

SUSTAINABLE ARCTIC SUBDIVISION FEASIBILITY STUDY

FINAL REPORT



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DECEMBER 2004

Prepared for:

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APPENDIX – Plateau Development Scheme Appendices



1. INTRODUCTION

1.1. Background

With the formation of the new territory of Nunavut on April 1, 1999, and the City of Iqaluit being named the territorial capital, the City of Iqaluit has experienced tremendous growth. In the five year period between 1996 and 2001, the City population grew 24%, making it the second fastest growing community in Canada over this time period. The City has experienced similar growth since 2001, and a relative continued high rate of growth is expected to continue. The medium population projection put forward by the City of Iqaluit's General Plan assumes a growth rate of 3.5% until 2005, declining to 3.0% between 2006 and 2015, and dropping further to 2.5% between 2016 and 2020. With a current population of 6,000, the anticipated growth rates will yield a population of approximately 10,000 by 2022.

This pace of growth has stressed much of the City's municipal infrastructure and has resulted in inadequate water and sewer infrastructure, dwindling supplies of readily available granular sources and solid waste issues. In addition, growth has created a severe housing shortage and a demand for all types of land uses. An increasing number of personal vehicles have created congestion during short periods at key intersections.

The General Plan, prepared in 2002, reported a supply of 2,243 housing units. The Housing Need Assessment prepared as a background report to this study concluded that more housing is needed for a growing population, to relieve crowded housing conditions, for special needs populations, and to assist in the recruiting of employees. The housing supply shortage is linked to the scarcity and high cost of serviced land, and the cost of building, maintaining and operating homes in Iqaluit. The shortage of housing has resulted in over-crowded housing conditions with the Nunavut resident-per-dwelling rate being 50 percent higher than in the rest of Canada.¹ The over-crowding is particularly acute in the Inuit community, with over 50 percent of Inuit living in over-crowded housing.

The medium housing projection in the General Plan for the city calls for approximately 1,700 additional new dwelling units to be constructed by 2022, an average of 85 units per year. Since the preparation of the General Plan in September 2002, approximately 256 units have been approved by the City or are pending development approval, however, over 80% of these units are apartment units which is a dramatic departure from the one-third (34%) which apartments have historically represented in the housing market. The demand for ground-oriented housing, both for rental and ownership, is high, however there is currently limited developed land available to accommodate new projects. All land in the most recent subdivision, the Lake Subdivision, has been leased and projects are either completed, in construction, or in the planning stages. Infilling and redevelopment of existing underused lots is ongoing and supported by the General Plan, however, cannot meet the demand, particularly for lower density, ground-oriented housing.

¹ 2002 *Nunavut Economic Outlook: An Examination of the Nunavut Economy*, Conference Board of Canada, November 2002.



To address the need for developable land, the City of Iqaluit is planning to develop a plateau above Nunavut Arctic College, identified as a Future Development Area (Area 'A') in the General Plan. The proposed development site (Area 'A') is comprised of approximately 64 hectares, of which an estimated 25 hectares are developable. The remaining area is on steep slopes, is comprised of rock outcrops or is within watercourse setbacks. Area A is now referred to as 'the Plateau'.

In Iqaluit, government in one form or another has always been the developer of land. Until 1996, the Government of the Northwest Territories (GNWT) developed land. The GNWT then turned over land development responsibility to the City (at that time the Town of Iqaluit). Since then the City has developed several subdivisions. The City is currently exploring the possibility of the private sector taking a lead in land development, but this approach would be the first of its kind in Nunavut and poses some unique challenges due to the land tenure system in Nunavut. The fact that the City is the only land developer, however, does present extraordinary opportunity, particularly with respect to introducing sustainable principles and approaches to land development practices.

As part of the City's commitment to environmental responsibility and sustainability, the City decided to explore the feasibility of developing Area A, the Plateau, based on sustainable development principles, which would focus on reducing the impact of land and housing development on the environment, municipal infrastructure and on operational budgets. The City hired a consulting group – SLB Consulting Ltd., FoTenn Consultants Inc., Marbek Resource Consultants Ltd., RWDI, CF Consulting and Planning, and D. Nielson Consulting Ltd. – in March of 2004 to undertake the study.

1.2. Project Funding

The City of Iqaluit received funding from the Federation of Canadian Municipalities' Green Municipal Enabling Funds, and Canada Mortgage and Housing Corporation (CMHC) to conduct a sustainable arctic subdivision feasibility study. The purpose of the study is to explore sustainable development best practices that can be applied to an arctic subdivision. Recommendations from this study were applied to the proposed development site, and the resulting Development Scheme will be used to develop this land in 2005.

Additionally, funds were received from Natural Resources Canada's Office of Energy Efficiency for the preparation of a report to present the business case for the City of Iqaluit to adopt an energy standard for low-rise homes. This report has been completed under a separate cover. Recommendations from this report were used to achieve sustainability principles for the Plateau Subdivision and to prepare minimum development standards for the proposed subdivision.

Council approved the Plateau Development Scheme on October 26, 2004. A Development Scheme is provided for in the *Planning Act* and is required by the General Plan for all Future Development Areas. The Plateau Development Scheme contains the following:

- Policy Framework
- Development Principles & Evaluation Criteria
- Development Concept Plan
- Servicing Plan
- Development and Servicing Policies



- Development Demonstration
- Implementation

This report summarizes the approach taken and the results that were achieved in the preparation of the Development Scheme.

1.3. **Sustainable Development**

There are many definitions of and approaches to sustainable development. For the purpose of this report, sustainable development was taken to mean:

The ability to meet the needs of the present without compromising the ability of future generations to meet their own needs.

(source: World Commission on Environment and Development)

Sustainable development was recognized to have three dimensions: environmental, social and economic. It considers these three dimensions and examines how they contribute to resource efficiency, affordability and occupancy well being. Sustainable development for Iqaluit, therefore, must be based on the vision and needs of the City and its residents, as well as the resources of the community. In a community such as Iqaluit, with its varied social concerns (Inuit and Non-Inuit), sensitive environment, and high energy costs, the justification for and benefits of sustainable development practices are even more evident than in southern Canadian communities.

CMHC defines five principles of sustainable housing. Based on these principles, sustainable communities are planned, designed, constructed and maintained to meet the needs of their occupants in terms of health, safety, affordability and flexibility, and are designed to respond to local and changing lifestyles. As well, these communities make efficient use of all resources, while minimizing impacts on the site's natural environment. These principles of sustainability should apply to all aspects of a community, including housing and built form, infrastructure and natural systems.

CMHC's five principles of sustainable housing are:

1. *Occupants' Health:* ensure good indoor air quality, safe drinking water, toxin-free materials, safety, and access to natural light and views;
2. *Energy Efficiency:* maximize energy efficiency in mechanical systems, infrastructure, materials, and equipment;
3. *Resource Efficiency:* make the most efficient use of materials, water, and energy during and after construction;
4. *Environmental Responsibility:* control pollutants, emissions and waste, and protect the integrity of the site's natural elements; and
5. *Affordability:* support a design and life-cycle that is affordable and financially viable for its occupants. (Ref.# 12)



1.4. **Project Objectives**

The purpose of the feasibility study was to explore best practices for energy-efficient housing designs, transportation, municipal infrastructure, and land-use to develop a sustainable arctic subdivision design. Recommendations of sustainable development options for an arctic climate were made and applied to the case study area, The Plateau. The resulting concept plan and development recommendations were incorporated into the Plateau Development Scheme which will become a sister plan to the General Plan. The Plateau Development Scheme will be used to develop the area in 2005.

The feasibility study aimed to fulfill the following four goals:

Goal 1: Demonstrate the benefits of sustainable development to residents, community stakeholders, municipal staff and council, builders and developers.

Objective:

- ♦ Organize public consultation sessions in the community to provide information and receive feedback from the residents, and community stakeholders.

Goal 2: Develop best practice options for a sustainable arctic subdivision that can be applied to a concept plan for The Plateau, used to guide future development in the City of Iqaluit; and serve as a model for other arctic communities.

Objectives:

- ♦ Research existing technologies and practices for sustainable development.
- ♦ Create a listing of best practices.
- ♦ Make recommendations of best practices for an arctic community.
- ♦ Make a business case for the City of Iqaluit to implement best practice options to future developments.

Goal 3: Reduce water, energy and resource consumption by implementing sustainable and energy efficient approaches to housing design, municipal infrastructure, transportation and land-use.

Objective:

- ♦ Develop a concept plan for The Plateau that incorporates recommended development options in an integrated planning approach.

Goal 4: Engage public in the planning and design process to ensure recommendations for a sustainable subdivision and the resulting concept plan are culturally and socially appropriate for community residents.

Objective:

- ♦ Develop a consultation plan that includes representatives from all facets of the community and provides individuals with a variety of options for participation.



1.5. Project Assumptions

A number of important assumptions were defined to frame the project. These assumptions were as follows:

- ♦ The recommendations of the Feasibility Study must provide clear direction and strategies for applying sustainable development practices to the Plateau Subdivision, with Phase 1 development to occur in 2005. In this way, strategies may be phased to allow demonstration projects to showcase approaches and for local expertise to grow.
- ♦ The City will be the land developer for at least Phase 1 of the Plateau Subdivision but may work with the private sector for future phases of development.

2. PUBLIC CONSULTATION

2.1. Consultation Strategy

A participatory approach to planning is a goal of this project (Goal #4) and a key objective of the City's General Plan Vision Framework. The approach is rooted in the fact that plans that encourage local involvement are usually more successful and better received by the community. Planning and design decisions should therefore not be based on generalizations about the North or on a southern model, but should look at the diverse and specific needs of the community and its residents.

