

# **REPORT**

## **Definition of Sustainable Planning Principles- Community Energy Plan Action Area 6**

City of Yellowknife Community Energy  
Planning Committee

**JW PROJECT #: 1010784**

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## **REPORT NO. 1010784**

REPORT TO

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ON

Definition of Sustainable Planning  
Principles- Community Energy Plan Action  
Area 6

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**May 31, 2006**

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## EXECUTIVE SUMMARY

The way that cities are planned and built has a dramatic impact on the use of energy and emission of greenhouse gases. Recognizing this, Action Area 6 of the City of Yellowknife Community Energy Plan concentrates on the development of a set of sustainability planning principles with respect to energy use and greenhouse gas emission reductions. These principles are to be applied to all planning activities in the city and to guide the development of environmentally sustainable communities.

Human society and communities of Northern Canada in particular, are facing major challenges associated with surging energy costs and changing climate. A reduction in the availability of cheap sources of energy (i.e. fossil fuels) and the threat of the impacts of an approximately 5-degree rise in temperature over the next 20 years could have significant impacts on Yellowknife. Recognizing these challenges, the City of Yellowknife has joined the Partners for Climate Protection Program and is expected to commit to reduction targets for GHG emissions.

The City of Yellowknife currently has in place a variety of initiatives that have begun to move the city towards greater energy and GHG emissions reduction targets. The Interim Community Energy Plan has set eight priority action areas, supported by an Energy Experts Roundtable, and an Energy and GHG Emissions Baseline Study. Additionally, the 2004 General Plan and the 2002 Downtown Plan include elements of sustainability planning that have implications for both energy and GHG emission reductions. For example, both documents support compact form and mixed-use development as key goals.

To comprehensively address sustainability planning, several models, approaches and guidelines have been developed by the pioneers of the sustainability movement internationally. The principles of sustainability, developed by these models and adopted by various organizations including Canadian municipalities, have addressed both sustainability outcomes (i.e. definition of goals) and sustainability processes (i.e. definition of strategy). Some principles are highly conceptual, while others are more practical.

Six sustainability models or sets of sustainability principles have been explored in this report. The Natural Step Framework, Melbourne Principles on Sustainable Cities, and The Triple Bottom Line Approach are examples of sustainability models that define the goals of sustainability on a conceptual basis. Smart Growth Principles, New Urbanism, and LEED (Leadership in Energy and Environmental Design) Neighbourhood Standards are examples of sustainability models that define sustainability strategies that can be implemented on the ground.

To examine the applicability of potential sustainability principles in a Northern context, the approaches taken by five other municipalities have

been described. These include the City of Whitehorse, City of Iqaluit, Hamlet of Wha Ti, Village of Fort Simpson, and City and Borough of Juneau. In most cases these municipalities have adopted sustainability principles that are strategy-oriented and can become the basis for decision making on an action by action basis. The language of Smart Growth and New Urbanism is often found within sustainability planning principles adopted by Canadian municipalities, including the cities in the North.

Through the course of this project, the community of Yellowknife had the opportunity to consider the various possible sets of sustainability principles in dynamic and active discussion forums. The focus of the project was on creating a participatory process that would allow for bottom-up and organic formulation of sustainability planning principles that are suitable to the Yellowknife context, instead of imposing on the City principles developed elsewhere.

The corner-stone of this approach was two workshops organized in April 2006. The first workshop hosted about 20 invited stakeholders, while the second workshop was open to the public. During the first workshop project stakeholders, including City planning staff, territorial government staff, municipal councilor, local architects and engineers, real state developers, community groups, environmental organizations, and professional association representatives worked in small teams to analyze various possible sets of sustainability principles and identify those elements most useful to the Yellowknife Context. At the end of the stakeholder workshop, a set of draft sustainability planning principles were formulated. During the second workshop the general public, including all interested citizens, were invited to provide input based on their own unique experiences to edit, expand, modify and enhance the suggestions formulated during the stakeholder workshop. By the end of the public workshop, a set of revised sustainability planning principles were brought forward.

The result of the workshop process was the emergence a set of unique sustainability principles that draw on various schools of thought identified in the literature, while reflecting the values and realities of a small Northern community. The participatory consultation process led directly to recommended sustainability planning principles in four general groups. The first group recommends ways to move forward on sustainability through an overarching planning approach. The other three groups focus on recommendations directly related to energy and GHG emissions in three sectors: community form, transportation, and building design. The recommended sustainability planning principles for the City of Yellowknife are as follows:

### **Recommendations for Overall City Planning**

- Develop a 50-100 year community vision and plan
- Learn from historical patterns of development

- Make energy demand and GHG emissions reductions and life-cycle analysis the norm for decision making
- Put in place a more effective, integrative, participatory planning process
- Re-investigate and re-invest continually
- Respect the local and regional ecology

### **Recommendations on Community Form**

- Encourage a mix of housing, shops, offices etc.
- Pursue opportunities for residential infill
- Create a town center/ strong downtown
- Preserve green spaces in the community
- Control parking/ road footprints
- Promote sustainable subdivision design

### **Recommendations on Transportation**

- Move away from car-oriented development and focus on “quality of life”
- Invest and innovate in public transit
- Create a space for active transportation
- Encourage connectivity and make it easy for people to get from one place to another

### **Recommendations on Building Design**

- Use energy efficient components in buildings
- Build with the landscape and natural features
- Treat “waste” as a resource
- Encourage development of renewable energy
- Develop upfront sustainability codes and standards and build them into the development permitting process

The recommended principles presented in this report do not contradict, but rather complement and strengthen the sustainability planning policies already in place in Yellowknife. They describe the type and magnitude of change that is necessary to ensure that energy and GHG emissions issues are adequately addressed and point to the urgency for moving forward. To translate these principles into action the City needs to modify its investments, regulations, bylaws, zoning, and plans as appropriate. To be truly effective, these principles should become the basis of planning, including the creation of future land-use plans and zoning bylaws for the City of Yellowknife.

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## APPENDIX A ADDITIONAL WORKSHOP INFORMATION

# DEFINITION OF SUSTAINABLE PLANNING PRINCIPLES

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## 1.0 INTRODUCTION

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### 1.1 Context of Study

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The City of Yellowknife faces some major challenges, as well as some opportunities in terms of energy conservation and reduction of Greenhouse Gas (GHG) emissions. As a municipality, Yellowknife has declared its commitment to environmental quality through participation in such initiatives as the Federation of Canadian Municipality (FCM) Partners for Climate Protection Program. To meet its obligations under the FCM Program, and to realize the benefits of better managing its energy supply and use, the City Council approved the development of the Yellowknife Community Energy Plan in 2005.

Community Energy Plans (CEPs) are a somewhat recent concept among Canadian municipalities, responding to the need of communities to take action on key social and environmental problems such as climate change and energy security while saving money on their ever increasing energy bills where possible. With the help of FCM and several other sources of Federal funding, several communities across Canada have now developed or are currently developing their own CEPs. In the Yellowknife context, the CEP is seen to be a decision-making tool used by policy makers to guide the future of energy production, delivery and consumption in the community. Accordingly, a Community Energy Planning Committee (CEP Committee) was established in 2005 to help assist the City with the development of the CEP.

Since its conception the CEP Committee has taken major steps including hosting workshops, public meetings and roundtables, and commissioned a baseline study on energy and emissions. Based on this process the CEP Committee has identified eight priority action areas and made recommendations to Council on further actions in these specific areas. One of these recommendations is that the City “establishes guiding principles for environmentally sustainable communities and applies these principles to all planning activities” (Action Area 6). To address this CEP Action Area, the City of Yellowknife contracted Jacques Whitford Ltd. (Jacques Whitford) to conduct this study and recommend a set of sustainability principles directed at energy and GHG emission reduction as part of the CEP.

## 1.2 Purpose and Methodology

The CEP Action Areas identified by the CEP Committee cover a range of technical, social and financial needs. Some focus on specific methods and technologies (energy efficiency in buildings, renewable energies, and transportation); while others emphasize the need for societal transformations (greening of government culture, public education) and others explore the economic feasibility of implementation of such initiatives (external funding sources, and revolving funds). Action Area 6 has a more conceptual focus than all other Action Areas. It asks for a set of “principles” which would guide the direction of planning and growth undertaken within city boundaries, specific to energy and GHG emission reduction.

The focus of this specific study is on researching and recommending a set of sustainability principles that are

- a) directly or indirectly related to energy conservation and GHG emission reductions;
- b) associated with planning and growth in Yellowknife; and
- c) relevant in the Northern Canada context.

The study undertaken by Jacques Whitford involved a review of literature, a number of interviews with members of the CEP Committee and City staff, a Stakeholder Workshop, and a Community Workshop Session (see Appendix A). The review of literature examined the elements of sustainability and potential sustainability principles already in place in Yellowknife, the international academic literature on sustainability principles in planning, case studies of other Northern communities and their approach to sustainability, and some possible actions associated with sustainability principles.

Interviews and the two workshop sessions were used to share the information gathered from literature, to engage community members in the discussion of planning principles, and to formulate the recommended sustainability planning principles. During the Stakeholder Workshop (afternoon of April 25<sup>th</sup>, 2006) a select group of about twenty stakeholders were presented with the results of the literature review and examined each of the six sets of commonly used sustainability principles described in Section 4 of this report. Based on their discussion a draft set of principles for City of Yellowknife CEP was developed. During the Community Workshop (evening of April 25<sup>th</sup>, 2006) a group of interested citizens gathered to review the draft sustainability principles created earlier in the day during the Stakeholder Workshop, and to complement, flesh-out, and expand the draft principles based on their own experience of the community. The recommendations of this report are heavily based on the discussions during these two sessions and reflect the ideas of stakeholders and the larger community gathered through this participatory process.



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## 2.0 BACKGROUND

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### 2.1 Issues with Energy and Greenhouse Gases

In recent years the issues of energy and GHG reduction have entered the public and political consciousness as a result of a number of local, national and global challenges faced by humanity. Experts argue that the world is heading towards a global energy crisis due to a decline in the availability of cheap oil which currently provides the main energy source for most nations. The media often speaks of "peak oil", defined as the time at which half of the world's oil reserves have been used, at which point world oil production peaks and then goes into irreversible decline, becoming progressively harder to get at and increasingly more expensive. Meanwhile, the global consumption of energy continues to rise, magnifying the imbalance in supply and demand, thus driving oil prices higher and rendering energy less accessible. The idea that oil would peak sometime during the current decade was first proposed by American geophysicist Marion King Hubbert in 1956, and the potentially disastrous impacts of a now foreseeable end of cheap oil have been described by the Club of Rome (*The Limits to Growth*, 1972) and Richard Heinberg (*The Party is Over*, 2003) among others.

