

Guiding Principles and Goals for the Green Design and Construction of the Meredith Centre



**This report was prepared upon the request of the Chelsea Foundation
by its Environment Team
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History and Vision

Chelsea, Québec, is blessed with an active, vibrant and engaged population that has demonstrated its belief that the health of the community and its environment can only be maintained by implementing environmentally sustainable practices. Through municipal leadership and community group partnerships, Chelsea has developed innovative environmental management programs and shown leadership in adopting policies that protect the community's natural resources. A few examples of these programs and initiatives are...

- Second Canadian municipality to implement a ban on the cosmetic use of pesticides
 - Prix National de l'administration publique du Québec 2002
- H₂O Chelsea
 - 2004 Quebec Network of Healthy Cities and Towns Award of Excellence,
 - Awarded the Mérite Ovation de l'Union des municipalités du Québec 2006
- Regular Septic tank pumping and monitoring program
- Innovative recycling program
 - Prix Phénix de l'environnement 2000
 - *Attestation de performance* ICI ON RECYCLE!

By partnering with community groups, the municipality has been able to proactively develop programs and policies that address environmental issues. Without forming such partnerships, municipalities the size of Chelsea would not have the capacity to set a sustainability agenda.

The many awards Chelsea has won for its sustainable environment initiatives are a tribute to the community partnerships that the municipality has formed. It is within a context of partnership that the Municipality of Chelsea, the Chelsea Foundation, and its environmental committee intend to work to develop the Meredith Centre and the site upon which it is located.

In line with Chelsea's history of leadership in environmentally sustainable practices, and the strong call that came forward during the public consultation process for a "green" approach to the construction of the Meredith Centre, the Chelsea Foundation's Environment Team proposes the following vision, and set of principles and goals, for the development of a sustainable community centre. This vision and related principles for developing the Meredith Centre grew from the vision and principles formulated by the Chelsea Foundation.

H₂O Chelsea is a partnership between the municipality, the University of Ottawa, and Action Chelsea Respect for the Environment (ACRE). Its goal is to develop a better understanding of ground and surface water resources in Chelsea in order to help inform municipal planning and management decisions.

Vision:
The Municipality of Chelsea, its citizens, and the Chelsea Foundation will build a community centre that incorporates advanced green building methods and respectful site and water practices into a facility that is designed to be economically and environmentally sustainable for seven generations of the community.

Two important structural features provide support to this vision: the purpose behind the vision, and a process by which the community can see this vision become real.

First, underlying this vision is the Seventh Generation precept (see side box), which those charged with determining how the Centre will be built must consider when reaching their design decisions. Not only will the Centre, from a simple facility standpoint, be designed to meet the cultural and social needs of



the present and future generations, but to be truly respectful of this precept, the design must also be sustainable from both environmental and economic perspectives. Additionally, the Centre will need to be flexible and adaptable in its design to be useful to all seven generations.

Seventh Generation is a precept of the Great Law of the Six Nations Iroquois Confederacy, which requires that chiefs consider the impact of their decisions on seven generations: the four existing generations and the three generations yet to come.

Second, in reviewing literature on Green Building design and construction, the environmental committee has become aware of a design process by which the vision outlined above can be achieved: the Integrated Design Process (IDP). A number of recent Canadian buildings have used the IDP to build highly efficient and healthy buildings from sustainable materials. Among other laudable features, these buildings were designed and built to use at least 50% less energy than conventional structures. The Mountain Equipment Co-op retail stores in Ottawa, Winnipeg, and Montreal were designed using the IDP process.

The IDP process is based on the awareness that buildings are integrated systems. To reach challenging performance standards for environmental sustainability and the functional requirements of the building, all the relevant building professionals and stakeholders must work together from the outset (see Appendix 1 for more detailed information about the IDP). This design group will need principles and goals from those commissioning the Centre at the earliest stages of the design process so that they can begin to explore design options.