Consistent with Project Goal #4 that states that a consultation plan that includes representatives from all facets of the community and provides individuals with a variety of options for participation should be developed, a Consultation Strategy was presented and approved by Council on April 27th, 2004. The purpose of the Consultation Strategy was to ensure that meaningful consultation with Iqaluit residents, elected officials, City staff, and other key stakeholders was undertaken throughout the planning process.

The Consultation Strategy addressed the following:

- ♦ The consultation approach
- ♦ The key steps in the proposed consultation process
- ♦ The client for the consultation;
- ♦ The consultation stakeholders;
- ♦ The decision-makers in the process;
- ♦ The consultation methodology
- ♦ The consultation timeline.

2.2. Consultation Results

The project team undertook a total of five consultation sessions. The following provides a summary of each consultation.



Consultation #1 – April 26th to 27th, 2004

The first consultation session was intended to initiate the project by meeting with the decision-makers to discuss the goals of the project; details of key tasks, deliverables and the schedule. Specific objectives were to:

- ♦ Communicate with Planning & Engineering Committee and City staff the goals of the project;
- ♦ Finalize the tasks and schedule;
- ♦ Obtain approval of the proposed consultation strategy;
- ♦ Meet with key government departments and agencies.

Consultation #2 – May 17th to 19th, 2004

The second consultation session brought together a diverse group of people from local, territorial and federal government departments, the development community, local groups representing a variety of interests, and the project team consultants to participate in workshops and a design charrette hosted by the City of Iqaluit. Specific objectives were to:

- ♦ Articulate the goals of the project;
- ♦ Share and illustrate research on best practices, background material, and issues analysis;
- ♦ Discuss and obtain feedback on the proposed principles of development and sustainability evaluation criteria;
- ♦ Provide workshops by experts in the areas of sustainable housing and design and energy efficiency;
- ♦ Run a design charrette with key stakeholders, experts, and other interested participants to explore options for developing a sustainable subdivision development;
- ♦ Communicate with Planning & Engineering Committee and City Staff the results of the above activities and to discuss key issues.

A total of 41 people participated in the design charette, divided into four teams. Included in the design charrette were two meetings with the elders, a public meeting and a public open house of the charette results. Prior to the charette, each participant was given access to a series of background reports to provide context to the development area. The package included the following reports:

- ♦ Sustainable Development Best Practises for an Arctic Subdivision
- ♦ Housing Needs Assessment
- ♦ Regulatory Framework – General Plan and Zoning By-Law
- ♦ Slope Analysis – Design Consideration
- ♦ Wind and Snow – Design Consideration.
- ♦ Infrastructure Review
- ♦ Recent History of Land Development in Iqaluit



- ♦ Land Tenure System Implications

The concepts and extensive notes prepared by each team were summarized and used to complete the development principles and evaluation criteria for the project that were to guide and test the concept plans prepared. The information was also used to prepare two preliminary design concepts for the development area.

Consultation #3 – July to August, 2004

The third consultation session was an informal session that took place over a month period in the summer. Specific objectives were to:

- ♦ Articulate the results of the design charrette;
- ♦ Propose preliminary design concepts consistent with the development principles;
- ♦ Obtain feedback on preliminary design concepts.

Two preliminary design concepts were made available on the project website and were posted around town to invite public comment. Letters were sent to each the charette participants to ask them to review the concepts and provide comments to the City regarding how well they meet the development principles, how the concepts could be improved or changed, potential challenges into implementation, and opportunities or constraints missed in the analysis. Approximately 30 pages of comments were collated into a single document and used to prepare a preferred concept plan.

Consultation #4 – September 20th to 21st, 2004

The fourth consultation session presented the preferred design concept and draft Development Scheme and provided an analysis of the concept based on the sustainability evaluation criteria. Specific objectives were to:

- ♦ Present and discuss the preferred design concept;
- ♦ Share analysis of design concept based on sustainability evaluation criteria;
- ♦ Obtain feedback on preferred design concept and analysis;
- ♦ Communicate with Planning & Engineering Committee and City Staff the results of the above activities and to discuss key issues.

The preferred concept plan and the analysis were presented at an open house, as well as to Council, and were distributed to the key stakeholders. A total of 13 people, including three City Councillors and two news reports attended an open house on September 20th. The following evening, a presentation of the preferred concept plan, phasing, lot costs, lot development standards, and implementation strategy was provided to Council. In addition, an overview of the key comments/questions received at the Open House was reviewed at the meeting with a response to each issue raised.

Consultation #5 – October 19th to 20th, 2004

The revised development concept plan and Draft Development Scheme was presented to Planning and Engineering Committee on October 19th. The presentation also provided an overview of the preliminary findings of the energy consultant's report – *An Energy Standard for*



Homes in Iqaluit – A Business Case. Recommendations of the report were incorporated into the Draft Development Scheme in terms of the lot development standards and the phasing in of sustainability objectives. The City of Iqaluit's Council subsequently approved the Plateau Development Scheme on October 26, 2004.

3. DEVELOPMENT CONCEPT

The Plateau Development Scheme outlines the land use, infrastructure, transportation and energy-related policies for the Plateau Subdivision. This document will be incorporated into the General Plan By-law and in this way, all development decisions must be consistent with both plans.

3.1. Land Use

3.1.1. Conventional Land Use

The approach to subdivision design in the past in Iqaluit has not favoured sustainable practices. The Road To Nowhere Subdivision, developed in 1999, is a case in point. Limited background analysis for the subdivision was undertaken in terms of assessing housing needs, wind and snow patterns and opportunities for solar orientation and a regulated building form were not explored. The subdivision was designed primarily for single-family lots with a limited number of medium density lots. The single-family lots did not sell very rapidly burdening the City with prolonged financing commitments. The large lot size with a frontage of 24 metres, which dramatically increases the servicing costs, made the lot price too expensive for many potential lessees. Many of the lots were eventually consolidated and rezoned to permit higher density. In addition, several parts of the subdivision experience severe snowdrifting, blocking doorways and increasing City operating costs for snow clearing. Little attention was given to walking trail and snowmobile linkages and mixed uses within the neighbourhood.

Movement away from this approach was partially realized with the 2003 Lake Subdivision which was influenced by the then draft General Plan policies. The design considered a mix of uses, trail connections, watercourse setbacks, and smaller lots with reduced frontages. The Plateau Subdivision was the first subdivision to be designed under the policies of the new General Plan. General Plan policies outline a list of Development Guidelines that require the design to consider open space networks and trails, protection of significant natural features, watercourse setbacks, existing drainage patterns, solar orientation, snowdrifting, and documented historical/cultural resources.

In addition, the General Plan notes the very high costs of upgrading municipal infrastructure for an increasing population and the contribution of these facilities to greenhouse gas emissions. Policies in the plan support sustainability initiatives such as water conservation and energy efficiency to reduce the ecological footprint as well as the social and economic cost of poor building design.

3.1.2. Existing Land Uses

The existing land is mostly vacant and undeveloped and is identified as a Future Development Area in the City's General Plan. Much of the 64 hectares of land is undevelopable due to steep slopes and a water drainage system. The area that was identified as suitable for development is approximately 25 hectares in size and is mostly located on a plateau of land north of Arctic



College and west of the Power Plant. This area is identified as the Upper Plateau. A smaller plateau of developable land exists to the west of Arctic College and is referred to as the Lower Plateau.

A number of current uses exist on the site. Natural Resources Canada (NRCan) currently operates two geomagnetic laboratories in the proposed development area, approximately 250m northwest of Arctic College. These laboratories require a minimum development buffer of 100m and direct line of sight with the Government of Canada building. The City is working in collaboration with NRCan to relocate these facilities. In addition, three unused steel lattice structures and a semi-submerged concrete bunker exist on a federally owned reserve lot north of the existing trailer park. It is intended that the towers and bunker be decommissioned.

3.1.3. Proposed Land Uses

Consistent with sustainable development principles, the Plateau Subdivision was designed with a mix of land uses and a range of housing dwelling types. The development principle to meet the needs of a growing population targeted the need for 250 to 300 dwelling units. The Development Scheme provides for approximately 300 dwelling units.

Residential

Policies in the General Plan call for this area to be primarily developed for residential uses. The area is very close to the Core Area despite the psychological distance presented by the elevation change and the lack of obvious integration with other neighbourhoods. The orientation and gentle sloping terrain of the plateau areas provide excellent opportunity for solar orientation of lots and a road layout that favours predominant wind patterns.

The *Housing Needs Assessment* completed for this project indicated a need for primarily ground-oriented housing with a full range of low and medium density housing types with low density meaning singles, semis, and duplex dwellings, and medium density meaning 4-plexes, 6-plexes, rows, and stacked rows. The ground-oriented housing is represented by yellow on Appendix A of the Plateau Development Scheme. Medium Density Residential is represented by orange. The development principles for the project targeted a minimum of 75% ground-oriented housing units. The Development Scheme proposes approximately 87% of the dwelling units to be ground-oriented. Low density residential is mainly located along the edge of the ridge and in the internal lots. Medium density residential is mainly located north of the low density residential taking advantage of rising elevation and with the intent that the larger scale and massing of these developments not interfere with solar exposure and views of the smaller buildings. In return, the smaller buildings and the more regular gaps between them permit more views and pedestrian permeability, particularly for the lots along the ridge. Approximately 38% of lot area offer unobstructed views to the sea.

