Along these lines, also from Yellowknife, interviewee D, while discussing nationally determined community sustainability indicators, states that:

*It needs to maintain a certain level of generality [and would be] in some way a little bit more equitable because there are lots of communities that, even if they are interested in this probably couldn't afford or have the capacity to begin to put it together.*

Likewise, interviewee D from Montreal, who expressed the need for a vertically transferable Canadian community sustainability indicator system to be based on national or international values, also contends that:

*It is especially difficult in a Canadian system where cities are creatures of the province.*

#### *5.1.4 Government Participation in Indicator Development*

Throughout the interviews, some issues arose around government taking part in the development and maintenance of community sustainability indicators. The primary concern was transparency within government agencies. Interviewee A from Sault Ste Marie cited instance of this, and interviewee C from Calgary also provided a specific example of this from Calgary, stating that:

*You can steer away from those certain measures; so you just say no, we don't measure things that way, we measure it differently. That's how they get away from it. And I've seen it here... they just develop a different indicator and say well, now we don't measure that way, we measure it differently... it's very much a defense mechanism, to say what we're doing is okay, we're really not that bad. That's why we've been asked not to do more benchmarking.*

On the same topic, interviewees B, C, and D from Sault Ste Marie encountered problems attaining data transparency, as government agencies refused to release information that reflected their department poorly. Interviewee A from Yellowknife faced a similar situation when attempting to obtain territorial tax information on oil and gas usage, expressing that:

*It just kind of boggles my mind; we're trying to make improvements to our environment and our local economy. Trying to build measures of where we're at today, where we want to go, and down the road figure out how successful we've been. And the roadblocks have been just nonstop.*

Another issue, from Yellowknife interviewees B and C, is the challenge of having current and long-term buy-in to the selected indicators. However, in Calgary they have addressed this issue in the Office of Sustainability by writing the development of annual reports on indicators and goals into their business plan, which Council approves prior to the indicators being assessed. Also, interviewee D from Yellowknife, a city councillor, recognizes the obligation to not obstruct data, despite its nature, in this statement:

*Yeah, I mean you have to, the point of it is to either show you what you're doing is great or that there's room for improvement. You have to recognize that there's probably going to be room for improvement in a number of areas.*

Another argument, which emerged along these lines from interviewee B in Halifax, is that decisions made by Council should reflect the desires of the community as they are elected officials. Similarly, interviewee A from Sault Ste Marie pointed out that there are other key stakeholders within the community other than just city council that “collectively form community governance”.

Interviewee C from Calgary discussed the potential of making decisions and trade-offs transparent to the public in an attempt to hold all stakeholders accountable for the decisions made. Interviewee B from Fraser River Basin also discussed this point, using the British Columbia greenhouse gas emission requirements as an example:

*By 2012 there will be the first interim report, and it's not looking good; it's a big assumption that setting the goal or setting a target actually inspires cities to act... it's going to be really politically contentious because, we are in a bit of a budgetary crisis mode in a lot of BC and so you have schools [that] have to reduce their emissions to that same standard. So you have school boards which are having to cut back on music classes and cut back on physical education and cram students into a classroom and they're spending thousands of dollars to buy carbon offsets in order to meet their targets... I think it's important to demonstrate the connections. If they could, in this case of the schools, show that rather than sending their money to plant trees in Uganda they were using the money to get fifth-graders to plant trees in the neighborhood and to learn about what it means, I think people would get behind that.*

Hence, there are potential issues surrounding some potentially controversial areas in terms of sustainability trade-offs; however, in this case, creative solutions can help to reduce friction between sectors.

### *5.1.5 Collaboration*

A final theme that emerged in the discussions of transferability in community sustainability indicators concerns collaborative community sustainability indicator systems. In this case, the comments and examples were mainly in support of collaboration; however, there were a couple instances where collaboration in the development of community sustainability indicators was seen to be unnecessary. First, interviewee A from Halifax was skeptical about the success of a collaborative effort in indicator management, stating that:

*Certainly, if there is better coordination or collaboration between the departments it would be easier, but everybody's doing their own thing and this only comes about every year or two so I imagine people aren't going to be too concerned with setting up a better system.*

Second, interviewee E from Montreal gave the following statement concerning community participation in the creation of indicators:

*No, I don't think it would be important because it is not a responsibility of the community to follow up on the implementation of a plan. It should actually be the opposite: based on what the community desires in terms of goals for sustainable development, we should figure out*

*what data is available and what means could be taken to achieve that. Figuring out what data is out there is not a role for everyone; it is an administrative task.*

Several collaboration success stories were shared throughout the interviews in making a case for collaborative efforts in sustainability planning and indicator development. The following testimonial from interviewee A in Yellowknife provides an effective example of this:

*I find that the initiatives that tend to be the most successful are the ones where we bring the community as a whole in at the ground floor. So the community is very engaged from the beginning. Our community energy plan was the cities first real foray into the area of sustainability. And that preceded the bigger smart growth plan and a lot of the things we've done since. It is a very good process for bringing in different sectors of the community and different stakeholders and that kind of thing, we did it with the committee process where there were representatives from the community at large, the Chamber of Commerce, Yellowknife's Dene First Nations, the Power Corporation, the utility company, the Government of the Northwest Territories, the federal government. And so in bringing these initiatives forward and maintaining momentum and keeping the community engaged in what we're doing, the best way to make a case for that is to show the success they are having.*

Interviewees A and D from Yellowknife also found that smaller communities, such as Yellowknife, have an easier time engaging the community relative to larger communities. Interviewees B and C from Sault Ste Marie also found that collaboration towards a common goal, in their Best Start project, resulted in increased cooperation, highlighting the success in increased cooperation and improved data from within the First Nations communities in the area. Interviewee B affirmed these sentiments about collaborative indicator development, stating:

*Partnerships are, I think, the key to everything... they're committed and they want to solve the issues, so they take ownership of that problem and they try to solve it.*

Collaborative approaches can also help with data collection and problem solving. The approach taken by Sustainable Calgary in consultation with the community was to ask people in their capacity as citizens. Thus there was no formal expert consultation, but those people with expertise and interest in furthering the good of the community were included as citizens. Interviewee A from Calgary attested that this produced a mix of skills and interested people. Also within Calgary, the Calgary Community Foundation's Vital Signs project takes on a collaborative approach. Vital Signs is not collaborative in determining the core issue areas that are reported on nor on the indicators used; however, when asked about this, interviewee B from Calgary stated that "we have a pretty good sense because of our work". Calgary's Vital Signs project, on the other hand, looks closely at public opinions on several key areas by administering polls to citizens that provide statistical data for the Vital Signs publication. The Calgary Community Foundation also administers round table sessions, titled Vital Conversations, in which interested citizens discuss the current issues and potential solutions within one of the core issue areas of the Vital Signs publication. In Calgary there is also now a Mayor's Committee for Civic Engagement, upon which key stakeholders from the community sit<sup>1</sup>, and the community developed Imagine Calgary Plan, where the city is simply one participant and includes various other stakeholders<sup>2</sup>. The Calgary Office of Sustainability, over the past year, has been working on a collaborative governance model to link and develop different sources of information to increase efficiencies and establish measures for the community<sup>3</sup>.

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<sup>1</sup> Interviewee B from Calgary

<sup>2</sup> Interviewees C and D from Calgary

<sup>3</sup> Interviewees C and D from Calgary

## **5.2 Information Sources and Indicator Presentation**

This section presents results pertaining to data sources and methods for displaying data, which are important to the development of indicators for a CCSIF (Research Question 1b). Current information needs, challenges, and examples are included in the first section and assertions about data needs of different audiences are in the second.

### *5.2.1 Improving Information Sources*

Information sources and issues collecting data emerged throughout the interviews along with ways different communities and organizations got around certain roadblocks. One of the major problems communities faced in finding information to populate indicators was the issue of inconsistent data. For instance, interviewee A from Calgary and interviewee B from Fraser River Basin pointed out that there is different information available based on different definitions of the community (i.e., Metro Calgary vs. the City of Calgary).

In Halifax, both interviewees noted issues in accessing information. Interviewee A remarked upon the inaccessibility of accurate collision data because local police and RCMP held separate databases and would not allow access. Interviewee B had issue with calculating GHG emissions because energy usage rates were kept in dollar amounts rather than real usage. Interviewee A from Yellowknife, interviewee E from Montreal, and interviewees A and B from Halifax echoed generally their troubles in finding relevant, accurate data alongside interviewee D from Montreal, who stated that:

*Sometimes we had to drop an indicator because of data problems. Sometimes we had data but it didn't give us any additional information, it didn't give us any added value. That is an issue when you are working around existing data. It is important to be sure that your data is replicable over time and that the definitions remain constant. For example with respect to air quality, measurements have been gradually improving. As instrumentation has improved, the particles that can be analyzed have been changing. This presents a challenge when you want to compare data over time.*

Another relatively recent issue is the loss of Statistics Canada census integrity. Interviewees B and D from Sault Ste Marie and interviewee A from Fraser River Basin expressed concern over the potential implications for the next set of census data. Related, interviewee D from Montreal asserted that:

*The Commissioner on Sustainable Development at StatsCan<sup>4</sup> created a section and indicators on that topic, but they often were not applicable in an urban environment. They were often more focused on land use, agriculture, ungulates... It is important, but some dimensions of urban environments that were ignored.*

In an attempt to overcome the above issues and compile all necessary and relevant data, Sustainable Calgary looks to the approximately 150 community organizations as well as other organizations (i.e., the United Way) as data sources<sup>5</sup>. In Montreal, multiple sources are used to mine data, as indicated by interviewee E:

*The CRE (Conseil Regional de l'Environnement) has a manager of sources of public data, who provides it every time we produce a report [and] the City does manage some data that is useful to us, but there is also the Quebec Society of Auto Insurance, the Transport Ministry, the MNR, Gaz Métro, Communauto, and so forth. There are many players that provide us with data that allow us to follow our progress on various indicators.*

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<sup>4</sup> Note: The Commissioner of Environment and Sustainable Development is not in Statistics Canada, but in the Office of the Auditor General. [Check to ensure your source was not talking about someone else, actually in Stats Can.]

<sup>5</sup> Interviewee A from Calgary

Interviewee D from Yellowknife also noted that, as aboriginal social statistics are particularly important, they use information provided by the territorial government to supplement their other data.

Interviewees in Calgary and Fraser River Basin all pointed out that in order to overcome data challenges they have created their own indicators<sup>6</sup>, though interviewee A from Fraser River Basin indicated that this was rare, as indicators are most practically developed at the community level.

In the interest of improving data sets, interviewee B from Calgary and interviewee B from Sault Ste Marie indicated that by simply using their data networks steadily, the data quality and reliability has increased. In attempts to improve the quality of information, interviewee A from Fraser River Basin, interviewee A from Halifax, and interviewee B from Sault Ste Marie all indicated that they had worked with data sources in their network, either formally or informally. Interviewee B from Sault Ste Marie gave an example of how they worked to improve one of their data sources:

*The province says [that hospitals] must collect these [values] and over time people stopped entering some of the fields. They are supposed to enter the birth weights, when they first started a little over half of the birth weights were entered. But no one was saying anything at the province, so [the hospital staff] said 'I guess they don't really care, so why should I bother running down and finding this out?' But then we started use the data locally [and] we are going back to the health nurses that were entering the data and showing them how we were using it in our own community and [the data] went right back up to almost 99% of the fields being filled in.*

Interviewee B in Sault Ste Marie also pointed out the benefits of using GIS, as one can collect and manage data over various geographic locations and explore it at various levels of aggregation.

Considering a national data management system, interviewee E from Montreal stated that:

*It would be very positive for the management of data. As we see in the case of GHGs, as soon as you have a tool that is shared between a number of municipalities, practices and the disclosure of information also become standardized, which allows data to be more efficiently compared.*

However, this interviewee also contemplated that such a system might not be worthwhile on the following bases: “Would it make sense to invest time and energy into a pan-Canadian or a pan-Quebec set when we are lacking information on a day-to-day basis?” and that “standardization will be incredibly difficult”.

### 5.2.2 Presentation

Presentation methods were discussed by some interviewees who regarded it as a very important and challenging part of the indicator process. Interviewee A from Halifax maintained that quick to read, eye-catching, ‘magazine article’ indicator reports do not contain enough depth to be useful to decision makers, while interviewee B from Yellowknife argued that attention grabbing, easy to read reports can stimulate further discussion. Interviewee A from Fraser River Basin also described the conflict that is faced in choosing an appropriate depth of data considering audience and limitations, and interviewee A from Calgary stressed that an eye-catching piece is effective from a marketing perspective; however, to be useful the data need more depth, offering the following metaphor:

*I always try to find ways to describe what the indicator work is doing. One metaphor for me is [that] these indicators are just a window [that provides] a broad picture of society in a whole lot of domains. So the education indicators that we have, we have only five education indicators, if you're an education administrator, or an education researcher, or are working for the Ministry [then] you're going to probably want to see whole lot more than [five]*

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<sup>6</sup> Interviewees A and B from Calgary and interviewee A from Fraser River Basin

*indicators and you are making decisions based on a whole lot more than [five] indicators. So this kind of provides a window into it, and you can go deeper and deeper. In the cyber world using one click [you can] get deeper and deeper into each level. So that's kind of one metaphor is that each of these provides one window that gets larger as you investigate that domain further.*

Interviewee A from Calgary speaks further to the idea of using web-based display tools to show depth in data and horizontal and vertical transferability, stating that:

*There is no shortage of data at this point, it's just making manageable for people, and accessible to making decisions.*

Interviewees B and C agree that there is value in these types of display tools for indicators, however the cost of such instruments would be a large challenge for a small community. To overcome the challenges of presenting indicator data, the Calgary Community Foundation used a professional graphics service<sup>7</sup>, and interviewee A from Fraser River Basin mentioned the use of narratives to help present the data in an appealing yet useful way, and ensures that limitations are always understood to prevent confusion or inaccuracies.

### **5.3 Core Set of Indicator Domains**

Each interview included a discussion of the indicator domains developed through the exercise in Chapter 4. This section includes assertions about these domains directed at answering Research Question 1a. All of the interviewees agreed on the relevance of the set provided and that it was a good starting point for a set of national indicators; however there were some relevant discussion about clarification of some of the domains and about the addition of other domains and indicators. Food security as a missing domain was mentioned by interviewee A in Calgary, interviewees B and C in Yellowknife, and interviewee A in Fraser River Basin, with the two interviewees from Yellowknife providing their local example:

*Interviewee C: At the community level we do community gardens and things like that... but in order for me to say that Yellowknife is a sustainable community, I can't be getting my food only from 1500 km or 2000 km away, I kind of laugh when they say that Yellowknife has won sustainability awards; but don't turn off the oil!*

*Interviewee B: yeah that's right, and we don't have any farms around us ...*

*Interviewee C: this is not a sustainable community. I mean we can get fish from the lake, but [food security is] a major issue here, that we could address... it's a black swan event that's way out there, but it's definitely a strong indicator.*

In addition, interviewee C from Yellowknife highlights the deficiencies in public knowledge on this topic:

*You're starting to see now, you're hearing people talk about it and there's a lot of literature on [it], but it's sort of a subculture discussion; it's definitely not a general discussion the people relate to. People go to the grocery store to get their food and they don't think past that... there was an interesting survey done several years ago where they were asking inner-city kids the question 'where does milk come from?' And a lot of kids said 'a cow', but there was one kid that said 'flowers'. 'Why flowers?' And the kid said, 'his only source of milk was from the can, canned milk that has a little flower on it', and so that was his understanding of where milk came from: flowers.*

Another additional category that was brought up more than once is ecological diversity. Interviewee A from Montreal stated that:

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<sup>7</sup> Interviewee B from Calgary

*Biodiversity seems to be something that is missing. The issue of nature in an urban environment is very important to Montrealers.*

This was reiterated by interviewee D from Montreal, stating the need to consider green spaces and biodiversity, and interviewee A from Calgary noted that “ecological diversity within an urban context” was missing. Interviewee A from Fraser River Basin also considered this an important area, however considered parts of this topic to be potentially unrelated to the community level:

*The other thing that I thought was around ecosystems, and again it's not going to be as relevant at a community scale than that a large river basin, but biodiversity... efficient wildlife, parks and protected areas, sensitive ecosystems, urban forests, that kind of ecosystem stuff. And yeah, maybe it's urban forests and municipal parks, maybe that's the extent of it, but maybe there's something more there about protection of wetlands or other sensitive habitats.*

Somewhat related is the idea of measuring the impact people have on their environment through ecological footprint assessment. Interviewees C and D from Calgary pointed out the importance of this type of measurement to sustainability indicator sets.

On a similar note, interviewee A from Fraser River Basin, interviewee D from Montreal, and interviewee C from Yellowknife highlighted the importance of GHG and climate change measures. Interviewee C from Yellowknife also drew a distinction between air quality and GHG emissions:

*Quite often air-quality and greenhouse gases are unintentionally put together, and they're quite different. Air-quality, particular matter in the air is quite different in greenhouse gases, if you address one you're not necessarily addressing the other. For example in Vancouver you could install a biomass boiler and achieve your greenhouse gas goals, but be spewing particulate matter into your area and actually reducing air-quality. And geographically your particulate and air-quality are different. So if you do it in downtown Vancouver you might have a different impact than if you did it in a different location with different air shed.*

Another domain that received attention was immigration, mentioned by both interviewee B in Calgary and interviewee A from Montreal. Interviewee B from Calgary also supplemented this, asking:

*How do we ensure their dignity and [that they are] working in their field?*

The final additional domain that was uncovered by more than one interviewee, interviewee A from Fraser River Basin and C from Montreal, was demographics that could be used to draw context to the indicator set.

Other domains, and in some cases indicators mentioned by only one interviewee, include employment diversity/industry concentration indicators<sup>8</sup>, social risk index<sup>9</sup>, early development instrument<sup>10</sup>, family retention and innovation<sup>11</sup>, and municipal financial security/infrastructure deficit<sup>12</sup>.

Interviewee A from Fraser River Basin and interviewee B from Halifax also both commented on the need to search out indicators that suit and interconnect multiple domains of sustainability (environment, society, and economy). Halifax interviewee B gave the following example:

*The only one that I'm keen on lately is... the local economy, and I'll [explain it briefly]. So there was measurement done in 2010 that \$0.13 of the average Nova Scotian's food dollar goes toward local agriculture. So, I think that, when you get into sustainability and you look*

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<sup>8</sup> Interviewee A from Fraser River Basin

<sup>9</sup> Interviewee D from Sault Ste Marie

<sup>10</sup> Interviewee B from Sault Ste Marie

<sup>11</sup> Interviewee A from Montreal

<sup>12</sup> Interviewee B from Yellowknife

*at your food shed... that [it] is an important indicator, that it is good to know... most of these things, when you're talking about progress, you're hitting the sweet spot on economy and environment. So if you're buying food locally, you are one that hits all three, socially, environmentally, economically.*

## 5.4 Progress Management

This section includes dialogue that contemplates how to measure progress towards sustainability within and between communities. The first sub-section presents discussion about the CM scoring methodology and the second considers the idea of goal based indicators, both of which inform responses to Research Question 2.