Principles

The following **principles**, the Environment Team believes, are the foundation from which the IDP team should start when making their design decisions. The goals that follow provide the context for establishing the performance targets needed to evaluate design options.

- **Ethical Responsibility:** The Centre will reflect the values of the community, and will recognize our social and civic responsibility to protect the environment for current and future generations.
- **Leadership:** The Centre will be an inspiration to citizens of Chelsea and neighbouring communities by showing that sustainability objectives can be achieved at construction costs similar to conventional building practices. The legacy of the Centre, as a result of designing for sustainability, will be that of greatly reduced facility operating costs and a healthy indoor environment that encourages the community to use the Centre's facilities.
- **Ecological Footprint:** The design team will factor impacts upon the environment into their decisions and wisely ensure that the Centre minimizes the overall material and energy inputs into the facility throughout its lifetime. The reuse of reclaimed materials, selection of materials that have a high recycled content, and a building design that considers ways to reduce material and energy inputs are examples of how the Centre can reduce its ecological footprint. The design team will also consider how to maximize the reuse of the Centre's building materials when it is renovated, adapted to other needs, and finally when it is decommissioned.
- **Healthy Indoor Environment:** The Centre will be designed to ensure that the well-being of those using its facilities is maximized. Factors such as indoor air quality, access to natural light, and attenuation of noise will affect how, and how often, people use the facilities of the Centre.



Building Development Goals

As an extension to the broader guiding principles, seven goals have been identified to more clearly explore or refine how consideration and concern for the environment is to be embodied in the Centre's development and operation:

1. Minimize energy inputs
2. Minimize the draw on the aquifer
3. Source building materials that minimize the building's ecological footprint
4. Manage effluent on site
5. Provide educational/engagement opportunities
6. Create a healthy place
7. Minimize the use of hazardous substances.

1. Minimize Energy Inputs

Purchased energy has an impact on the environment; purchasing "cleaner" energy (gas versus oil) only means that this energy is diverted from another use. Energy that is considered "cleaner" does not mean that it does not have impacts. For example, hydro reservoirs inherently have a large ecological footprint. Furthermore, the extraction, refinement, and distribution of energy have an environmental impact that is not reflected in the price of the energy. Simple conservation measures have far greater environmental benefit than using a "cleaner" energy.

Leadership:

- Design the building as an integrated system, factoring in techniques that provide natural cooling (shade, green, roof systems, passive air flow) and heating (passive solar heating) and maximize the benefit of passive heating and cooling by specifying a very efficient building envelope and ventilation system.
- Reduce lighting costs by designing a building that takes full advantage of natural light. Where insufficient natural light is available, provide lighting only at the intensity needed, and only when needed.
- Reduce cooling and heating costs by determining needs in advance and specifying efficient systems that can be integrated with the building.
- Eliminate waste heat (energy used to heat/cool air or water) by:
 - understanding the usage patterns of the facility and programming when and where the heat (or cooling) needs to be provided – ideally, an adaptable system that learns or responds to how the building is being used;
 - redirecting unwanted heat energy to where it can be used (e.g., heat generated from cooling is used for heating water); and
 - recovering energy with heat (energy) recovery systems (ERV/HRV), including heat from waste shower water.
- Where possible, use onsite sources of low-impact renewable energy. As a second choice, use off-site sources of low-impact renewable energy (e.g., through the purchase of renewable energy certificates).



2. Minimize the Draw on the Aquifer

The aquifer is the community's source of potable water. The ability of the aquifer to provide potable water for all who use it should take precedence over all other demands on the aquifer.

Leadership:

- Minimize water usage by:
 - specifying the most efficient dual flush toilets
 - specifying urinals that do not consume water
 - specifying sensor-activated, low-flow faucets and shower heads.
- Capture rainwater by directing roof runoff to a cistern. This water can be used for irrigation (soccer fields), showering, and recreational water.
- Cascade water down through the levels of water requirements based on the quality of the water. Potable water should only be used for drinking, but wasted potable water can be cascaded into a grey water system that provides the water needed for flushing. Captured rainwater can be used for washing and showering, which in turn can be used by the grey water system.