Residential Cluster

In each phase of development in the Upper Plateau, there is a least one lot that is identified with a 'Cluster Development' symbol, which provide an opportunity for clustered housing forms. Clustering results in lower land and servicing costs per unit, can reduce exposure to extreme weather conditions, and creates an enhanced sense of community. All cluster lots offer views of open space or the sea to provide opportunity to create a feeling of visual privacy. Development will be restricted to ground-oriented building forms.



Amending By-law No. 602 to the Zoning By-law currently in the approval process, proposes a new zone – the Cluster Residential Zone (RC) – for all lots identified for cluster development. The RC Zone is intended to introduce a more performance-based zone into Iqaluit's Zoning By-law. The RC Zone conditionally permits 'ground-oriented housing' which provides flexibility for the developer to propose a housing form that meets their development objectives as long as the conditional use criteria and basic zone provisions are met. Conditional use criteria for the RC Zone address the following functions of site development:

- ♦ physical site features
- ♦ adjacent lot development
- ♦ amenity spaces
- ♦ storage areas
- ♦ wind and snow patterns
- ♦ solar exposure
- ♦ views
- ♦ parking\access
- ♦ landscaping
- ♦ vehicular traffic

The applicant will be required to submit supporting materials with their Development Permit application to demonstrate compliance with the conditional use criteria. Zone provisions provide maximum flexibility where desirable, but also set limits to development by prescribing a maximum density, minimum landscaped open space to be retained, and minimum yard setbacks. In this way, site-specific development will be evaluated on a set of performance criteria.

Mixed-use Commercial

The development principles targeted that a minimum of 10% of lot area be designated for uses other than pure residential uses. The Development Scheme identifies approximately 18% of developable lot area for mixed-use commercial and institutional uses. Mixed-use commercial buildings have a commercial component on the main floor of the building with residential apartment units above. As shown on Appendix A of the Plateau Development Scheme, these mixed use sites are located at the entrance to the subdivision and adjacent to the anticipated community focal point at a four corners intersection. The lots are oriented to make solar exposure easier to achieve and the lots are generally located where the greater scale and massing of future buildings relative to other buildings will not impact development to the north in terms of solar exposure and view corridors.

Community

Community refers to buildings that provide a community service. The range of uses would include educational, recreational, and other institutional type uses, government services, daycare, place of worship, arts studio. It is intended that these buildings could incorporate a residential component. Community lots (shown in blue on Appendix A of the Plateau Development Scheme) are located in prime locations that offer good solar orientation, views to the sea, relatively flat building sites, and close proximity to primary roads or intersections. The number of community lots reflects a conservative estimate of anticipated community-use type



development. The demand for these lots will be monitored and their use re-designated to residential uses if there is no indication of uptake. This approach reserves the best land for community uses first instead of trying to find land later in the process, invariably more marginal land, to meet demand. In Phase 1 of the Upper Plateau, there is a community lot identified which will not be serviced with municipal piped water and wastewater. Although separated from the neighbourhood, it was intended this community use opportunity be provided for an energy intensive use that could tap into waste heat from the adjacent power plant. The use would need to be one that was not impacted by noise generated by the plant. A community greenhouse project was one use that was identified as having potential for this location. By identifying the lot, the City wishes to support the development of a special innovative initiative.

Core Area Use

Two lots in the Lower Plateau Phase 1 have been identified for uses such as government office, cultural/community/arts centre and limited residential development. The proximity of these lots to Arctic College, the new Nunavut Justice Centre just down the hill to the southeast, which is currently under construction, suggested that these lots may integrate well with Core Area and Capital District type uses. There is a scarcity of readily developable land in the Capital District. Existing vacant lots are already being constructed upon or are in the planning stages. Many of the lots are encumbered by their size, irregular shape, off-site parking, and lease status, among other issues. These lots will provide additional opportunities for Capital District redevelopment.

Public Recreation & Open Space

The lots identified in green on Appendix A of the Plateau Development Scheme are designated public recreation spaces and their location and size are consistent with General Plan policies for appropriately sized and located play spaces. Three neighbourhood playgrounds are proposed. Two would be targeted to younger children with play equipment – that in Phase 1 (Upper Plateau) across from the community focal point and a second in Phase 3 (Upper Plateau). Both of the locations are centrally located with good visibility. The last park is intended as a playing field and would be targeted to youth. This park is less centrally located, but still has good visibility from the road.

Phase 1 of the Upper Plateau identifies a public gathering space at the tip of the triangular Community lot. It is intended that a sculpture or other type of landmark be commissioned by the City to define this public space as a gathering place within the neighbourhood. At the division between Upper Plateau Phase 2 and 3, a picnic area has been identified, which ties into the Walking Trail network.

The majority of land in the subdivision is designated Open Space. Consistent with the development principle of protecting significant environmental features, a necklace of significant features have been identified on the Development Concept Plan (Appendix A) within the Open Space area and will be protected from development. The features include a ring of three significant rock outcroppings that provide excellent lookouts, a lake with drainage system along the north edge of the subdivision, and a berry-picking area that was identified in the City's Cultural Resources Mapping exercise. The Open Space area also includes the 30m setback from major watercourses. Convenient walking access to these features has been preserved in the lot layout and it is intended that secondary walking trails be constructed when funds are available.



3.2. Lot Development Standards

The Plateau Development Scheme also proposes lot development standards for all lots in the subdivision. This is a new initiative by the City in an effort to introduce more sustainable development practices into lot development. Previously, development on individual lots was regulated to the extent of the Zoning By-law in terms of density, yard setbacks, height limits, etc. The lot development standards go beyond these to outline both descriptive goals and prescriptive measures. There are 'basic' lot development standards that will apply to all development in the subdivision and there are 'enhanced' development requirements that will apply to a limited number of lots in each phase of development.

3.2.1. Basic Lot Development Standard

The basic lot development standard is provided in the Plateau Development Scheme. Each applicant for a Development Permit will need to demonstrate adequately to the City that their proposed development is consistent with the standard, in addition to the provisions of the Zoning By-law and policies of the General Plan. The Plateau Lot Development Standard address site layout, building design and building systems. Site layout standards deal with solar orientation, building entrances, enclosed storage areas, use of gravel fill, and shared driveways and building services. Building design standards address the influence of wind, topography, and solar exposure. Building systems standards address windows, water saving devices, water heaters, and ventilation.

The standard for Mixed-use designated lots will be the Model National Energy Code for Buildings (MNECB), plus 25%. This is the standard used for eligibility for funding under the Commercial Building Incentive Program (CBIP).

The standard for Community Use and Core Area Use designated lots are required to achieve the Leadership in Energy and Environmental Design (LEED[®]) certification. In addition to energy efficiency, LEED takes into account siting issues, water use efficiency, materials and resources used in construction, and indoor environmental quality. LEED awards points for meeting specific performance criteria that outperform typical standard practice. These are confirmed by an independent review and audit.

3.2.2. Enhanced Lot Development Standard

The enhanced requirements for development are aimed at encouraging special innovative projects that push the development standard envelope. The enhanced requirements will be a moving target with revisions to the definition throughout each phase of development. The idea is that these requirements will always set the bar higher than the standard in each phase of development. For example, in Phase 1, development must achieve R-2000 certification and all appliances installed must be ENERGY STAR[®] qualified, over and above the lot development standard for that phase.

3.3. Affordable Housing

The cost of housing is very expensive in Iqaluit. Currently home ownership is largely limited to those able to buy, build and maintain a single-detached. The only option for housing ownership is through the ballot draw system for a lot that is then developed by the successful applicants. The City intends to improve access for lower income groups to home ownership. Approximately



15% of the proposed ground-oriented units, or approximately 40 units, will be targeted to lower-income groups.

To do so, the Plateau Development Scheme recommends that the City reserve select medium density residential lots in each phase of development and award the lots based on a call for proposal to develop freehold row housing units. Criteria for the call for proposal will stipulate development and severance of lots within three years and will be evaluated based on life cycle costing of the units, flexibility and quality of design, adherence to the lot development standards, among other criteria as appropriate. Freehold townhomes provide ground-oriented housing that require less land per lot and are typically more energy efficient than single-detached homes. These characteristics reduce up-front capital costs and reduce on-going maintenance and operating costs and are thus considerably more affordable than single-detached housing forms. Zoning By-law amendments are currently underway to permit freehold townhomes in the appropriate zones. It is hoped that the demand for freehold townhomes will increase after the first demonstration projects such that private interests will seek to produce this more affordable housing form without City intervention.

3.4. Infrastructure

3.4.1. Existing Infrastructure

The City of Iqaluit's existing infrastructure is comprised of primarily buried water mains and sanitary sewers, trucked water deliver and sewage collection, gravel secondary roads, and gravel and paved collector roads.

Water Distribution and Sewage Collection

The City's is serviced approximately 60% by the utilidor (pipe) system and 40% by the trucked system. The water system is metered and the users are charged for the service based on water consumption. The water rates are independent of the deliver system.

The utilidor system has the advantage of level of service for the user. Unlike trucked services, the risk of running out of water does not exist, therefore the user feels less incentive to conserve water. The utilidor system also provides fire protection through the system of fire hydrants. The utilidor system is a far more cost effective method of providing the water and sewer services.

