Taking an Integrated Approach to Sustainable Community Design: A brief overview of EQuilibrium\textsuperscript{TM} Communities projects and a sample of other national and international projects

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One of the greatest challenges facing urban and rural communities today is the need to design sustainable neighbourhoods and communities. Sustainable community design is critically important because of the impact of our housing, neighbourhoods and communities on the limited resources of our planet and its limited capacity to absorb our waste. The design of neighbourhoods and communities has a major impact on our environment through its influence on travel patterns, traffic congestion and production of greenhouse gases. Our buildings are major consumers of land, energy and raw materials. The size and location of our houses, the materials and technologies used in construction and the infrastructure and systems supplying services all influence the amount of resources required to construct and operate our homes and the consequent impact on the environment.

While there is no specific template to follow in designing sustainable neighbourhoods and communities, architects and urban design teams are responding to this challenge by pursuing a number of design principles. Key among these is the importance of using an integrated design process to maximize the synergies among the diverse elements and functions of the built environment. This approach requires a multi-disciplinary team and extensive community engagement and stakeholder involvement.

This article focuses on recent initiatives to design sustainable communities, with particular attention paid to the EQuilibrium\textsuperscript{TM} Communities Initiative and the projects it is supporting. It also includes examples of other sustainable community projects in Canada and Europe.

After studying this article, readers will be able to:

- identify key principles of sustainable community design;
- describe the themes and indicators of the EQuilibrium\textsuperscript{TM} Communities Initiative;
- provide examples of how multi-disciplinary design teams have taken an integrated approach to design; and
- locate and access resources and tools to support the design of sustainable neighbourhoods and communities.

The article is organized in seven sections:

1. Sustainable Community Design
2. The EQuilibrium\textsuperscript{TM} Communities Initiative
3. The EQuilibrium\textsuperscript{TM} Communities Projects
4. Other Examples of Sustainable Community Projects in Canada
5. Sustainable Neighbourhoods outside Canada
6. Tools for Sustainable Community Design
7. Summary

Appendix – Additional Resources.
1. Sustainable Community Design

Although the term “sustainable community” is used frequently, many different definitions and related initiatives exist. While this article focuses on the definition articulated by Canada Mortgage and Housing Corporation (CMHC) and Natural Resources Canada (NRCan) through EQuilibrium Communities Initiative, other similar key concepts are also described.

Beginning in the late 1990s, sustainability initiatives broadened the focus from sustainable houses to sustainable neighbourhood and community design. Working at the neighbourhood scale provides opportunities to realize greater benefits and reduced costs as a result of integrated planning. For instance, working with multiple buildings and land uses provides opportunities to integrate energy and water systems and potentially to capitalize on renewable and waste energy for use in community energy systems. Planning developments on a neighbourhood scale can also facilitate pedestrian-friendly design features, making transportation alternatives such as walking, cycling and public transit viable options to frequent private vehicle use.

Examining the typical features of sustainable communities suggests that they have all the necessary amenities, activities and opportunities for daily life (i.e., housing, culture, employment, entertainment, health care, recreation, schools, shopping etc.) within easy walking or cycling distance or within a short public transit ride. They also help restore, preserve and enhance the natural environment. In other words, a sustainable community supports both healthy eco-systems and healthy living conditions.

Translating the concept of sustainability into a design scheme for a specific neighbourhood should be informed by the unique context and circumstances present in the neighbourhood. However, there are certain principles that apply universally regardless of context, and many sustainable community initiatives have identified sets of principles/performance objectives to guide their work (e.g., Smart Growth, LEED® for Neighbourhood Development, Living Building Challenge and One Planet Living).

**Smart Growth**¹ is an urban planning and transportation theory that concentrates growth in compact walkable urban centers to avoid sprawl and advocates land use and development principles for creating sustainable communities. These include:

- Encourage a diversity of land uses to ensure that each neighbourhood includes a mixture of homes, retail, business, and recreational opportunities.
- Build well-designed compact neighbourhoods where residents can work, shop and access recreation areas in close proximity to where they live;
- Provide a variety of transportation choices including walking, cycling, transit and driving;
- Create diverse housing opportunities to include individuals and families with varying income levels and at different life stages;
- Encourage growth in existing communities;
- Preserve open spaces, environmentally sensitive areas and areas of natural beauty;
- Protect and enhance agricultural lands;
- Utilize smarter, less expensive infrastructure and green buildings;
- Foster a unique neighbourhood identity; and
- Nurture engaged citizens.

¹ [http://en.wikipedia.org/wiki/Smart_growth](http://en.wikipedia.org/wiki/Smart_growth). Wikipedia is one of many available sources of general descriptions for such theories/programs
In 2010, the Canada Green Building Council (CaGBC) acquired the Smart Growth brand including the British Columbia’s (BC) programs such as Community Assistance Programs (CAP and CAP+), Smart Growth on the Ground (SGOG) and others that support the overall implementation of the ten aforementioned principles².

The **LEED® for Neighbourhood Development**³ (LEED-ND) rating system was launched in 2010 by the U.S. Green Building Council (USGBC) to guide and assess sustainable community development projects. The rating system integrates the principles of Smart Growth, New Urbanism⁴ (an urban design movement, which promotes walkable neighborhoods containing a range of housing and job types while encompassing principles such as traditional neighborhood design (TND), transit-oriented development (TOD) and “green building” into neighbourhood design). Components of LEED-ND include: smart location and linkages, neighbourhood pattern and design, green infrastructure and buildings, innovation and design process, and regional priority credit (this last component was introduced in the LEED 2009 rating systems to encourage the achievement of credits that address geographically specific environmental priorities). As with other LEED rating systems, LEED-ND offers four levels of certification: Certified, Silver, Gold and Platinum.