### 5.4.1 Scoring

This section relates very closely to the above transferability segment; however, since it also relates directly to Research Question 2, it was decided that these results, and the relative conclusions, warranted distinction. The scoring methodology from Chapter 4 was introduced to the interviewees, and opinions of it varied. Some were opposed, citing different reasons. Interviewee A from Calgary saw a lack of benefit from scoring communities on the same indicators, stating:

*I'm not convinced, I can't see the value in it; there's some value in that to making comparisons and getting attention, but ultimately it's an arbitrary process. Putting qualitative assessments on is arbitrary, deciding what your high and low is when you're on a scale of 1 to 6 is arbitrary, deciding whether they all have equal weight is arbitrary. So yes, it's a useful exercise, and the Canadian index of well-being has done that [but] you can't do anything with the Canadian index of well-being, if the Canadian index of well-being goes up or down, what are you going to do? You need to unpack it and look at each of those indicators one by one to decide. If you have limited resources what's the best thing to do? So, it's useful, but again you have to be careful of the kinds of assumptions that you make for the people are going to make.*

Similarly, interviewee A from Sault Ste Marie, who thought that communities should be responsible for determining their own goals and that other community's goals are not always relevant, nonetheless understands that there are commonalities that could be comparable. Interviewee B from Fraser River Basin added to the difficulties of inter-community ranking, citing the difficulty scoring communities based on actions since the outcomes are not always consistent:

*Arguably Vancouver did not set out to create a dense livable downtown core. What they did was set up to recoup tax losses from vacant office buildings. But as a result they converted the zoning of office buildings to residential, and low and behold a lot of people wanted to live in these buildings. And then it created the market incentive for grocery stores and services... so what I'm saying is that sometimes cities can appear to be moving in one direction with their policies but all of a sudden it creates another outcome that was never the intention.*

Interviewee B from Calgary was also passionately opposed to the idea of scoring, as is seen in the following statement from the interview:

*I'm against that whole idea of grading, like Maclean's, because I never think you're apples to apples. Anyway that's my opinion on that... I think it's destructive rather than constructive. But I do agree, I mean one of the interesting, and I was adamant about it when we met as Vital Signs communities, we would get together periodically to have a regrouping and discussion, and a lot of them would not use grades because they thought it was too judgmental.*

On the other hand, there were two interviewees who expressed a strong desire to be scored, and reasons for such appeals. Interviewee A from Yellowknife asserted that:

*The discussion at Council around a new type of initiative, something the city hasn't done before, counselors will always want to know, what are other communities doing and how do we compare. So having, coming back to the notion of a standardized set of indicators, but having a standardized measuring system to say here's how we consistently measure up against what these other communities are doing and normalizing the system as you said to perhaps simplify it, that makes it so much easier for the community to then communicate that to the public.*

Interviewee B from Halifax was excited by the idea of scoring, but had some reservations because of a past experience, and declared:

*We'd love to be scored... we participate in the Corporate Knights annual thing, which is okay but it has a lot of flaws to it. We were kind of pissed because we lost out to Mississauga last year. We dialed into the indicators and some of the weightings were not there, for example price density on total square area divided by people. We are the largest municipality in, geographically, so we will never be, unless we had 10 million people, which won't happen... but what I reported to Council is that the fact that we are behind Mississauga is fine, it's good to know that we have areas where we can improve.*

#### 5.4.2 Goal Based Indicators

The discussion around indicators tied to goals for indicator performance drew a couple of different opinions. The opinion of interviewee C from Calgary was that indicators should always be tied to goals, specifically policy aims; otherwise the measures have no purpose and the indicators are irrelevant. Interviewee B from Fraser River Basin, in discussing the use of best practices or stretch goals as targets, was adamant that best practices should be used. The following excerpt from the interview reveals the reasons for the position taken:

*The challenge with that is that if you're setting a goal and you don't know if it's attainable, I mean it's a stretch goal, then it becomes, well it's a math problem to figure out what is the distance you travel to attain it. So establishing a relative position toward that goal that you need in order to rank becomes kind of mathematically impossible.*

Hence, communities will weigh their decisions to achieve higher rankings rather than a more sustainable community (if these ends are divergent). This interviewee argued that best practices are more quantifiable and defensible because they are attainable. An example of the detriment of stretch goals was also provided:

*In Metro Vancouver, our regional government, they have established a goal of being a net zero waste region. So you say 'well, that sounds interesting, I want to get on board with that'. And you don't find out about the policy and nowhere in the policy is it the intention to reduce waste to zero. It's just that they want to capture people's imagination with that stretch goal. Well fair enough, it got me to look into it, but they don't actually know how to get there.*

Following the discussion of best practice vs. stretch goals, interviewees A and B from Montreal provided the following perspective:

*Interviewee A: It's possible that best practice is used because we want to have some a specific number but we don't necessarily know what that number should be, so the best practice is the only thing everybody can agree on.*

*Interviewee B: I think that while best practices are good and they move things forward, we do need targets. In any case we have them; there are commitments that are made, often at an international level, as in the case of GHGs. At some point you have to make good on such*

*commitments. It is important to keep track of how you are doing with respect to that. What is difficult is to admit when you have not been able to reach a target.*

Some other challenges and assertions about scoring processes also emerged, including the need to maintain transparency, the difficulty of defining certain indicators in numerical terms, retaining a consistent approach, and engaging lower ranked communities. From Fraser River Basin, interviewee A highlighted the need to make underlying data available in order that the ranking be useful to those involved. Such transparency was also advocated by interviewee A from Halifax and interviewee D from Montreal. Certain measures could prove difficult to define within a scoring process, Fraser River Basin interviewee A argued:

*The difficulty with sustainability of defining a one in six, especially with the social issues. What is a six on childhood poverty? Zero I guess. And biodiversity, what is a zero there? We won't know until it's too late.*

This interviewee, however, asserts that the scoring mechanism described is the:

*Best in terms of defensibility and visual presentation of complex data and looking at overall changes over time.*

Interviewee A from Yellowknife argued that a consistent approach over time is necessary to help communities stay informed on the areas of importance relative to the scoring process and to ensure transparency:

*This is one of the frustrating things about the Corporate Knights survey because the indicators changed from the last survey to this year. So, we had been first place or something for three or four years and then all of a sudden we dropped into about fifth. Then we get into the numbers and we found that the criteria they were using changed and I think they had simplified, who knows where they're going, reducing the number of indicators. But anyway it was just kind of funny thing, to see why we suddenly dropped.*

The issue of maintaining participation from lower ranked communities was discussed in some interviews, and brought about some areas for consideration. Interviewee A from Halifax acknowledged the issue of lower ranked communities dismissing a ranking system as incorrect, whereas interviewee A from Sault Ste Marie provided a case where partners in an evaluation system did not want to release information that showed their organization poorly, which could compromise the integrity of the scoring system; again, those parties doing well would then be the only ones participating and benefitting. Sault Ste Marie interviewee B provided a local example of this occurring, where Sault Ste Marie felt ‘burned by Pembina’ because the evaluation system displayed the community in a poor light:

*if Sault Ste. Marie has zero crimes or one crime, zero murders or one murders, your per capita throws you right off, so they haven't been popular with city Council when we were ranked 26/27 on something.*

## 5.5 Contextual Considerations

This section presents some emergent themes: findings around creating a CCSIF, including potential funding challenges, leadership roles, existing frameworks and national indicator sets, and ultimately thoughts on the specific creation of a CCSIF.

### 5.5.1 Funding

Only the two communities classified as small in size (Yellowknife and Sault Ste Marie) brought up the issue of funding indicator work within their communities. In both of these communities and Fraser River Basin there was also discussion of the potential for funding a Canadian community sustainability indicator project. In Sault Ste Marie, the Community Quality Institute used the city for funding and leveraged an increase in funding through showing the value of their work, as interviewee A explains:

*I proved to them, I said look this isn't just a fun little exercise, this is a necessity. Any community that wants to attract people, and with all of North America being on a decline in terms of birth rates, our population growth is going to come from immigration. And these people are mobile now, globally, we are not talking about attracting just from Toronto, we're talking about attracting people from all over the world. We are on the global stage whether we want to be or not, and these people can go anywhere. We need to prove to them quantitatively that this is a good community in which to put down roots.*

Another strategy for pursuing funding was to pursue satellite research and to bid on request for proposals for research<sup>13</sup>. The experience in Yellowknife was slightly different, where they have capacity building issues due to their size<sup>14</sup>. Interviewee A from Yellowknife, as a member of the Green Municipal Fund, attested that larger communities have the resources and systems in place also to compete better for sustainability funding, making it more difficult for smaller communities to win funds, demonstrated the following passage:

*I've been on the Green Municipal Fund since 2007 and you can see the communities that have the internal infrastructure to be able to churn out applications for these things. And you know that they've got the language down and they know exactly what the process is and they know exactly what they need to say and I suspect, it's typically the larger communities... I know some cities now are beginning to set up offices of sustainability.*

Despite this disadvantage, Yellowknife has been successful in gaining funding, which helped them to properly engage their community on their Smart Growth Plan<sup>15</sup>. Interviewee A from Yellowknife also pointed out the potential for territorial or provincial governments to assist smaller communities, and larger communities can take a leadership role. For example, Yellowknife has had a representative from Lonsdale Energy Corporation come to share experiences from the Dockside Green project in British Columbia and, Yellowknife has taken a leadership role within the Northwest Territories to help smaller communities<sup>16</sup>; Yellowknife interviewee A reveals experience in this capacity:

*I've gone to a Iqaluit a couple of times to talk about Yellowknife's community energy plan and how we went about it... and the relationship between the city and Yellowknife's Dene First Nation has improved quite a bit over the last few years and we've partnered on paving Ndilo, which is the other Yellowknife's Dene at the end of Latham Island... the city has offered to have an intern from their community work in our planning department and see how we do things and how that might translate into their own system. Those are small steps now, but it's kind of providing, I think, the foundation for a better relationship going forward with those communities.*

Interviewee A from Fraser River Basin commented that those communities that have trouble developing the capacity to develop indicators on their own could be greatly benefitted by a Canadian community sustainability indicator framework. Funding such a national framework, as interviewee B from Yellowknife stated, could come from a larger funding agency, such as FCM's Green Municipal Fund, though, interviewee A from Yellowknife believes that the Green Municipal Fund does not have a huge amount of resources:

*You know GMF has, in the grand scope of things, has a very finite source of funds. It's a \$550 million fund now, and a \$150 million has to be loaned to Brownfield projects, so there's not a lot of money there. And so as sustainability projects become more integrated and larger in scope, we found that the demand is far outstripping what we have available.*

<sup>13</sup> Interviewee A from Sault Ste Marie

<sup>14</sup> Interviewees A and D from Yellowknife

<sup>15</sup> Interviewee D from Yellowknife

<sup>16</sup> Interviewee A from Yellowknife

Another potential venue is introduced by interviewee B from Sault Ste Marie, based on the benefit that comparison brings to a community in applying for funding:

*If they can show that Sault Ste. Marie is doing more poorly than in other areas then hopefully they can draw additional funds to support early childhood development centers or initiatives or intervention that would support that.*

### *5.5.2 Leadership of a Canadian Community Sustainability Indicator Framework*

On a similar note as some of the above statements, this section looks into the discussions of potential organizations to house a Canadian community sustainability indicator framework. Some general assertions about the type of organization to house such a framework begin with Fraser River Basin interviewee B, who pointed out the importance of the Fraser Basin Council's goals matching the intended use of the framework. Interviewee E from Montreal emphasized the difficulty of a private company maintaining a national sustainability indicator framework, stating:

*I think that if a private agency were to collect data without making it public we would have a problem. Decisions must be made by public administrations, and people must be accountable for divulging information.*

Following this idea, interviewee A from Calgary thought it was best if a government or arms-length government organization took the lead on such an indicator framework.

Considering existing organizations that have the potential to house a Canadian community sustainability indicator framework, interviewee B from Calgary proposed the benefits of community foundations:

*I think the advantage of community foundations, is that we don't have an axe to grind. We don't have an agenda, which is rare for most organizations. We don't have an agenda other than to support community. So we can do this kind of work without seeming to be manipulative or having a particular slant.*

The community foundations organizations were supported by interviewee B from Fraser River Basin, describing the national structure, the Community Foundations of Canada, and their role in the Vital Signs projects:

*It is a franchise, so the umbrella is the Community Foundations of Canada, which is relatively small. The dynamics of the philanthropic industry is kind of interesting. The Vancouver Foundation is actually massive, [I think their endowment is] about \$5 million a year... and it's responsible for the whole province. Community Foundations of Canada is kind of a small, powerless little umbrella group. But they're franchising this Vital Signs initiative. Across Canada I think they're up to 17 communities now and they just go out and try to convince them to use this system. But even internationally, they have sold the brand of Vital Signs to Australia and they're working with others.*

The Community Foundations of Canada also releases an annual report based on the national results of their core indicators, according to interviewee B from Fraser River Basin. Another organization proposed as an effective champion for a Canadian community sustainability indicator framework was the Federation of Canadian Municipalities, supported by Yellowknife interviewees B, C, and D and Sault Ste Marie interviewee A. The latter also acknowledged the role provincial associations of municipalities could play in propagating such a framework. In conflict with these opinions, however, interviewee B from Fraser River Basin argued that the Federation of Canadian Municipalities may not be an appropriate choice:

*I'm concerned that there's a disconnect between FCM's agenda, you look at the state of federal politics in Canada, FCM has a long way to go just to get the federal government interested in municipalities, let alone urban issues or information... the time is not ripe for*

*them to really engage in this fact-finding mission, in this, you know laying out the issues in sort of a calculated manner.*

### *5.5.3 Existing National Indicator Sets*

Another similar area of discussion throughout some of the interviews concerned existing national indicator sets, and their deficiencies or benefits and their relation to the creation of a Canadian community sustainability indicator framework. The Canadian Index of Well-being (CIW) came up in two separate interviews, with interviewee A from Sault Ste Marie asserting that the CIW was using a majority of the funding available for national level indicator projects and that the indicators being developed were not relevant at the community level. Interviewee B from Fraser River Basin also questioned the lack of motivation in the CIW to consider city relevant indicators, and also mentioned the amount of resources being used, stating that they have “some of the best data geeks in the country working on it”.

Another sustainability indicator framework that received some attention was the Global City Indicator project at the University of Toronto. Interviewees D from Calgary and B from Fraser River Basin asserted that the structure resembled the framework discussed in this thesis, but took a global scale approach. Fraser River Basin interviewee B also cited the ICLEI US Star community index and the Newfoundland Community Accounts project as potentially valuable examples.

Interviewee A in Halifax gave the example of the Transport Association of Canada (TAC). TAC, while relevant only to the transportation sector, is a national, non-governmental organization that provides an indicator framework that allows opportunity for community input and inter-community methods comparison. TAC is also ubiquitous throughout Canadian communities as a trusted organization that sets transportation standards, according to interviewee A from Halifax.

A final comment from interviewee D in Montreal, which points out the importance of efficiency and collaboration between agencies, is that they receive a high quantity of requests for data from different organizations, each with its own methodology, and as a result the process has become tiresome.

### *5.5.4 Creating a Canadian Community Sustainability Indicator Framework*

This final section involves interviewee assertions about the creation of a Canadian community sustainability indicator framework, and also the willingness of certain parties to take part in such an organization. To start, there were some statements about the necessary actions to ensure the success of such a project. Interviewee C from Calgary made the claim that there would need to be a constant assessment and improvement of methods in indicator selection and measurement. This interviewee also contended that the indicators would need to be outcome based in order to be effective. Halifax interviewee B also made this declaration, citing the need for the indicator data to support recommendations and decisions within communities.

Interviewees were asked their perception of the value of a Canadian community sustainability indicator framework, and their inclination to participate in such a project. Interviewee A from Calgary stated that involvement in this type of framework

*would be something that would be of interest to people in the city or NGOs like ours that have the opportunity.*

Calgary interviewee C indicated Calgary’s willingness and excitement to be a part of a national community sustainability indicator framework:

*I am specifically very interested in seeing where this would go because it would be very helpful for us to start saying you know, what we’re doing is valuable, and it is very important to me to start looking at that piece of where you want to go, what are we doing to get there, and moving forward. And it’s becoming more and more valuable in our community, the whole of Calgary.*

In Fraser River Basin, interviewee B expressed value in a national indicator umbrella that provided core indicators. Interviewee B from Halifax also confirmed the willingness of that community to participate in a Canadian community sustainability indicator project, alongside interviewees B and C from Yellowknife who saw value in a framework maintained externally from Yellowknife and thought an effective approach would be to begin with a small number of communities as working groups to test the framework. The following statement demonstrates the value that a national indicator framework would have to Yellowknife:

*Indicators would be able to create measurement between communities and I think that would be tremendously valuable for Council to see that, if lagging here or if we have a niche competency in this one, let's exploit it further and be a model town on that, our we really need to pull up our socks on this compared to everyone else.*<sup>17</sup>

From a slightly different perspective, interviewee D from Montreal, when asked about the value of a national sustainability indicator framework, stated:

*I think there would be advantages and disadvantages. Among the advantages is the fact that it would allow for a more standardized procedure for cities, and possibly tools that would make accessible previously unavailable data. On the other hand you might incite the 'LEED Syndrome' where the ideas are good but the practices are so prescribed that you practically build a LEED cardboard box. It can become disconnected from the environment it is in. I get the feeling that the Sustainable Development Plan responds to the concerns of Montrealers and that they have a sense of ownership over it, whereas if you adopt something more systematic you might put a lot of energy into issues that are not necessarily priorities for the region.*

## 5.6 Summary

This chapter has provided the relevant results from the interviews, organized into themes associated with the research questions of this thesis. Table 5.1 highlights key findings from each section.