Historically the trucked system resulted in significantly lower water consumption rates. The risk of users running out of water resulted in users practising water conservation. With newer construction, homeowners are installing larger water tanks that provide a more dependable water supply, and have reportedly resulted in water consumption rates near that of the utilidor system. The trucked system provides a lower level of fire protection, as there are no fire hydrants, and water has to be shuttled to the fire by water truck. The operational cost of providing trucked services has been estimated to be 3 times higher than the utilidor system.

The City of Iqaluit has a user pay system for water and sewer services. This in essence means the users are charged for the services based on water consumption, however the City still subsidizes both systems. Although the utilidor system has a much higher capital cost, this cost is recovered through the leasing of the developed land. The capital costs for the trucked system, purchase of vehicles, is not a recovered cost, but is borne by the City as an operating cost. Therefore the utilidor system is a much more cost effective system for the City to provide



the services, among other benefits such as improved fire protection and reduced truck traffic in residential areas. The City of Iqaluit has recently decided that no new major development will proceed on the trucked system, and is taking steps to remove areas of the city off the trucked system and on to the utilidor system due to the differential operating costs.

Water Reduction Initiatives

The City of Iqaluit does not have a water reduction initiative program in place to encourage the use of water reduction technology or practises. The City did pilot a grey water recycling project in 2003. The project has seen many difficulties with code and regulatory problems, and the City is currently trying to rectify the problems. Due to this unsuccessful endeavour, the City is reluctant to utilize any technologies until they are fully proven in the arctic context.

3.4.2. Proposed Infrastructure

Servicing policies and a Servicing Concept Plan are contained in the Plateau Development Scheme. The Servicing Concept Plan is shown as Appendix B of that document.

Water and Sewer Services

The provision of basic municipal services is an essential obligation of the City. The City history with water delivery and sewage collection has shown that the use of a utilidor system is the most cost effective and dependable system, and provides the best level of fire protection. Therefore the Plateau Development Scheme includes the provision of water and sewer services through a buried utilidor system. The Development Scheme does not require the use of any grey water recycling technology due to the City's past history with these systems. However, it does not recommend restricting their use and recommends supporting any public or private demonstration projects that incorporates their use and finds practical solutions to problems that have been encountered in the past.

The Servicing Concept Plan in Appendix B of the Development Scheme indicates the limits of development which can be serviced through gravity sewers. The northern portion of Phase 3 is located outside these limits. The Development Scheme recognizes this by requiring these lots to include alternate sewage treatment, either onsite treatment or grey water recycling. Since this area is in the later phases of the subdivision, it is anticipated that these technologies will likely have been explored and proven by this time, and can be readily deployed.

Water Reduction Initiatives

The minimum lot development standard prescribed in the Development Scheme requires that all toilets, faucets and showers be equipped with low-flow fixtures (ie. low-flow toilets and showerheads and aerated faucets). It is estimated that these initiatives will save approximately 20% of the current water usage. To the average consumer this translates into a yearly savings of approximately \$267 based on an average family of four people. The costs to implement these savings are estimated to be approximately \$700. This translates into a 3 to 4 year simple payback period.

As the City subsidizes the cost of water services, it will also realize an operating savings from this initiative. In addition, the use of these devices will put generally lower demand on the City's infrastructure (ie. Wastewater Treatment Plant and Water Treatment Plant) than would



otherwise be required. Using these fixtures in the Plateau Subdivision will allow the City's water-related infrastructure to meet a population of 10,000, and service an estimated additional 200 to 300 persons. If these initiatives were adopted for all future development for the next 20 years, the same infrastructure could be expected to service an additional 750 to 1,000 persons.

3.5. Transportation Networks

3.5.1. Existing Transportation Network

The rapid growth in population, and an increase in private vehicle ownership, has resulted in an increase in the number of vehicles on Iqaluit's roads, with a reported 192 new cars being delivered this year. This continued growth in the number of vehicles has lead more traffic and more conflict between vehicles and pedestrians. Residents often cite congestion at the City's major intersections during peak hours as a concern. Any future development can be expected to exacerbate these problems.

Although vehicular traffic is becoming a problem, many residences do not own a vehicle, and rely on alternate modes of transportation, including walking, taxis, cycling in the summer and snowmobiling in the winter. The 2001 Census reported that 34% of residents walk to work, which in fact was down from the 41% reported in 1996. These numbers show that a considerable number of residents still walk to work, however that number is decreasing. The decrease can be at least partially contributed to the newer developed land being further from the downtown core.

Walking trails are identified in the General Plan and policies of the Plan support their protection and enhancement with trail markings and other trail infrastructure. The first trail development project is anticipated to be started in the summer of 2005 for a portion of trail that runs along the creek between the hospital and Koojesse Inlet. Walking trail linkages are encouraged for all new developments.

Snowmobiles not only are used for recreation, they are also major mode of transportation in the winter months. Currently their primary transportation routes within the City are the shoulders of the roads, and unmarked informal trails. This has been recognized as resulting in a conflict with vehicles and pedestrians. As a result, the City's General Plan promotes the segregation of snowmobile traffic throughout the City, identifies existing snowmobile trails and encourages the identification of trails through trail markings and clear crossing locations for both existing and new subdivisions.

The majority of roads in Iqaluit are gravel. Some of the major collector roads are paved, however the cost of paving is such that a substantial paving project is not being proposed at this time.

Roadways in new developments are generally built above the existing surface. Certain subsurface conditions, when disturbed, can make construction difficult. This has resulted in a philosophy of not disturbing the native material and to build the roads on embankments. In addition, to provide a solid road base, the embankments are generally constructed to promote and maintain permafrost in the native material. This is accomplished by constructing the roads on approximately 1.5 metres of fill.



3.5.2. Proposed Transportation Network

Road System

The road layout in the Plateau Development Scheme, considers the prevailing winds, solar orientation and the topography of the site. The major roads are aligned with the prevailing wind patterns to minimize snowdrifting and thus snow removal operations. The connector roads are aligned to maximize solar orientation of the lots to improve passive solar heating.

The proposed road system in subdivision will be gravel roads. It was recommended in the Development Scheme that the roadbed be constructed to a width of 8.5 metre to allow sufficient room for vehicle, snowmobile and pedestrians. The two alternate access roads, one from Saputi Road (Road to the Generating Station) in Phase 1 and one from the road to Upper Base in Phase 3 will be primarily service roads and a reduced width of 7.0 metres is recommended, as heavy vehicular or pedestrian traffic is not anticipated. The reduced width will result in an estimated 14 percent reduction in embankment material required.

It was also recommended in the Development Scheme that a geotechnical investigation of the site be carried out prior to construction of the roads. The objective of the investigation will be to identify the subsurface condition, location of bedrock, and soil types. This information will then allow the designer to identify the areas where the road structure can be reduced due to the presence of good subgrade material, or bedrock. It is estimated that this will lower the average height of the roadbed to 1.0 metre, resulting in a savings to the City of approximately 40 percent of the embankment material. Savings will also be passed onto the individual lot lessees as they will not be required to fill as high for road access to their lot. The visual impact of the high embankments will also be lessened.

A development cost estimate prepared for Council includes an amount for paving the lower part of Saputi Road, from Niaqunngusiaq Road (formerly Apex Road) , to the entrance to the development. This portion of Niaqunngusiaq Road is relatively steep, (10%) and the added traffic from the development will likely cause this to be a maintenance problem. This section would also generate considerable dust if left as a gravel surface. The addition of asphalt to this section of road will eliminate the need for road grading and resurfacing due to the traffic and slope, and protect the integrity of the surrounding tundra environment.

Walking Trails

The Plateau Development Scheme identifies an extensive walking trail system, as shown on Appendix C of the Plan. Priority will be given to the development of a Primary Walking Trail which will serve residents of the neighbourhood on a daily basis as the primary pedestrian access route to Arctic College and the Core Area. The Primary Walking Trail will also provide visitors to the community with a recreation opportunity and draw visitors to the neighbourhood. The Primary Walking Trail links to the main road in the subdivision and to a neighbourhood public space where a bus shelter is also proposed. Surface hardening and trail markers would establish the route and guide visitors. The development of the Primary Walking Trail has been budgeted in the Phase 1 development cost estimate.

Secondary Walking Trails are also identified in the Development Scheme, which will connect with the Primary Walking Trail. The Secondary Walking Trails include established pedestrian corridors, which bisect neighbourhood blocks. All pedestrian trail design in the neighbourhood



will incorporate measures to discourage snowmobile use and minimize intermodal conflict (i.e. tall bollards, boulders, trail markers). The trail network has been designed with trailheads at road ends to facilitate access.

Snowmobile Trails

The Plateau Development Scheme identifies north-south and east-west Snowmobile Trail links. It is intended that an east-west route traverse along the northern edge of the Upper Plateau and between Phase 1 and 2 of the Lower Plateau development to minimize pedestrian and snowmobile conflicts. Snowmobile routes and crossings across key roads would need to be properly identified to improve their safety and to avoid piling snow in these areas.

Transit

Transit service is an important component in providing transportation choice. The City of Iqaluit operates a single bus public transit system. The bus currently operates during the 3 daily peak periods to provide low cost alternate transportation to and from work. The bus route's nearest point to the future subdivision is a stop located at Nunavut Arctic College.

A loop extension to the City's existing bus transit service is proposed. The extension would connect via Saputi Road from the existing service along Niaqunngusiaq Road, as shown in Appendix C. A stop with bus shelter is proposed at the tip of the triangular Community lot intersection where a public space and trailhead are located. In Phase 2, the loop would be expanded with a stop and bus shelter at the edge of the Phase 2 development along the main road. Although the future of the City's bus transit system is unknown, the shelters should be built regardless as they serve the dual purpose as shelters at playground locations. The installation of a shelter has been budgeted in the Phase 1 development cost estimate.