3. Source Building Materials that Minimize the Building's Ecological Footprint

The selection of building materials must be based upon a variety of considerations, not simply considered in isolation as to whether a singular immediate need is fulfilled.

Leadership:

- Consider the source and production methods of materials to reduce "embodied" energy (the sum of the energy needed to produce and deliver the material).
- Employ building techniques that sensibly reduce material needs.
- Reuse reclaimed materials (e.g., wood from decommissioned buildings) or choose materials that have a high recycled content.
- Source materials that have been produced/harvested/extracted using well documented processes that encourage sustainability. For example, use wood-based materials whose wood component has been sourced from Forest Stewardship Council certified forests/woodlots (see www.fsc.org).
- Use relatively easy-to-source materials, both in terms of price and availability. If the building is meant to provide outreach to those interested in sustainable building in the local community, it must be possible to source these materials.
- Factor end-of-life considerations into material selection; materials should be installed in a dimension that can be reused when that part of the structure is disassembled, and if the material can not be reused, then it must be recyclable.
- Use fasteners that facilitate reusability. When a building is decommissioned, materials fastened with bolts and screws are easier to remove. Materials fastened with nails require much greater effort to remove and any nails that remain can damage cutting tools, reducing the reusability of these materials and the market for them.



4. Manage Effluent On Site

The handling of septic waste in rural settings requires regular pumping and transport of fecal solids for treatment and disposal at an off-site location. The cumulative lifetime energy costs of transporting septic tank sludge off site for treatment is not inconsiderable and needs to be examined.

Leadership

- Explore the feasibility of bio-filtration systems that can completely process sewer effluent on site, and whose by-products can be safely used by natural systems on site. These types of systems are commonly called Living Machines or Eco Machines.
- Choose janitorial cleaning solutions that are compatible with a bio-filtration system, and do not increase the nutrient loading of aquatic ecosystems or introduce harmful substances into them.

5. Provide Educational/Engagement Opportunities

Awareness of the “possible” remains a major impediment to the adoption of available and emerging approaches for achieving sustainability. Through the sharing of knowledge and experience, individuals and communities can learn to become better stewards of the environment.

Leadership

- Use the Centre, through all the efforts outlined within the previous goals, to showcase and embody sustainability in action.
- Pursue opportunities to educate and share in the story of the Centre prior, during and after its construction.
- Develop educational opportunities for a variety of audiences, including youth, adults, and decision-makers.
- Explore a variety of educational forms. For instance, passive education through observation of the inner operation or functioning of the building; outreach material as part of a resource library; informed and collegial staff who are familiar enough with the building design to provide an interpretive role; special events such as speaker series, story telling, etc.
- Provide opportunities for community members who have used sustainable building practices to showcase their efforts.



6. Create a Healthy Place

Built environments should be designed to be healthy, not only healthy for one's physical well-being, but also for one's emotional well-being. It should be recognized that actions that degrade the health of the environment will compromise our own health. A building whose design stems from the fundamental belief that the quality of the environment is inextricably linked to the health of the community will ultimately become a healthy place.

Leadership

- Provide a healthy experience for Centre visitors by incorporating natural features that stimulate their sense of well-being. Consider how sunlight can be a source of personal warmth, how plants can provide visual stimulus and improve indoor air quality, and how natural sounds can create a calming effect.
- Pursue restoration and rehabilitation opportunities as a way of enhancing the natural features of the Centre's site.
- Design the Centre to provide the highest level of indoor air quality.
- Build with materials that do not harm the short- or long-term health of the people who work in or use the Centre.

7. Minimize the Use of Hazardous Substances

Products that contain hazardous substances can have effects upon human and environmental health. They can affect indoor air quality by releasing volatile organic compounds. They can create problems if improperly disposed; for example, the leaching of heavy metals from electronic components. Also, materials that may be harmless in their finished state may harm the health of manufacturing and construction workers at points where the product is more hazardous to handle.