To date, 23 Canadian projects⁵ are registered as international USGBC LEED-ND pilot projects including Dockside Green in Victoria, Currie Barracks in Calgary, The Village At Griesbach in Edmonton and Faubourg Broisbriand in Broisbriand, Quebec. The CaGBC is currently developing Canadian equivalencies for the LEED ND program and these are anticipated to be released in 2011. Five Canadian projects and plans are registered as of July 2011⁶.

The **Living Building Challenge**⁷ was launched in 2006 by the Cascadia Green Building Council and since 2009 has been run by the International Living Building Institute (ILBI). It is a philosophy, advocacy tool, and certification program that goes further than LEED-ND in its mandatory requirements and covers projects ranging from small buildings to neighbourhood developments. It addresses seven performance criteria including: site, water, energy, health, materials, equity and beauty. The Living Building Challenge is based on actual, rather than simulated, performance with projects required to be operational for a minimum of 12 months prior to evaluation.

**One Planet Living**⁸ is a global initiative that envisions a sustainable world, where all people enjoy a high quality of life within the productive capacity of the planet while ensuring adequate space for the sustainability of wildlife and wilderness areas. One Planet Living is based on ten sustainability

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² [http://www.cagbc.org/Content/NavigationMenu/Programs/SmartGrowth/default.htm](http://www.cagbc.org/Content/NavigationMenu/Programs/SmartGrowth/default.htm) (July 6, 2011).
principles developed by the BioRegional Development Group⁹ and the World Wildlife Fund International¹⁰:

- Zero carbon: Making buildings more energy efficient and delivering all energy with renewable technologies;
- Zero waste: Reducing waste, re-using where possible, and ultimately sending zero waste to landfill;
- Sustainable transport: Encouraging low carbon modes of transport to reduce emissions, reducing the need to travel;
- Sustainable materials: Using sustainable and healthy products, such as those with low embodied energy, sourced locally, and made from renewable or waste resources;
- Local and sustainable food: Choosing low impact, local, seasonal and organic diets and reducing food waste and food transportation;
- Sustainable water: Using water more efficiently in buildings and in the products we buy; and manage water in such a way as to support healthy land-use, avoid local flooding and avoid pollution to watercourses;
- Land and wildlife: Protecting and restoring existing biodiversity and natural habitats through appropriate land use and integration into the built environment;
- Culture and heritage: Reviving local identity and wisdom; supporting and participating in the arts;
- Equity and local economy: Creating bioregional economies that support fair employment, inclusive communities and international fair trade; and
- Health and happiness: Encouraging active, sociable, meaningful lives to promote good health and well being.¹¹

All the initiatives and programs mentioned above have common principles that help define the neighbourhood as sustainable and liveable. Some have more characteristics than others, but they all share principles of mixed use, transit oriented design and emphasised water management indicating the importance of these principles in the design of sustainable communities. Design’s adherence to these principles is supported by the use of a particular way of designing: an Integrated Design Process (IDP).

**Integrated Design Process¹²**

Designing a sustainable neighbourhood or community is much more complex than simply adding in sustainable features to a design scheme. The key is developing a thorough understanding of the relationships between the diverse elements and functions of the built environment in addition to the requirements to meet performance objectives. This requires an integrated design approach that takes into account a wide variety of factors (e.g., resources, materials, emissions, natural habitat, future occupants, health and culture) and the interrelationships among them.

An integrated design approach relies upon interdisciplinary teams of design professionals and extensive community engagement and stakeholder involvement from the very early stage of the design through to

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⁹ [http://www.bioregional.com/](http://www.bioregional.com/)

¹⁰ [http://www.worldwildlife.org](http://www.worldwildlife.org)


its end at the beginning of operational stage. Such cooperation is essential to enable the design teams to develop various scenarios and assess them in terms of their effectiveness in meeting the objectives of all stakeholders. Very often objectives may be contradictory (e.g., neighbours may oppose the project, regulators may be unwilling to approve innovative approaches etc.).

Planning at the neighbourhood or community scale provides opportunities to capitalize on the interconnections among various objectives. For example, providing pedestrian pathways and bicycle paths will encourage activity, which supports objectives of improving health, reducing energy consumption, reducing pollution and creating active, safer streets (see Text Box Integrating Design Elements at the Community Scale for more information).

Computer models and design tools are available to assist in the design process. For example, the CMHC Life Cycle Costing Tool\(^{13}\) allows users to estimate and compare the costs of infrastructure for various design scenarios. This tool can assist with integration of land use planning variables, such as density and land use mix, with infrastructure costs as well as some external costs, such as vehicle and air pollution costs. Additional resources and examples are provided in the appendix.

**Examples of Integrating Design Elements at the Community Scale**

Planning at the neighbourhood or community scale provides opportunities to integrate various elements and systems in the design, such as:

- recovering heat from sewage or other waste sources for use in community energy systems;
- directing stormwater to soil volumes in planting pits, basins or swales to reduce run-off and improve stormwater quality, for example, bioswales;
- composting food waste into soil for use in on-site gardens;
- integrating energy solutions (such as photovoltaic panels) into the design of buildings so they blend in with the environment, are unobtrusive and feed into the community energy systems;
- capturing rainwater for use in toilet flushing and irrigation;
- creating compact, mixed use development concentrated around transit nodes, such as rapid transit stations to reduce car use and make community energy systems more viable;
- including a variety of land and building uses in close proximity and connected with pedestrian-oriented pathways to create more vibrant neighbourhoods and reduce the need to travel by car for daily needs; and

The integrated design process was developed to take advantage of the dynamics of large groups of individuals interacting together to achieve higher levels of performance in buildings and communities. An integral part of the IDP is the charrette (a working meeting) where all of the relevant stakeholders meet to set performance goals and develop design options to meet these goals. Having everyone work together on the design from the start can help eliminate the need for costly changes later. *It also has* the potential for reduced construction and operational costs as a result of integrated and collaborative thinking. In a design charrette, each specialist provides the group with recommendations for achieving the goals in their respective areas of expertise. Once the group has agreed on the goals, it can then explore possible, compatible integrated solutions. Often, during this process, team members will see

different but usually complementary ways of improving ideas. It is during this process of identifying and integrating a variety of diverse ideas that innovative, superior and more cost-effective solutions can emerge.