3.6. Energy Efficiency

New low-rise housing in Iqaluit is characterized by higher levels of energy efficiency than are typically found in new homes built in most other areas of Canada. This is due more to market forces than to the influence of regulation. There are still cost effective opportunities for further improving energy efficiency in new Iqaluit homes, however. The new development will provide the opportunity to demonstrate the advantages of building more efficiently.

3.6.1. Existing Energy Efficiency Context

At one time, Canada Mortgage and Housing Corporation (CMHC) inspected many new homes in Iqaluit, because they were the lending agency for most homes. Some years ago, however, CMHC stopped doing inspections, and since then there has been a lack of formal new home inspection in Iqaluit. The City is in the process of adopting a building code and implementing home inspection to enforce it. As part of that process, the City is evaluating the feasibility of introducing an energy standard for new low-rise housing.

The EnerGuide for Houses is Canada's most common system for rating the energy performance of low-rise housing. A tested home obtains a score on a scale from 1 to 100, based on expected energy consumption compared to a reference home of the same size in the same climatic region. Houses built to code in Southern Canada would typically score about 68. An energy efficient house would score in the high 70s. A house built to the R-2000 Standard (a popular



Canadian standard for efficient house construction) would score 80. Some houses have been built so efficiently they score well over 90.

In Iqaluit, most new houses constructed would score in the high 70s, with row houses slightly more efficient on average than fully detached homes. An energy standard equivalent to the R-2000 Standard would require modest changes to building practices, and would result in significant energy savings. A lower standard would not provide sufficient savings relative to the typical new Iqaluit house to be worthwhile. A higher standard than R-2000 would provide greater savings however would have significantly longer economic payback. The R-2000 Standard has the advantage of being an already existing standard in use elsewhere. Any higher standard would need to be developed specifically for Iqaluit, and would therefore entail higher start-up costs.

3.6.2. Proposed Energy Efficiency Initiatives for Residential Units

The development scheme incorporates energy efficiency both as part of the development standard and in the form of enhanced requirements during the different phases of development. The following energy efficiency initiatives will be standard for all housing units.

Passive Solar Improvements

The planned subdivision layout will permit most units to face the majority of their windows towards the south, improving solar gain and reducing heating costs with no incremental construction cost. The orientation of 70% of the windows in a southern direction will result in an estimated 1% reduction in energy costs.

Oil Water Heaters

Electric water heaters have been commonly installed in Iqaluit homes in the past. An oil water heater is somewhat more expensive to install and maintain, but it is much more efficient and less expensive to operate. Heating water electrically involves burning diesel fuel at approximately 29% efficiency to make the electricity at the power plant. An oil-fired water heater, on the other hand, burns heating fuel (essentially the same as diesel) at 80% efficiency. Electric water heaters will not be used in the Plateau Subdivision.

Heat Recovery Ventilators

Heat recovery ventilators (HRVs) are a key component of efficient house construction. In a heat recovery ventilator, the warm air being exhausted heats the cold ventilation air being brought into the house, thus allowing fresh outside air to replace indoor air while reducing heat loss. They are particularly beneficial in homes with hot water radiator heating, because they improve the circulation of air throughout the home and therefore help make the temperature more uniform.

Upgraded Windows

All windows installed must be Energy Star® qualified windows under the NRCAN EnerGuide program. High performance windows not only reduce energy consumption and improve comfort, but also reduce damage due to condensation, and reduce outside noise (for example snow mobiles and power plant)



Electric Baseboard Heaters

No homes will use electric baseboard heating, for the same reason electric water heaters are excluded: oil heat is much more efficient.

Additional Initiatives

In addition to the mandatory initiatives, construction of homes to the R-2000 efficiency standard will be encouraged in Phase 1. The R-2000 standard includes increased levels of insulation and high-performance windows. The most significant change between standard Iqaluit construction practice and R-2000 construction is likely to be in air tightness.

Some residential lots in the first phase will have enhanced requirements for energy efficiency. For these lots, official certification of R-2000 energy performance will be required, and all appliances installed must be Energy Star® qualified under the NRCan EnerGuide program.

As currently planned, future phases of development will raise the level of energy performance achieved. In the second phase, R-2000 certification will be required for all residential lots. The lots with enhanced requirements will be expected to achieve a higher level of energy performance than R-2000. For example, housing units may face a requirement to achieve an EnerGuide for Houses score of 83. The establishment of the enhanced requirement for the second phase will be based partly on experience from the first phase.

In the third phase, both the standard and the enhanced energy performance requirements will be reviewed and revised, based on the experience from the first two phases.

3.6.3. Energy Savings

Table 1 summarizes the savings for three dwelling unit types, showing the effects of the solar orientation (Upgrade Solar), the requirements for oil-fired water heaters and HRVs (Upgrade Mechanical), and the R-2000 requirement. The numbers in the shaded boxes are the consumption in the base case units from the Energy Standards report.

Table 1 – Energy Savings in New Houses

Segment	Fossil Energy (MJ)	Heating Fuel (litres)	Fossil Savings (%)	Electricity (kWh)	Diesel Fuel (litres)	Electricity Savings (%)
Fully Detached	81,672	2,087	--	15,793	5,069	--
Upgrade Solar	2,707	69	3%	12	4	0%
Upgrade Mech.	(35,824)	(913)	-44%	6,667	2,140	42%
EGH-80 (R-2000)	(10,908)	(278)	-13%	6,479	2,079	41%
Row House - End Unit	73,575	1,881	--	15,719	5,045	--
Upgrade Solar	2,781	71	4%	12	4	0%
Upgrade Mech.	(32,944)	(841)	-45%	6,634	2,129	42%
EGH-80 (R-2000)	(16,531)	(422)	-22%	6,406	2,056	41%
Row House - Mid Unit	63,704	1,628	--	15,678	5,032	--
Upgrade Solar	3,394	87	5%	15	5	0%
Upgrade Mech.	(32,189)	(825)	-51%	6,638	2,130	42%
EGH-80 (R-2000)	(22,903)	(587)	-36%	6,460	2,073	41%



Table 2 shows the energy cost savings for the three dwelling unit types, based on the same three upgrades. The energy consumption and costs for the base case units are shown in the shaded boxes.

Table 2 Energy Cost Savings

Segment	Heating Fuel (litres)	Fuel Cost	Electricity (kWh)	Electricity Cost	Total Energy Cost Savings	Total Energy Cost Savings (%)
Fully Detached	2,087	\$1,878	15,793	\$5,528	\$7,406	-
Upgrade Solar	69	\$62	12	\$4	\$66	1%
Upgrade Mech.	(913)	(\$822)	6,667	\$2,333	\$1,512	20%
EGH-80 (R-2000)	(278)	(\$250)	6,647	\$2,266	\$2,017	27%
Row House - End Unit	1,881	\$1,693	15,719	\$5,502	\$7,195	-
Upgrade Solar	71	\$64	12	\$4	\$68	1%
Upgrade Mech.	(841)	(\$757)	6,634	\$2,322	\$1,565	22%
EGH-80 (R-2000)	(422)	(\$380)	6,406	\$2,242	\$1,862	26%
Row House - Mid Unit	1,628	\$1,465	15,678	\$5,487	\$6,953	-
Upgrade Solar	87	\$78	15	\$5	\$84	1%
Upgrade Mech.	(825)	(\$743)	6,683	\$2,323	\$1,581	23%
EGH-80 (R-2000)	(587)	(\$528)	6,460	\$2,261	\$1,733	25%

Other Costs

No enforcement costs are assumed for either the Solar Upgrade or the Mechanical Upgrade. Construction costs for the Solar Upgrade are regarded as negligible.

Construction costs for the mechanical upgrade are estimated at approximately \$4,000. This is broken down as follows:

- ♦ HRV units cost up to \$2,700 installed, particularly in situations where some additional ducting is required (most Iqaluit houses have hydronic heating and therefore require some circulation ducting to move the ventilation air).
- ♦ Oil-fired heaters are approximately \$1,000 more, installed, in Southern Canada. We assumed a somewhat larger incremental cost in Iqaluit, or \$1,300.

The Solar Upgrade has no incremental cost to the homeowner, so its payback is instant. Table 3 shows the simple payback analysis from the homeowner perspective, for the Mechanical Upgrade option.

Table 3 Homeowner Perspective, Mechanical Upgrade

Year	Construction Cost	Mark-up	Incremental Selling Price	Annual Energy Savings	Simple Payback
Fully Detached	\$4,000	\$800	\$4,800	\$1,512	3
Row House	\$4,000	\$800	\$4,800	\$1,573	3



Table 4 shows the payback analysis, from the homeowner's viewpoint, of the upgrade to the R-2000/EGH-80 standard, relative to the typical Iqaluit home.

Table 4 Homeowner Perspective, Upgrade to R-2000

Year	Construction Cost	Mark-up	Incremental Selling Price	Annual Energy Savings	Simple Payback
Fully Detached	\$11,400	\$2,280	\$13,680	\$2,101	7
Row House	\$10,200	\$2,040	\$12,240	\$1,949	6

The Solar Upgrade option is not expected to have any impact on the homebuilder's cash flow. Both the Mechanical Upgrade and the R-2000 Upgrade are likely to have positive impacts on the home builder's cash flow, because the incremental cost will be recoverable, with an appropriate mark-up, as is the experience with R-2000 housing in other parts of Canada.