**Table 5.1 Results Chapter Key Findings**

Section	Sub-Section	Key Findings
<b>5.1 Transferable Community Sustainability Indicators</b>	<i>5.1.1 Uniqueness of Community</i>	<ul style="list-style-type: none"> <li>• Perceived contextual differences between communities has the potential to make it difficult to determine comparable indicators.</li> <li>• Comparison between communities is desired and can be helpful in determining local strengths and weaknesses, and in developing solutions.</li> </ul>
	<i>5.1.2 Core Indicators</i>	<ul style="list-style-type: none"> <li>• A core set of national sustainability indicators that is relevant at the community level is desired and would help to align local, provincial, and national sustainability goals.</li> <li>• Fraser River Basin comments provide examples of challenges and successes in creating multi-community sustainability indicators.</li> </ul>
	<i>5.1.3 Grassroots vs. Top-down Process</i>	<ul style="list-style-type: none"> <li>• A top-down process is desired by some, asserting that it would provide a basis for local indicator development and capacity building.</li> <li>• Other interviewees asserted that a grassroots approach should be sought in order to maintain relevance and</li> </ul>

<sup>17</sup> Interviewee C from Yellowknife

		transparency at the local level.
	5.1.4 <i>Government Participation in Indicator Development</i>	<ul style="list-style-type: none"> <li>• Government participation in indicator development and maintenance is not always virtuous; several examples show government agencies unwilling to publish negative results or altering measurement methods to improve their results.</li> <li>• Other examples show champions in government who oppose this dishonesty by strategy or simply apply more genuine sustainability ethics.</li> </ul>
	5.1.5 <i>Collaboration</i>	<ul style="list-style-type: none"> <li>• Collaborative efforts are beneficial in gaining community support and insight into community values.</li> <li>• Collaboration is perceived to be easier in smaller communities.</li> <li>• Calgary provides several positive examples of collaborative efforts.</li> </ul>
5.2 <b>Information Sources and Indicators</b>	5.2.1 <i>Improving Information Sources</i>	<ul style="list-style-type: none"> <li>• Accurate and consistent data are difficult to find, and as such agencies have had to be creative to find data themselves or look to provincial or territorial governments.</li> </ul>
	5.2.2 <i>Presentation</i>	<ul style="list-style-type: none"> <li>• Depth of information provided by indicators and indicator reports should be tailored to the desired audience.</li> <li>• Web-based display tools can help to cater to various audiences.</li> </ul>
5.3 Core Set of Indicator Domains	5.3.1 <i>Adequacy of Domain Set</i>	<ul style="list-style-type: none"> <li>• The domains determined in Chapter 4 suited all communities; all participants agreed.</li> <li>• Three additional domains were recommended by more than one interviewee: Food Security, Ecological Diversity, and GHG and Climate Change.</li> </ul>
5.4 Progress Management	5.4.1 <i>Scoring</i>	<ul style="list-style-type: none"> <li>• Some interviewees desired scoring and others were passionately opposed, not seeing the purpose.</li> <li>• The main challenges relate directly to those found in the transferability section; communities have different values and sustainability goals.</li> </ul>
	5.4.2 <i>Goal Based Indicators</i>	<ul style="list-style-type: none"> <li>• Indicators should be tied to attainable goals.</li> <li>• Some goals are difficult to quantify, especially in the social domain.</li> </ul>
5.5 Contextual Considerations	5.5.1 <i>Funding</i>	<ul style="list-style-type: none"> <li>• Smaller communities have more trouble building the capacity to undertake work on sustainability indicators. However, both small communities in this study have found ways to get funding for sustainability projects.</li> </ul>
	5.5.2 <i>Leadership of a Canadian Community Sustainability Indicator Framework</i>	<ul style="list-style-type: none"> <li>• Problems could arise from private sector leadership in a CCSIF; some interviewees suggested a government or arms-length government organization.</li> <li>• Two organizations were recommended as potential leaders: the Federation of Canadian Municipalities and the Community Foundations of Canada.</li> </ul>

	<i>5.5.3 Existing National Indicator Sets</i>	<ul style="list-style-type: none"> <li>• There are several national indicator sets and organizations, each with their advantages and disadvantages. However, none of them are clear leaders and there are no established standards.</li> </ul>
	<i>5.5.4 Creating a CCSIF</i>	<ul style="list-style-type: none"> <li>• Interviewees from each community saw benefits in creating a CCSIF and asserted willingness to participate if one were created.</li> <li>• A CCSIF would need to maintain local relevance to be useful and successful.</li> </ul>

## 6.0 DISCUSSION

This chapter synthesizes the results of the research conducted throughout this thesis with the extant literature to achieve the research objectives presented in Chapter 1. The discussion is accordingly divided into the following sections: transferability (Research Questions 1a and 1b), sustainable community indicator domains (Research Question 1a), sustainable community indicators (Research Question 1b), scoring methodologies (Research Question 2), and finally the emergent themes funding and capacity building, and creating a CCSIF.

### 6.1 Transferability

The concept of transferability has followed throughout this thesis and underlies responses to Research Questions 1a and 1b; the term ‘transferability’ was initially used in this thesis to describe sustainability criteria that had the potential to be relevant across different communities (horizontal) and between different levels of governance (vertical). The notion has proven to be applicable in much broader applications, being used to describe the ability of a CCSIF, or any part of such a framework (e.g., scoring, indicators, etc.), to be applicable within other communities and at different governance levels. This section will elaborate on this expansion, integrating the findings as outlined in table 6.1: beginning with horizontal transferability then moving on to vertical transferability.

**Table 6.1 Transferability Discussion Guide**

	Literature Review	Document Results	Interview Results	Comments
Horizontal Transferability	<ul style="list-style-type: none"><li>• Generic sustainability principles (Berke &amp; Conroy, 2000; Gibson, 2006; Infrastructure Canada, 2006).</li><li>• Common structure, unique local requirements (Gibson, 2006; Valentin &amp; Spangenberg, 2000).</li></ul>	<ul style="list-style-type: none"><li>• Preliminary set of community sustainability indicators and domains.</li></ul>	<ul style="list-style-type: none"><li>• Uniqueness of community.</li><li>• Communities desire comparison.</li></ul>	<ul style="list-style-type: none"><li>• Common structure, unique local requirements validated.</li><li>• Potential for a core set of sustainability indicators supplemented by community specific indicators to maintain community uniqueness.</li></ul>
	<ul style="list-style-type: none"><li>• Necessity and benefits of collaborative structures (Cartwright, 1997; Clarke &amp; Erfan, 2007; Cole, 2003; Dalal-Clayton &amp; Bass, 2002; Gibson, 2006; International Institute for Sustainable Development, 2011; Kitchen et al., 1997; V. W. Maclare, 1996; Ministry of Municipal Affairs and Housing &amp; Ontario Professional Planning Institute, 2009; L. Shen et al., 2011).</li></ul>		<ul style="list-style-type: none"><li>• Benefits of collaboration.</li><li>• Collaboration is easier in smaller communities.</li></ul>	<ul style="list-style-type: none"><li>• Benefits and need for collaborative approach validated.</li><li>• Further research into collaborative ease compared to community size could be beneficial.</li></ul>

<p><b>Vertical Transferability</b></p> <ul style="list-style-type: none"> <li>• Local level is optimal for sustainable development implementation (Eckerberg &amp; Forsberg, 1998; Kitchen et al., 1997; Nicollier et al., 2003; Peris et al., 2011; Sanchez &amp; Prado-Lorenzo, 2008; Valentin &amp; Spangenberg, 2000).</li> <li>• Local and global level should be linked in sustainable development (Berke &amp; Conroy, 2000).</li> <li>• United Nations Efforts to link global and lower levels (United Nations Department of Economic and Social Affairs, 1994; United Nations Department of Economic and Social Affairs, 1997; United Nations Division for Sustainable Development, 2009; United Nations, 2002; United Nations, 2005; United Nations, 2008; United Nations, 2011).</li> <li>• Examples of locally relevant, global sustainability goals and indicators (Anielski &amp; Winfield, 2002; Federation of Canadian Municipalities, 2010; Siemens AG - Corporate Communications; Siemens Economist Intelligence Unit, 2011; United Nations, 2008).</li> </ul>	<ul style="list-style-type: none"> <li>• Grassroots vs. top-down process.</li> <li>• Core indicators.</li> <li>• Government Participation in indicator development.</li> </ul>	<ul style="list-style-type: none"> <li>• Links between local and higher levels (vertical transferability) in sustainable development are necessary; however, it is unclear how this should be pursued.</li> <li>• Government participation in indicator development has the potential to be destructive.</li> </ul>
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### 6.1.1 Horizontal Transferability

Each of the three sets of generic sustainability principles presented in the literature review (Berke & Conroy, 2000; Gibson, 2006; Infrastructure Canada, 2006) had individual benefits and drawbacks; however, they all underscored the potential for horizontally transferable sustainability principles, indicators, and domains. Nonetheless, throughout the interview process it became clear that caution should be taken in pursuing transferability of indicators and domains between communities because of the unique population, features, and layout of each community. On the other hand, several interviewees also expressed a desire for horizontally transferable sustainability indicators so that they might compare their community with others, to highlight triumphs as well as weaknesses and to help develop solutions to local issues. Gibson's (2006) sustainability assessment guidelines reflect this complexity, stating (p. 172):

*The notion and pursuit of sustainability are both universal and context-dependent. While a limited set of fundamental, broadly applicable requirements for progress towards sustainability may be identified, many key considerations will be location-specific, dependent on the particulars of local ecosystems, institutional capacities and public preferences.*

Perhaps then there is a structure that could appease both of these assertions, with the ability to provide horizontally transferable community sustainability indicators while respecting community uniqueness. Valentin and Spangenberg (2000) suggest that this is possible using a common, overarching structure for all communities and different, community specific indicators for each community. However, this type of a structure precludes the simple comparison that would be possible through common indicators. Expanding on this idea though, a common set of horizontally transferable indicators could be sought, with the option of adding community specific indicators to maintain community uniqueness. The set of community sustainability indicators compiled in Chapter 4 (Appendices K and L) provides a preliminary set of such core indicators, which could be supplemented by each community and refined by all communities over time. Thus, while the set of indicators is preliminary and requires refining, it serves as a potential starting point for a framework that holds core, horizontally transferable sustainability indicators and encourages the addition of community specific indicators. One issue with this structure that arose from the interviews is the inadequacy of certain potential core indicators to accommodate attention to very different local contexts. This means that indicators would need to be pursued with controls for the unique contexts of communities. One interviewee provided an example of one such indicator: Energy use per degree day to allow communities with different climatic conditions to be compared. The question remains whether it would be possible to find such neutral and controlled-for-context indicators for all of the desired parameters.

Just as horizontal transferability has potential benefits in facilitating communication of core issues between communities; such a structure could also assist stakeholder interaction. Throughout the sustainability planning literature, authors universally stress the need for a collaborative approach (Cartwright, 1997; Clarke & Erfan, 2007; Cole, 2003; Dalal-Clayton & Bass, 2002; Gibson, 2006; Kitchen et al., 1997; V. W. Maclaren, 1996; Ministry of Municipal Affairs and Housing & Ontario Professional Planning Institute, 2009; L. Shen et al., 2011). Similarly, the Bellagio Principles devote three of ten principles to openness, effective communication, and broad participation (International Institute for Sustainable Development, 2011), which all favour a collaborative approach to sustainability assessment. Along the same lines, Shen (2011) points out the potential for indicators to simplify communication to all stakeholders. Findings from the interviews reinforced these assertions, emphasizing the benefits of a collaborative approach in gaining community support and insight into community values. Hence, the ubiquitous affirmation of the benefits and need for a collaborative approach to sustainability reinforces the current academic position. That being said, it also became apparent in the interviews that collaboration is easier within smaller communities, an assertion that was not found in the sustainability planning and assessment literature considered in this thesis. This argument might, however, be found in more specific literature that investigates collaborative structures. Nevertheless, further investigation of the relationship between community size and collaborative ease could prove valuable.

### *6.1.2 Vertical Transferability*

The local level is frequently perceived to be the optimal scale to undertake sustainable development (Eckerberg & Forsberg, 1998; Kitchen et al., 1997; Nicollier et al., 2003; Peris et al., 2011; Sanchez & Prado-Lorenzo, 2008; Valentin & Spangenberg, 2000), and Berke and Conroy (2000) suggest that sustainable development should “link local actions to global concerns” (p. 23). The United Nations has been a catalyst for this type of sustainable development, holding conferences and facilitating the creation of agreements and plans of action for sustainable development that are focused on national or local level actions to solve global sustainability issues (United Nations Department of Economic and Social Affairs, 1994; United Nations Department of Economic and Social Affairs, 1997; United Nations Division for Sustainable Development, 2009; United Nations, 2002; United Nations, 2005; United Nations, 2008; United Nations, 2011). This concern with local and national level actions achieving global sustainability goals conveys the desire for sustainable development processes to be vertically transferable. The various examples of higher level sustainability goals and indicators presented throughout this research (Anielski & Winfield, 2002; Federation of Canadian Municipalities, 2010; Siemens AG - Corporate

Communications; Siemens Economist Intelligence Unit, 2011; United Nations, 2008) show that it is possible to create higher level goals that require local action. Additionally, interviewees showed a desire for national sustainability indicators that are relevant at the local level to assist in aligning local, provincial, and national sustainability goals. Some interviewees also desired a national level structure to create a foundation for local level sustainability indicator development and to help those communities with capacity building issues. However, in a Fraser Basin interview it became apparent that it is difficult for higher governance levels to create indicators that speak to local circumstance. Similarly, other interviewees thought that a grassroots, bottom-up approach to national community sustainability indicators should be sought, declaring that nationally defined, top-down processes are not relevant at the local level. Hence, there is consensus that the local and national level sustainable development and sustainability indicators should be linked, but there is conflict over whether the overarching framework should be nationally or locally defined.

On a similar note, the interviews provided a potentially new topic related to government participation in sustainability indicator development. A number of examples of government agency obstruction to the provision of information for reporting or the development of sustainability indicators were reported during the interviews. Other examples showed more respectable examples of government champions who uphold more virtuous sustainability codes of ethic. Still, the obvious issue of certain government obstructions stresses the issue of whether government agencies are the appropriate conduit for vertically transferable sustainability indicators. Perhaps more usefully, the discussion points to potential criteria for evaluating which sorts of agencies at what levels ought to lead the exercise.

## 6.2 Community Sustainability Indicator Domains

This section discusses the community sustainability indicator domains developed in Chapter 4 that are used in the interviews to gain insight into answering Research Question 1a: What core set of sustainability indicator domains are relevant for all Canadian communities? Table 6.2 introduces the structure that the section will follow.

**Table 6.2 Community Sustainability Indicator Domain Discussion Guide**

	Literature Review	Document Results	Interview Results	Comments
Preliminary Set of Canadian Community Sustainability Indicator Domains	<ul style="list-style-type: none"> <li>Urban sustainability indicator evaluation (V. W. Maclaren, 1996).</li> </ul>	<ul style="list-style-type: none"> <li>Existing sets of national community sustainability indicators and domains.</li> <li>Preliminary set of Canadian community sustainability domains.</li> </ul>	<ul style="list-style-type: none"> <li>Complete acceptance of preliminary set of indicator domains.</li> <li>Proposed three new indicator domains.</li> </ul>	<ul style="list-style-type: none"> <li>Table 6.3 shows the proposed set of Canadian community sustainability domains.</li> </ul>
Pillars of Sustainability	<ul style="list-style-type: none"> <li>Sustainability Models (Cole, 2003; Lozano, 2008; Mebratu, 1998; Valentin &amp; Spangenberg, 2000).</li> <li>Maclaren's (1996) prescribed categories.</li> </ul>		<ul style="list-style-type: none"> <li>Categorization using the three pillars of sustainability has the potential to be destructive to cross-cutting domains.</li> </ul>	<ul style="list-style-type: none"> <li>Have the traditional three pillars of sustainability lost importance?</li> </ul>

### *6.2.1 Preliminary Set of Canadian Community Sustainability Indicator Domains*

The transferability discussion above suggests that larger sustainability principles and issues can be articulated at the local level, and provides examples of existing sets of issues and principles. Maclarens (1996) provides the basis for the evaluation of community sustainability indicators and domains in the Urban Sustainability Indicator Evaluation Matrix (Table 2.1). In Chapter 4, using this matrix, four existing sets of national community sustainability indicator sets (The Federation of Canadian Municipalities Quality of Life Reporting System, Statistics Canada's Trends in Cities Project, Alberta's Genuine Progress Indicators, and Siemen's US and Canada Green City Index) were evaluated and amalgamated to produce a set of preliminary Canadian community sustainability indicators and domains (Appendices K and L). The created domains were then used throughout the interviews conducted for this research to determine their relevance within the communities selected (Sault Ste Marie, Calgary, Yellowknife, Fraser Basin, Montreal, and Halifax). The results yielded complete acceptance of the preliminary domains, plus proposals for three potential additional domains (Table 6.3). Hence, these domains have been adopted to form the proposed set of Canadian community sustainability indicator domains, in response to research question 1a.

**Table 6.3 Proposed Canadian Community Sustainability Indicator Domains**

<b>Energy</b>	<b>Social Infrastructure</b>
<b>Land Use</b>	<b>Education</b>
<b>Transport</b>	<b>Health</b>
<b>Water</b>	<b>Safety</b>
<b>Waste</b>	<b>Financial Security</b>
<b>Air</b>	<b>Employment</b>
<b>Environmental Governance</b>	<b>Local Economy</b>
<b>Environmental Impacts Outside Cities</b>	<b>Food Security</b>
<b>Housing</b>	<b>Ecological Diversity</b>
<b>Civic Engagement</b>	<b>Greenhouse Gas Emissions and Climate Change</b>

Note: Shaded cells are proposed additions to the established set, but did not gain full consensus.

### *6.2.2 Pillars of Sustainability*

For the interview process, the domains were divided into three categories based on the pillars of sustainability: environmental, social, and economic. These pillar categories stem from the popular Venn Diagram (Figure 2.1) and Concentric Circles (figure 2.2) models of sustainability, and are included in Maclarens (1996) Urban Sustainability Indicator Evaluation Matrix. Some interviewees found that categorizing the domains under the three pillars of sustainability was unnecessary, and had the potential to be destructive. These interviewees asserted that, since some domains fit under more than one pillar, categorizing them in such a fashion could eliminate the benefits of these cross-cutting domains. That being said, Maclarens (1996) prescribes not only environmental, social, and economic categories, but also environmental-social, environmental-economic, social-economic, and environmental-social-economic

categorization, an approach which allows for categorization of domains that fit under multiple pillars. Also, other models of sustainability challenge the Venn Diagram and Concentric Circles models by providing other categorizations and layouts, such as Cole's CSAF Egg of Sustainability (Figure 2.3) (2003). Perhaps this is an indication that the traditional pillars of sustainability are becoming less entrenched in sustainability thinking and practice, motivated by the need to develop cross-cutting measures and solutions.

The need to adapt for cross-cutting domains is interesting though, as most of the established domains are set within the existing silos in society, and do not necessarily speak to more than one sustainability pillar or area of interest. That being said, the three new, proposed domains are of a more cross-cutting nature and speak more to identified sustainability issues rather than existing silos. Perhaps this means that there is a movement within sustainability planning toward the identification of more cross-cutting issues. Still, there are (at least) two very prominent areas of sustainability that have not been identified: social equity and green economy. Social equity is one of the basic principles of sustainability, but is not yet even identified as a domain within the structure proposed here. Is this because of our current socio-political systems? The issue of measuring social equity seems simple enough: measure the gap between the rich and poor. Whatever the barrier though, it seems that there is a lack of focus in this area. Green economy, on the other hand, speaks to a different issue within the current set of proposed domains. Green economy appears to be a solution to a set of sustainability issues, rather than an issue in itself. While it could be used as a proxy measure of the adoption of sustainable practices within our economy, it does not speak to real progress toward sustainability goals. There are several of these types of domains with the current proposed set (transport, social infrastructure, environmental governance, safety) that have the potential to obscure the definition and measurement of sustainability. This is not to say that they are not appropriate domains or that response type indicators are ineffectual, rather that there is a need to clearly identify the real goals of sustainability. Several interviewees highlighted the need for indicators to be attached to goals, and in order to provide effective direction for indicator selection, the definition of sustainability domains and their connection to sustainable progress should be clear.

### **6.3 Community Sustainability Indicators**

The first part of this section is tied directly to Research Question 1b: What preliminary sets of sustainability indicators exist to populate a CCSIF? The second part will discuss sustainability indicators and relevant findings from the interviews, as is outlined in Table 6.4.