Figure 1. IDP Charrette on one of the EQ Communities (Source: CMHC)

2. The EQuilibrium™ Communities Initiative

EQuilibrium™ Communities is a three-year, collaborative sustainable community demonstration initiative of Natural Resources Canada (NRCan) and CMHC under the Government of Canada’s ecoACTION umbrella. It supports demonstration projects that integrate a wide range of sustainability themes at the community scale and aims to maximize opportunities when multiple buildings, housing units and land uses are integrated across systems, such as energy, water, land use, transportation and the natural environment.

The Initiative is providing support to developers of selected sustainable community development projects that are designed to achieve high environmental and energy performance levels and that are financially viable and affordable. Support is made available for research, feasibility studies, design costs as well as visioning and alignment activities to improve performance in projects that are planned or underway. Monitoring and information sharing of projects will be undertaken to allow other developers across Canada to benefit from the experience gained by the project development teams.

The Initiative is structured around six interrelated themes that focus on design elements that are most directly impacted by urban form and are measureable.

- **Energy**: an energy-efficient community that balances energy supply and use to minimize greenhouse gas emissions;
- **Land Use and Housing**: a compact community with a balanced mix of activities, housing choices and commercial, institutional, recreational and industrial land uses;

- **Water, Wastewater and Stormwater**: a community that will minimize the use and disposal of water and negative impacts on watersheds;

- **Transportation**: a community that reduces fossil-fuel use from personal vehicle travel and provides opportunities for resource-efficient and healthy alternatives;

- **Natural Environment**: a community that protects, enhances and restores the natural environment; and

- **Financial Viability**: a marketable community that through its design, operation, integration and financing, is economically viable over the long term.14

Indicators for measuring performance across these themes are shown in Table 1.

**Table 1 – EQuilibrium™ Communities Performance Indicators**15

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Consumption in Buildings</td>
<td>Estimate of annual energy use in MJ/m² for each building type</td>
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<tr>
<td></td>
<td>Estimate of total energy use across all buildings</td>
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<tr>
<td>Neighbourhood Use of Renewable and Waste Energy</td>
<td>Estimate of annual energy planned for capture from renewable and industry/operational waste inputs (in GJ)</td>
</tr>
<tr>
<td>Housing Affordability</td>
<td>Percentage of dwellings with price/rent equal to/or lower than the average for the area</td>
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<tr>
<td></td>
<td>Breakdown of dwelling types</td>
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<tr>
<td>Land-Use Diversity</td>
<td>Breakdown of land area for each land use type (residential, mixed-use, commercial, industrial, agricultural, civic, public open space and natural habitat)</td>
</tr>
<tr>
<td>Proximity to Daily Destinations</td>
<td>Percentage of dwellings within 800m of grocery store, restaurant or café (coffee shop) and pharmacy</td>
</tr>
<tr>
<td>Proximity to Jobs</td>
<td>Number of jobs within a 5 kilometre radius of centre of development site</td>
</tr>
<tr>
<td>Proximity to Civic Amenities</td>
<td>Number of civic amenities (e.g., schools, libraries, community centres) within 800m of centre of development site</td>
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<tr>
<td>Transit-Supportive Density</td>
<td>Number of occupants per hectare</td>
</tr>
<tr>
<td></td>
<td>Number of jobs per hectare</td>
</tr>
<tr>
<td>Transit Proximity and Quality</td>
<td>Percentage of occupants and jobs within 400m of public transit access point.</td>
</tr>
<tr>
<td></td>
<td>Transit frequency</td>
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<td></td>
<td>Percentage of dwellings within 800m of rapid transit station</td>
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| Pedestrian Route Connectivity and Safety | Number of pedestrian route intersections per hectare  
Number of pedestrian route connections per kilometre of boundary |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Site Stormwater Infiltration</td>
<td>Percentage of stormwater falling within the development project site that will be infiltrated on-site</td>
</tr>
</tbody>
</table>
| Potable Water Use Reduction             | Percentage of dwellings with dual-flush, 3 or 4.5 litre toilets, low-flow fixtures, water-efficient front-loading clothes washers  
Percentage of dwellings with water recovered from non-potable sources (e.g., greywater, wastewater, rainwater) per end-use  
Percentage of landscaped area that is a water-efficient landscape type (e.g., xeriscapes, woodlands, wildflower meadows/prairies and low-maintenance lawns) |
| Tree Canopy Intensity                  | Total percent of project area with tree canopy  
Percentage of tree canopy from existing trees |
| Open Space Proximity and Quality       | Percentage of dwellings within 400m of a public open space  
Quality/size of open space |
| Natural Habitat Protected, Restored, Enhanced or Created | If the project site has existing significant natural habitat area, percentage of that area to be protected, restored or enhanced  
Percentage of the project site area for habitat creation |
| Agricultural Land Protected            | If existing productive agricultural land is part of the development site, percentage that is maintained or enhanced |
| Access to Locally Produced Food        | Area of dedicated food growing space per dwelling  
Percentage of dwellings within 800m of farmers’ market |
| Watershed Protection                   | Plans for minimizing or eliminating adverse effects to watercourses (both on- and off-site) and the lands that drain into them |

Additional criteria not listed in Table 1 include measures for ensuring financial viability such as innovative financing, marketability and long-term operational viability.