Leadership

- Apply the precautionary principle to the selection of materials. If there exists scientific evidence that a material is, or potentially is, carcinogenic, mutagenic, or toxic, then every effort should be made to exclude the use of that material.
- Choose products that do not lead to adverse health consequences for those manufacturing or handling them.
- Where there exists uncertainty about the components of a product, select products that meet regulations restricting the use of hazardous substances.

The **precautionary principle** states that when an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically.



Appendix 1: The Integrated Design Process

What is the IDP Method

The C-2000 Integrated Design Process (IDP) is a specific building design method intended to produce buildings with significant reductions in energy demand and water use, while providing improved indoor environments and healthier building sites. Following a detailed pattern, all the building design disciplines, plus the owner or owner's representatives, take part in a series of facilitated workshops leading to the completed design of the new project. The workshop teams are supplemented by technology specialists, according to the specifics of the design, to ensure that the team has all the information required to make the best decisions.

Who is Involved

In addition to architects and engineers, full involvement from the building owner is required. This often includes the owner's facility management personnel and possibly representatives of user groups. A design facilitator is added to this core team. His/her job is to ensure that no question goes unasked. Experts in construction costing and an energy simulator round out the core team, and specialty equipment experts can be called in on an "as needed" basis.

Importance of IDP Process

It is a significant point that the design method is more important than capital equipment. It means that high performance is not just for big-budget projects. In addition, because better thinking, not money, delivers the benefits, more building types can make effective use of the approach. This claim is supported by the fact that some schools and retail stores have been awarded the C-2000 label in addition to offices and apartments.

IDP Functionality

Integration is more than just having all the designers around a single table. A conscious approach to a project is required. This starts with the project brief, which is reviewed against the list of client needs. Reviewing the brief allows all of the participants in the process to develop an understanding of the vision for the project and the specific goals that are desired. Among these goals are fixed targets for energy and water consumption, and project-dependent goals for indoor air quality and thermal comfort, the reduction of ecological impacts, the maximizing of material re-use and recycling, and for durability, longevity and maintainability.

Together, the design team agrees on the goals and develops strategies to achieve them in a timely and cost-effective manner. The strategies are written out in a master report to create a reference point for project development. As the measures to satisfy the strategies are developed in greater detail, the reports are updated – thus forming the C-2000 project history. This history is needed to help the team prioritize measures should there be a conflict between goals or should the need arise to pursue one strategy at the expense of others. This is especially true for those projects that have the potential to outstrip the initial targets and move to higher levels of performance.



After reviewing the brief and setting preliminary targets, the specific project development gets underway. Over a series of workshop design sessions, the team progresses from site planning to final materials selection. Depending on project size there can be anywhere between four and ten design meetings. Energy modelling and cost-control monitoring are ongoing through each meeting. By necessity, early models are less detailed, but increase in specificity as the design develops. Typical groupings of meetings would be:

- Site planning, site ecology, building massing, and orientation
- Envelope design, fenestration design, and preliminary daylighting assessment
- Lighting and power design
- Ventilation design
- Heating and cooling design
- Material selection and detail coordination
- Pre-tender coordination and construction quality assurance
- Building commissioning and monitoring.

Design quality assurance and value engineering are part of each stage. The order of these meetings must be followed to keep to the principle of designing only from known information. As an example, heating and cooling are not assessed until all of the passive methods for controlling heating and cooling loads have been investigated. Passive control is a function of the wall and roof performance values, plus the window performance values (including shading), and the lighting and lighting control strategies. External and internally generated loads must be understood before proposals for heating and cooling can be meaningfully discussed. In this way, the capacity (and costs) of mechanical services equipment can be significantly reduced.