**Table 6.4 Community Sustainability Indicators Discussion Guide**

Preliminary Set of Canadian Community Sustainability Indicators	Literature Review	Document Results	Interview Results	Comments
	<ul style="list-style-type: none"> <li>• Urban sustainability indicator evaluation (V. W. McLaren, 1996).</li> </ul>	<ul style="list-style-type: none"> <li>• Existing sets of national community sustainability indicators.</li> <li>• Preliminary set of Canadian community sustainability indicators.</li> </ul>		<ul style="list-style-type: none"> <li>• Appendixes K and L provide a preliminary list of community sustainability indicators.</li> <li>• Recommendation that future versions of these indicators include more forward looking indicators.</li> </ul>

<p><b>Sustainability Indicators</b></p> <ul style="list-style-type: none"> <li>• Benefits of sustainability indicators (Cole, 2003; Dalal-Clayton &amp; Bass, 2002; Donnelly et al., 2007; Fehr et al., 2004; McCool &amp; Stankey, 2004; Rametsteiner et al., 2011; United Nations Department of Economic and Social Affairs, 2007; Wilson et al., 2007).</li> <li>• Selecting Indicators (Association of Municipalities of Ontario, 2008; Cartwright, 1997; Donnelly et al., 2007; Fehr et al., 2004; V. W. Maclaren, 1996; McCool &amp; Stankey, 2004; Meadows, 1998; Rametsteiner et al., 2011; Valentin &amp; Spangenberg, 2000).</li> <li>• Number of indicators (Cole, 2003; V. Maclaren, 1996; Sierra Youth Coalition, 2009; United Nations Statistical Institute for Asia and Pacific, 2007; Valentin &amp; Spangenberg, 2000).</li> </ul>	<ul style="list-style-type: none"> <li>• Number of indicators (Anielski &amp; Winfield, 2002; Federation of Canadian Municipalities, 2010)</li> </ul>	<ul style="list-style-type: none"> <li>• Improving information sources</li> <li>• Presentation</li> </ul>	<ul style="list-style-type: none"> <li>• Indicators have multiple benefits; however, to realize them there are several hurdles to overcome, including a lack of consistent data.</li> <li>• Number of indicators should be selected based on the target audience; web-based tools are believed to allow for multiple audiences to be satisfied.</li> </ul>
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### 6.3.1 Preliminary Set of Canadian Community Sustainability Indicators

In consideration of Research Question 1b, the review on the subject of sustainability indicators culminated in the presentation of Maclaren's (1996) Urban Sustainability Indicator Evaluation Matrix (Table 2.1), which provides a structure for choosing sustainability indicators based on established sustainability goals and indicator selection criteria. Hence, to facilitate the selection of sustainability indicators for this research, sustainability goals and indicator selection criteria were chosen from those presented in the literature (Table 2.1).

In Chapter 4, Maclaren's (1996) Urban Sustainability Matrix was used to evaluate the indicators from four existing national sets of community level sustainability indicator sets (The Federation of Canadian Municipalities Quality of Life Reporting System, Statistics Canada's Trends in Cities Project, Alberta's Genuine Progress Indicators, and Siemen's US and Canada Green City Index). Each set was evaluated on its own, and then the indicators were all amalgamated to create a preliminary set of community sustainability indicators (Appendices J, K, and L). Each of the sets was seen to have unique benefits and deficiencies, although combined they all lacked long-term consideration, mostly focusing on current, state

type measurement. This set of indicators was not used in the interview process because of time constraints. Hence this set represents the preliminary set of Canadian community sustainability indicators in response to Research Question 1b, with the recommendation that future iterations pursue a remedy to the lacking long-term considerations. Also, as in the sustainability domains discussion above, in the future these indicators should be selected in response to the established sustainability goals for the given domain, rather than a simple grouping of indicators within a category. Hence, the indicators should be meaningful and carefully selected to represent the given sustainability issue or phenomena.

### *6.3.2 Sustainability Indicators*

In the literature review it was found that indicators serve as the optimal tool for conducting sustainability assessment (Dalal-Clayton & Bass, 2002). This is because of their capacity as simple measures to illustrate larger issues, trends, and phenomena (Donnelly et al., 2007). Thus sustainability indicators can help to determine the state of sustainability issues, progress made toward sustainability goals (Fehr et al., 2004; McCool & Stankey, 2004; Wilson et al., 2007), and can assist in decision making and goal-setting (Cole, 2003; Rametsteiner et al., 2011; United Nations Department of Economic and Social Affairs, 2007).

A general consensus in the literature concerning the selection of sustainability indicators was that the process used should be transparent and participatory (Cartwright, 1997; V. W. Maclaren, 1996; Rametsteiner et al., 2011; Valentin & Spangenberg, 2000) to ensure that a holistic and relevant set of values are used to identify the phenomena to be measured (Association of Municipalities of Ontario, 2008; Donnelly et al., 2007) and that ultimately the indicators selected are useful and accepted within the community (Fehr et al., 2004; Rametsteiner et al., 2011). This process should also be iterative and adaptive to changing norms and values (Ramatsteiner et al., 2011) and also to continuously refine the indicators (Association of Municipalities of Ontario, 2008; McCool & Stankey, 2004; Meadows, 1998). Hence, future iterations of the preliminary set of Canadian community sustainability indicators should be undertaken on a regular basis and in a transparent, collaborative manner to ensure relevance to the communities they serve. In relation to this, many of the interviewees had difficulty finding accurate and consistent data. Many have had to develop creative solutions to finding data. This lack of appropriate data provides yet another hurdle to refining community sustainability indicators.

One other area of contention was identified around the number of indicators to use for assessing sustainability; various organizations and academics maintained different perspectives on the issue (Cole, 2003; Sierra Youth Coalition, 2009; United Nations Statistical Institute for Asia and Pacific, 2007; Valentin & Spangenberg, 2000), and the four sets from Chapter 4 provided a very disparate sample, ranging from 25 to 86 indicators. It was concluded from these arguments that there were two possible paths: 1) maintain the maximum number of indicators possible, constantly refine those indicators to maintain the best possible set, and look for ways to increase capital/time to expand the set, or 2) maintain the smallest possible set that is still comprehensive enough to encompass all relevant issues. However, Maclaren (1996) contends that the number of indicators should be selected based on the target audience. This notion was supported in the interview findings, where it was found that the depth of information provided by indicators should be tailored to the desired audience. This being said, a practical solution will be dependent on available resources. Likewise, on the topic of indicator presentation, web-based tools were seen to be very helpful in catering to various audiences. Using web-based indicator presentation tools, different levels of data can be obtained based on the user's preferences. Hence, target audience is important in developing indicator sets; however web-based tools are perceived to have the ability to cater to various audiences.

## **6.4 Scoring Methodologies**

This section discusses the research associated with Research Question 2: Is the MRCMH CM scoring methodology applicable to a CCSIF? Also, the concept of goal based indicators will be discussed, as it

was a common theme throughout the interviews. As in the sections above, Table 6.5 outlines the structure of this section.

**Table 6.5 Scoring Methodologies Discussion Guide**

	• Literature Review	• Document Results	• Interview Results	• Comments
Scoring Methodologies	<ul style="list-style-type: none"> <li>• Benefits of scoring (Skouloudis et al., 2009)</li> <li>• Varied complexities of frameworks (Bobbitt et al., 2005; Choon et al., 2011; Hemphill et al., 2004; Hu et al., 2011; Lee &amp; Chan, 2009; L. -. Shen et al., 2005; Yu &amp; Wen, 2010)</li> <li>• Sustainability Indicator Selection Criteria (Cole, 2003)</li> </ul>	<ul style="list-style-type: none"> <li>• CM Scoring Methodology (Siemens Canada Limited - Industry Sector, Mobility Division, 2010)</li> </ul>	<ul style="list-style-type: none"> <li>• Relevance of scoring.</li> <li>• Goal based indicators.</li> <li>• Maintaining participation of low scoring communities</li> </ul>	<ul style="list-style-type: none"> <li>• Further research required on scoring processes, as results are incongruent.</li> </ul>

In the literature, examples of scoring frameworks were plentiful and included examples from around the world. The benefits are well known and centre on allowing simplified comparisons and meaningful information output to stakeholders (Skouloudis et al., 2009). These framework differ in mathematical complexity; the more complex scoring systems included weighting parameters for each indicator (Hu et al., 2011; L. -. Shen et al., 2005; Yu & Wen, 2010), while the more simple ones normalized the indicators but weighted each equally (Bobbitt et al., 2005; Choon et al., 2011; Hemphill et al., 2004; Lee & Chan, 2009). Beyond the complexity differences, each scoring framework considered was different from the others in various ways, which supports the assertion that there is a lack of consensus on how to score and weight sustainability indicators (Hemphill et al., 2004).

The CM scoring methodology presented in Chapter 4 provides a system for scoring and normalizing both qualitative and quantitative indicators by using scoring rubrics that are developed alongside each indicator (Siemens Canada Limited - Industry Sector, Mobility Division, 2010). This scoring methodology forms the basis for Research Objective 2, and was used in the interview portion of this research in attempt to determine its feasibility for use in a CCSIF.

The CM scoring methodology was proposed within the interviews to determine interviewee opinions of its use in a CCSIF, and to incite discussion about the idea of scoring in general. In these discussions, some interviewees were against the idea of scoring other than to provide comparisons. One of the issues with scoring was that if the scores were based on actions, similar actions taken in different communities could have different outcomes. Scores tied to outcomes, however, as in the CM scoring methodology (Siemens Canada Limited - Industry Sector, Mobility Division, 2010), were not seen to have the same effect. On a similar note, the set of indicator criteria selected for this research (adapted from Cole, 2003) stated that each indicator be “attached to a clear and ambitious goal” (Cole, 2003, p. 34). Many interviewees reflected this need for indicators to be tied to attainable goals, and some of these interviewees also noted the difficulty of quantifying (or scoring) certain indicator results, especially for social indicators.

Certain interviewees were in favour of scoring, asserting that city councillors want to know how they are doing relative to other communities and that they like being scored but need to be aware of the criteria before the scoring is conducted. Reported inconsistencies in scoring methodologies used by Corporate Knights and the Pembina Institute undermined the perceived credibility of the scorings and created

animosity towards these organizations. Other interviewees were passionately opposed to the idea of scoring, contending that the results would be misleading since communities all have unique circumstances (as above in the transferability section).

A final issue with scoring communities that emerged from the interviews is maintaining participation of lower ranked communities. This is especially difficult if the overall purpose of the system conducting scoring is to further sustainable development, as those lower ranked communities are presumably those that would benefit most from participation. In this case, scoring could prove detrimental to the effects of a CCSIF, unless some incentive existed, monetary or otherwise, to maintain the participation of those communities that are not receiving the highest scores.

The interviews provided very little in terms of solutions to the lack of consensus in sustainability scoring methodologies found in the literature. In fact, the interviews provided new issues: some stakeholders are against scoring because they see it as irrelevant to sustainable development, others want to be scored, but cannot agree on how scoring should be pursued, some sustainability issues are very difficult to put to numbers, and communities do not want to participate unless they are doing well. However, the CM scoring methodology was held in high regard as a scoring methodology with the potential to be used in a CCSIF, but only if the above hurdles are overcome.

## **6.5 Emergent Themes**

The following sections present two themes that emerged from the interviews conducted for this research: funding and capacity building, and creating a CCSIF. These topics did not emerge in the earlier stages of this research; hence they are potentially new additions to the literature. That being said, these topics most likely exist in other bodies of literature; the question to ask in this case might be why they did not emerge in the literature included in this thesis. Thus, in the future, these topics could be researched to provide a better understanding of, and solutions to, the related issues.

### *6.5.1 Funding and Capacity Building*

Only interviewees from the two small communities discussed capacity building and funding as issues within their own communities. These smaller communities face the challenge of smaller budgets and city staff sizes. In both of these cases, however, the communities were able to find solutions to this problem. In Yellowknife, the Green Municipal Fund provided funding for a sustainability initiative, and in Sault Ste Marie, funding was increased from the City by showing the benefit of marketing the community to potential immigrants using indicators. Also, the ability of indicators to highlight areas of concern within a community to acquire provincial and/or federal funding was seen as beneficial. These communities face the challenge of building capacity because of their relative size; however, these examples also show the potential of indicators to highlight deficiencies, and allocate funding to help these communities. A CCSIF could provide a framework and core set of indicators for communities without the capacity to develop their own, and could help to highlight deficiencies within certain areas in communities that require assistance. Another way that capacity can be built without monetary exchange is to share experiences. In the case of Yellowknife, they have received assistance from larger communities in planning sustainability initiatives, sharing their experiences, and have also shared Yellowknife experiences with smaller communities. Hence, a leadership role can be taken by those communities that are further advanced in their sustainability planning cycle, to help smaller communities develop intellectual capacity. In the same sense, any community could help another community to build capacity in a specific area by providing their experience, regardless of size. The issue of funding and capacity building seems only to be considered by smaller communities; however, the connections created by the horizontal transferability of a CCSIF could help to further the capacity of all communities involved by sharing knowledge and experience.

### *6.5.2 Creating a CCSIF*

This section will discuss the specific structure of a CCSIF and the potential for the creation of such a framework, based on the results of this research and the above discussion. From the interviews, it is obvious that there are existing indicator sets and frameworks, prominently including the Canadian Index of Well-being (CIW) and the Global City Indicator Project (GCIP). The CIW was seen by interviewees to lack local focus, despite assertions about their exceptional staff and high level of funding. The GCIP, on the other hand, was revealed to be similar to the framework proposed within this research, but on a global scale. It was also noted that the abundance of indicator sets and scorecards has become burdensome for sustainability professionals to manage, and that the industry would benefit from efficiencies and collaboration or consolidation. A CCSIF could serve to manage these various data sources and indicator projects to create efficiencies by helping these organizations to reduce overlap.

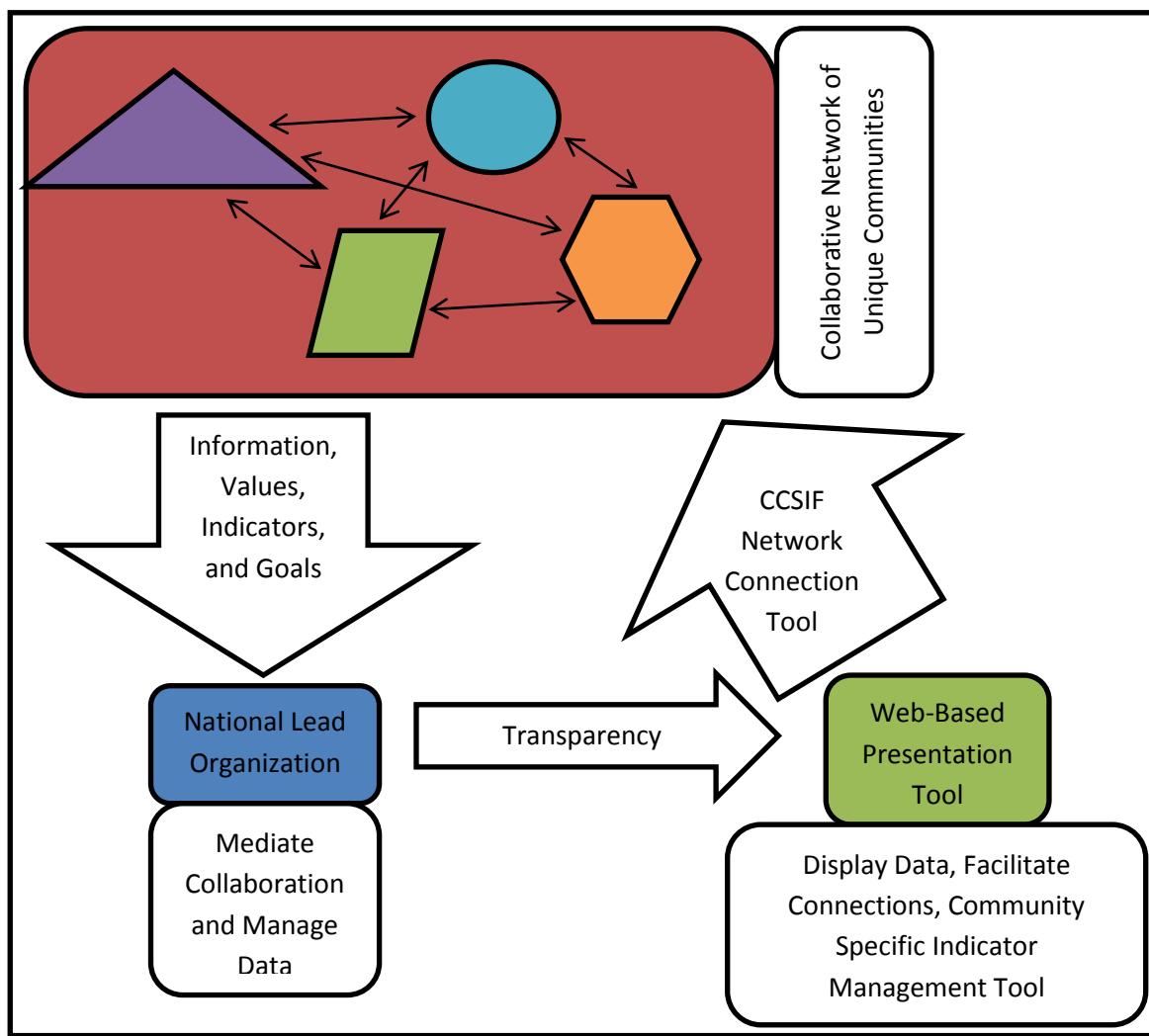
Certain interviewees provided some guidance for creating a CCSIF, including the need to maintain relevance within communities, and the need for constant assessment and improvement of indicators and methods. Most of the interviewees expressed great interest and excitement in the creation of, and involvement within a CCSIF; these interviewees were very aware of the potential benefits. One interviewee from Montreal provided some caution, emphasizing the possibility for standardized systems, like a CCSIF, to end up creating ‘cookie cutter’ solutions to specific community sustainability issues. This issue runs throughout the interviews, and could be solved by creating a CCSIF where the solutions would be developed within each community with support from the network of resources and connections maintained by the CCSIF. Hence, specific circumstances would not be overlooked, rather the tools to overcome local issues could be provided by a CCSIF.

The question of what type of organization would be appropriate to house a CCSIF brought varied responses. One assertion was that leadership by a private company could provide issues with public data availability. Transparency in this case would be up to the private organization, which could conflict with achieving sustainability goals. Other interviewees proposed that a government or arms-length government agency should lead such an initiative. Several offered the Federation of Canadian Municipalities (FCM) as the optimal choice, based on their position as a national body organization devoted to municipalities and because of their dedication to sustainable community development. One opponent was concerned however, that the current political situation was impairing FCM’s ability to undertake a project like this at this time. One organization that already serves in a similar capacity is the Community Foundations of Canada (CFC), with their Vital Signs project, described above. The CFC was shown to have the organizational infrastructure in place to potentially house a CCSIF, with a bottom-up structure where communities input to the national level organization, similar to FCM. Regardless, in order to house a CCSIF an organization should, at least, be committed to furthering community sustainable development within Canada, function in a transparent, bottom-up manner, and have the capacity to fund the development and maintenance of such a framework. It is also important to note that leadership by a government agency could be problematic, as shown above in the discussion of government interference with data and indicators.