The EQuilibrium™ Communities Initiative was launched in 2009 and was open to private, public and non-profit sector developers across Canada. To be eligible, projects were required to meet several criteria, i.e., a multi-building, multi-use project, with at least 50% of the built or renovated square footage dedicated to residential use. Proponents were asked to provide details of their project’s anticipated performance across the indicators along with evidence of their readiness to proceed with the project (i.e., control of the site, compliance with municipal growth policies and plans and financial ability to execute the project). A major component of the selection process was the project’s targeted performance levels for each of the indicators.

The Initiative provides support for various activities in an integrated design process for selected projects that are in the planning and design phase, enabling exploration of options from many different perspectives and areas of expertise.

### 3. The EQuilibrium™ Communities Projects

To date four projects have been announced (August 2011): The Ty-Histanis Neighbourhood Development on Vancouver Island, Station Pointe in Edmonton, Regent Park Revitalization (Phase 1) in Toronto and the Ampersand project in Ottawa.
Ty-Histanis Neighbourhood Development
The Ty-Histanis Neighbourhood Development is a project of the Tla-o-qui-aht First Nations (TFN) on the western shore of Vancouver Island. Located approximately 10 kilometers from Tofino, the Ty-Histanis Neighbourhood is situated on 84 hectares of land transferred from the Pacific Rim National Park Reserve (see Figure 2).

The project demonstrates the integration of occupant and expert input into the design process. Occupant involvement in the process will help ensure the design is practical and meets the needs of the future occupants over the long term. TFN used Initiative funding to bring together future occupants, project builders, architects, mechanical and structural engineers, landscape architects and energy modellers in a series of integrated design sessions. The dialogue resulted in creative and practical design solutions, including an improved building envelope design expected to achieve maximum performance on a standard budget.

Energy: The project is targeting a 50% reduction in greenhouse gas emissions mainly through a community energy system using ground source heat pumps (combined with radiant floor heating), electrical and mechanical systems and building envelope improvements (see Figure 3),
Land Use and Housing: Upon completion, TFN plans to include up to 215 homes (171 single-detached units, 32 duplex units and a 12-unit elders’ complex) as well as a health clinic, pharmacy, school, recreation centre and centres for youth and elders.

Water, Wastewater and Stormwater: A performance target is that 100% of pre-development stormwater remain on-site through infiltration and rainwater recovery. Bogs are to be used for natural water retention.

Transportation: The mixed-use development is anticipated to reduce dependence upon personal vehicle use, as amenities will be located within walking distance. The meandering footpaths, set back from narrow roads by vegetated swales, aim to encourage walking and bicycling, social interaction, health and fitness.

Natural Environment: Site planning, sensitive to the natural features of the property, aims to ensure that at least 40% of the site is maintained as undisturbed, natural, protected habitat.

Financial Viability: A central theme of the project is occupant involvement: members of the community are being involved throughout the process to ensure the finished product meets their housing needs and is affordable to them. TFN will continue to collect feedback from residents after occupancy to assess the on-going performance of the project.

The EQuilibrium™ Communities Initiative is supporting:
- stakeholder involvement and integrated design process;
- analysis to improve building performance and performance of the energy, water and landscape systems;
- monitoring energy and water consumption, housing affordability and occupant satisfaction; and
- showcasing project performance.

Figure 3 – Radiant Floor Heating, Ty-Histanis (Source: CMHC)
For more information:
http://cmhc.ca/en/inpr/su/eqsucoin/index.cfm and refer to Ty-Histanis

Station Pointe, Edmonton, Alberta
The Station Pointe project is a transit-oriented, brownfield development located on former industrial lands in the northeast part of Edmonton. It is being developed by The Communitas Group and is the first redevelopment within the Fort Road community renewal project initiated by the City of Edmonton. The project is currently in the design phase. The design of the buildings within the community is based on Passive House concepts with the emphasis on remaining affordable.16

Energy: The project is targeting a 75% reduction in whole building energy use by focusing on passive design features, including a superior envelope design.

Land Use and Housing: The mixed-use plan includes 220 affordable and market residential units in a mix of townhouses, mid-rise and high-rise apartments. It also includes more than 1,400 m² of commercial and retail space, a daycare centre and community facilities (see Figure 4).

Water, Wastewater and Stormwater: One target is to treat all wastewater produced in the development on site and re-use it for toilet flushing and irrigation and also to divert stormwater from the municipal sewer through a combination of on-site infiltration and capture, treatment and re-use on-site.

Transportation: The site is located within 300 m of a light rail transit station and bus terminal.

Natural Environment: As a former brownfield site, no natural habitat or agricultural lands were removed to create this project and new landscape and stormwater runoff reduction features are planned.

Financial Viability: Affordability is a guiding objective in the project, targeting prices below the area average. The neighbourhood is being developed as a number of housing co-operatives, including continuing and homeownership co-operatives, and also a “second-tier co-operative” which will operate as a neighbourhood association taking responsibility for the common property and systems. The developer is exploring the feasibility of offering a green loan to residents to cover the increased capital costs of energy-saving features. The loans would be repaid through monthly green fees equal to monthly energy savings.

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Figure 4 – Station Pointe  (Source: Hartwig Architects Inc.)

The Station Pointe team is using EQuilibrium™ Communities Initiative support to:
• integrated design charrettes
• conduct energy modeling and analysis aimed at integrating Passive House design principles with its building design;
• explore options for treating wastewater on site and rainwater harvesting; and
• research financial tools for making these options affordable for the future residents.