3.6.4. Societal Cost/Benefit Analysis

The societal benefits of the sustainable initiatives are primarily the reduction in greenhouse gas (GHG) emissions. Table 5 shows the reductions in GHG emissions resulting from each of the three upgrades from ten years of construction. The reductions assume an average of 83 units being built per year which is the average number of units needed to be built each year to meet the anticipated population growth defined in the City's General Plan. The savings are calculated over the life of the units, estimated at 30 years.

Table 5 GHG Savings from Ten Years of Construction

Segment	Units Built	GHG Savings from Heating Fuel (tonnes CO ₂ e)	GHG Savings from Diesel Generation (tonnes CO ₂ e)	TOTAL GHG Savings (tonnes CO ₂ e)	TOTAL GHG Savings (%)
Fully Detached	410				
Upgrade Solar		2,407	136	2,543	1%
Upgrade Mech.		(31,826)	74,624	42,798	17%
EGH-80 (R-2000)		(9,699)	72,565	62,866	25%
Row Houses	420				
Upgrade Solar		2,824	154	2,978	1%
Upgrade Mech.		(29,778)	76,073	46,295	19%
EGH-80 (R-2000)		(18,037)	73,767	55,730	23%
TOTAL	830				
Upgrade Solar		5,232	289	5,521	1%
Upgrade Mech.		(61,604)	150,697	89,093	18%
EGH-80 (R-2000)		(27,736)	146,332	118,596	24%

To analyze the societal benefits versus the implementation costs, the GHG reductions are given a value per tonne (\$10 per tonne). These savings and the energy savings can then be compared to the implementation costs. Tables 6 and 7 show the cost benefit analysis for the Solar Upgrade and the Mechanical Upgrades based on this approach.



Table 6 Cost/Benefit Analysis of Solar Upgrade

Year	Units Built	Energy Cost Savings (undiscounted)	Incremental Construction Costs (undiscounted)	Total Enforcement Costs (undiscounted)	Value of GHG Savings (undiscounted)	Total Cash Flow (undiscounted)	Total Cash Flow (discounted)
2005	83	\$0	\$0	\$0	\$0	\$0	\$0
2006	83	\$5,903	\$0	\$0	\$184	\$6,087	\$5,689
2007	83	\$11,806	\$0	\$0	\$369	\$12,175	\$10,634
2008	83	\$17,709	\$0	\$0	\$553	\$18,262	\$14,907
2009	83	\$23,612	\$0	\$0	\$735	\$24,346	\$18,574
2010	83	\$29,515	\$0	\$0	\$919	\$30,434	\$21,699
2011	83	\$35,418	\$0	\$0	\$1,103	\$36,521	\$24,335
2012	83	\$41,321	\$0	\$0	\$1,288	\$42,608	\$26,534
2013	83	\$47,224	\$0	\$0	\$1,472	\$48,695	\$28,341
2014	83	\$53,127	\$0	\$0	\$1,656	\$54,783	\$29,798
2015-2044	0	\$1,505,252	\$0	\$0	\$46,930	\$1,552,182	\$387,140
TOTAL	830	\$1,770,885	\$0	\$0	\$55,208	\$1,826,093	\$567,652

Table 7 Cost/Benefit Analysis of Mechanical Upgrade

Year	Units Built	Energy Cost Savings (undiscounted)	Incremental Construction Costs (undiscounted)	Total Enforcement Costs (undiscounted)	Value of GHG Savings (undiscounted)	Total Cash Flow (undiscounted)	Total Cash Flow (discounted)
2005	83	\$0	-\$332,000	\$0	\$0	-\$332,000	-\$332,000
2006	83	\$128,044	-\$332,000	\$0	\$2,978	-\$200,979	-\$187,831
2007	83	\$256,087	-\$332,000	\$0	\$5,927	-\$69,986	-\$61,128
2008	83	\$384,131	-\$332,000	\$0	\$8,905	\$61,036	\$49,823
2009	83	\$512,174	-\$332,000	\$0	\$11,883	\$192,057	\$146,519
2010	83	\$640,218	-\$332,000	\$0	\$14,861	\$323,078	\$230,350
2011	83	\$768,261	-\$332,000	\$0	\$17,810	\$454,071	\$302,567
2012	83	\$896,305	-\$332,000	\$0	\$20,788	\$585,093	\$364,366
2013	83	\$1,024,348	-\$332,000	\$0	\$23,794	\$716,142	\$416,801
2014	83	\$1,152,392	-\$332,000	\$0	\$26,743	\$847,135	\$460,786
2015-2044	0	\$32,651,105	\$0	\$0	\$757,240	\$33,408,346	\$8,332,580
TOTAL	830	\$38,413,065	-\$3,320,000	\$0	\$890,929	\$35,983,994	\$9,722,835

As shown, both of the upgrades provide a societal benefit. The solar upgrade has a much smaller net savings, however due to not having incremental construction costs the analysis shows it is still beneficial. The mechanical upgrades are shown to provide a substantial societal benefit. The high energy savings and GHG reduction clearly justify the incremental construction costs.

3.6.5. Proposed Energy Efficient Initiatives for Mixed-Used and Community Land Uses

As part of the development standard, Mixed-Use lots in the Plateau Subdivision will achieve energy performance at least 25% better than the Model National Energy Code for Buildings (MNECB). The MNECB features a number of mandatory requirements for commercial construction practice. In addition to demonstrating that they have met these requirements, developers will show that the predicted energy consumption of the buildings will be 25% below that of a reference building constructed to meet the MNECB. Software is available from NRCan for carrying out this prediction.

All development on Community Use and Core Area Use lots in the Plateau Subdivision will achieve LEED® certification. LEED, which stands for Leadership in Energy and Environmental



Design, is a broad-based rating system that assigns points for energy efficiency, careful building siting, water use efficiency, materials and resources used in construction, and indoor environmental quality.

4. SUSTAINABLE DEVELOPMENT BEST PRACTICES

4.1. Best Practices for Site and Building Design

As part of the background information prepared for this project, a report entitled *Sustainable Development Best Practices for an Arctic Subdivision* was prepared. This report put forth a number of recommendations for a sustainable Arctic Subdivision. The Plateau Development Scheme incorporated many of these recommendations. A summary of the key recommendations and how the Plateau Development Scheme responded is provided in Table 8.

4.2. Best Practices for Energy Supply Options

The *Sustainable Development Best Practices for Arctic Subdivision* report prepared as part of the background report for this project also reviewed the best practises for energy supply options for use in Iqaluit. Table 9 includes a brief description of the advantages, considerations, their suitability for use in Iqaluit, costs, and whether they require additional study. Options with high capital costs and those requiring additional study were deemed to be not suitable because these would not work with the project timelines for Phase 1 development in 2005. However, these energy supply options should continue to be explored for implementation in future phases of development, if appropriate. The remaining options are discussed further below.

Photovoltaics

Photovoltaics or solar cells are a high cost alternate energy source. They are applicable for use in Iqaluit, and would be especially effective during the summer months due to the high periods of solar radiation. Conversely they would not be very effective during the winter months due to low solar radiation.

Although photovoltaics have proven performance in arctic climates and are a suitable alternate source of energy, the use of photovoltaics is recognized to be a high cost option in which capital costs are not easily recovered. It is therefore an alternative that will be seen as a deterrent to development and is therefore not recommended that their use be mandatory.

The technology should be promoted, however, as a clean and safe alternative energy source. Technological strides should be monitored so that when it becomes more cost effective, this technology can be used more often in Iqaluit building projects.

Passive Solar

Passive solar is an attractive alternative as there is essentially little to no cost to the developer/owner. The main requirement to allow its use is lot orientation during the development planning phase. This alternative has been adopted in the preparation of the Development Scheme through maximizing the number of lots with a southern exposure and requiring that all buildings be oriented within 30 degrees of due south.



Table 8: Best Practices Site and Building Design Recommendations

BEST PRACTICES RECOMMENDATION	PLATEAU DEVELOPMENT SCHEME
Elements of Site Design	
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.
Transportation and Pedestrian Access	
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.



BEST PRACTICES RECOMMENDATION	PLATEAU DEVELOPMENT SCHEME
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.
Building Features and Design Recommendations	
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.



BEST PRACTICES RECOMMENDATION	PLATEAU DEVELOPMENT SCHEME
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.



Table 9: Best Practices Energy Supply Recommendations

Energy Supply	Advantages	Considerations	Applicable to Iqaluit's Climatic Conditions	Cost	Needs Further Study
Photovoltaics	Well tested in northern communities	Takes up a significant amount of space; if placed on roofs will affect building orientation	Yes – during times with solar radiation	High	No
Passive Solar	Well tested in northern communities	May cause overheating in the summer	Yes – during times with solar radiation	Low	No
Solarwall	System requires virtually no maintenance	Cannot have windows on the wall to which the Solarwall is attached	Yes – during times with solar radiation	High	Yes
Active Solar	Can be used for solar water and air heating	Long, dark winters may reduce cost-effectiveness	Yes – during times with solar radiation	High	Yes
Evacuated Tubes	Well designed for cold climates	Long, dark winters may reduce cost-effectiveness	Yes – during times with solar radiation	High	Yes
Wind Power	Can be more cost-effective than diesel generated energy	Iqaluit may not have sufficient wind speeds to make the project cost-effective	Equipment may have to be adjusted for arctic climate	High	Yes
EcoNomad TM Micro-Utility Module	Reduces water consumption and greenhouse gas emission and uses renewable energy	Although it is designed for arctic conditions, it has not yet been tested	Not sure	High	Yes
Cogeneration: Waste Heat	Increases the efficiency of diesel generation plant	Factors such as density, type of uses, cost of infrastructure considered. Buildings would still have to have a conventional energy system as backup when there was no output from plant.	Yes	no cost to residents for connecting dwellings to system	Yes – A feasibility study commissioned by Nunavut Power Corporation is underway
Distributed Generation	Can counter distribution constraints, improve the reliability of the existing system, and delay distribution upgrades	Requires considerable planning prior to the construction of site - +/- 1 year	Yes	No cost to residents if plant is owned and operated by NPC	Requires consultation with Nunavut Power Corporation



Waste Heat

Nunavut Power Corporation is initiating a program to use waste heat from their diesel generating station. Phase 1 of the project is scheduled for the year 2005 and includes the required upgrades to the generating station. Phase 2 will complete the distribution system and connect the client to the station and is scheduled for 2006.