When Using the Method is Important

An enthusiast would say that it is important to use IDP in all design opportunities. This condition however is likely to be tempered by the future building owner or other team members. The agreement of all team members on the design vision and project goals includes a commitment to using IDP. Without this commitment, the process is not recommended.

Questions will inevitably arise regarding delays to project schedule and the costs of additional design meetings. Fortunately, the C-2000 experience has shown that the incremental time and costs for using the IDP are quite small for the improvements in building performance gained. Depending on the size of the project, an additional 2 to 6 calendar weeks of time may be required, especially for design teams that have no previous experience with IDP. For experienced teams, the time factor can be reduced. The cost of the additional meetings is well covered by the maximum incentive available from federal government programs such as the Commercial Buildings Incentive Program (CBIP).

Appendix 2: Inspiring examples of green buildings

EXAMPLE 1: MAMMALS ON THE ROOF!

Spring Creek Firehall, Whistler, BC

More than 50% of the total roof area on the firehall is a **green roof**. The firehall roof has been planted with local indigenous grasses and drought-tolerant plants so there is no permanent irrigation required, which helps reduce water usage. These local plants require less maintenance than foreign plantings and minimize the use of fertilizers and pesticides. By using local plantings we hope to attract native wildlife, including birds, mammals, and insects, thereby creating a building site that is integrated with the natural surroundings.



Generally speaking, a green roof has a number of advantages:

- It reflects solar radiation in a natural way, which diminishes the need for cooling in the summer and helps reduce the heat island effect.
- It captures rainwater and return a portion of it back to the atmosphere via evapotranspiration, which diminishes the run-off from the roof.
- It provides extra insulation.
- It has a longer lifetime than a conventional roofing system.
- And last but not least: it makes the building blend in with the natural environment and offers a home to native wildlife: birds, insects, and... mammals!

Just imagine...

Instead of taking their space, the Meredith Centre could offer local wildlife a place to live on top of its roof! Symbolizing a community living in harmony with its natural environment.

EXAMPLE 2: HISTORY BUILT IN

MEC Building, Winnipeg, MB

Mountain Equipment Co-op (MEC) is a member-owned outdoor and adventure equipment retailer with outlets across Canada. In accordance with its core values of environmental protection, MEC has emerged as one of Canada's leading developers of sustainable buildings. MEC's Winnipeg store is its crowning achievement, being recognized by government and a host of other organizations as one Canada's most sustainable buildings.



From the perspective of **material reuse**, the Winnipeg MEC used a technique often referred to as **deconstruction** or **ecorenovation**. This involved the careful dismantling of two of the three existing buildings on the site, conducting an inventory of reclaimed materials, and then designing and constructing entire new sections of the building from these materials. In total, almost 4,000 tonnes of material were diverted from the landfill, thereby fulfilling the project's environmental objectives while reducing the project's total design and construction budget to less than Cdn \$100 per square foot. At the same time, the salvaged, weathered materials, such as Douglas Fir timber columns and reused brick, enhanced the retail aesthetic of the buildings, demonstrating that true sustainable design has many diverse and complementary benefits.

Generally speaking, the re-use of building materials has the following advantages:

- it diverts waste from landfills and avoids disposal costs;
- no new resources are used, so no resources are extracted from the Earth's crust, no trees are cut, etc.;
- no energy is used for the construction and transportation of new building materials;
- used, old, and / or vintage building materials can add to the atmosphere / aesthetic of a building.

Just imagine...

Chelsea's history would be built into its new Community Centre by incorporating recognizable building materials from the old Chelsea Town Hall, the old barn along the Hwy 5, logs from the bottom of the Gatineau River etcetera, - symbolizing the connection between the past, the present, and the future.

EXAMPLE 3: A ZERO EMISSIONS BUILDING

Beaufort Court Zero Emissions Building, Kings Langley, UK

The Beaufort Court Zero Emissions Building, Head Office of Renewable Energy Systems Ltd. in Kings Langley, is exemplary in its exploitation of cutting-edge sustainable energy technology. Originally built by Ovaltine in 1932 as an egg farm, it is now the first energy self-sufficient, zero-emissions commercial building in the world.

Five integrated sources of renewable energy -

wind turbine, photovoltaics, hybrid photovoltaic / thermal array and seasonal ground heat store, biomass heating, and bore hole cooling - are supported by a comprehensive mixed mode energy saving design.

Check it out at www.beaufortcourt.com



Just imagine...

A zero-emissions building, zero air pollution, zero contribution to climate change, and zero energy bill for Chelsea's new Community Centre!

EXAMPLE 4: A LIVING SYSTEM TREATS THE SEWAGE!

The Kortright Centre for Conservation

The Kortright Centre is a not-for-profit facility run by the Toronto and Region Conservation Authority. One of the unique features of the Kortright Centre is the Sustainable Living Centre, which demonstrates the latest developments in green building technologies.



The Sustainable Living Centre showcases a so-called “Living Machine”. This sewage treatment system is based on a biological ecosystem that simulates a natural wetland. The biological components are designed to naturally decompose and filter the sewage generated by Kortright’s Visitor Centre. The final effluent from the wetland is clean enough to support fish. The effluent is sterilized and reused to supply water for the washroom toilets.

For this wetland to function year round in a cold climate, it should be housed in a greenhouse. But greenhouses are inefficient buildings, with high heating costs in the winter. So Kortright chose to house its wetland in an extremely energy-efficient building, which uses a variety of renewable energy technologies. This building minimizes operating costs while facilitating the necessary temperature and light conditions for the wetland to flourish.

The building utilizes a unique combination of solar and geothermal energy to provide both its heat and electricity. It combines passive solar design (southern glass orientation, mass and insulation), in conjunction with a ground source heat pump and solar water-heating system to keep it warm during the cold winter months.

Just imagine...

No holding tanks, no pumping costs, and a radiant green indoor space that allows you to get re-energized during the long, cold winter!

EXAMPLE 5: LONG LIFE, LOOSE FIT, LOW ENERGY

Stratus, Niagara-on-the-Lake, ON

Stratus is a new 1,870 square metre wine-making facility located in Niagara-on-the-Lake, Ontario, Canada. The building is owned and operated by Stratus Vineyards Ltd. and consists of a production area, wine storage cellars, offices, and a retail area.



The governing architectural design principles for the winery can be characterized as ‘long life, loose fit, low energy.’ The building achieves this in a number of ways:



a) The ‘long life’ component is achieved by the choice of materials – all of the structural steel and exterior panels of the building (including the roof) are galvanized, thus adding to their longevity and eliminating the need for re-painting or re-surfacing in the future. Interior floor finishes are designed to be easily cleaned without the use of harsh chemical products and also to be very low maintenance. The infrastructure of services is designed with optimum flexibility in mind, allowing the present winemaker and future generations of winemakers to adapt the building to their needs.

b) The ‘loose fit’ component is achieved by designing a large-span building structure with a mezzanine suspended from the portal frame. This design frees up the floor space for this particular configuration of winery process, but also allows flexibility for future process designs. The main structural frame of the building has been designed to accommodate the structural loading and connections needed for future expansion plans.

c) The ‘low energy’ component is achieved through a number of measures: first, by designing a compact building enclosure with an excellent “surface area-to-volume enclosed” ratio. The exterior walls are highly insulated and solar heat gain from windows has been dramatically reduced by the use of sunshades above the small amount of southern exposure glazing (there is no glazing on the south and west of the actual process building). The primary glazing for the winemaking area is through a large clearstory-glazing band, which runs the length of the north face of the building at a high level. This clearstory window allows natural light into the process area, which in turn is filtered into the barrel cellar on the southern half of the building through the use of a translucent glazed wall. These measures significantly reduce the amount of artificial light needed to operate the building.

Just imagine...

A building ready for now and for the future. Fitting today’s needs and flexible to fit the needs of future generations. And all that with low maintenance and renovation costs.