For more information:
http://cmhc.ca/en/inpr/suscoin/index.cfm and refer to Station Pointe

Regent Park Revitalization, Toronto, ON
Toronto Community Housing (TCH) is redeveloping Canada’s oldest17

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17 Regent Park was originally built in 1948.
and largest social housing community, into a mixed-income, mixed-use community. The redevelopment will occur in 6 phases over a 15 year timeframe and will include the demolition and replacement of all the original buildings.\(^2\) Once completed, the 28 hectare Regent Park will more than double its population density and provide housing for 5,100 households.

**Figure 5 – Regent Park (view from balcony) (Source: CMHC)**

Phase 1 of the revitalization will create 360 affordable rental units for low- to moderate-income residents and 670 market-priced condominiums as well as office, retail and community uses. Phase 1 construction is completed and units are occupied.

The project includes a green building education program to encourage residents to reduce water and energy consumption. Water and energy use will be monitored regularly and communicated back to residents, enabling them to monitor and adjust their consumption patterns.

**Energy:** The development is projected to reduce energy consumption by between 40 and 50\% (compared to the Model National Energy Code for Buildings). Energy savings will occur due to energy-efficient building envelopes, lighting, appliances and mechanical systems and through connection to a community energy system. The energy system, which currently uses natural gas, is planned to generate electricity using combined heat and power (CHP) and use waste heat (through its connection to a community energy system) for residential heating that will also contribute to energy savings.

**Land Use and Housing:** The project includes a mix of townhouses and apartments (mid-and high-rise) in rental units for low to moderate income and market condominiums. In addition to being a mixed-income neighbourhood, it is a mixed-use neighbourhood, including two daycares, community agency space, a learning centre, employment hub and over 2,500 m² of retail and commercial services space, including a bank and a large grocery store.

**Water, Wastewater and Stormwater:** The project targets a maximum runoff volume of 50% of average annual rainfall through strategies such as green roofs and porous pavers. Strategies for reducing potable water use include low-flow fixtures and water-efficient landscape design.

**Transportation:** Located in Toronto’s east downtown, Regent Park offers excellent access to public transit, places of employment, civic amenities and other frequent daily destinations, all within easy walking distance, in a pedestrian-friendly, interconnected design.

**Natural Environment:** In spite of the high density, the design includes more public open space than in the previous lower density garden city design. Open space is connected to the pedestrian network, encouraging walking and cycling. New tree canopy coverage and green roofs enhance the natural environment.

![Figure 6 – Regent Park, street view (Source: CMHC)](image)

**Financial Viability:** Affordability is a central theme for the project. For 35% of the rental housing, rents will either be calculated based on household income or set at rates lower than the area average. The project also includes an affordable homeownership program.

Support from the EQuilibrium™ Communities Initiative is being used to:
- support analysis for the expansion and upgrade of the community energy system, including investigating the integration of combined heat and power into the system;
water use monitoring: and
showcase Phase 1 performance, such as guided site tours and an interactive information kiosk on water and energy consumption.

For more information:
http://cmhc.ca/en/inpr/su/eqsucoin/index.cfm and refer to Regent Park
http://www.torontohousing.ca/investing_buildings/regent_park

Ampersand, Ottawa, Ontario
The Ampersand project is a mixed-use neighbourhood development in the Chapman Mills Town Centre community in South Nepean, Ottawa (see Figure 7). The developer, the Minto Group, is investigating the feasibility of achieving net-zero energy consumption within the development, learning from the experience gained from Inspiration – the Minto ecohome built under CMHC’s EQuilibrium™ Sustainable Housing Demonstration Initiative.

Figure 7 – Ampersand Site Plan (Source: Minto Group Inc.)

Energy: A 14 unit condominium apartment, targeting net-zero energy consumption and featuring photovoltaic panels, is to be completed in 2011 and will be monitored and compared to a reference building built beside it. Other buildings are planned to include design features such as improved building envelopes and mechanical systems and energy-efficient appliances to reduce energy consumption. Minto is investigating the feasibility of a community energy system powered by biomass and other renewable energy sources such as photovoltaics.
**Land Use and Housing:** The project plans to include more than 1,000 new homes of various design including stacked townhouses and mid-rise apartments and approximately 25,000 m² of commercial/retail space, civic facilities and public open space.

**Water, Wastewater and Stormwater:** Minto is targeting stormwater run-off reduction by using permeable pavements and green roofs. The developer is investigating rainwater capture and treatment for non-potable water applications, such as irrigation and is also exploring greywater re-use opportunities.

**Transportation:** The site is adjacent to a number of daily destinations including grocery stores and restaurants and is a short walk to a rapid transit bus station and a proposed light rail transit station.

**Natural Environment:** Minto is researching the feasibility of providing tree canopy coverage for 30% of the site and providing areas for community and home-scale food growing.

**Financial Viability:** The developer is exploring the possibility of creating green financing options such as a green loan program to finance the initial costs of energy efficiency improvements as well as alternative purchasing options such as rent-to-own.

Support from the EQuilibrium™ Communities Initiative is being used to investigate:
- the feasibility of net-zero-energy consumption through improved building envelopes, mechanical systems and appliances, as well as a community energy system powered by biomass and renewable energy sources;
- stormwater run-off reduction through permeable pavement and green roofs;
- water-efficient landscaping and rainwater re-use; and
- green financing options.


These EQuilibrium™ Communities projects are very different from each other in many ways including size, scope, site characteristics (brownfield site, natural site, greenfield), location (urban centre, rural, suburban), climate (West Coast, Prairie, Ontario) and type (transit-oriented development, re-development, new community). In spite of their differences, these communities demonstrate adherence to the six interrelated sustainable development themes of the Initiative. They provide tangible examples of sustainable community design that will serve to inform architects, planners and other stakeholders in the design, construction and operation of sustainable communities/neighbourhoods.