Based on all of the discussion in this chapter, Figure 6.1 presents a proposed structure for a CCSIF. The national organization to lead the initiative would act mostly to mediate discourse on sustainability values, goals, and indicators, as well as to process, interpret, and publish data. In publishing data, the optimal path would be a web-based tool that allows for multi-depth analysis of results and has the ability to show connections between indicators, goals, and actions. Such a web-based tool could also easily facilitate connections between communities, access to resources, and could allow for additional, community specific indicators to be tracked by each community. All imperfections and limitations would need to be made clear within the web-based presentation tool to ensure transparency. Scoring could be undertaken as a method of grabbing attention, but as above, there are issues that will need to be resolved. Canadian communities would be charged with the definition of all terms within the framework to ensure relevance. Managing such a large number of stakeholders could be done in a conference or round table format,

however will most likely require more discourse and development. This format thus provides a transparent, bottom-up, collaborative approach to developing a CCSIF based on the perspectives of stakeholders (as were involved in this research). Any further development should be considered in collaboration with community stakeholders in order to maintain relevance and usefulness.

**Figure 6.1 Proposed CCSIF Structure**



## 6.6 Summary

This chapter discusses transferability (Research Questions 1a and 1b), creating a set of Canadian community sustainability indicator domains (Research Question 1a) and related indicators (Research Question 1b), perceptions of the CM scoring methodology (Research Question 2), and emergent themes. The transferability section considers the benefits of collaboration, maintaining the uniqueness of community while pursuing a common sustainability indicator structure, links between local and national/global levels of sustainable development, and government interference in sustainability indicator development. A preliminary set of community sustainability domains indicators for use in a CCSIF is displayed in Appendixes K and L and a proposed set of community sustainability indicator domains is provided in Table 6.3, which was affirmed to be relevant to each of the interview communities by all of the interviewees. The issue of whether the three pillars of sustainability are still relevant was discussed, relative to the literature and insights from interviewees. It became clear that there are several hurdles to

overcome in community sustainability indicator development, and that the number of indicators should be tied to the target audience; however, web-based tools are seen to provide sufficient levels of data for multiple audiences. Views about scoring proved to be incongruent; nonetheless providing questions for future research. Two new themes also emerged from the interview results. First, funding and capacity building seemed only an issue in smaller communities. And second, creating a CCSIF provided a look into existing sustainability indicator frameworks, potential leadership for a CCSIF, and a potential framework for a CCSIF. This chapter provides synthesis of the various forms of research conducted for this thesis, organized around, and providing answers to, the research questions and by considering two emergent themes.

## **7.0 CONCLUSIONS**

Throughout preparation of this thesis, an in-depth literature review, document analysis, and interviews were conducted. The results of this research are synthesised in the discussion chapter, which affirmed some concepts and added other potentially new ones. These contributions are summed up in this chapter, along with recommendations, limitations, future research suggestions, and concluding thoughts.

### **7.1 Theoretical and Practical Contributions**

Contributions from this research, both academic and practical, are found in, or are correlated to, the answers to the thesis research questions. Hence the contributions will be reviewed accordingly. The answer to Research Question 1a (What core set of sustainability indicator domains are relevant for all Canadian communities?) is found in Table 6.3, which presents the set of 17 approved and three potential additional Canadian community sustainability domains. During the investigation of these domains interviewees also asserted that the three pillars of sustainability (economic, social, and environmental) have the potential to be destructive to cross-cutting domains. This assertion highlighted the lack of cross-cutting domains within the current set and that several domains also identified responses rather than real sustainability progress. Future iterations should look to identify those domains that clearly identify sustainability goals.

Research Question 1b (What preliminary set of sustainability indicators exist to populate a CCSIF?) was answered in Chapter 4, through the exercise to amalgamate and refine four existing sets of Canadian community sustainability indicators (Appendices J, K, L); however it became apparent that future iterations would need to include more forward-looking indicators, and should reflect real sustainability progress through clearly identified sustainability goals attached to the given domain. Accordingly, in the literature and the interviews, the benefits of sustainability indicators were well known. Nonetheless, in order to realize these benefits there are several hurdles to be overcome, primarily the lack of consistent data to populate a set of national community sustainability indicators. Additionally, it was found in the literature that the number of indicators used should reflect the intended audience, which was affirmed in the interviews. In resolution to these assertions, interviewees also proposed the use of web-based tools that can accommodate various audiences based on user preferences.

Research Question 2 (Is the MRCMH CM scoring methodology applicable to a CCSIF?) was answered in a slightly more unclear way: the general usefulness of scoring was debated, despite the praise that was given to the CM scoring methodology. Hence, it was decided that if future research determined that scoring would be useful in a CCSIF, the CM scoring methodology would be an effective structure to use.

The research conducted to answer these research questions also provided a complementary theoretical contribution: a key theme that runs throughout this thesis is the concept of transferability. This concept was introduced in the literature review as the ability of sustainability indicators to be relevant across various communities (horizontal transferability) and between governance levels (vertical transferability). It was found in the interviews that a transferable set of indicators is desired, but must be made to consider unique community circumstances. One solution to this issue is to use a core set of common indicators and encourage communities to create their own supplementary and unique indicators. This method, however, would restrict comparability between communities. A second solution was introduced in one interview: finding indicators that control for unique community circumstances (i.e., energy use per degree day measures energy use while controlling for different climates). Indicators with controls for unique circumstances have the potential to work in providing transferable community sustainability indicators; however further research into finding such indicators is required to determine feasibility.

Furthermore, through the interviews conducted, this thesis provides two potentially emergent themes (funding and capacity building, and creating a CCSIF), that will hopefully provide the basis for further inquiry.

Each of the research questions provides not only academic contributions, but also practical contributions. The proposed set of Canadian community sustainability domains in Table 6.3, the preliminary list of community sustainability indicators in Appendices K and L, and the investigation into the CM scoring methodology individually could be used as tools for creating implementable sustainability indicator and domain sets, and scoring processes. Combined with the emergent theme of creating a CCSIF these results provide the preliminary structure for a CCSIF, which could be implemented and refined using the recommendations found within this research. The potential benefits for such a framework, if implemented, are extensive. A CCSIF could help to build sustainability capacity within communities by providing a structure to build from, connections with other communities, and through the identification of sustainability issues. Similarly, national and provincial level funding could easily be allocated based on these community assessments. Finally, assuming that web-based tools have the capacity to function for varied audiences, a CCSIF could function as a public outreach and educational tool, a channel for informing decision-makers, and a data source for scientists and academics.

## **7.2 Recommendations**

The research in this thesis culminates in the provision of a preliminary set of community sustainability indicators and domains, along with a potential scoring methodology for use in a CCSIF, if general concerns about scoping can be overcome. Combined with the sustainability goals, principles, and sustainability indicator selection criteria from the literature review and the emergent theme of creating a CCSIF, this thesis provides the necessary, preliminary framework for developing a CCSIF. The benefits of the creation of a vertically and horizontally transferable community sustainability indicator framework are also made clear throughout this research. Hence, it is recommended that this research be used to form the structure for the creation of a CCSIF to further community sustainability indicator development and positive progress toward local, regional, national, and global sustainability goals. Also, this research and the preliminary CCSIF structure provided should undergo future research to determine the validity of the included core set of indicators as well as the scoring system.

## **7.3 Limitations**

There were two major limitations in conducting this research. The first stems from a lack of time and resources, affecting the depth of certain areas of the research. Second, the level of statistical/mathematical knowledge held by the researcher influenced the ability of this thesis to provide a more thorough analysis of scoring mechanisms.

The first and most prevalent limitation in this research was the inability to gain consensus on a set of indicators because of time and resource restrictions. The list of indicators was deemed too extensive to include in the interviews, though the preliminary list of community sustainability indicators created through this research still does effectively achieve Research Question 1b. Similarly, given more time or resources, more communities or more interviewees could have been involved in the research. Also, more depth could have been added to the academic and/or practitioner document reviews. This limitation extends to the lack of time available to investigate indicators that control for contextual differences.

The second major limitation in the scoring section was the mathematical/statistical understanding required to understand the more complex scoring systems considered in the literature review. Approaching the issue of scoring methodologies from a statistical angle could have yielded more conclusive results in this section.

Other potential limitations stem from the methodological choices made during the early stages of this research. The assumptions taken from the literature influenced the discussion and writing of this thesis, and despite being clearly identified, different assumptions could have led to different results and conclusions. Similarly, the process of evaluating indicators using Maclaren's (1996) urban sustainability indicator evaluation matrix along with the four established indicator sets could have provided different results than other indicator evaluation methods (though none were found in the literature review) and

other established indicator sets from Canada or globally. Furthermore, the selection and presentation of the community sustainability domains during the interviews had the potential to influence interviewees' responses; given different domains or no domains at all, could have produced a completely different set of preliminary domains. This is not to mean that the methods used within this research were incorrect or insufficient; simply to acknowledge that other methods could have been pursued that might have produced different results.

#### **7.4 Future Research Suggestions**

This thesis has highlighted several areas for future research based on the findings of the research questions, potentially emergent concepts, and realized limitations. First, in the discussion about developing transferable community sustainability indicators, it was proposed that indicators with controls for unique local circumstances be created. One example of such an indicator was provided that controlled for climate differences and energy consumption (energy use per degree day). Further research is needed to determine indicators for all domains with controls for unique local issues. Also on the topic of sustainability indicators, it was established that there is a lack of consistent data sources within and between communities, and that more forward looking indicators are needed to populate future indicator sets; each of these issues requires further investigation.

Three new domains were proposed to supplement the verified list. These new domains, along with any potential others could form the basis of future research to create a more robust set of domains for use in a CCSIF. Also within the domains discussion was the notion that the three pillars of sustainability are potentially destructive to cross-cutting sustainability indicators. Further study into the relevance and potential effects of using the three pillars of sustainability could be of benefit not only to the sustainability indicator discussion, but also the general sustainability definition discussion.

The investigation into scoring methodologies was not as fruitful as was hoped, though it did provide some basis for further analysis into the general benefits of scoring sustainability indicators. Also, as the limitations suggest, further consideration, by researchers with a higher statistical understanding, of the various scoring methodologies available could provide a better evaluation, and provide more insight into optimal scoring methodologies.

Lastly, but perhaps most obvious, there is potential for exploration into the two potentially emergent themes: capacity building and funding, and creating a CCSIF. The issues around capacity building and funding sustainability indicators within smaller communities could be investigated, along with the potential for transferable sustainability indicators to effect funding and capacity building. This research has created a preliminary framework for a CCSIF, hence the future research that is suggested above would help to improve it; however, this preliminary structure and research would also benefit from real implementation to determine deficiencies and practical solutions to such issues.

#### **7.5 Concluding Thoughts**

This thesis has achieved the research objectives and provided answers to each of the research questions. Also, as is clear above, the practical and theoretical contributions are numerous, as are the potential areas for future research. Hence, the research conducted has been successful by adding to the current bank of knowledge and by providing prospects for further expansion. It is the hope that this thesis will contribute positively to sustainable development efforts, adding to the growing movement away from our destructive course and towards a better future for current and future generations.

## REFERENCES

- Allan, G. (1991). Qualitative research. In G. Allan, & C. Skinner (Eds.), *Handbook for research students in the social sciences* (pp. 177-189). London: The Falmer Press.
- Anielski, M., & Winfield, M. (2002). *A conceptual framework for monitoring municipal and community sustainability in Canada*. Drayton Valley: Pembina Institute.
- Association of Municipalities of Ontario. (2008). *A sustainability planning toolkit for municipalities in Ontario*. Association of Municipalities of Ontario.
- Berke, P., & Conroy, M. M. (2000). Are we planning for sustainable development? An evaluation of 30 comprehensive plans. *Journal of the American Planning Association*, 66(1), 21-33.
- Bobbitt, L., Green, S., Candura, L., & Morgan, G. A. (2005). The development of a county level index of well-being. *Social Indicators Research*, 73(1), 19-42.
- Campbell, S. (1996). Green Cities, Growing Cities, Just Cities?: Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association*, 62(3), 296-312.
- Cartwright, L. (1997). The implementation of sustainable development by local authorities in the South East of England. *Planning Practice and Research*, 12(4), 337-347.
- Choon, S. -, Siwar, C., Pereira, J. J., Jemain, A. A., Hashim, H. S., & Hadi, A. S. (2011). A sustainable city index for Malaysia. *International Journal of Sustainable Development and World Ecology*, 18(1), 28-35.
- Clarke, A., & Erfan, A. (2007). Regional Sustainability Strategies: A comparison of eight Canadian approaches. *Plan Canada*, 47(3), 15-18.
- Cole, L. R. (2003). *Assessing sustainability on Canadian university campuses: Development of a campus sustainability assessment framework*. Unpublished Master's Thesis, Royal Roads University, 1-66.
- Colton, J. (2010, October 2010). Municipal sustainability plans: Online survey explores the issues and challenges of planning and implementation. *Municipal World*, 13-14.
- Dalal-Clayton, B., & Bass, S. (2002). Monitoring and evaluation systems. *Sustainable Development Strategies: A resource handbook* (pp. 309-326). London: Earthscan.
- Devuyst, D. (2000). Linking Impact Assessment and Sustainable Development at the Local Level: The introduction of sustainability assessment systems. *Sustainable Development*, 8(2), 67-78.
- Donnelly, A., Jones, M., O'Mahony, T., & Byrne, G. (2007). Selecting environmental indicator for use in strategic environmental assessment. *Environmental Impact Assessment Review*, 27(2), 161-175. doi:10.1016/j.eiar.2006.10.006
- Eckerberg, K., & Forsberg, B. (1998). Implementing Agenda 21 in local government: The Swedish experience. *Local Environment*, 3(3), 333-348.

- Federation of Canadian Municipalities. (2010). Retrieved 08/26, 2011, from [http://www.fcm.ca/english/view.asp?x=1115&utm\\_source=QOLRS&utm\\_medium=303redirect&utm\\_campaign=QOLRSredirect](http://www.fcm.ca/english/view.asp?x=1115&utm_source=QOLRS&utm_medium=303redirect&utm_campaign=QOLRSredirect)
- Fehr, M., Sousa, K. A., Pereira, A. F. N., & Pelizer, L. C. (2004). Proposal of Indicators to Assess Urban Sustainability in Brazil. *Environment, Development and Sustainability*, 6(3), 355-366.
- Fontana, A., & Frey, J. (2000). The interview: From structured questions to negotiated text. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 645-672). Thousand Oaks: Sage.
- Gibson, R. B. (2006). Sustainability assessment: Basic components of a practical approach. *Impact Assessment and Project Appraisal*, 24(3), 170-182.
- Gunn, J. H., & Noble, B. F. (2009). A conceptual basis and methodological framework for regional strategic environmental assessment (R-SEA). *Impact Assessment and Project Appraisal*, 27(4), 258-270.
- Hemphill, L., Berry, J., & McGreal, S. (2004). An indicator-based approach to measuring sustainable urban regeneration performance: Part 1, conceptual foundations and methodological framework. *Urban Studies*, 41(4), 725-755.
- Holden, M., Roseland, M., Ferguson, K., & Perl, A. (2008). Seeking urban sustainability on the world stage. *Habitat International*, 32(3), 305-317. doi:10.1016/j.habitatint.2007.11.001
- Hu, A. H., Chen, L., Hsu, C., & Ao, J. (2011). An evaluation framework for scoring corporate sustainability reports in Taiwan. *Environmental Engineering Science*, 28(12), 843-858.
- Infrastructure Canada. (2006). *The path towards sustainability: an evaluation of the "sustainability-ness" of selected municipal plans in Canada*. Ottawa: Infrastructure Canada.
- Infrastructure Canada. (2011). *Gas Tax Fund*. Retrieved March 31, 2011, from <http://www.infc.gc.ca/ippi/gtf-fte/gtf-fte-eng.html>
- International Institute for Sustainable Development. (2011). *Complete Bellagio principles*. Retrieved April 20, 2011, from [http://www.iisd.org/measure/principles/progress/bellagio\\_full.asp](http://www.iisd.org/measure/principles/progress/bellagio_full.asp)
- Janesick, V. (2000). The choreography of qualitative research design. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 379-399). Thousand Oaks: Sage.
- Johnson, K., Hays, C., Center, H., & Daley, C. (2004). Building capacity and sustainable prevention innovations: a sustainability planning model. *Evaluation and Program Planning*, 27(2), 135-149. doi:10.1016/j.evalprogplan.2004.01.002
- Kitchen, T., Whitney, D., & Littlewood, S. (1997). Local authority/academic collaboration and local Agenda 21 policy processes. *Journal of Environmental Planning and Management*, 40(5), 645-659.

- Kondyli, J. (2010). Measurement and evaluation of sustainable development. A composite indicator for the islands of the North Aegean region, Greece. *Environmental Impact Assessment Review*, 30(6), 347-356.
- Layke, C. (2009). *Measuring nature's benefits: A preliminary roadmap for improving ecosystem service indicators*. (). Washington DC: World Resources Institute.
- Lee, G. K. L., & Chan, E. H. W. (2009). Indicators for evaluating environmental performance of the Hong Kong urban renewal projects. *Facilities*, 27(13), 515-530.
- Lewis-Beck, M. S., Bryman, A., & Liao, T. F. (2004). *The Sage encyclopedia of social science research methods*. Thousand Oaks: Sage Publications.
- Lozano, R. (2008). Envisioning sustainability three-dimensionally. *Journal of Cleaner Production*, 16(17), 1838-1846. doi:10.1016/j.jclepro.2008.02.008
- Maclaren, V. W. (1996). *Developing indicators of urban sustainability: A focus on the Canadian experience*. (). Toronto: ICURR Press.
- Maclaren, V. (1992). *Sustainable urban development in Canada: From concept to practice - Volume I: Summary report*. (). Toronto: Intergovernmental Committee on Urban and Regional Research Press.
- Maclaren, V. (1996). Urban Sustainability Reporting. *Journal of the American Planning Association*, 62(2), 184-202.
- Marchington, E. (2011). The 2011 Most Sustainable Cities in Canada. *Corporate Knights*, (34), March 9, 2012.
- Markwart, T. (2011). In Taylor A. (Ed.). Waterloo: University of Waterloo.
- McCool, S. F., & Stankey, G. H. (2004). Indicators of Sustainability: Challenges and Opportunities at the Interface of Science and Policy. *Environmental Management*, 33(3), 294-305.
- Meadows, D. (1998). *Indicators and Information Systems for Sustainable Development*. (). Hartland Four Corners: The Sustainability Institute.
- Mebratu, D. (1998). Sustainability and sustainable development. *Environmental Impact Assessment Review*, 18(6), 493-520. doi:10.1016/S0195-9255(98)00019-5
- Ministry of Municipal Affairs and Housing, & Ontario Professional Planning Institute. (2009). *Planning by design: A healthy communities handbook*. Toronto: Queen's Printer for Ontario.
- Nicollier, T., Jolliet, O., Ferrari, Y., & Jemelin, C. (2003). Assessing sustainability: An assessment framework to evaluate Agenda 21 actions at the local level. *International Journal of Sustainable Development and World Ecology*, 10(3), 225-237.
- Niemeijer, D. (2002). Developing indicators for environmental policy: data-driven and theory-driven approaches examined by example. *Environmental Science and Policy*, 5(2), 91-103.

Noble, B., & Harriman, J. (2008). *Strengthening the foundation for regional scale strategic environmental assessment in Canada*. (). Ontario: Canadian Council of Ministers of Environment.

Northey, M., Tepperman, L., & Russel, J. (2002). *Making sense: A student's guide to research and writing* (2nd ed.). Don Mills: Oxford University Press.

Pembina Institute for Appropriate Development. (2005). *Genuine progress? Alberta GPI*. ().The Pembina Institute.

Peris, J., Acebillo-Baque, M., & Calabuig, C. (2011). Scrutinizing the link between participatory governance and urban environment management: The experience in Arequipa during 2003-2006. *Habitat International*, 35(1), 84-92. doi:10.1016/j.habitatint.2010.04.003

Rametsteiner, E., Pütlz, H., Alkan-Olsson, J., & Frederiksen, P. (2011). Sustainability indicator development—Science or political negotiation? *Ecological Indicators*, 11(1), 61-70. doi:10.1016/j.ecolind.2009.06.009

Sanchez, I. M., & Prado-Lorenzo, J. (2008). Determinant factors in the degree of implementation of local Agenda 21 in the European Union. *Sustainable Development*, 16(1), 17-34. doi:10.1002/sd.334

Schwandt, T. (1997). In Labella P., Robinson S. (Eds.), *Qualitative inquiry: A dictionary of terms*. Thousand Oaks: Sage Publications.

Shen, L., Lu, W., Yao, H., & Wu, D. (2005). A computer-based scoring method for measuring the environmental performance of construction activities. *Automation in Construction*, 14(3), 297-309.

Shen, L., Jorge Ochoa, J., Shah, M. N., & Zhang, X. (2011). The application of urban sustainability indicators – A comparison between various practices. *Habitat International*, 35(1, pp. 17-29), January. doi:10.1016/j.habitatint.2010.03.006

Siemens AG - Corporate Communications. *Megacity Challenges: A stakeholder perspective*. (). Munich: Siemens AG.

Siemens AG - Corporate Communications and Government Affairs. (2009). *European green city index: Assessing the environmental impact of Europe's major cities*. Munchen: Siemens AG.

Siemens AG - Corporate Communications and Government Affairs. (2010). *Latin American green city index: Assessing the environmental performance of Latin America's major cities*. Munchen: Siemens AG.

Siemens AG - Industry Sector, Mobility Division. (2009). *Sustainable Urban Infrastructure: Vienna edition - Role model for complete mobility*. (). Erlangen: Siemens AG.

Siemens Canada Limited - Industry Sector, Mobility Division. (2010). *Complete mobility in the Greater Toronto and Hamilton area: A research report sponsored by Siemens examining complete mobility solutions*. Burlington: Siemens Canada Limited.

Siemens Economist Intelligence Unit. (2011). *US and Canada green city index*. Munich: Siemens AG.

Sierra Youth Coalition. (2009). *Tools and Frameworks*. Retrieved May, 27, 2011, from <http://www.syc-cjs.org/sc/tools>

Skouloudis, A., Evangelinos, K., & Kourmousis, F. (2009). Development of an evaluation methodology for triple bottom line reports using international standards on reporting. *Environmental Management*, 44(2), 298-311.

Tanguay, G. A., Rajaonson, J., Lefebvre, J., & Lanoie, P. (2010). Measuring the sustainability of cities: An analysis of the use of local indicators. *Ecological Indicators*, 10(2), 407-418.  
doi:10.1016/j.ecolind.2009.07.013

United Nations. (2002). *Johannesburg Plan of Implementation*. (). Johannesburg: United Nations.

United Nations. (2005). *Report of the international meeting to review the implementation of the programme of action for the sustainable development of small island developing states*. (). New York: United Nations.

United Nations. (2008). *United Nations millennium development goals*. Retrieved April 19, 2011, from <http://www.un.org/millenniumgoals/bkgd.shtml>

United Nations. (2011). *RIO+20 United Nations conference on sustainable development*. Retrieved 2011, May, 2011, from <http://www.uncsd2012.org/rio20/index.php?menu=61>

United Nations Department of Economic and Social Affairs. (1994). *Report of the global conference on the sustainable development of small island developing states*. (). Barbados: United Nations.

United Nations Department of Economic and Social Affairs. (1997). *Programme for the further implementation of Agenda 21*. ().United Nations.

United Nations Department of Economic and Social Affairs. (2007). *Indicators of Sustainable Development: Guidelines and Methodologies*. (). Retrieved from <http://www.un.org.proxy.lib.uwaterloo.ca/esa/sustdev/natlinfo/indicators/guidelines.pdf>

United Nations Department of Economic and Social Affairs. (2008). *World urbanization prospects the 2007 revision*. (). New York: United Nations.

United Nations Division for Sustainable Development. (2009). *Agenda 21*. Retrieved April 19, 2011, from <http://www.un.org/esa/dsd/agenda21/>

United Nations Statistical Institute for Asia and Pacific. (2007). *Building administrative data systems for statistical purposes-addressing training issues and needs of countries. Inception/regional workshop on reta6356: Improving administrative data sources for the monitoring of the MDG indicators*. (). Bangkok, Thailand: United Nations.

Valentin, A., & Spangenberg, J. H. (2000). A Guide to Community Sustainability Indicators. *Environmental Impact Assessment Review*, 20(3), 381 p.

Wilson, J., Tyedmers, P., & Pelot, R. (2007). Contrasting and comparing sustainable development indicator metrics. *Ecological Indicators*, 7(2), 299-314.

World Commission on Environment and Development. (1987). *Our common future*. (). Oxford: Oxford University Press.

Yu, Y., & Wen, Z. (2010). Evaluating China's urban environmental sustainability with Data Envelopment Analysis. *Ecological Economics*, 69(9), 1748-1755.

## APPENDICES

### Potential Interview Communities

### Appendix A

The following is a list of the potential interview communities for this research. They are listed with relative indicator reports or, in the case of the North, sustainability awards where indicators were unable to be found.

#### West

- Fraser Basin, BC (Sustainability Snapshots)
  - o Provides a good example of a system that includes both urban and rural considerations. Is a large community, experiencing growth.
- Whistler, BC (2020)
- Surrey, BC (Sustainability Charter Progress Report, FCM QoLRS)
- Vancouver, BC (Vital Signs, FCM QoLRS)
- Victoria, BC (Vital Signs, Indicators for Sustainable Community Report)
- Richmond, BC (Corporate Level only?)
- Nanaimo, BC (State of Sustainability Project)
- Canmore, BC (Biosphere Institute)

#### Prairies

- Calgary, AB (State of Environment Report, Sustainable Calgary State of Our City Reports, Vital Signs, FCM QoLRS)
  - o Inputs to several indicator sets, and provides an interesting political example based on current mayor and large unsustainable industry. Is a large community, experiencing growth.
- Winnipeg, MB (the Peg, FCM QoLRS)
- Medicine Hat, AB (Vital Signs)
- Red Deer, AB (Vital Signs)
- Edmonton (FCM QoLRS)
- Saskatoon (FCM QoLRS)
- Regina (FCM QoLRS)

#### Ontario

- Sault Ste. Marie (Community Quality Institute)
  - o Provides a good example of a shrinking community looking to sustainability for the future. Is a small community, experiencing declining population and a recovering economy.
- Hamilton (Vision 2020, FCM QoLRS)
  - o Pioneers in sustainability indicators since 1992. Is a medium size community, experiencing growth.
- Ottawa (Vital Signs, FCM QoLRS)
- Sudbury (Vital Signs, FCM QoLRS)
- Toronto (Vital Signs, Regional Watershed Monitoring Program, FCM QoLRS)
- London (FCM QoLRS)
- Kingston (FCM QoLRS)
- Municipality of Waterloo (FCM QoLRS)
- Municipality of Niagara (FCM QoLRS)
- Halton Region (FCM QoLRS)

- Region of Peel (FCM QoLRS)
- York Region (FCM QoLRS)
- Region of Durham (FCM QoLRS)

## **Quebec**

- Montreal (Vital Signs, The Montreal Process, FCM QoLRS)
  - o Award-winning, long time contributor to sustainability indicators. Is a large community, experiencing growth.
- Gatineau (FCM QoLRS)
- Laval (FCM QoLRS)
- Quebec City (FCM QoLRS)

## **Atlantic**

- Halifax, NS (Genuine Progress Indicators, FCM QoLRS)
  - o Only one to be found to use GPI. Is a medium size community, experiencing growth.
- St. John's, NB (Vital Signs)
- Charlottetown, PEI (ICSP includes proposed indicators)

## **North (None found to have developed Indicators)**

- Yellowknife, NWT
  - o Placed 4<sup>th</sup> in 2011 and 1<sup>st</sup> in 2010 and 2009 in Corporate Knights 'Most Sustainable Cities in Canada' ranking. Is a small community, experiencing growth from diamond boom.
- Whitehorse, YT
- Iqaluit, NU

**List of Interviewees that Agree to be Identified****Appendix B**

<b>Community</b>	<b>Candidate</b>
Calgary	Carolyn Bowen
Montreal	Daniel Bouchard
Montreal	Danielle Lussier
Calgary	Dick Ebersohn
Fraser River Basin	Dr. Meg Holden
Calgary	Dr. Noel Keough
Yellowknife	Jeffrey Humble
Sault Ste Marie	Ken Coulter
Calgary	Kerry Longpré
Sault Ste Marie	Kristen Hoffman
Yellowknife	Mark Henry
Yellowknife	Mark Heyck
Halifax	Mike Connors
Sault Ste Marie	Paul Beach
Montreal	Paul-Antoine Troxler
Halifax	Richard MacLellan
Yellowknife	Shelagh Montgomery
Fraser River Basin	Steve Litke
Sault Ste Marie	Steve Zuppa
Montreal	Tania Morency
Montreal	Virginie Zingraff

Dear [name of potential participant],

My name is Allan Taylor and I am a graduate student in Environment and Resource Studies at the University of Waterloo. I am working with Dr. Amelia Clarke from the School for Environment, Enterprise and Development (SEED). My thesis title is “Development of Indicators and Benchmarks of Sustainability for a Standardized Municipal Sustainability Index”. This research is being undertaken to assist communities pursue sustainable development. Specifically, this thesis aims to create a second generation set of sustainability indicators and benchmarks to be used in a municipal sustainability rating system.

I am looking for participants for the interview part of my research. I would like to ask you questions relating to your perspectives on indicator development and sustainable development implementation. The interview will take approximately one hour to complete. All responses to this interview will be kept anonymous and participants will not be identified in my research unless permission is granted.

Please reply to this email to express your interest, and to schedule an interview. I will send you more information upon receiving your reply.

This project was reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo.

Thank you very much for your consideration.

Sincerely,

Allan Taylor

Masters of Environmental Studies Candidate

Faculty of Environment

University of Waterloo

Office Phone: 519-888-4567 ext. 38370

Cell Phone: 519-500-3253

E-mail: [a3taylor@uwaterloo.ca](mailto:a3taylor@uwaterloo.ca)

Under the supervision of Dr. Amelia Clarke

School of Environment, Enterprise and Development (SEED)

University of Waterloo

Phone: +1 519-888-4567 ext. 38910

E-mail: [Amelia.Clarke@uwaterloo.ca](mailto:Amelia.Clarke@uwaterloo.ca)

<http://www.environment.uwaterloo.ca/business/faculty/clarke/index.html>

P = Potential Participant; I = Interviewer

I – Hello, could I speak with [name of potential participant] please

P - Hello, [name of potential participant] speaking. How may I help you?

I - My name is Allan Taylor and I am a Masters student in the Environment and Resource Studies program at the University of Waterloo. I am currently conducting research under the supervision of Amelia Clarke on municipal sustainability indicators. As part of my thesis research, I am conducting interviews with personnel involved in municipal sustainability initiatives to understand their perspectives on the development of municipal sustainability indicators and sustainable development implementation.

As you have worked on the [project name] in [City], I would like to speak with you about your perspectives on these topics. Is this a convenient time to give you further information about the interviews? Or could I send you further information about the interview via e-mail?

P - No, could you call back later (agree on a more convenient time to call person back).

OR

P - Yes, could you provide me with some more information regarding the interviews you will be conducting?

I - Background Information:

- My thesis title is “Development of Indicators and Benchmarks of Sustainability for a Standardized Municipal Sustainability Index”. This research is being undertaken to assist communities pursue sustainable development. Specifically, this thesis aims to create a second generation set of sustainability indicators and benchmarks to be used in a municipal sustainability rating system.
- I would like to ask you questions relating to your perspectives on indicator development and sustainable development implementation. The interview will take approximately one hour to complete. All responses to this interview will be kept anonymous and participants will not be identified in my research unless permission is granted.
- This project was reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo.
- Are you interested in participating?

P - No, I am not interested.

I - Thank you for your time. Goodbye.

OR

P - Yes, I am interested.

I - Great, let's schedule an interview, and I will send you more information via e-mail about the study [Schedule interview and get e-mail to send further information].

I - Thank you very much for your time.

P - Good-bye.

I - Good-bye.

## **General Information E-mail**

## **Appendix E**

Dear [name of participant],

This letter is to inform you about an interview for a Master's thesis research study at University of Waterloo. The interview will take about one hour and is about the development of municipal sustainability indicators. The aim of this interview is to identify why and how certain choices were made during sustainability indicator development in municipalities, to understand the challenges faced, and to realize the unique motivations for particular actions taken. You will be asked about your motivations and the challenges/obstacles you faced when you worked on previous sustainability indicators and sustainable development projects. Your observations and opinions are an important part of my study to explore motivations and impediments in current and past sustainable development initiatives.

All responses to this interview will be kept anonymous and participants will only be identified in my research by municipality and/or project, unless permission is granted for identification in a participant list in the thesis. You may decline to answer questions if you wish and you may withdraw from participation at any time by informing the researcher.

The interview will be held in person. With your permission, I would like to record the interview to facilitate analysis of the results. Interview recordings and any other data will be kept in a secure location and will not be made available to anyone.

Participation is voluntary. If you are willing to participate in this interview, please contact Allan Taylor at 519-500-3253 or [a3taylor@uwaterloo.ca](mailto:a3taylor@uwaterloo.ca) to confirm your participation. In your reply, please indicate a time when you will be available between [dates researcher will be in selected municipality] and a place where it would be convenient for you (Eg. your office).

I would like to assure you that this study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. Should you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes in the Office of Research Ethics at 519-888-4567, Ext. 36005 or [ssykes@uwaterloo.ca](mailto:ssykes@uwaterloo.ca).

After all of the data have been analyzed, you will receive an executive summary of the research results.

Thank you,

Allan Taylor

Masters of Environmental Studies Candidate

Faculty of Environment

University of Waterloo

Office Phone: 519-888-4567 ext. 38370

Cell Phone: 519-500-3253

E-mail: [a3taylor@uwaterloo.ca](mailto:a3taylor@uwaterloo.ca)

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University of Waterloo

Phone: +1 519-888-4567 ext. 38910

E-mail: [Amelia.Clarke@uwaterloo.ca](mailto:Amelia.Clarke@uwaterloo.ca)

<http://www.environment.uwaterloo.ca/business/faculty/clarke/index.html>

**Consent of Participant**

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

---

I have read the information presented in the information letter about a study being conducted by *Allan Taylor* of the Department Environment and Resource Studies at the University of Waterloo, under the supervision of Dr. Amelia Clarke. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision. I am aware that my comment will remain anonymous.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact the Director, Office of Research Ethics at 519-888-4567 Ext. 36005, or at ssykes@uwaterloo.ca.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

**Consent:**

- |   |  |
|---|--|
| I agree to participate in the study                                   | Yes <input type="checkbox"/> No <input type="checkbox"/> |
| I agree to the interview being audio recorded                         | Yes <input type="checkbox"/> No <input type="checkbox"/> |
| I agree that my name may be included in the thesis or any publication | Yes <input type="checkbox"/> No <input type="checkbox"/> |
| I would like a copy of the full thesis once it has been completed     | Yes <input type="checkbox"/> No <input type="checkbox"/> |

---

Print Name

---

Signature of Participant

---

Date and Location

---

Witnessed

Who:

Staff members that have worked on sustainability indicator development or sustainable development implementation.

How:

In person for approximately one hour

Objectives:

The purpose of this study is to develop indicators and benchmarks for sustainability at the municipal level. The aim of this interview is to identify why and how certain choices were made during sustainability indicator development in municipalities, to understand the challenges faced, and to realize the unique motivations for particular actions taken.

Interview Guide:

1. Introduction of my purpose of research and opportunity to answer any questions
2. Sign letters of consent
3. Interview
  - a. About the participant
    - i. What is/was your position during the project?
    - ii. What other roles have you assumed related to sustainable development in this community? (Probe if relevant)
  - b. Questions related to indicators
    - i. What process was used to select their indicators?
      1. Was an established set used/modified to fit?
        - a. If so, how were the decisions made and who was involved? (Probe if necessary)
      2. Were they created within the community?
        - a. If so, what type of process was used? (Probe if necessary)
    - ii. Do their indicators created through this research relate to the participant's municipality? (Probe to determine the fit of each indicator)
    - iii. How do the indicators created through this research compare to those developed in the participant's municipality? (Probe to assess commonalities and discrepancies in :
      1. Category orientation – How cross-cutting indicators fit with the community structure
      2. Community vs corporate sustainability perspective)
    - iv. Would a sustainability rating system with higher level indicators (like the ones developed) affect/assist their work? (Probe to discover why or why not if necessary)

- v. What challenges were faced in developing their sustainability indicators? (Probe if necessary to determine how they overcame each challenge)

- c. Questions related to scoring

- i. How do the city's sustainable development efforts compare to the best practices established through this research? (discuss based on each of the developed sustainability indicator categories)
- ii. What factors affected the decision to pursue these projects rather than others? (discuss based on each of the developed sustainability indicator categories)
- iii. What challenges were faced in pursuing these sustainable development efforts? (discuss based on each of the developed sustainability indicator categories) (Probe to discover how they overcame these challenges)
- iv. Are the best practice examples established through this research feasible for their community? (Probe to discover why or why not)
- v. Are these best practice examples feasible for use as benchmarks for the indicators developed through this research? (Probe to discover why or why not)

- d. Conclusion

- i. Do you have any other comments on the topics we have discussed?
- ii. Do you have any other questions about my research project?

Thank you

Dear [name of participant],

I would like to thank you for your participation in this study. As a reminder, the purpose of this study is to develop indicators and benchmarks for sustainability at the municipal level. It is hoped that the results of this study assist progress towards sustainability within municipalities.

The data collected during these interviews will contribute to a better understanding of the appropriate direction of municipal sustainable development indicators.

Please remember that any information pertaining to you as an individual participant will not contain any personal identifiers, you will only be identified by municipality and/or project [unless permission was granted for identification in a participant list in the thesis]. Once all the data are collected and analyzed for this project, I plan on sharing this information with the research community through seminars, conferences, presentations, and journal articles. If you are interested in receiving more information regarding the results of this study, or if you have any questions or concerns, please contact me at either the phone number or e-mail address listed at the bottom of the page. When the study is completed, I will forward a copy of the executive summary. The study is expected to be completed by April 2012.

As with all University of Waterloo projects involving human participants, this project was reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. Should you have any comments or concerns resulting from your participation in this study, please contact Dr. Susan Sykes in the Office of Research Ethics at 519-888-4567, Ext. 36005, or at [ssykes@uwaterloo.ca](mailto:ssykes@uwaterloo.ca).

Sincerely,

Allan Taylor

Masters of Environmental Studies Candidate

Faculty of Environment

University of Waterloo

Office Phone: 519-888-4567 ext. 38370

Cell Phone: 519-500-3253

E-mail: [a3taylor@uwaterloo.ca](mailto:a3taylor@uwaterloo.ca)

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E-mail: [Amelia.Clarke@uwaterloo.ca](mailto:Amelia.Clarke@uwaterloo.ca)

<http://www.environment.uwaterloo.ca/business/faculty/clarke/index.html>

## Ethics Clearance

## Appendix I

UNIVERSITY OF WATERLOO

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UNIVERSITY OF WATERLOO

OFFICE OF RESEARCH ETHICS

### Notification of Ethics Clearance of Application to Conduct Research with Human Participants

Faculty Supervisor: Dr. Amelia Clarke      Department: Environment and Business  
Student Investigator: Allan Taylor      Department: Environment & Resource Studies

ORE File #: 17392

Project Title: Development of Indicators and Benchmarks of Sustainability for a Standardized Municipal Sustainability Index

This certificate provides confirmation that the additional information/revised materials requested for the above project have been reviewed and are considered acceptable in accordance with the University of Waterloo's Guidelines for Research with Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. Thus, the project now has received ethics clearance. This clearance is valid for a period of five years from the date shown below and is subject to an annual ethics review process (see Note 2). A new application must be submitted for on-going projects continuing beyond five years.

**Note 1:** This project must be conducted in accordance with the description in the application and revised materials for which ethics clearance has been granted. All subsequent modifications to the application must be submitted for prior ethics review using ORE Form 104 and must not be initiated until notification of ethics clearance has been received.

**Note 2:** All ongoing research projects must undergo annual ethics review. ORE Form 105 is used for this purpose and must be submitted by the Faculty Investigator/Supervisor (FIFS) when requested by the ORE. Researchers must submit a Form 105 at the conclusion of the project if it continues for less than a year.

**Note 3:** FIs and FSSs also are reminded that they must immediately report to the ORE (using ORE Form 106) any events related to the procedures used that adversely affected the participants and the steps taken to deal with these.

Susan E. Sykes, Ph.D., C.Psych.  
Director, Office of Research Ethics

*7/15/2011*  
Date

OR  
Susanne Santi, M. Math  
Senior Manager, Research Ethics

OR  
Julie Joza, B.Sc.  
Manager, Research Ethics

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## Urban Sustainability Indicator Evaluation Matrix Application

## Appendix J

### FCM QOLRS

Type of Indicator (Domain)	Potential Indicator	Sustainability Goals								Indicator Selection Criteria							Pressure	State	Response
		1	2	3	4	5	6	7	8	A	B	C	D	E	F	G			
<b>Demographic and Background Information</b>	Population Growth									X	X	X	X	X				X	
	Household Size									X	X		X	X				X	
	Family Composition									X	X		X	X				X	
	Average Income	X								X	X	X	X	X				X	
	Renters & Owners		X							X	X	X	X	X				X	
	Population Mobility		X							X	X	X	X	X				X	
	Immigration									X	X		X	X				X	
	Language Spoken at Home									X	X		X	X				X	
	Visible Minorities									X	X	X	X	X				X	
<b>Affordable, Appropriate Housing</b>	Aboriginal Population									X	X	X	X	X				X	
	Rental Housing Affordability		X	X						X	X	X	X	X			X	X	
	Homeowner Affordability		X	X						X	X	X	X	X			X	X	
	Core Housing Need		X							X	X	X	X	X			X	X	
	Substandard Units	X	X							X	X	X	X	X			X	X	
	Changing Face of Homelessness		X							X	X	X	X	X			X	X	
	Vacancy Rates	X								X	X	X	X	X			X	X	
	Rental Housing Starts		X							X	X	X	X	X			X	X	
	Monthly Rent		X							X	X	X	X	X			X	X	
<b>Civic Engagement</b>	Cost of Housing		X	X						X	X	X	X	X			X	X	
	Overcrowding		X	X						X	X	X	X	X			X	X	
	Voter Turnout							X		X	X	X	X	X	X		X		
	Women in Municipal Government		X	X						X	X	X	X	X			X	X	
<b>Community and Social Infrastructure</b>	Volunteering			X						X	X	X	X	X			X	X	
	Charitable Donations									X	X	X	X	X			X	X	
	Social Housing Waiting Lists		X	X						X	X	X	X	X	X		X		
	Rent-Geared-to-Income Housing		X	X						X	X	X	X	X			X	X	
	Subsidized Child Care		X	X						X	X	X	X	X			X	X	
	Community and Social Services Occupations		X							X	X	X	X	X			X	X	
	Recreation Facilities									X	X	X	X	X			X	X	

	Cultural Facilities						X	X	X	X	X		X		X	
	Long Term Care Facilities						X	X	X	X	X		X		X	
	Recreation Programs						X	X	X	X	X		X		X	
	Libraries						X	X	X	X	X		X		X	
	Access to Health Care Professionals	X	X				X	X	X	X	X	X	X		X	
<b>Education</b>	Education Levels	X	X				X	X	X	X	X	X	X		X	
	Literacy Levels	X	X				X	X	X	X	X	X	X		X	
	Classroom Size	X					X	X	X	X	X	X	X		X	
	Composite Learning Index	X	X	X			X	X	X		X		X		X	
	Education Occupations	X	X	X			X	X	X	X	X	X	X		X	
<b>Employment and Local Economy</b>	Business Bankruptcies	X					X	X	X	X	X		X		X	
	Consumer Bankruptcies	X	X				X	X	X	X	X		X		X	
	Hourly Wages	X	X				X	X	X	X	X		X		X	
	Change in Family Income	X	X				X	X	X	X	X		X		X	
	Building Permits						X	X	X	X	X		X		X	
	Unemployment	X	X	X			X	X	X	X	X	X	X		X	
	Immigrant Unemployment	X	X				X	X	X	X	X	X	X		X	
	Quality of Employment	X	X	X				X	X	X	X		X		X	
	Labour Force Replacement	X	X	X			X	X	X	X	X		X		X	
<b>Natural Environment</b>	Air Quality	X		X	X			X	X	X	X	X	X		X	
	Commuting Distance	X	X	X	X			X	X	X	X	X		X	X	
	Mode of Transportation	X		X	X			X	X	X	X	X		X	X	
	Density	X		X				X	X	X	X	X	X	X		X
	Water Consumption	X		X	X			X	X	X	X	X	X	X	X	
	Wastewater Treatment	X		X	X			X	X	X	X	X	X	X	X	
	Waste Diversion	X		X	X			X	X	X	X	X	X	X	X	
	Recreational Water Quality	X		X				X	X	X	X	X	X	X		X
	Drinking Water Quality	X		X				X	X	X	X	X	X	X		X
	Ecological Footprint	X		X	X			X	X	X	X	X		X	X	
<b>Personal and Community Health</b>	Low Birth Weight Babies							X	X	X	X	X		X		X
	Teen Birthrate	X	X					X	X	X	X	X		X		X
	Premature Mortality	X						X	X	X	X	X		X		X
	Infant Mortality	X						X	X	X	X	X		X		X
	Body Mass Index	X						X	X	X	X	X		X		X
	Smoking Status	X						X	X	X	X	X		X		X
	Life Expectancy	X						X	X	X	X	X		X		X
	Physical Activity	X						X	X	X	X	X		X		X
	Prevalence of Asthma	X						X	X	X	X	X		X		X

	Mental Health		X						X	X	X	X	X		X	X	
<b>Personal Financial Security</b>	Families Receiving Social Assistance		X	X					X	X	X	X	X		X	X	
	Families Receiving EI		X	X					X	X	X	X	X		X	X	
	Incidence of Low Income Families		X	X					X	X	X	X	X		X	X	
	Children Living in Poverty		X	X					X	X	X	X	X		X	X	
	Income Gap		X	X					X	X	X	X	X		X	X	
	Social Assistance Rates		X	X					X	X	X	X	X		X	X	
	Working Poor		X	X					X	X	X	X	X		X	X	
	Community Affordability		X	X					X	X	X	X	X		X	X	
	Transit Affordability		X	X					X	X	X	X	X		X	X	
	Food Insecurity	X	X	X	X				X	X	X		X		X	X	
<b>Personal Safety</b>	Young Offenders		X						X	X	X	X	X		X	X	
	Violent Crimes								X	X	X	X	X		X	X	
	Property Crimes		X						X	X	X	X	X		X	X	
	Criminal Code Offences		X						X	X	X	X	X		X	X	
	Police Per Capita								X	X	X	X	X		X	X	
	Weapons Violations		X						X	X	X	X	X		X	X	
	Drug Violations		X						X	X	X	X	X		X	X	
	Traffic Incidents								X	X	X	X	X		X	X	
	Emergency Services Occupations								X	X	X	X	X		X	X	

Source: Adapted from (Federation of Canadian Municipalities, 2010; V. W. Maclare, 1996)

## Statistics Canada's Trends in Cities Project

Type of Indicator (Domain)	Potential Indicator	Sustainability Goals								Indicator Selection Criteria							Pressure	State	Response
		1	2	3	4	5	6	7	8	A	B	C	D	E	F	G			
Air Quality	Ambient Air Quality (Human Activity and Environment report – Environment Canada)	X			X	X				X	X	X	X	X	X	X		X	
Water Quality	Sewage Treatment Levels (primary, waste, secondary, and tertiary treatments – Environment Canada: Municipal Use Database (MUD))	X			X	X				X	X	X	X	X	X	X			
	Boil Days Advisories	X								X	X	X	X	X	X	X			X
Water Use	Domestic Water Use (litres per capita, per day – Environment Canada: MUD Industrial Water Use)	X			X	X				X	X	X	X	X			X	X	
	Total Water Use (litres per capita, per day)	X			X	X				X	X	X	X	X	X	X			
Environmental Impacts Outside of Municipalities/ Cities	Estimated Livestock Manure by Basin and Sub-sub-basin (based on livestock data from Census of Agriculture data with a coefficient applied – Manure report on StatsCan Website)	X			X					X	X	X		X			X	X	
	Nitrogen, Phosphorous, Coliform, and Fecal Coliform	X			X					X	X	X		X	X	X			X
	Pesticide Sales per Hectare	X			X					X	X	X	X	X			X	X	
	Fertilizer Application Rates (tonnes/ha – Agriculture Census)	X			X					X	X	X	X	X			X	X	
	Area Treated by Pesticides and Fertilizers	X			X					X	X	X	X	X			X	X	
Urban Land and Urban Land Use	Urban Land Use and Consumption of Agricultural Land by Water Drainage Basin (km <sup>2</sup> )	X			X	X				X	X	X	X	X			X	X	
	Population of Urban Centres (Statistics Canada Census)									X	X	X	X	X			X		X
Consumption of Agricultural Land	Conversion of prime agricultural land to urban development (cities/ municipalities have more accurate information than StatsCan)	X			X	X				X	X	X	X	X			X	X	
Population	Population by									X	X	X	X	X				X	

<b>Density by sub-sub-basin (Human activity measure)</b>	environmental geography (derived from census data)																	
<b>Transportation</b>	Travel by mode to work by municipality (StatsCan census)	X			X				X	X	X	X	X		X	X		X
<b>Waste Management</b>	Disposal (volume to landfill and incineration – StatsCan collects this data, but has trouble publishing due to confidentiality)	X			X	X			X	X	X	X	X	X	X	X		
	Recycling by material type	X			X	X			X	X	X	X	X	X	X	X		X
	Waste generation by residential and non-residential sources	X			X	X			X	X	X	X	X	X	X	X		
	Municipal expenditures on water and sewage treatment (StatsCan Econnections)	X			X	X			X	X	X	X	X		X			X
<b>Household Sustainable Consumption</b>	Drinking water quality and water conservation (StatsCan household environment survey – reported in Human activity and environment reports)	X	X		X	X			X	X	X	X	X	X	X		X	
	Waste management and recycling practices	x			X	X	X		X	X	X	X	X	X	X			X
	Pesticide and fertilizer use	X			X				X	X	X	X	X		X	X		
	Purchase of ‘green’ products	X			X		X		X	X	X	X		X			X	
	Individual/household participation in environmentally related activities	X			X		X		X	X	X	X		X			X	
	Commuting patterns and relationship to climate change	X			X				X	X	X	X		X			X	

Source: Adapted from (Anielski & Winfield, 2002; V. W. Maclare, 1996)

## Alberta's Genuine Progress Indicators

Type of Indicator (Domain)	Potential Indicator	Sustainability Goals								Indicator Selection Criteria							Pressure State	Response
		1	2	3	4	5	6	7	8	A	B	C	D	E	F	G		
<b>Environmental</b>	Oil, Gas Reserve Life	X			X	X				X	X		X					X
	Oil Sands Reserve Life	X			X	X				X	X		X					X
	Energy Use	X			X	X				X	X	X	X	X	X	X		
	Agricultural Sustainability	X			X	X				X	X		X		X	X		
	Timber Sustainability	X			X	X				X	X	X	X			X		X
	Forest Fragmentation	X			X	X				X	X	X	X			X		X
	Fish and Wildlife	X			X	X				X	X	X	X			X		X
	Parks and Wilderness	X			X	X				X	X	X	X			X		X
	Wetlands	X			X	X				X	X	X	X			X		X
	Peatlands	X			X	X				X	X		X			X		X
	Water Quality	X			X					X	X	X	X	X	X			X
	Air Quality	X			X					X	X	X	X	X	X			X
	Greenhouse Gas Emissions	X			X					X	X	X	X	X	X			
	Carbon Budget	X			X					X	X	X	X	X	X			X
	Hazardous Waste	X			X	X				X	X	X	X	X	X	X		
	Landfill Waste	X			X	X				X	X	X	X	X	X	X		
	Ecological Footprint	X			X	X				X	X	X	X	X	X	X		
<b>Social</b>	Poverty	X	X							X	X	X	X	X		X		X
	Income Distribution	X	X							X	X	X	X	X		X		X
	Unemployment	X	X							X	X	X	X	X		X		X
	Underemployment	X	X							X	X	X	X	X		X		X
	Paid Work	X								X	X	X	X	X		X		X
	Household Work	X								X	X	X	X	X		X		X
	Parenting and Eldercare	X								X	X	X	X	X		X		X
	Free Time	X								X	X	X	X	X		X		X
	Volunteerism									X	X	X	X	X		X		X
	Commuting									X	X	X	X	X		X		X
	Life Expectancy	X								X	X	X	X	X		X		X
	Premature Mortality	X								X	X	X	X	X		X		X
	Infant Mortality	X								X	X	X	X	X		X		X
	Obesity	X								X	X	X	X	X		X		X
	Suicide	X								X	X	X	X	X		X		X
	Drug Use	X								X	X	X	X	X		X		X
	Auto Crashes									X	X	X	X	X		X		X
	Divorce									X	X	X	X	X		X		X
	Crime	X								X	X	X	X	X		X		X
	Problem Gambling	X								X	X	X	X	X		X		X
	Voter Participation					X				X	X	X	X	X	X			X
	Educational Attainment	X			X					X	X	X	X	X	X			X

<b>Economic</b>	Economic Growth	X						X	X	X	X	X		X	X	
	Economic Diversity	X	X	X				X	X	X	X	X		X	X	
	Trade	X						X	X	X	X	X		X	X	
	Disposable Income	X	X					X	X	X	X	X		X	X	
	Weekly Wage Rate	X	X					X	X	X	X	X		X	X	
	Personal Expenditure	X	X					X	X	X	X	X		X	X	
	Transportation Expenditure							X	X	X	X	X		X	X	
	Taxes							X	X	X	X	X		X	X	
	Savings Rate	X	X					X	X	X	X	X		X	X	
	Household Debt	X	X					X	X	X	X	X		X	X	
	Public Infrastructure		X					X	X	X	X	X		X	X	
	Household Infrastructure		X					X	X	X	X	X		X	X	

Source: Adapted from (V. W. Maclaren, 1996; Pembina Institute for Appropriate Development, 2005)

## Siemen's US and Canada Green Cities Index

Type of Indicator (Domain)	Potential Indicator	Sustainability Goals								Indicator Selection Criteria							Pressure	State	Response
		1	2	3	4	5	6	7	8	A	B	C	D	E	F	G			
CO <sub>2</sub>	CO <sub>2</sub> emissions per unit GDP	X				X				X	X	X	X	X	X	X	X		
	CO <sub>2</sub> emissions per person	X	X		X					X	X	X	X	X	X	X			
	CO <sub>2</sub> reduction strategy	X	X			X		X	X	X	X	X	X	X		X			X
Energy	Electricity consumption per unit of GDP	X			X					X	X	X	X	X	X	X	X		
	Electricity consumption per person	X	X		X					X	X	X	X	X	X	X	X		
	Clean and efficient energy policies	X	X			X		X	X	X	X	X	X			X			X
Land Use	Green spaces	X	X		X					X	X	X	X	X			X		X
	Population density	X								X	X	X	X	X			X		X
	Green land use policies	X	X			X		X	X	X	X	X	X			X			X
	Urban sprawl	X		X						X	X	X	X	X			X	X	
Buildings	Number of LEED-certified buildings	X								X	X	X	X	X			X		X
	Energy efficient building standards	X	X			X		X	X	X	X	X	X			X			X
	Energy efficient building incentives	X	X			X		X	X	X	X	X	X			X			X
Transport	Share of workers travelling by public transit, bicycle, or foot	X	X							X	X	X	X	X			X		X
	Public transport supply	X	X							X	X	X	X	X			X		X
	Average commute time from residence to work	X								X	X	X	X				X		X
	Green transport promotion	X	X			X		X	X	X	X	X	X			X			X
	Congestion reduction policies	X	X			X		X	X	X	X	X	X			X			X
Water	Water consumption per capita	X	X		X					X	X	X	X	X	X	X			
	Water system leakages	X	X		X					X	X	X	X	X	X	X			
	Water quality policy	X	X			X		X	X	X	X	X	X			X			X
Waste	Stormwater management policy	X	X			X		X	X	X	X	X	X	X		X			X
	Percent of municipal solid waste recycled	X	X		X					X	X	X	X	X	X	X			X
	Waste reduction	X	X		X		X		X	X	X	X	X	X	X	X		X	X

	policies																		
<b>Air</b>	Nitrogen oxides emissions	X		X					X	X	X		X	X	X	X			
	Sulphur dioxide emissions	X		X					X	X	X		X	X	X	X			
	PM <sub>10</sub> emissions	X		X					X	X	X		X	X	X	X			
	Clean air policy	x		X			X		X	X	X	X	X	X		X		X	
<b>Environmental Governance</b>	Green action plan	X		X			X	X	X	X	X	X	X	X		X		X	
	Green management	X		X			X	X	X	X	X	X	X	X		X		X	
	Public participation in green policy	X		X			X	X	X	X	X	X	X	X		X		X	

Source: Adapted from (V. W. Maclare, 1996; Siemens Economist Intelligence Unit, 2011)

**Environmental****Energy***Quantitative*

- Electricity consumption (per person or unit of GDP)
  - o Similar: Energy use
- Oil, gas reserve life
- Oil sands reserve life

*Qualitative*

- Clean and Efficient Energy Policies

**Land Use***Quantitative*

- Green Spaces
- Population Density
  - o Similar: Population density of urban centers
  - o Cross-cutting with Demographic and Background, Housing
- Number of LEED certified buildings

*Qualitative*

- Green land use policies
- Energy efficient building standards
- Energy efficient building incentives

*Unsure how to measure*

- Urban sprawl
  - o Cross-cutting with Environmental Impacts Outside Cities

**Transport***Quantitative*

- Mode of transportation
  - o Similar: Share of workers travelling to work by public transit, bike, or foot
  - o Similar: Travel by mode to work
- Commute distance
  - o Similar: Average commute time from residence to work

*Qualitative*

- Green transport promotion
- Congestion reduction policies

*Unsure how to measure*

- Commuting patterns and relationship to climate change
  - o Cross-cutting with Civic Engagement

**Water**

*Quantitative*

- Water consumption
  - o Similar: Water consumption per capita
  - o Similar: Domestic or total water use
- Water quality
  - o Similar: Recreational or drinking water quality
- Wastewater treatment
  - o Similar: Sewage treatment levels (primary, secondary, tertiary)
- Boil days advisories
- Municipal expenditures on water and wastewater treatment
- Household drinking water quality and consumption (Statscan household survey)
  - o Cross-cutting with Civic Engagement

*Qualitative*

- Water quality policy
- Storm water management policy

**Waste**

*Quantitative*

- Waste diversion
  - o Similar: Percent of municipal solid waste recycled
  - o Similar: Recycling by material type
- Disposal (amount to landfill or incineration)
  - o Similar: Waste generation by residential and non-residential sources
  - o Similar: Landfill waste
- Hazardous waste

*Qualitative*

- Waste reduction policies

*Unsure how to measure*

- Household waste management and recycling practices
  - o Cross-cutting with Civic Engagement

## Air

### *Quantitative*

- CO<sub>2</sub> emissions (per person or GDP)
- Nitrogen oxides emissions
- Sulphur dioxide emissions
- PM<sub>10</sub> emissions
- Ambient air quality
  - o Similar: Air quality
- Greenhouse gas emissions

### *Qualitative*

- CO<sub>2</sub> reduction strategy
- Clean air policy

### *Unsure how to measure*

- Carbon budget

## Environmental Governance

### *Qualitative*

- Green action plan
- Green management
- Public participation in green policy
  - o Cross-cutting with Civic Engagement

## Environmental Impacts Outside Cities

### *Quantitative*

- Nitrogen, phosphorous, coliform, and fecal coliform
- Pesticide sales per hectare
- Fertilizer application rates
- Area treated by pesticides and fertilizers
- Conversion of prime agricultural land to urban development
  - o Similar: Urban land use and consumption of agricultural land by water drainage basin
- Agricultural sustainability
- Timber sustainability
- Forest fragmentation
- Fish and wildlife
- Parks and wilderness

- Wetlands
- Peatlands
- Ecological footprint

## **Social**

### **Demographic and Background**

#### *Quantitative*

- Average income
  - o Cross-cutting with Employment, Financial Security
- Renters and owners
  - o Cross-cutting with Housing
- Visible minorities
- Aboriginal population
- Population by environmental geography

#### *Unsure how to measure*

- Population mobility
  - o Cross-cutting with Transport

### **Housing**

#### *Quantitative*

- Rental housing affordability
- Homeowner affordability
- Core housing need
- Vacancy rates
- Rental housing starts
- Monthly rent
- Cost of housing

#### *Qualitative*

- Changing face of homelessness

#### *Unsure how to measure*

- Substandard units
- Overcrowding

### **Civic Engagement**

#### *Quantitative*

- Voter turnout
  - o Similar: Voter participation

- Women in municipal government
- Volunteering
- Charitable donations

*Unsure how to measure*

- Household pesticide and fertilizer use
- Purchase of ‘green’ products
- Individual/household participation in environmentally related activities

## **Social Infrastructure**

*Quantitative*

- Social housing waiting lists
  - o Cross-cutting with Housing
- Rent-geared-to-income housing
  - o Cross-cutting with Housing
- Subsidized child care
- Community and social services occupations
- Access to health care professionals
  - o Cross-cutting with Health
- Household work
- Parenting and eldercare
- Public infrastructure

## **Education**

*Quantitative*

- Educational attainment
  - o Similar: Education levels
- Literacy levels
- Classroom size
- Composite learning index
- Education occupations

## **Health**

*Quantitative*

- Teen birthrate
- Premature mortality

- Infant mortality
- Body mass index
- Smoking status
- Life expectancy
- Physical activity
- Prevalence of asthma
- Free time
- Obesity
- Suicide
- Drug use
- gambling

*Unsure how to measure*

- Mental health

**Safety**

*Quantitative*

- Young offenders
- Property crimes
- Criminal code offences
  - o Similar: Crime
- Weapons violations
- Drug violations

**Financial Security**

*Quantitative*

- Change in family income
  - o Cross-cutting with Employment
- Families receiving social assistance
  - o Similar: Social assistance rates
- Families receiving EI
- Incidence of low income families
- Children living in poverty
- Income gap
  - o Similar: Income distribution
- Working poor
- Community affordability

- Cross-cutting with Housing
- Transit affordability
  - Cross-cutting with Transport
- Poverty
- Underemployment
  - Cross-cutting with Employment
- Paid work
  - Cross-cutting with Employment
- Household disposable income
- Personal expenditure
- Savings rate
- Household debt

*Unsure how to measure*

- Food insecurity
  - Cross-cutting with Environmental Impacts Outside Cities, Local Economy
- Household infrastructure

## Economic

### **Employment**

*Quantitative*

- Hourly wages
  - Cross-cutting with Financial Security
  - Similar: Weekly wage rate
- Unemployment
  - Cross-cutting with Financial Security
- Immigrant unemployment
  - Cross-cutting with Financial Security
- Labour force replacement
  - Cross-cutting with Local Economy

*Qualitative*

- Quality of employment

### **Local Economy**

- Business bankruptcies
- Consumer bankruptcies
  - Cross-cutting with Financial Security

- Economic growth

*Unsure how to measure*

- Economic diversity
- Trade

## Repopulated Urban Sustainability Indicator Evaluation Matrix

## Appendix L

Type of Indicator (Domain)	Potential Indicator	Sustainability Goals								Indicator Selection Criteria							Pressure State	Response
		1	2	3	4	5	6	7	8	A	B	C	D	E	F	G		
<b>Environmental Indicators</b>																		
Energy	Electricity consumption per unit of GDP	X			X					X	X	X	X	X	X	X	X	
	Electricity consumption per person	X	X	X						X	X	X	X	X	X	X	X	
	Energy Use	X		X	X					X	X	X	X	X	X	X	X	
	Clean and efficient energy policies	X	X			X				X	X	X	X	X		X		X
Land Use	Green spaces	X	X	X						X	X	X	X	X		X		X
	Population density (Cross-cutting with Housing)	X								X	X	X	X	X		X		X
	Number of LEED-certified buildings	X								X	X	X	X	X		X		X
	Green land use policies	X	X			X				X	X	X	X	X		X		X
	Energy efficient building standards	X	X			X				X	X	X	X	X		X		X
	Energy efficient building incentives	X	X			X				X	X	X	X	X		X		X
	Urban sprawl	X		X						X	X	X	X	X		X	X	
Transport	Mode of Transportation	X		X	X					X	X	X	X	X		X	X	
	Share of workers travelling by public transit, bicycle, or foot	X	X							X	X	X	X	X		X		X
	Travel by mode to work by municipality (StatsCan census)	X			X					X	X	X	X	X		X	X	X
	Commuting Distance	X	X	X	X					X	X	X	X	X		X	X	
	Average commute time from residence to work	X								X	X	X	X	X		X		X
	Green transport promotion	X	X			X				X	X	X	X	X		X		X
	Congestion reduction policies	X	X			X				X	X	X	X	X		X		X
	Commuting patterns and relationship to climate change (Cross-cutting with civic engagement)	X			X					X	X	X	X	X		X		X

	Population Mobility		X						X	X	X	X	X			X	
<b>Water</b>	Water consumption per capita	X	X		X				X	X	X	X	X	X	X	X	
	Water Consumption	X		X	X				X	X	X	X	X	X	X	X	
	Domestic Water Use (litres per capita, per day – Environment Canada: MUD Industrial Water Use)	X		X	X				X	X	X	X	X		X	X	
	Total Water Use (litres per capita, per day)	X		X	X				X	X	X	X	X	X	X	X	
	Water Quality	X		X					X	X	X	X	X	X	X		X
	Recreational Water Quality	X		X					X	X	X	X	X	X	X		X
	Drinking Water Quality	X		X					X	X	X	X	X	X	X		X
	Wastewater Treatment	X		X	X				X	X	X	X	X	X	X	X	
	Sewage Treatment Levels (primary, waste, secondary, and tertiary treatments – Environment Canada: Municipal Use Database (MUD))	X		X	X				X	X	X	X	X	X	X		
	Boil Days Advisories	X							X	X	X	X	X	X	X		X
	Municipal expenditures on water and sewage treatment (StatsCan Econnections)	X		X	X				X	X	X	X	X		X		X
	Drinking water quality and water conservation (StatsCan household environment survey – reported in Human activity and environment reports) (Cross-cutting with Civic Engagement)	X	X		X	X			X	X	X	X	X	X		X	
	Water quality policy	X		X		X		X	X	X	X	X	X		X		X
	Stormwater management policy	X		X		X		X	X	X	X	X	X		X		X
<b>Waste</b>	Waste Diversion	X		X	X				X	X	X	X	X	X	X	X	
	Percent of	X	X	X					X	X	X	X	X	X	X		X

	municipal solid waste recycled																		
	Recycling by material type	X		X	X			X	X	X	X	X	X	X	X				X
	Disposal (volume to landfill and incineration – StatsCan collects this data, but has trouble publishing due to confidentiality)	X		X	X			X	X	X	X	X	X	X	X				
	Waste generation by residential and non-residential sources	X		X	X			X	X	X	X	X	X	X	X				
	Landfill Waste	X		X	X			X	X	X	X	X	X	X	X				
	Hazardous Waste	X		X	X			X	X	X	X	X	X	X	X				
	Waste reduction policies	X	X	X		X	X	X	X	X	X	X	X	X	X				X
	Waste management and recycling practices (Cross-cutting with Civic Engagement)	X		X	X	X		X	X	X	X	X	X	X	X				X
Air	CO <sub>2</sub> emissions per unit GDP	X			X			X	X	X	X	X	X	X	X				
	CO <sub>2</sub> emissions per person	X	X	X				X	X	X	X	X	X	X	X				
	Nitrogen oxides emissions	X	X	X				X	X	X		X	X	X	X				
	Sulphur dioxide emissions	X	X	X				X	X	X		X	X	X	X				
	PM <sub>10</sub> emissions	X	X	X				X	X	X		X	X	X	X				
	Ambient Air Quality (Human Activity and Environment report – Environment Canada)	X		X	X			X	X	X	X	X	X	X	X				X
	Air Quality	X		X				X	X	X	X	X	X	X	X				X
	Greenhouse Gas Emissions	X		X				X	X	X	X	X	X	X	X				
	CO <sub>2</sub> reduction strategy	X	X		X	X	X	X	X	X	X	X	X	X	X				X
	Clean air policy	X	X		X	X	X	X	X	X	X	X	X	X	X				X
	Carbon Budget	X		X				X	X	X	X	X	X	X	X				X
Environmental Governance	Green action plan	X	X		X	X	X	X	X	X	X	X	X	X	X				X
	Green management	X	X		X	X	X	X	X	X	X	X	X	X	X				X
	Public participation in green policy (Cross-cutting with Civic Engagement)	X	X		X	X	X	X	X	X	X	X	X	X	X				X
Environmental Impacts	Nitrogen, Phosphorous,	X		X				X	X	X		X	X	X	X				X

<b>Outside Cities</b>	Coliform, and Fecal Coliform																
	Pesticide Sales per Hectare	X		X				X	X	X	X	X		X	X		
	Fertilizer Application Rates (tonnes/ha – Agriculture Census)	X		X				X	X	X	X	X		X	X		
	Area Treated by Pesticides and Fertilizers	X		X				X	X	X	X	X		X	X		
	Conversion of prime agricultural land to urban development (cities/municipalities have more accurate information than StatsCan)  <span style="color:red">(Cross-cutting with Land Use)</span>	X		X	X			X	X	X	X	X		X	X		
	Urban Land Use and Consumption of Agricultural Land by Water Drainage Basin (km <sup>2</sup> )  <span style="color:red">(Cross-cutting with Land Use)</span>	X		X	X			X	X	X	X	X		X	X		
	Agricultural Sustainability	X		X	X				X	X		X		X		X	
	Timber Sustainability	X		X	X				X	X	X	X		X		X	
	Forest Fragmentation	X		X	X				X	X	X	X		X		X	
	Fish and Wildlife	X		X	X				X	X	X	X		X		X	
	Parks and Wilderness	X		X	X				X	X	X	X		X		X	
	Wetlands	X		X	X				X	X	X	X		X		X	
	Peatlands	X		X	X				X	X		X		X		X	
	Ecological Footprint	X		X	X				X	X	X	X	X	X	X	X	
<b>Social Indicators</b>																	
<b>Housing</b>	Renters & Owners			X					X	X	X	X	X			X	
	Rental Housing Affordability		X	X					X	X	X	X	X		X		X
	Homeowner Affordability		X	X					X	X	X	X	X		X		X
	Core Housing Need		X						X	X	X	X	X		X		X
	Vacancy Rates	X							X	X	X	X	X		X		X
	Rental Housing Starts		X						X	X	X	X	X		X		X
	Monthly Rent	X							X	X	X	X	X		X		X
	Cost of Housing		X	X					X	X	X	X	X		X		X
	Changing Face of Homelessness		X						X	X	X	X	X		X		X
	Substandard Units		X	X					X	X	X	X	X		X		X

	Overcrowding		X	X				X	X	X	X	X		X		X	
<b>Civic Engagement</b>	Voter Turnout					X		X	X	X	X	X	X	X		X	
	Women in Municipal Government		X	X				X	X	X	X	X		X		X	
	Volunteering			X				X	X	X	X	X		X		X	
	Pesticide and fertilizer use (household)	X			X			X	X	X	X	X		X	X		
	Purchase of 'green' products	X			X	X		X	X	X	X			X			X
	Individual/household participation in environmentally related activities	X			X	X		X	X	X	X			X			X
<b>Social Infrastructure</b>	Social Housing Waiting Lists <i>(Cross-cutting with Housing)</i>		X	X				X	X	X	X	X	X			X	
	Rent-Geared-to-Income Housing <i>(Cross-cutting with Housing)</i>		X	X				X	X	X	X			X		X	
	Subsidized Child Care		X	X				X	X	X	X	X		X		X	
	Community and Social Services Occupations		X					X	X	X	X	X		X		X	
	Access to Health Care Professionals <i>(Cross-cutting with Health)</i>		X	X				X	X	X	X	X	X			X	
	Household Work		X					X	X	X	X	X		X		X	
	Parenting and Eldercare		X					X	X	X	X	X		X		X	
	Public Infrastructure			X				X	X	X	X	X		X		X	
<b>Education</b>	Educational Attainment		X			X		X	X	X	X	X	X			X	
	Literacy Levels		X	X				X	X	X	X	X	X			X	
	Classroom Size		X					X	X	X	X	X	X			X	
	Composite Learning Index		X	X	X			X	X	X		X		X		X	
	Education Occupations		X	X	X			X	X	X	X	X	X			X	
<b>Health</b>	Teen Birthrate		X	X				X	X	X	X	X		X		X	
	Premature Mortality		X					X	X	X	X	X		X		X	
	Infant Mortality		X					X	X	X	X	X		X		X	
	Body Mass Index		X					X	X	X	X	X		X		X	
	Smoking Status		X					X	X	X	X	X		X		X	
	Life Expectancy		X					X	X	X	X	X		X		X	
	Physical Activity		X					X	X	X	X	X		X		X	
	Prevalence of Asthma		X					X	X	X	X	X		X		X	
	Free Time		X					X	X	X	X	X		X		X	
	Obesity		X					X	X	X	X	X		X		X	
	Suicide		X					X	X	X	X	X		X		X	

	Drug Use	X					X	X	X	X	X	X	X	X	
	Problem Gambling	X					X	X	X	X	X	X	X	X	
	Mental Health	X					X	X	X	X	X	X	X	X	
<b>Safety</b>	Young Offenders	X					X	X	X	X	X	X	X	X	
	Property Crimes	X					X	X	X	X	X	X	X	X	
	Criminal Code Offences	X					X	X	X	X	X	X	X	X	
	Weapons Violations	X					X	X	X	X	X	X	X	X	
	Drug Violations	X					X	X	X	X	X	X	X	X	
<b>Financial Security</b>	Average Income (Cross-cutting with Employment)	X					X	X	X	X	X			X	
	Change in Family Income (Cross-cutting with Employment)	X	X				X	X	X	X	X	X	X	X	
	Families Receiving Social Assistance	X	X				X	X	X	X	X	X	X	X	
	Social Assistance Rates	X	X				X	X	X	X	X	X	X	X	
	Families Receiving EI	X	X				X	X	X	X	X	X	X	X	
	Incidence of Low Income Families	X	X				X	X	X	X	X	X	X	X	
	Children Living in Poverty	X	X				X	X	X	X	X	X	X	X	
	Income Gap	X	X				X	X	X	X	X	X	X	X	
	Income Distribution	X	X				X	X	X	X	X	X	X	X	
	Working Poor	X	X				X	X	X	X	X	X	X	X	
	Community Affordability (Cross-cutting with Housing)	X	X				X	X	X	X	X	X	X	X	
	Transit Affordability (Cross-cutting with Transport)	X	X				X	X	X	X	X	X	X	X	
	Poverty	X	X				X	X	X	X	X	X	X	X	
	Underemployment (Cross-cutting with Employment)	X	X				X	X	X	X	X	X	X	X	
	Paid Work (Cross-cutting with Employment)	X					X	X	X	X	X	X	X	X	
	Disposable Income	X	X				X	X	X	X	X	X	X	X	
	Personal Expenditure	X	X				X	X	X	X	X	X	X	X	
	Savings Rate	X	X				X	X	X	X	X	X	X	X	
	Household Debt	X	X				X	X	X	X	X	X	X	X	
	Food Insecurity (Cross-cutting with Environmental Impacts Outside)	X	X	X	X		X	X	X		X	X	X	X	

	Cities, Local Economy)														
	Household Infrastructure		X						X	X	X	X		X	X
<b>Economic Indicators</b>															
<b>Employment</b>	Hourly Wages (Cross-cutting with Financial Security)		X	X					X	X	X	X	X		X
	Weekly Wage Rate		X	X					X	X	X	X	X		X
	Unemployment (Cross-cutting with Financial Security)		X	X	X				X	X	X	X	X		X
	Immigrant Unemployment (Cross-cutting with Financial Security)		X	X					X	X	X	X	X		X
	Labour Force Replacement (Cross-cutting with Local Economy)		X	X	X				X	X	X	X	X		X
	Quality of Employment		X	X	X				X	X	X	X		X	X
<b>Local Economy</b>	Business Bankruptcies		X						X	X	X	X	X		X
	Consumer Bankruptcies (Cross-cutting with Financial Security)		X	X					X	X	X	X	X		X
	Economic Growth		X						X	X	X	X	X		X
	Economic Diversity		X	X	X				X	X	X	X	X		X
	Trade		X						X	X	X	X	X		X

Note: Similar indicators are placed next to each other and highlighted in matching colours.