Scientists, academics, environmentalists, industrialists and activists have proposed and pursued a number of different approaches to tackling the current and emerging problems associated with the energy crisis. These include conservation measures (using less energy), energy efficiency measures (using energy more wisely), and diversifying energy sources (using alternative sources of energy). An integrated and holistic approach drawing on all three types of measures is required to adequately address the emerging problems.

On the other side of the energy crisis coin, there is the issue of GHG emissions and climate change. When conventional fuels such as oil, natural gas, coal, wood and peat are consumed to generate energy they release a number of by-products into the earth's atmosphere. A handful of such by-products including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), water vapour (H<sub>2</sub>O) and nitrate oxides (NO<sub>x</sub>), known as greenhouse gases, produce an "enhanced anthropogenic greenhouse effect". Similar to the glass wall of a greenhouse, GHGs prevent long wave solar radiation from escaping, leading to an overall increase in the average temperature of the earth's surface. The phenomenon is known as climate change (sometimes referred to as global warming) and has been shown to be responsible for broad changes in climate often with undesirable effects. Impacts of climate change include an increase in the frequency of extreme weather events, changes in ocean currents, melting of polar ice, changes in precipitation levels, change in the range and survival of animals, plants, insects and other species, and impacts on human societies such as availability of clean water, stability of homes and infrastructure, and food security. An

overwhelming majority of scientists now agree that human activities, in particular the generation and use of energy from fossil fuels, are responsible for these changes.

Recognizing that climate change is one of the most serious challenges faced by human society today, several approaches have developed to address it. There are two overall responses to climate change: adaptation and mitigation. Adaptation consists of reactive measures that respond to impacts of climate change already upon us with the hopes of adjusting human life to fit the new set of circumstances. Mitigation measures, on the other hand, are proactive and concentrate on changing human behaviour with the hopes of preventing, decelerating, delaying or reducing the level of climate change. Mitigation measures, which form the basis of the Kyoto Protocol, aim at reducing GHG emissions as the primary way of reducing climate change impacts.

The link between fossil-fuel based energy and GHG emissions means that the two problems are best addressed simultaneously. Most efforts that address energy problems through conservation, efficiency and alternative energies also address GHG emission reductions. For example, if less people drive in a community there is less oil dependence in that community (*i.e.* potentially smaller energy problems) and there are also fewer GHGs emitted (*i.e.* potentially smaller contribution to climate change). While the impacts of climate change are not necessarily observed in the same community where fossil fuels are burnt, a global solution to the two problems requires that each and every community reduces its own emissions to the extend possible.

Yellowknife currently uses about 5,582,424 GJ of energy and emits some 367,000 tonnes of CO<sub>2</sub>-equivalent in GHGs annually (City of Yellowknife Energy and Emissions Baseline, 2005). These numbers are expected to increase by about 19% over the next 10 years and can put significant financial, social and environmental burdens on both local and global communities. Recognizing the potential problems described above, and the link between energy use and GHG emissions, the Yellowknife CEP Committee has addresses the two issues together throughout the CEP process, of which the current study is a part.

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## 2.2 Analysis of Existing Initiatives in Yellowknife

There are currently a number of planning initiatives, policies, processes and documents in place in Yellowknife that have implications for sustainable planning and reductions in energy use and GHG emissions. Prior to drafting a new set of guiding principles for sustainable planning it is important to identify these and to understand how they already incorporate provision for sustainable use of energy and GHG reductions. Some current key documents and their application to the topic at hand are described briefly below.

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### 2.2.1 Interim Community Energy Plan

In November 2005 the CEP Committee issued an interim version of the CEP. This document is largely a narrative of what the CEP Committee has achieved since initiation, what funding is available for the CEP process and how it is being used, specifically with respect to the eight priority Action Areas defined by the CEP Committee. In addition, it establishes a framework of tasks needed to be undertaken to complete the CEP.

Of interest to the discussion on sustainability planning principles are the vision and goals for the CEP based on a visioning workshop. According to the Interim CEP report the vision for the City of Yellowknife is as follows:

*Vision: Through an ongoing Community Energy Planning approach, and with due consideration of economic, social and environmental costs and benefits, our community will strive to meet or exceed the standards of climate protection excellence as set out by the FCM's Partners for Climate Protection Program.*

The vision set out in the Interim CEP is accompanied by three goals.

- *Enlist the support of the community by providing information and encouraging participation in the community energy planning process;*
- *Create a CEP that will reduce GHG emissions through increased energy efficiency and use of renewable energy; and*
- *Create an innovative CEP that evolves with the community and technology.*

Implicit within the vision are already some indications of the sustainability principles the community is willing to embrace. Though the word “sustainability” is not mentioned in the vision, the language of sustainability is certainly present through the commitment to continuous community participation and commitment to considering economic, social and environmental costs and benefits simultaneously. The goals re-iterate the commitment to an inclusive, adaptive and continual planning process.

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### 2.2.2 Energy and Emissions Baseline Study

Commissioned by the CEP Committee and responding to the first of five Milestones of the FCM Partners for Climate Protection program, the Energy and Emissions Baseline Study provides an inventory of past, present and projected energy use and GHG emissions for the City of Yellowknife. The study shows that fuel types, emissions, levels of efficiency and available alternatives vary greatly among different sectors (residential, commercial, institutional and transportation). The recommendations point to the need for a flexible, adaptive and sector-specific planning process. A one-size-fits-all approach to sustainability is not practical or useful, but the numbers in the baseline study allow for identification of priorities and potential areas of action within each sector of the community.

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### 2.2.3 Energy Experts Roundtable Report

In July 2005 the City of Yellowknife hosted a day-long roundtable discussion for local energy experts. The task of the roundtable was to sort through a set of 24 potential action areas and identify priority actions that the CEP Committee and the City could act on immediately. The final results of the roundtable discussion were a set of eight Action Areas. The Action Areas include:

- Action Area 1: “House in order”- greening the municipal government
- Action Area 2: Transportation
- Action Area 3: Public involvement- education
- Action Area 4: Actively seeking funding from all sources
- Action Area 5: “Revolving” green fund
- Action Area 6: Environmentally sustainable guiding principles
- Action Area 7: Energy efficient building standards
- Action Area 8: Renewable energy and technologies

The Energy Experts Roundtable Report provides some details on the discussions that took place relating to each Action Area. Of interest are the notes from discussion under Action Area 6 as the point of genesis for this study. These notes suggest that the energy experts had somewhat various ideas in mind on what “environmentally sustainable guiding principles” would look like, though the discussion was primarily focused on principles that could be applied to physical city planning, in particular land-use planning and regulations. Topics of discussion included lot orientation, density, sprawl, subdivision design, energy efficiency codes, public transit, bike paths, and mixed use development. Specifically, references were made to the concept of Smart Growth as a possible paradigm for sustainability planning principles. This documentation confirms the need for the sustainability planning principles drafted in this report to focus on city planning as it relates to energy use and GHG emissions. It also suggests that there is considerable overlap between Action Area 6 and some of the other Action Areas, in particular Action Areas 2, 7 and 8.

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### 2.2.4 General Plan (Bylaw 4315)

Appreciating that the sustainability planning principles required by Action Area 6 need to focus on city planning, it is important to consult the key planning documents for the City. The current General Plan for City of Yellowknife was conceived in 2004 based on a Citizens’ Survey and forms the basis of planning and development for the city. The General Plan has sustainability language built into its very core. The first paragraph of the General Plan declares that “fundamentally, the 2004 General Plan direction and approach will facilitate community sustainability.”

The General Plan contains a set of seven high level principles, some of which are directly or indirectly linked to sustainability:

- *Community consultations;*
- *respecting legislation;*
- *balancing built and natural areas;*
- *rezoning for compact form;*
- *creating viable pedestrian and vehicular connections;*
- *meeting residential, commercial and institutional development needs; and*
- *encouraging partnerships.*

The commitment to environmental sustainability is built into the General Plan at the level of values, and with connection to planning considerations under three strategic directions: Environmental Responsibility, Infrastructure and Transportation.

The Environmental Responsibility direction identifies the “need for better building and design practices, including consideration of energy demand and use that facilitates sustainable community development.”

The Infrastructure direction asks for “research into new energy efficiency technologies to achieve maximum lifecycle in infrastructure” and a “review of existing water and sewer systems for purpose of upgrading energy efficiency”. Discussions on alternatives to standard sewage system including “heavy home” sewage treatment and water recycling systems, natural drainage systems, and energy efficient design are included.

Finally, the Transportation direction sets out the parameters for a sustainable transit system based on the following key principles:

- *Provide appropriate community densities;*
- *Provide mixed land uses (to accommodate a range of travel options or trip purposes);*
- *Organize density, land use and buildings to benefit from transit;*
- *Minimize passenger walking distances (maximum of 400 m);*
- *Create a pedestrian-friendly environment;*
- *Reduce transit travel time; and*
- *Build quality, user-friendly transit facilities (i.e. shelters, designated stops).*

The review of the General Plan suggests that issues of sustainable planning are part of the consciousness of the City already, and have in some cases been pursued to a considerable level of detail, especially with respect to transportation. Where urban, neighbourhood design, and building design is concerned there are additions to be made to the key principles listed above.

It should also be mentioned that the General Plan identifies a need of the CEP, recognizing the fact that energy issues and GHG missions need to be addressed more comprehensively than what is presented currently in the Plan. The General Plan is updated every five to ten years by the City. The next update to the General Plan should be able to address energy and GHG issues much more strongly, given the resources that will be provided by the CEP.

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### 2.2.5 Downtown Plan

It is often the case that the downtown of a city is where the values and vision of the city can best be showcased. As the heart of economic and social activity for the city, it is interesting to review the plans for Yellowknife's Downtown.