4. Other Examples of Sustainable Community Projects in Canada

**Dockside Green in Victoria, British Columbia**

Dockside Green is a six-hectare brownfield development located in Victoria’s Upper Harbour. It is the largest development of City land in Victoria’s history and, when completed, will include 26 buildings totalling 122,000 m² of mixed residential, office, retail and industrial space (see Figure 8). Dockside
Green developers were committed to achieving LEED® platinum certification on most buildings. The few exceptions include restaurant and pub facilities.

![Dockside Green, 3D](Source: CMHC)

All buildings have green roofs and rooftop gardens and are designed to use 45 to 55% less energy than the Model National Energy Code. Renewable energy systems include an on-site biomass gasification plant that turns waste wood into energy for space heating and domestic hot water. Electricity is produced from the biomass plant and also from photovoltaic panels and wind generators. Residential suites are metered to show domestic water and electricity usage, allowing residents to monitor and be billed for their consumption.

A central feature of the development is a series of connected naturalized creeks and waterways flowing through the site alongside a pedestrian walkway (see Figure 9). Wastewater, which is treated on-site and reused for flushing toilets, laundry and landscape irrigation, is also used to recharge the waterway. The development offers a range of transportation choices including a car share program, bicycle trails, pedestrian walkways and easy access to a harbour ferry dock and public transit.

![Dockside Green Waterway](Source: CMHC)

For more information: [www.docksidegreen.com](http://www.docksidegreen.com)
Technopole Angus, Montreal, Quebec

Technopole Angus is a 50.6-hectare mixed-use development located on the site of the former Canadian Pacific Railway Yards east of downtown Montreal. It is now a booming business park with over one million square feet of office rental space including state-of-the-art laboratories and office space for a variety of businesses. Originally intended for demolition, the old locomotive assembly plant was preserved and converted into office space and light industrial premises. Eventually, the site will contain over 2.6 million square feet of office space built to LEED® standards.

The high-density business park is described as “a convivial model urban campus, promoting exchanges at every level: between persons and public spaces, between the built environment and the public domain, between businesses and the city”³. It includes park and open spaces and is well integrated into the adjacent residential neighbourhood.

The redevelopment also includes a total of 1,200 housing units (townhouses, condominium apartments and seniors’ apartments ranging from 84 to 232 m² in a range of floor plans allowing for a variety of lifestyles.⁴ Small parks and grassy areas for recreation are incorporated among the residential buildings. There is a large grocery store on site and easy access to other nearby shopping areas (see Figures 10 and 11 for before and after development).

*Figure 10 - Technopole Angus, 1992*
(Source: International Initiative for a Sustainable Environment (iiSBE) http://iisbe.org)

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Village at Southeast False Creek, Vancouver, British Columbia

Village at False Creek is the first phase of a three phase redevelopment plan for the southeast shore of False Creek – a former industrial site adjacent to Vancouver’s downtown peninsula. Originally designated as the Olympic Village for the 2010 Winter Games, Village at Southeast False Creek (See Figure 12) is now a mixed-use neighbourhood with 1,100 residential units, local businesses, community facilities and approximately 2.5 hectares of green space including green roofs, garden plots for urban agriculture, playgrounds and wetlands.

The project includes market condominiums, rental housing and affordable housing. The seniors’ affordable housing building is the first multi-unit residential building in Canada to target net zero energy.
through improvement to its envelope and use of efficient mechanical and electrical systems. The building is heated using waste heat from a grocery store located on its ground floor. The remainder of the building’s energy use will be offset by the production of hot water from solar thermal arrays installed on the roof (see Figure 13).

Other innovative design features include extended roof structures on some buildings to increase their capacity to collect rainwater and to make its collection and use more visible to residents (see Figure 14).

All buildings are connected to the Neighbourhood Energy Utility (NEU) – a community energy system capable of producing heat from a variety of renewable energy sources such as heat recovered from a municipal sewer line adjacent to the property and surplus heat energy generated from roof-mounted solar thermal arrays. Heat is distributed through a system of underground piping from the NEU to energy transfer stations located in the basements of all buildings.

The Village at False Creek was awarded Stage 2 LEED® platinum status by the US Green Building Council in 2010.

For more information: http://www.thechallengeseries.ca/

Toronto Waterfront Revitalization For more information: http://www.waterfronttoronto.ca/

In 2001, the Toronto Waterfront Revitalization Corporation (now known as Waterfront Toronto) was established to direct a comprehensive, integrated approach for renewal of the waterfront. This is the largest urban redevelopment project in North America and one of the largest waterfront developments in the world. Once completed, the 800-hectare development will include 40,000 new residences (20% will be affordable housing), 40,000 new jobs, new transit infrastructure and 300 hectares of parks and public space (see Figure 15).
The East Bayfront and West Don Lands waterfront communities, currently under construction, will feature green roofs, pedestrian-friendly streets, extensive parks and public spaces, affordable housing, new jobs and easily accessible public transit.

The East Bayfront community, situated on 23 hectares of former industrial land, will contain 6,000 residences (including 1,200 affordable units); 3 million square feet of commercial space for 8,000 new jobs; 5.5 hectares of parks and public space; and a 1 kilometre waterfront promenade. The West Don Lands riverfront community will contain 6,000 new residences along with commercial space, an elementary school and two child care centres. The 32-hectare site will contain over 9 hectares of parks and public space, including Underpass Park – the most extensive park ever to be built under an overpass in Canada (see Figure 16). The community, situated within a 15-minute walk to downtown Toronto, will be the site of the 2015 Pan American Games Athletes’ Village.

5. Sustainable Neighbourhoods outside Canada
There are many examples of sustainable neighbourhoods in other countries, especially in Europe. Two examples, one from Sweden and one from Germany, are included here for further inspiration. The

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6 http://www.waterfronttoronto.ca/explore_projects2/west_don_lands (June 21, 2011).
whole municipality of Malmo, Sweden is aiming to run completely on renewable energy by 2030.\(^8\) Vauban, Germany prides itself as being a “suburb without cars”.

**Bo01, Malmo, Sweden – City of Tomorrow\(^9\)**

Bo01 (“Living 2001”) is a sustainable housing development located on a former brownfield site on the waterfront in Malmo, Sweden. Currently housing 1,400 residents, it is the first stage of a large-scale sustainable neighbourhood development that will eventually house 10,000 residents and contain a mix of residential, commercial and community facilities.

The design for Bo01 was guided by the Quality Program - a list of development guidelines covering architectural qualities, choice of materials, energy consumption, green space requirements and technical infrastructure.\(^10\) Twenty-six architectural firms, from European countries participating in the program, designed the buildings, giving the development a striking diversity of styles. Five-storey buildings are situated along the sea-front promenade to create a protection from the Baltic Sea winds for the shorter buildings and courtyards situated in the interior of the development (see Figures 17 and 18). Rainwater is captured and funnelled from rooftops into connected channels and rain gardens.

*Figure 17 - Malmo – “cold side” (higher storey buildings along the sea front) (Source: CMHC)*

*Figure 18 – Malmo “warm side” (inner courtyard, rain gardens and shared access to underground parking) (Source: CMHC)*

The district energy system is completely powered by renewable energy sources including solar, wind and heat extracted from seawater.\(^11\) Receptacles for garbage, organic waste and recyclables are connected to an underground pipeline which sucks the material to a central storage area where it is

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10 A downloadable version of the Quality Program is available at http://malmo.se/download/18.4a2cec6a10d0b3e08b00012615/kvalprog_bo01_dn_eng.pdf (June 21, 2011).
11 Seawater is used in a geothermal system that supplies 80% of all heating and cooling requirements.
picked up by municipal waste trucks. Food waste from grinders in the kitchen is turned into biogas for electricity and heat generation.

For more information:
http://www.malmo.se/English/Western-Harbour/Plans-and-on-going-projects/Bo01-expo-area/Detailed-development-plans-Bo01.html
http://www.urbandesigncompendium.co.uk/bo01MalmoSweden
http://malmo.se/English/Sustainable-City-Development/Bo01---Western-Harbour.html

Vauban, Germany - The Suburb Without Cars
Vauban is a sustainable, neighbourhood located on the outskirts of Freiburg, Germany near the Swiss and French border. Situated on a 38-hectare site that was formerly a French military base, the neighbourhood is now home to approximately 5,500 residents and provides 600 jobs. The integrated design process included extensive community participation, co-ordinated by a citizen’s organization, Forum Vauban.

All homes are built to high energy-efficiency standards, many achieving the Passive House standard of 15 kWh/m² per year and some achieving a "plus energy" standard by producing more energy than they need from photovoltaics and selling the surplus back to the City’s energy grid. Streets are laid out in a fused grid system (see Textbox – The Fused Grid) with crescents and cul-de-sacs connecting to a network of pedestrian and bike paths. Cars are not allowed on most of the streets and, where permitted, can travel only at “walking speed”. Houses cannot have a garage or driveway. Most residents do not own cars, but those that do, must purchase a space at one of the multi-storey car parks on the periphery of the development at a cost of 17,500€ (approximately $25,000). Tram stops, connecting Vauban to Freiburg are located within walking distance of all homes (see Figure 19).

For more information:
http://www.vauban.de/info/abstract.html
http://en.wikipedia.org/wiki/Vauban,_Freiburg

Figure 19 – Vauban tramway
(Source: http://www.badische-seiten.de/bilder/freiburg-vauban/index.php%3Fo%3Dfriburg-vauban)

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12 A study conducted in 2009 found that approximately 70% of the residents did not own a private vehicle.

The Fused Grid

The Fused Grid is a model for laying out neighbourhoods and districts. It combines the geometries of inner city grids and the cul-de-sacs of conventional suburbs. The objective is to retain the best characteristics of each with none of their disadvantages while raising the quality of the neighbourhood environment. The Fused Grid uses a continuous grid of roads for district and regional connectivity and a discontinuous grid of streets for neighbourhood safety. The neighbourhood grid is supplemented by footpaths that connect all streets, turning a neighbourhood into a fully connected pedestrian realm (see Figure 19).

![Fused Grid Street Pattern Model](Image)

**Figure 19 – The Fused Grid**


7. Summary

Sustainable communities can be described as communities that support healthy eco-systems and healthy living conditions. They have all the components necessary for daily life (i.e., culture, employment, entertainment, health care, recreation, schools, shopping etc.) within easy walking or cycling distance or within a short public transit ride. They offer a diversity of housing types and sizes; a spectrum of social
and cultural amenities; a full mixture of land uses; a range of commercial opportunities; an easily accessible, interconnected and affordable transit system; and pleasant public spaces.

Designing a sustainable community requires an interdisciplinary design team working within an integrated design process that includes extensive community engagement and stakeholder involvement. It requires a thorough understanding of the relationships between the diverse elements and functions of the built environment and seeks to capitalize on the interconnections between elements and systems (e.g., waste from one area providing fuel for another). Designing at the neighbourhood/community scale provides opportunities to integrate systems (such as water and energy systems) across multiple buildings and land uses.

The EQuilibrium™ Communities Initiative projects and other sustainable community projects in Canada and elsewhere demonstrate that certain principles apply universally, although these principles are interpreted locally to suit the particular context and circumstances of the neighbourhood/community.

In summary, sustainable communities that are designed following the above principles, are intended to:
- significantly reduce energy use and waste;
- reduce demand for urban resources such as land, infrastructure and human resources;
- lower long term costs;
- preserve ecosystems;
- support healthy local economies; and
- increase health and quality of life.

Sustainable community design is critically important because the impact our neighbourhoods and communities have on the limited resources of our planet and its limited capacity to absorb our waste. The design of neighbourhoods and communities has a major impact on our environment in macro scale; however, good design increases liveability and even affordability, while reducing need for and cost of, new infrastructure. The size and location of our houses, the materials and technologies used in construction and the infrastructure and systems supplying services all influence the amount of resources required to construct and operate our homes and the consequent impact on the environment.

The task of designing sustainable communities and neighbourhoods places a large responsibility on architects and planners to be accountable not only to immediate clients and stakeholders, but also to unseen stakeholders as well as future generations. With this responsibility there also comes a tremendous opportunity to explore new expressions of urban form.
Appendix – Additional Resources and Examples

Alternative Development Standards: A Guide for Practitioners
Alternative development standards represent flexible and innovative approaches to shaping residential development in a way that is consistent with improved environmental performance of communities, with benefits for affordability, diversity, liveability and environmental health.

Brownfield Redevelopment Case Studies
These cases are examples of residential projects that have overcome the barriers to brownfield redevelopment.

Conservation Subdivision Design Handbook
For designs that identify and preserve unique, scenic, or significant open space features in large contiguous blocks, with homes clustered together on smaller lots.

Conservation Design for Subdivisions
http://www.gnb.ca/0009/0136/0005/index-e.asp

Comparing Canadian New Urbanist and Conventional Suburban Neighbourhoods
This study compares travel patterns, social engagement and other behaviours and perceptions of occupants of four pairs of developments of these two types of suburban development patterns.

Comparing Neighbourhoods for Sustainable Features
This research compares neighbourhoods for certain aspects of affordability, liveability and the environment. The comparisons include proximity to daily destinations (schools, parks, jobs, transit), car usage, housing costs, house size, housing choice and more.

Complete Streets Resources
Complete Streets is a concept aimed at designing and operating the entire roadway with all users in mind - including bicyclists, public transportation vehicles and riders, and pedestrians of all ages and abilities.
http://www.completestreets.org/complete-streets-fundamentals/resources/

Greyfield Redevelopment Case Studies
This includes three municipal initiatives and seven built projects in Canadian cities that have stimulated greyfield redevelopment for housing in Canada.

Greenhouse Gas Emissions from Urban Travel: Tool for Evaluating Neighbourhood Sustainability
This tool estimates vehicle km travelled based on urban form, location and demographic variables users can input for any real or hypothetical neighbourhood.

**LEED® for Neighbourhood Development (LEED®-ND) Connections Tool**
The Connections Tool assists LEED®-ND registered design teams to document street connectivity and walking and bicycling distances.

**LEED® 2009 Green Neighbourhood Reference Guide**
This reference guide support design teams in developing LEED®-ND projects.

**Life Cycle Costing Tool for Community Infrastructure Planning**
The Life Cycle Costing Tool was created to allow design teams to estimate the major costs of community development, particularly those that change with different forms of development (e.g., linear infrastructure) and to compare alternate development scenarios.

**Low Impact Development Stormwater Management Planning and Design Guide**
Provides direction on landscape-based stormwater management planning and low impact development stormwater management practices, and thereby helps ensure the continued health of the Credit Valley and Toronto Region Conservation Authorities’ watersheds.
http://www.creditvalleyca.ca/sustainability/lid/stormwaterguidance/index.html

**Playbook for Green Buildings and Neighborhoods**
Guidance and resources to rapidly advance green buildings, neighborhoods and infrastructure.
www.greenplaybook.org

**Quality Program for Bo01, Malmo, Sweden**
The Quality Program was developed by the City of Malmo, in collaboration with the developers involved in the Bo01 development. It includes a list of development guidelines covering architectural qualities, choice of materials, energy consumption, green space requirements and technical infrastructure
http://malmo.se/download/18.4a2ce6a10d0ba37c0b800012615/kvalprog_bo01_dn_eng.pdf

**Residential Intensification Case Studies**
Case studies of 12 municipal initiatives and 23 built projects in Canadian cities that have stimulated residential intensification and resulted in new housing units.

**Sustainable Community Planning and Development: Design Charrette Planning Guide**
A sustainable community design charrette focuses on specific issues and details of a given site in relation to the surrounding community and ecosystem, using the broad concept and goals of sustainability to focus and guide directions. This Guide describes the four phases of planning a successful charrette.
Sustainable Sites Initiative™
An interdisciplinary effort to create voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices.
http://www.sustainability.org/

Transit-Oriented Development Case Studies
These case studies provide lessons from recent residential and mixed-use developments built near transit nodes.

Transit Supportive Guidelines 2011 Draft, Province of Ontario, Ministry of Transportation
These guidelines are a distillation of transit-friendly land use planning, urban design and operational practices, drawing from experiences in Ontario, elsewhere in North America and abroad.

Urban Design Compendium. Chapter 2: An Integrated Approach
www.urbandesigncompendium.co.uk

Questions

1. What are some of the key principles or themes for designing a sustainable neighbourhood/community?

2. Describe how the four EQuilibrium\textsuperscript{TM} Communities projects are addressing the following features of sustainable communities: (a) sustainable transportation, (b) low impact stormwater management and (c) energy efficiency.

3. Explain how the some of the EQuilibrium\textsuperscript{TM} Communities projects aim to ensure financial viability over the long-run.