Integrating the use of waste heat as part of the first phase of development is not possible due to Nunavut Power Corporation's pilot project and associated schedule. There are also a number of factors that will influence NPC's decision for delivery waste heat, such as the density of development, distance and terrain to the client and availability of excess heat.

Distributed Generation

For distributed generation to be viable, a large demand for heat is required. If a consumer is available for the heat, then power can be economically produced. Power generation without the benefit of selling the heat is not as efficient as can be produced in the power generating station. The proposed development does not offer the large heat consumer; therefore the use of distributed generation is not deemed practical at this time.

5. CONCLUSION

The feasibility study explored sustainable development best practices that could be applied to an arctic subdivision. The study resulted from the City's commitment to environmental responsibility and sustainability. In October of 2004, Iqaluit City Council approved the Plateau Development Scheme, which outlined development principles, a development concept plan and implementation strategy for applying the knowledge from the feasibility study into a development project. This exciting project will see the development of Iqaluit's first subdivision that is guided by sustainable development practices. The application of the knowledge gathered from the feasibility study will result in substantial achievements.

The Plateau Subdivision site layout, development standards and policies will:

- ♦ Pilot the R-2000 standard in Phase 1 of development and then use R-2000 as a standard for lot development in future phases;
- ♦ Improve occupant health by introducing the R-2000 standard, requiring heat recovery ventilators as a ventilation standard in all housing, requiring solar orientation of all buildings and dwelling units; and maximizing views to the sea;
- ♦ Significantly reduce per capita consumption of key resources such as water, diesel fuel, heating oil, gasoline, and granular resources.
- ♦ Reduce greenhouse gas emissions;
- ♦ Protect significant environmental features on the site;
- ♦ Provide a greater mix of uses than previous Iqaluit subdivisions;
- ♦ Support the development of more affordable home ownership options by actively supporting the development of freehold townhomes through a call for proposal process;
- ♦ Support the GN social housing program through preferential lot selection;



- ♦ Provide a higher level of active and passive recreational opportunities than previous neighbourhoods;
- ♦ Introduce LEED and MNECB + 25% as standards for community use and mixed-use developments respectively;
- ♦ Achieve lower costs for the City on an ongoing basis for both operating costs and upgrading of municipal infrastructure costs;
- ♦ Support a greater awareness of sustainability issues and sustainable building practices that could be applied throughout the City;
- ♦ Support the development of local expertise and knowledge of sustainable development and building practices.

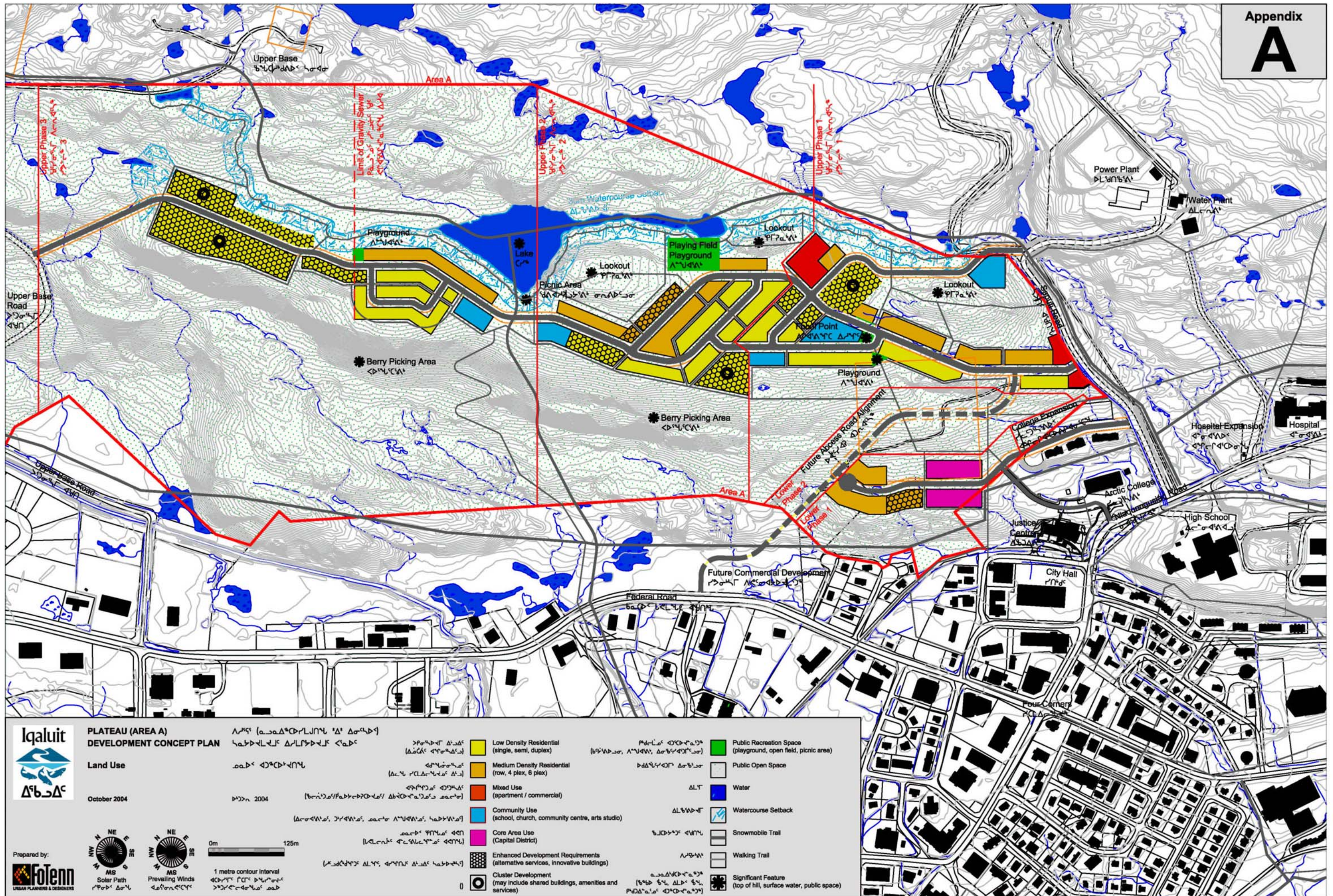
Since the adoption of the Plateau Development Scheme by Council, a Phase 1 Subdivision Plan has been prepared and General Plan and Zoning By-law Amendments necessary for implementation of the Development Scheme are underway. The City continues to seek opportunities to ensure the success of this project.