A Downtown Plan was produced in 2002 as a planning document and an action strategy to enhance downtown Yellowknife. While there is no specific mention of sustainability in this plan, many of the concepts resonate with the principles of sustainability planning. The Plan defines the following visions: "*Downtown Yellowknife is a compact, vibrant, and diverse urban neighbourhood.*" This is to be largely achieved by two mechanisms that have been recognized in the sustainability literature, namely mixed-use development, and compact urban form.

The emphasis of both mixed-use and compact form come under the theme of Creating a Northern Neighbourhood - A Place to Live, Work, Shop and Play. It is acknowledged that a vibrant downtown will include a mix of uses. The emphasis of this theme is on new residential development within the downtown, but also includes new development and investment in office space and employment, retail and shopping use, and recreation and entertainment. Additionally it is suggested that development within the city should be concentrated in a compact form in downtown. Vacant sites within the downtown need to be redeveloped and the outward growth of the city should be contained through infilling in the downtown core where possible. Both mixed-use and compact development strategies promote a lifestyle that is less dependent on the automobile for transportation. Short distances between home, work, shopping, and recreation facilities can be easily covered on foot, bike, or bus. Shorter distances also help save energy in delivery of infrastructure and services. Additionally, row-housing and other forms of attached building development reduce the need for home heating and can be counted towards the sustainability effort.

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### 2.3 Other Relevant Initiatives

In addition to the above mentioned plans and programs, the City of Yellowknife reportedly has an overall set of sustainability principles under development and is also looking into amending its zoning bylaw at the present time. Meanwhile the Government of North West Territories is currently reviewing the NWT *Planning Act*, including the public consultation requirements for planning. Further information on these initiatives is not available at the time of this study; however, it is recommended that the CEP and in particular the CEP Sustainability Planning Principles developed in this report are taken into account before either of these initiatives are finalized.



### 3.0 COMPREHENSIVE SUSTAINABILITY FRAMEWORK

Within the academic literature, there are a number of approaches to defining sustainability and sustainability principles. We hear about sustainability principles, objectives, system conditions, frameworks, practices, tools, systems, measures and outcomes. These are growing rapidly and sometimes they are presented as if they are contradictory or in competition. To clarify the way in which different sustainability concepts relate to each other a number of lead theorists, academics and practitioners who pioneered the sustainability movement have developed a systems approach to looking at sustainability. This systems approach is described here as a way of beginning to make sense of the different sustainability models available.

In the seminal paper “Strategic sustainable development - selection, design and synergies of applied tools”, the collective body of sustainability experts describes a hierarchy of five system levels that together form a comprehensive sustainability framework. The five levels of this hierarchical system can be summarized as such:

<b>Five Level- Technical Definition</b>	<b>Five Levels- Simple Definition and Explanation</b>
<i>1. Principles for the constitution of the system (e.g. ecological and social principles).</i>	<i>The Overall System</i> To “do” sustainable development effectively we must understand how the ecosphere (the space between the earth’s crust and the outer edges of the atmosphere) works. We need to understand the laws of science, ecology, biological/geological/chemical cycles, social development etc.
<i>2. Principles for a favorable outcome of planning within the system (e.g. principles for sustainability).</i>	<i>The Outcome level = The Success Level</i> In order to know what it is that sustainable development in trying to achieve, we need a set of principles that define success. These are essentially the goals of the system with respect to sustainability.
<i>3. Principles for the process to reach this outcome (e.g. principles for sustainable development).</i>	<i>The Process Level = The Strategy Level</i> To achieve the goals defined at the Outcome Level, we need principles to guide the process of moving forward on sustainability. These strategic guidelines or policies help us choose the most appropriate course of action.
<i>4. Actions, i.e. concrete measures that comply with the principles for the process to reach a favorable outcome in the system (e.g. recycling and switching to renewable energy).</i>	<i>Action</i> Actions are the individual moves that we choose to achieve the strategies that take us to success.

<p><i>5. Tools to monitor and audit (i) the relevance of actions with reference to principles for the process (e.g. indicators of flows and key-figures to comply with principles for sustainability), and/or monitoring (ii) the status of the system itself, and impacts (e.g. eco-toxicity and employment), or reduced impacts, as a consequence of strategically planned societal actions.</i></p>	<p><i>Indicators</i></p> <p>Indicators, tools and matrices are required to support our actions. Their main function is to evaluate how well the sustainability actions taken comply with the over goal or plan, and how much they are actually contributing to sustainability.</p>
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The top three levels of this hierarchy concentrate on principles, the rules or norms that form the basis of thinking, decision making and direction setting. The lower two levels focus on concrete actions to be undertaken and concrete ways to measure their success. At this point it is less important to distinguish between the three sets of principles described above than to understand the difference between principles and actions.

Traditionally, planning of cities and communities has focused on action. Planning staff and City Council has focused on analyzing the needs of the community and formulating propositions that would address those needs as quickly as possible. Applying this system becomes somewhat problematic when considering large and long-term problems such as energy security or climate change. Often, public debate and discussion in Council tend to focus on the short term consequences or immediate implications of various energy options (wind, solar, nuclear, biofuel, fossil fuels, hydro etc.). The full potential, scale and long term consequences of such choices are often lost in the debate. There is rarely a life-cycle-analysis (calculating the cost of a system or product over its entire life span including upfront planning and development costs, production costs, operation and maintenance costs, disposal or salvage costs, and any costs for cleaning up the environment) and little ways of evaluating the value of an option from several different interests or perspectives. In response, there has been a growing understanding amongst the public that there is a need for a set of agreed-upon principles that ensure consistency amongst actions and help to guide all individual decisions towards some final goal in the long term. Where the final goal is sustainability, a set of principles are needed to define and guide sustainability actions.



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## 4.0 REVIEW OF SUSTAINABILITY PRINCIPLES

There are a number of different schools of thought and ways of defining sustainability principles. They vary in their scope, their philosophical grounding, their scientific vigor, their applicability, and their outcomes. Most sustainability principles are too general to focus directly on energy and GHG emissions. However, there are aspects of most sets of principles that have implications for these topics. The discussion of the sustainability principles below highlights the connections between specific principles and their implications for energy and GHG emission reduction.

Different sets of principles are used by different organizations, including corporations, governments and community groups, for different purposes and depending on the level of interest and understanding at the organizational level. The case of cities and communities is of interest for the purposes of this study. Literature research suggests that cities and communities across Canada and the United States have adopted a range of sustainability principles, some of which can apply generally to the functioning of a municipality, while others would apply specifically to the workings of a specific department, for example, Planning and Development. Generally speaking, some municipalities have decided to adopt sustainability principles at the “outcome” level (level 2 identified in the hierarchy of system levels described in Section 3) while others have preferred to use sustainable development principles at the “process” level (level 3 identified in the hierarchy of system levels described in Section 3). Sometimes the set of sustainability principles adopted by a municipality mixes outcome principles and process principles.

Some examples of primarily Level 2 sustainability planning principles include those offered by The Natural Step, Melbourne Principles, and the Triple Bottom Line. Canadian municipalities that have incorporated these sustainability principles into their planning include Town of Canmore AB, Resort Municipality of Whistler BC, Halifax Regional Municipality NS (The Natural Step); Region of Niagara ON (Melbourne Principles and Triple Bottom Line); City of Hamilton ON, and City of Calgary AB (Triple Bottom Line). The advantage of Level 2 sustainability principles is that they help define where a community wants to get to in terms of sustainability. They are useful in situations where a community is seeking consensus on goals and outcomes to unite the thinking of its members before it moves forward.

Some examples of primarily Level 3 sustainability planning principles include Smart Growth, New Urbanism, and LEED Neighbourhood Standards. Communities that have become known as models in adopting these sustainability planning principles include Village of Valemount BC, City of Vancouver BC, City of Burlington VT (Smart Growth), Celebration FL, Orangeville ON, and Markham ON (New Urbanism). The strength of Level 3 sustainability principles is that they help define a process to get to

sustainability. They are useful when a community is already somewhat determined on where they want to go and is seeking consensus on a practical roadmap for how to get there. In the case of a community such as Yellowknife, where the need for a Community Energy Plan has already been acknowledged and demonstrated through the allocation of staff time and budget, Level 3-type sustainability principles will likely be of particular interest in charting the way forward.

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#### 4.1 The Natural Step

Founded in 1989 in Sweden by Dr. Karl-Henrik Robèrt, the Natural Step now has offices in 12 countries and is one of the most talked about sustainability models. It is a scientifically-based framework which relies on a set of powerful metaphors to popularize and make accessible the notion of sustainability. The strength of the natural step is in defining the problem of living in an unsustainable world, promoting a vision of sustainability, identifying in basic terms a set of sustainability principles called “system conditions”, and describing an “ABCD” methodology for moving towards sustainability planning. The Natural Step can be and has been used by a variety of organizations ranging from private companies to governments. Their methodology emphasizes a participatory approach and has been particularly popular with municipalities in the past few years as it is normally compatible with the process of public engagement that is an essential component of the planning process.

The Four Principles or System Conditions of the Natural Step are as follows:

1. *In a sustainable society, nature is not subject to systematically increasing concentration of substances extracted from the earth's crust.*
2. *In a sustainable society, nature is not subject to systematically increasing concentration of substances produced by society.*
3. *In a sustainable society, nature is not subject to systematically increasing degradation by physical means.*
4. *In a sustainable society, people are not subject to conditions that systematically undermine their capacity to meet their needs.*

While phrased in somewhat unfamiliar language the systems conditions of the Natural Step are in fact fairly straight forward. System Condition 1 basically suggests that humans should limit extraction of raw material including metals, minerals, and fossil fuels from the earth. System Condition 2 states that we need to reduce our rate of releasing potentially harmful human-made substances into the ecosystem. System Condition 3 holds that human society should slow down the process of deforestation. Finally System Condition 4 recommends a more equitable distribution of wealth on earth so that all humans can make ends meet.

The primary system condition with implications for energy reductions is the first. According to the first system condition of the Natural Step humans need to significantly reduce their rate of extraction of fossil fuels. The Natural Step identifies two alternative approaches to the current situation: “dematerialization” and “substitution” which translate to changing the *amounts* and the *types* of fuels respectively. Initiatives such as energy conservation and energy efficiency correspond to the former and initiatives such as investment in alternative energies to the latter.

Additionally the second system condition addresses the issue of GHG emissions. This system condition tells us that our continual release of anthropogenic substances such as GHGs into the atmosphere is incompatible with sustainability, given that it systematically increases the concentration of human-made substances.

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## 4.2 Melbourne Principles on Sustainable Cities

In April 2002 about 40 experts and decision makers from across the world came together in Melbourne Australia to formulate what are now called the 'Melbourne Principles on Sustainable Cities'. The Melbourne Principles were adopted by the Local Government Session of the World Summit on Sustainable Development in Johannesburg in 2002. The Principles are quite high level and provide cities with a framework to develop a consensus around sustainable development policy and programs. Their main strength is that they are comprehensive enough to capture the essential elements needed in a city to ensure that societies meet their needs, while ensuring that the individuals' well-being does not compromise the well-being of others in the community, including other species and the planet.

The Melbourne Principles for Sustainable Cities are:

1. *Provide a long term vision for cities based on sustainability, intergenerational, social, economic, and political equity, and individuality.*
2. *Achieve long term economic and social security.*
3. *Recognise the intrinsic value of biodiversity and natural ecosystems and their protection and restoration.*
4. *Enable communities to minimize their ecological footprint.*
5. *Build on the characteristics of ecosystems in the development and nurturing of healthy and sustainable cities.*
6. *Recognise and build on the distinctive characteristics of cities including their human and cultural values, history and natural systems.*
7. *Empower people and foster participation.*
8. *Expand and enable co-operative networks to work towards a common sustainable future.*

9. *Promote sustainable production and consumption, through appropriate use of environmentally sound technologies and effective demand management.*
10. *Enable continual improvement, based on accountability, transparency and good governance.*

At first the applicability of Melbourne Principles to a specific sustainability issue such as energy and GHG emissions is not apparent. However, a long term sustainability vision (Principle 1) would have implications for energy use and GHG emission reductions. It can certainly be argued that energy security is an important part of economic and social security (Principles 2) and therefore municipalities should promote renewable energies that can provide energy security. The concept of minimizing ecological footprint (Principle 4) suggests that societies should reduce both conventional energy use and GHG emissions since the former takes up a lot of land to produce and the latter impacts large pieces of land, both beyond the fair share “footprint” of each human being on earth. Sustainable production and consumption (Principle 9) includes the production of alternative energy sources and reducing energy demand in an efficient manner in accordance with conservation principles. Truly sustainable production and consumption also imply that contributions to GHG emissions should be kept at a minimum. Other concepts such as commitment to community participation, and to the joint consideration of environmental, social and economic values resonate with the planning principles already recognized in Yellowknife by the visions and goals of the CEP.

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#### 4.3 Triple Bottom Line

The Triple Bottom Line is a framework for assessing the sustainability of each decision or action. This is a particularly popular framework within the business world and links strongly with the commitment to Corporate Social and Environmental Responsibility, recognizing the fact that the true success of an organization and its actions should be measured based on economic, social as well as environmental considerations. Increasingly municipalities are using the Triple Bottom Line principle, sometimes in conjunction with other principles such as the Melbourne Principles, to give their decision makers the ability to judge every proposal against a comprehensive set of grounds.

As suggested by its title, the Triple Bottom Line principle is that sustainability is achieved when a proposal, project, initiative, plan or direction creates value on three separate but overlapping fronts. Here is how the Triple Bottom Line principle can be stated:

*An initiative can be said to contribute to sustainability if as a direct or indirect result of the initiative*

- *Community well-being is enhanced, AND.*
- *Environmental well-being is enhanced, AND*
- *Economic well-being is enhanced.*

The Triple Bottom Line approach does not have much to say directly about energy and GHG emission reductions, though the condition of enhanced environmental well-being implies that clean forms of energy should be prioritized over polluting forms of energy. The conditions of enhancing social and economic well-being also apply to individual energy and GHG related projects. An initiative that helps reduce climate change can have significant positive economic and social impacts by decreasing damage to communities. For example, savings would be made in avoiding social and monetary costs of emergency response and clean up after extreme weather events, if simple actions can slow down the rate of climate change.

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#### 4.4 Smart Growth

While the approaches discussed above come from the sustainability literature and the sustainability management school of thought, Smart Growth has emerged within the discipline of city planning. Smart Growth, which was introduced as a concept in the early 1970s, is essentially a set of principles and policies governing transportation and land use planning that benefits communities and preserves the natural environment. Smart Growth principles challenge old assumptions in urban planning, such as the need for residents to use automobiles or to have detached houses. The idea of Smart Growth has grown in popularity as an alternative to urban sprawl, traffic congestion, disconnected neighborhoods, and urban decay. Smart Growth has been picked up in Canada as a concept for the city core, promoting high density, transit oriented, and mixed use downtown neighbourhoods in communities such as the City of Vancouver, and Village of Valemount, BC.

Proponents of Smart Growth advocate comprehensive planning to guide, design, develop, revitalize and build communities that have a unique sense of community and place, preserve and enhance natural and cultural resources, equitably distribute the costs and benefits of development, expand the range of transportation, employment and housing choices, value long-range, regional considerations of sustainability over a short term focus, and promote public health and healthy communities. However, the key idea of Smart Growth is “quality of life”, a notion that implicitly captures the values of environmental quality, economic prosperity and social vitality.

There is a strong link between Smart Growth and the principle of the triple bottom line and the life-cycle-analysis approach. Smart Growth principles seek to balance the economic profits gained from development with benefits offered to the community. They emphasize the role of developers in providing community services and amenities. While they promote economic growth, Smart Growth principles ensure that it does not come at the expense of long term social and environmental prosperity.

There are ten key principles of Smart Growth:

- 1) Housing Choice- Create a range of affordable, quality housing choices*
- 2) Vibrant, Walkable Complete Communities- Foster development that creates vibrant, unique, walkable complete communities where uses like residential and commercial are mixed to create attractive places to live, work and play.*
- 3) Smart Building Design- Encourage building designs that contribute to the context of a pedestrian-oriented neighbourhood and use green building technologies.*
- 4) Renew Existing Communities- Direct development away from unsettled areas and encourage growth and renewal in existing communities.*
- 5) Green Infrastructure- Utilize green infrastructure to save money and protect the environment.*
- 6) Green Space, Farmland and Ecologically Sensitive Areas- Preserve and enhance green spaces, farmland and environmentally sensitive areas.*
- 7) Broad-Scale, Integrated Planning- Undertake broad-scale planning for cities and towns in adjacent regions in a way that integrates land use and transportation planning for the entire region.*
- 8) Transportation Options- Provide varied transportation options and infrastructure for walking, bicycling, car pooling, car sharing, scooters, public transit and others.*
- 9) Community Involvement- Encourage effective community involvement early in the process to find unique solutions that fit with the community's vision of itself.*
- 10) Focus on Implementation- Utilize planning processes, tools and incentives to facilitate private sector investment and ease of navigation in achieving smart growth solutions.*

The principles of Smart Growth have direct and significant implications for the energy use and resulting reduction in GHG emissions by a community. Creation of walkable and complete communities (Principle 2) means that residents will have to make fewer vehicular trips. Smart building design (Principle 3) provides for the highest levels of energy efficiency and possible reliance on renewable technologies such as solar heating. Renewal of existing communities (Principle 4) ensures that infrastructure is delivered in



the most energy efficient manner by reducing the need to service rural and suburban homes far away from the city core. Green infrastructure (Principle 5), which could include natural drainage areas for sewage treatment or recycled water systems also reduces the need for energy-intensive delivery of basic infrastructure. Finally, the diversification of transportation options (Principle 8) allows for alternatives to the vehicle and thus reduces dependency of fossil fuels.

Some aspects of Smart Growth appear to have already been considered in Yellowknife and are mentioned in a partial manner, for example, in the Transportation section of the General Plan (though without explicit reference to a comprehensive Smart Growth set of principles). A strengthening of these principles in the approach to land development and regional growth can ensure that transportation and land-use decisions are made in harmony with each other, using the synergy from the two to make a significant impact in terms of reducing energy use and GHG emissions.

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#### 4.5 New Urbanism

New Urbanism emerged in the 1980s as a North American movement of planners, architects, theorists and developers reacting to the phenomenon of urban sprawl with a renewed belief in the power and ability of traditional neighborhoods to restore functional, sustainable communities. The focus of New Urbanism is on recreating the neighbourhood unit, a spatial configuration that creates a human-scale, walkable community. New Urbanism has been applied to suburban areas as well as the downtown core, where medium to high density row houses – as opposed to high rises – dominate the landscape.

New Urbanism is typically marketed as an urban design and architecture standard. Like Smart Growth, New Urbanism champions quality of life above all other values. The heart of new urbanism is in the design of neighborhoods, which can be defined by 13 principles, according to the Congress for the New Urbanism. An authentic neighborhood contains most of these elements:

1. *The neighborhood has a discernible center. This is often a square or a green and sometimes a busy or memorable street corner. A transit stop would be located at this center.*
2. *Most of the dwellings are within a five-minute walk of the center, an average of roughly 2,000 feet.*
3. *There are a variety of dwelling types—usually houses, rowhouses and apartments—so that younger and older people, singles and families, the poor and the wealthy may find places to live.*

4. *At the edge of the neighborhood, there are shops and offices of sufficiently varied types to supply the weekly needs of a household.*
5. *A small ancillary building or garage apartment is permitted within the backyard of each house. It may be used as a rental unit or place to work (for example, office or craft workshop).*
6. *An elementary school is close enough so that most children can walk from their home.*
7. *There are small playgrounds accessible to every dwelling—not more than a tenth of a mile away.*
8. *Streets within the neighborhood form a connected network, which disperses traffic by providing a variety of pedestrian and vehicular routes to any destination.*
9. *The streets are relatively narrow and shaded by rows of trees. This slows traffic, creating an environment suitable for pedestrians and bicycles.*
10. *Buildings in the neighborhood center are placed close to the street, creating a well-defined outdoor room.*
11. *Parking lots and garage doors rarely front the street. Parking is relegated to the rear of buildings, usually accessed by alleys.*
12. *Certain prominent sites at the termination of street vistas or in the neighborhood center are reserved for civic buildings. These provide sites for community meetings, education, and religious or cultural activities.*
13. *The neighborhood is organized to be self-governing. A formal association debates and decides matters of maintenance, security, and physical change. Taxation is the responsibility of the larger community.*

Though the emphasis of the movement is not on environmental improvements, the principles lead to a host of environmental benefits including energy conservation and reduction of GHG emissions. The proximity of dwelling units to key destinations such as the neighbourhood centre (Principle 2), the commercial and institutional units on the edge of the neighbourhood (Principle 4), schools (Principle 6) playgrounds (Principle 7) and civic buildings (Principle 13) ensure that most residents can meet their basic needs by walking or biking, instead of using a car. Creating a complete neighbourhood including all destinations mentioned above gives residents things to do in the neighbourhood, thus alleviating the need to drive out of the neighbourhood. The provisions for public transit (Principle 1) and pedestrian comfort (Principle 9) further ensure that the use of the car is reduced. The standards described by the New Urbanism principles in effect



create a dense and compact community which is also advantageous in terms of reducing the energy demand for space heating and infrastructure delivery.

New Urbanism offers some very specific and detailed ideas on how to make mixed use and complete communities. Again, the City of Yellowknife appears to be inline with some of these principles as suggested by the Transportation section of the General Plan. The detail offered by the New Urbanism principles such as the consideration and inclusion of all essential services within walking distance, can add to the effectiveness of policies already adopted in Yellowknife.

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#### 4.6 LEED Neighbourhood Standards

The LEED (Leadership in Energy and Environmental Design) accreditation system for green building practices has been around for a while in the United States and has spread in Canada in the past decade with the opening of the Canadian Green Building Council. LEED is a voluntary compliance system that recognizes buildings for meeting the highest standards of energy efficiency and environmental quality. Recently, the U.S. Green Building Council, the Congress for the New Urbanism, and the Natural Resources Defense Council got together to produce a similar set of standards not just for individual buildings but for entire neighbourhoods. A set of LEED Neighbourhood Development Rating System standards was developed in 2005. These have not yet been adopted by the US Green Building Council or used to certify any neighbourhoods. But they do offer an exceptionally well-developed and detailed set of principles that are likely to be used in the United States and soon after in Canada to define the standard of energy efficiency that a sustainable neighbourhood can be expected to demonstrate.

Similar to the LEED for Green Building system, the LEED for Neighbourhood rating system assigns a score to each development based on its ability to meet a set of requirements and to go beyond these requirements and achieve extra credits. Both the requirements and the credits of the LEED Neighbourhood rating system are presented here as principles, with the understanding that most are specific enough to be interpreted as concrete actions, and that a LEED certified neighbourhood would adhere to a large number of these.

Abbreviated statements of sustainability principles put forward by LEED are presented in the table below. Those that have direct or indirect implications for energy and GHG emission reductions are highlighted in bold.

<i>Location Efficiency</i>	<ul style="list-style-type: none"> <li>▪ <b>Transportation Efficiency</b></li> <li>▪ <b>Water and Stormwater Infrastructure Efficiency</b></li> <li>▪ <b>Contaminated Brownfields Redevelopment</b></li> <li>▪ <i>High Cost Contaminated Brownfields Redevelopment</i></li> <li>▪ <b>Adjacent, Infill, or Redevelopment Site</b></li> <li>▪ <b>Reduced Automobile Dependence</b></li> <li>▪ <b>Contribution to Jobs-Housing Balance</b></li> <li>▪ <b>School Proximity</b></li> <li>▪ <b>Access to Public Space</b></li> </ul>
<i>Environmental Preservation</i>	<ul style="list-style-type: none"> <li>▪ <i>Imperiled Species and Ecological Communities</i></li> <li>▪ <i>Parkland Preservation</i></li> <li>▪ <i>Wetland &amp; Water Body Protection</i></li> <li>▪ <i>Farmland Preservation</i></li> <li>▪ <i>Erosion &amp; Sedimentation Control</i></li> <li>▪ <i>Support Off-Site Land Conservation</i></li> <li>▪ <b>Site Design for Habitat or Wetlands Conservation</b></li> <li>▪ <i>Restoration of Habitat or Wetlands</i></li> <li>▪ <i>Conservation Management of Habitat or Wetlands</i></li> <li>▪ <i>Steep Slope Preservation</i></li> <li>▪ <b>Minimize Site Disturbance During Construction</b></li> <li>▪ <b>Minimize Site Disturbance Through Site Design</b></li> <li>▪ <i>Maintain Stormwater Runoff Rates</i></li> <li>▪ <i>Reduce Stormwater Runoff Rates</i></li> <li>▪ <i>Stormwater Treatment</i></li> <li>▪ <i>Outdoor Hazardous Waste Pollution Prevention</i></li> </ul>
<i>Compact, Complete, &amp; Connected Neighborhoods</i>	<ul style="list-style-type: none"> <li>▪ <i>Open Community</i></li> <li>▪ <b>Compact Development</b></li> <li>▪ <b>Diversity of Uses</b></li> <li>▪ <b>Transit-Oriented Compactness</b></li> <li>▪ <i>Housing Diversity</i></li> <li>▪ <i>Affordable Rental Housing</i></li> <li>▪ <i>Affordable For-Sale Housing</i></li> <li>▪ <b>Reduced Parking Footprint</b></li> <li>▪ <i>Community Outreach and Involvement</i></li> <li>▪ <i>Block Perimeter</i></li> <li>▪ <b>Locating Buildings to Shape Walkable Streets</b></li> <li>▪ <b>Designing Building Access to Shape Walkable Streets</b></li> <li>▪ <b>Designing Buildings to Shape Walkable Streets</b></li> <li>▪ <b>Comprehensively Designed Walkable Streets</b></li> <li>▪ <b>Street Network</b></li> <li>▪ <b>Pedestrian Network</b></li> <li>▪ <b>Maximize Pedestrian Experience</b></li> <li>▪ <b>Superior Pedestrian Experience</b></li> <li>▪ <i>Applying Regional Precedents in Urbanism and Architecture</i></li> <li>▪ <b>Transit Subsidy</b></li> <li>▪ <b>Transit Amenities</b></li> <li>▪ <b>Access to Nearby Communities</b></li> <li>▪ <i>Adaptive Reuse of Historic Buildings</i></li> </ul>

<i>Resource Efficiency</i>	<ul style="list-style-type: none"> <li>▪ <i>Certified Green Building</i></li> <li>▪ <i>Energy Efficiency in Buildings</i></li> <li>▪ <i>Water Efficiency in Buildings</i></li> <li>▪ <i>Heat Island Reduction</i></li> <li>▪ <i>Infrastructure Energy Efficiency</i></li> <li>▪ <i>On-Site Power Generation</i></li> <li>▪ <i>On-Site Renewable Energy Sources</i></li> <li>▪ <i>Efficient Irrigation</i></li> <li>▪ <i>Greywater &amp; Stormwater Reuse</i></li> <li>▪ <i>Wastewater Management</i></li> <li>▪ <i>Reuse of Materials</i></li> <li>▪ <i>Recycled Content</i></li> <li>▪ <i>Regionally Provided Materials</i></li> <li>▪ <i>Construction Waste Management</i></li> <li>▪ <i>Comprehensive Waste Management</i></li> <li>▪ <i>Light Pollution Reduction</i></li> <li>▪ <i>Contaminant Reduction in Brownfields Remediation</i></li> </ul>
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The list above is presented here to demonstrate the range of possible actions to promote the sustainability principles associated with design of neighbourhoods. For a full account of what each principle means and how to apply it, readers are referred to the LEED for Neighbourhood Developments, Rating System, Preliminary Draft, September 2005.

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## 5.0 SUSTAINABILITY IN OTHER NORTHERN COMMUNITIES

The City of Yellowknife is not the only northern Canadian City to have given consideration to sustainability with respect to energy use and GHG emissions. Several other municipalities and groups in the North have made similar efforts. The examples of the City of Whitehorse YK, City of Iqaluit NU, Wha Ti Community NWT, Village of Fort Simpson NWT, and City and Borough of Juneau AS are briefly discussed below.

Most Northern communities can benefit from the sustainability principles and energy/GHG reduction policies associated with transportation, urban form, building design, and infrastructure delivery such as those described in Section 4. However, Northern communities are faced with some exceptional challenges due mainly to two factors:

- 1) harsher climate that increases the energy needs of the community (e.g. to heat buildings, maintain roads and utilities, and deliver municipal services such as snow removal); and
- 2) limited financial and human resources.

Some specific design ideas for the North can address these specific challenges. But for the most part the extra challenges faced in the North only magnify the urgency to act and to incorporate the principles and best practices known to planners for sustainability.

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### 5.1 City of Whitehorse

As a member in the FCM Partners for Climate Protection Program the City of Whitehorse has completed an emissions baseline study, has GHG reduction targets in place (20% below 1990 levels for City emissions and 6% below 2001 levels for community emissions by 2013), and has put in place a local action plan for GHG emission reductions for both the municipality and the community. The local action plan identifies recommended key actions related to buildings, transportation, infrastructure, and land development. Additionally, Whitehorse has built sustainability into its Official Community Plan (2002), which offers a set of general Principles of Sustainability (social, economic, and environmental), as well as specific Environmental Sustainability Policies. This second set of statements, which is very much in line with principles of Smart Growth and New Urbanism as well as some of the recommendations of LEED Neighbourhood Standards, is presented below:

1. *Future development shall be directed in as compact a manner as feasible given already established land use patterns.*
2. *New development should occur in a sequential manner based on available municipal services and financial considerations.*
3. *Developers for new residential development are encouraged to consider lot layouts and site planning to maximize solar exposure and housing designs that are energy efficient.*
4. *In order to minimize vehicular trips, and to provide shopping opportunities closer to residential areas, a mix of residential and commercial development shall be encouraged in the downtown. In addition, neighbourhood commercial development shall be encouraged to continue in already established neighbourhoods and to locate in future residential neighbourhoods.*
5. *The City may consider educating property owners to retrofit existing buildings with sustainable energy alternatives and conservation measures through educational programs.*
6. *Where practical, the City may consider pursuing natural energy alternatives for new development. This may be accomplished through educational programs. Examples of natural energy alternatives include the implementation of wind, solar and geothermal power.*
7. *In order to ensure good air quality in the Whitehorse area, the use of modern pollution control technology and the implementation of additional emission reduction and management strategies shall be actively pursued.*
8. *As funding and resources allow, the City shall coordinate with Territorial and Federal authorities in order to cleanup contaminated sites.*
9. *The City may, in reviewing its road and servicing standards, consider potential development standards that are environmentally appropriate, economically efficient and effective from a maintenance perspective.*

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## 5.2 City of Iqaluit

The City of Iqaluit is a growing city with projections for significant growth in both population and number of dwelling units. The City is concerned about climate change, and about the rising costs of infrastructure and service delivery to the growing community. The General Plan for the City of Iqaluit puts forward a number of policies under a Sustainability Initiative. The focus of these policies is on conservation and subdivision design. The policies are:

1. *Council shall encourage developers of new residential buildings to pursue a lot layout and building orientation to maximize solar exposure and energy-efficient building designs.*
2. *Council will encourage building owners to retrofit existing buildings with energy efficiency and alternatives upgrades through education programs and/or financial aid.*
3. *Council will encourage water conservation methods, such as water recycling systems, to reduce per capita water consumption.*
4. *Council shall pursue funding from agencies such as Federation of Canadian Municipalities (FCM), Natural Resources Canada (NRC), and the Canada Mortgage and Housing Corporation (CMHC), to help implement sustainable, energy-efficient, or alternative energy technologies in building design and urban form. Such funding could be used for demonstration or pilot projects, research projects, or subsidies for innovative development projects.*
5. *Council shall develop a green plan to guide environmental policies.*
6. *Council will consider adopting measures to reduce construction waste going to the landfill and consider a recycling program for building materials.*

In the context of these high level sustainability policies, a very interesting initiative of the City of Iqaluit is the design and implementation of the first model Sustainable Arctic Subdivision. The Plateau Subdivision was approved by City Council in 2004 with the vision to describe how to build a more sustainable neighbourhood while considering community needs and values, available resources, and climate. According to recent press releases, the first phase of the project consisting of detached single family homes is well underway with about one dozen homes in various stages of construction. The central water infrastructure was put in place in February 2006. The response from developers to this phase of the project has been unprecedented, with all lots advertised for sale under the single family detached home category being purchased immediately. Unfortunately, recent news is indicating that the level of interest in other building categories such as row-housing has not been as encouraging. The City has prepared a comprehensive report and an illustrated guide on Development Standards for an Arctic Sustainable Subdivision. A summary of the best practices available and their application to the Plateau Subdivision are summarized in the table below. Note the similarities between this set of development standards and those suggested by the LEED Neighbourhood Standards.



BEST PRACTICES RECOMMENDATION	PLATEAU DEVELOPMENT SCHEME
<b>Elements of Site Design</b>	
Design the arrangement and orientation of buildings, streets and infrastructure to preserve the site's natural, cultural and historical features.	✓ Design protects a traditional berry picking area, 3 significant rock outcrops, pond, and drainage system.
Design housing and street layouts to follow the natural contours of the site to avoid or minimize re-contouring or infilling of land.	✓ Design uses natural topography to align the major roads along the direction of the prevailing wind, maximize the southern orientation of the building lots, and to maximize views.
Orient and design buildings to create wind patterns that prevent snow drifting and accumulation.	✓ Larger buildings are required to undertake a snow study of preliminary building design.
Orient buildings and place windows to access maximum solar gain. Site buildings to maximize solar gain and avoid shading during times when the sun is at a low angle.	✓ Design maximizes the southern orientation of the building lots, and requires the building façade with the most windows to face south within 30 degrees.
To create a sense of community, design a public space that is protected from the elements and accessible from all dwellings.	✓ Design includes two major lots reserved for community use development as well as a public space for public gatherings.
Cluster dwellings to reduce land and service costs and exposure to extreme weather.	✓ In each phase of development, a minimum of one lot has been reserved for clustered housing.
<b>Transportation and Pedestrian Access</b>	
Make connections to existing walking and snowmobile trails that are accessible and do not conflict with vehicular traffic.	✓ Design incorporates walking and snowmobile trails within the subdivision and provides connections to the existing networks, that are intended to minimize conflict with vehicular traffic.
Design a continuously linked walkway to encourage pedestrian traffic. Create walkways that are safely lit, obstacle-free, and provide the shortest route.	✓ The trail network links the majority all lots in the subdivision in a direct and convenient manner. Trail design will need to consider safety and discourage use by snowmobiles.
Provide safe walkways to and protective shelters at all public transit stops.	✓ Bus shelters are located at key intersections on the walking trail network.
Incorporate short blocks, narrow streets, dead ends, and hierarchical and curvilinear streets to control vehicle access and speed within the subdivision when designing street layout.	✓ The road network is design to control speed through its alignment and intersections.
<b>Building Features and Design Recommendations</b>	
Provide choices in housing in terms of design and cost. Provide multi-unit dwellings as a housing option.	✓ Approximately 35% of dwelling units will be low density such as singles, semis and duplexes, 50% will be medium density multi-family buildings, and the remaining will be apartment units in mixed use buildings. In addition, strategies in the Plan recommend the City initiate the development of affordable housing through the use of call for proposals. The Plan targets 15% of ground-oriented units to be built in this way, or a total of 40 units.
Use the technologies provided by the R-2000 and Green Home Programs as a framework for designing energy-efficient and healthy arctic dwellings.	✓ Phase 1 of the development uses R-2000 as a building guideline, and it becomes a requirement in the future phases. In addition it is a requirement of building on enhanced lots in phase 1.
Choose windows with insulating spacers, heat reflective coatings and gas fills. Use silicon weather stripping around windows. Use heating tape or metal fins to keep weather stripping warm and prevent damage from extreme weather conditions. Use a third pane window system.	✓ Lot development standards require all windows be ENERGY STAR qualified windows, which have high energy efficiency ratings.
Place vestibules at building entrances to prevent heat loss when exterior doors are opened, protect the main door, and provide extra storage and work spaces.	✓ Lot development standards require that all ground-oriented housing incorporate vestibules into dwelling unit design.
Explore the option of installing heat recovery ventilators for ventilation and to ensure good air quality.	✓ Lot development standard requires that all buildings use Heat Recovery Ventilators as a ventilation standard.
In choosing a heating distribution system for a building designed to be energy efficient, choose one that can be easily serviced in Iqaluit.	✓ Lot development standard prohibits the use of base board electric heaters.
Install water-saving devices such as faucet aerators, efficient showerheads, low flow toilets, and composting toilets.	✓ Lot development standard requires the use of low-flow water fixtures.
Reduce water pressure in the water distribution system.	✓ The pressures in a water distribution system are a function of fire protection capabilities, and therefore a reduction in the distribution system pressures may not be desirable. The water pressures should be reduced by the user.
Consider metering water use to reduce consumption.	✓ The City's water system is metered and consumers are billed based on consumption rates.

### 5.3 Hamlet of Wha Ti

Wha Ti is the first community within the North West Territories to have implemented a Community Energy Plan as part of the Wha Ti Sustainable Community Project. Prepared in 2004, the CEP was developed with community consultation and includes the results of energy demand and energy alternatives assessments, as well as the identification of the players involved in making energy decisions in Wha Ti. It also includes recommendations for how the community can develop its future energy system. The Wha Ti CEP makes the following recommendations which are consistent with many of the sustainability planning principles presented in this report so far:

#### 1. *Energy Efficiency*

- a. Identification of short term and long term energy efficiency retrofit measures*
- b. Ensuring new buildings incorporate energy efficiency and renewable energies*
- c. Actively promoting alternative energy expertise in community*
- d. Substituting imported materials with local materials*
- e. Reduce water consumption*

#### 2. *Renewable Energy*

- a. Promote mini-hydro projects*
- b. Maximize passive solar space heating*
- c. Seek opportunities for solar air heating and hot water heating*
- d. Start a wood stove change-out program*
- e. Create a plan for dry fire wood use*
- f. Promote pellet stoves*

#### 3. *Human Behaviour*

- a. Initiate an awareness and education program*
- b. Build a demonstration Wha Ti Health House*
- c. Investigate smart metering*

#### 4. *Energy Investment Revolving Fund*

#### 5. *Implementation Plan*

Several of the above recommendations have reportedly been followed up. In particular, the recommendation to promote mini-hydro projects has gained some momentum, given the priorities of the community and the



excitement around the potential for such a project. The first run of the river mini-hydro development is currently in the design stage and construction is expected to start in the summer of 2007.

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#### 5.4 Village of Fort Simpson

The Village of Fort Simpson initiated a community energy plan process in 1996 to identify different ways to reduce its energy consumption and utility costs. Following the completion of an energy audit and several community consultations, the Village prepared an action plan which outlined the various goals of the community and strategies and timeframes to be followed in implementing and completing the plan. The key community goals identified in the Fort Simpson Community Energy Plan are as follows:

- *Reduce the electrical power peak from 1.8 megawatts to 1.0 megawatts by 1999.*
- *Promote energy awareness through school presentations, public meetings, displays and high visibility energy audits to educate community members on potential ways of reducing energy usage.*
- *Promote Reducing, Reusing and Recycling to reduce the volume of material delivered to the landfill site. This would lower operating costs and adverse environmental impacts.*
- *Investigate alternate energy sources to identify sources that are more cost effective and environmentally friendly than the existing diesel generators.*
- *Promote the use of gray water systems to reduce water/sewage production and delivery costs.*
- *Investigate the establishment of a district heating system using radiant and exhaust heat recovered from the NWTPC diesel generators.*
- *Install a waste-oil furnace or boiler to use the waste-oil from internal combustion engines. The waste-oil (80 drums or more each year) that is presently trucked out of the community for disposal could produce heat at a lower cost than refined heating oil and repay the capital cost in less than one year.*

Detailed information on the status of progress on energy issues in Fort Simpson is not available. Unfortunately, anecdotal information suggests that follow up on the recommendations of this early plan have been weak and no substantial results have been achieved. However, records of Fort Simpson Council meeting minutes in April 2006 suggest that the idea of a CEP is being revisited currently and efforts can be expected to start up again in the near future.

## 5.5 City and Borough of Juneau

Recognizing sustainability as an emerging world-wide approach to planning, the 2003 Comprehensive Plan for the City and Borough of Juneau (CBJ) includes a whole chapter on Sustainability Growth and Development (Chapter 2). This document offers one of the most comprehensive approaches taken by municipalities covered in this research to address issues of sustainability, especially with respect to energy and GHG emissions, on a detailed and practical basis. There is a set of no less than 32 sustainability policies set for the municipality. Those that have relevance to energy and GHG reductions are summarized below. Note the similarities to Smart Growth and New Urbanism ideas.

Policy 2.3. To promote compact urban development within and adjacent to existing urban areas.

Policy 2.21. To analyze the CBJ energy system, establish a long-term energy plan, and implement that plan for the efficient and sustainable use of energy in CBJ.

Policy 2.22. To incorporate technologies and operating practices that will promote efficient and cost effective energy use into all of CBJ's new and existing buildings and energy-using projects.

Policy 2.23. To maximize the use of local energy resources and keep energy dollars within the community.

Policy 2.24. To include the indirect or external costs of energy use in its economic analyses.

Policy 2.25. To maximize the use of renewable energy resources.

Policy 2.26. To encourage electrical energy use patterns which minimize utility investment.

Policy 2.28. To encourage the transportation of CBJ residents, visitors, freight, mail and parcels with renewable energy on public transportation.

Policy 2.29. To require cost effective energy, efficient buildings and remodeling practices.

Policy 2.30. To encourage large industrial users to be as efficient as possible in their use of energy, use renewable energy sources and to make energy by-products available for use elsewhere in the community.

Policy 2.31. To encourage waste reduction and recycling activities which have a positive net-energy transfer that has a positive or cost-neutral fiscal impact to the CBJ.

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## 5.6 Summary

The review of sustainability principles adopted in Northern communities demonstrates an interest in practicality. All Northern communities reviewed in this study have adopted sustainability planning principles at a strategy level. None have adopted high outcome level principles such as the Natural Step or Melbourne Principles. Given the limitations in human and financial resources, focusing on the practical aspects of sustainability makes sense for the North.

The review in Section 5 also suggests that Northern communities can relate to most of the sustainability planning principles, especially at the Strategy Level (Level 3), developed elsewhere in the world. Principles such as compact form, mixed use and increased transportation options are universal concepts that can be adopted in the North just as well as anywhere else. Actions need to be adapted to the local context under these same universal principles.

## 6.0 RECOMMENDATIONS

The review of literature presented in Section 4 and 5 demonstrates that what different municipalities are adopting as their “sustainability principles” or “sustainability policies” range from some very high level and conceptual statements, to some very specific and detailed action items. Both Level 2 principles (Outcome or goal oriented Principles) and Level 3 (Process or strategic policy Principles) principles described in Section 3 are used by various municipalities, though Northern municipalities tend to concentrate on the latter rather than the former.

In the context of this study, the Energy Experts Roundtable Report suggested that the “principles for sustainable communities” that Action Area 6 asks for, are expected to be at Level 3 or a Process Level. During the Stakeholder Workshop and the Community Workshop Sessions in April 2006 it became clear that the Yellowknife community is much more interested in detailed and instructive energy and GHG-related planning principles than in general and overarching sustainability principles. Specific planning principles such as Smart Growth, New Urbanism, and LEED Neighbourhood Standards were easily understood and debated by the community and both stakeholders and the general public were very interested in seeing that level of detail in the Yellowknife CEP. However, a number of attendees at both workshops felt that overarching sustainability principles were also important and useful in the larger planning and decision-making process for which the City is responsible. High level sustainability principles such as the Natural Step, Melbourne Principles, and Triple Bottom Line were seen as “motherhood statements” that are essential as backbone for the CEP but should not become the sole focus of it.

Based on the outcomes of the two workshops four groups of recommended principles have been identified. The first group of recommended principles targets the larger city planning picture and reflects lessons learned from the higher level and overarching sustainability principles discussed in Section 4.1 to 4.3. These principles have indirect impacts on energy use and GHG emission reductions. The second group focuses on principles of Community Form, the third group on principles for Transportation, and the last group on principles for Building Design, each targeting an area of activity in the city with specific planning principles echoing the discussion in Section 4.4 to 4.6. These principles have direct impacts on energy use and GHG emission reductions.

Note that the CEP Committee has commissioned separate studies on transportation, renewable energy, and residential energy efficiency. The recommendations of these specialized studies should take precedence over the recommendations below as far as these specific topics are concerned.

## 6.1 Recommendations for Overall City Planning

### **Principle One: Develop a 50-100 year community vision and plan**

Given that the issues of energy use and GHG emission reduction are best understood within a long term timeframe (50-100 years), it is essential to begin engaging both citizens and decision makers in long term thinking. It is widely acknowledged that Yellowknife and its geo-political context are changing rapidly, especially given the impacts of climate change on Northern landscapes. The City should facilitate a community visioning process that explores the desired shape of the city and the desired life-style of its inhabitants many years from now given this context of change. The City should then develop and long term plan to realize the vision.

### **Principle Two: Learn from historical patterns of development**

The debate over sustainability is largely a reaction to the unsustainable ways of living that human societies have been immersed in over the last century and the problems that have resulted. There are lessons to be learned from historic patterns of development including those that have been sustainable, and those that have failed to be sustainable. For example, the original development of Yellowknife (the “Old Town”) adopted many features recommended in this report such as building with the landscape and developing a compact mixed use neighbourhood where many residents worked, lived and obtained their services within walking distance. Studying the past should be an integral part of Yellowknife visioning and community planning, in particular with regards to energy and GHG emission reductions.

### **Principle Three: Make energy demand and GHG emissions reductions and life-cycle analysis the norm for decision making**

In order to address the sustainability of each project, the requirements and consequences of that project need to be considered from different angles (social, cultural, economic, and environmental) and over the entire life-time of the project including up-front costs, maintenance and operation costs, and costs of decommissioning and clean up. The City departments and the Council should enhance their current decision making process by adding multi-dimensional and life-cycle costing to current considerations. Initiatives that have the potential to impact energy and GHG emissions need to be examined by multiple lenses before implementation.

### **Principle Four: Put in place a more effective, integrative, participatory planning process**

To ensure that various aspects of a project and its full costs are considered in decision making, an integrative and inclusive planning process needs to be in place. The City should actively seek the participation of stakeholders and the public in decision making that has implications for energy and GHG emissions. It is acknowledged that while a fully participatory process may be

more time-consuming it is likely to be more effective and produce better results in terms of ensuring support for sustainability initiatives.

#### **Principle Five: Re-investigate and re-invest continually**

Given the ever-changing state of the world, including emergence of new problems but also of new solutions, communities should continually re-investigate their options and re-invest in their neighborhoods. New technologies, new models and new information should be considered as they become available and the planning system should have enough flexibility to incorporate necessary changes on a continuous basis.

#### **Principle Six: Respect the local and regional ecology**

Decisions regarding the production or use of energy and emission of GHGs should not negatively impact other aspects of the local and regional ecology. The earth and the ecosystem, including the local landscape should be respected and protected in all planning and development activities.

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### **6.2 Recommendations on Community Form**

#### **Principle One: Encourage a mix of housing, shops, offices etc.**

To ensure that services and destinations are within walking distance of housing units, the City should encourage, through zoning, a mix of uses where possible. It should promote residential or institutional units above street-level commercial development and allow ancillary buildings (granny suites, workshops, offices) on residential lots.

#### **Principle Two: Pursue opportunities for residential infill**

To reduce energy use and cut back on GHG emissions the City should provide incentives for residential expansion within or close to already developed areas. The most energy efficient location for residential units is in existing neighbourhoods. Urban infilling in the form of development on vacant lots and brownfields should be encouraged, as should residential development adjacent to existing neighbourhoods or major destinations.

#### **Principle Three: Create a town center/ strong downtown**

Commuting to meet daily needs is an energy intensive process and contributes to GHG emissions. The City should build public destinations within or close to residential neighbourhoods. A vibrant downtown or town centre, shops and offices on the edges of the neighbourhood, accessible open spaces and playgrounds, community centers and schools are some of the essential services that help create a complete community. Invest in public spaces to keep people in the neighbourhood.

#### **Principle Four: Preserve green spaces in the community**

While green spaces do not have a significant direct impact on energy or GHG emission reductions they are a very important component of

sustainability within Yellowknife. Remaining green spaces within the city allow for an integration of nature and protect ecological functions within the community. They also make the community more attractive and desirable, encouraging residents to walk or bike within the neighbourhood instead of driving in their cars to get away from the city. For these reasons the City should preserve green spaces within the community and connect them as much as possible.

#### **Principle Five: Control parking/ road footprints**

The size of paved areas within the city has an impact on the attractiveness of the neighbourhood. Wide roads and large parking lots adjacent to the street do not promote walking or biking. Instead they make space for cars and facilitate automobile commute. Additionally they have negative consequences for ecological functions and for the quality and quantity of surface water run-off. Therefore the City should limit the amount of paving and the size of roads and parking spaces within the community.

#### **Principle Six: Promote and pilot sustainable neighbourhood design and retrofit**

The above mentioned five principles are some of the examples of ways to design a sustainable neighbourhood. Many other models, templates, examples and guidelines exist for this same purpose. The City should create a pilot sustainable neighbourhood (for example as part of future development at Niven Lake), every aspect of which is designed with regard for sustainability, especially in terms of energy and GHG emission reductions. Similarly, the City should take on a pilot project on retrofitting a neighbourhood for energy efficiency and GHG reductions (for example at Range Lake). Eventually, all neighbourhoods within the city should be designed or retrofitted according to full sustainability guidelines.

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### 6.3 Recommendations on Transportation

#### **Principle One: move away from car-oriented development and focus on “quality of life”**

Driving is currently the primary mode of transportation within the city of Yellowknife and the infrastructure (wide roads, large parking lots) serves the automobile. To move towards sustainability with respect to energy use and GHG emission reductions this paradigm must change. The focus of transportation should not be simply on getting from one place to another, but on the quality of life that includes citizens' experience of the city while they are in transit. Amenities and design features should be used by the city to make neighbourhoods welcoming to pedestrians, cyclists, public transit users, and others using alternatives to the car. Disincentives to the car, such as higher parking fees should be considered by the City as an option.



### **Principle Two: Invest and innovate in public transit**

To get residents and visitors out of cars and onto public transit, the City should provide appropriate, comfortable and convenient public transit options. Public transportation is especially needed between residential areas and major destinations outside of the neighbourhood such as the airport, or between different residential nodes. Transit routes should be designed in consultation with communities, and need to be made comfortable and attractive through installing covered bus shelters, kiosks, bulletins, and information on routes and schedules at all bus stops. Where full size buses are not appropriate the City should look into smaller buses (mini-buses or vans), shuttles, and community taxis.

### **Principle Three: Create and maintain a space for active transportation**

The City should make streets attractive and safe for active transportation. Promote walking, biking and other forms of active transportation by a variety of design initiatives including narrowing the streets, installing bicycle lane or corridor on main streets, planting trees, providing benches and adequate lighting, promoting public art, promoting street level shops, reducing blank walls and parking lots against sidewalks and creating short blocks that are easy to navigate on foot.

### **Principle Four: Encourage connectivity and make it easy for people to get from one place to another**

Transportation networks within Yellowknife are currently fragmented and disjointed. The City should think in terms of connecting streets, sidewalks, and trails to make active transportation more feasible. Well built and connected sidewalks and trails should be designed into the neighbourhood from the start and not as an afterthought. The City should also consider creating a formal walking or skating lane on Frame Lake during the winter.

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## **6.4 Recommendations on Building Design**

### **Principle One: Use energy efficient components in buildings**

Many appliances and building components follow energy efficiency standards and can meet certain certifications such as Energy Star. The City should at a minimum educate builders and home owners about these energy efficient components and should also consider providing incentive programs (such as tax credits) that encourage the purchase of energy efficient components. Energy efficient infrastructure systems such as grey water recycling should also be supported by these programs.

### **Principle Two: Build with the landscape and natural features**

The City of Yellowknife has a unique geology and ecology that is worth preserving. As much as possible new developments should respect existing forms in the landscape including rocks, wetlands, rivers, trees and animal



habitats. Avoiding drastic changes to the landscape such as blasting rock, offers opportunities for energy savings and reduction of GHG emissions. The City should require that developers give consideration to building with the natural features surrounding the new development. Where natural features allow it, the City should support grey-water and stormwater reuse, natural treatment of wastewater, community composting, and installation of shared infrastructure for processing wastewater in remote subdivisions. Traditional natural systems used for distributed management of stormwater and wastewater require less energy and contribute to less GHG emissions than conventional infrastructure such as swage treatment plants.

### **Principle Three: Treat “waste” as a resource**

Waste created in construction, destruction or operations of a building can have large energy costs and GHG emission costs associated with its disposal. For this reason, and to conserve materials, the City should require that developers give consideration to using construction and decommissioning waste as resources or making it available for other developments (for example through a scavenging site at the landfill). The City should continue to provide recycling facilities for those materials that have a net positive energy transfer, and should ensure that buildings and neighbourhoods are designed to encourage recycling (for example, by providing interior space for recycling bins in commercial buildings).

### **Principle Four: Encourage development of renewable energy**

Space heating is the largest consumer of energy within the City of Yellowknife, responsible for more than 80% of total energy used in the community. Buildings have the potential to reduce the use of conventional energy and GHG emissions by switching to renewable energy sources. The City should encourage and provide financial incentives for experimentation with solar, wind, geothermal, and pellet stoves. Additionally, southern orientation of buildings should be required to maximize the use of passive solar energy for space heating.

### **Principle Five: Develop upfront sustainability codes and standards and build them into the development permitting process**

The four principles described above are some of the ways in which homes can be made more sustainable in terms of energy use and GHG emission reductions. There are other comprehensive models, templates and guidelines already in place, including the R-2000 model and the LEED Green Building Standards. The City should adopt one set or a selection of elements from these existing standards and introduce its own energy efficient lot development standards as part of the development permitting process. Legislating energy efficiency standards will ensure that all new homes are optimized to reduce energy use and GHG emissions.

## 7.0 CONCLUSION

Based on a review of literature and consultations with stakeholders and citizens, four sets of recommendations on sustainability planning principles with respect to energy use and GHG emission reductions are presented in Section 6. The principles recommended here are in line with the intention of the City of Yellowknife, as expressed in the General Plan and other documents. For example consider the following list of transportation policies in the 2004 Yellowknife General Plan, already discussed in Section 2.2.4 of this report.

- *Provide appropriate community densities;*
- *Provide mixed land uses (to accommodate a range of travel options or trip purposes);*
- *Organize density, land use and buildings to benefit from transit;*
- *Minimize passenger walking distances (maximum of 400 m);*
- *Create a pedestrian-friendly environment;*
- *Reduce transit travel time; and*
- *Build quality, user-friendly transit facilities (i.e. shelters, designated stops).*

The principles recommended in Section 6 do not contradict any of the above, but do provide further specifications on some, refine and prioritize them, and high light the importance of them. For example where the General Plan's policy is to *Provide appropriate community densities*, the recommended principles above specify a mechanism for doing so: *pursue opportunities for residential infill*. The recommended principles to *Invest and innovate in public transit* encompasses several of the policies in the General Plan: *Minimize passenger walking distances, Reduce transit travel time, and build quality, user-friendly transit facilities*. The discussion of this principle in Section 6 provides some mechanisms for doing so: provide transit between residential areas and major destinations outside of the neighbourhood such as the airport, design transit routes in consultation with communities, install covered bus shelters, kiosks, bulletins, and information on routes and schedules at all bus stops, and look into smaller buses (mini-buses or vans), shuttles, and community taxis where full sized buses are not appropriate.

As demonstrated in the above examples, the aim of the recommended principles is to complement and strengthen, not to contradict, the positive policies that the City already has in place. The conceptual vigor of the principles recommended here comes from the following:

- they were developed in regards to valid community concerns around energy use and GHG emissions;
- they were developed based on an extensive review of international literature on sustainability; and

- they were developed with significant input from stakeholders and community members.

The inclusion of these principles as a part of the CEP ensures that energy use and GHG emission issues and their implications for city planning are comprehensively addressed and clarified for all interested citizens, staff, and decision makers. It also gives a sense of urgency to the need to move forward with sustainability principles in the future development of the City of Yellowknife. It is crucial that the planning principles discussed in this report, upon adoption by Council, become the basis of future planning including the creation of General Plans and Zoning Bylaws.

## 8.0 REFERENCES

- Arctic Energy Alliance, Energy Community Planning Guide to Northern Communities
- Boyd, David, Sustainability within a Generation, David Suzuki Foundation, 2004
- City of Iqaluit General Plan, By-law 571, June 2003
- City of Iqaluit, Plateau Subdivision Development Standards An Illustrated Guide for Sustainable Development, March 2005
- City of Iqaluit, Sustainable Arctic Subdivision Feasibility Study, December 2004
- City of Whitehorse, 2002 Official Community Plan
- City of Whitehorse Local Action Plan (LAP) to Reduce Energy and GHG Emissions for City Operations and the Community February 2004
- City of Yellowknife 2004 General Plan (Background Report, and Bylaw 4315), November 2004
- City of Yellowknife Community Energy Planning Committee, Terms of Reference, January 2005
- City of Yellowknife Downtown Plan, July 2002
- City of Yellowknife Energy and Emissions Baseline Study, September 2005
- City of Yellowknife Interim Community Energy Plan, November 2005
- City of Yellowknife Report on Energy Expert "Roundtable", September 2005
- City and Borough of Juneau, Comprehensive Plan, 2003
- CMHC, Healthy Housing in the North towards a Northern Healthy House Demonstration Project, November 2002
- CMHC, Northern Landscaping: A Guide to Restoring Plants and Soil in Northern Communities, September 2002
- Congress for New Urbanism, <http://www.cnu.org/>
- Government of the Northwest Territories, Sustainable Development Policy, March 1993
- Richard Heinberg, The Party is Over: Oil, War, and the Fate of Industrial Societies, New Society Publishers, March 2003
- Hubbert, M. King Nuclear Energy and the Fossil Fuels: Exploration and Production Research Division, Shell Development Company, Publication Number 95, Houston, Texas, June 1956
- LEED for Neighborhood Developments: Rating System - Preliminary Draft, September 6, 2005

Meadows, Donella H., Dennis L. Meadows, Jørgen Randers, and William W. Behrens III. (The Club of Rome), Limits to Growth, Potomac Associates, New York, 1972

Robert et al, Strategic sustainable development - selection, design and synergies of applied tools, Journal of Cleaner Production 10 (2002) 197–214

Smart Growth BC, <http://www.smartgrowth.bc.ca/index.cfm>

Smart Growth Online, <http://www.smartgrowth.org/default.asp>

The Natural Step, Sustainability, Step by Natural Step, February 2006

United National Environment Program (UNEP), Melbourne Principles for Sustainable Cities

Wha Ti Community Energy Plan, June 2004

P:\EnvSci\101xxx\1010784 Yellowknife Sustainability Principles\Report

# **APPENDIX A**

Additional Workshop Information

**City of Yellowknife Sustainability Planning Principles & Practices  
related to Energy and Greenhouse Gas Reduction**

**Stakeholders Workshop  
April 26<sup>th</sup> , 2006 1:30-4:30 pm**

**Workshop Agenda**

- Welcome and Introductions
- The Problem Statement
  - Energy
  - Climate Change
- Sustainability Solutions and Frameworks
- The Need for Sustainability Principles in Yellowknife
- Exploring some Sustainability Principles (Group Activity)
- Break
- Reporting Back on Group Activity
- Examples from Northern Communities
- Group Discussion
- Break
- Draft Proposed Principles for Yellowknife
- Conclusion

**City of Yellowknife Sustainability Planning Principles & Practices  
related to Energy and Greenhouse Gas Reduction**

**Public Presentation  
April 26<sup>th</sup> , 2006 7:00-9:00 pm**

**Public Presentation Agenda**

- Welcome and Introductions
- The Problem Statement
  - Energy
  - Climate Change
- Sustainability Solutions
  - What is sustainability?
  - Existing Sustainability Models and Principles
- Proposed Sustainability Principles for City of Yellowknife
- Group Discussion
- Conclusion





**Figure 1: Michael Gannon, Interim Yellowknife Energy Coordinator, delivers the opening remarks at the Stakeholder Workshop.**



**Figure 2: Aftab Erfan, Jacques Whitford, delivers the presentation during the Stakeholder Workshop.**



**Figure 3: Group work during Stakeholder Workshop.**



**Figure 4: Group work during Stakeholder Workshop.**





**Figure 5: Group Discussion during the Community Workshop.**



**Figure 6: Discussions during the Community Workshop.**



**Figure 7: Nick Lawson, Jacques Whitford, wraps up the Community Workshop.**