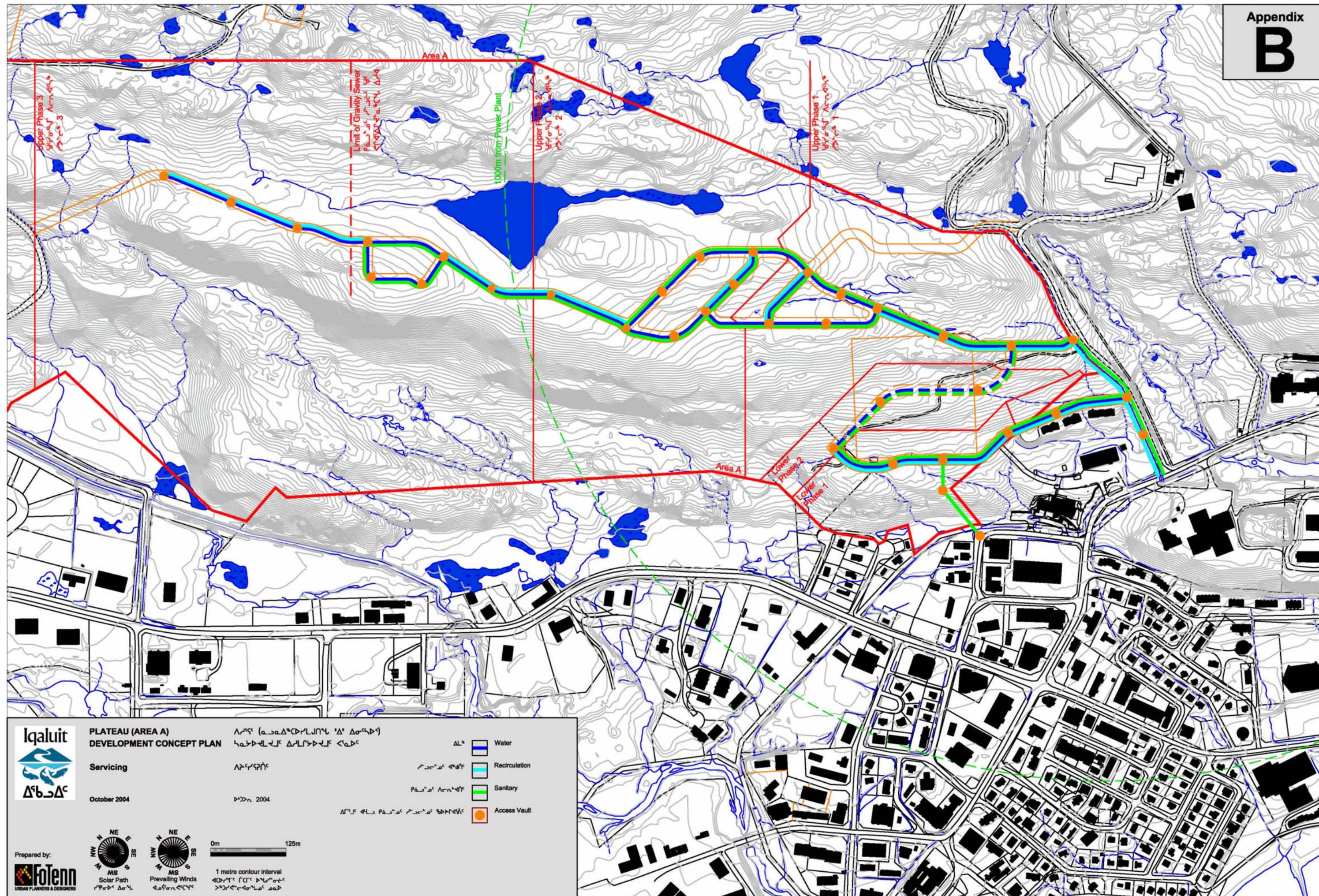


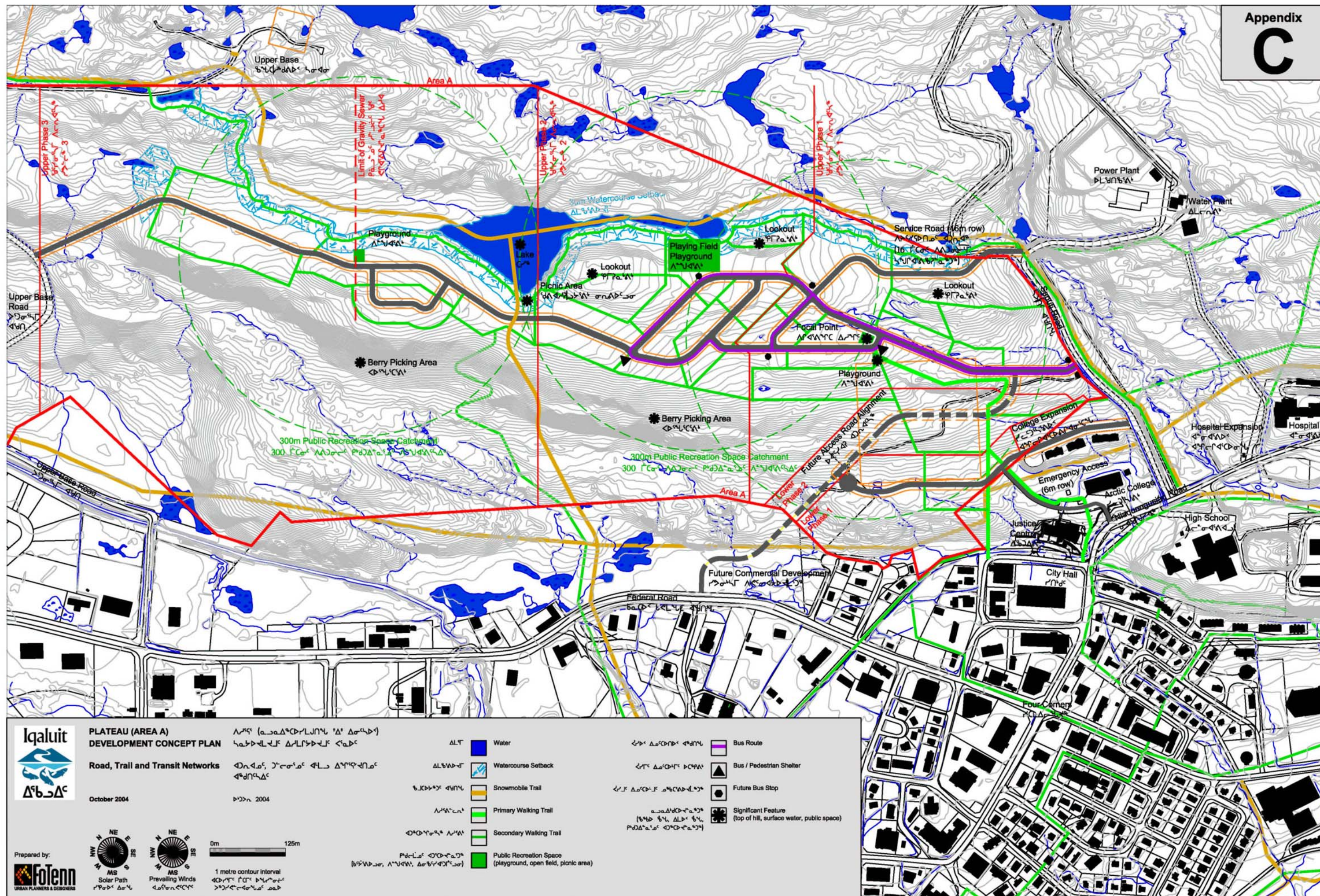
Appendix

Plateau Development Scheme Appendices





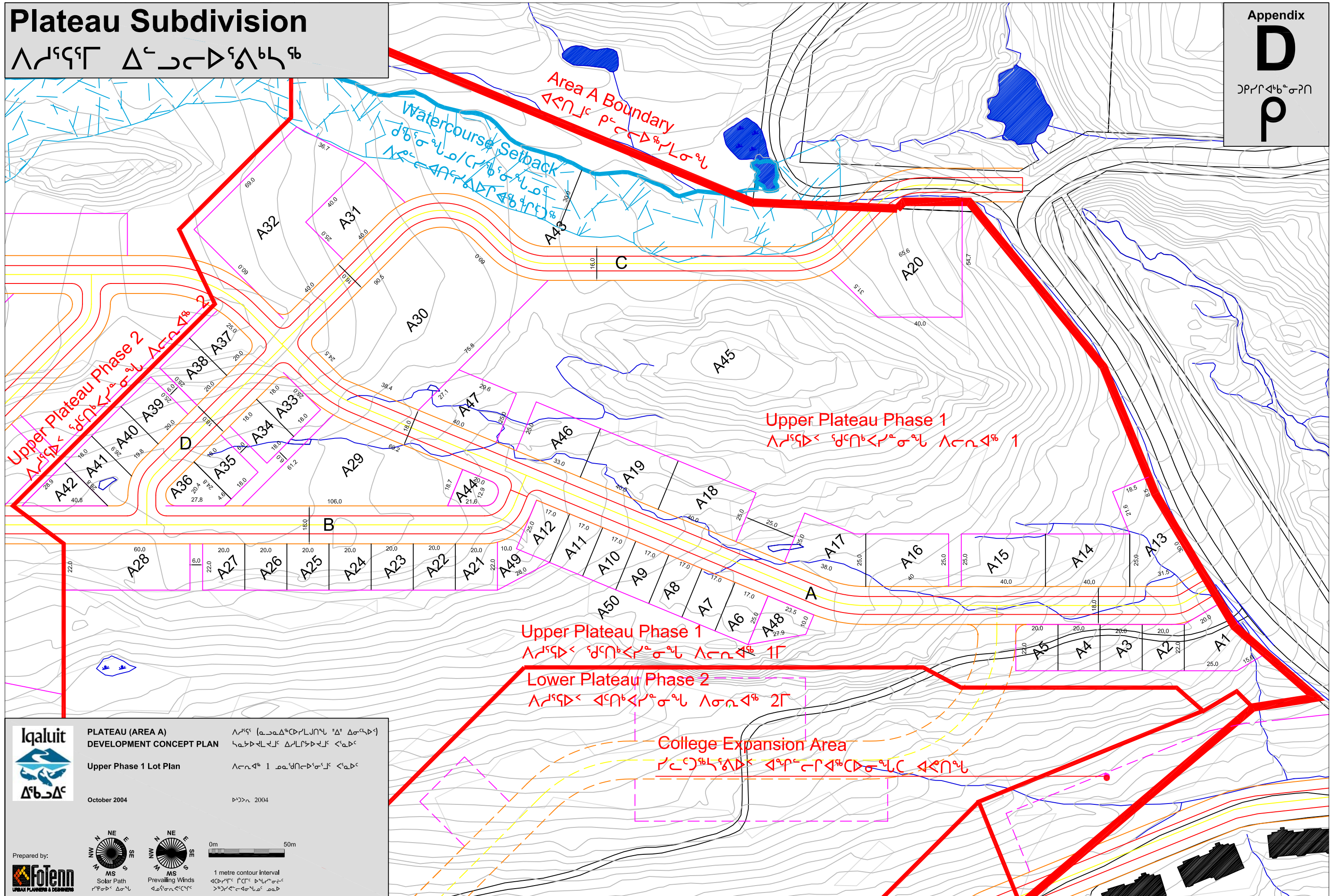




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October 2004

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Prepared by:

