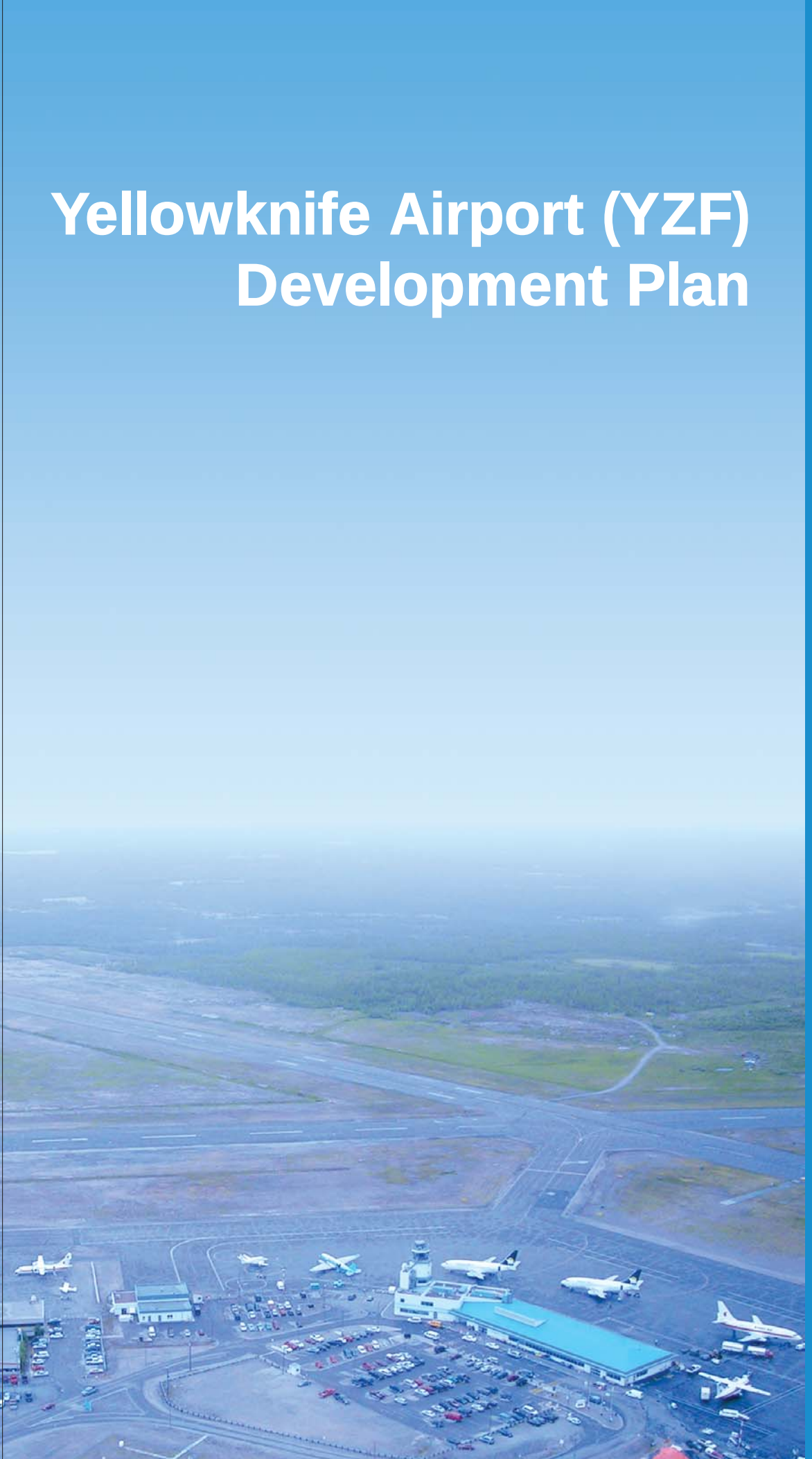
Yellowknife Airport (YZF) Development Plan



Prepared for

Northwest Territories Transportation

Government of the
Northwest Territories
Department of Transportation
Airports Division

November 2004

Yellowknife Airport (YZF)
Development Plan

Final Report

Prepared by
Inter*VISTAS* Consulting Inc.
Earth Tech (Canada) Inc.
and PDK Airport Planning Inc.

For
Government of the Northwest Territories,
Department of Transportation, Airports Division

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Preface

The Yellowknife Airport (YZF) Development Plan is not a commitment on the part of the Territorial Government to expand/improve the airport infrastructure at the Yellowknife Airport. It serves as a framework within which future project proposals will be scrutinised. Justification of these projects and programs, however, will be detailed in program documentation once sufficient growth is realised. Implementation of these projects will be subject to territorial priorities and the availability of funds.

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Executive Summary

The objective of the *Yellowknife Airport (YZF) Development Plan* is to address future airport infrastructure needs to meet forecast passenger, aircraft movement and air cargo demands for the next 20 years (until 2023). The Development Plan was produced on the basis of a defined planning period and a systematic planning methodology, and contains requirements assessments and expansion/development proposals for each airport component – airside facilities, landside facilities, and airport support elements.

The integration of the recommendations contained in the Development Plan creates a strong vision for the long-term development of the airport, and provides guidance with respect to the overall development of land on the site.

Several issues and factors are expected to influence future demand for airport facilities. Key issues involve:

- The size of aircraft expected to be operated at the airport;
- The growth in the northern economy, particularly in the mining, oil and gas and tourism sectors;
- The airport's role as a major base of operations for northern air services and as an en-route alternate for Extended Twin-engine Operations (ETOPS) flights;
- Future airport security requirements; and most importantly,
- The ability of the existing developed areas to accommodate expansion of existing facilities and new tenanted activities.

Integrating these issues, the plan provides current and forecast traffic levels as a basis for facility requirements assessments:

- Annual Enplaned and Deplaned (E+D) passenger traffic is currently approximately 320,000 passengers. By 2023, passenger traffic is expected to range between 440,000 and 629,000 annual passengers. Approximately 74% of total E+D passenger traffic (236,00 annual passengers) currently use the Passenger Terminal Building. The remaining portion of traffic (approximately 84,000 annual passengers) is handled through private air carrier or expeditor facilities away from the Passenger Terminal Building.
- Annual aircraft movements are currently at approximately 51,000 movements. By the end of the planning period in 2023, these are expected to range between 63,000 and 101,000 annual movements. Approximately 70% of all aircraft movements are attributed to 'Itinerant' traffic.
- Cargo traffic is currently estimated at approximately 23,000 annual tonnes, with 20-year volumes forecast to range between 29,000 and 53,000 annual tonnes.

Key to the strategy put forward in the Development Plan is the proposal to initiate development of the west-side land area within 5 to 10 years. This timeframe is required to develop detailed plans, pursue further stakeholder consultation and secure the funds required for associated projects. In the meantime, pressing needs must be addressed for the existing airport infrastructure.

Airside infrastructure is in good condition, requiring only regular maintenance and upkeep. To leverage emerging market opportunities and address some capacity issues, however, improvements to the airport's runway and taxiway infrastructure are proposed. Key improvements include:

- A staged expansion of Runway 15-33 to a total length of 3,500m. The first phase would extend the runway by approximately 760m – extending the length to 3,050m and allowing it to accommodate long-haul aircraft serving international destinations. The final phase would extend the surface by an additional 450m – extending it to a full length of 3,500m and allowing the airport to accommodate long-haul freighter operations. In order to execute these expansion plans, the airport must acquire approximately 32ha of land south of the main runway. Implementation of this proposal must be warranted by appropriate market conditions and will require further assessment of the Yellowknife market potential for the required services. Initial implementation would not occur at least until the end of the 2008-2013 period. Approach aids will be reviewed and possibly relocated as part of the runway expansion proposal.
- A staged construction of a new parallel taxiway to Runway 15-33 to increase operational capacity and keep flight delays at a minimum during peak hours. The first stage of this proposal would consist of a partial taxiway running from the intersection of Runway 09-27 to the mid-point of Runway 15-33. The initial phase would be implemented in association with the construction of the future passenger terminal complex on the west-side of the site.

Before Passenger Terminal Building operations are transferred to the west-side of the site, pressing needs must be addressed in the existing facility. Of particular importance are needs to meet federally mandated security requirements through the installation of a Hold Baggage Screening (HBS) system and to address areas experiencing significant congestion in the passenger terminal complex. Over the next two years, the Airports Division will implement a number of projects to preserve and enhance the operational effectiveness of the facility until such a time that the proposed west-side development is inaugurated. Specific initiatives include:

- A northern expansion of the existing Passenger Terminal Building to accommodate a new Hold Baggage Screening area and improvements to the adjacent check-in area.
- Reconfiguration of the older portion of the existing structure (the southern end of the building) to accommodate an expanded arrivals and retail area.
- Reconfiguration of the existing Passenger Terminal Building aircraft parking apron to increase capacity, and an expansion to the north to provide sufficient area to accommodate aircraft de-icing operations.
- Improvements to the Passenger Terminal Curb and public parking lot area through resurfacing and reconfiguration.

Development of the west-side land area will provide the airport with ample land to meet market demand for aviation facilities and airport businesses, as well as the flexibility required to accommodate traffic growth well into the distant future. By 2023, it is envisioned that the west-side land area will accommodate:

- A new passenger terminal complex (including a Passenger Terminal Building, aircraft parking apron, vehicle parking and access roads), providing increased levels of service to the travelling public and air carrier users, in addition to ample surrounding land to provide for longer-term expansion requirements;
- A Combined Services Building, integrating airport maintenance and Emergency Response Services under one roof;
- An aircraft de-icing facility and relocated aircraft fuel facilities; and
- Substantial aviation and complementary industrial tenanted development.

Development of the west-side area will occur in stages, consistent with growth in air traffic demand (passenger and cargo), tenanted land development and operational requirements. Initial projects are projected to occur on the site between 2008 and 2013, with the proposed development of the Combined Services Building and the initial phase of the new Passenger Terminal Building and ancillary facilities. Pending agreement with the City of Yellowknife and the GNWT, Department of Transportation, the west-side project will be made possible through a realignment and extension of the Forward Operating Location (FOL) access road to service the site.

The eventual replacement of the existing trucked water delivery and sewage collection system by the connection of the airport site to the municipal water and sewage system is also proposed over the long-term period. However, associated projects will be dependent on the availability of funding and the level of development that may occur to the west of the airport boundary.

Total cost of the proposals contained in this document is estimated to be in the order of $100 million spread out over the next 20 years. These include approximately $10-$15 million for the redevelopment of the existing passenger terminal complex (funds for this project have already been approved) and approximately $40-$45 million for the proposed west-side passenger terminal complex.

Section One – Planning Process

Introductory Note

As the introductory section to the Development Plan, this section uses and/or introduces specific terms that are referenced throughout this document. The following defines these terms for the purpose of clarity.

Document-specific Terminology

Yellowknife Airport (YZF) Development Plan – The official name of this document. Use of the shorter term 'Development Plan' is used interchangeably in this document.

City of Yellowknife – The official name of the city. Use of the word 'Yellowknife' is more generic in application, refers to the general area in which the city is located and is not defined by any specific geographic boundaries.

Yellowknife Airport (YZF) – The official name of the airport. YZF is the official designator as attributed by the International Air Transportation Association (IATA). Use of the term 'airport' is more generic in application and relates to airport facilities in general.

Aviation-related Terminology

Aerodrome – Area of land, water (including frozen surface) or other supporting surface used or designed, prepared, equipped or set apart for use either in whole or in part for the arrival and departure, movement or servicing of aircraft and includes any building, installations and equipment in connection therewith.

Air Carrier – As defined by Transport Canada, "Air Carriers are aircraft operators, including foreign carriers, licensed by the Canadian Transportation Agency to transport persons, mail and/or goods by air." At the Yellowknife Airport, they include not only those utilising the Passenger Terminal Building, but also the carriers using their own facilities. These include helicopters and aircraft providing commercial air services for activities such as oil, gas and mining explorations, medevac services, mine supply, recreational hunting and fishing passengers and supply, forest fire fighting, aerial mapping and other related activities.

Airport – An aerodrome for which, under Part III of the Canadian Air Regulations, an airport certificate has been issued by the Federal Minister of Transport.

Air Service – A service, provided by means of an aircraft that is publicly available for the transportation of passengers or goods, or both.

Canadian Air Transport Security Authority (CATSA) – The government agency responsible for the security of the travelling public at 89 designated Canadian airports.

En-route Alternate Airport – The purpose of an en-route alternate airport under Extended-range Twin Engine Operations (ETOPS) is to provide a point of landing in the event of an engine failure, or other emergency such as an on-board fire. Transport Canada defines an alternate airport for the purpose of ETOPS as being:

> *An airport that is adequate with regards to the performance requirements that are applicable at the expected landing weight. In particular, it should be anticipated that at the time of use, the airport will be available, and equipped with the necessary ancillary services such as Air Traffic Services, lighting, communications, weather reporting, navigational aids and emergency services; and at least one approach aid will be available for an instrument approach.*
>
> *A suitable airport for the purpose of ETOPS is an adequate airport with available weather reports, forecasts or combinations of, indicating that weather conditions will be at or above minima, and field condition reports, indicating that a safe landing can be accomplished during the period of intended operation.*

Extended-range Twin-engine Operations (ETOPS) – As defined by the International Civil Aviation Organization (ICAO) and describing "the rule permitting newer twin-engine commercial aircraft to fly routes that, at some points, are further than a distance of 60 minutes flying time from an emergency or diversion airport." This definition covers twin-engine airliners such as the Boeing 757, 767, 777 and Airbus A300, A320 and A330 series flying long distance routes, especially over water, desert or remote polar areas, that were previously off-limits to twin-engine aircraft.

Fixed Base Operators (FBO) – Private businesses that provide services such as air taxi, flight instruction, aircraft servicing, and aircraft maintenance and repair at airports. FBO facilities at most airports typically consist of private hangars, flight planning offices and lounges dedicated to corporate or private aircraft operators. At the Yellowknife Airport, those air carriers not using the Passenger Terminal Building for scheduled and non-scheduled charter services are often referred to as FBOs.

General Aviation – As defined by Transport Canada, "all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire."

NAV CANADA – The corporation providing air navigation services in Canadian airspace and air traffic services in international airspace for which Canada has assumed responsibility.

Passenger Terminal Building (PTB) – An installation provided with the facilities for boarding and unloading aircraft and the in-transit handling of traffic.

Transport Canada – The federal authority responsible for the regulation of civil aviation in Canada.

1.0 Introduction

1.1 Background

1.1.1 Current Situation

The Yellowknife Airport (YZF) plays an important role in serving the City of Yellowknife – the Diamond Capital of North America – as well as the Northwest Territories (NT). It is a gateway hub to Southern Canada and a major connecting point within the territorial air transportation network. Having experienced continued strong growth over the past decade; the airport facilitates scheduled and charter services for passengers and cargo. It is pivotal within the northern air cargo network – accommodating more air cargo than most similar-sized Canadian airports – and provides for the needs of the region's general aviation community.

From the airport, First Air, Canadian North and Northwestern Air Lease operate flights between Yellowknife and major centres in the South, such as Edmonton, Calgary and Ottawa. These and other carriers (i.e. Buffalo Airways, Air Tindi, Arctic Sunwest, Summit Air, North Wright Airways Ltd.) operate scheduled and charter flights to other communities in the Northwest Territories, Nunavut and the Yukon.

The airport is an essential piece of infrastructure for national defence and the provision of civil protection services to the North. Through the Department of National Defence (DND) Forward Operating Location (FOL), it is the base for fighter aircraft used for national security and North American air defence purposes. It is also a base for northern forest fire fighting operations, and a base and transfer point for territorial medevac operations.

The airport has a significant impact on the economies of the City of Yellowknife and the Northwest Territories. Not only do air services create jobs directly benefiting Yellowknife residents, the air services to and from the airport provide key support to the territory's oil, gas and mining activities, as well as the North's growing tourism sector. According to a 2003 economic impact study,[1] including indirect and induced effects, the airport accounts for $91 million in expenditures and 1,100 full-time jobs in the North. By 2007, it is expected to grow to have an impact of 1,500 full-time jobs and over $120 million in expenditures.

1.1.2 Challenges and Opportunities

The Yellowknife Airport was transferred from the Government of Canada to the Government of the Northwest Territories (GNWT), Department of Transportation, Airports Division in 1995 in accordance with the National Airports Policy. Over the past few years, the aviation industry has undergone significant changes including air carrier restructuring and consolidation, the September 11, 2001 terrorist attacks on the U.S., and the subsequent implementation of new security regulations and measures. More recently, the emergence of the Severe Acute Respiratory Syndrome (SARS) and the Iraqi conflict have contributed to a further downturn of the international and domestic aviation industry, creating significant challenges for airport operators around the world.

However, the northern air transportation network has suffered less from the instability that has affected the international and domestic aviation industry over the past few years. Strong economic growth, northern air carrier ownership and the absence of Air Canada in the northern market have contributed to maintaining a relatively lively air carrier industry in the region.

Other developments in the international aviation market are creating major opportunities that could benefit the airport, the City of Yellowknife and northern communities as a whole. New polar routes, established as a result of the opening of Russian airspace and allowing new generation of aircraft such as the B 777 to fly non-stop between North America, Asia and Europe, intersect the Yellowknife Airport's airspace. Supported by the availability of Air Traffic Control and Emergency Response Services (ERS) at the airport, this results in the airport increasingly being designated by air carriers as an en-route alternate airport that may be used in case of an in-flight emergency. Opportunities to attract stops on international passenger and cargo flights are also possible.

Since the devolution of airports in Canada from the federal government to local control, there has been challenges for airports on a wide-range of significant issues and concerns, including safety and security, facilitation and infrastructure and economic issues.

Canadian airports are as unique and diverse as the country they serve. Within the 43 largest airports in the country are the National Airport System (NAS) airports, the airports operated by all three territorial governments and a number of the most significant municipally run airports. Collectively, these facilities handle almost 100% of the country's air cargo traffic, all international passenger traffic, and more than 95% of domestic passenger traffic.

These airports generate considerable economic impact – collectively totalling in excess of $30 billion in economic activity in the communities they serve. More than 150,000 jobs directly associated with the airports generate more than $8 billion annually. Most importantly, since airport devolution, these airports have invested more than $8.2 billion in infrastructure improvements (new terminal buildings, access roads, bridges, runways and taxiways) at minimal cost to taxpayers.

The successful development and management of Canada's airports is highlighted by a commitment to safe operations, creative management, prudent investing and a dedication to customer service that has become the hallmarks of these airports. Together, Canadian airports share best practices and focus their concerns on legislation, regulations and policies that will help airports achieve even more for their communities in the future.

1.1.3 A Need for New Facilities

To expand as an aviation hub for the North, the Yellowknife Airport is in need of renewal of its primary facilities. The PTB, originally constructed in the 1960's and expanded in 1988, is ageing and reaching passenger processing capacity. Aircraft pavement structures and utility systems will require investments to restore or extend life-cycle use and meet increased demand. Improving upon this infrastructure will create new opportunities for the community through increased services and land development potential. To this end, previous plans to build a new passenger terminal facility and ancillary development on the west-side of the airport site must be advanced to allow the Yellowknife Airport to meet future demand and opportunities.

In addition, fulfilling the role of an en-route alternate airport imposes a set of inherent requirements on the airport with regards to ensuring the safety of international air services over-flying the region. These include the provision of emergency services and maintenance capabilities.[2]

This Development Plan prepares the Yellowknife Airport for the future and provides the framework required for the fulfilment of its role through facilitation of land development and construction of facilities on the site. The proposals put forward in this document total approximately $100 million in capital requirements. While a considerable amount of funds have recently been allocated for a number of pressing projects, proposals totalling approximately $80 million to $90 million still need to be addressed and funded by the Airports Division over the next 20 years.

The Development Plan describes development options regarding land use, facilities, and services to ensure that the Yellowknife Airport serves its multiple roles and accommodates the expected levels of traffic over the next 20 years at enhanced level of service to those currently provided. Since airport development and land uses are not static in nature, the overall planning process also takes a forward looking approach with respect to longer-term requirements.

1.2 Airport Development Plan Objectives

The Development Plan addresses future airport infrastructure needs for on-site development for a 20-year period (the 'planning period'). This Development Plan aims to:

- Provide a rational and comprehensive framework to guide future development at the airport;
- Identify requirements for operational facilities and, where appropriate, corresponding needs for land expansion, redevelopment or relocation;
- Propose appropriate development options and staging to match demand;
- Ensure that future development does not conflict with the safe operation of the airport;
- Designate airport land uses; and
- Encourage compatible land uses in adjacent subdivisions.

1.3 Use of this Document

This document is intended to serve as a 'living document' – providing opportunities to update individual subsections, as warranted by the progress of individual development proposals, or changes to the local context.

The chapters in this document can be read as self-contained treatments of the subjects covered by their titles. References to other planning documents and materials, and general notes are made as chapter endnotes where appropriate. These references are intended to supplement the Development Plan and are provided to avoid duplication of information within the document. Glossaries of aeronautical, planning and/or technical terms used in this document are provided at the beginning of each chapter.

1.4 Organization of this Document

This document is generally organized according to the structure adopted by the International Civil Aviation Organization's (ICAO) *Airport Planning Manual*[3]. It is divided into five sections covering main areas of interest such as, for example, airside development, landside development and airport support elements. Each section is further subdivided into chapters that address specific topics. Although every effort has been made to follow ICAO's standardised document organization, the authors have modified some document content and/or organizational requirements where necessary to better reflect the prevailing conditions and planning requirements at the Yellowknife Airport.

The general content of the document sections is as follows:

- Section One – Introductory Elements including aviation statistics and forecasts, and site evaluation.
- Section Two – Airside Development covering runway, taxiway and apron infrastructure, as well as air and ground navigational aids.
- Section Three – Landside Development covering the passenger and cargo facilities, and ground transportation infrastructure.
- Section Four – Airport Support Elements including airport operations infrastructure, fuel facilities and security.
- Section Five – Systems Integration bringing together the ensemble of proposals put forward throughout the document to form a cohesive development strategy for the airport site.

1.5 Notes and References

[1] *Economic Impact of the Yellowknife Airport, Final Report;* The Transport Institute, University of Manitoba, September, 2003.

[2] *Yellowknife Airport, An Analysis of En-route Alternate Airport Facility Requirements and Associated Issues*; Inter*VISTAS* Consulting Inc., October 2002.

[3] *Airport Planning Manual (Doc 9184-AN/902), Part 1, Master Planning, Second Edition*; International Civil Aviation Organization, 1987.

2.0 Planning Considerations

2.1 About this Chapter

The future development of the Yellowknife Airport will be guided by the strategies and proposals put forward in this document. In preparing this Development Plan, use of appropriate methodologies, data and background materials were essential to the formation of sound planning assumptions. This chapter provides an overview of the key planning considerations that contributed to the overall planning process.

Specific aviation terminology use in this section is defined below:

Aircraft Movement – An aircraft take-off or landing at an airport. For airport traffic purposes, one arrival and one departure is counted as two movements.

National Airports Policy (NAP) – A federal government policy which establishes the federal government's role in airports.

Planning Aircraft – Aircraft whose operational requirements are most demanding with respect to the determination of runway lengths, pavement strengths and other physical characteristics of the airport design.

2.2 Preplanning Co-ordination

Consultation is an integral part of the preplanning process. In preparing the Development Plan, consultations were conducted with numerous stakeholders, including representatives from municipal, territorial and federal government departments and agencies, air carriers using the Yellowknife Airport and airport users (including airport tenants). The organizations that provided input to the Development Plan include:

- Adlair Aviation (1983) Ltd.
- Air Tindi Ltd.
- Arctic Sunwest
- BHP Billiton Diamonds Inc.
- Buffalo School of Aviation
- Braden Burry Expediting Ltd.
- Buffalo Airways
- Canadian Air Transport Security Authority
- Canadian Business Aircraft Association
- Canadian North (NorTerra Inc.)
- City of Yellowknife
- Dene First Nation, (N'dilo)
- Department of National Defence, Northern Command
- Diavik Diamond Mines Inc.
- First Air
- Great Slave Helicopters Ltd.
- NAV CANADA
- North Slave Metis Alliance
- NWT Association of Communities
- Public Works Canada, Yellowknife
- Summit Air Charters Ltd.
- Transport Canada, Prairie and Northern Region

The Yellowknife Airport Development Plan Steering Committee – comprising government and industry stakeholders – guided plan development and provided regular input. Meetings, a workshop, presentations and on-going communications were held with the Committee, as well as with individual members of the group.

Strong support of the recommendations contained in this document were communicated by airport stakeholders during the final stages of the Development Plan process. Letters of approval and support are provided in Appendix A.

2.3 Information Requirements

2.3.1 Background Studies and Planning Documents

A number of previous studies and plans were used for background information. These include:

- City of Yellowknife, 2004 General Plan (Draft).
- Aircraft Movement Statistics, TP 577, Statistics Canada/Transport Canada (2003);
- Economic Impact of the Yellowknife Airport, Final Report (2003);
- 5-Year Capital Acquisitions Plan (2003);
- 20-Year Needs Assessment Plan (2003);
- Yellowknife Airport Operations Manual (2003);
- 2001 Facility Energy Audit – Yellowknife Airport (2001);
- Reaching New Markets, 2000 Aeronautical Market Study (2000);
- Air Terminal Building Yellowknife – Technical Status Evaluation Report (1998);
- Yellowknife Airport Development Plan Update (1998); and
- Environmental Audit, Report of Findings (1993).

2.3.2 Additional Studies

The following additional studies were prepared over the course of the planning process and provided the required input to the final Development Plan document:

- Yellowknife Airport Parking Study – Draft (2003);
- West-side ATB Option Assessment (2003);
- Water and Sewage Servicing Strategy (2003); and
- Analysis of En-route Alternate Airport Facility Requirements and Associated Issues (2002).

2.4 Economic Feasibility

Implementation of the proposals contained in this document will require considerable capital investment in airport infrastructure. As airport operator, the Airports Division is responsible for financing most capital projects with the exception of those under the mandate of NAV CANADA,

the Canadian Air Transport Security Authority (CATSA), or those provided by private tenants on the airport site. Consequently, the economic feasibility of each proposal is a primary evaluation criterion.

For the purpose of this planning document, capital costs are provided as broad order-of-magnitude estimates (generally Class D estimates). The order-of-magnitude estimates, coupled with the identified safety, security, capacity, and/or service gains, determine the feasibility of each individual proposal and their importance within the overall development program. They also serve to identify the degree of financing required for program implementation. Specific order-of-magnitude estimates for each proposal are provided in Chapter 16.0 – Development Proposals.

2.5 Use of Consultants

The Airports Division is responsible for the planning and development of the Yellowknife Airport. In preparing this document, the Airports Division called upon a number of consultants to supplement the skills and capabilities of its in-house staff.

Inter*VISTAS* Consulting Inc., in association with Earth Tech (Canada) Inc. and PKD Airport Planning Inc. (PAPI) produced this document. Inter*VISTAS* Consulting was the primary consultant to this project, and provided overall project management services along with forecasting, demand/capacity, airside and passenger terminal and land use planning tasks. Earth Tech (Canada) contributed technical expertise relating to civil engineering and environmental matters. PKD Airport Planning Inc. provided initial passenger terminal and parking facility alternatives and concepts. Note that all analyses, alternatives and concepts underwent significant review by Airport Division staff and the Development Plan Steering Committee, and were further refined in collaboration with Inter*VISTAS*' team of professionals.

2.6 Planning Procedure

The document was produced on the basis of a defined planning period and a systematic planning methodology. Use of available data and existing study results; review of operations and services, user and community consultations, quantitative analyses and expert assessments form the basis of this methodology. General planning principles and a hierarchy of land uses, consistent with typical planning methodologies used at airports across Canada, were adopted in the preparation of this plan.

The plan focuses primarily on facilities and the land area situated within the airport boundary. Development issues relating to this area were studied and considered in relation to the characteristics and constraints that are specific to the airport site. Where warranted, consideration was given to environmental conditions and the adjacent land uses that would affect airport operations and future development areas.

The assessments and development requirements identified in this document are consistent with Transport Canada planning standards and guidelines contained in *Aerodrome Standards and Recommended Practices*[1] and *Land Use in the Vicinity of Airports*[2], and other applicable international standards and guidelines, such as the ICAO's *International Standards and Recommended Practices*[3].

Where appropriate, alternatives were developed to provide solutions to facility or infrastructure deficiencies. The development and assessment of these alternatives was undertaken through an iterative process, relying upon input from the Development Plan Steering Committee to further refine layouts, concepts and alternatives. Over the course of the project, a number of airport components and development alternatives were assessed in more detail to further refine development strategies. The long-term direction of future land development on the site beyond the planning period was a critical issue that needed to be addressed, most particularly the location of long-term passenger terminal operations.

The alternatives presented in this document are the result of the evolution of a number of preliminary concepts presented to the Development Plan Steering Committee and further modified based on their comments, suggestions, and additional studies. The alternatives retained are those that are deemed the most appropriate to suit demand and operational requirements. Alternatives that were discarded over the course of the planning process are not presented in this document.

The alternatives presented are conceptual in nature and are intended to provide the necessary framework for further implementation planning, architectural design and/or engineering detail. The level of detail associated with the latter types of work is beyond the scope of a Development Plan.

2.7 Planning Period

The *Yellowknife Airport (YZF) Development Plan* contains requirements for each airport component, with most background analyses based on data available up to the end of 2003. The plan addresses a 20-year planning period and is intended to guide development to 2008, 2013 and 2023, respectively. Proposals are made for the short-term (5-year) period, medium-term (10-year) period and long-term (20-year) periods. The Development Plan focuses however on the medium-term (10-year period), given that the development of the west-side area will be required within this timeframe.

Potential requirements of relevance to the current planning exercise, but outside the 20-year timeframe of the planning period are also highlighted to substantiate specific proposals put forward in this document, where appropriate.

2.8 Airport Role

The role of an airport in the aviation system is an important consideration for the planning of facilities and infrastructure. The Yellowknife Airport is designated as a National Airport System (NAS) airport under the National Airports Policy. NAS airports link Canada coast to coast, as well as internationally, and are considered essential to Canada's domestic prosperity and international competitiveness.

The Yellowknife Airport plays multiple roles in serving the residents and businesses of the City of Yellowknife and the Northwest Territories alike. To this extent, the Yellowknife Airport is the hub airport of the Northwest Territories and the North – not only serving passenger traffic but also that of freight, mail, forest fire fighting, pilot training, tourism, adventure travel, mining and exploration and military activities. The airport connects northern communities with one another, as well as with those situated in the South, facilitating the sustainable development of our communities and the fulfilment of the social and economic potential of our regions. The airport also acts as a gateway to Western Nunavut and still maintains its ties to the Kitikmeot communities located in Nunavut.

The airport supports surveillance activities in the Canadian North by the Department of National Defence (DND) by providing access to the DND's neighbouring Forward Operating Location, and accommodates military aircraft throughout the year.

The airport is also designated by air carriers as an en-route alternate airport for polar and high latitude flights under ETOPS.

These multiple roles are fundamental in determining future activity at the Yellowknife Airport and ultimately drive facility land requirements and the planning of airport development. More specifically, the roles of the Yellowknife Airport are to serve:

- As the major point of domestic air carrier service by providing facilities to accommodate medium-size jet aircraft, and linking the North with southern Canadian urban centres;
- As an interchange point for domestic east-west service linking Whitehorse, Yukon Territory, and Rankin Inlet and Iqaluit, Nunavut Territory, as well as northerly points, such as Resolute Bay;
- As a Forward Operating Location base for fighter aircraft (i.e. Canadian Armed Forces F-18) used for national security purposes, and North American Air Defence purposes;
- As a base of operation for aircraft operators providing scheduled passenger, cargo and mail service to smaller regional communities;
- As a base for charter operators serving other communities in the Northwest Territories;
- As a base for private aircraft owners and operators;
- As a base for government flying operations, including RCMP and military Search and Rescue;
- As a major base for helicopter operators;
- As a facility providing both initial and advanced flight training;
- As a base of operation for a variety of special air services, including recreational flying, aerial inspection, reconnaissance and aerial surveys;
- As a facility for aerial forest fire fighting operations, and a base of operations for the GNWT's Resources, Wildlife and Economic Development (RWED), Forest Management services;
- As a site for aircraft maintenance and repair;
- As a major base for one or more regional airline operations, including First Air, Canadian North, Buffalo Airways, Northwestern Air Lease Ltd., Air Tindi, and Arctic Sunwest;
- As a base and transfer point for territorial air medevac operations, including Kitikmeot Region in Nunavut Territory; and
- As an en-route alternate airport for polar high latitude flights under Extended Range Twin-Engine Operations (ETOPS).

The general role of the Yellowknife Airport has not changed significantly throughout the years; however, activity levels have changed. These changes are highlighted later in Chapter 3.0 – Forecasting for Planning Purposes.

2.9 Planning Aircraft

2.9.1 General Considerations

Airports are designed to permit regular operation of aircraft up to and including a specific maximum size. For planning purposes, these aircraft are known as the 'planning aircraft'. The performance characteristics and dimensions of planning aircraft are significant parameters for airport planning and design. Different planning aircraft are sometimes adopted for individual airport components, such as runways, aircraft parking aprons, etc., as a result of variances between short-term capacities and long-term development objectives, as well as different development objectives for targeted market segments, such as passenger and cargo activities.

The following reviews the aircraft requirements that are relevant to the short and long-term development of the Yellowknife Airport facilities. For planning purposes, the aircraft references used in this document are consistent with the categorisation adopted by Transport Canada[4] and ICAO[5]. Aircraft codes and a sampling of corresponding types are provided in Table 2-1 (below).

Table 2-1: Aircraft Codes and Sample Aircraft Types

Code	Wing Span	Outer main gear wheel span	Sample Aircraft Type
A	Up to but not including 15m	Up to but not including 4.5m	Beechcraft 58, Cessna 172, DHC2 Beaver
B	15m up to but not including 24m	4.5m up to but not including 6m	DHC Twin Otter, CRJ 200, CRJ 700, F28-2000
C	24m up to but not including 36m	6m up to but not including 9m	Dash-8, F28-4000, ATR 42-200/300, HS 748, B 717, B 727, B 737, A320
D	36m up to but not including 52m	9m up to but not including 14m	B 757, B 767, L382 Hercules
E	52m up to but not including 65m	9m up to but not including 14m	B 747, B 777, MD 11, A 330, A 340
F	65m up to but not including 80m	14m up to but not including 16m	A380

Source: Transport Canada, 1996.
*: Distance between the outside edge of the main gear wheels.

2.9.2 Current and Expected Composition of the Northern Air Carrier Fleet

The largest aircraft currently operating on regular scheduled bases at the airport are Code C aircraft, such as the B 737-200. These jet aircraft are useful for northern operations due to their combination passenger/cargo capabilities, and ability to operate on gravel strips (once modified), such as those at various mine sites in the North, and from Cambridge Bay and Resolute Bay.

Both First Air and Canadian North operate the B 737-200 aircraft on a regular scheduled basis at Yellowknife. Averaging approximately 540 aircraft movements per month, the B 737-200 is by far the single most commonly operated aircraft at the airport.[6] This aircraft model has not been manufactured for at least 20 years, however. The particular aircraft operated by both carriers are approximately 25 to 30 years old. Based on discussions with air carrier representatives, these aircraft can be expected to be in service for an additional 5 to 10 years.

Major air carriers across North America and Europe have been reshaping their fleets with increased use of less expensive and smaller regional jets and turboprop aircraft on regional or short-haul routes. First Air for example operates the ATR-42-300 series (Code C). Both First Air and Canadian North have stated that they could move to greater use of these aircraft in the future. Operation of these aircraft in the northern environment could grow over the long-term period provided they provide flexibility in meeting combination passenger and cargo capabilities.

2.9.3 Planning Aircraft for Existing Passenger Terminal Building Components

Given the current and expected composition and use of the northern air carrier fleet, Code C aircraft are adopted as the primary planning aircraft for existing aircraft operations areas and related Passenger Terminal Building (PTB) planning. However, since wide-bodied aircraft could be expected to serve the Yellowknife Airport with selected international charter passenger services over the course of the planning period, provisions are required to accommodate larger aircraft at selected locations on the site. Code D aircraft, the largest aircraft capable of being accommodated on the existing main aircraft parking apron, is adopted as the planning aircraft only for individual components of the existing main aircraft parking apron (Aprons I and II) and PTB.

2.9.4 Planning Aircraft for Long-term Development Components

The introduction of international passenger services in support of the northern tourism industry and the development of international cargo services as a result of the opening of polar and high latitude air space are opportunities that the Airports Division wishes to pursue over the course of the planning period. Given the aircraft range required to reach targeted international markets, these air services would likely be provided on Code D or E aircraft. To provide the required flexibility in meeting these eventual opportunities, the larger Code E aircraft has been adopted as the planning aircraft for the primary long-term development components and facilities, such as runways and taxiways, aircraft parking aprons, transitional zoning, passenger terminal buildings and other buildings adjacent to aircraft operational areas.

2.10 Notes and References

[1] *Aerodrome Standards and Recommended Practices (TP 312E)*, *4th Edition*; Transport Canada, 1993.

[2] *Land Use in the Vicinity of Airports (TP 1247E)*, *7th Edition*; Transport Canada, 1996.

[3] *International Standards and Recommended Practices, Aerodromes, Annex 14 to the Convention on International Civil Aviation*; International Civil Aviation Organization.

[4] *Aerodrome Standards and Recommended Practices (TP 312E), 4th Edition*; Transport Canada, 1993.

[5] *Aerodrome Design Manual, Part 2, Taxiways, Aprons and Holding Bays, Third Edition*; ICAO, 1991.

[6] Based on analyses of 2001 NAV CANADA Aircraft Movement Statistics (NCAMS) data for the Yellowknife Airport.

3.0 Forecasting for Planning Purposes

3.1 About this Chapter

Current and forecast traffic levels provide a basis for facility planning. Analyses undertaken in this document are based on aviation activity forecasts that reflect timely information, local knowledge relative to the local market, and industry trends. This chapter describes the collection of aviation statistics in Canada and at the Yellowknife Airport, along with definitions of specific terminology used in the following sections. It discusses the forecasting framework from forecast requirements to forecasting approach and methodology. The socio-economic environment that is expected to influence traffic at the airport is also examined. Finally, forecast growth in passenger and aircraft movement traffic at the airport, along with cargo volumes, for 2008 and 2013 are produced. In addition to this forecast period, longer-term forecasts extending to 2023 are also prepared as a basis for longer-term development strategies.

Specific aviation forecasting terminology used in this chapter is defined below:

Aircraft Operations – Made up of 'Itinerant' aircraft movements (aircraft which depart or arrive at an airport en-route to or from other destinations) and 'Local' aircraft movements (movements that do not leave the Air Traffic Control circuit, largely training/recreational flights). At the Yellowknife Airport, 'Itinerant' activity accounts for more than half of total operations.

Cargo – Any goods carried on an aircraft and covered by a waybill.

Deplaned Passengers/Cargo – Passengers or cargo off-loaded from an aircraft at an airport in Canada.

Enplaned Passengers/Cargo – Passengers or cargo loaded on to an aircraft at an airport in Canada.

Enplaned/Deplaned (E+D) Passenger Traffic – The general expression of total passenger demand. E+D passengers include all those originating from or destined to the Yellowknife Airport, plus those passengers connecting through the airport en-route to other destinations on licensed scheduled/charter air services. They include not only passengers utilising the Yellowknife PTB, but also the reported/estimated passenger traffic from carriers using their own terminal, hangar or apron facilities.

'Itinerant' Movement – At airports with Air Traffic Control Towers and/or Flight Service Stations, 'Itinerant' movements are those in which aircraft proceed to or arrive from another location; or where aircraft leave the circuit but return without landing at another airport. At airports without Air Traffic Control Towers, a movement in which the aircraft arrives from or departs to a point other than the reporting airport, or a movement by an aircraft that leaves the close proximity of an airport and returns without landing at another airport.

'Local' Movement – At airports with air traffic control towers and/or flight service stations, 'Local' movements are considered as movements in which aircraft remain in the circuit. At airports without Air Traffic Control Towers, a movement in which the aircraft remains in the close proximity to the airport. 'Local' movements are often carried out during training flights, equipment tests, etc.

'Other Commercial' Movement – Flights performed by Commercial aircraft operators not included in the 'Air Carrier' categories. Flying schools, agricultural sprayers, water-bombers, aerial photographers and surveyors, etc. are examples.

Planning Peak Hour (PPH) – The hourly traffic volume used for facility planning purposes. This level (which falls between the average traffic volume and the absolute peak) is determined in accordance with planning standards.

Private Aircraft – Aircraft used solely for private purposes, not for hire and compensation, which are classified as "Private" or "Private Restricted" in the Canadian Civil Aircraft Register or similar registries of other countries. Owners include individuals, groups and business firms.

3.2 Aviation Statistics Reporting

Aviation statistics are a critical input to the forecasting process. It is important to ensure this base value is correct and used appropriately. However, due to the current reporting requirements and process in place in Canada, complete or timely traffic data is not necessarily available.

The collection of aviation activity data by Statistics Canada is governed by the *Statistics Act* and *Canada Transportation Act*. The resulting statistics are published as official Statistics Canada/Transport Canada statistics with various lag times. (For example, 2002 carriers traffic at Canada airports were released in June 2004.) Different reporting statements are required from different levels of carriers (carrier levels based on amount of traffic handled) to report different parameters. The basic carrier-reporting statistics are passengers, cargo and carrier flight data. In addition, NAV CANADA also reports aircraft movement data to Statistics Canada for individual airports.

This section does not intend to describe the detailed reporting requirements of each traffic activity, but rather to point out the general inadequacy of the resulting data that are generated from the current reporting process. For passengers, carriers are required to report only revenue traffic, missing the non-revenue traffic that also uses airport facilities. For confidentiality reasons, there is no public information regarding which carrier(s) report, or which ones who are late in reporting their data.

There is more deficiency in air cargo statistics. Reported cargo data by Statistics Canada definition does not include mail. Regional and local scheduled carriers do not file cargo data on their Activity Survey form[1] to Statistics Canada. Cargo carried by courier flights or domestic cargo flights are not collected. As such, official Statistics Canada air cargo data for an airport can be significantly under-reported.

Total aircraft movement statistics reported by NAV CANADA are generally recognised as accurate and acceptable, although the distribution among categories sometimes requires more user attention to interpret.

To supplement the completeness and timeliness of the official Statistics Canada/Transport Canada aviation statistics, Canadian airports collect their own traffic data through formal carrier operations agreements or on an ad hoc basis. Airports operated by airport authorities are generally more advanced in their collection and distribution of such site data. In the case of the Yellowknife Airport, the official Statistics Canada traffic data are judged to be inadequate for the reasons discussed above and based on anecdotal evidence, particularly for the air cargo traffic. However, there is no site traffic data available for the airport. Therefore, the Airports Division and Inter*VISTAS* Consulting consulted the carriers and operators at the Yellowknife Airport to establish a more reliable traffic basis upon which the airport traffic forecasts have been developed and prepared.

3.3 Forecasting Requirements

Aviation activity forecasts are essential inputs to airport management and planning. They are required to assess operational performance, to identify deficiency in facility capacity, to establish future facility/land use requirements, and to plan for relative timing of capital projects implementation.

For systematic planning and development of an airport, comprehensive and consistent traffic forecasts are vital. Various aviation activities interact with one another and determine the demands on airport facilities. Therefore, traffic forecasts should be fully integrated into the planning process to ensure consistency regarding the assumptions underlying the Development Plan.

Good planning practice requires awareness of the uncertainties surrounding the forecasts. As ICAO states: “the objective of forecasting is not to predict the future with precision, but to provide information that can be used to evaluate effects of uncertainty about the future.” Thus, a forecast range has to be produced to reflect the uncertainties along with corresponding underlying forecast assumptions.

3.4 Forecasts Required

Forecasts are generally expressed in terms of annual passengers, aircraft movements and air cargo throughput. These direct forecasts represent the trends that the airport traffic is anticipated to grow – affected mainly by factors external to the airport planning process. Annual traffic forecasts provide the basis upon which derived forecasts such as peaking activities are generated. Annual forecasts are also essential input to estimate annual revenues and resource requirements.

Facility use at an airport varies from month to month and during various times of the day. Annual traffic volumes by themselves do not reflect airport utilisation and capacity requirements. It is critical that airport facilities be planned and designed to cope with the peaking characteristics of passengers, aircraft movements and air cargo. Peak period forecasts are therefore required.

Planning for the absolute peak demands (i.e. the greatest demands anticipated) will result in facilities impracticably oversized or under-utilised. In view of this, airport planners and designers have adopted various planning peak concepts for planning the specific components of the airport (e.g. airside, PTB, etc.). These concepts are defined in the corresponding chapters of this report.

3.5 Accuracy and Limitations of Forecasts

It is important to note that aviation forecasts are always in a state of revision or update, as the input and factors used to develop the forecasts are continually changing. The priorities and actions of carriers/operators in response to the changing demand and environment further amplify the variation. In using forecasts, therefore, consideration must be given not only to the forecasts themselves but also to the implications of the uncertainties ascertained within them.

Because of the dynamic nature of the forecasts, future facility needs and corresponding land requirements should be expressed for specific activity levels. In this way, the facility/land requirements for a certain activity level remain relatively constant. The actual implementation schedule can be moved earlier or later, however, as demand warrants.

Low and high aviation forecasts are produced to address some of the uncertainties, including economic cycles, which differ from the medium forecast scenarios. For planning purposes, the medium and high forecast ranges are to be applied.

3.6 Converting Annual Traffic Forecasts into Planning Criteria

Although annual traffic forecasts reflect the anticipated growth trends and provide a broad indication of future airport capacity needs, it is the peak period traffic demand (planning peak hour in general) that will determine future capacity needs and facility requirements.

Forecasting planning peak demand is a complex task, which requires understanding of the characteristics and causes of the peaks such as market demand and carrier scheduling. The variability of flights on different days of a week may reflect market maturity. As traffic grows and markets mature, daily service for such markets would evolve, spreading the increased traffic to other days of the week. Also, during the peak period of a day, existing carriers serving the peak traffic tend to schedule additional flights to the same markets away from the current peak. As such, peak traffic growth for the medium and longer-term is expected to be slower than that of annual traffic growth due to peak spreading.

There is no universal method for deriving peak traffic demand from annual traffic forecasts. For the Yellowknife Airport, it involved establishing the historical relation between peak traffic and annual traffic. Based on this relation and the understanding of market development and schedule evolution at the airport, plus consultation with carriers/operations, the various peak traffic forecasts were produced.

3.7 Factors Affecting Traffic Growth

Air travel is a derived demand. Demand for air transportation between origin and destination markets is derived from the socio-economic interactions between these markets, shaped by carriers' network and available airlift capacity. The role of an airport in the region it is located also plays an important part in the growth and development of the airport's traffic.

Generally, business/trade activity, tourism/visitor activity and visiting friends and relatives constitute the basic components of air travel at an airport. The level of aviation traffic at an airport is related to the general socio-economic conditions of the markets and regions it serves and particularly the way in which these conditions affect the traffic components. The growth in population, the economy

(represented by GDP in general) and personal disposable income will all combine to shape future traffic demand.

Travel demand can also be influenced by major world events, particularly in the short-term. In recent years, the world airline industry has experienced dramatic changes. Before the terrorist attacks on the U.S., the world economic slowdown had impeded air travel growth and airline profitability. The tragic events of September 11th, 2001 prompted a sharp downturn in passenger traffic in many markets, in particular to/from and within the U.S. In 2001, world airline traffic fell by 4%. These effects continued into 2002, and were intensified by the build up of the U.S. led war with Iraq. World traffic in 2002 recovered only marginally by 0.4%.[2] For the first part of 2003, the Iraq War and, in particular, the concerns regarding the outbreak of Severe Acute Respiratory Syndrome (SARS) had negatively impacted traffic. World traffic appeared to start recovery after May and ended the year with 1% increase.[3]

For the Canadian airline industry, 2001 was also a dramatic year. Air Canada finalized its integration with Canadian Airlines International during the year. Canada 3000 initiated its integration of Royal Airlines. The short-lived Roots Air lasted less than two months. Finally, the September 11th terrorist attacks and the aftermath of the tragedy had shaken up the whole airline industry. This period also witnessed the demise of Canada 3000. Total Canadian airport traffic declined by 2% in 2001, followed by a further decrease of 4.9% in 2002.[4]

In 2003, the Iraq War, the Air Canada bankruptcy, SARS and BCE (mad cow disease) have all combined to further impact Canadian traffic in the earlier part of the year. Passenger demand started to recover in the latter part of the year. By year-end, there was only 0.5% decrease over 2002.[5]

Traffic is apparently on its way to more recovery, under the influence of the price incentives that airlines have offered to stimulate the market.[6] There are uncertainties regarding when air travel will fully recover. This depends not only on the pace of economic recovery, but also the dissipating fear of potential travellers and the health of the airline industry itself. Nevertheless, according to ICAO, world passenger traffic is forecast to rebound with 4.4% and 6.3% increase for 2004 and 2005, respectively.[7] Transport Canada, for its part, expects Canadian air travel to recover, surpassing the 2000 traffic level by 2005, and to continue to grow.[8]

Traffic demand at the Yellowknife Airport appears to be influenced more by the regional socio-economic environment, particularly the resource sector development, than the major negative world activities. Diamond mining in the region has and will continue to positively affect traffic at the Yellowknife Airport. Located at the diamond capital of North America, the Yellowknife Airport passenger activity reached a new level in 1998, fuelled by the opening of the Ekati mine in that year. Amid the negative world aviation environment, the airport experienced about 5% growth in passenger traffic in 2001 and maintained similar traffic level in 2002. With production started in early 2003, the Diavik mine also joined the Ekati mine to generate steady traffic demand as a result of miners' work rotation. The scheduled opening of the Snap Lake diamond mine in 2007 will add more traffic to the Yellowknife Airport.

3.8 Principles of Forecasting

Reliable forecasts are critical input to the planning process. The production of traffic forecasts for the Yellowknife Airport has been guided by a set of forecasting principles that are judged to result in more dependable forecasts. These principles of forecasting are:

- Forecasts are a part of decision making – Understanding the needs for the forecasts and communicating with users regarding the nature of the forecasts and their application.
- Be objective – Sound judgement is always an integral part of the forecasting process, however, impartiality should be maintained through the process.
- Use reliable and most current data – A correct and solid traffic basis is essential. If not available, different data sources should be consulted to establish the best estimates.
- Use the most appropriate forecasting methodology and technique – Different traffic component forecasts require different forecasting technique(s) due to data availability and completeness, as well as the forecast requirements such as the level of details.
- Ensure internal and external forecast consistency – Consistent assumptions should be applied through the forecasting process, both for input variables and forecast adjustments.
- Deal with forecast uncertainty – Uncertainties surrounding the forecasts should be addressed by providing a forecast range along with the corresponding assumptions.

3.9 Forecasting Approach and Methodology

Due to the variant nature of individual traffic components and availability/limitation of data and information, a pragmatic and yet systematic approach has been adopted to forecast aviation traffic at the Yellowknife Airport for the 2008, 2013 and 2023 forecast periods, respectfully. The combination of trend analysis, market and industry outlook, consultation with carriers/operators and professional judgement produced the traffic forecasts. The adopted forecasting methodology involved the following general steps:

- Reconfirmation of the role of the Yellowknife Airport within the national/regional airport system and air services network;
- Review of historical and current traffic trend, particularly market evolution;
- Identification of socio-economic activities that have and continue to affect traffic growth;
- Collection/synthesis of information regarding socio-economic activity growth;
- Reference with available demand elasticity's;
- Review of industry outlook, the most recent Transport Canada aviation forecasts;
- Review of available existing and previous Yellowknife Airport forecasts;
- Consultation with air carriers/operators at the Yellowknife Airport regarding market growth potential and market conditions;[9]
- Incorporation with other relevant assumptions, such as potential for tourism development, mining activity and source of employees to generate traffic forecast range; and
- Assessment of the reasonableness of the aviation forecasts.

Significant floatplane activities occur in the Yellowknife area. These activities occur outside the airport boundaries and are not statistically recorded as Yellowknife Airport activities. As such, they are not accounted for in the forecasts for the Yellowknife Airport.

3.10 Socio-economic Environment

3.10.1 The Northwest Territories

The population of the Northwest Territories was estimated at 41,400 in 2003.[10] Yellowknife is the only chartered city in the Territory, accounting for 44% of its population, with the remainder of the population dispersed in a small number of towns, hamlets and settlements across the Territory. The majority of the population is situated along the Mackenzie River or along its tributaries. Approximately half the territorial population is aboriginal.

The Northwest Territories began the new millennium with a growing economy. In 2001, approximately $1.4 billion in capital investment was made in the territory – an increase of 130% from 1999. This dramatic growth has been driven by mining and oil and gas extraction, which accounted for $1.2 billion of the 2001 investment.[11] Capital investment in the Northwest Territories dropped by some 39% because of the completion of the Diavik mine, but it will still remain approximately $300 million higher than 1999 levels. In 2001, the real GDP of the territory grew by 19.2 % - the highest growth rate in Canada. In 2002, however, the real GDP grew at a rate of only 3.3%, and is projected to level off at 0.8% in 2003.[12] The slow-down in growth is a reflection of a drop in capital investment from 2001, as a result of the completion of the first two diamond mines. The Ekati mine started production in 1998 and the Diavik mine in early 2003.

Diamond mining is expected to continue to generate new employment. Construction of the Snap Lake mine is expected to commence in 2005, and the mine is expected to commence with production in 2007. The value of diamond production was $800 million in 2002, and is forecast to increase to $2.5 billion by 2008[13]. Passenger demand will certainly increase as more workers shuttle between Yellowknife and the mining and production sites, and as they make journeys to larger urban centres in Canada. For example, approximately 300 of the 500 employees at the Ekati diamond mine are Yellowknife residents.[14]

The Northwest Territories have seen a substantial increase in oil and gas exploration in recent years driven by increasing demand in the United States and the depletion of traditional North American reserves. In the last two years, petroleum companies have bid approximately $650 million for Crown exploration licenses in the Northwest Territories. The proposed Mackenzie Gas Project via the Mackenzie Valley route, supplying natural gas to Southern Canada and the U.S., is forecast to create 6,000 person-years of employment in the Northwest Territories during construction and generate $600 million in economic activity. These projects generally generate additional traffic during the regulatory application process from meetings between developers, government officials, native groups and other stakeholders, in and around Yellowknife. Also, during the construction stage of the Mackenzie Gas Project, it is expected that the Yellowknife Airport will serve as a gateway for construction personnel since it is a jet-capable facility and already receives scheduled services from several carriers.

Tourism plays an important role in the diversification of the territorial economy. In 2000, over 39,000 non-resident leisure travellers visited the Northwest Territories (including the Aurora tourists, adventure travellers, and tourists for hunting and fishing activities), spending

approximately $30 million. The number of visitors dropped to approximately 33,000 in 2001, which was a direct result of a 50% drop in visitors participating in Aurora tours. During this period of time, it is estimated that revenues from tourism have decreased $11 million or 25%. Preliminary survey results for 2002/03 show that road-based tourism has increased 22% from 2001. At the same time, the number of Japanese Aurora visitors has increased, suggesting recovery after the initial effects of September 11th. With support from the territorial government, tourism in the Northwest Territories is expected to continue growing (exact forecasts are not available at this time). Whilst some tourists will travel by car, many will access the territory through the Yellowknife Airport, particularly international visitors.

3.10.2 The City of Yellowknife

The City of Yellowknife is the capital of the Northwest Territories and serves as a centre for federal, territorial and municipal government services.[15] Economically, Yellowknife is a centre for mineral exploration and production, and is now the diamond capital of North America.[16] In addition to being the administrative, finance and mining centre, Yellowknife is the main health services and commercial centre of the Northwest Territories.

The city is also a renowned destination for Aurora tourism (i.e. tourism specifically associated with the viewing of the Aurora Borealis, or more commonly known as the northern lights.) This tourism activity has seen extraordinary growth – increasing 50% per annum since 1994/95 until 2001. Despite recent declines due to world events, growth is expected in this tourism sector in the future.

In 2001, Yellowknife's population was 16,541, decreasing 4.2% since 1996.[17] The city's population is projected to increase at about 1.3% per year over the next 20 years.[18]

Personal disposable income (PDI) for the Yellowknife region, already higher than the Canadian average, is forecast to grow at an average annual rate of 1.5% over the next 10 years, with higher growth in the short-term. The regional economy in terms of real GPD is also expected to increase at over 2.5% per year for the next decade.[19]

Yellowknife is currently suffering from shortages in skilled workers and housing, a fact supported by a very low unemployment rate of 2.4%. These concerns have been expressed publicly by representatives of the municipal and territorial governments. The shortages threaten the strength of territorial economic growth, as those who move to the North to find employment are confronted with a lack of accommodations. Further exacerbating the situation, new construction is limited due to a shortage of skilled workers to finish individual projects.

3.10.3 Nunavut

The Yellowknife Airport still maintains ties with Nunavut, acting as a staging point for services to the territory. Nunavut has not experienced the same level of economic growth as that of the Northwest Territories. In 2001, real GDP grew by 3.7%, considerably lower than the Northwest Territories growth of 21%, but still the second-highest growth in Canada. Capital investment in 2001 was $251 million compared with $1.4 billion in the Northwest Territories. However, Nunavut does have strong potential, particularly in the energy sector – it is estimated that 15% of Canada's gas reserves and 5% of its oil reserves lie within Nunavut's borders. Increased exploration and extraction activity in Nunavut in the future could have a positive impact on traffic at Yellowknife Airport.[20]

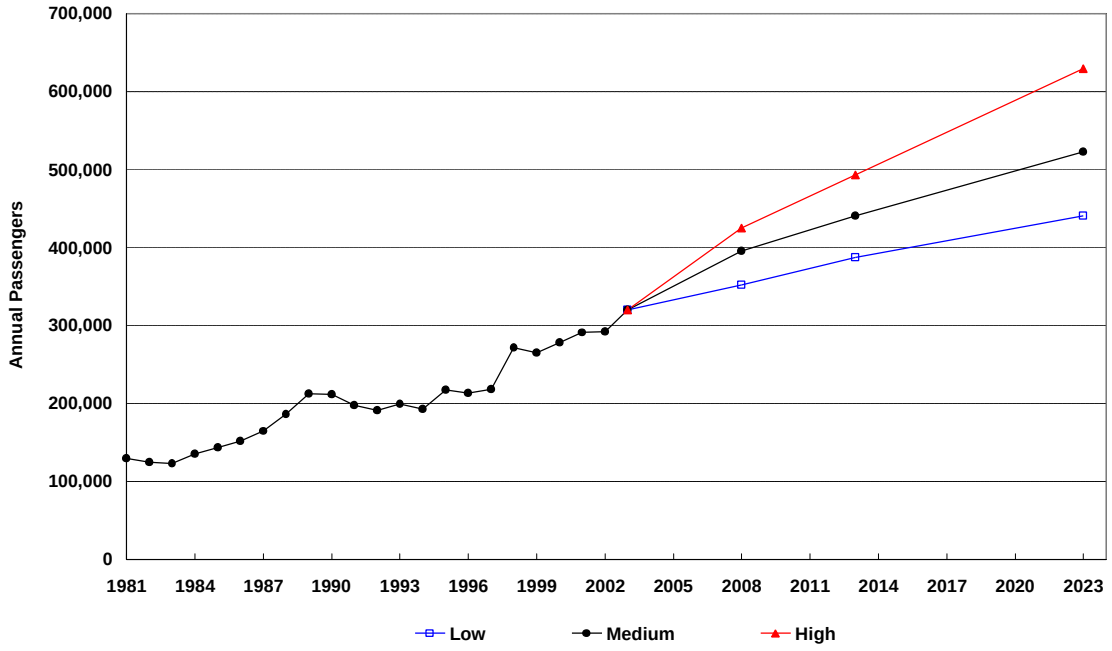
3.11 Preparation of Aviation Forecasts

3.11.1 Enplaned and Deplaned Passengers

Enplaned and deplaned passengers at the Yellowknife Airport include not only passengers utilising the PTB, but also the reported/estimated passenger traffic from carriers using their own terminal, hangar or apron facilities. The PTB passenger traffic is currently associated with regular scheduled and charter traffic of four carriers, First Air, Canadian North, Buffalo Airways Ltd. (Hay River service) and Northwestern Air Lease. In 2003, of the 320,000 total airport passengers, the PTB handled about 74%, or 236,000 passengers. The balance of the total passenger traffic, approximately 84,000 passengers associated with air services by Canadian North (mine charters), Buffalo Airways Ltd., Air Tindi Ltd. and Arctic Sunwest Charter, etc. were handled at other facilities. The following discussions and forecasts refer to total airport passenger traffic. For planning PTB terminal facility requirements, the peak demand forecasts reflecting only the relevant traffic are used (see Chapter 9.0 – Passenger Terminal Building).

Historical traffic and the *medium* passenger forecasts with the *low* and *high* ranges are presented in Figure 3-1 (below). Detailed forecast tables are provided in Appendix B.

Figure 3-1: Enplaned and Deplaned Passenger Forecasts



Source: 1981-2002 data from Statistics Canada. 2003 estimate based on carrier reported data to GNWT/Yellowknife Airport.

Air passenger traffic at the Yellowknife Airport has experienced a generally progressive upward trend over the last two decades. Passenger activity first peaked in 1989 at 212,000 passengers per year, followed by three years of decline to just over 191,000 passengers by 1992. Traffic recovered and increased to 218,000 passengers in 1997.

Fuelled by the development/construction and subsequent opening of the Ekati diamond mine, traffic at Yellowknife reached a new level of 272,000 annual passenger in 1998. The work rotation at the Ekati mine generates steady traffic demand at the airport.

Although mine-related traffic generally does not pass through the main terminal, mineworkers use the terminal for their trips to Southern Canada and continue to contribute to overall airport traffic. Similarly, the requirement for southbound passengers en-route from other northern destinations on scheduled flights to deplane and undergo security screening at the Yellowknife Airport is a unique characteristic of the airport's traffic pattern that impacts airport operations.

Political/administrative activity leading to the formation of Nunavut Territory (April 1999) also contributed to the 1998 traffic peak. However, the relocation of some government jobs from Yellowknife to Nunavut after the formation of the new territory contributed to a minor slippage of traffic the following year.

In 2000, site infrastructure development and project construction of the Diavik mine boosted passenger activity at Yellowknife. Passenger traffic continued to increase in 2001, reaching a historical high of level of about 291,000 annual passengers, despite the overall traffic decline in the international carrier industry. The Yellowknife Airport experienced a similar traffic level in 2002. Incremental passenger demand occurred at the airport when the Diavik mine entered operation in early 2003. The development and anticipated operation of the Snap Lake mine in 2007 will further increase traffic at the Airport.

The increase of aviation activity at an airport, particularly passenger traffic, is generally related to the growth of the socio-economic environment of the markets/region it serves. In the case of the Yellowknife Airport, however, with its role in supporting regional resource development, traffic can grow much faster than normally attributed to socio-economic growth. The three scenario forecasts with the major assumptions are described further below.

Medium Growth Scenario

Under a *medium* forecast scenario, from the base year 2003, passenger traffic at the airport is expected to grow at an average annual rate of 4.3% over the first 5 years, reaching 395,000. By 2013, traffic is expected to reach 440,000, representing a 3.2% annual increase for the 10-year period. Over the longer-term 20-year horizon, the Yellowknife Airport is projected to handle 522,000 passengers annually. The *medium* forecasts are based on the following major assumptions:

- Yellowknife will maintain its role as an administrative, financial and commercial service centre of the Northwest Territories;
- Continued growth in the socio-economic environment (population, provincial GDP and personal disposable income as discussed previously in this chapter; and
- Moderate growth in tourism.

High Growth Scenario

In addition to the above assumptions, under a *high* forecast scenario, potential gas pipeline development along the Mackenzie Valley is assumed to generate additional traffic demand. During the regulatory and environmental review period necessary for this development, additional growth

would be generated from the numerous meetings between government and corporate officials, native groups and other stakeholders, in Yellowknife and other communities. The *high* forecast scenario also assumes there are more mine employees from the North, or relocated from Southern Canada and settled in the Yellowknife region, resulting in more traffic to/from the airport. In addition, more tourist activity by air is assumed to materialise. Under these assumptions, passenger activity is forecast to grow at a higher annual rate of 4.4% over the 10-year horizon, attaining 493,000 passengers by 2013. By the end of the 20-year planning period, the airport would be expected to handle 629,000 annual passengers.

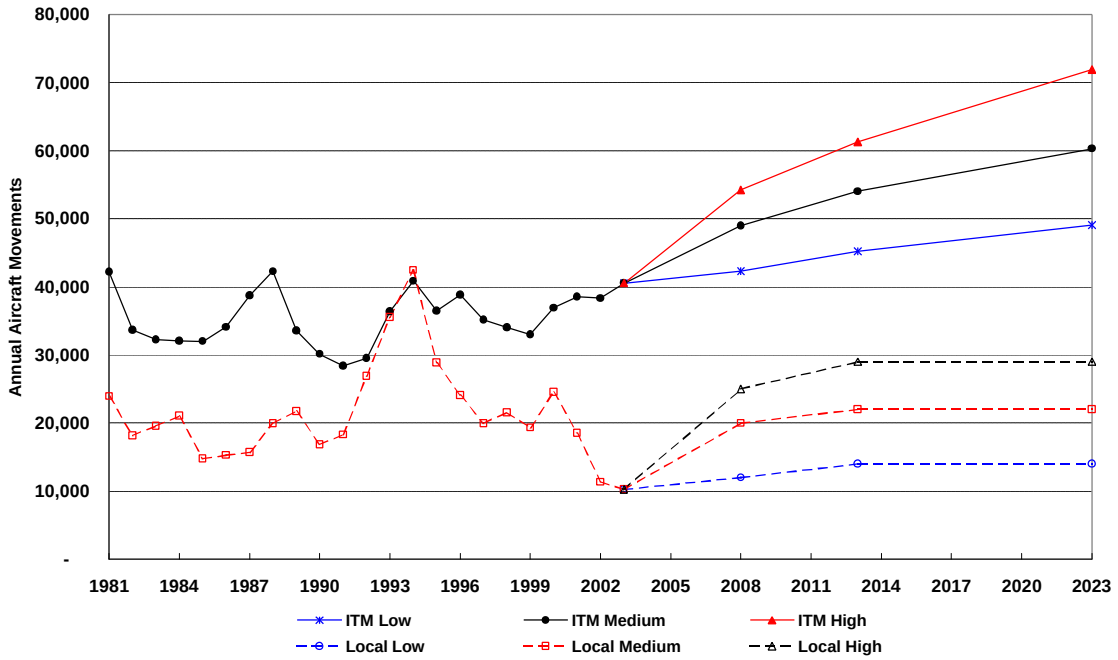
Low Growth Scenario

The *low* forecasts assume slower socio-economic growth for the region and less active mining development/business aside from those already planned such as the Snap Lake mine. This scenario also assumes more mine employees would come from other remote areas and Southern Canada due to limited qualified mine employees from the Yellowknife region when all major mines are in full production. These mine employees could be flown directly to/from the mine sites and by-pass Yellowknife. In addition, minimal growth in tourism is assumed. Accordingly, passenger traffic would increase moderately at 1.9% annually over the planning period, reaching 387,000 annual passengers in 2013. Under these conditions, the airport is forecast to handle 440,000 passengers annually by 2023.

3.11.2 Aircraft Movement Activity

Aircraft movement activity is comprised of 'Itinerant' (ITM) and 'Local' aircraft movements. The forecasts for each segment are presented Figure 3-2 (below). Detailed forecast tables are provided in Appendix B.

Figure 3-2: Aircraft Movement Forecasts



Source: *Aircraft Movement Statistics (TP 577)*; Statistics Canada/Transport Canada, 2003.

'Itinerant' Aircraft Movements

For the past two decades, 'Itinerant' aircraft activity followed a pattern of peaks and troughs with a first peak at 42,200 movements occurring in 1981. This peak was followed by a few years of decline and a second peak at 42,300 annual operations in 1988. By 1991, 'Itinerant' movements at the Yellowknife Airport had fallen to a historically low level of 28,400 operations, but rebounded to a third peak of 40,800 by 1994. Since then, 'Itinerant' operations have ranged between 33,000 and 38,800 movements a year until 2002. In 2003, the airport handled approximately 40,600 'Itinerant' aircraft movements, up 5.9% from the previous year. Individual components of 'Itinerant' aircraft activity experienced different changes during the historical period.

Over the course of the next ten years, total 'Itinerant' aircraft movements are forecast to increase at an approximate rate of 2.9% per year, reaching 54,000 operations by 2013. By the end of the 20-year forecast horizon, these activities are expected to reach close to over 60,000 movements annually.

'Air Carrier' Movements

During the period of passenger growth described previously, scheduled carrier services changed considerably at the airport. During the 1980's, scheduled major carriers transported most passengers, using combi-jet aircraft, while few scheduled regional/local carrier services were offered. The latter carriers emerged mostly during the 1990's, and grew considerably during that period, forming an integral part of the present-day air services network.

For the passenger carrier movement forecasts, it is assumed that services to northern communities would be maintained with some service increases to regional centres in the Territories. New/increased direct services to major Southern Canada centres would also continue to develop. Southbound traffic is expected to grow at a slightly higher rate than that of the rest of the airport traffic. However, existing carriers could rationalise their services for business viability reasons. Passenger carrier operations are therefore forecast to grow in-line with passenger demand, albeit slightly lower than passenger growth as a result of increased aircraft load productivity.

Other carrier movements, including small charter and courier operations, are expected to increase in-line with growth in the regional economy, but influenced by the degree of mining activities occurring around the Yellowknife area, and potential oil and gas development along the Mackenzie Valley.

By 2013, total carrier movements are forecast to increase at 2.7% annually to 44,900 movements, with low and high ranges at approximately 39,300 and 49,800, respectfully. By the end of the 20-year forecasting horizon, air carrier operations are expected to generate 54,400 annual movements.

'General Aviation' Movements

General aviation movements include 'Other Commercial' activities, 'Private/Corporate' aircraft movements and 'Government' civil/military aircraft) activities. 'Other Commercial' operations include commercial flight training, agricultural sprayers, aerial surveys and aerial inspection services, etc., by non-government aircraft.[21] 'Private' aircraft movements include both corporate and personal aircraft operations. 'Government' civil/military aircraft operations at the Yellowknife Airport include search and rescue, fire protection services, and military activities.

Operations related to mine traffic, recreational activities (hunting, fishing, etc.) are typically provided by licensed carriers and are not classified as 'General Aviation' traffic, by definition. These operations have been captured in the 'Air Carrier' movements.

'General Aviation' activity ranged between 5,200 and 9,200 annual movements in the last decade with the exception of 1993 and 1994, when 'Other Commercial' operations were distinctly high. In 2003, the airport handled about 6,200 'General Aviation' operations. While 'Other Commercial' traffic remained within historical range, 'Private/Corporate' and 'Government' aircraft activities were considerably below historical levels.

Recovery and growth are more likely from 'Other Commercial' and 'Private/Corporate' aircraft operations, along with increased mining activities and related corporate functions. Potential oil and gas development in the Mackenzie Valley could generate additional activity, contributing to the higher forecasts. 'Government' aircraft operations are expected to fluctuate within the historical range.

Overall, 'General Aviation' traffic is forecast to rebound to approximately 9,100 operations to 2013, with *low* and *high* forecasts ranging between 5,900 and 11,500 movements. By the end of the 20-year forecast horizon, growth is expected to be much slower, reaching approximately 9,900 movements annually.

'Local' Aircraft Movements

'Local' movements are mostly related to civil flight training at the Yellowknife Airport.[22] These activities have historically followed a cyclical pattern. Between 1990 and 1997, this pattern was particularly erratic as a result of the start-up and closure of a very active flying school.[23] A similar pattern also occurred in 2000/2001, albeit at a much smaller scale. Traffic continued to decline in 2002 and appeared to bottom out in 2003 with just over 10,200 operations. For the first half of 2004, Yellowknife Airport handled 27% more 'Local' movements than for the same period in 2003.

Over the course of the planning period, flying training is expected to continue at Yellowknife Airport. 'Local' movements are anticipated to continue following a cyclical pattern, but are unlikely to reach the historical high level described earlier given past and recent experiences. As such, order-of-magnitude forecasts are expected to be within the historical average, ranging between 14,000 and 29,000 operations a year. 'Local' aircraft movement forecasts are depicted in Figure 3-2 (page 3-11). Detailed forecast tables are provided in Appendix B.

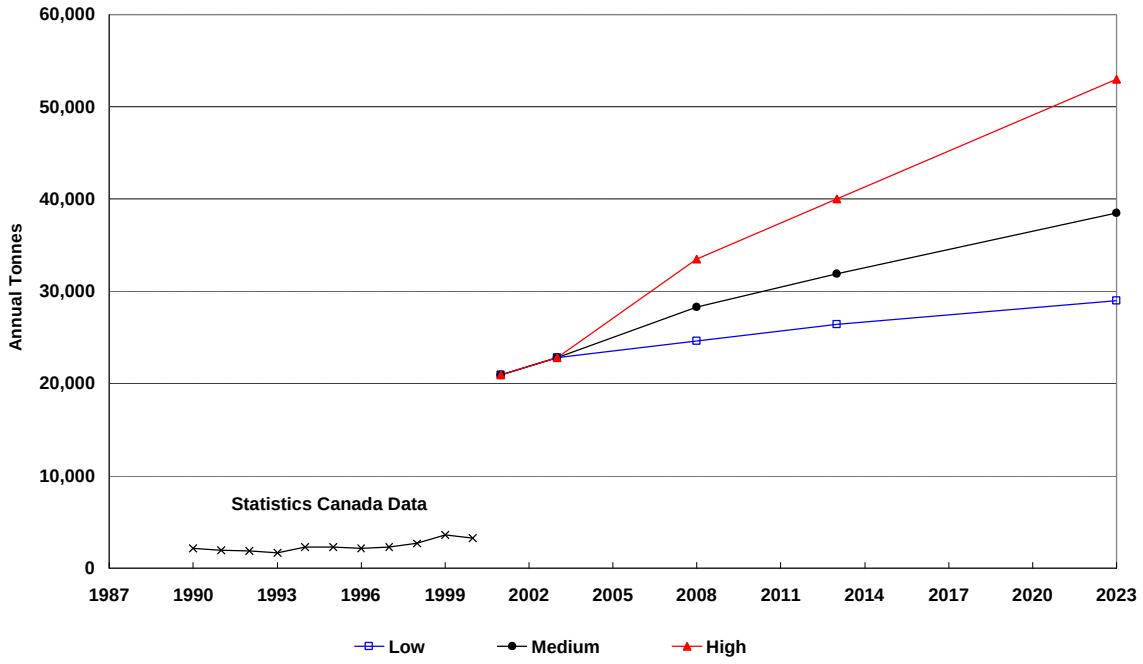
3.11.3 Air Cargo Activity

As discussed in previously in this chapter, there are no accurate air cargo statistics for many Canadian airports, including the Yellowknife Airport. The historical data from Statistics Canada are incomplete due to the reporting requirements and problems associated with the reporting process. Through consultation with key cargo carriers/operators, the amount of air cargo going through Yellowknife was estimated at approximately 21,000 tonnes in 2001 and 22,800 tonnes in 2003, much more than those officially reported. Given the lack of data and the disparities that exist between individual site reporting methods, it is difficult to position the importance of the airport's cargo traffic in the overall Canadian or northern air cargo markets.

Air cargo is a significant factor at the Yellowknife Airport and for the City of Yellowknife. Not only does it contribute to traffic levels, but it is also a significant economic generator for the region. Air cargo activity at the Yellowknife Airport serves different functions: courier operations, food/grocery transportation to northern communities, regular re-supply to mining operations and activities supporting mine development, etc. Given the reliance of the mining industry on air cargo services, the scale and project life of individual mines will affect the amount of cargo handled at the airport. With the existing diamond mines (i.e. the Ekati and the Diavik mines) and the anticipated Snap Lake mine, cargo traffic at Yellowknife is expected to grow in a manner reflective of the region's mining activities. As a result, air cargo operations can be expected to expand and later contract in-line with the Snap Lake mine development and construction project, and be influenced from activities related to other mines that may begin operations over the next 20 years, as well as the potential gas pipeline development along the Mackenzie Valley.

Figure 3-3 (below) illustrates the air cargo forecasts within the low and high ranges. Detailed forecast tables are provided in Appendix B.

Figure 3-3: Enplaned and Deplaned Cargo Traffic Forecasts



Source: 1990-2000 based on Statistics Canada data. 2001/2003 based on data/information provided by carriers.

Short-term forecasts of air cargo traffic are optimistic in view of the anticipated Snap Lake mine project. Over the longer-term, traffic is expected to experience more moderate increases, in-line with the growth of the regional socio-economic environment and more stable mine operations. By 2013, the Yellowknife Airport is forecast to handle approximately 32,000 tonnes of cargo, reflecting an average annual growth of approximately 3.4% over a 10-year period under the medium growth scenario, and ranging between 26,400 and 40,000 tonnes a year under the low and high scenarios. By 2023, 38,500 tonnes of cargo is expected to go through the Yellowknife Airport annually. The high scenario forecasts also include additional mining activity that may materialise in the North.

The above cargo activity forecasts have not considered the potential for international cargo going through Yellowknife, if and when an extended runway at the Airport could support economic operations of long range freighters. A comprehensive market analysis should be conducted to identify the presence of tangible potential demand and the incremental increase in traffic the associated marketing initiatives would derive.

3.12 Notes and References

[1] Statistics Canada Reporting Statement and Form.

[2] *PIO 12/2003*; International Civil Aviation Organization (ICAO), August 2003.

[3] *PIO 07/2004*; International Civil Aviation Organization (ICAO), June 2004.

[4] Transport Canada, based on all reporting airports, June 2003.

[5] Based on advanced data reported by airports to Transport Canada.

[6] *"Traffic Recovery Intensifies in July" News Release*; International Air Transportation Association (IATA), September 9, 2003.

[7] *PIO 12/2003*; ICAO latest forecasts, August 2003.

[8] *Transport Canada Forecast Update*; June 2003.

[9] Consultation with Canadian North, First Air and Arctic Sunwest Charters were conducted in person by project team members, and others (Air Tindi, Buffalo Airways Summit Air) via telephone. Individual air carrier input is not disclosed for confidentiality reasons.

[10] *2003 NWT Socio-Economic Scan*; NT Bureau of Statistics, 2003.

[11] NT Bureau of Statistics, 2002.

[12] *2003 NWT Socio-Economic Scan*; NT Bureau of Statistics, 2003.

[13] *An Economic Overview of the NWT*; Resources Wildlife and Economic Development, Government of NT, Summer 2002

[14] Canadian Press, 29 October, 1999.

[15] For example, the concentration of government departments in Yellowknife, which deal with all resource development in the NWT, generates a considerable traffic base for the Yellowknife Airport.

[16] Originally, exploration and production activity was gold mining-based but has now been surpassed by diamond mining.

[17] Statistics Canada, 2003.

[18] *NWT Bureau of Statistics Projection 1999-2019*; NT Bureau of Statistics, 1999.

[19] *Transport Canada General Forecast Update 2003/2004*; Informetrica Ltd. and Conference Board of Canada.

[20] Detailed NT – Nunavut traffic data is not available.

[21] Licensed passenger and cargo-related operations are recorded by Transport Canada as Air Carrier movements.

[22] In recent years, only 13-16% of 'Local' movements was attributed to military aircraft.

[23] Based on discussions with airport management, NAV CANADA personnel and airport flight training operators.

4.0 Financial Arrangements

4.1 About this Chapter

Meeting the demands of operating a major commercial aviation facility is not without challenge. Indispensable to the overall planning process is the determination of the sources and the extent of the financial means available for the provision and continued operation and maintenance of the Yellowknife Airport's facilities and services. This chapter reviews prevailing financial conditions at the airport and discusses the challenges the Airports Division faces with regards to the funding mechanisms available to the airport.

Specific airport-related terminology used in this chapter is defined below:

Aircraft Landing Fee – Fee charged to arriving aircraft on the basis of a flat rate or certified Maximum Gross Weight (MGW) on landing. Fee applies to all aircraft except piston engine aircraft.

Airport Land Rental Fee – Fee that applies to all non-Passenger Terminal Building land rentals.

Aircraft Parking Fee – Fee applying to all aircraft parked at various locations at the airport.

Concession Fee – Fee that is based upon a percentage of the concession gross income, and sometimes combined with a minimum rental payment. This includes a throughput fee for the sale of AVGAS for piston engine aircraft.

General Terminal Fee – Fee based upon air carrier use of the Passenger Terminal Building for processing passengers, and charged on the basis of the seating capacity of aircraft used.

Other Fees/Charges – Revenues derived from airport licensed advertising or public use facilities or equipment.

Passenger Terminal Building Lease Space Rental Fee – Fee applied for occupancy of Passenger Terminal Building space by tenants such as air carriers, CATSA screening contractor, car rental operators, concessions, vending machines, etc.

Vehicle Parking Charge – Fee that applies to the general public, tour operators and other airport tenants for the use of airport-managed vehicle parking facilities.

4.2 Financial Plan

The GNWT, through the Department of Transportation, has been responsible for financing airport operations and most capital improvement projects since 1995. Prior to this time, this responsibility was with the Government of Canada. Historically, low traffic volume airports in Canada and other international locations did not generate sufficient revenues to cover development and operating costs, and consequently relied upon government subsidy. Since the opening of the Yellowknife Airport in 1945, the facility has never generated sufficient revenues to cover costs. In 1995, at the time of transfer of ownership from the Government of Canada, the operating deficit was in excess of $1 M annually. Despite a strong traffic growth and solid tenant base, the financial performance is

still in deficit status. This performance is partially due to current operational demands, a Northern location and a reluctance by the local government (GNWT) to increase user fees and charges commensurate with financial demands.

Airport revenues are principally generated from aeronautical sources such as aircraft landing fees and terminal use charges, along with non-aeronautical sources such as land and building rentals and concessions fees. At the Yellowknife Airport, all revenues generated are credited to the GNWT consolidated Revenue Fund. At the time the Canadian National Airports Policy was implemented in 1994 and negotiations were underway for the transfer of the Arctic Airports, including the Yellowknife Airport, the airport was reporting an operational deficit in excess of $2M annually. (See Table 4-1: Financial Performance 1992 (below) for a summary of the 1992 financial performance as outlined by Transport Canada.)

Table 4-1: Financial Performance 1992 (Thousands $)

Item	Thousands $
Revenues	$980
Expenses	$3,126
Operating Profit (Deficit)	($2,146)

Source: *National Airports Policy (TP 12163)*; Transport Canada, 1994.

Since the Airports Division assumed responsibility for the operation and management of the airport in 1995, expenditures almost doubled the reported revenues, in spite of diligent management and cost control measures implemented by the GNWT, Department of Transportation. Although the financial performance of the facility has improved since the transfer, the airport continues to report significant annual operating losses. Table 4-2 (below) provides a summary of the airport's financial performance since 1995.

Table 4-2: Financial Performance 1995-2003 (Thousands $)

	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03
Revenues								
Landing Fees & Other Fees	$268	$302	$316	$275	$280	$285	$1,068	$1,015
Lease Rental	$506	$541	$569	$642	$736	$733	$823	$823
Concessions	$254	$291	$260	$204	$179	$227	$158	$194
Misc.	$6	$2	$8	$7	-	-	-	-
Total Revenues	**$1,034**	**$1,136**	**$1,153**	**$1,128**	**$1,195**	**$1,245**	**$2,049**	**$2,032**
O&M Expenditures								
Expenditures	$2,611	$2,675	$2,618	$2,749	$2,802	$2,886	$3,104	$3,867
Recoveries*	-	$(110)	$(94)	$(89)	$(69)	$(77)	$(89)	$(104)
Net Expenditures	**$2,611**	**$2,565**	**$2,524**	**$2,660**	**$2,733**	**$2,809**	**$3,015**	**$3,762**
Operating Profit (Deficit)	**$(1,577)**	**$(1,429)**	**$(1,371)**	**$(1,532)**	**$(1,538)**	**$(1,564)**	**$(966)**	**$(1,730)**

* Includes disbursements recovered from NAV Canada for rent, utilities, and other charges associated with NAV Canada's operations in the terminal building.

Source: GNWT, Department of Transportation, Airports Division, 2004.

To offset reported losses, the GNWT significantly increased the fees charged to aircraft operators at the facility in 2001/2002. Landing fees were increased by 76% and terminal fees were implemented. As a result, the share of aeronautical revenues in the annual budget increased from approximately 25% to 50% of total revenues. Nonetheless, the airport continues to report significant operating losses.

Many of the proposals presented in this document aim to increase the revenue generation potential of the airport through renewal of existing facilities and expansion of the land asset available for lease. To achieve this potential, the overall development proposals put forth total approximately $100 million in capital requirements over the next 20 years. While every effort has been made to propose projects that are scaled to minimize expenditures, these capital requirements are will beyond the airport's financial ability. Some proposals may therefore require more modest implementation or, where possible, be pushed to a later date. In addition, given the level of capital investment required to maintain the airport's role and meet its long-term revenue generation potential, new revenue sources and additional external funding will also be required.

4.3 Airport Funding

4.3.1 Funding Mechanisms

Given the financial performance outlined above, the ability to finance the proposals contained in this document will be dependent upon the availability of additional funds from the GNWT and other external sources. The absence of funding could force the abandonment of the current development proposals and require operations to continue in the existing facilities. This would not only lower levels of service over the long-term period, but could also potentially compromise safety of operations.

As outlined previously in this document, the Yellowknife Airport administration falls under the authority of the GNWT, Department of Transportation. Funds for airport operation and improvements are from public appropriations. These funds must be approved by the GNWT Legislative Assembly, and thus must compete with other priorities of the day of the government.

The Canada National Airports Policy and subsequent legislation by the Government of Canada has enabled the formation of a not-for-profit corporation called a Canadian Airport Authority (CAA) to manage the affairs of an airport that has been divested from Transport Canada. With the exception of a few privately owned and operated airports and those in the Canadian North, airports in Canada are now generally incorporated as these not-for-profit entities and governed by independent appointed Board of Directors. This administrative authority bring airports greater financial autonomy and flexibility with regards to access to funds from various funding programs, and enables the airport to establish fees to finance capital improvement costs. It also increases the importance of self-financing for the airport administration. The concept of an airport authority to operate the Yellowknife Airport is under study by the GNWT.

4.3.2 External Funding Sources

Under certain conditions, a number of other organizations may be called upon for funding, where appropriate. Safety-related projects may be eligible for funding through Transport Canada's *Airport Capital Assistance Program (ACAP)*.

Specifically, eligible projects include, in order of priority:

- Safety-related airside projects, such as rehabilitation of runways, taxiways, aprons, and associated infrastructure;
- Heavy airside mobile safety equipment (runway snowplows, sweepers, or winter friction testing devices, etc.);
- PTB/landside safety-related projects such as sprinkler system installations or barrier-free access improvements; and
- Asset protection/refurbishing/re-lifting or projects to help reduce operating costs.

Depending on specific requirements, some projects may also be eligible for direct funding from the other federal government organizations, such as the Canadian Air Transport Security Authority (CATSA), NAV CANADA, etc. The Government of Canada, through the Canadian Air Transport Security Authority (CATSA), has recently agreed to participate in the deployment of security personnel and equipment according to Government of Canada requirements for enhanced security at airports.

Since the Canadian National Airports policy was introduced in 1995, Airport Improvement Fees (AIFs) have been introduced by a number of NAS airport authorities and Non-NAS airports. On average, AIFs now represent approximately 20 percent of total NAS airport revenues, and this percentage continues to grow. The AIF rates currently vary from $5.00 to $28.00 per passenger. The majority of AIFs are collected through the air carriers' ticket systems, yet some are still collected directly by the respective airport. However, on average, the AIF account for approximately 28 per cent of total revenues generated by the airport authorities collecting such fees. Similar user-type fees are prevalent at airports throughout the world. Implementation of user fees at Yellowknife Airport will require legislation change and government approvals.

The airport is designated by international air carriers as an en-route alternate for use in case of in-flight emergencies on flights over-flying the region. This designation is assigned in individual flights upon the filing of flight plans for high latitude or polar flights that over-flying the region. At present, no contributions are made by the international aviation community at any airport around the world towards the maintenance of suitable and adequate airport infrastructure to accommodate large aircraft that may be diverted to Yellowknife in case of an in-flight emergency. A need exists therefore to engage Transport Canada and international aviation organizations in working towards obtaining the necessary contributions for the infrastructure and equipment needed at the Yellowknife Airport to serve this role. These requirements are identified throughout this document. The GNWT and the Government of Canada will promote dialogue to advance opportunities with impacted users and authorities with jurisdiction.

5.0 Airport Site

5.1 About this Chapter

The inherent characteristics of an airport site are vital input to the planning process. The suitability of a site to accommodate aircraft operations and to provide for the future expansion of facilities is an important consideration. This chapter provides an overview of the key physical and environmental characteristics of the Yellowknife Airport and provides an assessment of the potential to accommodate future development on the site.

Specific aviation terminology used in this section is defined below:

Airside – The movement area of an aerodrome, adjacent terrain and buildings and portions thereof, to which access is controlled.

Landside – The area of an aerodrome not intended to be used for activities related to aircraft operations and to which the public normally has unrestricted access.

Noise Exposure Forecast (NEF) – The officially recognised metric measurement used for airport noise assessment in Canada.

5.2 Location

The Yellowknife Airport is located 6 kilometres from the centre of the City of Yellowknife and immediately west of the edge of the built-up community. The airport site is bordered on its northern edge by Long Lake and Highway #3. The latter passes through portions of the airport site via a right-of-way held by the GNWT, Department of Transportation. Old Airport Road immediately neighbours the eastern edge of the site, extending towards the city's growing retail district. The Range Lake residential and the Kam Lake industrial subdivisions border to the south and southeast, respectively.

The area adjacent to the western edge of the airfield is the location of NAV CANADA's Independent Secondary Surveillance Radar (ISSR), and the Department of National Defence's (DND) Forward Operating Location. (These facilities are outlined in more detail further in this document). The Yellowknife Golf Club, owned and operated by the Airports Division, is also located in this area. Situated immediately southwest of the airport site, access to the FOL site is made via a dedicated road running south from Highway #3, in proximity to the airport's western boundary. Land situated further to the west is undeveloped.

5.3 Airport Land Area

5.3.1 General Layout

The airport occupies approximately 572ha of land, which includes the airport's operational grounds (524ha) and the land situated north of Highway #3 (47ha) accommodating the Yellowknife Golf Club. The airport is legally registered as Lot 1, Block 906, pursuant to the Canada Lands Surveys Act (April 02, 2002).

The site is owned and operated by the Airports Division. The airport land was previously owned by the Government of Canada and transferred to the GNWT through the implementation of the 1995 *GNWT/Transport Canada Arctic A Airport Transfer Agreement*.

Airside land, including runways and taxiways and aprons, and the developed quadrants situated north of Runway 09-27 occupy approximately 338ha of the total land area. The remainder of the site (234ha), including the ancillary land situated north outside the operational area of the airport and north of Highway #3 is for the most part undeveloped.

As illustrated in Figure 5-1 (page 5-3), the site can be broken down into six distinct land areas:

- **Airside land** (281ha) – accommodating the airport's runways, taxiways and most of the airport's navigational aids.
- **Northeast quadrant** (41ha) – the main airport development area consisting of the PTB, aircraft parking aprons, vehicle parking facilities, most air carrier support services, operational support infrastructure and the passenger terminal access system.
- **Northwest quadrant** (16ha) – the more recently opened commercial development area currently accommodating diamond processing and some general aviation facilities such as Adlair Aviation Ltd. The latter provides private air medevac service and regular charters.
- **Southeast quadrant** (82ha) – mostly undeveloped land, accommodating the Very High-Frequency Omni-Range (VORTAC) navigational aid and a limited number of land tenants.
- **Southwest quadrant** (105ha) – land commonly referred to as the 'west-side' and currently undeveloped. (Note that the Independent Secondary Surveillance Radar (ISSR) is located approximately 700m from the western boundary of this quadrant.)
- **Ancillary land** (47ha) – additional land outside of the main operational site, comprising land that accommodates the Independent Secondary Surveillance Radar (ISSR), as well as other parcels situated north of Highway #3 that accommodate, among others, the float plane base and Yellowknife Golf Club.

5.3.2 Land Parcel Development

The development of land parcels on the site varies by the nature of the activities that occur at the airport, and the degree to which access to airside areas is afforded, or required. Airside services (e.g. air cargo operations, aircraft maintenance hangars, etc.) are typically located adjacent to or in proximity to runway and taxiway infrastructure, whereas landside services (e.g. car rental facilities, fuel storage, etc.) are normally situated on land that does not require direct access to airside infrastructure.

Most developable land parcels situated in the airport's northeast quadrant are currently occupied by independent tenants, benefiting from the proximity of the PTB and existing aircraft parking aprons. These tenants consist mostly of air service operators providing scheduled and charter air passenger and cargo services, including Medevac services, as well as ground handling, aircraft maintenance and off-PTB passenger handling operations. Airside accessible land also accommodates some government aviation facilities, including the GNWT's Resource Wildlife and Economic Development (RWED) forest fire fighting base in the northeast quadrant, and provide access to the DND's Forward Operating Location facilities, situated adjacent to the southwest

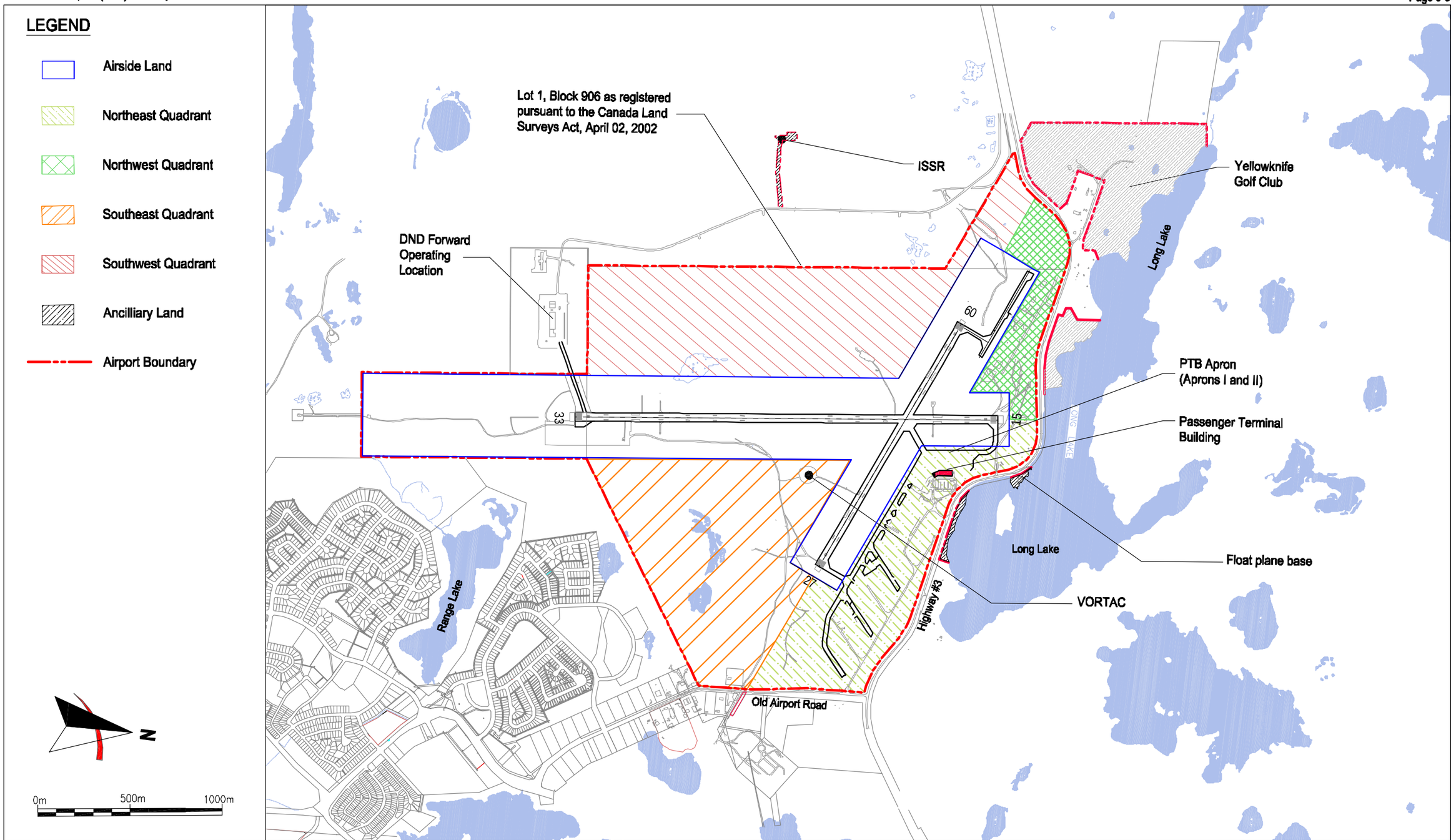


Figure 5-1: Airport Layout

Northwest Territories Transportation

DATE: November, 2004

For planning purposes only

quadrant (west-side) of the airport. The airside lots in the northwest quadrant are occupied by diamond processing facilities and some general/charter aviation activities.

Landside development at the airport is, at present, located in the northwest quadrant, in the northeast quadrant around the PTB, off Bristol Avenue along Highway #3, and off Dickens Street along Old Airport Road and off Old Airport Road. There is no land access directly off Highway #3. There is only one property that has direct access to Old Airport Road (Northwest Transport). Figure 5-2 and Figure 5-3 (pages 5-5 and 5-6, respectfully) for the location of individual tenants.

5.3.3 Land Occupancy

The total land area available for, or occupied by, airport development in the northeast and northwest quadrants is approximately 57ha, including the passenger terminal, maintenance facilities and roadways. Of the total land in the northern quadrants only 14% remains vacant and undeveloped. The vacant land parcels in these quadrants total approximately 8ha, broken-down into lots varying in size from 0.5ha to approximately 2.0ha. For the most part, these current vacant/undeveloped land parcels are situated at the western extremity of the northwest quadrant. Table 5-1 (below) summarises land occupancy in each quadrant by broad land use category.

Table 5-1: Airport Land Occupancy by Quadrant (ha)

	Northeast Quadrant	Northwest Quadrant	Southwest Quadrant	Southeast Quadrant	Total by Category
Airport Operational Land (PTB, roadways, parking, maintenance facilities)	13.6	2.8			16.4
Tenanted Lots	27.1	5.5		1.8	34.4
Vacant/undeveloped land	0.5	7.8	104.8	80.1	193.2
Total Developable Area	**41.2**	**16.1**	**104.8**	**81.9**	**244.0**

Source: Inter*VISTAS* Consulting, 2004.

The 1998 *Yellowknife Airport Development Plan Update* determined that absorption of leased land parcels at the airport had occurred at an annual rate of 2.7% for the 15-year period between 1983-1997. Since the opening for development of the northwest quadrant in 1998, an additional 7.6ha of land have been leased at the airport, resulting in a significantly higher annual absorption rate of 5.4% for the 1998-2003 period, increasing the average absorption rate to 3.4% over the previous 21-year period.

Continuation of the land take-up trend at the airport will depend on a number of factors. Economic conditions will affect the timing of many of the developments in the region. In spite of a relative softening of the land development marketplace at most North American airports immediately following September 11th, 2001, the Yellowknife Airport continued to perform reasonably well, with a number of leaseholds changing hands and expressed interest in the few vacant land parcels.

Legend

1 Superior Propane Inc.
2 Imperial Oil
3 First Air
4 Ted's U-drives Ltd.
5 Air Norterra Inc. (Canadian North)
6 Graham Fuglsang
7 102643 Aviation Ltd. (Ursus Aviation)
8 Department of Indian and Northern Affairs
9 Bathurst Inlet
10 Buffalo Parcel
11 Petro Canada
12 Canada Post Corp.
13 Air Tindi Ltd.
14 Hay River Liquor Retail 615
15 Tenant Parking
16 Shell Canada Products Ltd.
17 Kingland Ford Mercury Sales
18 Nunasi Helicopters
19 Robinson Trucking Ltd.
(Arctic Sunwest Charters)
20 Air Tindi Ltd.
21 Great Slave Helicopters Ltd.
22 Northwest Transport Ltd.
23 Braden Burry Expediting Ltd.
24 Gov't of NWT (RWED)
25 Air Tindi Ltd.
26 Air Tindi Ltd.
27 G&G Expediting
(Diavik Diamond Mines Inc.)
28 Buffalo Airways
29 Ministry of National Defence
30 First Air (Bradley Air Services)

Commercial Lease

Goverment

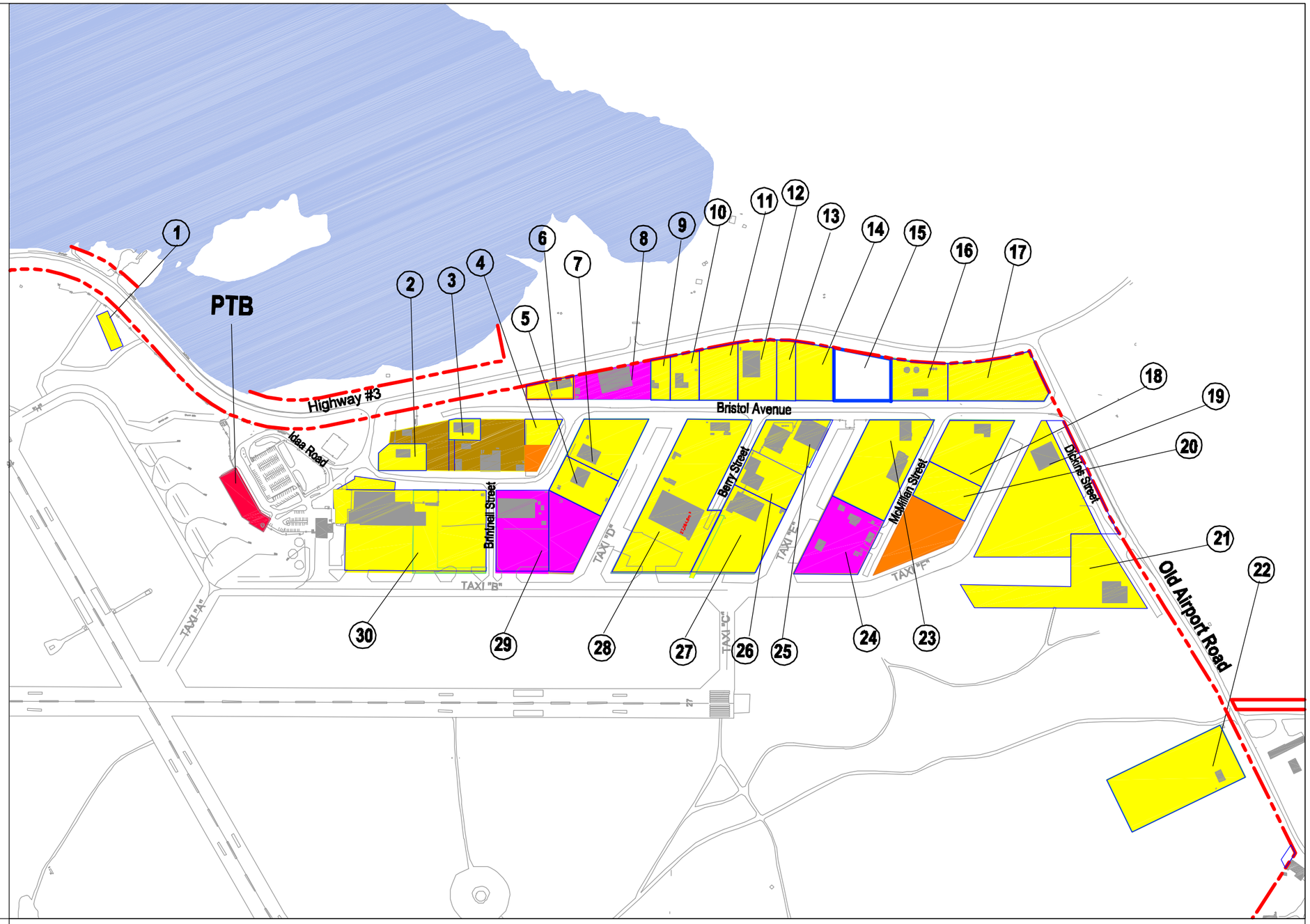
Airport Maintenance

Vacant

Airport Boundary

N

0m 100m 200m



Northwest Territories Transportation

Figure 5-2: Land Parcel Development (2004) - Northeast & Southeast Quadrants

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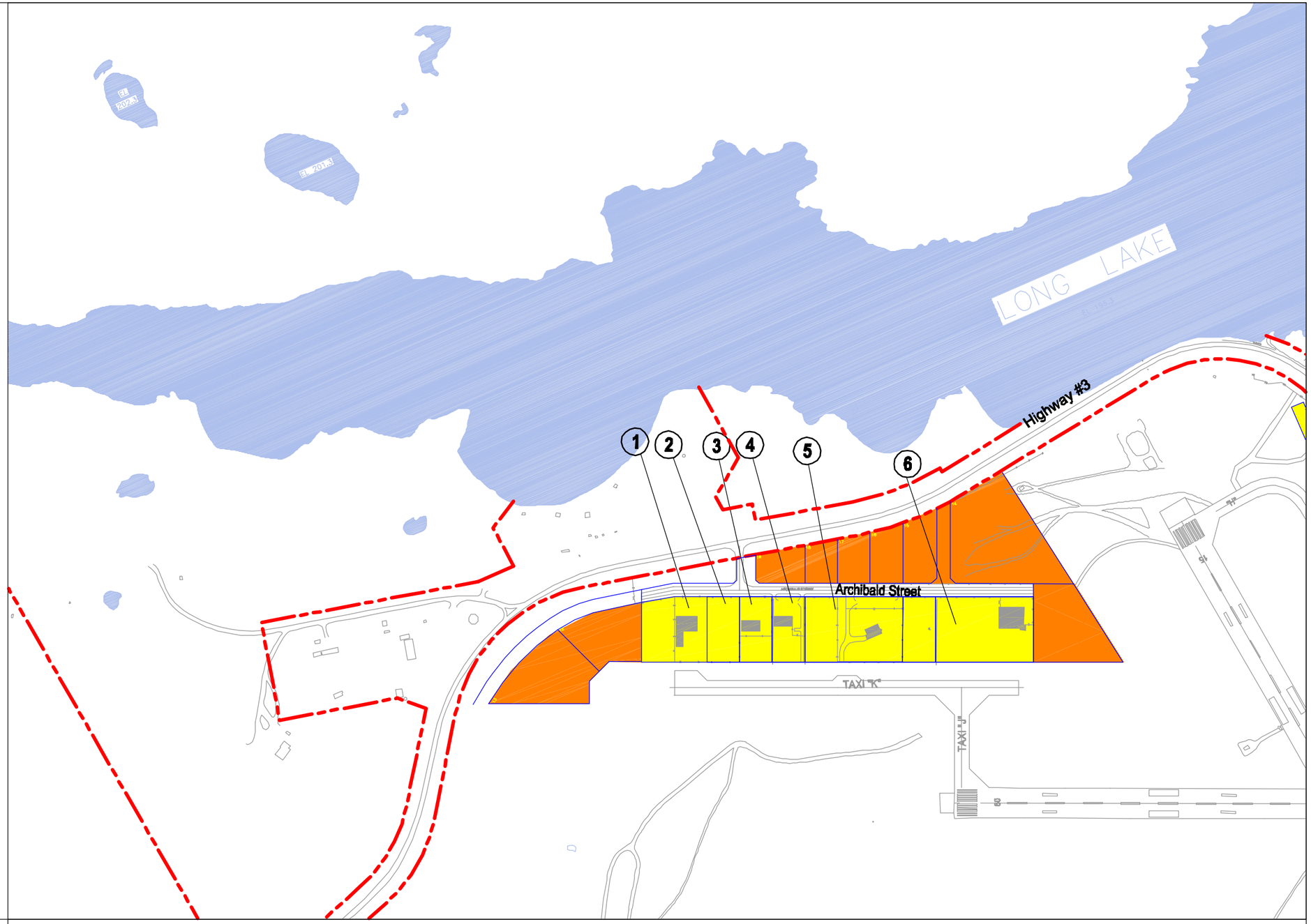
Legend

1 Diavik Diamond Mines Inc.
2 Laurelton Diamonds Inc.
3 994589 NWT LTD.
(Arselanian Cutting Works)
4 Sirius Diamonds NWT Ltd.
5 BHP Diamonds Inc.
6 Diamond Air Inc.
(Adlair Aviation)

Commercial Lease

Vacant

Airport Boundary



Northwest Territories Transportation

Figure 5-3: Land Parcel Development (2004) - Northwest Quadrant

DATE: November, 2004

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With regional economic growth expected to continue fuelling demand for additional land parcels at the airport for the foreseeable future, future land take-up is expected to follow a similar pattern to that observed over the past few decades. Future land take-up will however experience some periodic fluctuations resulting from peaks in economic activity and new incremental demand derived from potential new air services.

Consistent with the take-up rate described above (approximately 3.4% p.a.), the continuation of this overall trend could result in more than 14ha of land needed to accommodate new land tenants at the airport development by 2013 – above and beyond the incremental land needed for expansion of the passenger terminal complex. New land requirements for airport tenants could surpass 33ha by the end of the planning period. In both cases, requirements will surpass the land capacity of the northern quadrants.

In light of the land capacity shortfall, the expansion of existing airport facilities, such as the PTB, will be difficult to achieve without relocating some existing tenants and/or airport functions, given the current layout of the airport site and the size and location of available land parcels.

5.4 Site Inspection

5.4.1 Land Characteristics

The airport site is relatively flat, with escarpments at the extreme southern end of the site and along the shore of Long Lake, in proximity to the northern end of Runway 15-33 and Taxiway H. The latter characteristic limits options for expansion of existing apron and taxiway facilities in this area.

The airport is built on top of a sand deposit overlying granitic bedrock of Precambrian origin (Canadian Shield). The northern and western portions of the site are predominantly composed of sands and gravel, while large portions of the soil in the southeast quadrant consist of silts and clays. The latter conditions considerably constrain the development potential of the southeast quadrant.

The site lacks permanent streams that would enable adequate natural surface and subsurface drainage. Prevailing soil conditions and topography are also believed to impede the natural drainage of surface waters around the airport's runways and taxiways. A system of ditches and culverts manages storm and melt water drainage from this area.

Subsurface drainage from the northern quadrants occurs towards Long Lake, and from the southern quadrants towards Frame Lake and Range Lake. The water table is believed to be relatively high, ranging from 1.5 to 2m below the surface. The extent of marshland on the site varies according to prevailing climatic conditions.

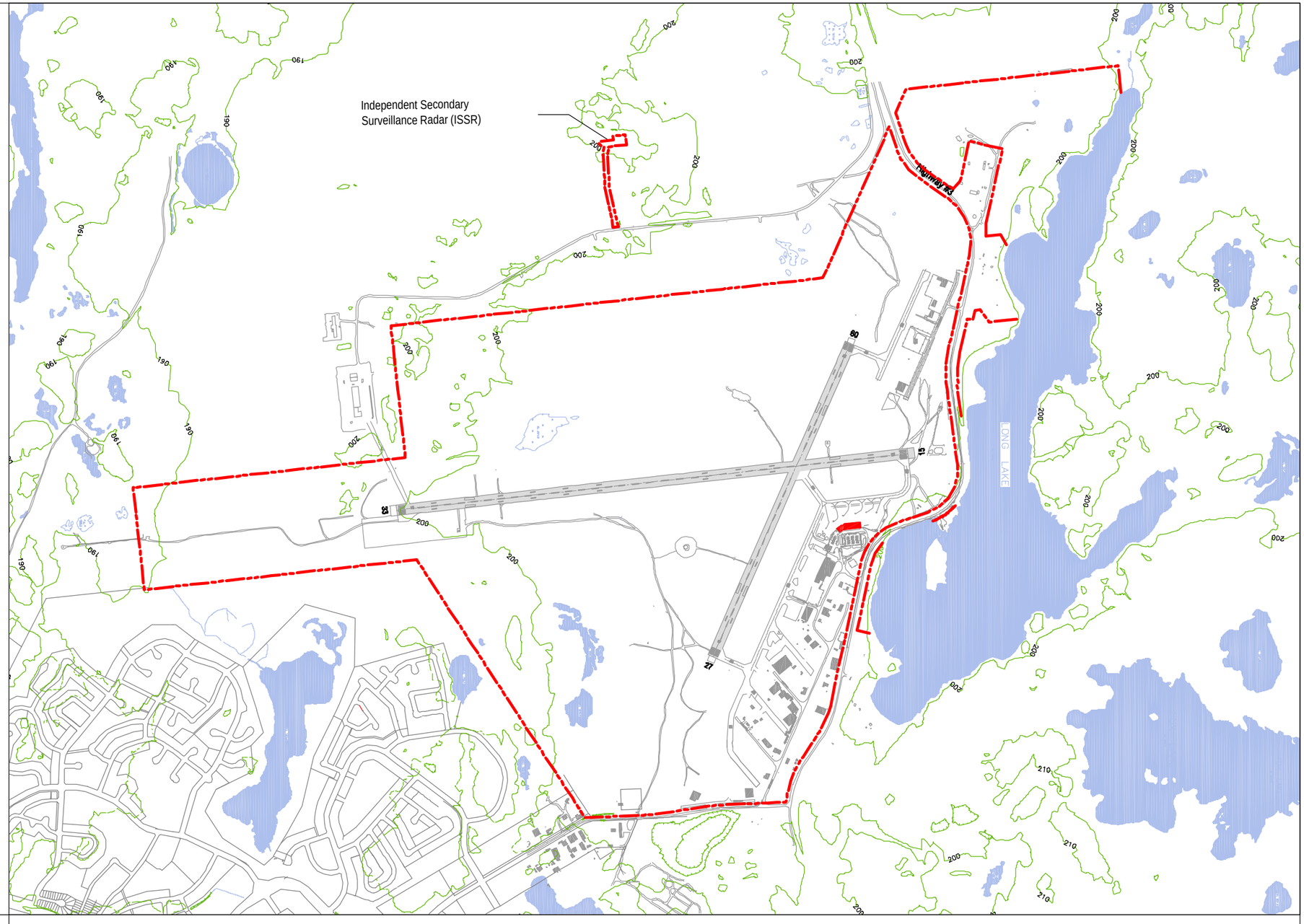
Figure 5-4 (page 5-8) depicts the overall physical characteristics of the site.

LEGEND:

Water

Horizontal Contours (Elevation m)

Airport Boundary



N

0m 500m

Source:
Government of the Northwest Territories,
Department of Transportation, 2001.

Northwest Territories Transportation

Figure 5-4: Airport and Environs Physical Characteristics

DATE: November, 2004

For planning purposes only

5.4.2 Environmental Condition

The Yellowknife Airport was last subjected to a full environment audit in 1993,[1] and an *Environmental Baseline Study (EBS)* in 1994.[2] Both the environmental audit and EBS involved a review of historical documents and data to identify sites where former activities may have discharged environmental hazardous materials, vapour surveys where bulk fuel storage had occurred, and surveys of present day tenant activities.

Since completion of the 1993 *Environmental Audit*, a Remedial Action Plan has been put forward to address outstanding areas of environmental concern. Some sites have been remediated as a result. A number of areas still require monitoring or implementation of additional measures to ensure the long-term environmental management of the airport site. The latter sites do not pose any immediate threat to public health or safety, although some areas will require remediation before development or redevelopment occurs.

In December 2002, EBA Engineering Consulting Ltd., under a contract with the Airports Division conducted an environmental review of the Yellowknife Airport. The objective of the review was to identify potentially contaminated areas that were not previously identified, and to determine if issues of environmental concern remained outstanding.

The review yielded several outstanding and new environmental concerns/issues. These concerns and issues have been previously presented to Transport Canada prior to the July 2001 deadline for identification of hazardous substances, as per clause 8.9 of the *GNWT/Transport Canada Arctic A Airport Transfer Agreement*. A summary of the areas that continue to be of environmental concern for soil and groundwater contamination is provided in Appendix C.[3]

5.5 Airport Environs

The Yellowknife Airport is situated on the urban fringe of the City of Yellowknife. Most urban development is situated to the east of the airport. Land uses immediately to the east of the site are varied, with residential, commercial and industrial activities occupying most of the adjacent land area. More specifically, the Old Airport Road corridor comprises considerable industrial and more recently built large-scale commercial businesses, while the Range and Frame Lakes areas are primarily occupied by residential development. The Kam Lake area, situated at the southern end of the urbanised area, is zoned for industrial activities although some residential development occurs in the subdivision to accommodate individual caretaker residences. Further to the east of the airport site lies the city's Central Business District (CBD).

5.5.1 Community Planning

General Plan

The City of Yellowknife and the GNWT are responsible for land use and development planning in the Yellowknife region. Land uses around the airport site are guided by the City of Yellowknife, General Plan, and controlled through municipal Zoning By-laws.

The recently released the *2004 General Plan (Draft)* recognises the importance of ensuring compatible airport vicinity land uses and proposes a strategy that manages residential growth through infill and directing new development in appropriate sectors of the city.

Over the long-term period, the City intends to allow development to the west of the airport site, in conjunction with the future airport site development discussed later in this document. In particular, encouraging industrial development adjacent to the airport site and residential development further to the west. Development of this quadrant would be enabled once connection to municipal services are possible and would likely involve the realignment of the FOL Road and connection with Deh Cho Boulevard to the south of the airport site. The latter project would also accompany future airport development and is also outlined later in this document.

Municipal Zoning

In 1998, the City adopted the *Zoning By-law No. 4024* that identifies the permissible land uses within the Airport Environs Zone and along airport land abutting Highway #3 and Old Airport Road.[4] The Zoning By-law permits a number of industrial, commercial and recreational land uses within the Airport Environs Zone. Specifications of the permitted land uses and site development requirements can be referenced at www.city.yellowknife.nt.ca.

Consistent with the land use layout described earlier, the Kam Lake subdivision is zoned for industrial purposes (albeit permitting low density residential development to accommodate caretaker housing). The Frame and Range Lake subdivision are primarily zoned for residential uses. The proximity of the latter subdivisions to the airport site is a concern due to the incompatibility that exists between residential activities and relatively noisy aircraft operations.

Capital Area Development Scheme

The airport site is also located within the Capital Area. In 1996, the GNWT and the City of Yellowknife prepared the *Capital Area Development Scheme By-law No. 3934*. The Scheme provides the conceptual framework within which the future development and preservation of the Capital area will occur. The Scheme is also intended to reinforce the image of the City of Yellowknife as the Capital of the Northwest Territories. The goals and objectives set out in the Development Scheme cover building design, environmental protections and the use of land.

Of particular relevance for airport development is a requirement that a 20m landscaped buffer be provided between all development and the right-of-ways of Highway #3 and Old Airport Road. Specifications are also provided with respect to land uses, lot access and landscaping characteristics. The *Capital Area Development Scheme By-law* may be referenced at www.city.yellowknife.nt.ca.

5.5.2 Noise Exposure

The aviation noise environment in the vicinity of an airport is dependent upon a number of factors, such as:

- The volume and mix of aircraft traffic;
- The proportion of day and night operations that occur at the airport;
- Departure and arrival flight routings as dictated by wind and weather conditions;
- Airport configuration;

- Air carrier and air navigation operational practices; and
- The number of people living nearby.

The GNWT and the Yellowknife Airport are sensitive to the impact of aircraft noise on the neighbouring community. While individual reaction to noise is highly variable, planning tools are used to predict the levels of noise impacts generated by aircraft operations to assist in making land use and zoning decisions.

The Noise Exposure Forecast (NEF) is the officially recognised planning tool in Canada for airport noise assessment. These calculate the sound generated by individual aircraft types operating, or expected to operate, at the airport, and adjust for the number of operations that are forecast to occur.[5] Noise is represented by the illustration of noise contours to designate areas of equal noise exposure and provide information to assist in planning for compatible land uses. Transport Canada requires that noise exposure maps depict the 40, 35, and 30 contours. At extended distances from aircraft flight paths, ambient noise levels typically dominate. Since the NEF is a computer-generation of a compendium of factors, it cannot be directly related to decibel noise measurements.

To identify current conditions at the Yellowknife Airport, noise contours were prepared to reflect 2001 operations, as well as NEFs for the 2021 period. These are shown in Figure 5-5 and Figure 5-6 (pages 5-12 and 5-13).[6] Details of the methodology and assumptions used in the preparation of the noise contours can be referenced in the *Development of NEF Contours – Yellowknife Airport*[7] report.

2001 Noise Contours

The 2001 Noise Contours are influenced mainly by operations on Runway 15-33, with a lesser level of activity on Runway 09-27. Noisier jet aircraft operations (B 737-200, Fokker F28) dominate the noise contours, with B 737 operations on Runway 15-33 being particularly important. As a result of the location of the existing Passenger Terminal Building near the end of Runway 33 and when weather conditions permit, these aircraft favour arriving on this runway, and departing in the opposite direction on Runway 15.

The large 'bulge' in the contours to the northwest of the airport, beyond the intersection of Runway 15-33 and Runway 09-27, is due to aircraft departing on Runway 33 and turning to en-route headings. The similar 'bulge' to the southeast of the airport reflects similar turns by aircraft departing on Runway 15 and turning southeast to their en-route headings.

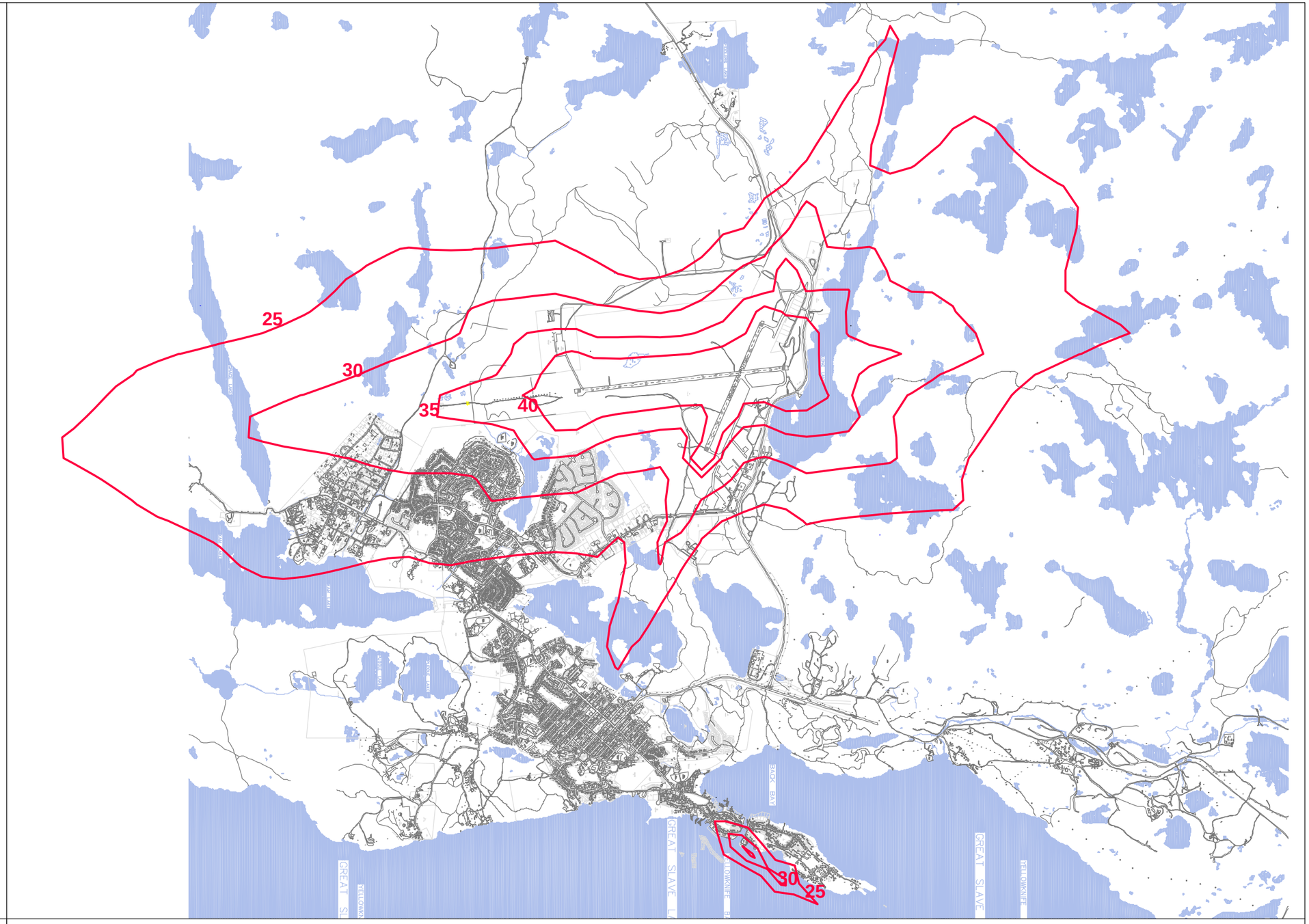
Transport Canada standards indicate that land areas situated within the 30 noise exposure contour and above are inappropriate for residential activities.[8] Based on 2001 aircraft operations, portions of the Frame, Range and Kam Lakes subdivisions are situated within this noise exposure area.

2021 Noise Exposure Forecast Contours

The 2021 noise exposure area shown in Figure 5-6 (page 5-13) is expected to be significantly smaller than that occurring in 2001 (see Figure 5-5, page 5-12). The reduction in noise exposure is expected to be a direct result of the gradual replacement of the existing aircraft fleet operating to and from the airport with quieter aircraft.

LEGEND

2001 NEP Contours
(Existing Runway)



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0m 1000m 2000m

Northwest Territories Transportation

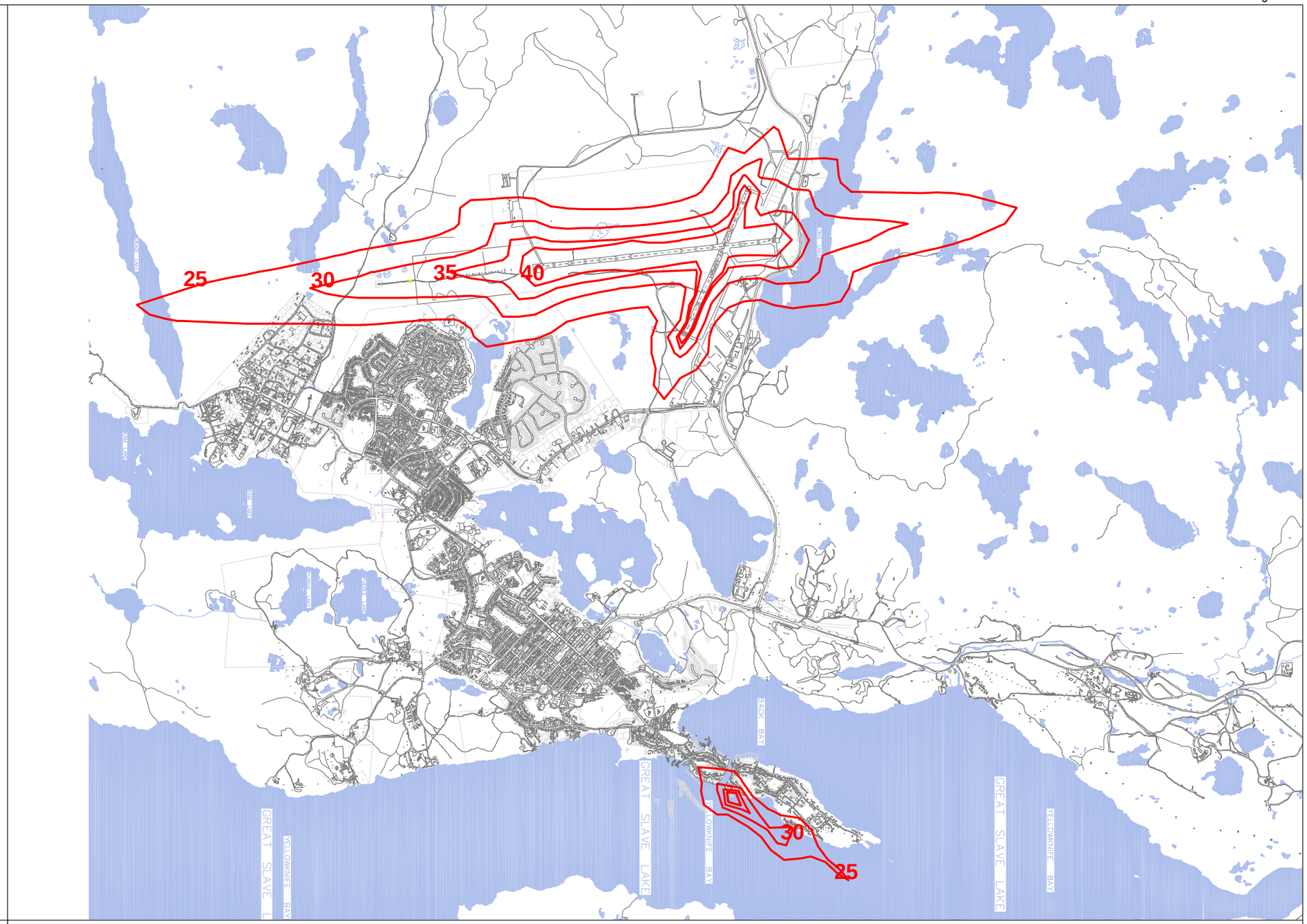
Figure 5-5: 2001 Noise Contours

DATE: November, 2004

For planning purposes only

LEGEND

2021 NEF Contours
(Existing Runway)



N

0m 1,000m 2,000m

Northwest Territories Transportation

Figure 5-6: 2021 Noise Exposure Forecast (NEF) Contours

DATE: November, 2004

For planning purposes only

The replacement of the fleet will occur as aircraft reach the end of their life cycle or as air carriers procure newer generation aircraft that provide increased fuel efficiency. These new generation aircraft are not only significantly quieter but have a better power to weight ratio, enabling them to climb at higher rates on takeoff. The consequence of these effects (lower noise emission and better climb rate) is not only limited to the shrinkage of the noise exposure areas but also the elimination of the 'bulges' in current contours discussed previously.

The replacement of the aircraft fleet will benefit those subdivisions identified above that are currently within the 30 noise exposure contour. The reduction in the noise exposure envelops will displace the 30 NEF contour closer to the runway, and move away from the inhabited areas adjacent to the airport site.

5.6 Potential Development Sites

The assessment of the layout, occupancy and land characteristics of the airport site indicate:

- Only few lot parcels (approximately 8ha) remain available to accommodate new land tenants in the northern quadrants, with very limited land currently available in the northwest quadrant (0.5ha).
- A negligible amount of land is available to accommodate expansion of the passenger terminal complex (i.e. PTB, main aircraft parking apron, passenger terminal curb, public vehicle parking area, and associated access roads).
- The escarpments at the northern end of the site limit options for expansion of the main aircraft parking apron and associated taxiway access.
- The Capital Area Development Scheme restrictions related to development along the Highway #3 corridor considerably limit the ability to maximize utilisation of the northern quadrants.

Given these conditions, selection of a new site(s) capable of accommodating demand beyond the current capacity of the developed northern quadrants is required. The southwest (west-side) and southeast (East-side) quadrants possess vast amounts of land that could eventually be used to this effect (up to 105ha and 82ha, respectfully). Table 5-2 (below) outlines the development issues relative to each of these quadrants.

Table 5-2: Site Development Issues

	West-side Development	East-side Development
Site Development Characteristics	Greenfield nature of the site provides maximal flexibility in accommodating immediate and long-term development requirements. Site topography and soil composition (sand and gravel) easily capable of accommodating development. Some rock outcroppings exist in the southwest quadrant, which may impact future development feasibility of adjacent commercial lots.	Site is currently unoccupied except for the presence of the VORTAC navigational aid. The presence of the VORTAC imposes restrictions on development on the site. Soil composition (silts and clays) limit the development potential of a portion of the site.

Table 5-2 (cont'd)

	West-side Development	East-side Development
Operational Considerations	Provides improved airside access to Runways 09 and 33. Increases taxiing time to Runways 15 and 27. Greenfield site can easily incorporate de-icing operations and provide flexibility in accommodating future dedicated facilities.	Provides improved airside access to Runway 33. Increases taxiing time to Runways 15 and 09. VORTAC will require relocation to enable site development.
Land Use Implications	Enables new development projects to be directed to the west-side prior to construction of new airport infrastructure. Opportunity to fully exploit 105ha west-side land asset. Provides flexibility in planning for and accommodating potential future PTB complex on the west-side. This could eventually require relocation of major air carrier and fuel facilities from northeast to southwest quadrant to ensure long-term operational efficiency and minimize airfield ground movements.	Enables new development projects to be directed to the east-side quadrant prior to construction of new airport infrastructure. Only a portion of the total 82ha of land can be easily developed due to prevailing soils composition. Triangular shape of east-side land area ill-suited for accommodating potential future PTB complex and associated development.
Access Issues	Requires upgrade to FOL Access Road to improve site access. Access can be developed in partnership with City of Yellowknife.	Requires road connections with Old Airport Road. Will increase traffic flows and congestion along Old Airport Road.
Other Issues	Consistent with municipal growth strategy that favours long-term development to the west of the airport site. Provides opportunity to spur urban development to the west of the airport site, and offset costs related to eventual water and sewage network development in this area.	Water and sewage services may be enabled through direct connection with existing municipal network to the east of the site. Inconsistent with municipal growth strategy that favours long-term development to the west of the airport site.

5.7 Evaluation and Proposed Site for Long-term Development

Given the high cost associated with access and site services, new development cannot be simultaneously accommodated in both southern quadrants. The west-side of the airport site will require greater road access and water and sewage infrastructure compared to those that would be required on the east-side of the site. Although the associated servicing cost would likely be lower on the latter site, enabling development to occur here would require relocation of the VORTAC navigational aid, and could considerably impact traffic flows in adjacent commercial and residential neighbourhoods.

The flexibility afforded by the size, layout and soil composition of the west-side, coupled with municipal strategies to direct future urban growth to the west of the airport site, favour the opening of the west-side of the airport site. Directing future airport development to this area would create the necessary synergy to enable the airport to grow in partnership with the territorial capital, and position the western edge of the municipality to effectively accommodate future growth.

In addition, opening the site for new development would afford the possibility of relocating the passenger terminal complex to a location more appropriately suited for longer-term expansion. The size of the greenfield site would provide opportunity to locate the Passenger Terminal Building at

the mid-point of Runway 15-33. Thus reducing reliance on Runway 33 for arrivals and Runway 15 for departures, and improving operational efficiencies.

The development of the west-side of the site will be driven by individual airport development projects that will occur over the course of the 20-year planning period. A strategy consistent with this proposal and that will enable the development of this quadrant is presented in detail in Section Five – Systems Integration.

5.8 Notes and References

[1] *Report of Findings, Environmental Audit, Yellowknife Airport*; Transport Canada, Airports, Western Region; 1993.

[2] *Yellowknife Airport Environmental Baseline Study*; Dillon Consulting, March 1995.

[3] The environmental status was last updated by the Environmental Affairs section of the GNWT, Department of Transportation in July 2002.

[4] Land use definitions contained in By-law 4024 where further amended through By-law 4028 to include diamond facilities in the permitted use table.

[5] Due to the higher social impacts of night-time noise, aircraft movements at night are factored to have 16.7 times the impact of daytime movements. For the purpose of NEF calculations, night-time hours extend from 10 p.m. to 7 a.m.

[6] The contours remain preliminary unless officially approved by Transport Canada.

[7] *Development of NEF Contours – Yellowknife Airport, Final Report;* Inter*VISTAS* Consulting Inc. and UAL Urban Aerodynamics Ltd., August 2004.

[8] *Land Use in the Vicinity of Airports (TP 1247E), 7th Edition;* Transport Canada, 1996.

Section Two – Airside Development

Introductory Notes

The airside facilities consist of the components necessary to support aircraft operations. They comprise the runway and taxiway system, apron surfaces, visual and landing aids and airside operations support infrastructure. The capabilities, capacity and usability of the airside system under a wide-range of conditions must be consistent with the operating requirements of the air carrier markets the airport seeks to serve.

This section provides a description of the airport's airside facilities, and delivers an assessment of future requirements, predicated on the aviation activity forecasts contained in Chapter 3.0 – Forecasting for Planning Purposes.

Planning Principles and Assumptions

Airside planning in this document is directed by the strategic objectives for the Yellowknife Airport. It is undertaken in accordance with the following principles and assumptions:

- Safety is always the first priority.
- Security is a high priority but secondary to safety.
- Airports are available for use 24-hours per day unless restricted by NOTAM. Airport services at airports such as Air Traffic Control, Flight Service Stations, Emergency Response Services, airside maintenance, fuel and other services are published in NAV CANADA, Canada flight Supplement. The Yellowknife Airport normally operates with full services on the basis of a 16-hour day.
- Land must be preserved to provide new capacity, when justified by increased demand.
- Airside system operating efficiency must be optimised to control costs, where appropriate, for the airport operator and/or the air carriers using the airport.
- Current 'primary' infrastructure designations may be reconsidered when new facilities are developed on the west-side of the airport site.

The identification of current deficiencies, future infrastructure requirements and development options are based on the criteria outlined below.

- Aerodrome Reference Point: N62^{o} 27' 47"; W114^{o} 26' 25"
- Aerodrome Reference Point Elevation: 199m Above Sea Level (ASL)
- Airport Reference Temperature: 20.8^{o} C
- Aerodrome Reference Code : 4C
- Planning Aircraft:
  Primary Runway(s) and Primary Taxiway(s) – Code E aircraft
  Existing PTB Apron – Code C and D aircraft
  Long-term 'primary' apron – Code E aircraft

6.0 Runways and Taxiways

6.1 About this Chapter

This chapter examines the Yellowknife Airport's runway and taxiway system, incorporating demand/capacity analysis with market-driven infrastructure requirements. Imaginary surfaces extending beyond the physical limits of the runway system – the Obstacle Limitation Surfaces and derived Aeronautical Zoning Regulations – are also presented.

Specific aviation terminology used in this section is defined below:

Aerodrome Reference Point – The designated point or points on an aerodrome normally located at or near the geometric centre of the runway complex that establishes the locus of the radius or radii of the outer surface (as defined in the Zoning Regulation).

Clearway – A defined rectangular area on the ground or water under the control of the appropriate authority, selected or prepared as a suitable area over which an aeroplane may make a portion of its initial climb to a specified height.

Contaminated Runway – A contaminated runway has standing water, slush, snow, compacted snow, ice or frost covering more than 25% of the required length and width of its surface.

Federal Aeronautical Zoning Regulations – A regulation respecting a given aerodrome pursuant to Section 4 of the Aeronautics Act.

Glidepath – A descent profile determined for vertical guidance during a final approach.

Instrument Approach Procedure – A series of predetermined manoeuvres by reference to flight instruments for the orderly transfer of an aircraft from the beginning of the initial approach to a landing, or to a point from which a landing may be made.

Instrument Flight Rules (IFR) – A set of rules governing the conduct of flight under instrument meteorological conditions.

Instrument Landing System (ILS) – Radio navigation system that provides aircraft with horizontal and vertical guidance during an approach landing. ILS equipment includes a localiser for azimuth guidance and glidepath transmitter for vertical guidance. There are three categories of ILS – each providing specific decision height minima and visual ranges for runway approach procedures.

ILS Category I – An approach procedure to a height above touchdown of not less than 61m and with runway visual range of not less than 549m.

Instrument Meteorological Conditions (IMC) – Meteorological conditions less than the minima specified in Subpart 602 of the *Canadian Aviation Regulations* (CARs) for visual meteorological conditions (VMC), expressed in terms of visibility and distance from cloud.

Localiser – The component of an Instrument Landing System (ILS) which provides lateral guidance with respect to the runway centreline.

Obstacle Limitation Surfaces – A surface that establishes the limit to which objects may project into the airspace associated with an aerodrome so that aircraft operations at the aerodrome may be conducted safely.

Pavement Load Ratings (PLR) – Numbers expressing the bearing strength of a pavement for unrestricted aircraft operations. PLR are expressed on a scale of 1 (weakest pavements) to 12 (strongest pavements).

Power Plant – The source of propulsion. For example, piston engines, turboprop and jet engines. 'Helicopters' include both piston and turboshaft-driven engines.

Precision Approach – Instrument approach using azimuth and glide path information provided by an instrument landing system or a precision approach radar.

Runway – A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

Runway Identification Lights (RILS) – Two uni-directional flashing strobe lights situated at the approach end of the runway.

Runway Strip – A defined area including the runway and stopway intended to reduce the risk of damage to aircraft running off a runway; and to protect aircraft flying over it during take-off or landing operations.

Stopway – A defined rectangular area on the ground at the end of a take-off run available prepared as a suitable area on which an aircraft can be stopped in the case of an abandoned take-off.

Taxiway – A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another.

Taxiway Strip – An area including a taxiway intended to protect an aircraft operating on the taxiway and to reduce the risk of damage to an aircraft accidentally running off the taxiway.

Visual Flight Rules (VFR) – Rules that govern the procedures for conducting flight under visual conditions.

Weight Group – The classification of weight classes in groups for statistical purposes.

6.2 Runway and Taxiway Characteristics

6.2.1 Runways

The Yellowknife Airport airside system has two intersecting runways, as illustrated in Figure 6-1 (page 6-4). The characteristics of the runways are described below. Runway data is summarised in Table 6-1 (following page).

- **Runway 15-33** is the primary runway, 2,286m long, 45m wide, with two taxiway exits at the north end. Runway 33 is the main instrument runway, certified to 4C precision standards and equipped with a Category I Instrument Landing System (ILS). The runway is in good condition, but with some surface unevenness due to permafrost degradation/freeze-thaw activity.

- **Runway 09-27** is a secondary runway, 1,524m long, 45m wide and certified to 3C non-precision standards, but is protected by Registered Zoning and by the *Airport Operations Manual* for precision operations.[1] The condition is good apart from unevenness due to permafrost degradation/freeze-thaw activity.

Table 6-1: Runway Data for Yellowknife Airport

Runway	15	33	09	27
Reference Code	4C	4C	3C	3C
Approach	Non-precision	Precision	Non-precision	Non-precision
Runway Dimensions	2,286m x 45m	2,286m x 45m	1,524m x 45m	1,524m x 45m
Clearway dimensions	305m x 152m	305m x 152m	305m x 152m	305m x 152m
Stopway length	Nil	Nil	Nil	Nil
Strip dimensions	2,406 X 300m		1,643 X 300m	

Source: Yellowknife Airport Operations Manual, 2003.

Table 6-2 (below) illustrates the annual percentage of use for each runway by 'Itinerant' traffic, based on 2001 data. Runway use is determined by wind direction, weather conditions, aircraft operating requirements and noise management considerations. Runway 15-33 predominates as the most used runway with 57% of movements, split almost equally between each direction. Runway 09-27 accounts for 36%. Again, fairly evenly split between the two directions.

Table 6-2: Runway Usage (2001)

Runway	Day Movements (7AM - 10PM)			Night Movements (10PM - 7AM)			Total Movements
	Arrivals	Departures	Total	Arrivals	Departures	Total	
Runway 09	22%	13%	17%	17%	16%	17%	17%
Runway 15	20%	37%	29%	18%	40%	25%	28%
Runway 27	13%	25%	19%	6%	25%	12%	18%
Runway 33	38%	19%	28%	56%	14%	43%	30%
Helicopter	7%	7%	7%	2%	3%	2%	7%
Overshoot	0%	0%	0%	1%	2%	1%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Inter*VISTAS* Consulting, 2001.

LEGEND

Airport Boundary

00 Runway Designators

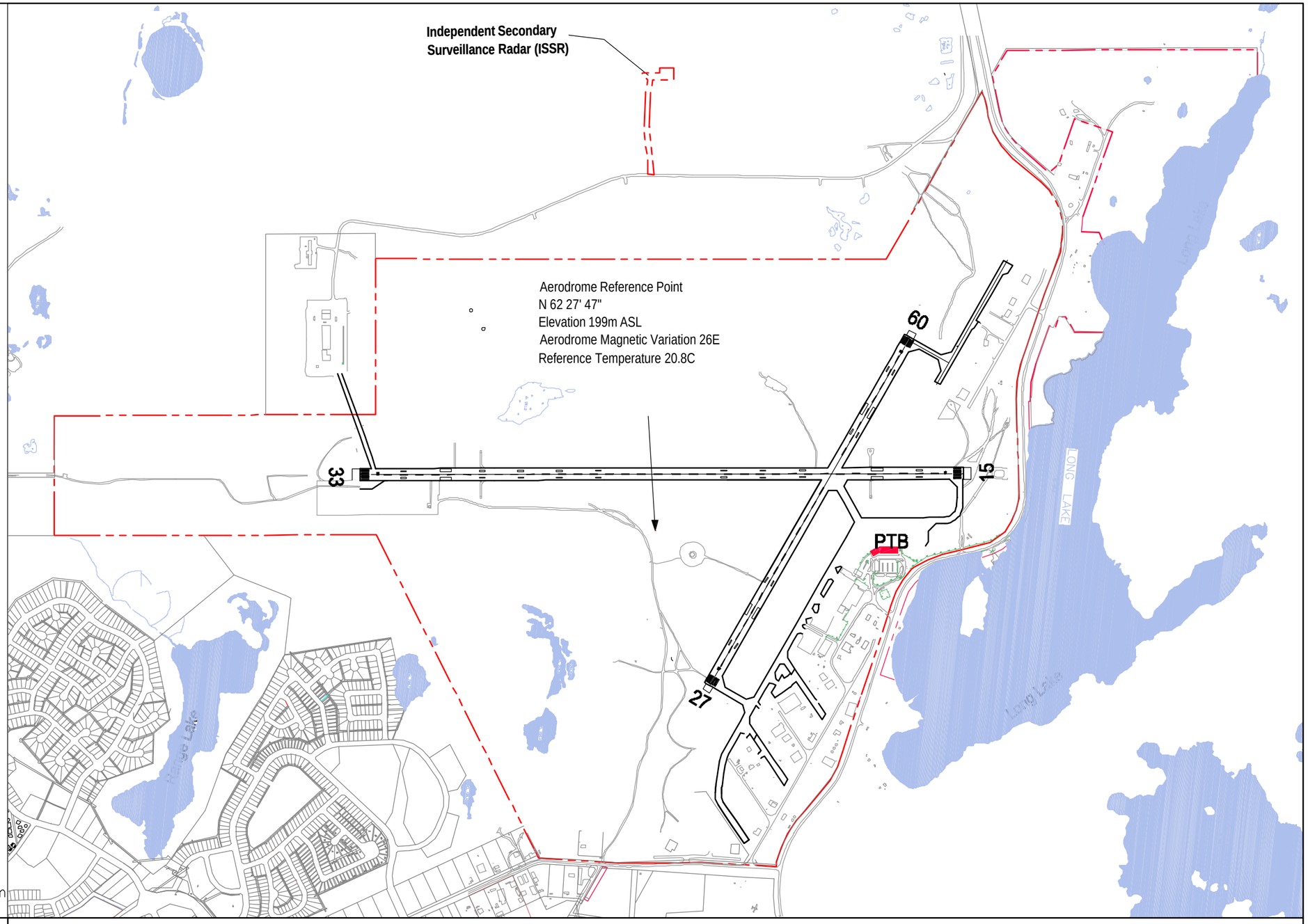


Figure 6-1: Existing Runway System

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DATE: November, 2004

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6.2.2 Taxiways

The Yellowknife Airport possesses a relatively limited taxiway system. The taxiway system connects the north side of the runway system with the airport's aircraft parking aprons and existing airside accessible tenant lots. Table 6-3 (below) provides details of the physical characteristics of the various taxiways. The taxiway system is illustrated in Figure 6-2 (page 6-6).

Table 6-3: Taxiway Data for Yellowknife Airport

Taxiway	A	B	C	D	E	F	G	H	J	K
Reference Code	E	C	C	C	C	C	C	C	C	C
Taxiway Width	30m	23m	23m	23m	23m	23m	15m	23m	23m	23m
Strip Width	93m	57m	57m	57m	57m	57m	57m	57m	57m	57m

Source: Yellowknife Airport Operations Manual, 2003.

The existing taxiway system is a limiting factor for runway utilisation and capacity. The absence of a parallel taxiway south of the intersection of Runways 15-33 and 09-27 for access to or from Runway 33 creates runway occupancy problems and increased aircraft operation costs. Aircraft departing on Runway 33 must taxi on the runway. Aircraft landing on Runway 33 must taxi on the runway until they reach Taxiway A. These operations require extended runway occupancy time and cost to the aircraft operator.

Aircraft departing on Runway 09 from all areas except the northwest quadrant must taxi on the runway. Aircraft landing on Runway 27 must taxi on the runway unless they can exit at Taxiway A. These operations require extended runway occupancy time and costs to the aircraft operator. Taxiway B is the only true parallel taxiway at the airport. However, Taxiway B must contend with two-way traffic demand. This situation can cause delays.

6.2.3 Pavement Strength

Runway and taxiway surfaces should be capable of withstanding the traffic of aeroplanes they are intended to serve. All runway and taxiway surfaces at the Yellowknife Airport possess a Pavement Load Rating (PLR) 12.[2] This PLR indicates the strongest rated bearing strength for aircraft manoeuvring surfaces, and enables the runways and taxiways to accommodate all current and planned production aircraft.

LEGEND

Airport Boundary

"X" Taxiway Designators

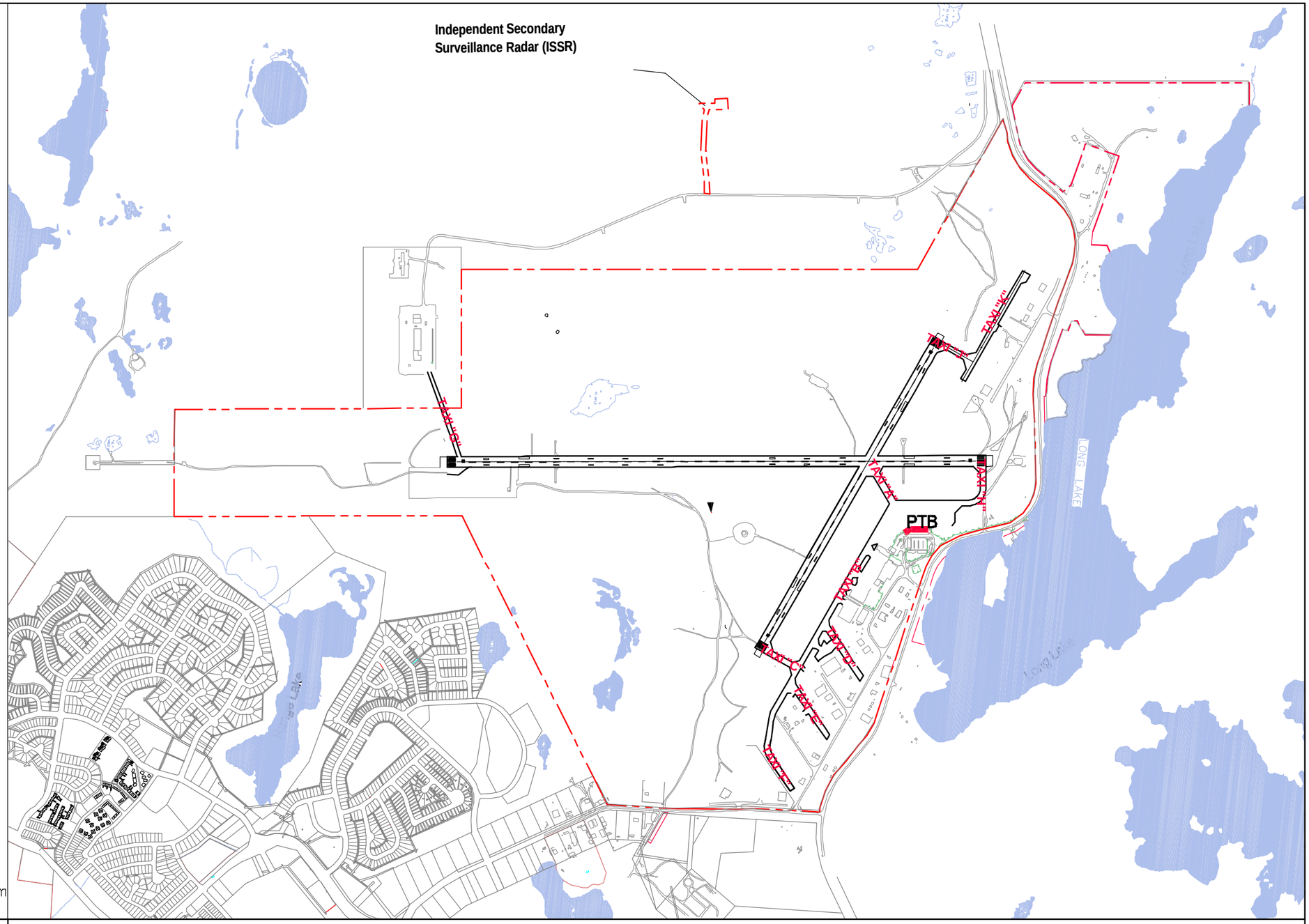

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Figure 6-2: Existing Taxiway System

DATE: November, 2004

For planning purposes only

6.2.4 Imaginary Surfaces – Airport Zoning and Obstacle Limitation Surfaces

Airport land must conform to *Obstacle Limitation Surface* (OLS) standards, as defined by Transport Canada in *Aerodrome Standards and Recommended Practices,*[3] and typically established in accordance with the certification of individual runways. The OLS are illustrated conceptually in: *Aerodrome Standards and Recommended Practices (TP312E), 4th Edition*; Transport Canada, 1993.

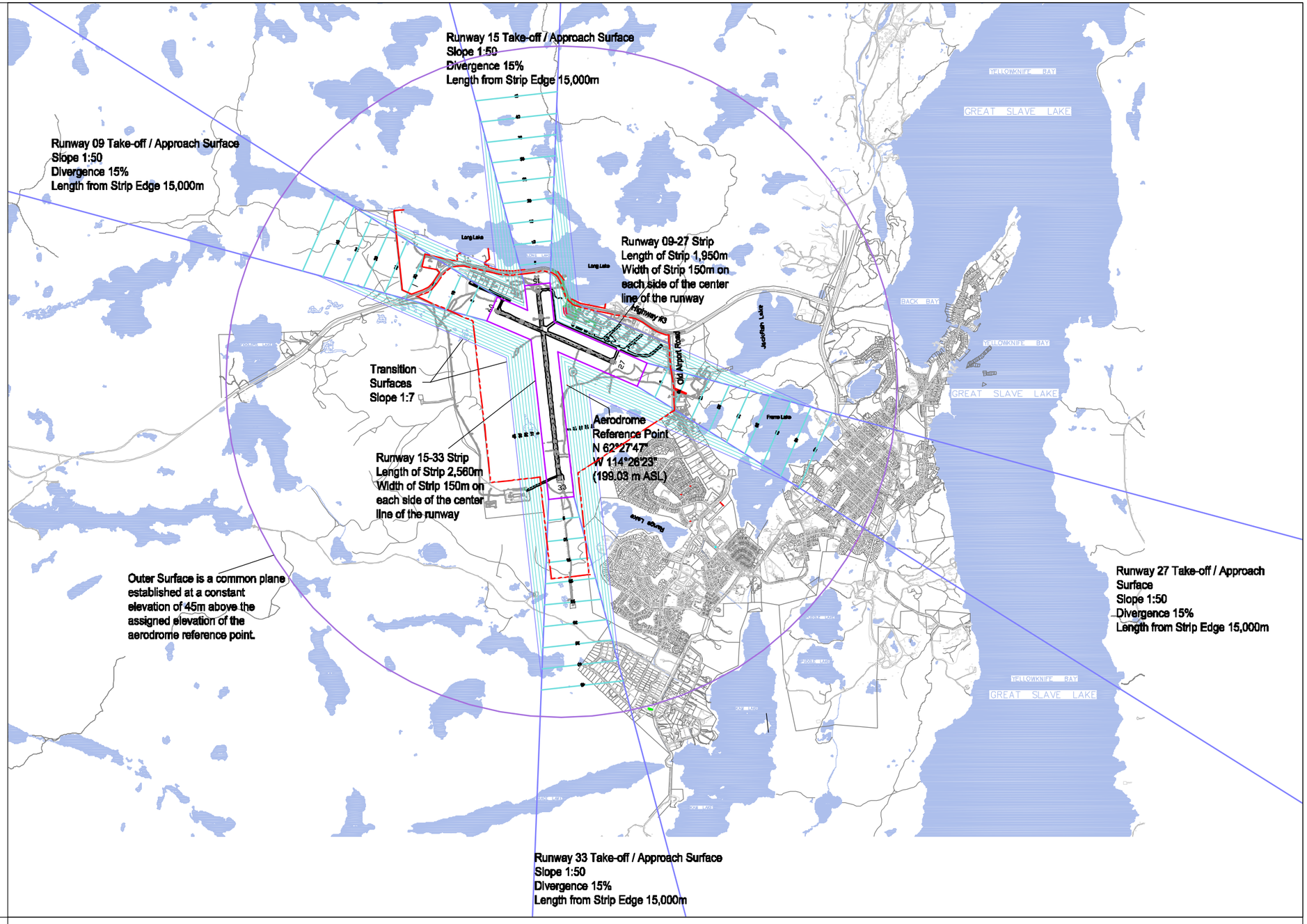
Land surrounding the airport site is protected by Federal Aeronautical Zoning Regulations, as defined in the *Yellowknife Airport Zoning Regulations* and shown on the Federal Department of Transport's *Yellowknife Zoning Plan* dated June 12, 1981. The Zoning Regulations are enshrined in the Federal Aeronautics Act. The Registered Zoning Plan is typically an extension of applicable *Obstacle Limitation Surfaces* beyond the airport site. Illustration of the Yellowknife Airport Zoning is provided in Figure 6-3 (page 6-8). The *Yellowknife Airport Zoning Regulations* can be referenced at www.tc.gc.ca (search words: Yellowknife Airport Zoning). A copy of the *Yellowknife Airport Zoning Regulations* are on file at the GNWT Land Titles office in Yellowknife for reference purposes.

The OLS and Zoning Regulations prohibit the erection of any structure that may compromise unobstructed safe aircraft operations. The maximum height of any structure is governed by its proximity to the runways, taxiways and any electronic or navigational aid equipment. Off-airport land affected by these Regulations is annotated on the Land Title to alert owners of the restrictions. All development located on and off the airport site is subject to these restrictions and guidelines.

LEGEND

- Runway Strip Outline
- Transitional and Approach Surfaces Outline
- 00 Height Maximums (m above runway reference level)
- Airport Boundary
- Outer Surface

Note:
Aeronautical surfaces consistant with Transport Canada *Aerodrome Standards and Recommended Practices (TP312E)*



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0m 1000m 2000m

Northwest Territories Transportation

Figure 6-3: Existing Yellowknife Airport Zoning

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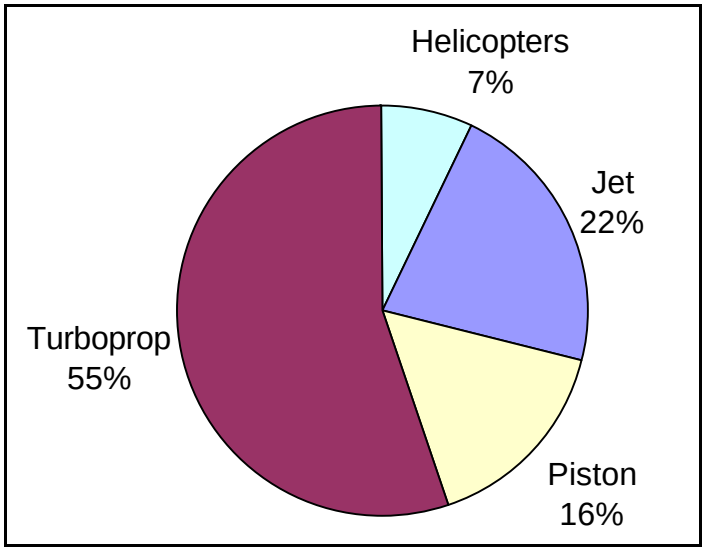
6.3 Aircraft Operations

The figures below present a breakdown of the chief characteristics of aircraft operations during 2001. An analysis of these components is important for assessing airfield capacity, as well as for understanding runway usage and seasonal patterns.

6.3.1 Type of Power Plant

The power plant type is an important factor in assessing airfield requirements because of the different operating characteristics associated with jet and turboprop aircraft, and helicopters.[4] As shown in Figure 6-4 (below), turboprop aircraft are the dominant aircraft type making up 55% of traffic. Based on input provided from air carriers and expected growth of the northern aviation market, the current mix of turboprops and jets is estimated to continue over the planning period.

Figure 6-4: Aircraft Power Plant Type (2001)



Source: Inter*VISTAS* Consulting, 2001.

6.3.2 Aircraft Weight Group

For air traffic control purposes, aircraft are classified in different categories based on the Maximum Take-off Weight (MTOW), as shown in Table 6-4 (below).

Table 6-4: Aircraft Weight Groups

Category	Maximum Take-off Weight (MTOW)	Example
Light	0 to 5,670kg (12,500 lbs.)	Cessna 402
Medium	5,670 to 136,077kg (12,500 to 299,900 lbs.)	A320, B 737, F28, ATR 42
Heavy	Over 136,078kg (300,000 lbs.)	B 767, B 777, A340

Source: Canadian Aviation Regulations, Part VIII – Air Navigation Services.

These categories are used to reference the required separation during approach, landing and takeoff for wake turbulence avoidance. In 2001, approximately 32% of air traffic were in the Light category, 68% in the Medium category, and only a negligible number of Heavy aircraft movements.

It is important to note however that the Heavy aircraft movements occurring at the airport are not scheduled or charter operations. They are usually emergency operations resulting from mechanical or medical situations arising on long-range flights that over-fly the region. The airport is used in these instances as a result of its designation as an en-route alternate by the air carriers operating polar or high latitude flights over the region.

6.4 Airport Usability

Airport usability is a measure of the airside system's capability to support operations throughout the year given the site's historical wind and weather conditions.

6.4.1 Wind Coverage

Transport Canada recommends that the number of runways and their orientation with respect to prevailing winds should provide availability not less than 95% of the time for the class of aircraft the airport is intended to serve.[5] The selection of the maximum cross-wind component to be used for planning purposes depends on the role and type of traffic at the airport. Medium to large jet aircraft have a greater tolerance to cross-winds with limitations of 25-knots or more. Smaller aircraft may be limited to 15-knots or less.

Most of Yellowknife Airport's traffic is in the 'Medium' and 'Light' aircraft categories. For this reason, a conservative value of a maximum 15-knots (28km/h) cross-wind component has been selected in calculating usability. Table 6-5 (below) provides a summary of the wind coverage under 10-knot and 15-knot cross-wind conditions.

Table 6-5: Annual Wind Coverage (Percent) – Maximum 10-knot and 15-knot Cross-wind

Runway(s)	All Weather		VFR		All IFR	
	10-knot	15-knot	10-knot	15-knot	10-knot	15-knot
15	57.5	61.7	57.8	61.5	54.8	62.7
33	65.7	71.5	66.4	72.0	59.8	67.3
15 & 33 Combined	89.1	99.0	89.8	99.1	82.7	98.1
09	67.9	72.5	67.3	72.1	73.2	77.2
27	57.0	60.7	57.8	61.5	50.5	53.5
09 & 27 Combined	90.7	99.1	90.6	99.1	91.8	98.8
All Runways	**98.24**	**99.9**	**98.26**	**99.9**	**98.04**	**100.0**

Source: NAV CANADA, 2001.

While the 15-knot data indicates that Runway 15-33 alone provides in excess of 95% wind coverage, reference to 10-knot conditions show that the overall value would drop to an unacceptable 89.1% usability, which would prejudice small aircraft and flying training operations. It should be noted that calm wind conditions prevail 34% of the time.

6.4.2 Occurrence of Instrument Meteorological Conditions

Instrument Meteorological Conditions (IMC) – the conditions requiring aircraft operations to conform to Instrument Flight Rules – prevail when ceiling and visibility values are less than 305m Above Ground Level (AGL) and 3 statute miles visibility. Although the Yellowknife Airport enjoys VFR weather for over 90% of the time, winter months have a relatively high concentration of IFR

conditions, as shown in Table 6-6 (below). The data indicates that maintaining an appropriately high usability value is an important component in providing reliable transportation during the October – February period.

Table 6-6: Percent of Month IFR Conditions Exist (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10.9	11.3	4.3	3.6	3.9	2.9	2.0	3.5	7.3	26.0	23.4	15.8

Source: NAV CANADA, 2001.

6.4.3 Usability Factor

The usability factor represents the percent of annual time during which operations may be undertaken at the airport by suitably equipped aircraft. Table 6-7 (below) displays the usability factors for various weather bands under conditions of a 15-knot cross-wind (10-knot for ceilings below 91m). The chart indicates the availability of runways for each weather condition and compares that to the approach procedure minima to obtain a sum of annual usability

Table 6-7: Yellowknife Airport Usability Factor – 15 Knot Cross-wind

Weather Condition	Annual % Occurrence	Runway(s) Available	Wind Coverage	Usability	Unusability
VFR	90.44%	15-33 09-27	99.91%	90.36%	0.08%
1000/3 - 800/2	2.92%	15-33 09-27	100.00%	2.92%	0.00%
800/2 - 500/1.5	3.15%	15-33 09-27	100.00%	3.15%	0.00%
500/1.5 - 400/1	1.24%	15-33 09-27	99.99%	1.24%	0.00%
400/1 - 386/0.75	0.13%	15-33 27	98.06% *	0.13%	0.00%
386/0.75 - 326/0.75	0.57%	15-33	97.68%	0.56%	0.01%
326/0.75 - 300/0.75	0.25%	33	69.14%	0.17%	0.08%
300/0.75 - 200/0.5	0.82%	33	61.26%	0.50%	0.32%
200/0.5 - 100/0.25	0.39%				0.39%
100/0.25 & below	0.09%				0.09%
	100.00%			**99.03%**	**0.97%**

** The wind coverage figure is an estimate*

Source: Inter*VISTAS* Consulting, 2001.
Notes: 1. Weather bands are expressed in ceiling height in feet and visibility in statute miles.
2. Frequencies intermediate values have been obtained by interpolation.

The overall usability factor of 99.03% is considered an acceptable and quite high value. Runway 15-33 on its own has a usability of 98.1% (maximum 15-knot cross-wind).

6.5 Airport Capacity

6.5.1 Demand

The aircraft movement forecasts (Chapter 3) covered the annual outlook of 'Itinerant' and 'Local' traffic for the 20-year planning period. Annual movement data provides a broad indication of capacity needs.

Planning Peak Hour (PPH) forecasts support a finer analysis of demand characteristics, and provide an indication of the onset of congestion during heavy demand periods.

Table 6-8 (below) contains the Planning Peak Hour forecasts for 'Itinerant', 'IFR' and 'Air Carrier' operations for the 20-year planning period.

Table 6-8: Planning Peak Hour Aircraft Movement Forecast

	2003	2008 Med – High	2013 Med – High	2023 Med – High
Itinerant	19	23 – 25	25 – 28	28 – 33
IFR	12	15 – 16	16 – 18	18 – 21
Passenger Carriers	11	12 – 13	13 – 14	15– 16

Source: Inter*VISTAS* Consulting, 2004.

6.5.2 Capacity

The estimated practical annual capacity approximates 150,000 movements.[6] This is sufficient to meet the forecast demand throughout the planning period, which may reach up to approximately 100,000 operations over the 20-year period under a High growth scenario (as described in Chapter 3.0 – Forecasting for Planning Purposes).

The hourly runway capacity is currently restricted by the limitations of the taxiway system. Runway occupancy times of 2 to 3 minutes occur on Runway 15-33 due to aircraft backtracking during landing or takeoff. (Runway usage is shown in Table 6-2, page 6-3.) During periods of traffic peaks (busy periods), delays will occur due to the constraints of the current airside configuration. The limitations of the taxiway system are mitigated to a certain extent by the fact that calm winds prevail at the Yellowknife Airport for over a third of the time. Under calm wind conditions, aircraft can arrive on Runway 33 and depart on Runway 15, thereby obviating the need for backtracking. For safety reasons, this operating pattern is not optimal when conditions of reduced visibility prevail.

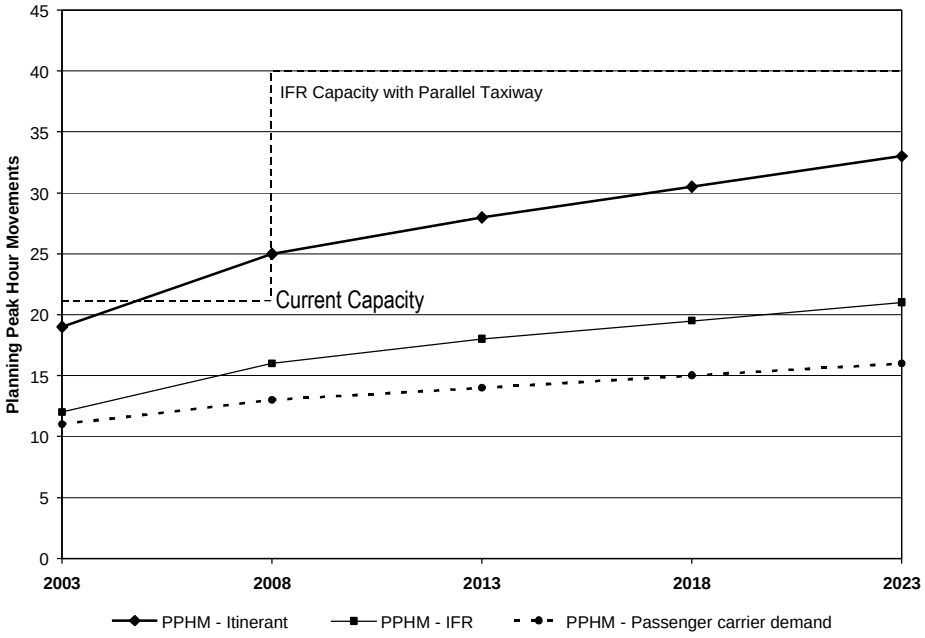
The current hourly capacity ranges from an estimated 21 movements per hour for IFR operations to over 40 movements per hour for VFR aircraft. Runway 09-27 has the highest capacity as a result of having a comparatively more complete taxiway system, but use of this runway is limited by its length and IFR approach capability.

6.5.3 Demand / Capacity Assessment

As 'Itinerant' traffic demand increases, it is expected that peak period congestion will result in delays, particularly for IFR traffic. As shown in Table 6-9 (following page), without a parallel taxiway for Runway 15-33, 'Itinerant' demand will soon exceed IFR capacity, indicating that significant delays may occur during poor weather conditions.

A full taxiway system, serving Runway 15–33 would increase capacity to about 40 operations per hour – a 100% improvement. This improvement would easily be able to meet the 'Itinerant' peak over the period. Development of a Code E taxiway parallel and to the west of this runway is therefore proposed. A staged development of the proposed taxiway is recommended given the incremental capacity increases partial taxiway development can provide.

Table 6-9: Peak Hour Runway Demand and Capacity (Medium Range Forecast)



Source: Inter*VISTAS* Consulting, 2004.

6.6 Runway Length

Several factors influence the length of runway required. Generally, takeoff distances are greater than landing distances due to relative differences in weights, speeds and acceleration/deceleration rates. In the event of an engine failure during the takeoff phase, air carrier aircraft must be capable of climbing safely to altitude. The takeoff weight of the aircraft is thus a factor not only of the available runway length and slope, but also of temperature, elevation and obstacles along the proposed flight path. Wet or snow covered runways increase both landing and takeoff requirements.

6.6.1 Runway 09-27

The high availability of Runway 15-33 under all weather conditions at 15-knot cross-winds indicates that Runway 09-27 is not required by medium to large aircraft as a cross-wind runway. For this reason, and contrary to the previous Development Plan,[7] extension of this runway is no longer considered necessary.

6.6.2 Runway 15-33

Runway Extension Requirements

At a length of 2,286m, the existing Runway 15-33 is of sufficient length to accommodate operations to destinations within North America, but is not long enough to support departures of international passenger and cargo services to European and Asian destinations. A market study undertaken in 2000[8] concluded that a minimum runway length of 3,050m was necessary to establish the Yellowknife Airport as both a destination and technical stop airport.

This assessment considers requirements by region and potential market segment to be served – passenger and cargo using the most probable design aircraft for evaluation.

- **Passenger Markets** – Operations to Europe with a B 767-300ER would require a 3,050m runway. The latest passenger version of the B 767 family – the 767-400ER – is well suited to the potential Japanese market. Under International Standard Atmosphere (ISA) conditions, a 3,050m runway would support service to Tokyo, Osaka and Seoul.
- **Cargo** – Cargo aircraft economics dictate that the aircraft be operated with maximum cargo payload to achieve the best yield. A fully loaded cargo aircraft is much heavier than the same fully loaded passenger aircraft. Consequently, cargo operations impose the most rigorous runway requirements, as any reduction from maximum takeoff weight may involve payload and/or range reductions. Using the B 747-400F as an example, a 3,050m runway would be adequate for service to points such as Frankfurt, Germany and Narita, Japan. The longer-haul Asian markets such as Hong Kong and Shanghai would be payload penalised.

  Consequently, the review of typical payload/range combinations of typical cargo aircraft operating characteristics suggests that if Yellowknife is to participate in a significant way in the international air freight sector, the capability to extend the runway to a length of 3,500m should be protected. The Yellowknife Airport will require a runway of similar length if it wishes to compete in this market. Another important factor in long-range freighter operations is the availability of an alternate airport. The closest suitable alternate for Yellowknife is Edmonton International, situated approximately 550 NM away.

  Although a runway of this length would rate among the longest in Canada, it would provide cargo operators the flexibility required to serve long-range markets. (Runway lengths at airports across the country are provided in Appendix D.) Extension should only be pursued if market opportunities materialise for such operations. This is not expected to occur however within the 20-year planning period, but could emerge beyond this timeframe.
- **En-route Alternate Airport Operations** – An assessment performed for the Airports Division in 2003 measured the adequacy and suitability of the Yellowknife Airport infrastructure to meet the requirements of Extended Range Twin Engine Operations (ETOPS) flights.[9] At a length of 2,286m, Runway 15-33 marginally meets the runway landing length requirements of most large twin-engine aircraft under maximum landing weight or contaminated runway conditions. Coupled with the availability of ILS precision approach capability, this runway renders the airport adequate for designation by air carriers as an en-route alternate under ETOPS. (The designation by air carriers allows the airport to be included in the flight plans for commercial flights.) The current runway length would be a constraint for all large aircraft departures with a full load. A 3,050m runway generally meets runway landing length criteria of all aircraft types currently used on international routes that could utilise the airport in case of an emergency.

Noise Impacts

A Noise Exposure Forecast was prepared to demonstrate the probable noise impact of the potential extension to 3,500m for the 2021 period. The resulting NEF is illustrated in Figure 6-5 (page 6-16). The resulting noise exposure area is relatively larger than that shown for the same period under the existing runway configuration (see Figure 5-6, page 5-13). The extended runway length stretches the noise envelope towards the south of the airport. In addition, the introduction of larger aircraft – made possible by the longer runway – will increase noise levels through a slight widening of the exposure area.

However, consistent with the conclusions of the 2021 NEF for the existing runway configuration, noise exposure in adjacent neighbourhoods will be considerably reduced compared to those experienced today, with the exception of the undeveloped land areas situated immediately to the south of the Runway 15-33 extension. The reduction in noise exposure will result from the replacement of the current aircraft fleet operating at the airport by quieter aircraft.

LEGEND

2021 NEF Contours
(Extended Runway)

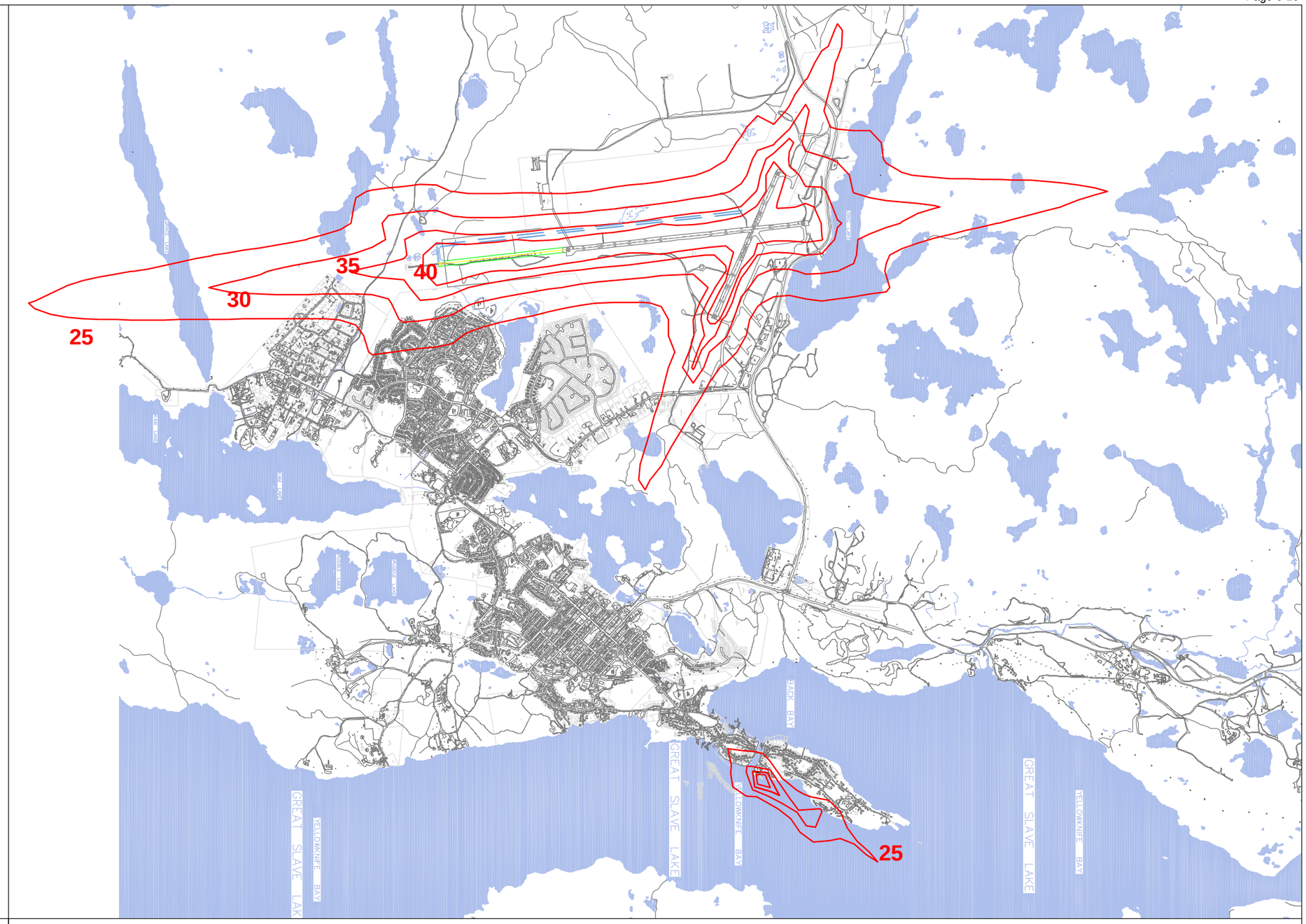


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Figure 6-5: 2021 NEF Contours (Extended Runway 15-33)

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6.7 Phased Development Plan

The proposed development plan for the runway and taxiway system is illustrated in Figure 6-6 (page 6-19).

6.7.1 Runway Extension

Consistent with the market segment requirements described above, Runway 15-33 should be initially extended to 3,050m, and then to 3,500m only when warranted by market conditions for cargo operations. The total cost of this proposal is estimated at approximately $19 million, with approximately $12 million for the initial extension to 3,050m.

Based on a preliminary assessment of current market conditions, the initial extension would not be required at least until the end of the 2008-2013 period. The final decision and timing of the extension, particularly for the maximal recommended length, should be dependent upon the results of a comprehensive market analysis that supports the presence of tangible demand for the enhanced services.

To provide for the eventual extension, it is proposed that sufficient land be reserved over the next 2-years for a runway extension to 3,500m, plus a 305m clearway and approach lighting, to ensure that future off-airport development not compromise the project. Protecting land for this purpose involves acquiring approximately 32ha of Commissioners Land, along with the establishment of an associated easement to accommodate relocated approach lights at the south end of Runway 15-33. The Airports Division is currently in discussion with other government officials to acquire the land reserve.

The extension project, land requirements, and affected land area are illustrated in Figure 6-7 (page 6-20).

6.7.2 Registered Airport Zoning

The runway extension proposal requires amendments to the existing Registered Airport Zoning in order to protect against eventual encroachments from off-airport development to the south of Runway 15-33.

To this end, a request must be submitted to Transport Canada to amend the Registered Airport Zoning Plan once the necessary additional land has been acquired by the Airports Division to accommodate the eventual extension. (Analysis of the obstacles surrounding the airport site indicates that no existing structures would penetrate the revised Obstacle Limitation Surfaces.) Figure 6-8 (page 6-21) illustrates the resulting proposed Airport Zoning, defined as per Transport Canada's *Aerodrome Standards and Recommended Practices*[10].

Legal search of the land titles and surveying of the affected land area will likely be required. Affected landowners would be notified of the changes on Title.

6.7.3 Taxiway Development

The capacity benefits of a taxiway development are incremental, based on the actual length of the extension. Development of a parallel taxiway to the end threshold of Runway 15 would meet peak demand at least to the 20-year forecast horizon. However, given the plans to advance the development of a PTB on the west-side of the airport site, incremental capacity gains can be achieved through a phased development of the parallel taxiway. To this extent, the optimal positioning of a future terminal complex at the mid-point of the runway justifies an initial development of a portion of the parallel taxiway from Runway 09-27 to approximately the mid-point of Runway 15-33. It is proposed that the development of this taxiway segment be initiated before 2013, in association with the construction of the future passenger terminal complex. Additional extensions of the taxiway are proposed through the planning period. These extensions will be implemented, as required, to ensure capacity sufficiently outpaces long-term demand. The total cost of this proposal is estimated at approximately $7.1 million, with approximately $1.8 million for the initial partial development to mid-point of Runway 15-33.

To accompany future development on the west-side of the site and to facilitate access to Runway 09-27 from this area, an additional parallel taxiway in this area will also be needed south of this runway. The timing of this development will however be contingent upon the leasing of adjacent land parcels for aviation purposes. This would be likely to occur before 2013. The cost of this proposal is estimated at $1.6 million.

Given the capacity increase provided by the taxiway proposal, the development of high speed taxiway exits over the course of the planning period would not be necessary, but could be considered during the design stages. Over the long-term period, these would provide some incremental capacity increases from the low runway occupancy times they would provide.

The existing Taxiway H which connects the PTB aircraft parking apron with the threshold of Runway 15 may eventually require widening to provide sufficient wheel edge clearance for occasional use by Code E aircraft (such as the B 747) throughout the curved 90 degree turn section. (Designation as a Code E taxiway would however impact upon the available aircraft parking space on the PTB apron as a result of wider clearance requirements.) Addition of filets may also be required at other taxiway exists. These upgrades should occur however as dictated by market demand. Aircraft of the B 767-200 size should not encounter difficulty with the current configuration.

LEGEND

- Required Land Acquisition for Proposed Runway Extension
- Easement Requirement
- Airport Boundary

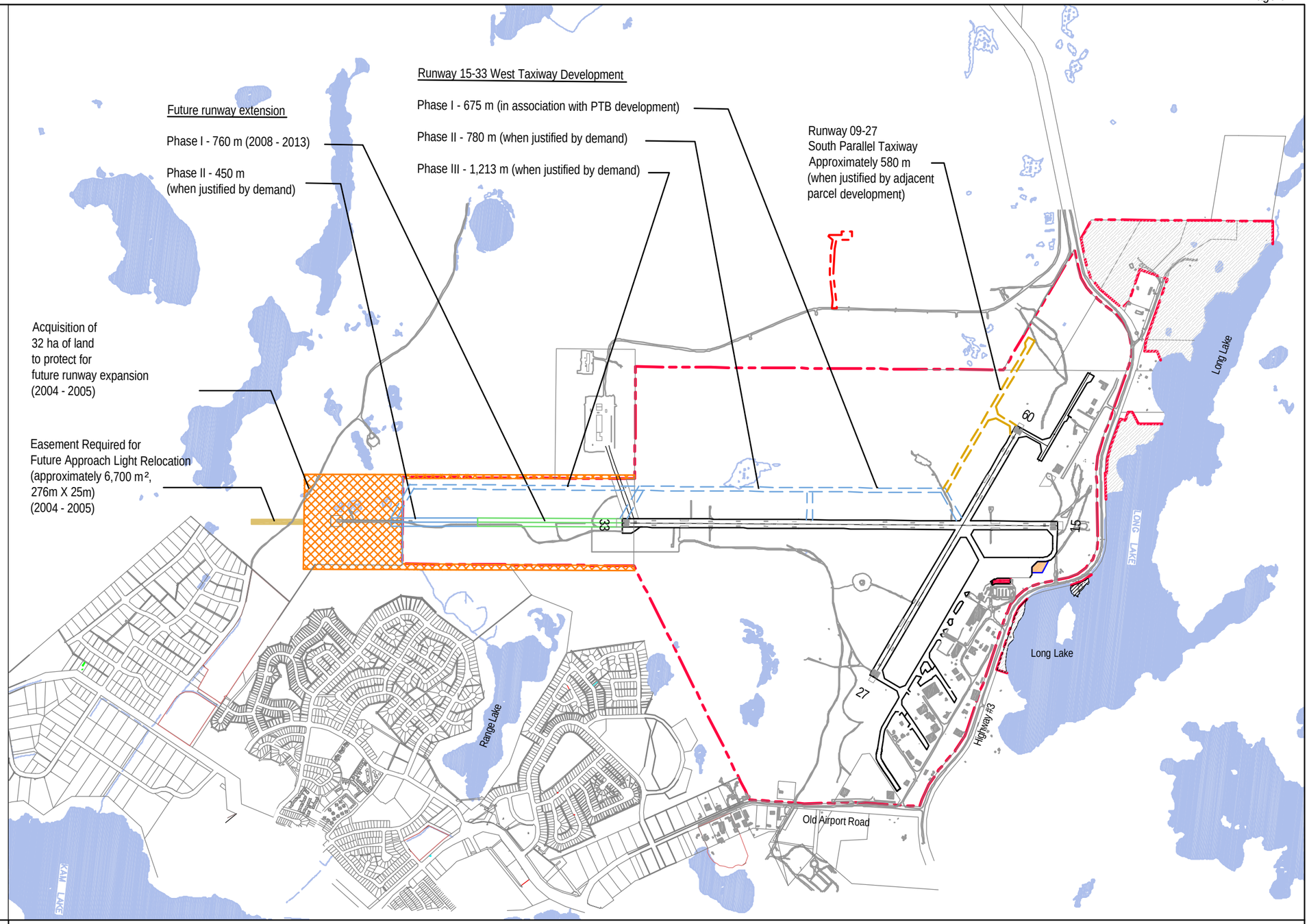

Figure 6-6: Runway and Taxiway Development Proposals

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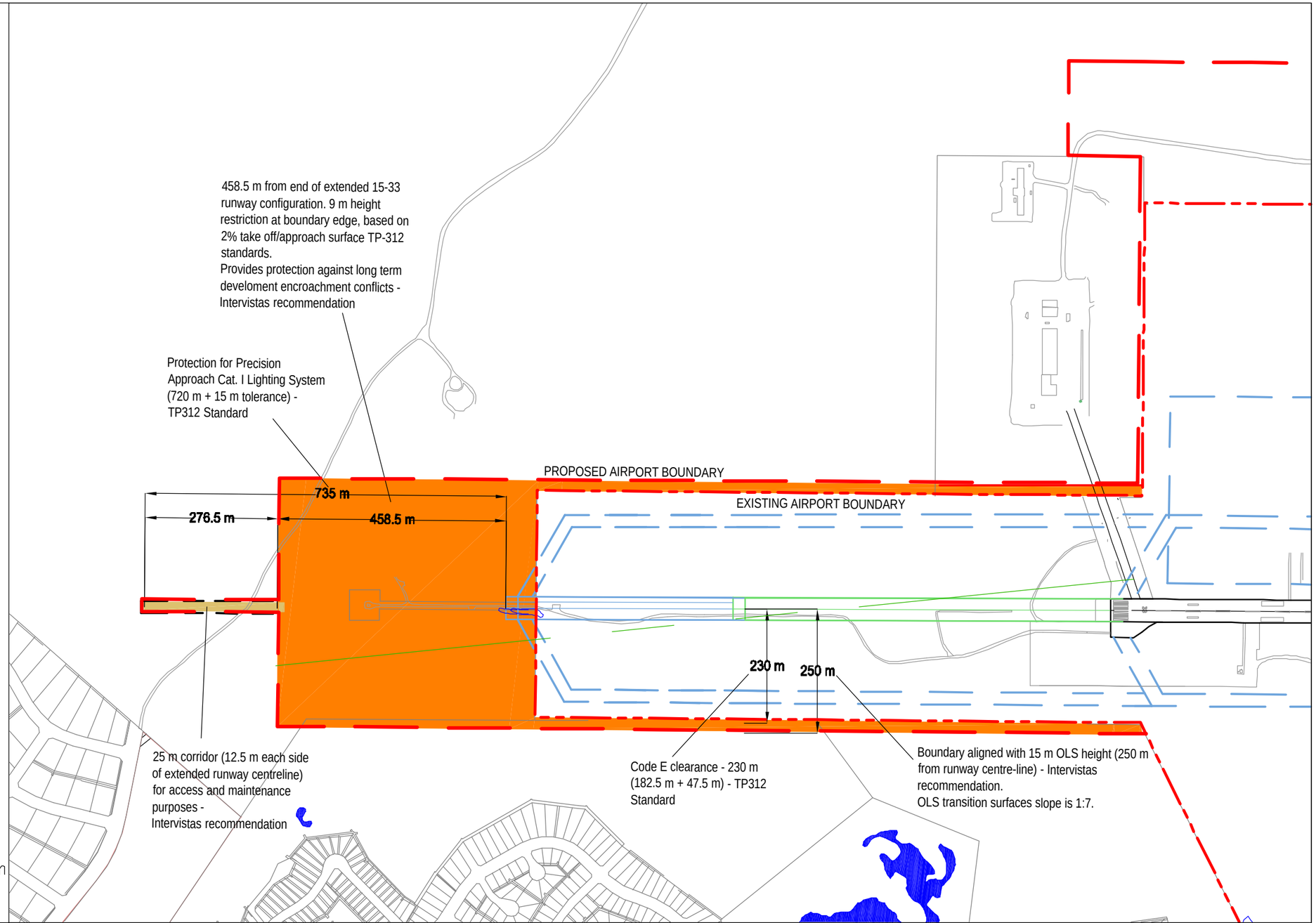

Figure 6-7: Runway Extension Land Requirements

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LEGEND

- Runway Strip Outline
- Transitional and Approach Surfaces Outline
- 00 Height Maximums (m above runway reference level)
- Airport Boundary
- Revised Site Boundary
- Outer Surface

- Additional Land Area Required (Approx. 31.7 ha)
- Area Impacted by Modified Obstacle Limitations and Aeronautical Zoning. Permissible heights would be lowered by approximately 20m.

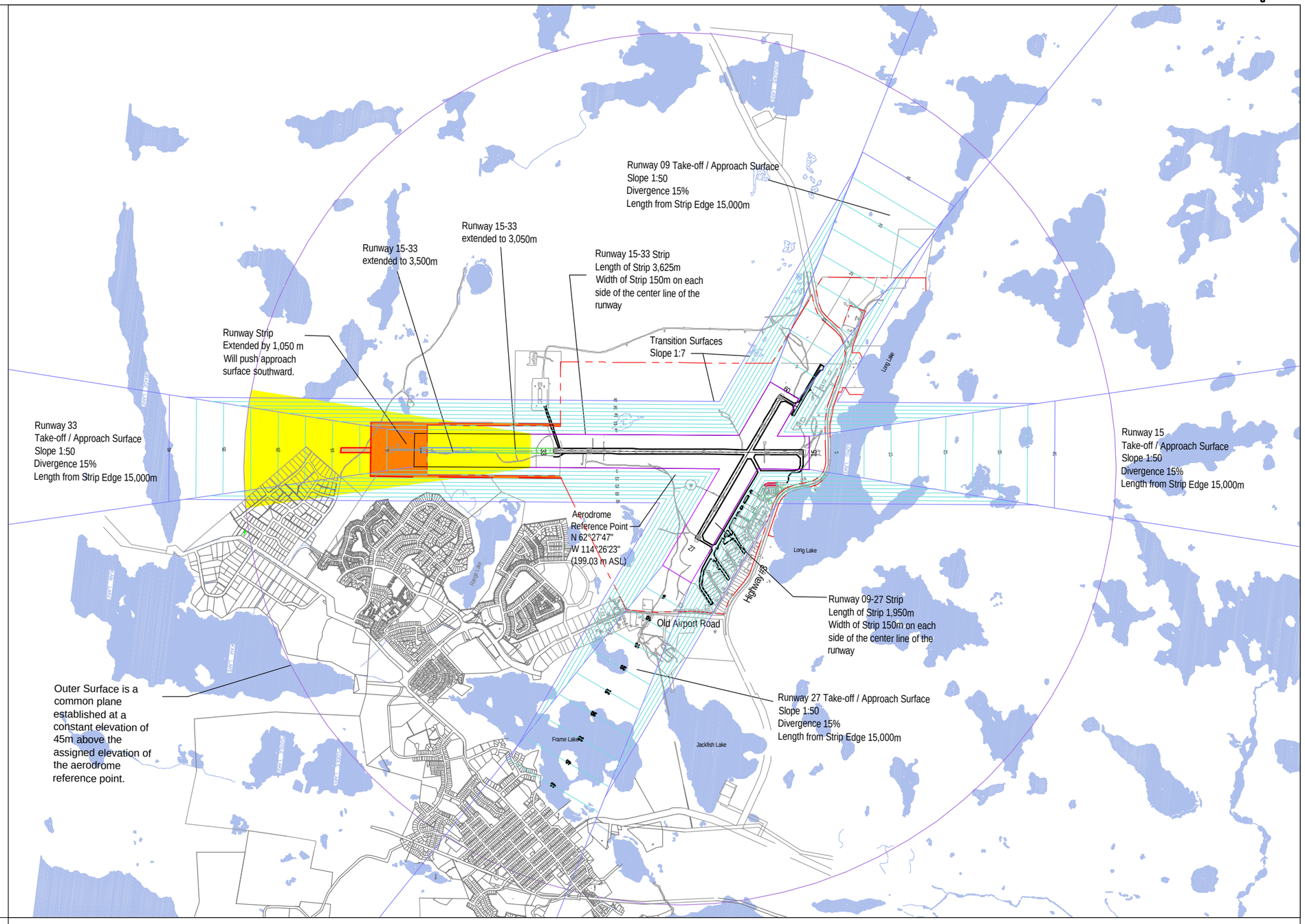

Figure 6-8: Proposed Airport Zoning

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6.8 Notes and References

[1] The protection for precision approach establishes a much wider runway strip width (300m) than is required under non-precision approach certification (150m). The strip width establishes the location and positioning of associated Obstacle Limitation Surfaces (Transitional Surfaces) and impacts the extent of adjacent usable areas.

[2] The PLR of Taxiway G is unknown.

[3] *Aerodrome Standards and Recommended Practices (TP 312E), 4th Edition*; Transport Canada, 1993.

[4] Helicopter operations include both piston and turboshaft-driven engines. Helicopters are aggregated separately however due to their distinct operating characteristics.

[5] *Aerodrome Standards and Recommended Practices (TP 312E), 4th edition*; Transport Canada, 1993.

[6] The capacity of the existing runway system was calculated using the traffic characteristics and operating patterns described earlier. The methodology employed estimated hourly throughput capacities for each operating configuration. The hourly capacities were extended to annual values by applying the average annual availability of each configuration.

[7] *Yellowknife Airport Development Plan*; LPS Aviation and FSC Group, 1998.

[8] *Reaching New Markets, 2000 Aeronautical Market Study, Northwest Territories*; LPS Aviation, 2000.

[9] *Alternate En-route Airport Facility Requirements and Associated Issues*; Inter*VISTAS* Consulting Inc., January 2003.

[10] *Aerodrome Standards and Recommended Practices (TP 312E), 4th Edition*; Transport Canada, 1993.

7.0 Aprons

7.1 About this Chapter

An aircraft apron is defined as "an airside area that accommodates aircraft for the purpose of passenger and cargo loading or unloading, fuelling, parking or maintenance."[1] At the Yellowknife Airport, aircraft aprons may also accommodate general aviation, helicopter and military operations. This chapter describes the characteristics of the various aircraft aprons maintained by the Airports Division at the Yellowknife airport. Where relevant, reference is made to aprons that are situated on privately leased commercial lots.

Specific aviation terminology used in this chapter is defined below:

Aircraft Stand – A designated area on an apron intended to be used for parking an aircraft.

Apron Taxiway – A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.

Controlled Apron – Apron on which aircraft and vehicle movements are radio-controlled by NAV CANADA Air Traffic Control.

Line Maintenance – In relation to an aircraft, means routine checks, inspections and malfunction rectification performed en-route and at base stations on the aircraft during transit, turn-around or night stops.

NOTAM – A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. See *Aeronautical Information Publication (AIP) Canada, Section MAP 5.0* for complete definition and details.

7.2 Planning Parameters

There are four designated aircraft parking aprons at the Yellowknife Airport, as well as eight non-designated aircraft parking aprons maintained on privately leased lots by the airport's land tenants. Most of the non-designated aprons have joint purposes, generally providing for charter, cargo, aircraft maintenance, government and general aviation activities. The location of each apron is illustrated in Figure 7-1 (page 7-2).

The PTB apron (Aprons I and II) is the main aircraft parking apron at the airport and is a primary consideration for long-term planning. This apron is constrained by the location and configuration of the runway system, the resulting Obstacle Limitation Surfaces, the sloping terrain on a portion of the site and the proximity of adjacent facilities (PTB, airport firehall and First Air hangar).

LEGEND

Designated Aprons

1. Apron I - PTB Apron
2. Apron II - PTB Apron
3. Apron III (non-controlled)
   First Air (Bradley Air Services)
4. Apron IV (non-controlled)
   Ministry of National Defence

Non-Designated and Non-Controlled Aprons

5. Air Norterra Inc. (Canadian North)
6. Spur Aviation
7. Buffalo Airways
8. G&G Expediting
   (Diavik Diamond Mines Inc.)
9. Air Tindi Ltd.
10. Braden Burry Expediting Ltd.
11. Gov't of NWT (RWED)
12. Air Tindi Ltd.
13. Nunasi Helicopters
14. Arctic Sunwest Charters
15. Great Slave Helicopters

Airport Boundary

Figure 7-1: Aircraft Apron System

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However, the airport's other aprons play vital roles in meeting ancillary operational requirements and tenant needs. The roles and location of the different aircraft parking aprons define the key parameters for apron planning at the airport:

- The layout and design of new primary aircraft parking aprons must provide flexibility in accommodating potential increases in aircraft sizes and operations, notably future wide-body operations (passenger and/or cargo).
- Due to the constraints associated with the topography and functional development around the existing PTB aircraft apron, apron expansion options are limited. However, the apron must provide for the parking of a Code D aircraft, when required.
- To ensure new airport facilities provide flexibility in meeting long-term growth opportunities, future primary aprons are to be located, sized and configured to accommodate at least one Code E aircraft.
- Future airside accessible lots are to be sufficiently sized to allow the construction of appropriate-sized aircraft aprons by individual tenants.

7.3 Passenger Terminal Apron

7.3.1 Primary Characteristics

Aprons I and II (the 'PTB apron') serve the PTB and provide a combined area of approximately 32,900m^2. The current layout of the aprons (Aprons I and II) is illustrated in Figure 7-2 (page 7-4). The apron is presently configured for 7 Code C aircraft parking stands in Power-in /Power out mode of operation. The airport often accommodates 8-9 aircraft of varying size (jet or turboprop) and mode of operation. The latter configuration position's 2 turboprop aircraft parking stands at the northern end of the apron, and requires these aircraft to operate in Push-in/Power-out mode. The Push-in operation is performed by the air carriers and, as such, the resulting parking stands are not marked. Code D and E aircraft can also be occasionally accommodated at the northern or southern ends of the apron depending upon traffic at the time.[2] These aircraft usually do not stay for long periods of time. The transitional surfaces that currently apply to the runway system (see Chapter 6.0 – Runways and Taxiways) constrain most parking positions to aircraft up to the size of Code C.

Although the primary function of the PTB apron is to serve passenger and cargo operations, medevac, some general aviation, overnight parking and special emergency technical stop operations are also accommodated on this apron.

All aircraft operations on the PTB apron are ground-load type, with no passenger boarding bridges. In some cases, passengers must walk long distances on the apron to reach some of the more remote parking positions.

7.3.2 Pavement Strength

Aircraft parking apron surfaces should be capable of withstanding the traffic of aeroplanes they are intended to serve. Apron I and II surfaces possess a Pavement Load Ratio (PLR) 12. This PLR indicates the strongest rated bearing strength for aircraft manoeuvring surfaces, and enables these parking aprons to support all current and planned production aircraft.

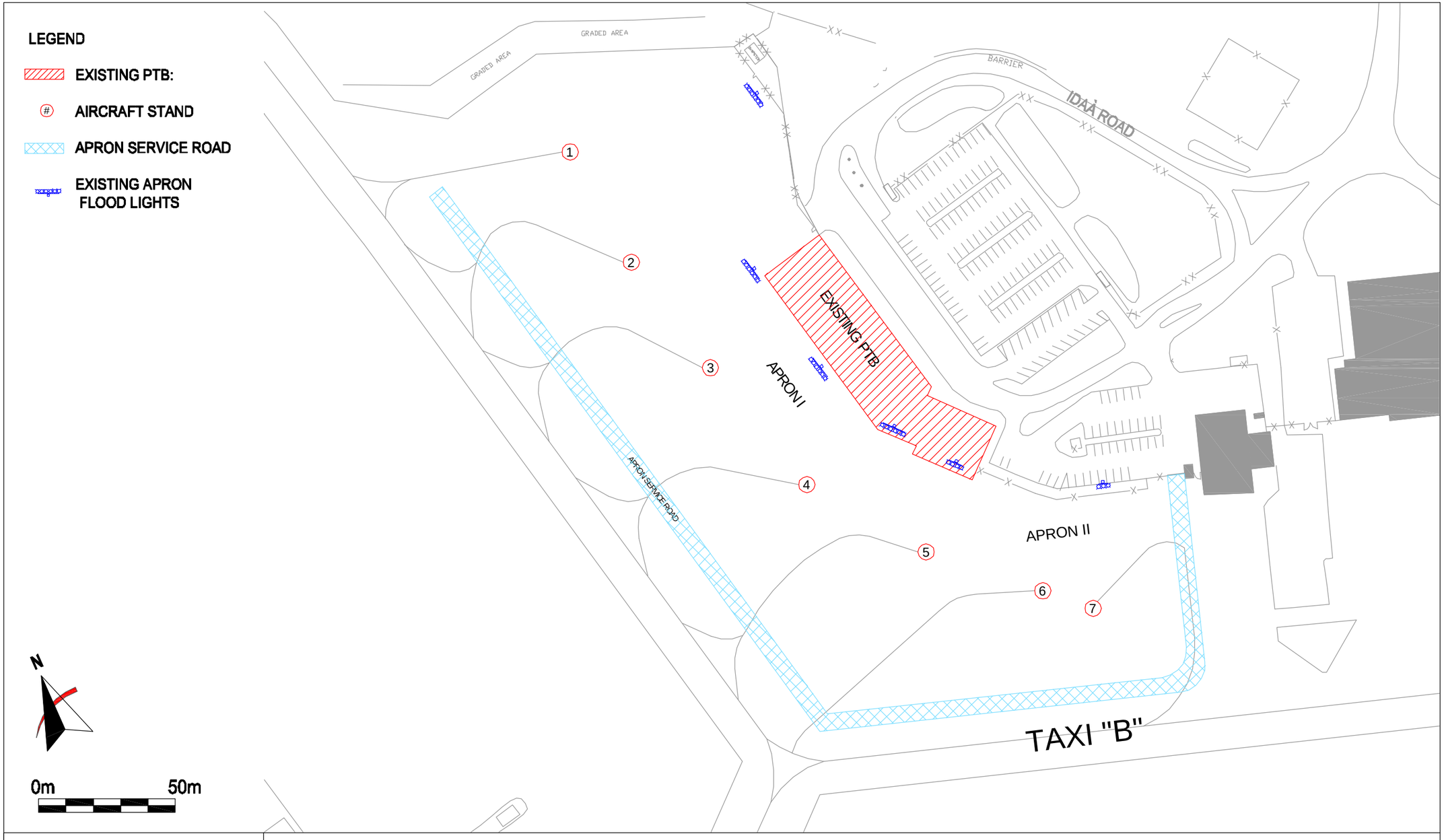

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Figure 7-2: Existing PTB Apron Configuration

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7.3.3 Aircraft Parking Stand Demand

The identification of future aircraft parking stand requirements is based on a review of carrier schedules and derived peak hour aircraft traffic. Analysis of recent flight schedules indicates that 8 aircraft stands are simultaneously occupied during peak periods approximately split evenly between jet (e.g. B 737, F28) and turboprop (e.g. ATR 42, DC 3) operations. However, based on a review of airport operations and discussions with airport staff, off-schedule charter operations exert considerable pressure on apron capacity. The existing apron is therefore at capacity and will require reconfiguration and/or expansion to relieve the current strain on capacity.

Table 7-1 (below) identifies forecast peak hour movements and derived apron parking position requirements for the 20-year planning period. Given the overall utilisation pattern of the apron and options to direct off-schedule aircraft operations to other areas of the airport, the current layout of 8 stands is considered a baseline towards accommodating current demand. Future requirements are estimated through a factoring of the current number by the growth in peak hour passengers.[3] The forecast mix of jets and turboprops is estimated to remain at the current ratio over the planning period. Note that a larger share of positions should be capable of accommodating larger jet aircraft to provide operational flexibility. These positions may also accommodate smaller turboprop aircraft when required.

Table 7-1: Forecast PTB Apron Space Requirements

	2003	Requirements		
		2008	2013	2023
Peak Hour Movements (Air Carrier)	11	12 – 13	13 – 14	15 – 16
Derived Aircraft Position Requirements	8	9	10	12

Source: Inter*VISTAS* Consulting, 2004.

The existing PTB apron can accommodate up to 9-10 aircraft, of varying size, through the reconfiguration of the existing layout and some minor expansion to meet requirements to 2013.[4] Beyond this timeframe, considerable apron expansion on the existing site would be required to meet the projected demand for 12 parking positions.

7.3.4 PTB Apron Design

Usable Apron Space

A key consideration in the use of the PTB apron space is the requirement to accommodate larger aircraft to respond to future changes in air carrier fleets and future market development initiatives. Of notable interest for the Yellowknife Airport is the potential to attract international passenger and/or air cargo services.

The Obstacle Limitation Surfaces resulting from the current configuration and operation of the runway system – particularly the protection of Runway 09-27 strip for precision approaches – limit most of the usable area of the PTB apron to Code C aircraft. Transport Canada standards require precision approach runways to maintain a 300m-wide strip (extending 150m from both sides of the runway centerline).[5] Due to the location of the existing runway strip protection area for Runway 09-

27, the tails of aircraft larger than Code C category would infringe upon the Transitional Surfaces that extend outward from the edge of the runway strips.

Although this protection is consistent with the existing Airport Zoning Regulations, the runway is certified for non-precision approaches. These require a much narrower 150m runway strip protection (75m extending 75m from both sides of the runway centreline).

A reduction of the Runway 09-27 strip width, consistent with Code 3C non-precision standards, could be considered as a means to shift the related Transitional Surface and provide sufficient clearance to accommodate Code D aircraft positions on Apron II.[6]

Enacting this change would involve an amendment to the *Airport Operations Manual*, and would not affect the existing Airport Zoning Regulations. During earlier reviews of this option, NAV CANADA has expressed a preference to maintain the existing runway strip width to provide maximal operational flexibility in the use of the runway infrastructure. This option will not be further pursued. Although this will limit the apron to being able to accommodate one Code D aircraft in the B 757 category, larger aircraft may be accommodated on an occasional basis through issuance of a NOTAM.

Design Concepts

Many different apron design concepts were prepared over the course of this planning process, with a number of these subsequently discarded for cost and/or operational reasons. The following presents the two main configuration concepts that have been retained for consideration:[7]

I - **North End Turboprop Operations.** Maintains existing turboprop operations at the north end of Apron I, and allows for a Code D aircraft to park using two turboprop positions at the north end of the apron.

II - **South End Turboprop Operations.** Relocates most turboprop operations to the south end of Apron II, and allows for a Code D aircraft to park using two turboprop positions at the north end of the apron.

These alternatives are illustrated in Figure 7-3 (following page)and Figure 7-4 (page 7-8). Table 7-2 (page 7-9) provides an overview of the characteristics of the concepts. Due to the operational implications of each, adoption of either concept will determine the general direction taken with regards to future apron and PTB operations.

Figure 7-3: Apron Layout Alternative I - North End Turboprop Operations

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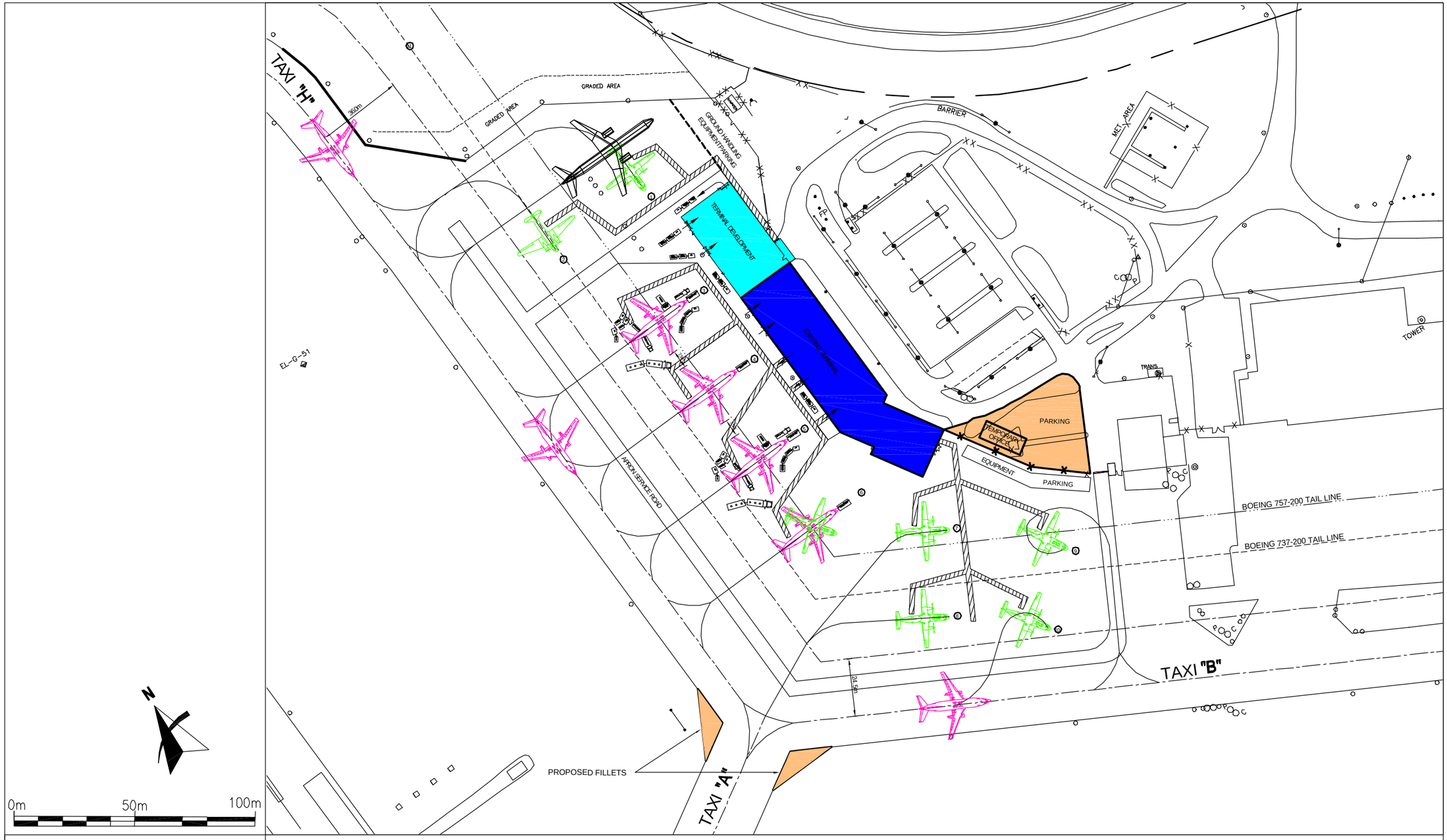

Figure 7-4: Apron Layout Alternative II - South End Turboprop Operations

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Table 7-2: Apron Layout Alternative Assessment

	I – North End Turboprop Operations	II – South End Turboprop Operations
Parking Positions		
Total	10	10
Max. # Code D	1 – Code D	1 – Code D
Aircraft Manoeuvring	Power-in/Push-out	Power-in/Push-out
Implications		
Apron Movements	Does not provide optimal apron movement paths for turboprop aircraft utilising Runway 09-27	Minimizes apron movements for turboprop aircraft using Runway 09-27
Departure Lounge Location	Preserves current screened and non-screened departure lounges at northern end of facility.	Requires development/relocation of non-screened departure area at southern end of building and requires relocation of ground floor administrative offices and reconfiguration of related area. Provides greater flexibility to redevelop existing PTB layout.

Preferred Existing PTB Apron Configuration Concept

Alternative II – South End Turboprop Operations is the preferred PTB apron configuration concept because of the flexibility it provides for PTB redevelopment options and the shorter apron movement distances it affords for turboprop aircraft operating on Runway 09-27.

7.3.5 PTB Apron Development

Proposed Short-term PTB Apron Configuration

To minimize passenger circulation on the PTB aircraft parking apron as a result of the relocation of turboprop positions at the southern end of the parking surface, the preferred apron configuration requires that departing unscreened passengers be accommodated at the southern end of the terminal building. This would be accommodated through expansion of the terminal building or addition of an annex at its southern end. (PTB redevelopment proposals are discussed further in Chapter 9) This addition would impede upon a portion of the aircraft parking apron – requiring a minor alteration to the preferred apron configuration to ensure appropriate passenger and ground vehicle circulation corridors, as well as adequate spacing between aircraft. The resulting apron configuration would provide nine aircraft parking positions, with four designated for use by Code C aircraft. Figure 7-5 (page 7-10) illustrates the resulting proposed PTB apron configuration.

The proposed configuration would provide capacity to approximately 2008. An additional position could be provided through some minor reconfiguration to meet the forecast demand for 10 positions by 2013. The latter configuration would however result in some circulation constraints on the apron due to the reduced spacing around the aircraft parking positions.

Given the functional relationship between the PTB and the aircraft parking apron, the apron reconfiguration proposal will need to be implemented concurrently with associated passenger terminal redevelopment projects. Pending availability of funding for the latter project, it is proposed that the apron reconfiguration be completed by the end of 2006.

LEGEND

- EXISTING PTB
- PROPOSED PTB EXTENSION
- APRON WALKWAY
- (#) AIRCRAFT STAND
- APRON SERVICE ROAD
- EXISTING APRON FLOOD LIGHTS
- CONSTRUCTION WORK AREA

Note:
The construction work area is only for the duration of the PTB improvement works. The area reverts to normal apron and landside use.

N

0m 50m

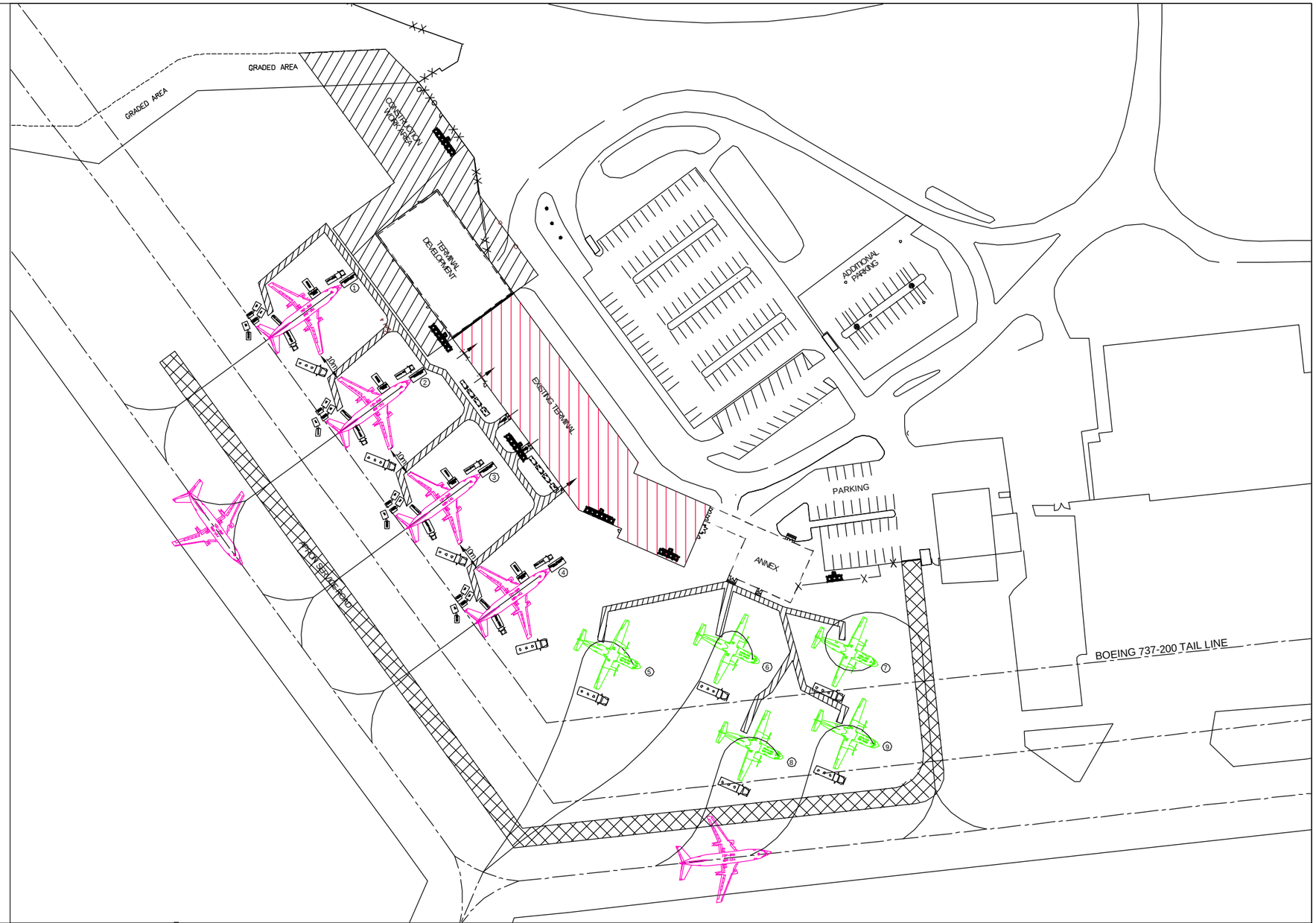

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Figure 7-5: Proposed PTB Apron Configuration

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Long-term PTB Apron Development

Beyond the practical capacity of the existing PTB apron surface, significant expansion of the PTB apron would be required both to the north and to the south to accommodate the 12 aircraft parking positions forecast for the end of the planning period. (The northerly expansion would involve considerable additional land fill, while the southerly expansion could involve partially impeding upon some of the area currently occupied by First Air.) Given the cost implications of the required apron surface expansion, no further consideration is made for this project.

It is proposed that corresponding apron capacity (12 aircraft parking positions) be provided in conjunction with the development of the new PTB on the west-side of the airport site. (This project is discussed in further detail in Chapter 9 and illustrated in Figure 9-3, page 9-15.) The timing of this project should therefore not exceed 2013 – approximately when demand for aircraft parking positions is expected to greatly exceed the practical capacity of the existing apron.

7.4 Cargo Aprons

Significant volumes of air cargo currently transit through the Yellowknife Airport on passenger, dedicated freighter and combi-passenger/cargo configured aircraft. However, there is no cargo terminal and no apron dedicated to cargo activities at the airport.

A considerable amount of cargo handling currently occurs on the PTB apron during the turn-around of passenger and combi configured flights. First Air, Air Tindi, Buffalo Airways, G&G Expediting and Braden Burry Expediting also process air cargo from their hangers and adjacent aprons. (See Figure 7-1, page 7-2, for the location of the associated aprons.)

Cargo requirements are discussed in more detail in Chapter 10 – Cargo Facilities.

7.5 Maintenance Aprons

There is no dedicated aircraft maintenance apron at the Yellowknife Airport. However, First Air, Air Tindi, Buffalo Airways, Arctic Sunwest and the Department of National Defence undertake a significant amount of aircraft maintenance in their hangars and on the adjacent apron. (See Figure 7-1, page 7-2, for the location of the associated facilities.) The maintenance activities that currently occur on the site consist mostly of regular line maintenance and emergency repairs resulting from an unexpected mechanical breakdown of an aircraft component. Major aircraft overhaul operations are performed at large aircraft maintenance bases at other airports.

As the primary aviation centre for most northern carriers, the Yellowknife Airport will likely continue to experience growth in aircraft maintenance operations, consistent with the growth of aviation traffic and air carrier fleets. These activities will occur in facilities to be located on privately leased lots. Planning for the subdivision and development of airside lots will therefore need to ensure that new land parcels are of sufficient width and depth to accommodate appropriately sized aircraft aprons and hangars. The size of the aprons will depend however on the type of aircraft they are intended to serve.

7.6 Aircraft De-icing

Aircraft de-icing on sub-zero days with precipitation was made mandatory by Transport Canada in 1991. Aircraft de-icing is however an air carrier responsibility. Aircraft embarking passengers processed through the PTB and other aircraft using the main apron, currently undergo de-icing operations on the North end of Apron 1. All other aircraft de-icing operations, such as at Air Tindi, Arctic Sunwest Charters, Adlair Aviation, Braden Bury Expediting, G&G Expediting, DND, etc., are conducted on the tenant leased areas. There are no systems or facilities in place at any of these locations for the collection of spent de-icing fluids (glycol and water).

Safe and efficient aircraft operations, as well as passenger and cargo processing, are of primary importance in the development of any aircraft de-icing facilities. The requirements for a de-icing operation will differ greatly at each airport.

The most important task for the design of new de-icing facilities is to evaluate the type of facility best suited for the airport's needs. This evaluation will entail an assessment of the actual physical layout, the operational requirements and the environmental sensitivity of the airport. The environmental circumstances, ranging from the proximity of the airport to rivers, lakes and water sources, the runoff patterns to be expected, the types of receiving water and the movement rates of water bodies, all impact the problem. Another variable is the type of soil and the potential for soil contamination.

Typically, de-icing facilities for the main apron are common use facilities available to any user of the airport.

7.6.1 Containment and Collection of Spent De-icing Fluids

Aircraft de-icing fluids are glycol-based fluids with additives, such as wetting agents and anti-icing inhibitors, mixed in varying concentrations with water. The climatic conditions at the Yellowknife Airport are such that not a significant amount of aircraft de-icing is required. The annual spray quantities used at the airport are therefore relatively low (approximately 100,000 to 200,000 litres/year). Most de-icing operations and the largest volumes of de-icing fluids used occur on the PTB apron. In spite of the absence of a collection system, there has not been any indication of storm water discharges from the airport exceeding national or local regulated standards.

The Yellowknife Airport air carriers and the GNWT, Department of Transportation monitor the use of de-icing fluids and storm water discharges, industry applications in this area and developing technology for the collection and disposal of spent de-icing fluids. The GNWT-Department of Transportation, in consultation with airport stakeholders, has developed a *Yellowknife Airport, Glycol Mitigation Plan*. Through this plan, airport users will report the annual application use of aircraft de-icing fluids and the application locations. The Department of Transportation will continue to monitor the use of the aircraft de-icing fluids, as well as the quality of storm water runoff from the airport property. The Department, with the airport stakeholders, will investigate methods of storm water collection and containment to ensure compliance with regulated water quality standards.

7.6.2 Aircraft De-icing Location

Aircraft de-icing operations for aircraft using the PTB should be located in close proximity to the PTB apron and the runway system for operational efficiency. However, the storm water drainage arrangements should be designed to mitigate potential runoff to adjacent water courses.

Throughout the planning process leading up to the production of this document a number of alternatives and sites were identified and put forward for consideration by the Airports Division staff, air carrier representatives and other airport stakeholders. Alternatives included infield sites, taxiway drive-thru facility and dedicated apron de-icing facilities on expanded PTB apron areas.

Given the constraints associated with the position of the Obstacle Limitation Surfaces, the airport's topographic characteristics and competing requirements for other facility development, most alternatives were deemed inappropriate for implementation. Given the desire to advance the development of a new passenger terminal complex on the west-side of the site, a more simple approach is proposed.

The preferred and most appropriate approach would involve a northern extension of Apron I by approximately 3,600m^2, with access to Taxiway H, to accommodate one dedicated aircraft de-icing pad. The proposed de-icing facility concept is illustrated in Figure 7-6 (page 7-14).

The proposed Apron improvements will facilitate common use aircraft de-icing operations during the winter season, as well as off-gate aircraft parking without passenger processing, as may be required during other periods. These works are contained in the current PTB Improvements project and construction activities began in the Fall of 2004. The new apron facilities are scheduled to be operational by late 2005.

Over the long-term period, air traffic growth will increase the number of de-icing operations that occur at the airport, and result in requirements for larger de-icing facilities capable of simultaneous aircraft de-icing. Long-term requirements to accommodate larger aircraft de-icing facilities at the airport will be factored in the configuration of future west-side passenger terminal infrastructure. The potential locations will be selected on the basis of common use by airport users, and to maximize the operational efficiency for aircraft use of the PTB Apron and runway/taxiway system.

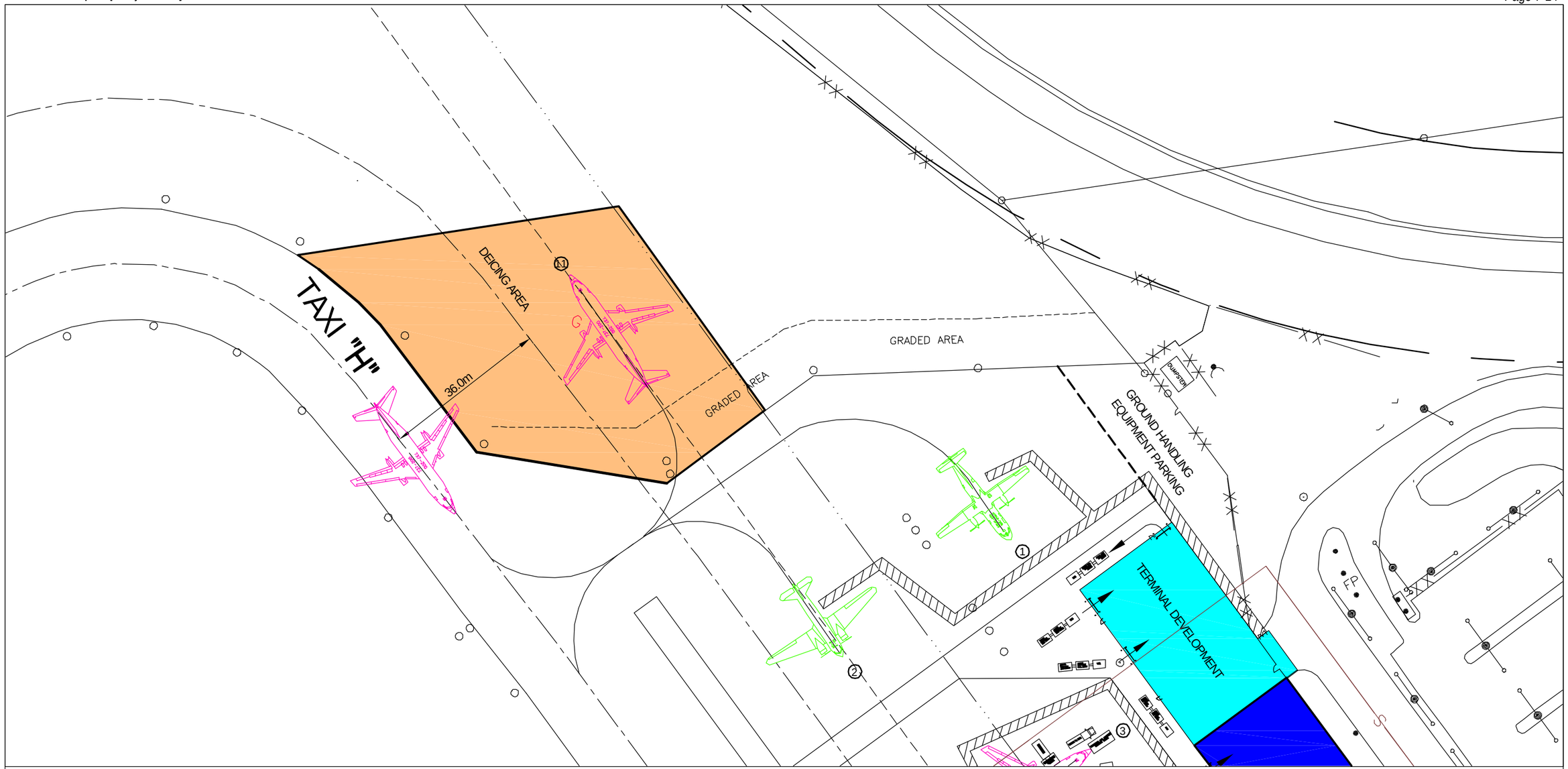

Figure 7-6: Proposed Apron I De-icing Facility

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7.7 Parking Apron

There is no apron dedicated to the parking of commercial aircraft at the Yellowknife Airport. Currently, the PTB apron accommodates some overnight parking. Due to the volume of traffic currently handled on the PTB apron, aircraft parking is difficult to accommodate on this apron.

General aviation and charter aircraft typically park on the aircraft aprons of the respective operators.

The absence of a dedicated parking apron is a limiting factor for airport operations and those of the general aviation tenants on the site. The current Development Plan makes no specific prevision for the development of designated aircraft parking aprons. However, airport infrastructure development will likely result in some excess apron capacity through future PTB redevelopment or the potential vacation of existing leased lots. Designation of these areas for dedicated aircraft parking will be considered as excess capacity is created on the site. In addition, the proposed aircraft de-icing apron may be used for commercial aircraft parking when the surface is not required for de-icing operations.

7.8 Holding Bays

There are no dedicated holding bays at the Yellowknife Airport. No specific requirements are identified for these facilities.

7.9 General Aviation Aprons

General aviation aircraft operations occur at various locations, most notably on the Spur Aviation site on Taxiway D and Adlair Aviation along Taxiway K in the northwest quadrant. Other airport tenants G&G Expediting and Braden Burry Expediting also provide some general aviation services, mostly serving charter flights dedicated to northern gas and oil exploration and mining industries.

The general aviation aprons provide space for the parking and maintenance of private and some small charter aircraft, as well as enabling the movement of passengers and freight on some charter flights. The aprons are also essential in facilitating northern medevac flights. Although no specific requirements are identified for these facilities, proposals are made later in this document to improve services provided to existing general aviation operators and provide additional land for future growth of this sector on the airport site.

7.10 Government Aprons

Apron IV (not controlled) is dedicated to DND 440 Transport Search and Rescue Squadron and the RCMP. A non-designated apron situated on the GNWT Resource Wildlife and Economic Development (RWED) lot at the intersection of Taxiways E and F is used a base for water-bomber operations. No specific requirements are identified for these facilities.

7.11 Helicopter Apron

The airport does not have dedicated helicopter final approach and take-off areas or apron parking areas, although some helicopter operations may occur from the PTB apron. Other helicopter

operations are also conducted from the Great Slave Helicopters base situated at the East-end of the airport site, off Old Airport Road. No specific requirements are identified for these facilities.

7.12 Isolated Aircraft Positions

Transport Canada and ICAO require that parking areas be designated for the isolation and holding of aircraft known or considered to be a threat.[8] The *Airport Operations Manual*[9] designates an area situated at the end threshold of Runway 09 as the aircraft isolation area for the airport.[10] This site meets all existing guidelines and would be less disruptive in the event that an aircraft would require isolation. Over the longer-term period, an additional location could be designated at the southern end of the proposed Runway 15-33 parallel taxiway.

7.13 Apron Security

Apron security is provided by a security fence and access portals for passengers and vehicles. The primary gate that is controlled by airport security personnel is situated in the PTB employee parking lot adjacent to the firehall building (see Figure 7-1, page 7-2 for location). An additional airside access point for vehicles is provided via an unmanned gate located on Brintnell Street, between the First Air and Department of National Defence lots. The gate is activated through security pass controllers issued by airport administration and, in some cases, by the tenants. Tenants with airside lot access must control passenger and employee access to their respective airside areas.

Subject to the availability of funding, it is proposed that the unmanned apron access point situated on Brintnell Street be upgraded to ensure adequate control through a manned presence, or installation of video cameras linked to the guard station.

7.14 Fixed Facilities

Fixed aircraft servicing installations typically include hydrant fuelling, fixed ground power, potable/non-potable aircraft water supply, compressed air, etc. Most of these services are not delivered via fixed facilities at the airport. Rather, they are currently provided through mobile equipment supplied by the air carriers operating at the airport.

7.15 Apron Taxiways and Aircraft Stand Taxi Lanes

Apron taxiways, aircraft stand taxi lanes and passenger walkways/corridors are identified via paint markings on the controlled aprons – mostly on the PTB apron and to a lessor extent on Aprons III and IV. Few markings exist to delineate various operational areas, such as equipment storage areas. Existing and proposed markings on the PTB apron are illustrated in Figure 7-2 (page 7-4) and Figure 7-5 (page 7-10), respectively.

7.16 Apron Service Roads and Ground Equipment

Service vehicles circulate on the PTB apron along designated apron service roads. Ground equipment parking currently occurs on the apron in close proximity to the PTB.

The proposed aircraft configuration discussed previously in this chapter requires reconfiguration of the service roads and ground equipment storage areas on the PTB apron. The proposed realignments on the PTB apron are illustrated in Figure 7-5 (page 7-10).

7.17 Notes and References

[1] *International Standards and Recommended Practices, Aerodromes, Annex 14 to the Convention on International Civil Aviation, Volume I, Aerodrome Design and Operations*; International Civil Aviation Organization (ICAO), 1999.

[2] Larger Code D and E aircraft must be parked in a tail-in positions (e.g. the tail adjacent to the PTB) in order not to infringe upon the transitional surfaces of the runway system.

[3] Although this approach would overestimate future requirements if the average aircraft size increases over the planning period, the impact on the forecast requirement would be small to negligible given that future aircraft operating in the North would likely remain in the Code C category.

[4] Based on the current and expected mix aircraft and the results of layout model simulations.

[5] *Aerodrome Standards and Recommended Practices (TP 312E), 4th Edition*; Transport Canada, 1993.

[6] Note that the available apron space, coupled with Transitional Surface limitations, do not permit accommodating Code E aircraft within the existing passenger terminal development area. These aircraft could nonetheless be accommodated on an irregular basis, with the issuance of NOTAMs when required.

[7] Although two concepts are presented, a number of derivatives for each can be developed. The GNWT Arctic Airports Division is currently reviewing more detailed final layouts.

[8] These areas must be at least 100m from other parked aircraft or buildings and should be as far as practical from any other airport activity, including utility systems.

[9] *Yellowknife Airport Operations Manual*; GNWT, Department of Transportation, 2003.

[10] *Yellowknife Airport Operations Manual;* GNWT, Department of Transportation, 2003.

8.0 Air and Ground Navigation Aids and Traffic Control Services

8.1 About this Chapter

The Yellowknife Airport is operational 24 hours a day, 7 days a week, for day and night Visual and Instrument Flight Rules traffic. It is equipped to handle Category I precision approaches on Runway 33 and non-precision approach to Runway 15. There are also defined non-precision approaches for Runways 09 and 27. The airport can support virtually all forms of commercial, corporate and general aviation.

These operational capabilities result from the availability of appropriate air and ground navigational aids and traffic control services on the site. This chapter provides a review of these equipment and services.

Specific aviation terminology used in this section is defined below:

Aerodrome Beacon – Aeronautical beacon used to indicate the location of an aerodrome from the air.

Air Traffic Control (ATC) – A service provided for the purposes of preventing collisions between aircraft, and on the manoeuvring area between aircraft and obstructions, and expediting and maintaining an orderly flow of air traffic.

Air Traffic Control (ATC) Tower – A facility established on an airport to provide ATC services on and in the vicinity of that airport.

Distance Measuring Equipment (DME) – A device used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

Flight Information Centre – A specialised air traffic service unit established to provide aviation weather briefing, aerodrome advisory service, flight information service and alerting service and to conduct weather observations.

Flight Service Station (FSS) – An aeronautical facility providing mobile and fixed communications, flight information, search and rescue alerting, and weather advising services to pilots and other users.

Global Position System (GPS) – A system of orbiting satellites used for navigation purposes and capable of giving highly accurate geographic co-ordinates.

Marker – An object displayed above ground level in order to indicate an obstacle or delineate a boundary.

Non Directional Beacon (NDB) – A radio beacon transmitting non-directional signals whereby the pilot of an aircraft equipped with direction-finding equipment can determine bearing to or from the radio beacon.

PAPI – Precision approach path indicator.

RILs – Runway Identification Lights.

Tactical Air Navigational System (TACAN) – A ultra high-frequency (UHF) omni-directional navigational aid that provides slant distance, in nautical miles from a ground station to an aircraft, and the azimuth in degrees from the station.

Visual Approach Slope Indicator System (VASIS) – An airport lighting facility providing approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams.

VHF Omni-directional Range (VOR) – A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north.

VORTAC – A combination of a VOR and TACAN at one location. VORTAC provides azimuth navigational information on VHF, and azimuth and distance information on UHF.

8.2 Visual Aids

8.2.1 Airside Lighting

The airside system is fully equipped to support night operations. An aerodrome beacon is mounted on the ATC Tower. The four wind direction indicators (windsocks) serving the runway system are lighted.

The runway and taxiway system possesses appropriate lighting systems. These are summarised in Table 8-1 and Table 8-2 (below), respectively.

Table 8-1: Runway Lighting

Runway	15	33	09	27
Edge Lights	High Intensity	High Intensity	High Intensity	High Intensity
Approach Lights	RILS	High Intensity	Low intensity	Low intensity
Approach Slope Indicator	PAPI	VASIS	PAPI	PAPI

Source: Yellowknife Airport Operations Manual, 2003.

Table 8-2: Taxiway Lighting

Taxiway	A	B	C	D	E	F*	G	H*	J*	K*
Edge Lights*	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME

*ME – Medium Intensity Edge Lighting
Source: Yellowknife Airport Operations Manual, 2003.

8.2.2 Markings, Signs and Markers

An ensemble of markings, airside signs and markers are present on the runway, taxiway and apron systems to convey aeronautical information, indicate an obstacle or delineate specific boundaries. Among others, these include:

- Runway designators (painted on the pavement surface at the start of each runway);
- Runway and taxiway centreline markings;
- Aircraft parking stand markings;

- Mandatory instruction signs to indicate a location beyond which an aircraft taxiing or vehicle shall not proceed; and
- Taxiway edge makers.

All markings, signs and markers are consistent with Transport Canada *Aerodrome Standards and Recommended Practices* criteria.[1]

8.3 Radio Navigation Aids

8.3.1 Instrument Approach Aids

An Instrument Landing System (ILS) provides Category I (CAT I) precision approach to Runway 33 and a non-precision approach to Runway 15. A non-precision NDB approach is also available for Runway 33.

The ILS is designed to provide an aircraft with a precision final approach with horizontal and vertical guidance to the runway. The ground equipment consists of a localiser, a glide path transmitter and an NDB along the approach path. There are 3 categories of ILS – each providing specific decision height minima and visual ranges for runway approach procedures. CAT I ILS allow approaches to a height above touchdown of not less than 61m and with runway visual range of not less than 549m.[2]

The location of the ILS ground equipment is illustrated in Figure 8-1 (page 8-4).

In addition, global position system (GPS) approaches have been published for all runways.

Table 8-3 (below) documents the types of instrument approach procedures and the lowest landing minima for each runway.

Table 8-3: Instrument Approach Procedures

Runway	Type	Aid	MDA/DH*	Notes
33	Precision	ILS CAT I	61m	
33	Non-precision	NDB	149m	GPS overlay
15	Non-precision	ILS (BC)	99m	Back course
15	Non-precision	VOR	118m	GPS overlay
09	Non-precision	VOR	118m	GPS overlay
27	Non-precision	GPS	118m	

* Minimum Descent Altitude (MDA) applies to Non-precision approach limits. Decision Height (DH) applies to precision approach limits
Source: Canada Air Pilot, 2004.

The distribution of operations among the runways, supported by the weather analysis provided in Chapter 6, indicates that Runway 33 is the preferred arrival runway. Aided by the prevalence of light winds, aircraft arriving from the south are frequently able to use Runway 33 for arrival, and Runway 15 for departure to the south to minimize taxi time and distance.

Currently, Runway 15 is served by an ILS back-course non-precision approach. When the ILS azimuth transmitter is replaced with the modern units now being retrofitted by NAV CANADA, the back-course signal will no longer be available. The runway is however served by NDB, VOR/DME and GPS approaches, which should prove adequate for most operations.

ILS Localiser Restriction Areas:

- Area "A": Circle 75m radius centred on the localiser array. No objects higher than 1.2m.

- Area "B": Rectangle 365 m x 610 m centred on the localizer array. No metallic objects higher than 1.2m, no non-metallic objects higher than 2.5m.

- Area "C": The area originating at the centre of the localiser array covering an arc of 36° in the direction of the runway and terminating 6100 m from the localizer array; or to the distances specified for the takeoff approach surfaces, the transitional surfaces, and the horizontal surfaces; whichever is the lesser.
No metal-walled structure should subtend a total vertical angle greater than 0.8°, no structural steel work should subtend a total vertical angle greater than 1.6°, and no non-metallic object should subtend a total vertical angle greater than 2.4°. Trees are included in this latter category. Note that these are "bottom-to-top" subtended angles measured from the antenna elements, with no reference to the horizon or the horizontal place being meant. Within the remaining 324°, these restrictions can be relaxed by a factor of approximately 2. Restrictive easements are normally obtained by NavCanada when necessary.

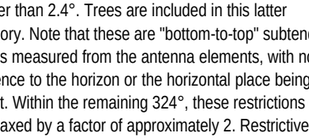
Glide Path Restriction Areas:

- Area "D": The area originating at the glide path antenna covering an arc of 30 ° and extending 1500m in the approach direction. No metallic fences, power lines, telephone lines, buildings, roads or railroads.

Note: This is the "ideal" situation. In practice, compromise will be necessary at existing airports. Horizontal bars in approach lighting systems should be avoided within 600m of the glide path antenna. At CAT II sites in particular, every effort should be made to ensure that existing encroachments on these restrictions are not aggravated. An obstruction-free area of 900m minimum is highly desirable but this should be extended to 1500m if circumstances permit, particularly in the case of a categorized facility.

- Area "E": A triangle with a base 150m wide extending from the glide path antenna in the direction away from the runway with the apex intersecting Area "D" at approximately 570m in the approach direction.
- Area "F": Triangular area between Area "D" and the Runway.

Source: Land Use in the Vicinity of Airports (TP1247), Transport Canada, 1996.



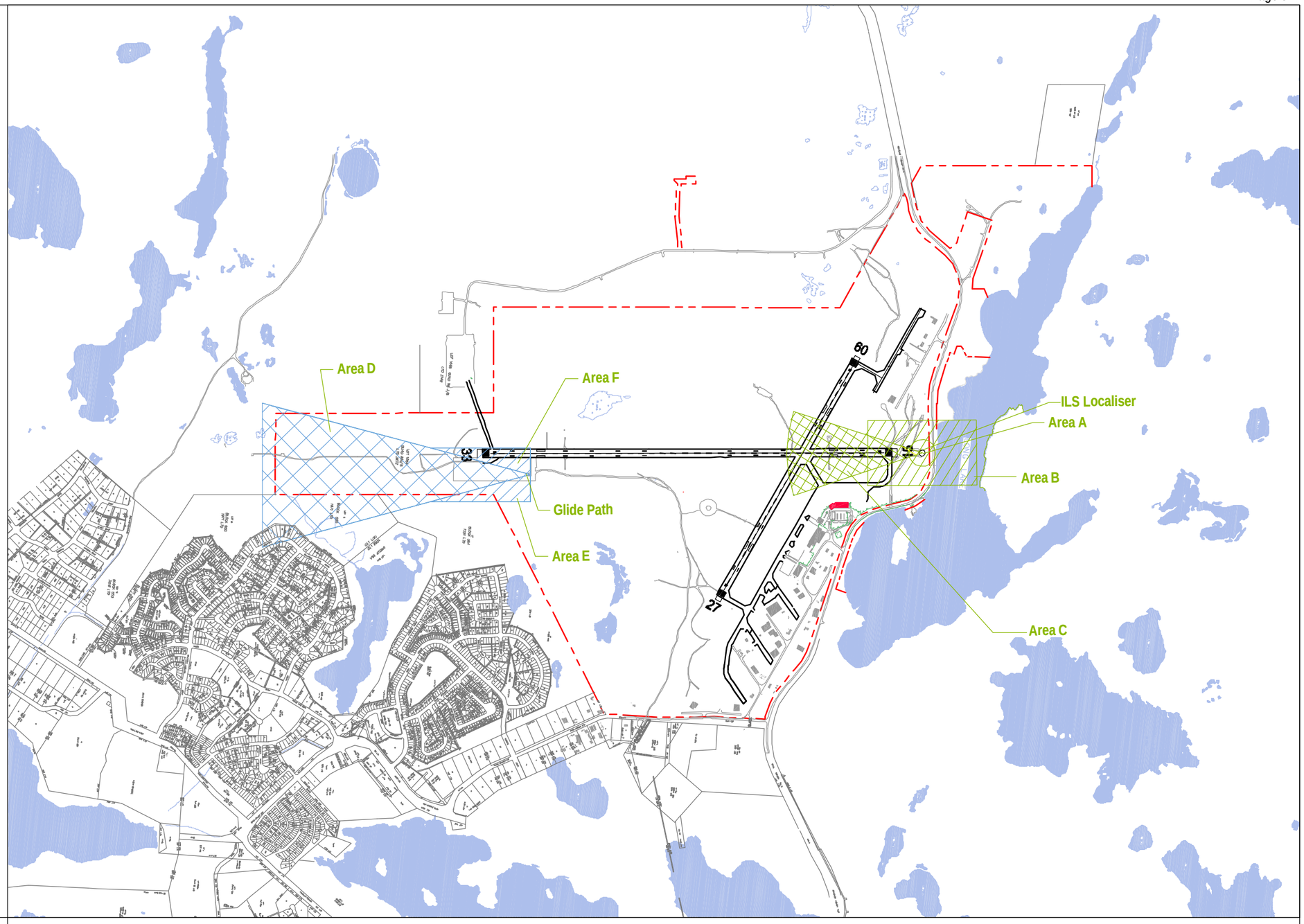


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Figure 8-1: Radio Navigation Aids - ILS

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If the runway is extended, it is proposed that NAV CANADA be requested to review the requirements for approach aids and the provision of a precision capability for Runway 15. To provide the precision capability, the rock outcrop adjacent to this runway would first have to be removed.

The approach aids serving Runway 09-27 are adequate. Given the already high airport usability, little marginal improvement would be achieved unless a precision approach system was installed to provide descent heights of 61m AGL or less. This would involve high costs not justified by the small incremental value. The current designation of this runway as a non-precision runway is appropriate. The continued protection of this runway by the airport for precision approaches is preferred by NAV CANADA.

8.3.2 Terminal Area Navigation Aids

Guidance for aircraft operating in the Yellowknife Terminal Area is provided by a VORTAC (VHF Omni Directional Range and TACAN/DME system), NDB, a VHF Direction Finder and Air Traffic Control radar. The locations of these navigational aids are shown in Figure 8-2 and Figure 8-3 (pages 8-6 and 8-7).

8.3.3 Independent Secondary Surveillance Radar

An Independent Secondary Surveillance Radar (ISSR) was commissioned in 2001 and became operational in February 2002. The ISSR provides state-of-the art continuous radar and flight information. The ISSR interrogates an aircraft's transponder, which then causes it to send back an information including an identification code, aircraft altitude and speed, thereby providing three dimensional position information and aircraft identification. The radar has a range of 250 nautical miles up to an altitude of 70,000 feet. The radar information is fed into NAV CANADA's air traffic management system at the Edmonton Area Control Centre (see below) and to the Yellowknife Airport Air Traffic Control Tower. The ISSR generates substantial safety and service benefits for airport and trans-oceanic traffic, both of which are currently experiencing high and growing demand.

The location of the ISSR is illustrated in Figure 8-3 (page 8-7).

8.4 Demarcation of Critical Areas

Protection areas are established to ensure that objects and structures do not interfere with the operation of electronic navigation aids. These areas are shown in Figure 8-1 (page 8-4). Specific guidelines are defined in *Land Use in the Vicinity of Airports*[3].

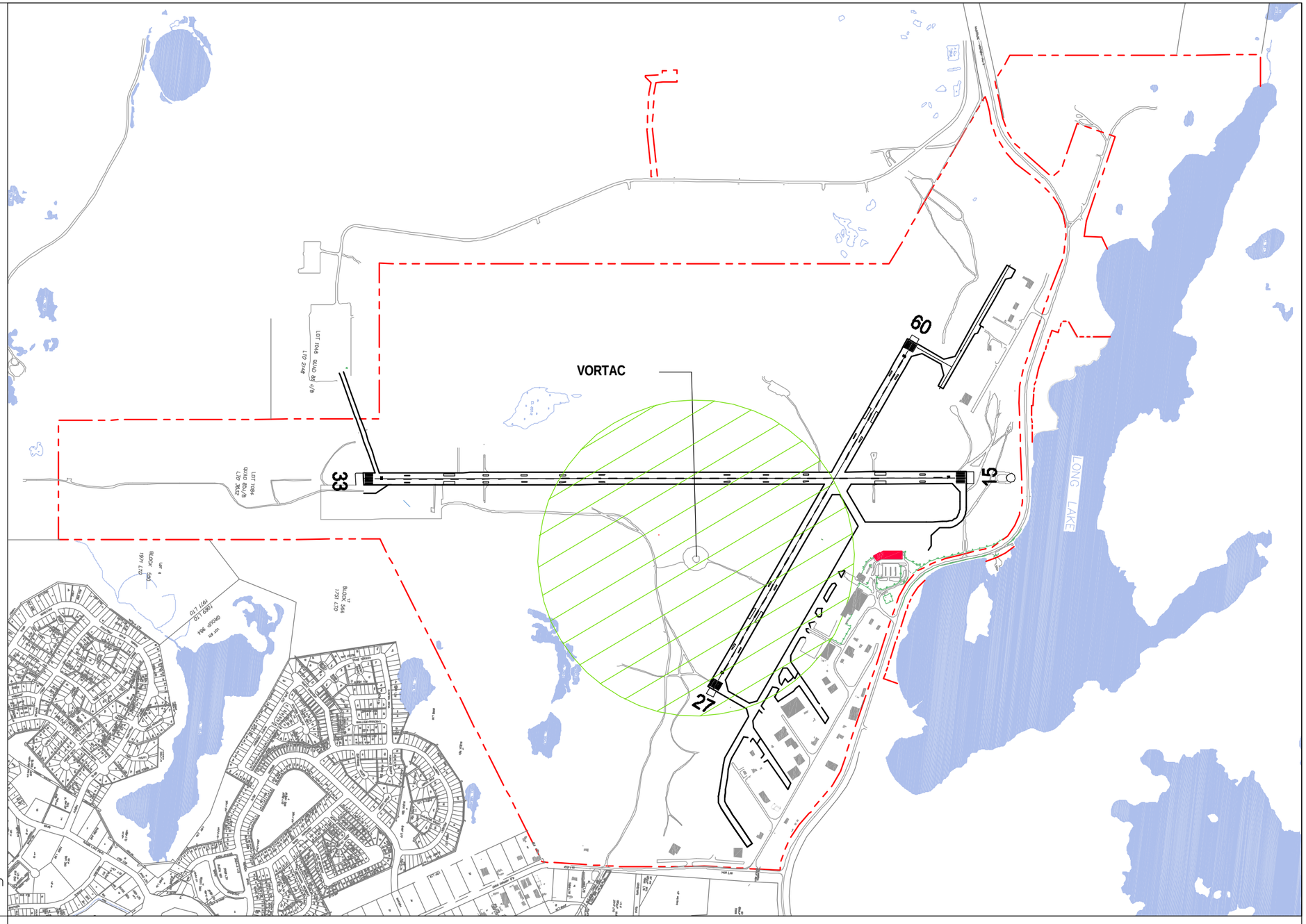
8.5 Air Traffic Services

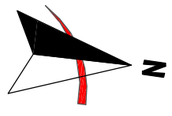
NAV CANADA provides services to air traffic from two facilities located at the airport and from Edmonton. (Refer to NAV CANADA and Canada Flight Supplement for procedures in Canada.)

VORTAC/DME Restriction Area:

- Within 300 m of the DME site, no trees, no fences, no wire lines, no structures, no machinery and no buildings, except with the prior written consent of the NavCanada and only where calculations show that the proposed obstruction has no impact on the operation of the navigational aid.
- From 300 m to 600 m of the DME site the highest point of structures and buildings having a large metal content, and wire lines and fences shall not extend more than 0.5 degrees above the horizontal plane as measured from the array centre. These limits may be increased by 50% for fences and lines which are essentially radial or which subtend an angle of not more than 10 degrees measured in the horizontal plane. Wooden structures or buildings with negligible metallic content may subtend vertical angles up to 2.5 degrees. No structures, buildings, wire lines or fences shall be permitted without written permission from the NavCanada.
- Beyond the 600 m, large continuous metallic objects such as overhead power lines, masts, water towers or large metal-clad buildings which will penetrate beyond 0.5 degrees above the horizontal plane as measured from the array centre are to be analyzed for potential interference prior to being approved.

Source: Land Use in the Vicinity of Airports (TP1247), Transport Canada, 1996.





0m 500m 1000m

Northwest Territories Transportation

Figure 8-2: Radio Navigation Aids - VORTAC/DME

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VHF-DF Restriction Area:
- Within 45m of the site, ground shall be level.
- Within 90m of the site, ground shall be clear of trees, masts, metal fences and vehicles.
- Within 180m of the site, ground shall be clear of buildings, car parks and small metal structures.
- Within 365m of the site, ground shall be clear of built-up areas, hangars, railways and large aircraft hard-standings.

ISSR Restriction Area :

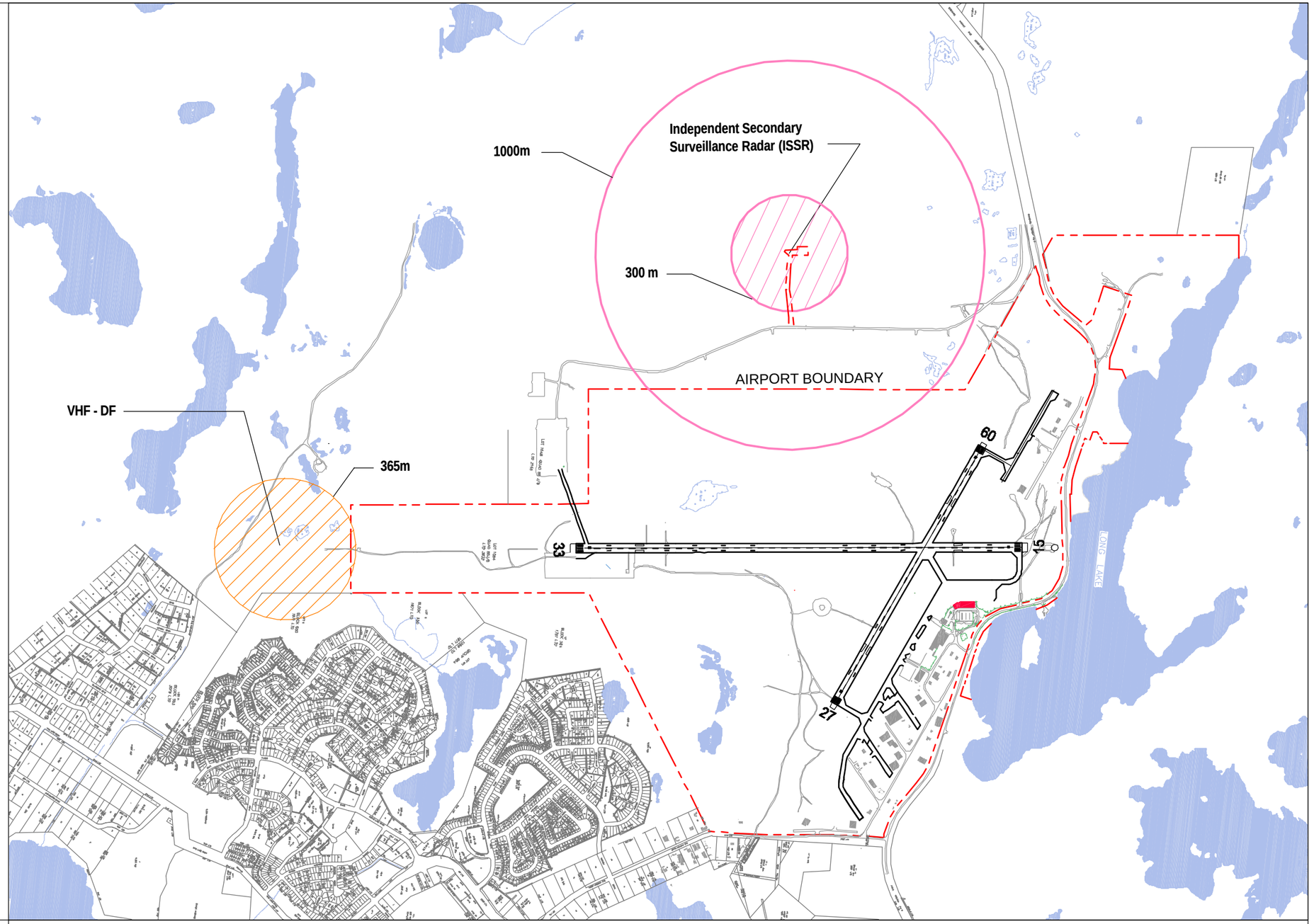
i) within 300m of the radar site, no building or other structure should be allowed to exceed a height of 5m below the geodetic height of the antenna platform. The preference is to have no structure at all or to have trees surrounding the site.

ii) from 300m to 1000m from the radar site, the upper limit on the height of an allowable structure is increased at a rate of approximately 0.007m per metre. Thus at a distance of 1000m from the site, the structure can be as high as the geodetic height of the antenna tower platform.

iii) beyond 1000m from the radar site, no site protection requirement is specified; however, it is preferable not to have any large structure exceeding 0.25° above the radar horizon. Large structures are defined as having an azimuth of more than 0.43°. No structure that blocks critical airspace should be allowed. The consequences of building such a structure should be brought to the attention of those responsible for approving the proposal for construction.

The provisions given above for a primary Radar System apply as well for a Secondary Surveillance Air Traffic Control Radar System. In addition, it is essential that all buildings or other structures within 1000m of the radar be constructed with non-metallic materials having a low reflectivity at frequencies from 1.0 to 1.1 GHz.

Source: Land Use in the Vicinity of Airports (TP1247), Transport Canada, 1996.



N

0m 500m 1000m

Northwest Territories Transportation

Figure 8-3: Radio Navigation Aids - VHF-DF, ISSR

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8.5.1 Air Traffic Control Tower.

The Air Traffic Control Tower is located on the PTB, and provides airport control services between 06:00hrs and 21:00hrs. A staff of 11 provides air traffic control for a radius of 5 nautical miles around the airport.

8.5.2 Flight Service Station

A Flight Service Station (FSS) is located in the PTB, adjacent to the Air Traffic Control Tower, and is operational 24 hours a day. The FSS is one of 72 in operation in Canada. Currently, 15 Flight Service Specialists deliver flight planning, en-route flight information and weather briefings. They also provide airport advisory services for flights arriving and departing the area when the ATC Tower is closed. The FSS also provides airport advisory services when the tower is closed.

8.5.3 Flight Information Centre (FIC)

Yellowknife has been selected as the site for the Flight Information Centre (FIC) which will provide services to aviation throughout the Northwest Territories. The centre will be created from an upgrade to the FSS and will constitute one of Canada's nine information centres. As of the date of publication of this document, the FIC was not yet officially operational, although a toll free telephone access number was put in place for the Yellowknife service area.

8.5.4 Area Control Centre

Instrument Flight Rules Air Traffic Control service to arriving and departing aircraft is provided from the Area Control Centre (ACC) in Edmonton. Radar data from the ISSR facility located on the west side of the airport is transmitted to ACC controllers to provide position data on transponder equipped aircraft in the Yellowknife area. A radar display exists in the airport Air Traffic Control Tower, as well as in the ACC.

8.6 Search and Rescue Services

The Canadian Forces are responsible for conducting Search and Rescue Services in Canada. For Search and Rescue procedures in Canada, refer to NAV CANADA and the *Canada Flight Supplement*.

8.7 Apron Management and Safety

The *Yellowknife Airport Operations Manual*[4] identifies designated apron management authority and manoeuvring procedures. Air Traffic Services (ATS) provide advisory service for the management of apron operations in support to the Airport Ramp Control Procedures.

All operators of vehicles/support equipment and pedestrians on manoeuvring areas adhere to the requirements set forth in *Manual of Airport Traffic Directives for the Operation of Vehicles on Airport Movement Areas*, the *Airport Traffic Regulations* and the *Yellowknife Airport Local Airport Traffic Directives* (LATDs).

A Yellowknife Airport Apron Safety Plan has been developed for the airport and is used in conjunction and compliance with any current agreements, licences, leases, airport operational procedures, Air Carrier Operating Certificates and Operational Manuals. Refer to the *Yellowknife Airport Operations Manual* for further details.

8.8 Communications

For aeronautical communications procedures in Canada, refer to NAV CANADA and *Canada Flight Supplement*.

8.9 Notes and References

[1] *Aerodrome Standards and Recommended Practices, 4th Edition*; Transport Canada, 1993.

[2] *Aeronautical Information Publication (A.I.P. Canada – TP 2300E), Section 3.13.6*; Transport Canada.

[3] *Land Use in the Vicinity of Airports (TP 1247E)*, *7th Edition;* Transport Canada, 1996.

[4] *Yellowknife Airport Operations Manual;* Yellowknife Airport, 2003.

Section Three – Landside Development

Introductory Notes

Airport landside systems consist of the operational areas that are situated outside the designated airside area of the airport. The landside system typically includes the PTB, cargo facilities, and access, internal airport circulation and parking infrastructure.

The northern quadrants of the Yellowknife Airport accommodate most of the site's development. However, the layout and occupancy of these existing development areas pose serious limitations to the expansion of the airport's landside system. This section matches current requirements to the capabilities of the northern development areas and puts forward general proposals for the eventual relocation of key landside infrastructure to the west-side of the site.

9.0 Passenger Terminal Building

9.1 About this Chapter

The Passenger Terminal Building provides facilities necessary for passenger processing, air carrier operations and ancillary services to support most passenger activities at the airport. As discussed previously in Chapter 3.0 - Forecasting for Planning Purposes, a significant volume of passenger traffic at the Yellowknife Airport is not processed through the PTB. (These passengers are processed through private general aviation and charter facilities situated in the northeast quadrant of the site.)

This chapter examines the deficiencies and current operational requirements of the existing PTB, addresses the viability of maintaining passenger-related operations on the current site and puts forward proposals to address immediate and longer-term requirements. Provisions to meet long-term land requirements for private general aviation and charter passenger traffic are included as part of the overall land use strategy for the airport in Chapter 16 – Development Proposals.

Specific aviation terminology used in this chapter is defined below:

Baggage Make-up Area – The area where checked baggage for departing flights is sorted and loaded into containers or onto baggage carts.

Departure Lounge – A common area used for assembling originating, transit or transfer passengers who have been accepted by the airline prior to boarding the aircraft.

Explosive Detection Systems (EDS) – Manual or automated systems used primarily to check for explosives in carry-on baggage and checked baggage.

HVAC – Heating, ventilation and air conditioning system.

Hold Baggage Screening (HBS) – Screening of baggage destined for the hold of an aircraft.

Pre-Board Screening (PBS) – Security screening of persons and their personal belongings and carry-on baggage prior to entering a designated sterile area, conducted before boarding an aircraft.

Screening Checkpoint – An area of an airport used for the screening of persons and carry-on baggage and other things in the possession or control of persons who are screened; includes an explosive detection screening checkpoint used for the screening of carry-on baggage.

9.2 General Considerations

9.2.1 PTB Passenger Traffic

The total enplaned and deplaned passenger traffic at the Yellowknife Airport includes not only passengers utilising the PTB, but also the reported/estimated passenger traffic from carriers using their own terminal, hangar or apron facilities. PTB passenger traffic, itself, is currently associated with regular scheduled and charter traffic of four carriers, First Air, Canadian North, Buffalo Airways

Ltd. (Hay River service) and Northwestern Air Lease. In 2003, of the 320,000 total airport passengers, the PTB handled approximately 74%, or 236,000 passengers. The balance of the total passenger traffic, approximately 84,000 passengers associated with air services by Canadian North (mine charters), Buffalo Airways Ltd., Air Tindi Ltd. and Arctic Sunwest Charter, etc. were handled at other facilities. For planning PTB facility requirements, the peak hourly demand must be considered. Current and forecast peak hour passenger traffic are outlined in Table 9-1 (page 9-4).

9.2.2 Configuration

The existing Yellowknife Airport PTB consists of a multi-storey structure, with a single-storey northern wing addition. Totalling approximately 2,320m^2 of floor space, the ground floor of the building currently accommodates all PTB passenger processing operations. These include the check-in, security screening, departure lounges and baggage areas, as well as airline support offices and commercial areas. The ground floor also contains airport administration and Transport Canada's Airworthiness Group offices.

NAV CANADA occupies most of the upper floors with the Flight Service Station (FSS), Flight Information Centre (FIC) and Air Traffic Control Tower operations. A partial basement provides space for HVAC, trade shops and storage facilities. Current space allocations within the existing building are identified in Table 9-1 (page 9-4).

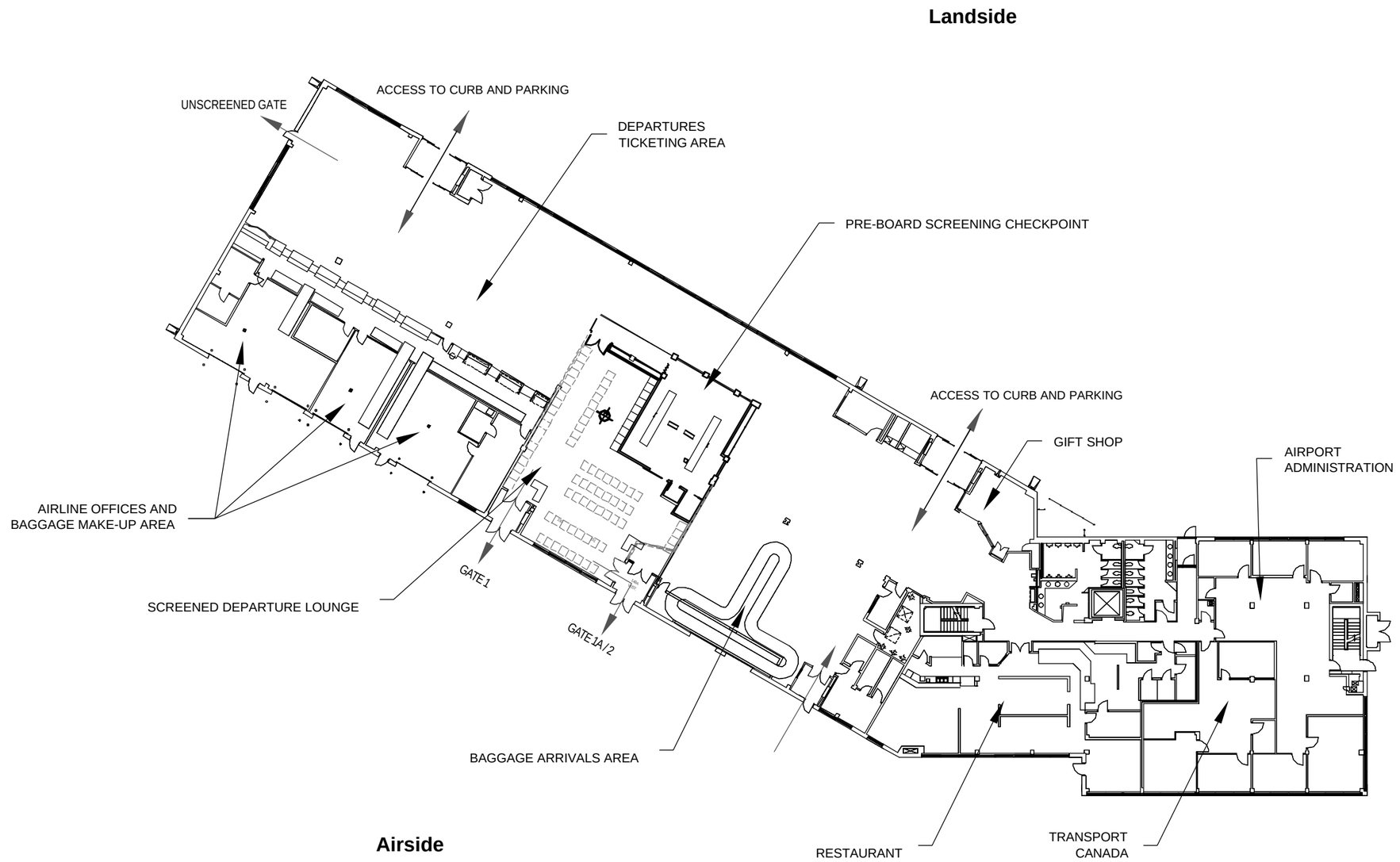
Built in 1963, the original structure housed passenger operations on the ground floor, and office and support functions on the upper floors. The Air Traffic Control Tower was added in 1972. In 1988, the building was renovated and expanded with the construction of the northern wing for passenger processing operations and the reconfiguration of the original portion to its current layout. This expansion was completed and occupied in June 1990. The departure lounge was expanded in 1999-2000 to accommodate concurrent jet departures. The public washrooms were renovated in 2001-02. More recently, in 2003, the passenger PBS checkpoint was expanded – doubling the number of screening lines[1] but reducing the general circulation and waiting space and baggage arrivals area. Figure 9-1 (following page) illustrates the current ground floor layout.

9.2.3 Condition

The existing structure is generally in good condition. A detailed analysis of the building conducted by Airports Division staff in 1998 concluded that few building deficiencies were present in terms of condition or compliance with the *National Building Code of Canada (1995)*.[2] The older original portion of the facility is, however, poorly laid out and difficult to reconfigure given its structural design.[3] A review of the building undertaken for the preparation of the Development Plan concluded that a number of structural and mechanical components of the original PTB structure were approaching the end of their useful life and would require replacement or considerable rehabilitation by 2008-2013.

9.2.4 Space Requirements

Forecast air carrier activities and derived peak hour traffic dictate the requirements for passenger terminal development. Table 9-1 (page 9-4) identifies forecast peak hour passenger traffic and provides a breakdown of PTB space requirements for 2008, 2013 and the longer-term 2023 periods, based on Transport Canada guidelines,[4] updated from recent experience at other airports of similar size category (100,000 to one million annual passengers).



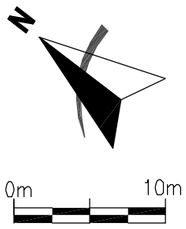


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Figure 9-1: Existing Passenger Terminal Building Layout - Ground Floor

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Table 9-1: Forecast PTB Space Requirements

	Current Allocation (m^2)	Space Currently Required (m^2)	Forecast Space Requirements		
Year			**2008**	**2013**	**2023**
Peak Hour Passengers (One Way)	280		320	350	420
Terminal Subsystems					
Check-in Counters (#)	16	16	19	20	24
Basement – Building Services	**766**	**766**	**766**	**766**	**766**
Ground Floor					
Check-in Area	87	116	121	132	158
Queuing Area	200	303	373	408	490
Airline Offices	54	97	100	109	131
Hold Baggage Screening	180*	700	805	885	1,070
Pre-board Security (Passengers and carry-on baggage screening)	92	92	92	110	130
Screened Departure Lounge	187	347	361	393	473
Concessions	300	385	400	437	525
Baggage Arrivals Area	200	308	320	350	420
Customs/Immigration	56	72	75	82	98
Washrooms	71	103	107	117	140
General Circulation and Waiting	590	930	967	1057	1268
Admin/Operations	201	257	267	292	350
Other Admin (Transport Canada)	103	103	No forecasts provided as it is assumed that future additional office space could be located at a separate off-terminal location.		
Sub-total Ground Floor	**2,321**	**3,812**	**3,987**	**4,372**	**5,252**
Second Floor					
Airport Admin and Distinguished Visitors Lounge	25	25	25	25	25
NAV CANADA	590	590	590	590	590
Sub-total Second Floor	**615**	**615**	**615**	**615**	**615**
ATC Tower - NAV CANADA					
Third Floor	69	No forecasts provided as it is assumed that NAV CANADA would meet exceeding space requirements through an off-terminal location.			
Fourth Floor	89				
Fifth Floor	48				
Sixth Floor	25				
Seventh Floor	13				
Total Gross PTB Area (current)	**3,946**				
Total PTB Operational Area (current and forecast)	**3,702**	**5,193**	**5,368**	**5,753**	**6,633**
Total Passenger Processing Area (current and forecast)**	**2,017**	**3,452**	**3,720**	**4,080**	**4,902**

* Current Hold Baggage Screening area does not include the forecast requirements to accommodate EDS equipment and associated sortation systems.

** Total Ground Floor excluding Admin/Operations and Other Admin.

Source: GNWT, Department of Transportation, Airports Division and Inter*VISTAS* Consulting, 2004.

The existing passenger processing and ancillary areas situated on the ground floor of the building, excluding airport administration and Transport Canada, occupy approximately 2,000m^2 of floor space. While the existing facility has undergone significant expansion and reconfiguration over the years, it is undersized to meet current and future operational requirements. As shown above, current passenger processing space requirements are approximately 70% greater than actual inventory.

The size and layout of the building currently limit the airport's ability to provide adequate levels of service to passengers and carriers. Coupled with the older age of the original portion of the building, the shortfall also limits the operational flexibility of the facility.

By 2013, passenger processing space requirements are forecast to be double that of the current inventory. Consistent with the growth of passenger traffic, these requirements will continue to grow well into the future and must soon be addressed through significant expansion or development of a new facility.

9.2.5 Location

Facility Expandability

Addressing the functional issues and space requirements highlighted above command significant reconfiguration and expansion of the PTB structure. The expandability of the facility on the current site is limited by the configuration of airside infrastructure, the density and layout of adjacent land development, the location of Highway #3 and the airport boundary, and the overall topography of the site.

Assessments and preliminary expansion concepts developed for the purpose of the Development Plan indicate that the current site can accommodate expansion to meet some of the 2008-2013 requirements through reconfiguration and extension of the existing structure. The facility would still however operate at reduced levels of service and the manner in which it is expanded will impact the expandability of adjacent infrastructure – most notably the passenger terminal curb and vehicle parking areas, and the aircraft parking apron.

Beyond the current planning period, considerable additional expansion will be required to meet demand. Given the limitations of the current site, the longer-term expansion of the existing PTB would involve considerable capital investments, yet still deliver a passenger terminal complex[5] that would be operationally constrained and increasingly difficult and expensive to expand further.

Siting

Maintaining the existing PTB location or relocating the facility to a new location emerged as a critical issue for the long-term financial and operational viability of the Yellowknife Airport. As discussed previously, the west-side of the site has been identified in previous planning documents as the proposed location for long-term development. As part of the Development Plan process, the Department undertook an assessment of the opportunities to relocate the PTB complex to the proposed site, with the aim of further leveraging the development potential of this large land asset, and providing greater flexibility for overall airport development. The results of the assessment are described in the *West-side Passenger Terminal Building Option Assessment*[6] report.

Table 9-2 (below) provides a summary of the assessed alternatives.

Table 9-2: Site Development Concept Assessment[7]

	West-side Development	North-side Development
Site Development Characteristics	Greenfield nature of the site provides maximal flexibility in accommodating immediate and long-term development requirements. Site topography and soil composition easily capable of accommodating development. Some rock outcroppings exist on the west-side site, which may impact future development feasibility of adjacent land parcels.	Current and future facility expandability limited by: Significant elevation changes north of Apron I; Obstacle limitations associated with the site's proximity to the runways intersection; Location of First Air hanger to the south – would eventually require tenant relocation to accommodate long-term PTB expansion; and Requirement for concurrent expansion to parking facilities further limits expansion potential.
Operational Considerations	Provides improved access to Runways 09 and 33. Increases taxiing time to Runways 15 and 27. Greenfield site can easily incorporate new de-icing operations and provide flexibility in accommodating future dedicated facilities.	Long-term PTB expansion will eventually require relocation of NAV CANADA offices and ATC Tower to off-terminal location. Maintains long taxiing times to access Runway 33. Configuration of current operational areas limits efficiency and expandability of de-icing operations.
Land Use Implications	Ability to direct new development projects to west-side site prior to construction of new PTB complex. Provides opportunity to fully exploit 105ha of west-side land asset. Will eventually require relocation of major air carrier and fuel facilities from northeast quadrant to west-side site to ensure long-term operational efficiency and minimize airfield ground movements.	Preservation of existing site cannot leverage development of southern quadrants. Would direct lot and support facility development to southeast quadrant (82 developable ha) due to proximity of existing urban areas (services and road network) – would require relocation of VOTAC navigational aid. Optimises long-term use of proximate air carrier facilities, but eventual saturation of existing commercial development area will limit long-term tenant growth.
Access Requirements	Requires upgrade to FOL Access Road. New airport service road to access new terminal area.	Minor road reconfiguration requirements to accommodate future traffic demand.
Other Issues	Provides opportunity to spur urban development to the west of the airport site, and offset costs related to eventual water and sewage network development in this area.	Significantly larger PTB floor area due to angled site configurations and current building layout – will result in higher annual Operations and Maintenance (O&M) costs.
Cost-effectiveness	Approx. Cost: $ 41.9 million (Class D estimate) More costly than north-side development, but provides greater long-term revenue opportunity from larger west-side land area.	Approx. Cost: $32.6 million (Class D estimate) Lowest cost option – Related development of the southeast quadrant would incur costs associated with VORTAC relocation (est. $400,000).

Proposed Long-term PTB Location

Although the expansion of the existing PTB facility would be the least costly solution to addressing current capacity issues, it would not provide the ability to meet long-term requirements. As

discussed earlier in this document, the expandability of the current PTB is constrained by the presence of adjacent major facilities such as the public and employee parking lots, the alignment of Highway #3 and considerable elevation changes to the north of the site. A new location for the passenger terminal complex is needed therefore to meet long-term traffic demand.

As part of an overall long-term development strategy, the development of a new passenger terminal complex on the west-side of the site would provide the necessary stimulus to allow development of this area of the airport, as well as the land situated west of the airport boundary. Due to its larger and relatively easier developable land area, the west-side site has emerged as a viable location for this project. It has been decided therefore that the west-side site be designated to accommodate future PTB development and that sufficient land be reserved on the site to provide for long-term expansion of this facility and ancillary infrastructure.

The process involved with the further advancement of this project, particularly with regards to funding, detailed engineering work and stakeholder consultation, will likely take many more years. Given the capacity limits of the proposed short-term expansion/redevelopment project, it is proposed that the new west-side passenger terminal complex be operational by the end of the 2008-2013 period. In the meantime, the existing PTB shall continue to meet traffic demand, albeit with some limitations to the overall levels of service the facility will provide.

9.3 Passenger Building Connections with the Airport Access System

Landside access to the PTB is made via the passenger terminal curb that runs along the entire frontage of the building, and linked to the airport road access system via the Idaa Road. The passenger terminal curb provides the interface between passengers, well-wishers and employees and the various functions of the building. The curb provides pick-up, drop-off and vehicle wait areas (bus, taxis, etc.) that are generally organized in a manner that is consistent with the functional layout of the PTB. Requirements for the existing PTB access system are presented in Chapter 11.0 – Ground Transport and Internal Airport Circulation and Parking.

Long-term PTB development will require that similar facilities be provided and that provisions are made to enable long-term expansion of the terminal access system.

9.4 Passenger Processing

Air Carrier Operations

Currently, air carrier check-in and baggage handling operations are accommodated in individually leased areas, with each carrier occupying a designated floor space area. Given the lower frequencies of some of the carriers' services, this practice considerably reduces the efficiency of the overall area allocated for airline operations within the building. Implementation of a common use check-in counter system would improve utilisation of the air carrier operational areas, without disproportionately increasing the amount of floor space allocated to these activities.

Growth in passenger traffic at the airport has also resulted in significant increases in space required for air carrier administrative and operational functions. Air carrier offices are generally co-located within the baggage make-up areas, and most are over capacity. Other PTB tenants have also requested additional office space.

Passenger Pre-Board Screening

The Canadian Air Transport Security Authority (CATSA) is responsible for the screening of passengers and their belongings prior to boarding commercial flights at 89 airports in Canada. Passengers departing from Yellowknife on flights to Southern Canada, Whitehorse, Iqaluit, as well as any international destination are required to submit themselves and their carry-on bags to Pre-Board Screening (PBS).

The PTB currently possess one PBS checkpoint at the entrance to the screened departure lounge. In compliance with new passenger screening requirements and to improve throughput capabilities, the PBS checkpoint was expanded in 2003. The expansion doubled the number of screening lines, integrated Explosive Detection Trace equipment and provided space for a secondary search area.

9.5 Baggage Processing

Outbound Baggage Screening

CATSA has imposed a deadline of December 31, 2005 for the deployment of Explosive Detection Systems (EDS) for the screening of hold-baggage (checked bags) at Canadian Airports.[8] This requirement considerably impacts the use and operation of the PTB's baggage make-up areas. The existing outbound baggage make-up areas situated behind the check-in counters currently do not provide sufficient space for efficient air carrier operations. The screening system to be put in place generally involves a multi-step process that incorporates use of various detection equipment and, if necessary, leading to manual searches of checked luggage. The deployment of the HBS system (EDS equipment, necessary sortation system and staff areas) considerably increases the floor space required for baggage handling beyond the capability of the current PTB footprint. An enlargement to the facility by the end of 2005 is required to meet these regulations.

Since the new system will involve considerable capital costs for detection and sortation equipment, installation of individual systems for each carrier can not be justified. Implementation of a shared or common-use outbound baggage handling system is proposed.

The GNWT, Department of Transportation and CATSA have reached agreement on a proposed solution. The Department will be proceeding through design and construction projects to implement the required HBS system, along with a general upgrading of other related passenger and aircraft processing facilities in the passenger terminal complex (apron, PTB, landside).

9.6 Passenger Waiting

Screened Departure Lounge

Passengers departing from Yellowknife on flights to Southern Canada, Whitehorse, Iqaluit, and any international destination are required to submit themselves and their carry-on bags to Pre-Board Screening and be segregated from those persons that have not been screened by proceeding to the screened departure lounge. The existing screened departure lounge is clearly undersized to meet demand during peak departure hours. Based on the existing configuration, the screened departure lounge can accommodate 100-115 departing passengers – well below the capacity of two simultaneous departing B 737 aircraft under full passenger configurations. In addition to this deficiency, the existing screened departure lounge does not provide washroom facilities or

concessions, requiring screened passengers to exit the departure lounge and repeat the screening process if use of these facilities is required prior to aircraft boarding. An expansion of the facility is required to address these issues.

Non-screened Departure Lounge

Passengers departing from Yellowknife on flights to destinations situated above the 60th parallel, with the exception of Whitehorse and Iqaluit, are not required to submit to Pre-Board Screening and, thus, are not required to be segregated in a screened departure lounge. Currently, these passengers are processed through the unscreened passenger gate (Gate 1A/1B) situated at the northern end of the terminal building adjacent to the air carrier check-in counters (see Figure 9-1, page 9-3). The designated waiting area for this gate is open to the general queuing area of the check-in counters and contains a very small number of seats. At peak periods, congestion occurs in this area due to the mixture of waiting non-screened passengers and those waiting in queue at the check-in counters.

Although the proposed configuration of the PTB apron (see Chapter 7.0 - Aprons) will somewhat alleviate the congestion by reallocating most turboprop positions in proximity to the southern end of the building, new non-screened departure facilities are needed at this extremity of the building to maximize the functionality of the apron configuration. Future new PTB development will also need to recognise this distinct operating characteristic and ensure that sufficient functional space is provided for this function.

9.7 Canadian Inspection Services (CIS)

Upon arriving in Canada on an international flight, all passengers must be processed by officials of the Canada Border Services Agency (CBSA).[9] In some cases, secondary screening or follow up processing may be required from Citizenship and Immigration Canada, the Canadian Food Inspection Agency and/or Health Canada.

The lack of space in the PTB considerably limits its ability to efficiently accommodate immigration inspection services. Currently, these services are provided on an occasional basis through isolation of the arrivals area from the general circulation and waiting area, where passengers claim their luggage and are interrogated by CBSA officials before exiting to the public areas. Officials from the other inspection agencies may be called in from regional offices in Yellowknife when secondary or follow-up processing is required.

While this arrangement is typical for airports with relatively low international operations, the size of the existing terminal sometimes requires that both the arrivals area and the screened departure lounge be used for arriving passenger queuing and interrogation/inspection purposes. When this occurs, domestic operations are seriously impeded, as they are temporarily halted until all international arriving passengers have cleared the arrivals area.

Pursuing opportunities to introduce international air services at the airport requires the allocation of sufficient floor space to accommodate a more efficient functional area for queuing, interrogations and inspection processes. The processing of international air passengers would also require detention facilities to accommodate individuals with immigration issues, and sufficient office space to house inspection personnel.

9.8 Passenger Connection with Aircraft

The Yellowknife Airport is not currently equipped with aircraft boarding bridges. Passengers connect between aircraft and the PTB by walking across the open aircraft parking apron. Because passengers travelling to most northern destinations are not subjected to Pre-Board Screening, this results in screened and non-screened passengers circulating simultaneously on the apron. These flows require supervision by airport and air carrier employees to ensure that no security breaches occur.[10]

The structural configuration of the existing PTB does not easily enable the installation of aircraft boarding bridges to facilitate passenger connections to the terminal building. The structure would require addition of second floor passenger facilities (departure lounges or access corridors) to permit the installation of this equipment. Given the cost implications of this installation, this improvement will not be pursued in the existing facility. It is proposed however that the development program for the new PTB provide the ability to eventually incorporate aircraft boarding bridges to facilitate the operational security of the airport and to enhance customer service for passengers.

9.9 Transit and Transfer Passengers

The Yellowknife Airport does not posses a designated transit or transfer lounge. Non-screened passengers arriving from other northern destinations en-route to Southern Canada, Whitehorse or Iqaluit, and in-transit on a through-flight or transferring onto a connecting flight require screening before embarking on the southern leg of their journey. These passengers must disembark from the aircraft and proceed with their carry-on bags to the PBS checkpoint for clearance before re-embarking on the south-bound aircraft. This situation places increased pressure on an already strained screened departure lounge.

When the HBS system becomes operational by the end of 2005, all checked bags will be subjected to screening. This will increase the volume of bags currently handled at the airport since these will require unloading from the aircraft and reloading once they are cleared. The proposed HBS system for the airport has been designed to accommodate this incremental increase in bag volumes. This factor will require consideration for the design of the future west-side PTB.

9.10 Passenger Amenities and Other Passenger Building Services

9.10.1 General Circulation and Waiting Spaces

The current layout of the PTB is a result of periodic and incremental alterations to the floor plan undertaken to meet growing passenger, air carrier and airport operations demands. As a result, general circulation and waiting spaces have gradually been reduced or merged to the extent where considerable congestion occurs during peak hours. The problem worsened following the recent expansion of the PBS checkpoint. Appropriate space for air carrier check-in queues, better separation of the non-screened departure areas from other public areas, and more ample general circulation and waiting space is required, as identified in the forecast space requirements contained in Table 9-1 (page 9-4).

9.10.2 Washroom Facilities

Public washroom facilities are situated solely at the southern end of the PTB, away from the general passenger flow that occurs in the arrivals and departures areas. The facilities were renovated in 2001-2002. No washroom facilities are available in the screened departure lounge. The limited amount of facilities considerably limits the level of service afforded to PTB users. Additional public washroom facilities will be proposed as part of the PTB redevelopment program.

9.10.3 Retail, Food and Beverage and Other Concessions

The Yellowknife Airport currently possesses a restaurant, a small gift shop and two car rental concessions. The limited scale of these services constrain the level of service afforded to PTB users and produce less than optimal revenue streams to the airport. As part of the PTB redevelopment strategy, the Airports Division commissioned a Retail Study to identify services and product offerings appropriate for the Yellowknife Airport clientele. The Retail Study is expected to be completed by the end of 2004.

9.10.4 Other PTB Facilities

The PTB also houses other non-passenger related services such as the Transport Canada Air Worthiness Group on the ground floor, and NAV CANADA services on upper floors of the older, original section of the building, in the Air Traffic Control Tower. The location and space occupied by these services impose limitations to the functional layout of the building. Since Transport Canada activities on the site are not airport-dependent, it is proposed that they be relocated to provide incremental space for passenger-related operations on the ground floor of the building.

9.11 Consideration of Disabled and Elderly People in Passenger Building Planning

The Canadian Transportation Agency (CTA) is responsible for developing and administering accessibility regulations covering the Canadian transportation network governed by the *Canada Transportation Act*. Under the Act, the Agency has the power to remove "undue obstacles" from the federally regulated transportation network, including airports and air carriers.

In addition, facilities at the airport must comply with accessibility standards set out in the *National Building Code of Canada (1995)*[11] and City of Yellowknife By-laws.

9.12 PTB Development Plan

9.12.1 Planning Concept

Recognising current PTB deficiencies and expansion requirements at early stages of the Development Plan process and the limitations of the existing site, various PTB expansion concepts were put forward for review over the course of the planning process.

To measure the suitability of the existing site, most concepts were developed to suit 20-year requirements. These explored northerly and southerly expansion of the existing building, along with addition of second floor operating areas. Key to the concept evaluations and revisions were the compatibility between the aircraft parking apron layout and the ability of the facility to provide adequate flows between the preferred aircraft parking configuration and specific PTB operational

areas, such as departure lounges, arrivals hall and baggage handling areas. The concepts revealed the difficulty the PTB would face in evolving into a functional and efficient operating facility over the long-term period given the limitations of the existing site.

As outlined in this chapter, it is proposed that a new facility be constructed on the west-side of the site. Until such a time that funding is secured, definite construction plans are available and the new facility is operational, the existing facility must still provide appropriate levels of service to its users. Previous concepts were therefore scaled-down and priority given to meeting new security and the most pressing space requirements. Addressing all space requirements, such as those associated with general circulation and waiting areas, are no longer a prime objective. Instead the Airports Division aims to ensure the facility meets on-going operational and security requirements until design, funding and construction of the new facility is complete. Revised concepts where prepared under the following directives:

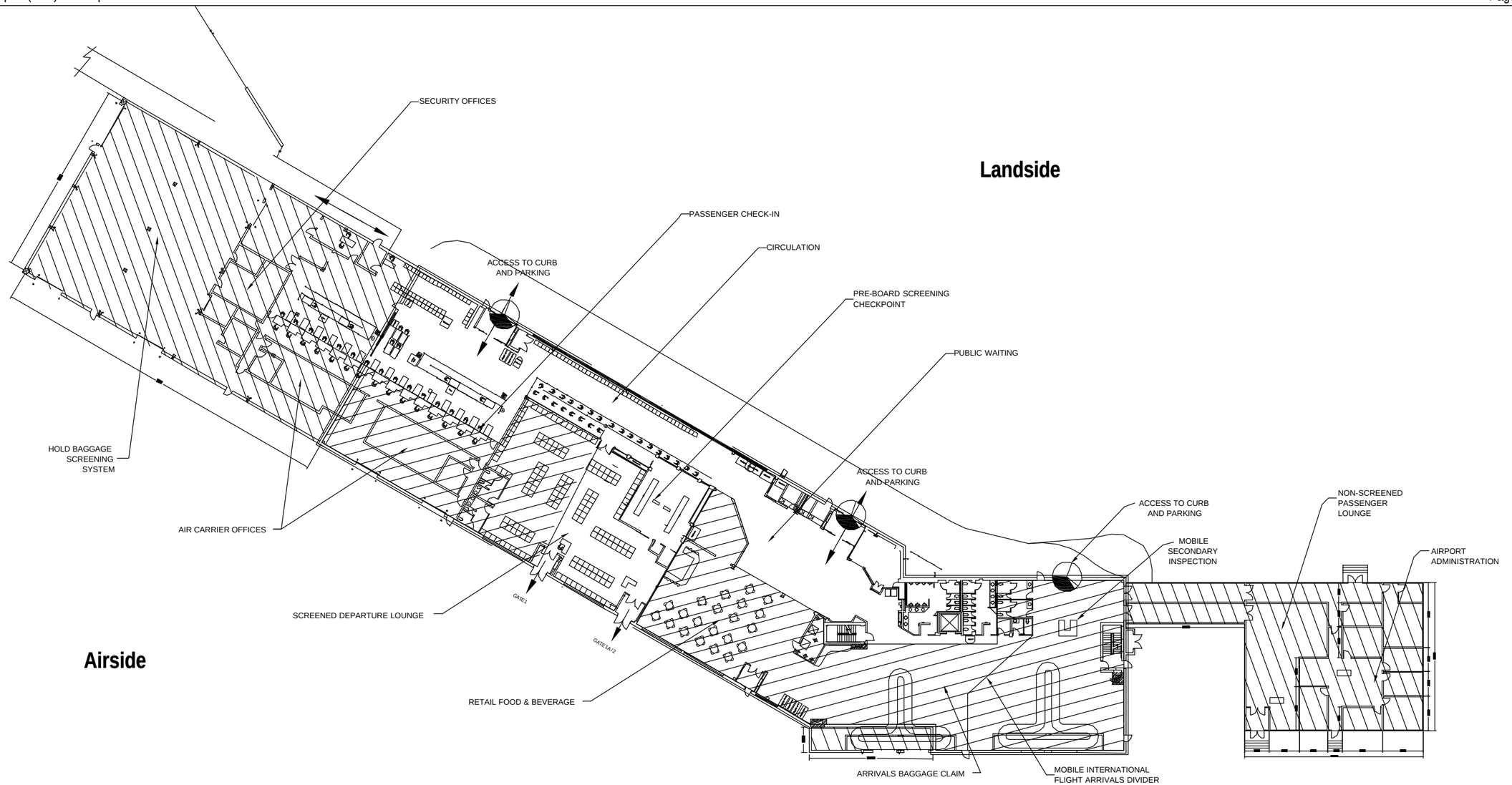
- Minimize capital requirements, given the facility's potential relocation;
- Provide the necessary space for new Hold Baggage Screening (HBS) systems;
- Maintain the recently expanded PBS checkpoint in its current location;
- Increase the efficiency of airline operations areas through introduction of common-use check-in and baggage make-up areas, and provision of appropriate office space;
- Provide allowances for potential incorporation of appropriate Canadian Inspection Services facilities to the building; and
- Provide space for public washroom facilities in the screened departure lounge.

Based on various PTB floor plan expansion iterations, a single expansion to the northern wing of the building, accompanied by the reconfiguration of the southern portion of the ground floor, has emerged as the most effective manner to address immediate requirements.

9.12.2 Proposed PTB Expansion

The preferred concept is illustrated in Figure 9-2 (following page). The concept contains the following features:

- A 1,000m^2 northerly expansion to accommodate the HBS system and related operations and office areas. Use of the system and related baggage handling area would be shared among carriers.
- Relocation and expansion of the arrivals area to provide two baggage carousels and the potential isolation of a portion of the area for Canadian Inspection Services operations, when required.
- Relocation of the non-screened departure lounge and administrative offices in a portable annex structure (approximately 400m^2).
- A doubling in size of the screened departure lounge, and installation of public washroom facilities in the post-security area.
- Increased space for air carrier offices through relocation of the baggage make-up area to the HBS area.



LEGEND:

NEW CONSTRUCTION

RECONFIGURED

N

0m 10m 25m

Northwest Territories Transportation

Figure 9-2: Proposed Configuration - Existing PTB

DATE: November, 2004

For planning purposes only

The overall expansion derives from CATSA requirements to implement an HBS system at the airport. Development of the PTB expansion concept was undertaken in consultation with CATSA and the carriers operating from the facility. The value of the project is approximately $10 to $15 million - funded jointly by the GNWT and the Government of Canada.

The work will be stage to minimize disruptions to airport operations, with implementation initiated in 2004. The proposed reconfigured ground floor space would be adequate to meet overall requirements to approximately 2008-2013.

9.12.3 Preferred New Long-term PTB Development

As discussed previously, it is proposed that the passenger terminal complex be relocated to the west-side of the airport site by the end of the 2008-2013 period. To ensure overall consistency between short and long-term Development Plan proposals, preliminary planning has been undertaken to identify the exact siting and general layout of the future passenger terminal complex. Key concept elements include:

- The definition of bloc layouts representing required footprints and aircraft movement areas;
- The airside infrastructure required to access the PTB site; and
- Provisions for ancillary development such as cargo facilities, fuel storage and maintenance buildings for initial land use planning purposes.

The preliminary site and facility concept incorporates a preliminary PTB concept, aircraft parking apron and the roadwork required for two-lane access and associated parking surfaces. The preliminary layout is illustrated in Figure 9-3 (page 9-15).

The proposed future development is situated mid-way along the airport's primary runway (Runway 15-33) to minimize aircraft movements to either end of the runway.

The PTB concept is based on the development of a passenger processing structure with piers on either side of the building, providing opportunities for eventual addition of second floor departure lounges, aircraft boarding bridges and flexibility for future expansion.

The preliminary apron layout is designed to meet the 2023 requirements for 12 aircraft parking positions identified in Chapter 7.0 – Aprons. The layout provides one stand capable of accommodating Code D aircraft. The latter is expandable to allow an upgrade to Code E standards in the future. Provision for the development of a dedicated de-icing facility is also made.

Preliminary estimates for this project indicate costs could be in the range of $40 to $45million for all associated works, including vehicle parking, apron, internal roads, and utilities. More detailed planning for this facility is required before more specific costing may be provided, and a specific development program can be put forward.

LEGEND

- Existing Airport Boundary
- Proposed Airport Boundary
- 1 Proposed access corridor alignment/extension
- 2 Proposed Passenger Terminal Building
- 3 Proposed Public Parking Lot
- 4 Proposed PTB Apron
- 5 Proposed fuel facility location
- 6 Proposed airport maintenance building
- 7 Proposed Runway 09-27 south parallel taxiway
- 8 Existing Passenger Terminal Building
- 9 Proposed Phase I Runway 15-33 parallel taxiway
- 10 Proposed Phase II Runway 15-33 parallel taxiway

N

0m 250m 500m

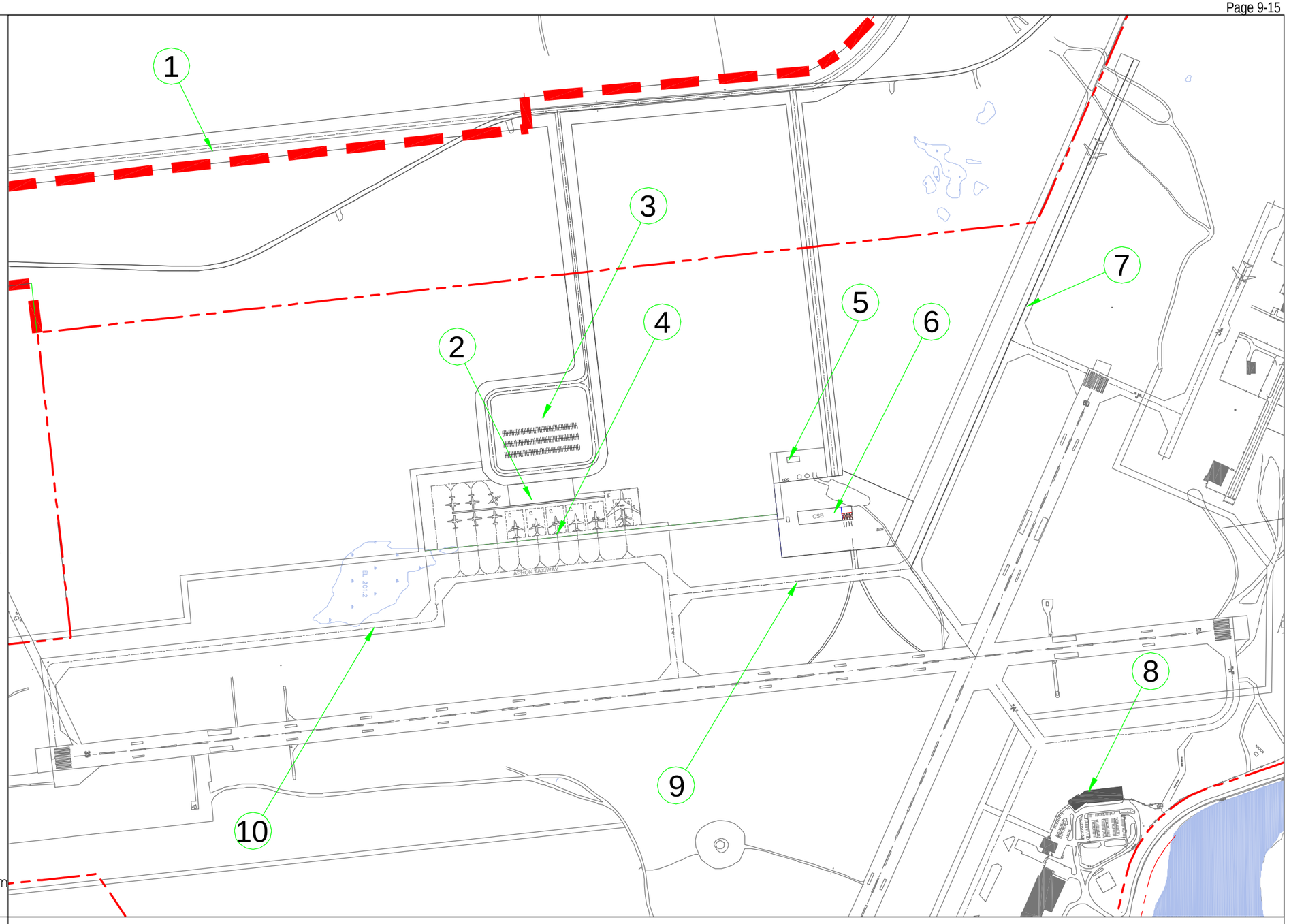


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Figure 9-3: Preliminary Site and Facility Concept Layout - Future PTB

DATE: November, 2004

For planning purposes only

9.13 Notes and References

[1] An additional magnetometer, explosive detection equipment and a secondary search area were installed in the PBS checkpoint.

[2] *Air Terminal Building, Yellowknife, Technical Evaluation Report*; Technical Support Section, Project Management Division, Department of Public Works and Services, Government of the Northwest Territories, 1998.

[3] The original PTB is a steel post and beam structure characterised by the presence of numerous supporting columns and low ceilings. These components typically constrain reconfiguration opportunities within the building.

[4] *Systemised Terminal Expansion Program (STEP), AK-62-08-000*; Transport Canada, 1986.

[5] The passenger terminal complex consists of the PTB, the aircraft parking apron, and PTB-related vehicle access and parking facilities.

[6] *West-side Air Terminal Building Option Assessment*; Inter*VISTAS* Consulting Inc., 2003.

[7] Ibid.

[8] The December 2005 deadline is for deployment of systems for the screening of checked domestic baggage. Only checked baggage, including in-transit baggage, destined for airports south of the 60th parallel must be subjected to the screening process. The deadline for deployment of systems for international and transborder destined baggage was December 31, 2003.

[9] The Canadian Border Services Agency was created in December 2003 and is part of a new portfolio that integrates key functions previously spread among three organizations: the Customs program from the Canada Customs and Revenue Agency, the Intelligence, Interdiction and Enforcement program from Citizenship and Immigration Canada, and the Import Inspection at Ports of Entry program from the Canadian Food Inspection Agency.

[10] Screened passengers must remain segregated from all unauthorised non-screened person until arrival at their final destination.

[11] *National Building Code of Canada 1995*; Institute for Research in Construction, 1995.

10.0 Cargo Facilities

10.1 About this Chapter

The Yellowknife Airport currently serves as a major staging point for northern re-supply operations, with significant volumes of cargo transported to a number of northern communities and remote mining sites. Dedicated cargo and combination passenger/cargo aircraft operate to and from the airport on a daily basis. The airport is also the base for First Air's Hercules L382 – Canada's only civilian Hercules cargo aircraft.[1] Yet, the airport does not possess any dedicated cargo facilities. This chapter reviews existing handling capabilities at the airport, and assesses potential requirements with the aim of ensuring that appropriate areas are reserved on the site to eventually enable development of these facilities.

Specific aviation-related terminology used in this section is defined below:

Cargo Apron – A defined area, on a land aerodrome, intended to accommodate aircraft for the purposes of loading and unloading cargo, fuelling, parking and maintenance.

Cargo Terminal – A facility that houses cargo that is processed and properly prepared for loading and unloading from cargo aircraft.

Combi Aircraft – An aircraft that is designed to carry both passengers and cargo within the passenger cabin. Usually, the configuration of the aircraft can quickly be changed in order to carry more cargo or passengers, whichever is necessary.

Freighter Aircraft – An aircraft that is strictly designed to carry only cargo.

10.2 General Considerations

A key consideration for cargo planning at the Yellowknife Airport is the lack of facilities dedicated to the processing and storage of air cargo, and related aircraft manoeuvring areas. Currently, cargo is processed in air carrier and general aviation hangers and on the PTB aircraft apron (Aprons I and II), alongside other aircraft and passenger operations. Not only does the absence of facilities constrain existing cargo operations at the airport, it also limits the growth potential of the northern cargo market.

As discussed in Chapter 3.0 – Forecasting for Planning Purposes, the cargo sector will likely be strengthened by the growth of the northern economy. Eventual incremental growth could result from the airport playing a role in the integrated cargo carrier/courier network due to its position along polar routes. (Although this sector is already strongly entrenched at Anchorage, long-term capacity and expansion issues at this airport could create demand for relocation or spill-over of operations to another northern airport over the long-term period.). In addition, the development of diamond-related facilities at the airport may also leverage demand for new air-related distribution activities at the airport over time. These activities, in turn, will generate requirements for new or expanded cargo handling and storage installations, as well as additional facilities to accommodate and maintain associated equipment.

Airport operators are not typically sole providers of specific air cargo infrastructure. Instead, facilities are usually developed through private sector investment – reflecting market demand and growth opportunities. The role of the airport operator in this sector is to facilitate the development of these facilities by providing suitably situated land and enabling airside access for facility operators. In some cases, the airport operator may deliver dedicated aircraft parking apron space to leverage the development of these facilities.

Addressing future opportunities requires that the Airports Division provide sufficient land, above and beyond that required for existing passenger and general cargo services, to accommodate new facilities. Since this type of development would also generate demand for additional apron surfaces, the cargo planning processes must consider providing sufficient land allocations to accommodate potential long-term demand for additional aircraft parking stands in proximity to potential future cargo areas.

10.3 Siting

Significant volumes of air cargo currently transit through the Yellowknife Airport on passenger, dedicated freighter and combi passenger/cargo configured aircraft. Since most northern cargo is currently, and can be expected to continue to be, transported on passenger/combi aircraft, locations in proximity to the passenger terminal complex will be required

The airport's northern quadrants currently do not provide sufficient space to enable the development of an appropriately sized cargo apron and ancillary cargo terminal, given the current occupancy levels and the prevailing Obstacle Limitation Surface restrictions (see Chapter 6.0 – Runways and Taxiways) at the airport. To provide for the eventual construction of dedicated cargo facilities on the site, it is proposed that land use planning for new airside accessible land on the west-side of the airport protect land for the eventual development of dedicated cargo aprons. These would involve specific land reserves for future cargo terminal/apron construction and/or the provision of land parcels of sufficient width and depth to accommodate appropriately sized aircraft aprons. Chapter 17.0 – Land Use contains the proposed Land Use Plan for the airport site.

10.4 Cargo Terminals

As discussed previously in this document and highlighted above, there are no dedicated cargo terminals at the Yellowknife Airport. However, First Air, Canadian North, Air Tindi, Buffalo Airways, Arctic Sunwest Charters and G&G Expediting and Braden Burry Expediting process air cargo through their facilities. Figure 10-1 (page 10-4) illustrates the location of the associated facilities.

10.4.1 Floor Space

Cargo facility requirements can be based upon the cargo volumes expected to be processed at an airport, with order-of-magnitude cargo terminal requirements derived from the application of a facility utilisation rate – expressed in terms of Annual Tonnes Per Square Metre (ATPSM) – to long-term forecasts.

Benchmark utilisation rates are translated into potential floor space requirements for the Yellowknife Airport in Table 10-1 (below). These are based on the cargo forecasts presented in Chapter 3.0 – Forecasting for Planning Purposes and detailed in Appendix B. Utilisation rates at other Canadian airports typically range between 1.5 and 4.0 ATPSM. Those shown in Table 10-1 are reflective of those achieved at other Canadian airports where moderate cargo volumes are processed and where manual handling procedures prevail.[2] (Manual handling procedures generally result in lower throughput capabilities compared to facilities that adopt partial or fully automated handling standards.)

Table 10-1: Forecast Cargo Traffic and Derived Facility Space Requirements

Year	Forecast Traffic* (Tonnes)	Derived Facility Space Requirements (m^2)		
		Low Throughput (1.5 ATPSM)	Medium Throughput (3.0 ATPSM)	High Throughput (4.0 ATPSM)
2003 (estimate)	23,000	15,350	7,650	5,750
2008	28,300	18,850	9,450	7,100
2013	31,900	21,250	10,650	8,000
2023	38,500	25,650	12,850	9,650

* Medium Range Forecasts
Source: Inter*VISTAS* Consulting, 2004.

Airports with cargo volumes within the range of those at the Yellowknife Airport generally achieve lower throughput as a result of very limited investments in internal storage equipment and longer freight dwell times in the facilities. Comparatively, cargo operators at the Yellowknife Airport have achieved considerable operational efficiencies as a result of the limited space available for freight handling and storage. New cargo facilities at the airport would therefore likely achieve throughput in the medium range. This would result in derived potential cargo facility space requirements of 7,650m^2 (current), reaching up to 12,850m^2 by the end of the planning period (2023).

Note that the cargo throughput productivity at Canadian airports is low in comparison to international gateway airports.[3] The introduction of automated handling procedures could considerably increase the productivity of future facilities and lower demand for overall floor space at the airport.

10.4.2 Land Areas

Air cargo land use requirements are closely tied to related facility space and land occupancy. Typically, land occupancy ratios for industrial warehouse buildings range between 0.2 and 0.4 depending on the degree of truck unloading/loading to occur. At the Yellowknife Airport, considerable volumes of air cargo transit through the airport via air, with a portion transferred to/from truck mode for local/regional distribution. Given the characteristics of the Yellowknife air cargo market, the land occupancy ratio can be set at 0.4.

This resulting land requirement could therefore range between 1.9ha for current needs to 3.2ha to meet long-term demand.

LEGEND

① First Air
② Air Norterra Inc. (Canadian North)
③ Buffalo Airways
④ G&G Expediting
(Diavik Diamond Mines Inc.)
⑤ Air Tindi Ltd.
⑥ Braden Burry Expediting Ltd.
⑦ Arctic Sunwest Charters

Airport Boundary

N

0m 100m 200m

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Figure 10-1: Cargo Processing Locations

DATE: November, 2004

For planning purposes only

10.5 Cargo Aprons

There are no dedicated cargo aprons at the Yellowknife Airport. As highlighted previously, a considerable amount of cargo is currently handled on the PTB apron (Aprons I and II) during the turn-around of passenger and combi configured flights. First Air, Air Tindi, Buffalo Airways, Arctic Sunwest Charters, G&G Expediting and Braden Burry Expediting also process air cargo from their hangars and adjacent aprons. (See Figure 7-1, page 7-2, for the location of the associated aprons.)

The airport's northern quadrants currently do not provide sufficient space to enable the development of an appropriately sized cargo apron and ancillary cargo terminal given the current occupancy levels and the prevailing Obstacle Limitation Surface restrictions at the airport. To provide for the eventual construction of dedicated cargo facilities on the site, it is proposed that land use planning for new airside accessible land on the west-side of the airport protect land for the eventual development of dedicated cargo aprons. Since a portion of cargo volumes at the airport is transported on passenger or combi configured flights, it is proposed that the future cargo apron be positioned with direct access to the future PTB apron.

To provide maximal flexibility in meeting long-term opportunities, the apron will initially require a configuration capable of accommodating at least one Code C aircraft, with a potential to upgrade to Code E standards over the long-term period. A land area enabling an initial configuration for the simultaneous parking of two Code C aircraft or one Code E aircraft is proposed. The land area to be reserved for this purpose is illustrated in the Airport Land Use Plan presented in Chapter 17.0 – Land Use.

10.6 Cargo Terminal Area Access and Parking

Landside access to the potential cargo terminal area will require appropriate roadworks to enable the efficient movement of vehicles to and from the site. To minimize traffic conflicts between trucks accessing the cargo facility and passenger vehicles accessing the proposed PTB, a dedicated roadway, segregating the cargo traffic from the PTB traffic, should eventually be provided to the cargo terminal.

10.7 Canadian Inspection Services

Air cargo arriving from a foreign destination must be cleared by the Canada Border Services Agency (CBSA). For air cargo inspections, the CSBA integrates the functions previously held by the Customs program from the Canada Customs and Revenue Agency, and the Import Inspection at Ports of Entry program from the Canadian Food Inspection Agency.

Future development will require appropriate space be allocated for CSBA offices. These may be provided within the proposed PTB or within the proposed adjacent cargo terminal. Consultation with the CSBA will be required during the detailed planning of the PTB and/or future cargo facilities.

10.8 Notes and References

[1] The Hercules is a powerful, versatile aircraft, perfect for Canada's North. It can land on short, packed earth, rough dirt, gravel or ice runways and carry payloads up to 47,000 pounds. Flying from its base at the Yellowknife Airport, a typical work day for the plane can include a number of diverse cargo trips to ferry supplies and transport heavy equipment to mining sites (including Diavik and Ekati diamond mine sites) and communities, as well as construction supplies for mining exploration camps, oil drill rigs, fuel, trucks, tractors, food and other items.

[2] Based on average throughput figures derived for Vancouver, Regina, Winnipeg and Moncton airports.

[3] Based on available data, throughput at gateway airports such as Seattle and Portland are 6.0 and 7.5 ATPSM, respectfully; while larger international airports such as Los Angeles and London Heathrow range from 10.0 to 14.4, respectfully.

11.0 Ground Transport and Internal Airport Circulation and Parking

11.1 About this Chapter

This chapter deals with the components necessary to accommodate the ground transport of passengers, freight and employees to, from and within the landside areas of the airport site. More specifically, the chapter evaluates airport access, internal roadway circulation, the passenger terminal curb and parking facilities. Analyses of these components cover existing capacity, and anticipated demand. Existing and future shortfalls are identified and options addressing deficiencies are also formulated. For reference purposes, access, internal airport circulation and parking infrastructure is illustrated in Figure 11-1 and Figure 11-2 (pages 11-2 and 11-3).

Specific aviation terminology used in this chapter is defined below:

Airport Tenant Parking – Ancillary parking areas situated on the airport site and dedicated to those tenants and their customers that do not require access to the PTB.

Commercial Vehicle – All non-privately operated commercially-owned vehicles accessing the airport site. At the Yellowknife Airport, these generally consist of buses and courtesy vehicles, taxis, and delivery trucks.

Fire Route – An area on a highway, public parking lot, private property and airport access or intra-airport internal circulation road where properly worded signs are on display indicating that parking is prohibited in order to provide fire department and other emergency vehicles unobstructed access to adjacent properties in the event of fire or other emergency.

Long-term Parking – Defined as vehicle parking for a duration surpassing the 3-hours short-term period, or generally more than a day. Users are mainly comprised of members of the travelling public who leave their vehicles at the airport for the duration of their trip.

Meteorological Observation Site – Site that contains weather observation equipment. The purpose of this site is to obtain weather data representative of the runway complex for the support of forecasting and aircraft operations.

Passenger Terminal Building-related Parking – The parking area situated in proximity to the PTB. Users are generally comprised of the travelling public using the terminal facility, visitors and well-wishers, and PTB employees (airport administration, carrier and concession employees, etc.).

Passenger Terminal Curb – Component of access and internal airport circulation infrastructure, generally fronting and using the main public access-way to the PTB. Main components of this facility generally include vehicular traffic lanes, through lanes, bypass lanes, curb/manoeuvring lanes, sidewalk platforms for passenger/baggage loading and unloading, and pedestrian crossings.

Short-term Parking – Defined as parking duration of less than 2-3 hours, which effectively comprises individuals seeing passengers off at the terminal or coming to meet them.

Third-party Operator – A person or an organization that supplies a service or a set of services under contract to a main service provider or operator.

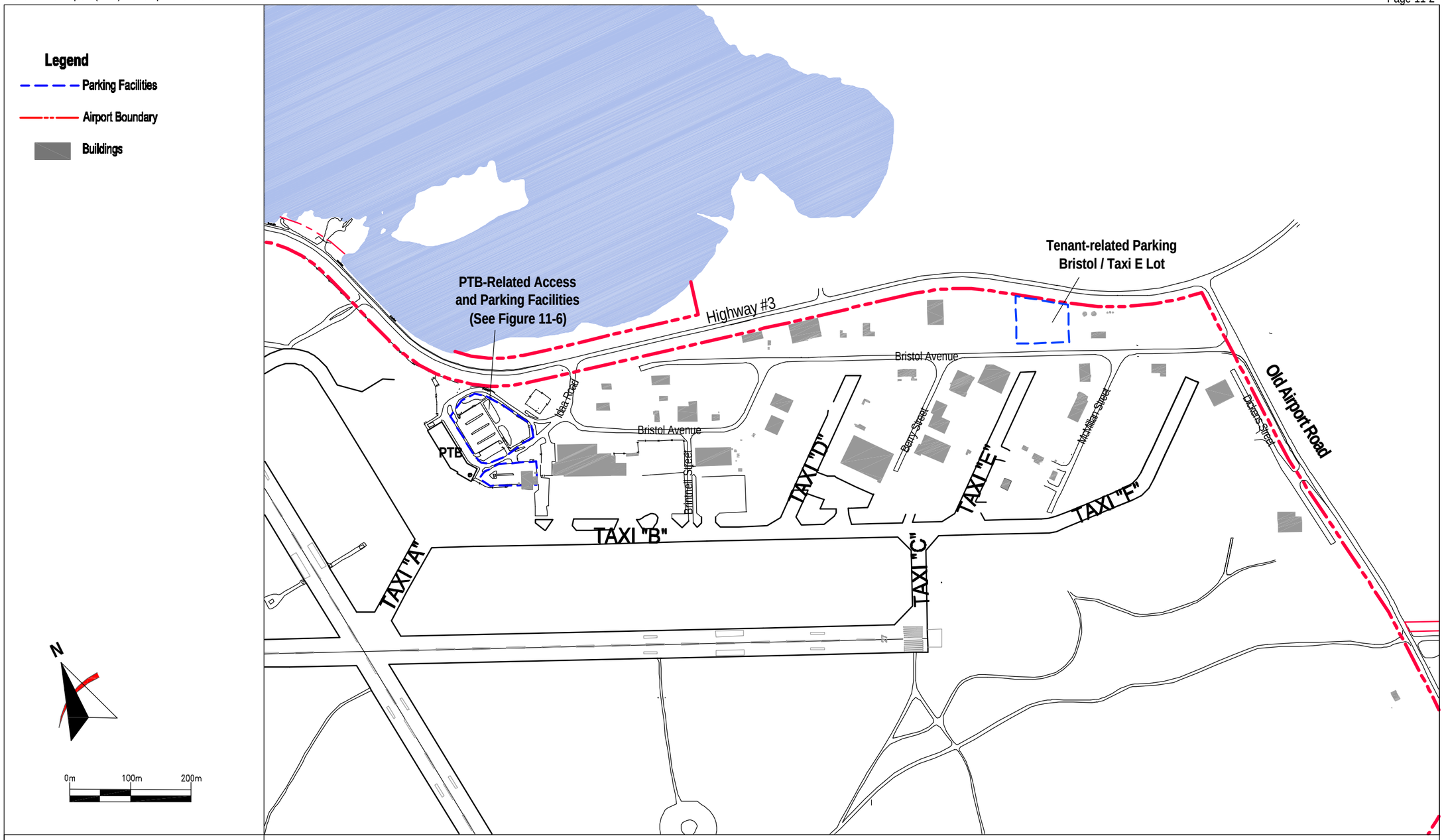

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Figure 11-1: Access, Internal Circulation and Parking Infrastructure - Northeast and Southeast Quadrants

DATE: November, 2004

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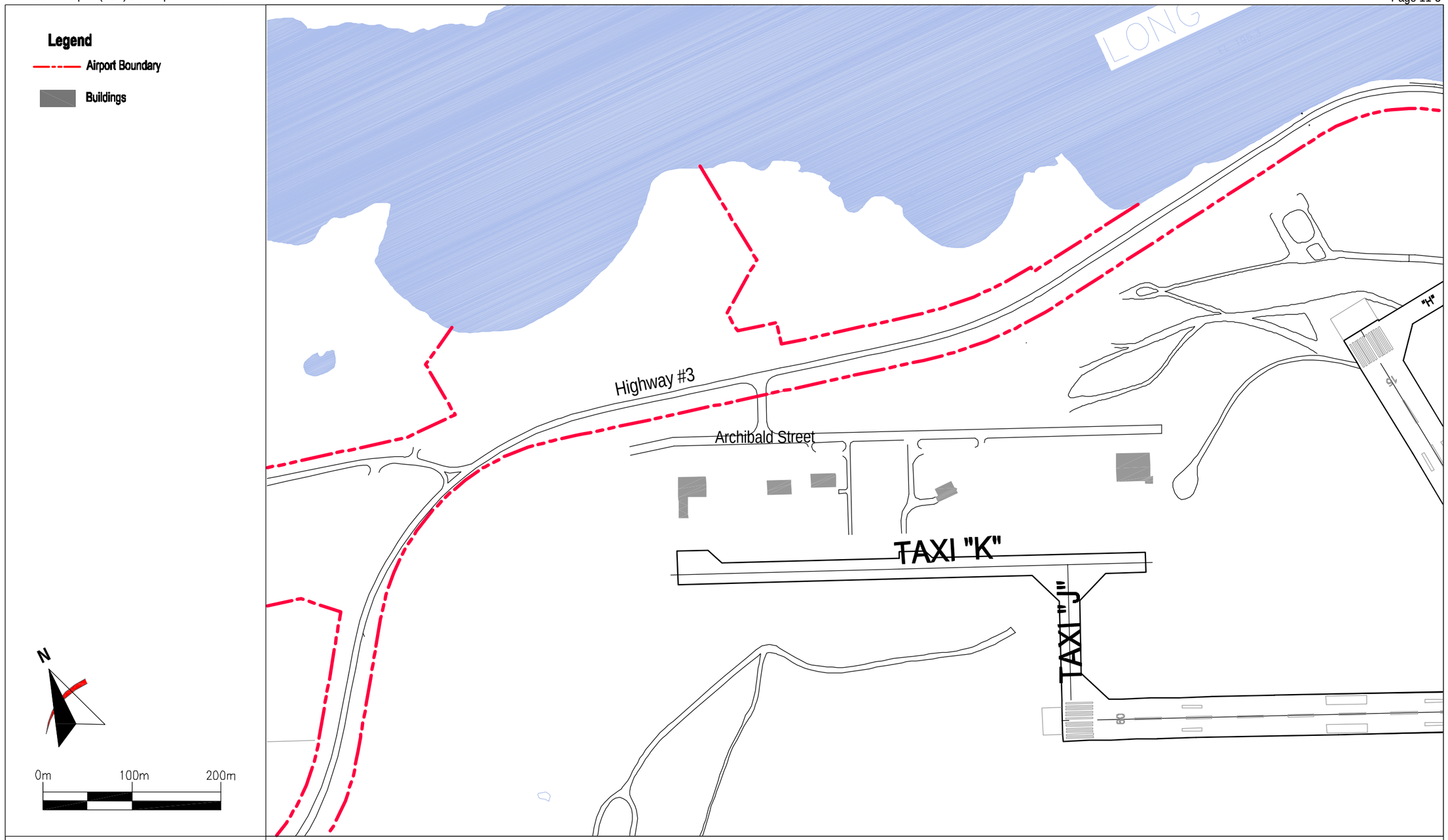


Figure 11-2: Access and Internal Circulation - Northwest Quadrant

Northwest Territories Transportation

DATE: November, 2004

For planning purposes only

11.2 Airport Access

11.2.1 General Considerations

As illustrated in Figure 11-1 (page 11-2), primary access from the City of Yellowknife to the airport site is provided via Highway #3, which skirts the northern periphery of the airport and separates airport land from the adjacent Long Lake. Old Airport Road, bordering the eastern edge of the airport site, provides secondary access to/from the City of Yellowknife. Highway #3 is under jurisdiction of the GNWT, Department of Transportation, Highways Division. Old Airport Road is under City authority up to the City boundary.

As passenger traffic continues to grow, the capacity of the Idaa Road/Highway #3 intersection will become an issue. Although current volumes at this intersection are relatively low, turning lanes should be added at an appropriate time in anticipation of future growth in demand. The timing of such improvements would depend simultaneously on airport traffic growth and that of the development of a new passenger terminal complex in the west-side of the site. The turning lanes can be easily accommodated within the current right-of-way.

11.2.2 West-side Access

The west-side of the site can be currently accessed by the FOL Access Road. Located outside the airport site, running in a relatively parallel alignment with its western boundary, the road is under the authority of the Department of National Defence (DND). This road is currently gravel surfaced, and provides access to the FOL site itself and to the ISSR facility.

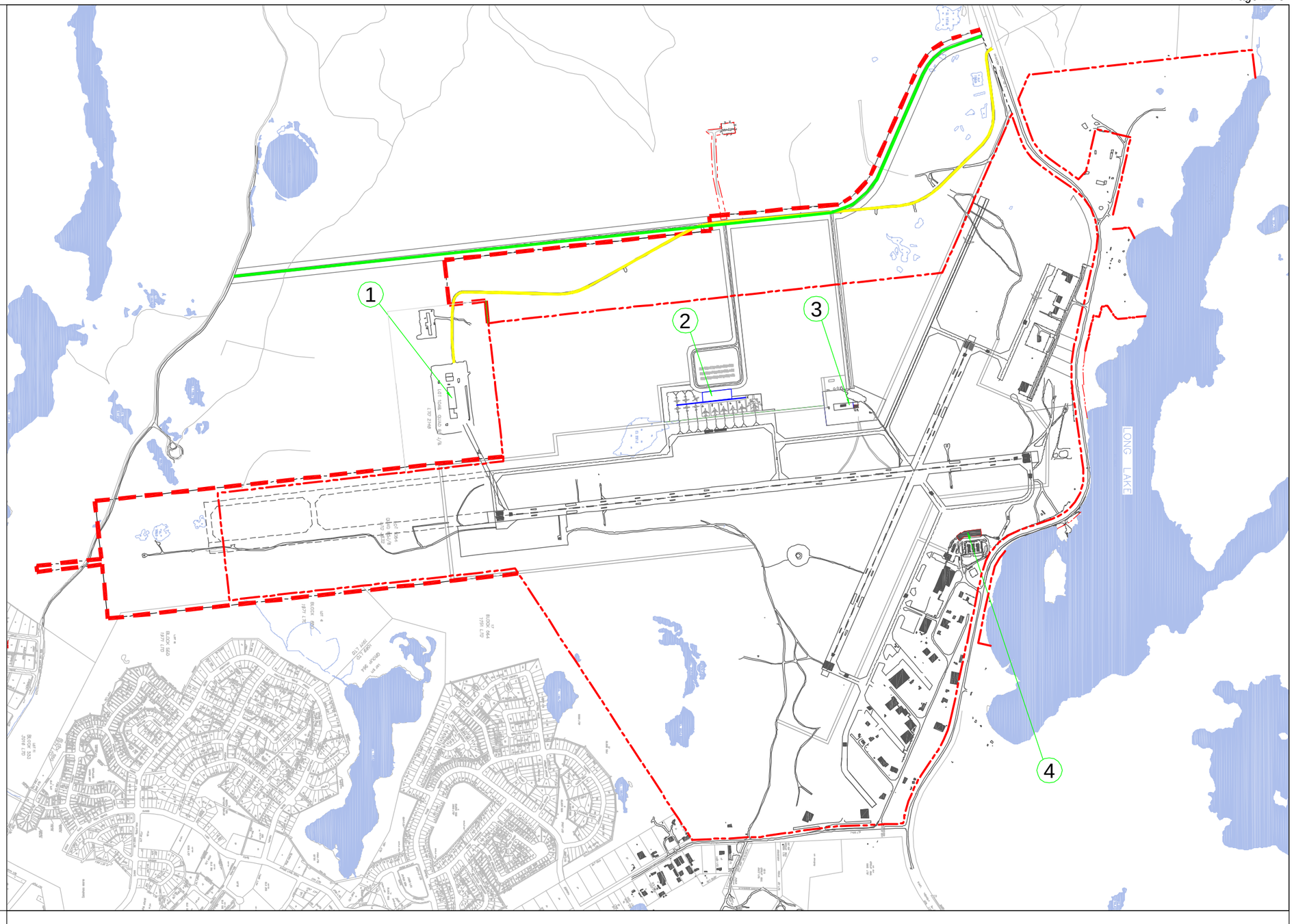
Considerable upgrades and extension of the existing FOL Access Road towards Deh Cho/Fiddlers Lake Road are required to enable the development of this quadrant of the airport site. These improvements would facilitate access to the west-side of the airport site from the Kam Lake Industrial subdivision, provide an alternate access route to the airport from the subdivisions located southeast of the site, and provide alternate emergency access to new development areas.

The City of Yellowknife, in association with the GNWT, Department of Transportation, have discussed the upgrade and extension of the FOL Access Road. This project is outlined in the recently submitted *City of Yellowknife, 2004 General Plan (Draft)*[1] as critical to the development of both the western quadrant of the airport and the pursuit of the City's long-term industrial development strategy.

The Airports Division has put forward a proposed alignment for this road as part of the preliminary planning for the development of the west-side of the airport site, as illustrated in Figure 11-3 (page 11-5). The proposal calls for the existing road to be extended southward from the junction point with the FOL site to connect to Deh Cho Boulevard/Fiddlers Lake Road. The northern portion of the road would also need to be shifted by a maximum of approximately 360m from its current location to improve the safety of the approach to the Highway #3 intersection (see Figure 11-3, page 11-5), and improve the ability to subdivide land for future industrial development along the corridor. Turning lanes from the Highway would also be required, as discussed above.

LEGEND

- Existing Airport Boundary
- Proposed Airport Boundary
- Existing FOL Access Road
- Proposed Access Road Corridor
- 1 FOL site
- 2 Proposed passenger terminal complex
- 3 Proposed maintenance building
- 4 Existing PTB



N

0m 500m 1000m

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Figure 11-3: GNWT Proposed FOL Access Road Extension and Alignment

DATE: November, 2004

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The City of Yellowknife is currently reviewing this project and related power, water and sewage service options. The timing of development of this road segment is contingent upon the approval timeframe adopted for future development of the Yellowknife Airport's west-side site. No cost estimates have yet been prepared.

11.3 Airport Traffic Data

PTB access and parking facility requirements can be closely linked to demand derived from passenger and terminal employee activities. As a basis to the assessments outlined in this chapter, Table 11-1 (below) summarises the forecast annual enplaned and deplaned passenger forecasts to 2023 shown in Chapter 3.0 – Forecasting for Planning Purposes. For baseline purposes, the derived PTB Planning Peak Hour Passenger (PPHP) forecasts are also provided.

Table 11-1: Enplaned and Deplaned Passengers and Planning Peak Hour Passenger Forecasts (PPHP)

	2003	2008	2013	2023
Annual	325,000	395,000	424,000	505,000
PPHP Carrier Passengers for PTB[2] (departing and arriving)	510	580	640	770

Source: Inter*VISTAS* Consulting, 2004.

Formal vehicle counts and vehicular traffic forecasts were not part of the scope of the original Development Plan process. However, based on typical road design standards, the access roads to and from the PTB are capable of accommodating approximately 1,200 vehicles per hour (based on a two-lane configuration), well above the forecast peak hour passenger traffic shown in Table 11-1 (above).

11.4 Internal Airport Roadway Circulation

The existing internal airport road network is illustrated in Figure 11-1 (page 11-2). Idaa Road, a two-lane bi-directional roadway, intersecting with Highway #3 immediately east of the PTB area, is the primary access road to the passenger terminal and its associated parking facilities. This roadway travels west for approximately 100m, before splitting to provide one-way circulation around the PTB's main parking area.

Two primary roads provide access to the airport's current individual leased areas. Access to the northeast quadrant is made via Bristol Avenue – a two-lane bi-directional service road. Its western extremity connects with Idaa Road immediately east of where the latter splits to become a one-way loop road (the passenger terminal curb) near the PTB. At its eastern end, Bristol Avenue connects to Old Airport Road at the airport boundary, and to a number of small stub roads that provide access to airside properties located in the northeast quadrant. This road accommodates large freight/cargo carrying trucks and private vehicles.

Dickens Street provides access to the tenanted lots located off Old Airport Road. Archibald Street provides access from Highway #3 to the lots situated in the northwest quadrant.

All landside roads are paved with gravel shoulders, except for the portion of Idaa Road that loops around the PTB parking area. The latter portion possesses a concrete curb and gutter cross-section.

All roads on the airport site are under the authority of the Airports Division.

The road allowances in the northeast quadrant of the airport are sometimes lined with vehicles despite the fact that "No Parking" signage is in place to protect fire route access.

Although the existing network of airport roads provides adequate levels of service to existing development areas, wear and tear will eventually require rehabilitation of some existing road surfaces (e.g. resurfacing, and shoulder grading). Installation of streetlights would also improve nighttime visibility and increase the sense of security on the site.

The extension of existing or the addition of new roads will also be required to enable the development of new land parcels. Archibald Street, in particular, in the northwest quadrant will require an extension by approximately 150m to provide access to the few remaining land parcels available for development in the airport's northern quadrants. The cost of this proposal is estimated at approximately $80,000 and should be implemented by 2006 to meet demand for new parcels until the west-side site is accessible and available for development. Overall, new roads at the airport, in particular those serving the proposed west-side development, will need to be configured to maximize the availability of developable land, and to provide flexibility in lot sizing.

Direct access by Fire Department vehicles to at least one face of every building by means of a street, yard or roadway must be ensured in conformance with the *National Fire Code of Canada*[3]. Adequate signage indicating that parking is prohibited in critical locations to ensure fire route access must also be installed on new roadways.

11.5 Passenger Terminal Curb

11.5.1 General Considerations

Configuration

The portion of Idaa Road in front of the PTB that serves as the passenger terminal curb is three lanes wide and enables loading and unloading of passengers, visitors and well-wishers, public transportation and delivery services at the PTB. Figure 11-4 (page 11-9) illustrates the current curb layout and space allocation.

Management of vehicle movements in front of the PTB is difficult due to the limited curb length and a lack of proper enforcement measures. A visual survey of curb activities performed for the purpose of this study counted several anomalies. These include unattended vehicles or lengthy idling, vehicles parked in the "No Parking" and other restricted zones (i.e. vehicles parked in the handicap zone without proper permits), and considerable space consumed by courtesy and shuttle vehicles.

The current configuration of the passenger terminal curb, coupled with the location of crosswalks and lot egress points, generate numerous traffic conflicts, and raise safety concerns for vehicular and pedestrian traffic. The latter is of particular importance on the inside, or easternmost lane of the roadway, where buses and courtesy vehicles typically load and unload passengers.

Space Requirements

The current capacity problems observed on the passenger terminal curb are not of a traffic volume nature, but one that derives from the limited loading/unloading space along its length. Table 11-2 (following page) outlines forecast curb length and vehicle space requirements.

Table 11-2: Curb Length and Vehicle Space Requirements

	Currently Available	Forecast Requirements		
		2008	2013	2023
Vehicle Spaces (#)	22	27	30	36
Curb Length (m)	180	243	270	324

Source: Inter*VISTAS* Consulting, 2004.

Future requirements for loading/unloading space along the curb will grow in proportion to the growth in peak hour passenger traffic at the terminal building. Although this growth simultaneously drives the need for terminal expansion, expansion of the curb through potential extension of the PTB frontage is difficult to achieve. Improved enforcement of the various designated spaces and drop-off areas can reduce some of the misuse of space and improve productivity of the limited curbside area. Similarly, the demand for additional curb or frontage space will be moderated through more efficient management of the curb spaces and timely improvements to the parking product offerings.

Nonetheless, some improvements will be implemented to the curb area design and space allocations to facilitate the flow of vehicles accessing the PTB.

11.5.2 Regulation Enforcement

Traffic and parking enforcement is currently under the responsibility of the Airports Division, and enforced through measures enacted by the airport administration. These measures include issuance of traffic violations and occasional vehicle impoundment.[4] Violation notices (or 'traffic tickets') are enforced by the City of Yellowknife Municipal Enforcement Division. Although this regulatory authority provides appropriate measures for the airport administration to collect fines, the absence of regular patrols to monitor curb violations results in the occurrence of a considerable number of unreported infractions that ultimately disrupt traffic flows along the passenger terminal curb.

Traffic and parking regulation enforcement along the airport's public access roads is critical for effective demand management. The current security contract at the airport provides staffing for the manned parking booth and collection of the parking fees for use of the PTB public parking lot. The scope of this contract could be expanded to ensure enforcement of the curb areas. However, costs associated with on-going curb patrols are relatively high and would not necessarily provide the best cost/benefit.[5] Similarly, this responsibility could be awarded to a parking management firm in the event that the Department chose to contract management of the airport's parking facilities to a third-party operator. In each case, however, collection of fines for parking violations would be difficult given the limited legal authority a private management organization would have on fine collection.

Regulatory enforcement through vehicle towing and impoundment could be implemented. This practice would only be suitable for dealing with repeat offenders and/or vehicles parked in emergency zones, and would not provide an appropriate solution to the day-to-day problems encountered in this facility.

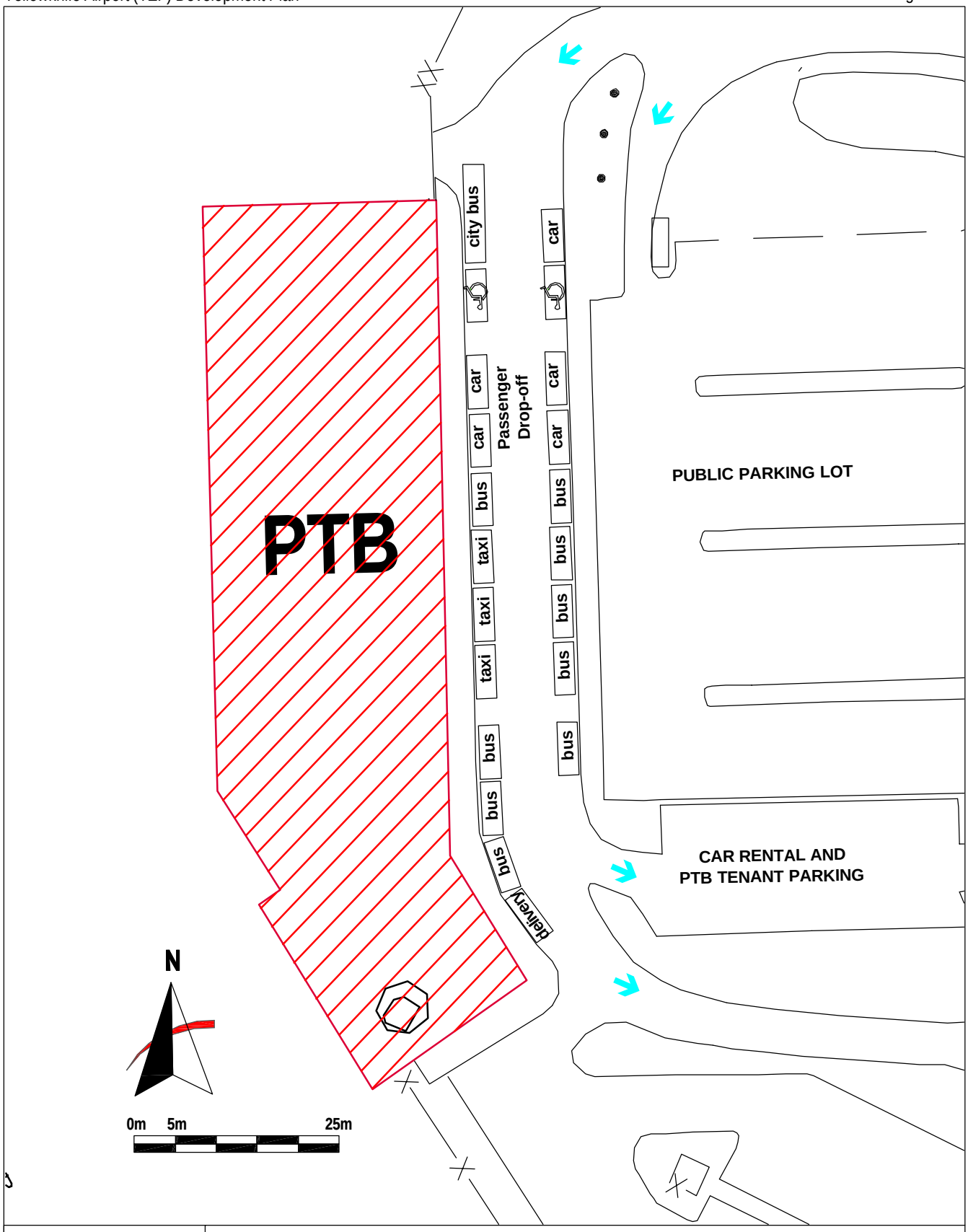

Figure 11-4: Current Passenger Terminal Curb Layout

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A viable alternative could involve delegating enforcement authority to the City of Yellowknife, and sharing infraction revenues. City of Yellowknife officials have indicated that an additional employee would be required to allow the City to absorb the airport enforcement requirements. This would not consist of a dedicated employee, but rather one that would be provided through shift adjustments to provide seven-day weekly coverage. The full cost of an employee could be negotiated at a lower net cost to the airport to account for the fines collected through infractions at the airport. (The actual costs incurred to the Airports Division would depend on the infraction revenue split between the Department and the City.) The latter alternative merits further consideration for integration into the broader strategy for parking management at the airport.

11.5.3 Curb Management

Efficient management of the limited amount of available curb space will significantly contribute to alleviating some of the problems currently encountered. Designation of the entire curb area for very limited duration parking can increase the availability of curb stalls, while significantly reducing the obstructions caused by double parked or very slow moving vehicles searching for available curb stalls.

Currently, approximately half of the curb stalls are designated for relatively extended use parking (i.e. handicapped, buses, delivery vehicles). It is proposed that these parking activities be separated from regular through-traffic, either via physical segregation of individual lanes or relocation of extended parked vehicles (e.g. shuttle buses, delivery vehicle, etc.).

11.5.4 Curb Design

The redevelopment of the existing PTB is unlikely to increase curb space. Development of dual curbs or relocation of specific vehicular activities have been assessed with the aim of improving traffic flows. Two basic curb layouts have been prepared to illustrate potential utilisation of the curb area. These are illustrated in Figure 11-5 (following page). Table 11-3 (below) summarises the characteristics of both.

Table 11-3: Curb Design Alternatives Evaluation

	Advantages	Disadvantages
Alternative 1 Preservation of existing curb space, with relocation of some commercial vehicle parking	- Minimal capital investment. - Easily implemented. - Segregated passenger and commercial traffic. - Increases availability of curb space .	- Bus and other commercial vehicle traffic flow through public parking facility. - Requires issuance of permits to enable free and unimpeded access to the public lot by commercial vehicles.
Alternative 2 Dual Curbs (Curb expansion to four lanes with central island)	- Segregated traffic flow s. - Dedicated loading and unloading curb area and reserved access lane for buses and other commercial vehicles.	- Higher capital costs than Alternative 2. - Potential traffic conflicts between commercial vehicles and car rental traffic.

The curb management alternative discussed previously and the greater construction requirements associated with the implementation of Alternative 2 versus those associated with the simpler Alternative 1 configuration significantly reduces the attractiveness of a dual curb configuration. As such the existing curb layout will be retained, with shuttle bus areas eventually integrated within the passenger terminal parking facility.

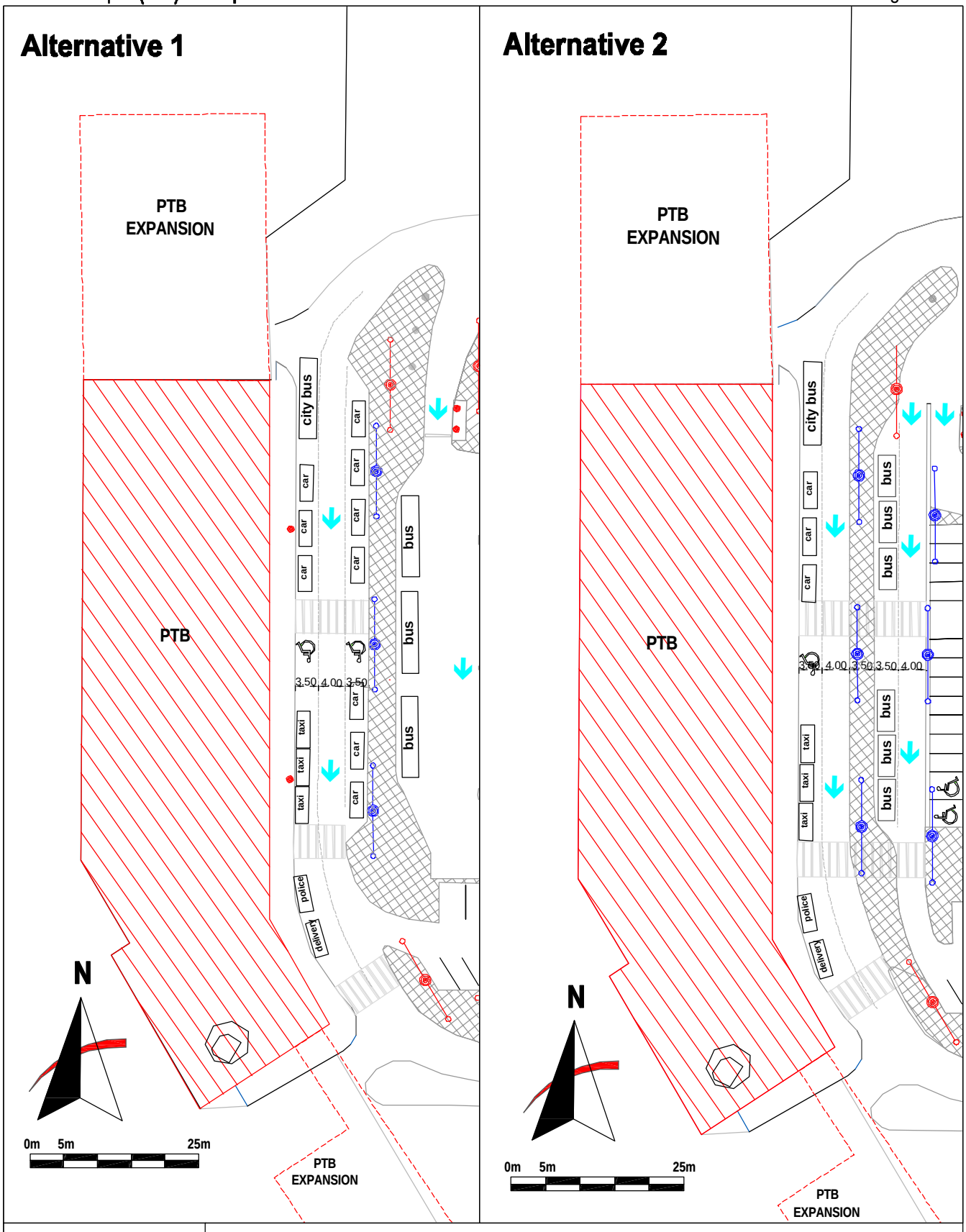

Figure 11-5: Passenger Terminal Curb Design Alternatives

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11.6 PTB-related Vehicle Parking

11.6.1 General Considerations

Configuration

PTB-related parking is currently provided in three separate, yet proximate surface lots adjacent to the PTB. Users include members of the travelling public; visitors and well-wishers; airport administration employees; rental vehicles; GNWT employees or those permitted VIP status and reserved parking spaces; and PTB tenant employees, including police, security, air carriers and other tenants.

The current layout of the PTB-related parking facilities is illustrated in Figure 11-6 (following page). Note that limited space exists to accommodate expansion outside the current areas allocated for these facilities.

Space Requirements

Forecast parking requirements for the terminal area are summarised in Table 11-4 (below). The table shows total PTB-related parking requirements growing by approximately 50% and 79% by 2013 and 2023, respectfully.

Since it is proposed that the existing passenger terminal complex be relocated to the west-side by 2013, the planning for the existing site attempts to accommodate forecast demand to 2008-2013. Space requirements forecast for the 2013 and 2023 periods provide a baseline for the detailed planning and design of the west-side site, when these tasks are undertaken.

Table 11-4: Existing PTB-related Parking Capacity and Forecast Demand

	2003	Forecast Parking Requirements		
		2008	2013	2023
Annual Enplaned + Deplaned Passengers	325,000	395,000	440,000	522,000
Public - Total	135	175	195	235
- *Short-term*[6]		*35*	*40*	*45*
- *Long-term*		*140*	*155*	*190*
Car Rentals	13	25	30	35
Employee (PTB-related)	73	95	105	125
Total	221	295	330	395

Source: Inter*VISTAS* Consulting, 2004.

11.6.2 Public Parking Lot

Public parking (travelling public, visitors and well-wishers) is currently accommodated in a 105-stall paved lot located within the Idaa Road loop and directly in front of the PTB. Approximately thirty additional spaces are available on an unorganized unpaved area extending past the existing paved surface.

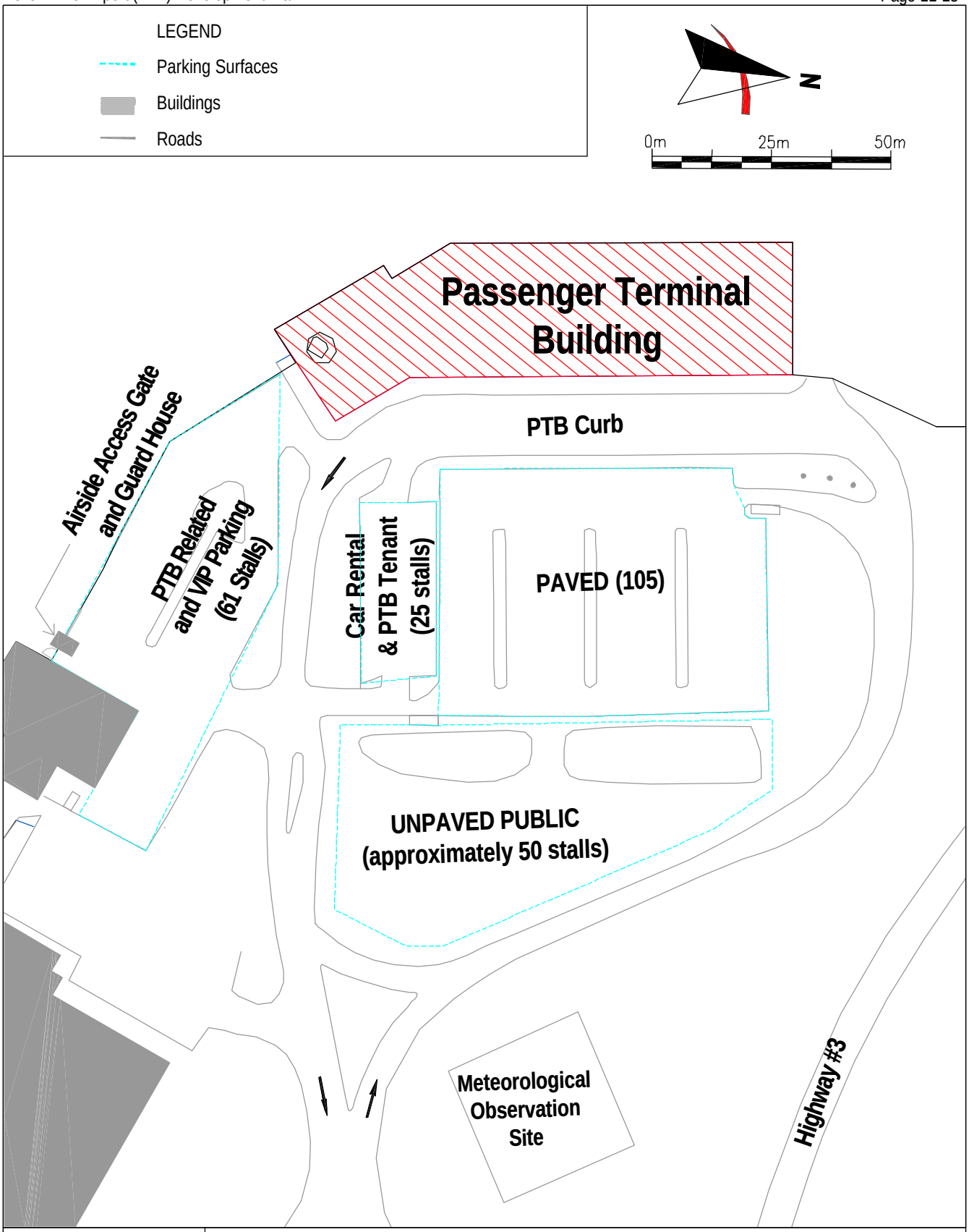

Figure 11-6: Existing PTB-related Access and Parking Facilities

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An automated pay-on-foot parking system was put in place in this lot in the late 1990's.[7] The system had a number of shortcomings and was decommissioned in 2001. When the system was functional, the parking lot was reported to operate at less than 50% of its capacity. After the system was decommissioned, parking was provided free of charge to PTB users (passengers, employees, visitors and well-wishers), resulting in the facility frequently reaching capacity.

A paid and controlled parking environment was however re-established in 2002[8] through operation of a manned collection booth. The current fee structure is presented in Table 11-5 (below).

Table 11-5: Current PTB-related Public Parking Fees

Duration	Fee
1st Hour	Free
Hourly	$1.00/hour to daily maximum
2 to 14 days	$6.00/day
15 days and over	$3.00/additional day

* Fees in effect August 2004.

The reintroduction of fees in 2002 for use of the public lot has alleviated the saturation problems observed when the Development Plan was originally undertaken, and has incrementally freed-up parking capacity. The capacity benefit provides flexibility in meeting peak period demand, along with the stall availability required to ensure adequate levels of service in the public lot.

Given the improved utilisation of the public lot, its current capacity is acceptable for the immediate-term period. Nonetheless, reconfiguration is required to provide acceptable capacity through to the end of the operational utility of the existing PTB, and to increase the level of service provided by the facility.

With a focus to increase customer service, improve revenues and simplify the management process for the Airports Division, a study of the airport's parking operation was prepared in 2002 as part of the Development Plan process. The study included an assessment of parking management options and fee structures for the Public Parking facility.[9] An excerpt of the assessment is included in Appendix E. Key proposals include:

- Evaluating opportunities to contract management of day-to-day operations to a third party-operator to provide flexibility in ensuring that parking services are provided without significant daily involvement on the part of the airport administration. Specific contract provisions guaranteeing minimum concession-based rents should be considered.
- Consideration of the re-implementation of an automated pay-on-foot parking fee collection system with equipment suitable for northern climates. (Suppliers such as Skidata, Federal, and Amano market systems that are both suitable for this type of operation and provide good performance records in cold weather.)
- Proposed revision to the airport's parking fee schedules to achieve a balance between competitiveness with those within the local marketplace, and comparability with those implemented at other similar-sized airports. (The airport administration has since implemented a revised fee structure consistent with these proposals.)

11.6.3 Other PTB-related Parking Lots

Immediately south of the public lot and still within the Idaa Road loop is a separate parking area accommodating 13 car rental stalls and 12 spaces for PTB tenant parking.

A third parking lot is located between the PTB and the firehall. This lot provides 55 GNWT employee and PTB tenant parking stalls and 6 VIP spaces. An airside access gate is also located at the eastern end of the lot, adjacent to the firehall building. The addition of portable structures at the southern end of the PTB outlined in Chapter 9.0 – Passenger Terminal Building will encroach however on a portion of this lot, and will result in a reduction of the available vehicle parking surface.

The lots dedicated for GNWT employee, PTB tenant, and car rental parking are often saturated. Rental car parking occasionally overflows into proximate unsurfaced areas, in part due to other vehicles parking in these stalls, suggesting that better enforcement is needed. An increase in capacity will be needed nonetheless to meet market demand.

Terms for the use of PTB tenant and car rental stalls are generally defined in individual tenant leases. Block engine heaters are available for the 55 employee and 13 rental car parking spaces.

11.6.4 Proposed Development – Existing Parking Site

Capacity Potential

The existing PTB parking areas possesses a practical capacity of approximately 270 – 290 stalls (230-250 stalls within the Idaa Road loop and approximately 40 in the existing lot situated between the PTB and the firehall).[10] Although the existing land reserve can provide sufficient capacity to meet forecast demand for the next few years, a shortfall is expected to occur between 2008-2013 – approximately at the same time as the reconfigured PTB reaches its practical capacity. This shortfall will increasingly become acute as traffic continues to grow at the airport. To provide flexibility in accommodating demand, short, long-term and some PTB employee parking may be consolidated into a single lot.

Over the next few years, improvement to the existing parking facilities will be required. To assess the potential to meet PTB-related parking demand, numerous parking facility layout concepts were explored. Initial parking facility concepts were further detailed in the draft *Yellowknife Airport Parking Study*[11]. This study concluded that the Yellowknife Airport's PTB-related parking facilities can not be expanded without considerable capital investment to realign roadways, relocate the existing Meteorological Observation Site[12], or to reclaim portions of existing airport tenant leased land.

Based on these results, a more conservative approach to the redevelopment of the PTB-related parking facilities will be adopted to minimize capital expenditures. This approach aims to minimize major capital expenditures on the facility in anticipation of the relocation of the passenger terminal complex over the 2008-2013 period.

Configuration Concept

The redevelopment of the Yellowknife Airport's PTB-related parking facilities must ensure that the facilities provide an upgraded level of service to airport users, and remain attractive for potential third-party involvement. The key redevelopment criteria is as follows:

- Maximize utilisation of available parking surfaces;
- Minimize, to the extent possible, major reconfiguration/reconstruction requirements;
- Maintain the current 3-lane passenger terminal curb configuration, with the eventual relocation of commercial vehicle curb operations within the public lot;
- Provide for the eventual implementation of an automated pay-on-foot system;
- Consolidate short, long-term and some PTB tenant employee parking in the main public lot; and
- Account for the proposed installation of portable structures at the southern end of the PTB (see 9.0 – Passenger Terminal Building) by slightly modifying the PTB employee lot situated between the PTB and firehall for airport administration (given the proximity to the administrative offices) and specific VIP parking.

Figure 11-7 and Figure 11-8 (pages 11-17 and 11-18) illustrates 2 potential configurations of the PTB-related parking and curb areas, consistent with the approach, criteria and capacity characteristics presented above. The configurations differ by the general direction of the stall row alignments - either in an east/west or north/south configuration.

Main elements of the potential configurations include:

- Total capacity ranging between 260 and 280 vehicles (depending on the layout, and based on a parking stall module length of 18.9m across from the centre to centre of row dividers and a width of 2.75m);
- Retention, to the extent possible, of existing paved surfaces and curbing;
- Combined short, long-term and PTB-related employee parking areas;
- Eventual integration of bus and PTB delivery vehicle loading bays within the public parking lot.
- Single entrance and exit gates (expandable to twin gates, if required); and
- Partial reduction of parking stalls situated in the lot between the PTB and the firehall to account for the encroachment of the portable structure to be installed at the southern end of the PTB.

(Although a north/south stall row alignment provides a slightly greater capacity, its implementation would involve relatively higher costs due to requirements to reposition a number of existing light-posts and pave additional surfaces.)

The Airports Division is currently preparing a more detailed layout plan for implementation based on these options. The value of this project is estimated at $500,000. Work is expected to commence in the latter half of 2004 with the expansion of the paved surface. Additional internal lot reconfiguration will occur during subsequent stages over the course of the 2004-2006 period.

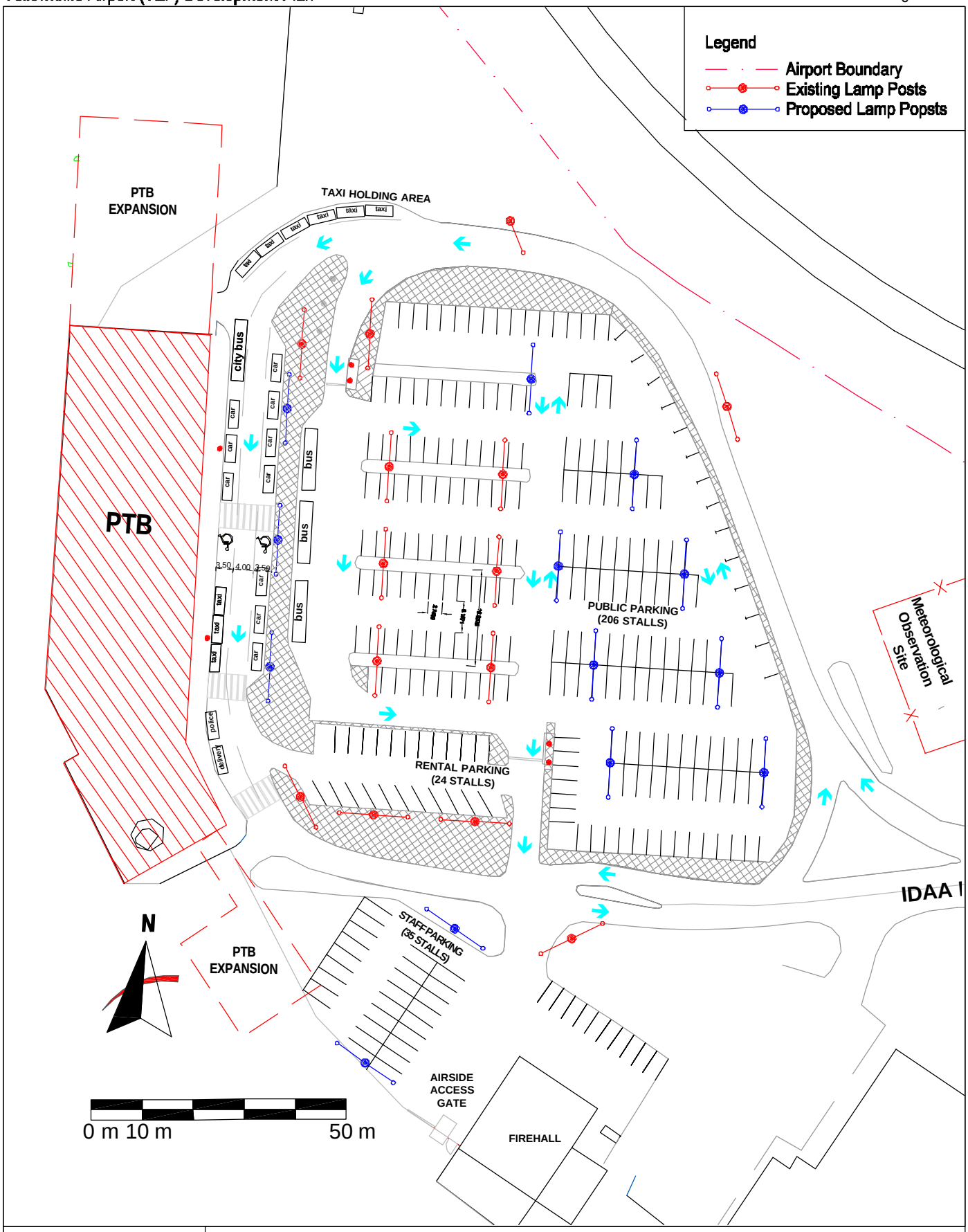

Figure 11-7: Potential PTB-related Parking Facility Layout - Option 1

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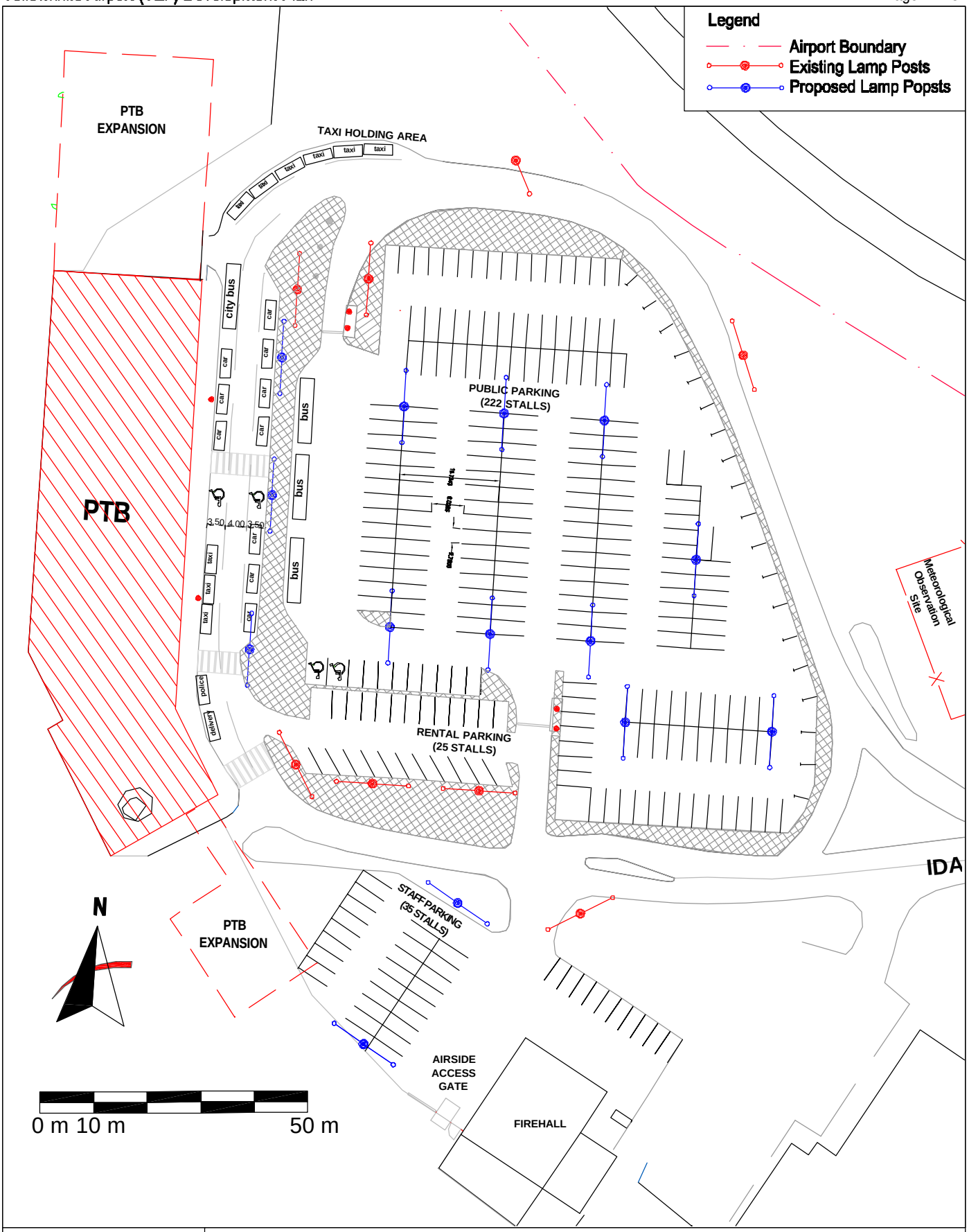

Figure 11-8: Potential PTB-related Parking Facility Layout - Option 2

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11.6.5 Proposed Development – West-side PTB Parking Facility

Parking requirements for the west-side PTB will range between approximately 330 in 2013 and 400 stalls by 2023. Beyond this period, additional parking surfaces may also be required. To provide flexibility in meeting long-term demand, it is proposed that the future passenger terminal complex meet initial 2013 requirements and provide sufficient land area to expand beyond the 2023 requirements. The preliminary layout for the proposed west-side passenger terminal complex is illustrated in Figure 9-3, page 9-15 (Chapter 9.0 – Passenger Terminal Building).

11.7 Airport Tenant Vehicle Parking

11.7.1 General Considerations

In areas other than those proximate to the PTB, airport tenants who lease land from the Airports Division are encouraged to provide parking for their employees and customers within the boundaries of their leased lots. However, lot sizes and development layouts do not always provide sufficient space to adequately address tenant and customer parking needs within the boundaries of some individual lots. As a result, some parking occurs on most street shoulders and unoccupied parcels of land in the northeast quadrant. The absence of convenient parking areas for use by airport tenants and their customers in the northeast quadrant is therefore a serious problem and a long-standing issue at the airport.

Until recently, employees and customers[13] of several businesses located at the northeast end of the airport had been using a vacant unleased lot, situated along Bristol Avenue and beyond the end of Taxiway E for vehicle parking (the 'Bristol / Taxi E lot', as shown on Figure 11-1, page 11-2). Use of this lot was made on an informal basis at no charge, and not formally authorised by the airport administration.[14]

Airport Tenant Parking Lot

To better control parking activities in this area of the airport site and to derive some revenues from the vacant land asset, the Airports Division and the airport administration re-designated this lot in 2003 for use as a formal airport parking facility by tenants and their customers. To this end, a rate schedule (see Table 11-6, below) has been put in place with fees currently collected by the security company contracted to manage collection of fees from the PTB's public lot. Aside from the addition of a second approach to access the lot from Bristol Avenue, no other upgrades have been made to the site.

Table 11-6: Airport Tenant Parking Lot Rates

Duration	Fee
Day	$4.00
Week	$25.00
Month	$80.00

* Fees in effect August 2004.

Space Requirements

Informal surveys of lot utilisation undertaken prior to the formalisation of the parking lot counted as many as 130 tenant and customer cars in the lot during weekdays and over 40 on most weekends. Demand for this lot can be expected to grow as current and future tenants intensify their activities, most particularly those operating charter flights to and from northern mine sites.

Over the near-term, growth could exceed the capacity of the informal layout that has emerged from the previous unauthorised utilisation of the lot. This situation could eventually result once again in cars 'spilling' onto the shoulder of Bristol Avenue, or the informal utilisation of other unoccupied parcels of land.

11.7.2 Optimal Configuration

The existing lot is characterised by a haphazard layout that results in a less than optimal utilisation of the available space. The current lot possesses a practical capacity of approximately 200 stalls. Minimal upgrading to the existing surface is required to allow a better delineation of stall spaces and circulation areas, and to optimise lot capacity. Figure 11-9 (following page) illustrates the optimal configuration of the lot. The cost of the upgrade is estimated at approximately $100,000. The proposal has not yet been scheduled and implementation will be dependent upon if an when funds may be made available.

The airport administration currently manages the parking facilities and contracts fee collection to the security firm overseeing similar functions at the PTB public lot. As options are reviewed for the long-term operation of the airport's parking facilities, consideration will be given to the inclusion of the Bristol / Taxi E lot in the broad mandate for operations in the event a third-party operations model is adopted. The level of future capital investment in the upgrading of lot infrastructure will also be dependent on the operational model to be implemented.

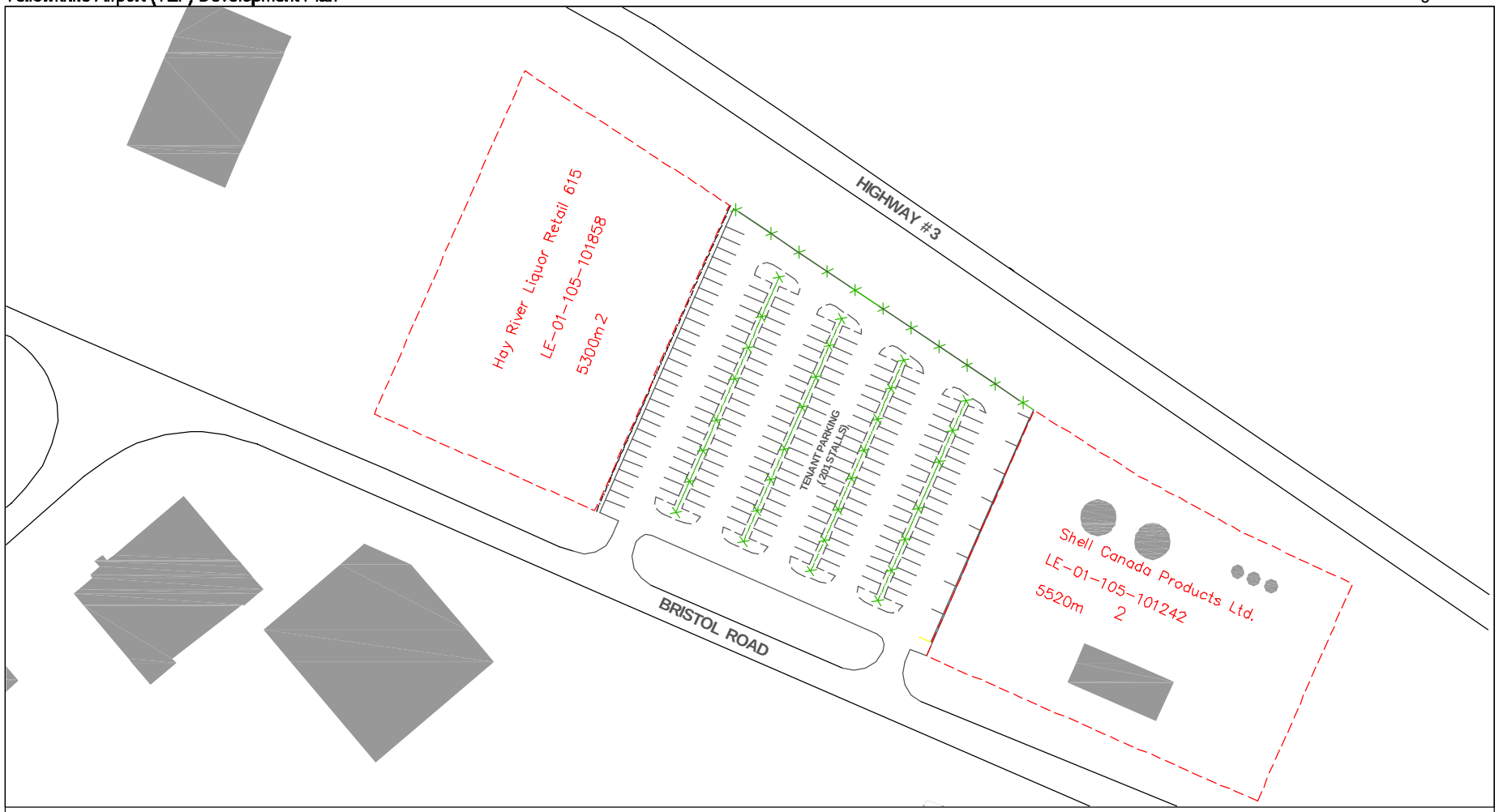

Figure 11-9: Bristol/Taxi E Lot Optimal Configuration

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11.8 Notes and References

[1] *City of Yellowknife, 2004 General Plan, Background Report and General Plan, Draft*; Terriplan Consultants, Dillon Consulting Ltd. and the City of Yellowknife, April 2004.

[2] Planning Peak Hour Carrier Passengers at terminal based on schedules for an average day of the peak month, includes only PTB flights, enplaned and deplaned passengers.

[3] *National Fire Code of Canada 1995*; Institute for Research in Construction, 1995.

[4] Vehicles found abandoned on airport roads or along the passenger terminal curb are ticketed and towed by private company to off-site locations.

[5] At $17.00/hour, the salary associated with a 12-hour/day 7 day/week staffing coverage would incur annual cost of approximately $75,000.

[6] The short-term parking allocation represents approximately 20% of total users at any given time, based on the study team's knowledge of airport parking markets.

[7] Parking revenue authority was approved at the Yellowknife Airport pursuant to the Executive Council Decision Recorded as #95-18-2 dated June 5, 1995 authorising the Minister of Transportation to accept the transfer of the Arctic "A" Airports.

[8] Parking fees were re-introduced on August 2002.

[9] *Revised Draft, Yellowknife Airport Parking Study*; Inter*VISTAS* Consulting Inc. and Stantec Consulting Ltd., March 2003.

[10] Based on various preliminary layout concepts prepared by the project team.

[11] *Revised Draft, Yellowknife Airport Parking Study*; Inter*VISTAS* Consulting Inc. and Stantec Consulting Ltd., March 2003.

[12] Land for the Meteorological Observation Site is provided under agreement with NAV CANADA.

[13] Mostly diamond mine employees using off-terminal charter air services and who must leave vehicles for extended periods at the airport.

[14] Kingland Ford has also used the lot for parking of it's used vehicle inventory.

Section Four: Airport Support Elements

Introductory Notes

The Yellowknife Airport serves multiple roles in the aviation industry. As the local airport, it connects the City of Yellowknife and the surrounding region to the world and ensures that northern communities have access to medical services through medevac flights. As a gateway airport to the North, it acts as a hub for air traffic flying between Northern and Southern Canadian communities, and acts as the entry point for tourism traffic to the region. As a facilitator of economic growth, the airport supports the oil, gas and mining industries through the provision of aviation facilities for scheduled, charter and cargo traffic. And finally, as an en-route alternate airport, it ensures the availability of ground services in response to in-flight emergencies for polar and high latitude air traffic.

To support these roles, a number of buildings and infrastructure is required. This section covers the essential infrastructure components that are necessary for continuous airport operations.

12.0 Airport Operations and Support Facilities

12.1 About this Chapter

Airport operations and support infrastructure at the Yellowknife Airport consists of those facilities that enable the operation of the facility and support aviation activities on the site. These typically include airport administration and maintenance structures, medical and emergency services, meteorological services and general aviation facilities. This chapter reviews each operation and support component, and identifies requirements for the 20-year planning period.

Specific aviation terminology used in this chapter is defined below:

CARs (Canadian Aviation Regulations) – A compilation of regulatory requirements designed to enhance safety and the competitiveness of the Canadian aviation industry. They correspond to the broad areas of aviation which Transport Canada, Civil Aviation is mandated to regulate (e.g. personnel licensing, airworthiness, commercial air services, etc.).

Emergency Response Services (ERS) – On-site emergency and fire fighting services. Formerly "Crash, Firefighting and Rescue Services".

Field Electrical Centre (FEC) – Facility ensuring power supply via electrical junction for the main power grid to the airside lighting systems, a portion of the PTB, air navigation systems and the

Load (electric) – The amount of electric power delivered or required at any specified point or points on a system. Loads originate primarily at the power consuming equipment of the customer.

12.2 Administration and Maintenance Buildings

12.2.1 Airport Administration

Airport administration and operations offices are currently located in the southern end of the PTB – in the older original portion structure. Ground floor airport administration offices occupy approximately 200m^2 of floor space. The Distinguished Visitor Lounge (DVL) and boardroom facilities occupy approximately 40m^2 of space on the second floor of the building. There is also dedicated space in the basement for building services operation and controls.

The airport currently employs the equivalent of 25 full time staff (person/years), five of which are occupy functions that are located in the airport's administrative offices. Airport administrative functions are expected to grow as air traffic and airport activities expand. By 2023, administrative office space requirements are expected to reach approximately 350m^2 (as identified in Chapter 9.0 – Passenger Terminal Building).

The proposal to redevelop the ground floor of the existing PTB reallocates the area currently occupied by the airport administration for use as an expanded arrivals area. To enable the

reconfiguration, the airport administrative functions are to be relocated to a portable annex structure to be added at the southern end to the PTB, as illustrated in Figure 9-2 (page 9-13).

12.2.2 Airport Maintenance

The Yellowknife Airport possesses a maintenance compound consisting of four independent structures – the maintenance garage, the carpentry and electrician shops and the sand storage building – and some exterior storage areas. The existing maintenance garage was constructed in 1963 and is approximately 860m^2 in size. The three other structures of varying ages range between 115m^2 and 150m^2 in size. The total floor space provided by all four structures is approximately 1,200m^2.

The compound is situated in the northeast quadrant along Bristol Avenue in close proximity to the runway and taxiway system, but is without direct airside access. This situation reduces the efficiency of airside maintenance operations, particularly during runway snow clearing.

The maintenance buildings are deficient in a number of areas:

- The structures are considered to be in poor to adequate condition and are approaching the end of their useful life.
- Asbestos insulation has been found encapsulated in some of the structures.
- The layout and size of the area is considered to be insufficient to ensure the efficiency of operations. For example, the working bay in the maintenance garage also serves for equipment parking. This sometimes contributes to some congestion within the building.
- The facilities lack the ability to accommodate the additional aircraft maintenance and snow clearance equipment required for the expanded runway and taxiway system.

Table 12-1 (below) compares existing to required functional components and associated area requirements.

Table 12-1: Maintenance Facility Components Requirements

Components	Existing (m^2)	Proposed Area (m^2)
(1) Maintenance Bays	800	416
(2) Parking Bays (7 bays = 14 vehicle parking positions)		1,421
(3) Offices	20	32
(4) Trade Workshops, Associated Offices and Other Storage	313	555
(5) Washroom, Shower, Change and Locker Rooms	5	50
(6) Lunch/Training Room	30	50
(7) Building Services	12	63
Total Gross Maintenance Facilities	**1,180**	**2,587**

Source: GNWT, Department of Transportation, Airports Division, 2003.

Given the space deficiencies and structural conditions of these buildings, a decision has been made to relocate the maintenance facility to the west-side of the airport site. An airside location in proximity to the proposed location of the future PTB and the intersection of the two runways has been retained. Figure 12-1 (page 12-4) illustrates the proposed location of the new facility. The value of this proposal is estimated at approximately $6 to $8 million, including space for relocated Emergency Response Services within the facility (see below). No funds are currently available for construction. The Airports Division wishes however to implement this proposal by 2008.

12.3 Emergency Response Services

12.3.1 Infrastructure and Siting

The Yellowknife Airport is required to provide on-site aircraft fire fighting services, in accordance with Transport Canada regulations.[1] Emergency equipment and staff are housed in the firehall, east of Apron II. The firehall building also houses the Field Electrical Centre (FEC). The building was constructed in 1974 and renovated in 1996, and is currently considered in good condition. The firehall is approximately 364m^2 in size and contains three vehicle bays. The current location provides ready access to all existing runway surfaces and meets the three-minute response time currently required by Transport Canada regulations.[2]

Currently, two medium foam tenders are in service at the airport, providing a total usable volume of extinguishing agents of 11,500 litres. This equipment enables the airport to provide Category 6 airport fire fighting service.[3,4] This category of service is sufficient to meet response requirements for the level and type of aircraft activity currently occurring at the airport, namely Code C (B 737) operations.

A third medium foam tender is also present, but is currently out of service. Re-commissioning of this equipment would raise the total usable volume of extinguishing agents to 16,500 litres and enable the airport to meet up to Category 7 requirements, adequately meeting response requirements for aircraft up to the size of a B 757-200 or B 767-200. Except for a few minor shortfalls, the firehall can meet Category 7 requirements.[5]

The location of the firehall will likely be insufficient to allow the ERS to meet the required response time if Runway 15-33 is extended to a length of 11,500'. In addition, the location of the building constrains the layout and operational flexibility of the eastern end of Apron II.

Given these considerations and the plan to develop new maintenance facilities on the west-side of the site, the Airport Division intends to develop a Combined Services Building (CSB) that integrates the firehall with the proposed maintenance facility. The combination of both services in the same building would provide significant economies of scale, both in terms of construction and maintenance of the facility.

12.3.2 Space Requirements

Firehall space requirements are dependent upon the size and number of movements derived from the largest aircraft operating at the airport. Canadian Aviation Regulations require that the critical category for fire fighting be based on the number of commercial movements at the airport during the three busiest consecutive months of the year. Typically, airports are required to meet the category of fire fighting services that correspond to the largest aircraft to incur 700 or more

LEGEND

Airport Boundary

Proposed Maintenance Building Location

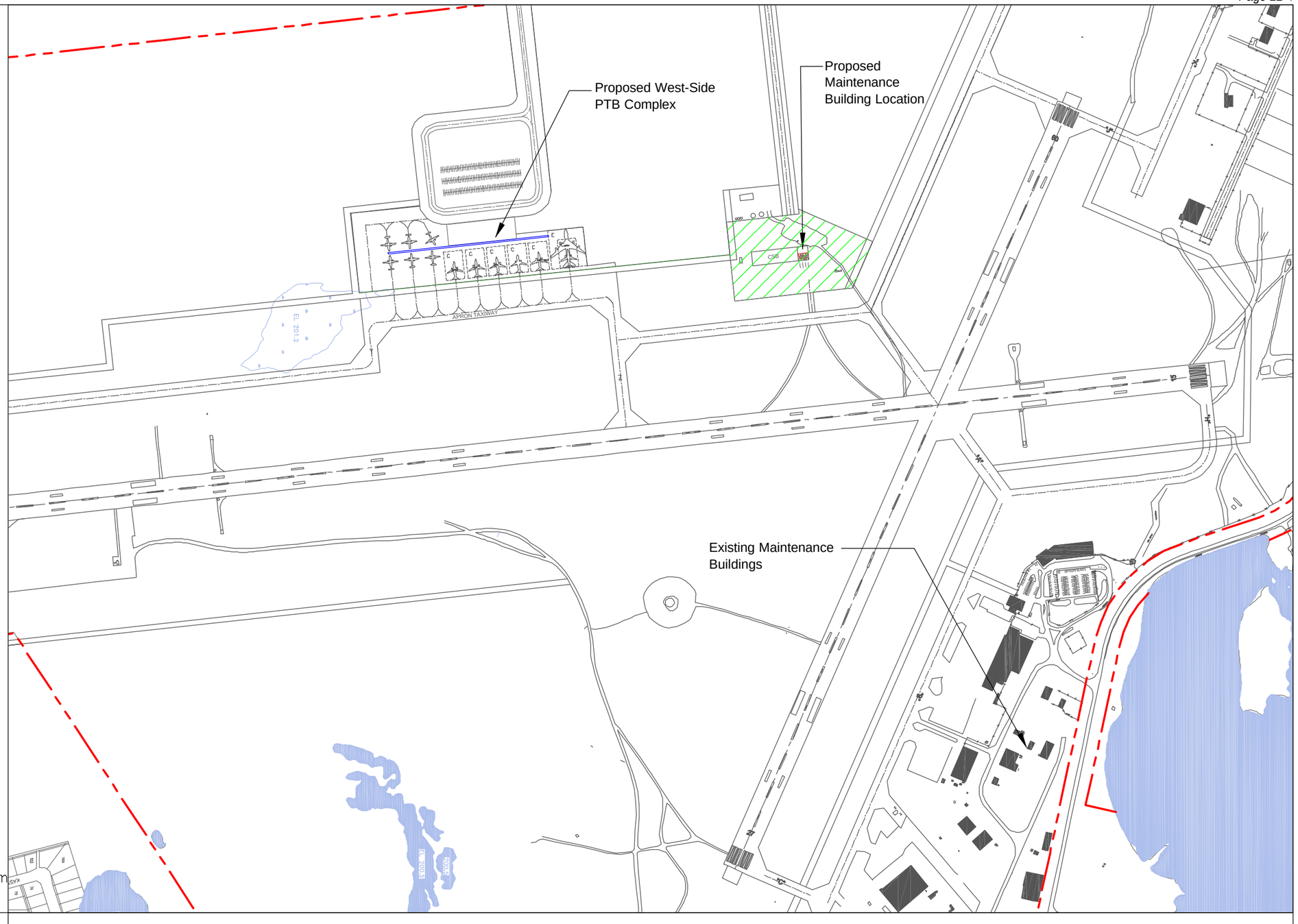

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Figure 12-1: Proposed Maintenance Building Location

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movements over the three-month period. At the Yellowknife Airport, the largest aircraft to surpass this level of activity is the 737-200 (Category 6), with over 500 movements per month. Movements incurred by larger aircraft are currently negligible.

An increase in level of service requirements would only result from significant increases in traffic from larger aircraft. Surpassing the aircraft movement criteria described above would require over seven aircraft movements per day of a larger aircraft category. Given the characteristics of the northern aviation market, it appears unlikely that potential introduction of international passenger and/or cargo services will generate a corresponding volume of traffic. In addition, the analysis undertaken to identify facility requirements deriving from the airport's status as an en-route alternate airport indicate an increase in the declared ERS category for the purpose of serving the occasional arrival of diverted or en-route traffic would not be required. A need to increase the level of fire fighting services is relatively low, but would be preferable to ensure high levels of emergency services to the international aviation industry.

Nonetheless, it is proposed that the new facility be developed to Category 7 standards, consistent with the type and amount of equipment currently on-site. Table 12-2 (below) identifies existing and required functional components and associated area requirements to fully accommodate Category 7 Emergency Response Services in the proposed CSB facility.[6]

Table 12-2: Emergency Response Services Space Requirements (m^2)

Components	Existing (m^2)	Proposed Area (m^2)
(1) Vehicle Storage Bays (3)	210	273
(2) Offices	22	40
(3) Workshops and Other Storage	45	75
(5) Washroom, Shower, Change and Locker Rooms	17	50
(6) Lunch/Training Room	25	35
(7) Building Services	12	20
Total Gross Fire Hall Area	**364**	**493**

Source: GNWT, Department of Transportation, Airports Division, 2003.

The proposed CSB facility would integrate the respective spatial requirements of the maintenance and firehall facilities identified in Table 12-1 (page 12-2) and Table 12-2 (above), respectfully. The resulting proposed building would therefore be constructed to provide a floor area totalling approximately 3,080m^2. As discussed previously in Section 12.2.2 – Airport Maintenance, funds are not currently available for this project, although the Airports Division wishes to implement this proposal by 2008.

12.4 Emergency Medical Services

There are no dedicated medical facilities at the Yellowknife Airport. However, the airport plays an important role in ensuring the availability of medical services to northern communities and the air traffic that over-flies the region.

The Yellowknife Airport supports northern medevac operations provided by a number of charter carriers situated on the site. These operations are common at the airport, sometimes occurring on

a daily basis. Special provisions and operational procedures are in place to appropriately handle these flights and facilitate the transfer of the ill passenger to the Yellowknife Hospital.

The airport also plays an important role in providing support for commercial aviation in the case of in-flight medical emergencies. As a designated en-route alternate by air carriers over-flying the region, the airport commonly accommodates the unscheduled arrival of commercial flights on polar or high latitude routings, and facilitates the transfer of the ill passenger to the local hospital.

Further, the airport's Emergency Plan contains procedures for dealing with medical emergencies in case of an aircraft accident. No specific requirements are identified for on-site medical facilities.

12.5 Ground Vehicle Fuel Stations

The airport administration and a number of tenants posses vehicles that are operated on restricted airside areas. The refuelling of these ground vehicles currently occurs at individual pump facilities located at each vehicle operator site. Soil contamination or the ignition of fires due to spillage or improper storage is a matter of concern.

To reduce potential risks, it is proposed that the development of a dedicated ground fuel station be considered on the site. Given the proposed development of a Combined Services Building, followed by the development of a new PTB, a fuel station in proximity to these future facilities would support operations situated on the west-side of the site. The fuel station need not be dedicated solely for use by restricted airside vehicles. It may also serve landside vehicles and through-traffic circulating along Highway #3.[7]

12.6 Electricity Supply

Electrical power is supplied to the airport through the city's power grid. Power is supplied by the Northwest Territories Power Corporation (NTPC) from the remote Snare Lakes hydro developments and by the Jackfish Power Station, a diesel powered thermal-electric power plant located approximately 2km east of the airport. Distribution of power within the City of Yellowknife is done by Northland Utilities. The distribution network on the airport site is well maintained and generally in good condition.

12.6.1 Field Electrical Centre

The Field Electrical Centre (FEC) is located in the firehall building, and ensures normal power supply to the airside lighting systems, a portion of the PTB, air navigation systems, and the Meteorological Observation Site. The facility is well maintained and in good condition.

Electrical services are brought underground to the FEC and the PTB from a pad-mounted transformer, which ultimately provides volt service to the FEC's main breaker. All loads in the FEC distribution are essential and are carried by an Interruptible Power Unit (IPU).

The FEC includes a 250 kW, diesel-powered IPU. This unit supplies emergency power to all essential loads in the airside lighting system (the airside lighting system is described in Chapter 8.0 – Air and Ground Navigation Aids and Traffic Control Services), PTB, pumphouse, firehall, various transmitters and the VORTAC site. Although energy meters are available on each major sub-feed from the FEC, no indication of demand is provided.

Capacity

The existing facility meets current operational demands, but the loading on the IPU is approaching capacity. While peak demand is estimated at 187 kVA and the unit is rated for 250 kW, much of the load is highly inductive, particularly for airside lighting. As a result, reserve capacity is necessary for starting these loads.

The additional lighting resulting from the proposed expansion of the airport's airside facilities, namely the development of parallel taxiways, the development of a de-icing apron and the potential Runway 15-33 extension, will increasingly place additional demands on FEC load capacity.

Although no airside electrical demand records are available, further assessment of current and future loads will be required before specific upgrade proposals can be made. A detailed electrical services study will need to be undertaken to precisely identify load capacities and associated service equipment requirements at the FEC.

Location

As stated previously, the existing facility is well maintained and in good condition. Although the airport's Emergency Response Services are proposed for relocation to a CSB over the short-term period, the building in which both the FEC and ERS are located need not be demolished. The portion of the firehall currently occupied by the FEC provides ample space to accommodate additional electrical servicing equipment. The FEC should remain in its present location.

12.6.2 Airside Electrical Systems

Electrical installations in the airside system include the various operating and abandoned circuits for runway, taxiway and approach lighting, as well as feeds to the various navigational aids. Regulators for the airside lighting circuits, consisting of eight 20 kW regulators and one 10 kW regulator, are located in the FEC.

Cabling is routed below runway and taxiway surfaces in various 100mm ducts, and is tested regularly. When found to be faulty, cabling is replaced and upgraded.

12.6.3 Existing PTB Electrical Systems

Power services are brought to the PTB from a direct connection to the local electrical grid and from the FEC. From the same utility pole that feeds the FEC pad-mount transformer, a primary feed is routed to another pad-mounted transformer that feeds the PTB. From the transformer, power is fed to the main breaker in the PTB electrical room. This breaker sources power to the building's normal loads, and also has provisions to source essential loads.[8]

The proposed expansion of the PTB and future parcel development will increase electrical demand in the northern quadrants. Since electricity is already provided to a portion of the PTB via direct connection to the local utility company, additional feed for the expanded building can be provided in a similar manner. The electrical services study proposed previously should however individually assess future demand for the expanded PTB facility, as well as evaluate options to provide all or part of the building's electrical supply from the FEC and/or direct connection to the local electricity grid. (Direct connection to the local grid could potentially alleviate long-term demand on FEC sources.)

12.6.4 West-side Development

The west-side of the site currently does not posses direct connection to the airport's electrical supply system given its undeveloped state. The site may be serviced through direct connection to the local utility company. This will require extension of the city's power grid to adequately service the site and, potentially, increases to the distribution capacity of related grid components. The electrical services study proposed previously should assess these requirements in further detail.

12.7 Gas System

ICG Propane, now owned and operated by Superior Propane, installed the gas storage and distribution system in 1990. The system includes a bulk storage tank located north of Apron 1 and east of Runway 15, and a piped distribution system, which supplies the PTB, firehall and other buildings in the northeast quadrant. The existing propane distribution network on the site is illustrated in Figure 12-2 (page 12-9).

12.8 Telecommunications

Telecommunication systems and services are provided by NorthwesTel Inc. The general phone system for the Yellowknife Airport ties into the distribution grid for the City of Yellowknife. The land line facility located in the PTB supports all activities within the building, as well as a number facilities situated to the west.

Internet communication is provided by NTNet, and connected to the NorthwesTel system.

12.9 Flight Catering Kitchens

There is currently no flight catering kitchen on the airport site. YK Inflight Service currently provides catering services to the air carriers at the airport through their facilities located in the city.

As traffic increases and the west-side development is initiated, demand for a facility on the airport may emerge. This facility may be easily accommodated on a land parcel situated in proximity to the proposed new terminal building. (See Chapter 17.0 – Land Use, for description of the land use strategy for this area of the airport.)

12.10 Meteorological Services

Environment Canada, under a contract with NAV CANADA, is responsible for the collection of weather observations and production of aviation weather forecasts.

Weather observations at the Yellowknife Airport are collected at the airport's Meteorological Observation Site. The site currently occupies a 900m^2 of land located between the PTB public parking lot and Highway #3. NAV CANADA provides meteorological briefing services.

12.11 Aircrew Briefing and Reporting

NAV CANADA currently provides aircrew briefing and reporting services through the Flight Service Station located in the PTB (see Chapter 8.0 – Air and Ground Navigation Aids and Traffic Control Services).

LEGEND

Existing Propane Service

Airport Boundary

Sewage Holding Tank

Lower Pumphouse

Maintenance Garage Sanitary Main and Underground Tile Field

PTB

Firehall

First Air

DND

Arctic Sunwest Charters

N

0 m 50 m 100 m

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Figure 12-2: Existing Propane Service

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12.12 Aircraft Maintenance Area

There is no dedicated aircraft maintenance area at the Yellowknife Airport. Aircraft Maintenance is however provided by a number of airport tenants occupying lots in the northern quadrants of the site, such as First Air, Air Tindi, Buffalo Airways, Arctic Sunwest and the Department of National Defence. These activities are performed alongside cargo and other ground operations.

As traffic and demand increase, sufficient demand may emerge to develop a dedicated maintenance facility at the airport. This facility could be easily located on an airside lot situated on the west-side of the airport. Planning for the subdivision and development of new airside lots in this quadrant will need to ensure that land parcels are of sufficient width and depth to accommodate appropriately-sized structures and aircraft parking aprons, if required.

12.13 General Aviation Facilities

General aviation operations occur at various locations. Spur Aviation and Adlair Aviation, situated along Taxiways D and K respectfully, provide small charter aircraft services and support medevac operations. G&G Expediting and Braden Burry Expediting also provide general aviation services, mostly serving charter flights dedicated to northern gas and oil exploration and mining activities. The latter tenants currently handle considerable volumes of non-PTB passenger traffic on charter flights on their aprons and through limited facilities. As identified in Chapter 3.0 – Forecasting for Planning Purposes, these facilities currently handle approximately 84,000 enplaned and deplaned passengers annually. (See Figure 5-2, page 5-5, for the location of these tenants.)

Private general aviation and corporate aircraft operations based in or visiting Yellowknife are generally supported by one of these tenants or directly by services provides by the airport administration. No dedicated Fixed Base Operators (FBO), providing ground handling, fuelling and parking service to this segment of the general aviation market exists at the airport. FBO facilities at most airports typically consist of private hangars, flight planning offices and lounges dedicated to corporate or private aircraft operators.

As a major component of development in the northern quadrants, demand for further development will continue along with the growth of the local aviation market. Appropriate airside accessible land will be provided in the west-side of the airport site to accommodate this development.

12.14 Notes and References

[1] The airport falls under CARs 303 regulations since it handles at least 200,000 passengers annually and is a main point of origin and destination for inter-provincial air service in Canada.

[2] CARs 303 requires that the response time to reach the midpoint of the furthest runway(s) and any other movement area not exceed three minutes in optimum conditions of visibility and surface conditions.

[3] Aircraft categories for fire fighting differ from those designated for aerodrome reference purposes (shown in Appendix A). Aircraft categories for fire fighting are listed in Subsection 303.5 of CARs 303 (see www.tc.gc.ca/aviation/regserv/carac/CARS/cars/303e.htm)

[4] Category 6 coverage requires 7,900 litre total coverage and a minimum of two fire fighting vehicles. Based on CARs 303 standards, Category 6 aerodromes serve aircraft up to, but not including, 39m in length and a 5-m wide fuselage.

[5] Accommodation of the Chief's office and the disaster trailer/pick-up truck would continue to be outside the firehall, however.

[6] Prepared by the GNWT, Department of Transportation, Airports Division. The requirements generally follow CARs 303 and ICAO guidelines.

[7] Landside access for restricted airside use vehicles would require appropriate licensing to allow these vehicle to circulate on public roads.

[8] The essential power loads include those for building heating systems, airport electronics, fire alarm, exit lighting and emergency lighting.

13.0 Aircraft Fuel Facilities

13.1 About this Chapter

The storage and handling of fuel at the Yellowknife Airport is an important consideration for operational and development planning given the safety issues associated with the storage, transportation and distribution of the product. This chapter reviews existing fuelling operations at the airport and addresses overall operational requirements.

13.2 Fuelling of Aircraft

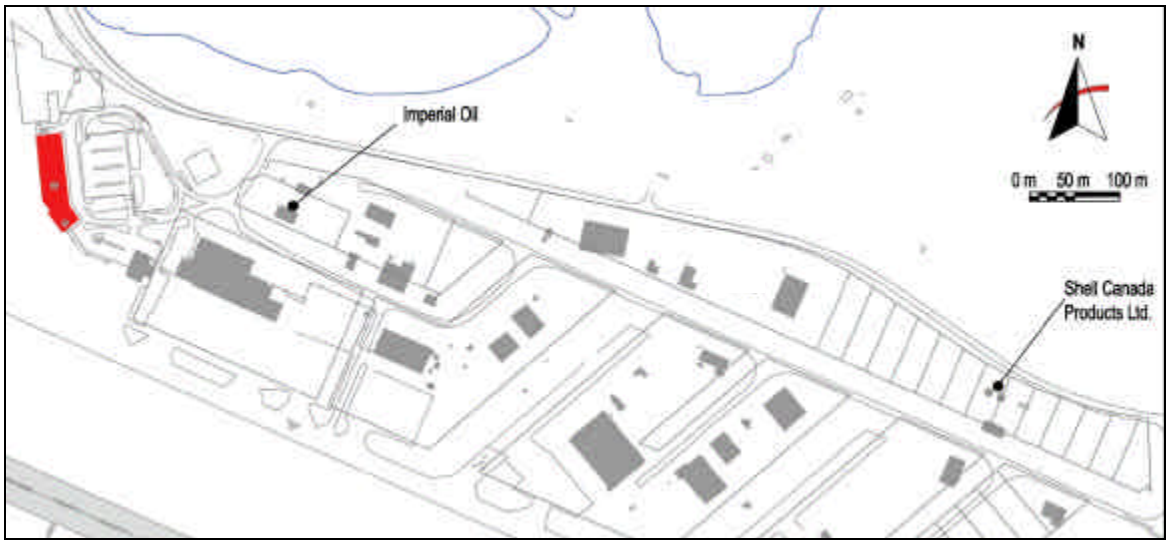
Aircraft fuelling services at the Yellowknife Airport are provided by private contractors operating franchise services for major oil companies. Current operators consist of Glacier Aviation (Shell) and True North Petroleum (Imperial Oil Esso). Fuel is delivered to aircraft via tank trucks. Airport staff has indicated that there currently is a shortage of fuel trucks during peak periods.

13.3 Location of Storage

Fuel storage is located at each of the supplier lots north of Bristol Avenue, as shown in Figure 13-1 (below). Fuel trucks accessing the various aprons must circulate on landside areas for distances varying between approximately 300m and 800m before accessing the airside security control gates. The lack of direct airside access from these facilities is a matter of concern given the risks involved with the transportation of significant quantities of fuel along public roadways.

The proposed west-side development will need to reserve appropriately located land to accommodate the eventual relocation of these facilities. This eventual relocation would also contribute to freeing up some incremental land in the capacity-constrained northeast quadrant for new tenant development.

Figure 13-1: Location of Fuel Storage Tanks



13.4 Storage Capacity

The storage capacity of aviation fuel is provided by Glacier Aviation (Shell) and True North Petroleum (Imperial Oil Esso). Between these two tenants, the combined total storage capacity of Jet A-1 fuel is approximately 1.55 million litres. Additionally, the two tenants have a combined storage capacity of 348,500 litres of Avgas. Note that although Esso holds a majority of the fuelling contracts at the airport, Shell has greater storage capacity of Jet A-1 and Avgas fuel.

13.5 Operational Safety

There are safety considerations that may need to be addressed with regards to fuelling and fuel storage. Firstly, there is a concern with the location of True North Petroleum (Imperial Oil Esso) with regards to the close proximity of the PTB. This close proximity requires the fuel vehicles to access the airport apron via the public roads leading up to the terminal. This may pose a problem with respect to PTB operations in the event of a fuel spill. The eventual relocated fuel facilities will require airside accessible land to minimize the risks to public areas.

A second concern is the type and size of fuelling vehicles the fuel service providers are currently using. This has a direct impact on aircraft spacing and parking on the terminal apron. The Airports Division plans to meet with the fuel service providers to resolve these issues so that the apron space can be utilised to its maximum potential.

14.0 Security Considerations

14.1 About this Chapter

The events of September 11, 2001 fundamentally changed how transportation security is viewed and delivered in all modes of transportation. For the aviation industry, security is not the sole responsibility of airport operators or an individual government agency, but rather that of the entire industry. A systems approach is therefore in place to ensure that each facet of the operational environment is properly secured and is prepared for emergency situations. This chapter reviews the key components of the airport's security system and assesses the infrastructure elements under the responsibility of the Airports Division.

Specific aviation terminology used in this chapter is defined below:

Airport Security Service – Service aimed at preventing unlawful interference with civil aviation or ensuring that appropriate action is taken where that interference occurs or is likely to occur.

Non-Passenger Screening (NPS) – Screening of non-passengers at entrances to restricted areas other than PBS checkpoints.

Restricted Area – A section of the airport to which access is restricted to authorised persons and vehicles. This area is identified by appropriate signage.

Restricted Area Pass (RAP) System – The current system for control of access to restricted areas of Canadian airports.

Restricted Area Identification Card (RAIC) – The national system being developed by CATSA for enhanced control of access to restricted areas of Canadian airports by non-passengers.

14.2 Security Responsibility

14.2.1 Civil Aviation Security

Transport Canada is responsible for setting regulations and standards that air carriers, airport operators and air navigation service providers are required to follow in accordance with the Federal *Aeronautics Act*. Transport Canada Inspectors conduct detailed inspections, both announced and unannounced, combined with special purpose audits, to ensure that regulations and standards are met.

Operations at the Yellowknife Airport are governed by the regulations contained in the *Aeronautics Act*, and are subject to Transport Canada inspections and audits.

14.2.2 Passenger and Non-Passenger Screening

The screening of passengers and their belongings is under the responsibility of the Canadian Air Transportation Security Authority (CATSA).[1] CATSA's responsibilities fall into six major areas:

- Pre-Board Screening (PBS) of passengers, carry-on and checked baggage;
- Acquisition, deployment, operation and maintenance of explosives detection systems at airports;
- Contracting for RCMP policing serves on selected flights;
- Implementation of the Restricted Area Identification Card system (RAIC);
- The screening of non-passengers entering airport restricted areas; and
- Contributions for supplemental airport policing services.

Pre-Board Screening at the Yellowknife Airport is currently provided by the Aeroguard Company Ltd. under contract from CATSA, in accordance with *CATSA Standard Operating Procedures*. Non-Passenger Screening (NPS) at the airport is not yet in operation, but will be initiated in accordance with CATSA's implementation schedule. The Aeroguard Company will be responsible for providing NPS operations in the PTB.

14.2.3 Airport Security

ATCO-Frontac Services Ltd. are contracted to provide security services at the airport. These services consist of PTB security and control of the airside access gate to the PTB apron (located adjacent to the firehall). The company does not control any other airside access points, and does not provide passenger and non-passenger screening in the PTB. As described above, the latter activities are under CATSA's responsibility.

Airport staff ensure patrols of airside and adjacent areas.

Access to restricted areas for non-passengers is currently controlled through the Restricted Area Pass (RAP) program. Locally, this program is managed by the airport administration, in accordance with the standards and operational procedures set forth by Transport Canada and the Canadian Air Transportation Security Authority (CATSA).[2]

14.2.4 Regulatory and Operational Safety Programs

Implementation of regulatory and operational safety programs at the Yellowknife Airport is the responsibility of the airport's Manager of Safety and Security. The Manager is responsible for implementation of the *Emergency Response Plan, Fire Prevention Program, Airport Safety Program*, the *Movement Area Access and Control Procedures*, *Apron Management and Safety Plan*, *Wildlife Control Program*, and other environmental, security and safety programs as required. These programs and plans are outlined in the *Yellowknife Airport Operations Manual*[3].

14.2.5 Jurisdictional Police

The Royal Canadian Mounted Police (RCMP) Division G provides police services to the City of Yellowknife and the airport, under the terms of a policing agreement with the Government of the Northwest Territories. The RCMP is responsible for criminal investigation and follow-up for

incidents occurring on the airport site. It is also responsible for responding to screening-related services, including but not limited to response at the PBS checkpoint. The RCMP is non-resident on the airport site and provides response when summoned.

14.3 Landside Security

14.3.1 Pre-Board Screening

The PTB currently possesses a PBS checkpoint at the entrance to the screened departure lounge.[4] In compliance with new passenger screening requirements and to improve throughput capabilities, the PBS checkpoint was expanded in 2003. The expansion provided for a doubling of the screening lanes, integration of Explosive Detection Trace equipment and a secondary search area.

14.3.2 Hold Baggage Screening

As part of CATSA's mandate to deploy Explosive Detection Systems at Canadian airports, the systematic screening of hold baggage (checked luggage) for the presence of explosives will be mandatory by December 31, 2005. The screening systems to be put on place in Canadian airports involve a 5-step process that incorporates use of various detection equipment and, if necessary, leading to manual searches of hold baggage. The planned expansion of the existing PTB will provide approximately 700m^2 of floor space for the HBS system and common use baggage make-up area. Funding for the development of the HBS facility is provided by the Government of Canada.

Planning for the new PTB to be located on the west-side of the airport site will need to incorporate sufficient space to accommodate a similar facility.

14.4 Airside Security

14.4.1 Airside Access

Apron access is made via the controlled gate situated in the PTB employee parking lot adjacent to the firehall building. The gate is controlled by the airport security service at a manned guard station.

A secondary airside access point for vehicles is provided for airport maintenance staff, RCMP and fuel trucks via an unmanned gate located on Brintnell Street, between First Air and the Department of National Defence lots. The gate is activated through security pass controllers issued by the airport administration and, in some cases, by the tenants.

Tenants with airside lot access must control access to their respective airside areas.

Subject to the availability of funding, it is proposed that the secondary unmanned apron access point situated on Brintnell Street be upgraded to ensure adequate control through a manned presence, or installation of video cameras linked to the guard station.

14.4.2 Perimeter Fencing

The airside area, including aircraft parking aprons, has full security fencing around its perimeter. Notwithstanding, deer and coyotes are frequently present on airside areas.

14.4.3 FOL Airside Access

The Department of National Defence operates a Forward Operating Location on a site bordering the southwest portion of the airport. Airside access between the FOL site and airport land is made via Taxiway G (see Figure 6-2, page 6-6, for the location of the taxiway). Use of the taxiway and responsibility for security maintenance between the two sites is governed by the *Memorandum of Understanding Between Transport Canada and the Department of National Defence Relative to Civil/Military Operations at the Inuvik and Yellowknife Airports in the Northwest Territories*.[5]

14.4.4 Isolated Aircraft Parking Position

Aircraft that is known or considered to be a threat are required to be isolated from other aircraft parking positions, buildings or public areas and the perimeter fence. As identified previously in this document, a location situated at the end threshold of Runway 09 is designated as the Isolated Aircraft Parking Position at the airport.[6]

14.5 Notes and References

[1] CATSA was formed through the Canadian Air Transportation Security Authority Act in 2002 in response to the events of September 11, 2001.

[2] CATSA is currently implementing an Restricted Area Identification Card (RAIC) program across Canada, incorporating the use of biometric identifiers and a national database to authenticate the validity of the card.

[3] *Yellowknife Airport Operations Manual*; GNWT, Department of Transportation, 2003.

[4] Only passengers on flights to destinations in Southern Canada (south of the 60th parallel), Whitehorse and Iqaluit are required to undergo Pre-Board Screening.

[5] A copy of the memorandum is provided in the *Yellowknife Airport Operations Manual*.

[6] See *Yellowknife Airport Operations Manual;* GNWT, Department of Transportation, 2003.

15.0 Water Supply and Sanitation

15.1 About this Chapter

The limitations of the existing water supply and sanitary sewage collection system are major issues for the operational viability of the airport site. The Airports Division, in association with the consultants involved in the preparation of this Development Plan, have assessed issues, opportunities and constraints regarding the various water distribution and sewage collection systems that could be put in place for all or portions of the airport site.

This chapter reviews existing conditions and puts forward proposals for the long-term development of the water supply and sanitation system. More specifically, the chapter reviews the system's components, and evaluates its capability to meet long-term demand. The chapter is prepared in part through research and assessments performed by the consultants involved in the Development Plan, and supplemented with the results of a 2003 *Water and Sewage Servicing Strategies* study[1]. (The study was undertaken to review the potential to connect the airport's water distribution and sewage collection system to that of the City of Yellowknife.) Proposals for future service delivery are presented later in this section.

Consistent with the proposals contained in the 2003 study, the system will need to satisfy a number of requirements, including:

- Sewage collection and treatment to the satisfaction of regulatory authorities;
- Sufficient water provision for both potable and non-potable consumption needs;
- Fire protection services that are consistent with new or renovated development needs; and
- The operability of the system in the Yellowknife climate.

Specific technical terminology used in this chapter is defined below:

Potable Water – Water that is safe for drinking and cooking.

Water Table – The level of groundwater.

15.2 Water Supply

15.2.1 Water Distribution

The water supply for the Yellowknife Airport is provided by two distinct systems, respectively consisting of potable and non-potable water delivery systems.

Non-potable Water

Non-potable water is provided to the PTB and approximately half of the northeast quadrant by an on-site piped system (as illustrated in Figure 15-1, following page), owned and operated by the Airports Division.

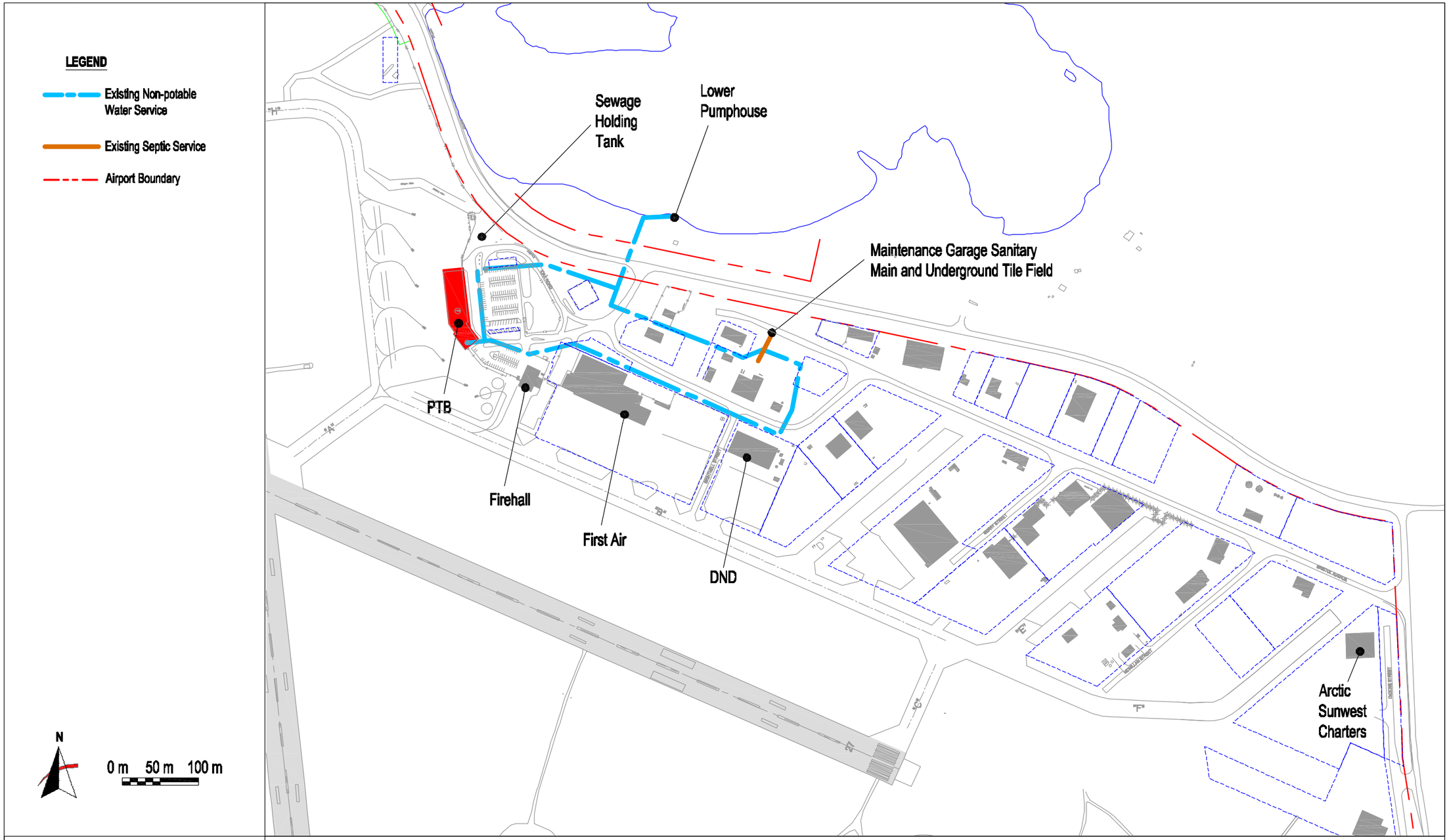


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Figure 15-1: Existing Non-Potable Water and Septic Services

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The non-potable water system consists of:

- An intake and pumphouse at Long Lake;
- A 1,220m^3 storage reservoir (907m^3 fire storage and one day peak use storage of 313m^3);
- Pumping facilities, including two fire, two duty and freeze protection pumps; and
- A buried looped distribution watermain system.

The system provides the non-potable water supply and approximately 7,560 l/min fire fighting flow to the PTB and adjacent areas. Condition assessments performed in the *Water and Sewer Servicing Strategies*[2] report indicates that the reservoir/pumphouse and raw water intake buildings were well maintained and in reasonable condition, but the intake and the supply line to the reservoir were in need of replacement. The Airport Division has currently allocated approximately $500,000 for this project, and implementation is expected by the end of 2004.

In addition, a number of issues have been identified relating to the use of PVC piping in the water reservoir/pumphouse, and the design of the thrust blocking mechanism in the piping system.[3] These issues are mainly regulatory in nature and proposals were made in the 2003 study for further assessments.

Tenant and other facilities not covered by the piped system exclusively use trucked water supply for potable and non-potable requirements.

Potable Water

Potable water is provided by the City of Yellowknife. The treated potable water for the airport is delivered by pipe to the City of Yellowknife's Pumphouse No. 4, from where it is trucked by Bromely and Sons, under private contracts to individual users. Individual buildings are fitted with separate water storage tanks and pressure systems. Regular delivery schedules are maintained and storage tanks are generally sized to suit the demands and delivery routine. (Off-schedule delivery is possible in the event that a user runs out of potable water.)

15.2.2 Water Demand

The current total volume of water usage at the airport is not well documented. Nonetheless, for planning purposes, order-of-magnitude water consumption and sewage generation estimates can be made on the basis of the conclusions of the *Water and Sewage Servicing Strategy* report, and discussions with water trucking and sewage disposal operators.

Current Water Consumption

Based on 2003 consumption information, total potable and non-potable airport water usage averages approximately 35m^3 per day (4,800 gallons). The following assumptions were used as a basis to the estimate:

- **Non-potable Water** – 15.7m^3 per day, based on the 6-year average identified in the 2003 *Water and Sewer Servicing Strategies* report. This water is provided to a portion of the site via the underground piped system. The largest user of non-potable water is the PTB, which accounts for an average of 74% of the total use. Those tenants not connected to the underground piped system exclusively use potable water.

- **Potable Water** – 19.4m^3 per day, based on discussions with the local water delivery contractor.[4] This water is trucked to individual facilities, including the PTB, and tenants.
- **PTB Potable Water** – 1.5 to 1.8m^3 per day, based on discussions with the local water delivery contractor.

Table 15-1 (below) provides a breakdown of the overall demand by water product and facility.

Table 15-1: Estimated Average 2003 Water Consumption (m^3)

	Daily	Monthly	Annually
Total Water Demand	**35.1**	**1,053**	**12,812**
PTB	13.4	402	4,892
Other Facilities and Tenants	21.7	651	7,920
Non-potable Water	**15.7**	**471**	**5,731**
PTB (74% of total demand)	11.6	348	4,235
Other Facilities and Tenants	4.1	123	1,496
Potable Water	**19.4**	**582**	**7,081**
PTB	1.8	54	657
Other Facilities and Tenants	17.6	528	6,424

Source: Earth Tech (Canada) and Inter*VISTAS* Consulting, 2003.

Current demand is adequately managed through the non-potable piped system and potable water trucked delivery. As specified previously, the non-potable system possesses a storage capacity of 1,220m^3, consisting of 907m^3 fire storage and a 'peak day use' capacity of 313m^3. The 'peak day use' capacity is well above the estimated daily non-potable demand identified in Table 15-1 (above).

Based on the potable water consumption estimates provided above, approximately 1.4 truckloads of potable water per day are required to service the entire site. (Each truckload possesses a 13.6m^3 capacity.)

Future Water Demand

Table 15-2 (below) summarises potential demand for the 2013 and 2023 periods. Details of the estimates for each water product follow.

Table 15-2: Potential Average Daily Water Demand (m^3)

	2003			2013			2023		
	Potable	Non-Potable	Total	Potable	Non-Potable	Total	Potable	Non-Potable	Total
PTB	1.8	11.6	13.4	2.5	15.9	18.4	3.0	19.0	22.0
Other Facilities and Tenants	17.6	4.1	21.7	24.6	5.7	30.3	34.3	8.0	42.3
Total Demand	**19.4**	**15.7**	**35.1**	**27.1**	**21.6**	**48.7**	**37.3**	**27.0**	**64.3**

Source: Earth Tech (Canada) and Inter*VISTAS* Consulting, 2003.

Potable Water

Current PTB demand is approximately 1.8m^3 per day (see Table 15-1, page 15-4). Based on the forecast growth of passenger traffic, potable water requirements for the PTB could grow to approximately 2.7m^3 and 4.0m^3 per day by 2013 and 2023, respectfully.

For other locations, future demand can be estimated based on potential increases in land occupancy. In 2003, the year for which consumption information was available, airport tenants occupied 34.4ha and, together, generated an average demand for water of approximately 21.7m^3 per day (potable and non-potable, see Table 15-2, page 15-4). An annual land absorption in the range of 3.4% is within the 20-year historical average (see Chapter 5.0 – Airport Site) and can be used for baseline purposes to project long-term demand. Under a scenario where land occupancy would grow in a manner similar to that experienced over the past two decades (3.4% annual absorption;), potable water demand at these locations would increase by approximately 40% by 2013 and by more than 95% by 2023 – bringing total daily demand to 24.6m^3 and 34.3m^3, respectfully.[5]

Combined daily PTB and tenant demand for potable water would reach 27.1m^3 by 2013 and 37.3m^3 2023. This level of demand would result in requirements for 2 truckloads of water per day by 2013, and increasing to 3 truckloads by 2023 – based on a 13.6m^3 capacity of a water delivery truck. (Compared to the current demand for approximately 1.5 truckloads). In the event that the non-potable piped system is expanded, the relative increase in delivery requirements would be lower. Overall, continuation of the trucked delivery system remains an adequate option for meeting potable water demand in the northern quadrants. The PTB expansion will require however that sufficient water storage capacity is provided.

A more effective distribution system will be required for the longer-term period – particularly once development of the west-side of the site is initiated – to account for an approximate 77% increase in total demand by 2023, and to ensure appropriate levels of service beyond that period.

Non-Potable Water

Using a similar methodology, PTB non-potable water demand can be expected to increase at rates similar to those described above, to bring total demand up to approximately 15.9m^3 and 19.0m^3 per day, respectfully, by 2013 and 2023. For non-PTB-users, daily non-potable water consumption could range from approximately 5.7m^3 to 8.0m^3 for the same period. Total site consumption (including the PTB) would attain 21.6m^3 and 27.0m^3.

Given the on-site non-potable water storage capacity of 313m^3, the existing piped system is adequate to provide sufficient supply to meet long-term demand, even under a much higher land absorption scenario.

However, with part of the northeast quadrant and the entire northwest quadrant not served by the piped system, some tenants exclusively use trucked potable water to meet current potable and non-potable demand. This distribution system has considerable impacts on the overall demand for potable water demand on the site.

The extension of the piped network to serve existing developed areas is a means of alleviating demand for trucked potable water to the site. An extended network could also be eventually converted to a potable water distribution system.

15.2.3 Fire Protection

Fire flows for external hydrants are normally calculated following *Water Supply for Public Fire Protection, a Guide to Recommended Practice (1999)*, as published by the Fire Underwriter's Survey for both sprinkler-equipped buildings and non-sprinkler-equipped buildings.[6] Municipalities have no legal responsibility to provide fire protection and there are, therefore, no legal water system requirements.[7]

The assessments performed as part of the *Water and Sewage Servicing Strategies* report reviewed the adequacy of the existing water distribution system to meet fire flow requirements. The fire suppression requirements at the Buffalo Air Hangar – one of the site's largest facilities – were identified in this report. Requirements are summarised below.

Fire Hydrants

Sufficient fire hydrant flow is required where sprinkler systems are not available in individual structures. The existing 7,560 l/min fireflow for two hours provided via the existing piped non-potable water system is below Fire Underwriters Survey recommendations for non-sprinkler-equipped hangers, such as Buffalo Air (15,000 l/min for 3.25 hrs).[8] To meet recommended guidelines, additional fire hydrant flow will be required to suppress a fire in the non-sprinkler equipped building. This would involve larger watermains, larger fire pumps and approximately 2,925m^3 fire storage versus the current 907m^3 of fire storage.

Buildings Equipped with Sprinkler Systems

Based on National Fire Protection Association (NFPA) standards, the existing piped non-potable water system cannot meet requirements for the Buffalo Air Hanger. The existing 7,560 l/min fire flow for two hours available from the current non-potable system is below the requirements for a hanger such as Buffalo Air should it be equipped with sprinklers in the future (approximately 17,500 l/min for one hour). This fire flow could be accommodated in the existing storage reservoir (907m^3) if some of the excess maximum day storage is dedicated to fire protection. The fire pump's, main sizes and reservoir fill rate would however need to be increased. The Buffalo Air hanger could also be sprinkled independent of the piped system. This would require on-site storage capacity of non-potable water of approximately 1,060m^3.[9] Given the size of the tankage on site, this may not be cost effective.

Although the airport is under no legal obligation to provide fire fighting water flow capacity, increasing non-potable water flow and storage capacity at the airport would be required for the site to meet current guidelines. The NFPA requirements, exceeding those of the Fire Underwriters Survey for exterior hydrants for sprinkled buildings, should be adopted as design parameters for system upgrades on sprinkler-equipped buildings if on-site storage is not provided.

15.3 Sanitation

15.3.1 Sewage Collection

Sanitary Sewage

A piped sewage collection system does not exist at the Yellowknife Airport. Sewage from the PTB currently flows to a sewage holding tank on land situated to the north of the building. The tank was installed in September 2004 at a cost of $275,000. Prior to this date, PTB sewage flowed by gravity to a tile field located north of Taxiway A, between Apron I and Runway 15. The tile field was reported as being in or below the water table and was overloaded. This situation was reportedly contributing to permafrost degradation, subsequent ground settlement in the vicinity of the tile field, and some water table contamination. The tile field has been fully decommissioned.

The Maintenance Garage utilises a separate septic tank and tile field adjacent to the facility.

The existing sanitary sewage disposal system for all other buildings consists of sewage holding tanks with pumpout facilities. A private trucking contractor currently vacuum-pumps the sewage from these tanks on regular intervals and discards the waste into the City of Yellowknife sewage system. The wetlands system ultimately discharges to the North Arm of Great Slave Lake.

Storm Water Drainage

The airport site contains well-drained sand and gravel areas, with a relatively high water table.[10] With an annual precipitation rate in the order of 300mm, precipitation and rainfall intensities are relatively low in the Yellowknife area. Storm water drainage is managed at the airport by a series of ditches and culverts with no overall scheme or dedicated disposal/collection point(s).

Airport staff have indicated some problematic drainage on airside areas, particularly with the ditches situated immediately to the south east of the intersection of Runways 15-33 and 09-27. Based on preliminary assessments, this deficiency would be solved through re-grading of the affected ditches. Ditch monitoring and re-grading constitute part of the airport's regular maintenance program.

Sewage Generation

Current volumes of sewage generated at the airport are not well documented. Typically, however, total sewage volumes fall within the range of total water consumed (potable and non-potable). Based on the assessment provided earlier, approximately 35m^3 of sewage per day (consistent with total water consumption) can be used for planning purposes. Since sewage vacuum trucks are similar in capacity to water trucks, this volume of sewage would result in a daily average of approximately 2.6 truckloads.

PTB and aircraft washing operations are likely the highest individual generators of sewage waste. With the new PTB sewage holding tank and the maintenance garage tile field treating a portion of the site's sewage, and aircraft wash run-off being directed to ditches, the amount of sewage requiring retention and transportation off-site is, in fact, lower. It is difficult however to provide a more detailed estimate without further technical assessment of septic field and drainage capacity.

Under the assumption that the volumes of sewage generated on the site are similar to those of total water consumed, average daily sewage volumes could theoretically range from approximately 48.7m^3 by 2013 and by 64.3m^3 per day by 2023. Removal of this sewage would involve 3 to 4 vacuum truckloads per day by 2013 – increasing to 5 truckloads per day by 2023 – if the existing septic fields where abandoned and formal collection of aircraft wash run-off was required.

These volumes of sewage would require a significant number of individual sewage holding tanks and likely continuous collection service from the local sanitary disposal service. A more efficient sewage collection and treatment system is required.

15.3.2 Solid Waste Disposal

The solid waste collected at the airport is transported to the City of Yellowknife waste disposal site.

A requirement resulting from the potential introduction of international air services would be the need to destroy waste generated in-flight to prevent the spreading of non-indigenous bacteria or disease to Canadian soil. Incineration is the typical means of destroying this waste. Given the relatively low levels of international traffic that can be expected to occur at the airport,[11] and the high cost of construction and operation of such a facility,[12] on-site incineration is not recommended.

Disposal of waste of international origin could be achieved through the Yellowknife Hospital incinerator. When required, the Airports Division could establish an agreement for joint-use of this facility. These arrangements are not uncommon at many smaller international airports, and provide cost-effective alternatives to the construction and operation of on-site incineration facilities.

15.4 System Development Plan

The following provides a summary of the key conclusions made in the *Water and Sewage Servicing Strategies* report. Note that although the assessment covered a considerably different land development proposal,[13] the overall proposals remain valid. Where appropriate, the results and conclusions of the *Water and Sewage Servicing Strategies* report have been adjusted in this document to reflect the direction adopted by the current development scheme.

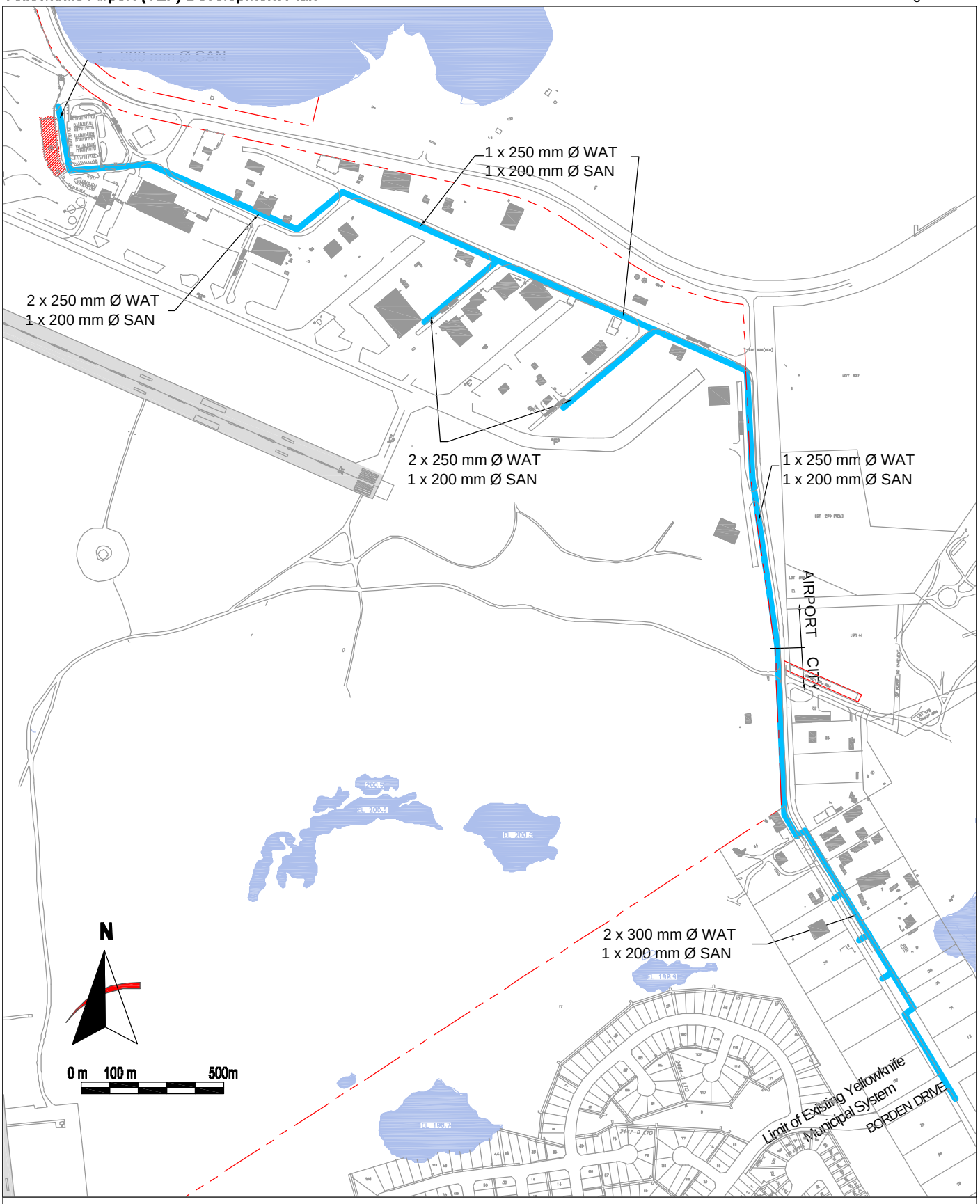
The *Water and Sewage Servicing Strategies* concluded:

- Trucked services should not be maintained over the long-term period due to the limitations they impose on airport development and fire fighting capabilities.
- The northeast quadrant (and, if ever developed, the southeast quadrant) should be connected to the City of Yellowknife potable water system due to the cost effectiveness of the solution compared to the development of an independent airport system.
- Extension of the City of Yellowknife sewer system to the eastern quadrants appears feasible, although a more detailed knowledge of the thermal conditions is required.
- The extension of the water and sewage systems along Old Airport Road will allow adjacent properties to connect to the municipal system and potentially leverage redevelopment of these properties.

The proposed systems for the northeast and northwest quadrants are illustrated in Figure 15-2 and Figure 15-3 (pages 15-10 and 15-11), respectively.[14] A majority of the potential users support the extension of the municipal system to the airport site, although the cost of the service connection is considered a determining factor in their decision. Preliminary estimates indicate the value of this project at $8 to $10 million. No funding is currently available for implementation however. Further evaluation of financing options and potential costs per user is required before implementation can proceed.

Future West-side Services

In addition to the service requirements and proposals put forward in the 2003 report, the proposed passenger terminal complex and CSB development in the west-side will require that a water distribution and sanitary sewage collection system be envisioned. Given the length of piping required to connect the quadrant to the proposed extended system in the northern quadrants and the lack of adjacent urban development, connection to the municipal system would involve significantly high capital costs. The development of new properties on this site should provide for trucked services, at least until on-site and adjacent off-site development can leverage the development of a municipal piped water and sewage system on the west-side of the airport.



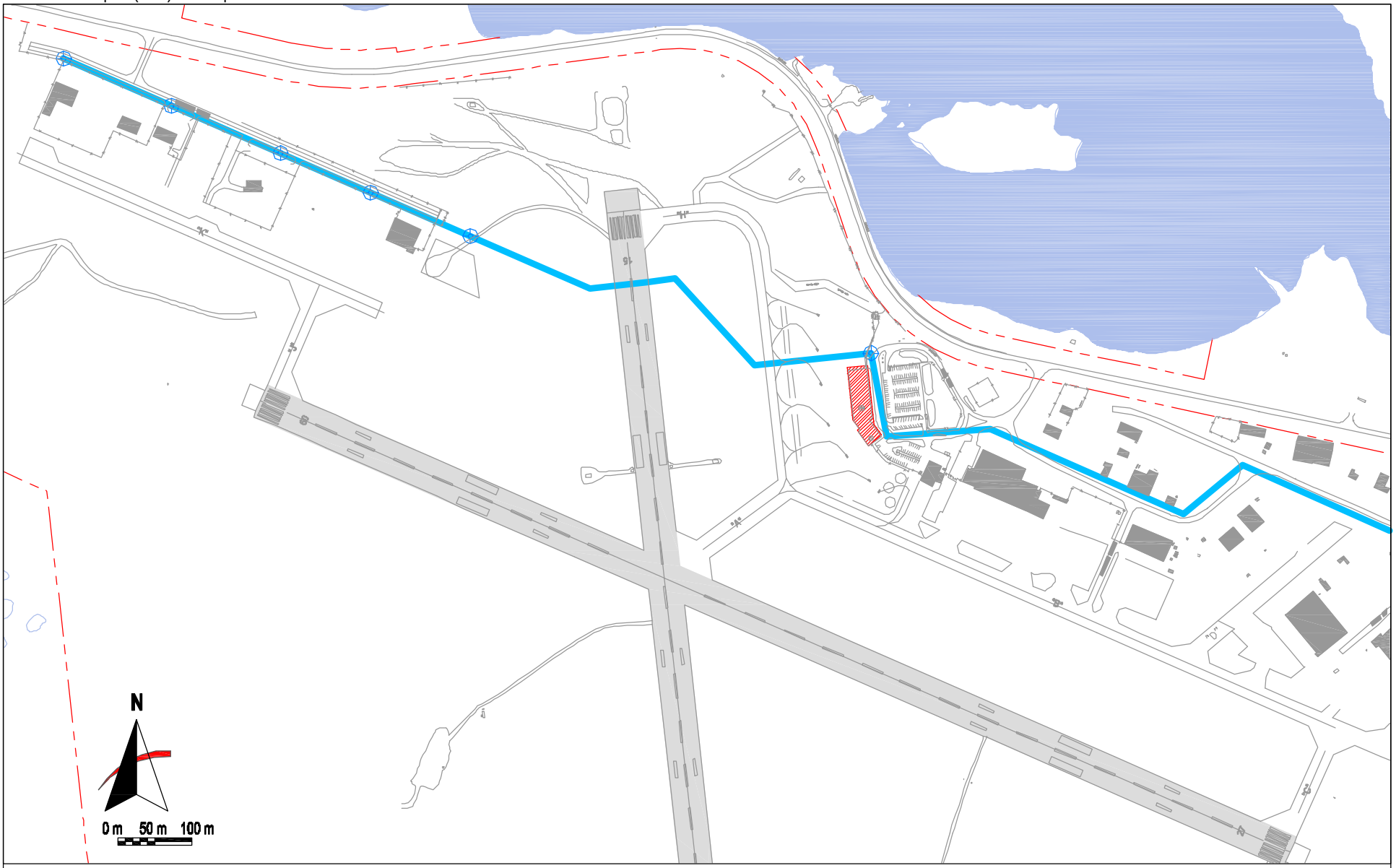
Source: Earth Tech (Canada) Inc. (2003)

Northwest Territories Transportation

Figure 15-2: Proposed Water and Sewage Services System Northeast Quadrant

DATE: November, 2004

For planning purposes only



Source: Earth Tech (Canada) Inc. (2003)

Proposed Hydrant / Water Vault Locations

Northwest Territories Transportation

Figure 15-3: Proposed Water and Sewage Services System Northwest Quadrant

DATE: November, 2004

For planning purposes only

15.5 Notes and Reference

[1] *Water and Sewage Servicing Strategies*; Earth Tech (Canada) Inc., 2003.

[2] *Water and Sewer Servicing Strategies*; Earth Tech (Canada) Inc., 2003.

[3] Details of these issues are contained in the 2003 *Water and Sewer Servicing Strategies*.

[4] The contractor advised that up to ten truckloads a week were supplied to the airport in 2003 (including the PTB). With each truckload possessing a capacity of 13.6m^3 (3,000 gallons), this water consumption equates to approximately 19m^3 per day.

[5] Note that water demand from individual facilities will vary radically, depending on the nature of the development, and the number of people working at the facility. New developments, such as a hotel for example, may have substantial water demand/sewage generation.

[6] It must be noted that these calculated flows are “guides” not “Code” requirements.

[7] *Community Fire Protection and Prevention North of 60*; page 19.

[8] *Echo Bay Hanger*; Reid Crowther and Partners Ltd. for the GNWT, Department of Public Works and Services, 1997.

[9] Ibid.

[10] The water table in the infield is approximately 1.8m below the surface.

[11] One wide-body international flight typically generates only a few large bags of garbage.

[12] The cost of construction would be in the range of $1 million.

[13] The service area adopted for the *Water and Sewage Strategies* report was based on earlier recommendations to develop the southeast quadrant. Updates made to the strategies contained in previous drafts of the Development Plan have shifted focus of the long-term development areas towards the southwest quadrant.

[14] Note that the system illustrated is a modified version of that put forward in the *Water and Sewage Services Strategies* report. The original proposal provided for connections to the southeast quadrant. The latter area is no longer the preferred focus for long-term airport development.

Section 5: Systems Integration

Introductory Notes

The advancement of the west-side site development for Passenger Terminal and Combined Services Buildings is a key element of the long-term development strategy for the Yellowknife Airport. Not only will these initiatives considerably improve the operational efficiency and levels of service of airport; they also require an integrated approach to overall development of the facility for over the course of the next 20-years.

The purpose of this section is to synthesise the requirements and proposals derived from the analyses undertaken in the previous sections, and to integrate these requirements to achieve an efficient and logical airport development scheme. The ensuing development program and Airport Land Use Plan are based on the strengths of existing infrastructure and facilities and the proposed redevelopment of the airport's passenger terminal complex.

16.0 Development Proposals

16.1 About this Chapter

The Development Plan has put forward a considerable number of proposals for individual airport components. This chapter summarises and integrates these proposals to form a coherent program for the long-term development of the airport site. The overall development scheme reflecting the vision for the future layout of the airport site is presented. The individual projects, general timelines for development and related cost estimates are outlined in this chapter to support the achievement of the development scheme.

16.2 Long-term Development Scheme

Implementation of the proposals presented in this document will frame the long-term program for airport development and provide guidance with respect to capital planning requirements. The integration of the opportunities, the constraints and the proposals presented throughout this document form the long-term development scheme for the airport. The long-term airport layout is presented in Figure 16-1 (page 16-2).

16.2.1 Airport West Development

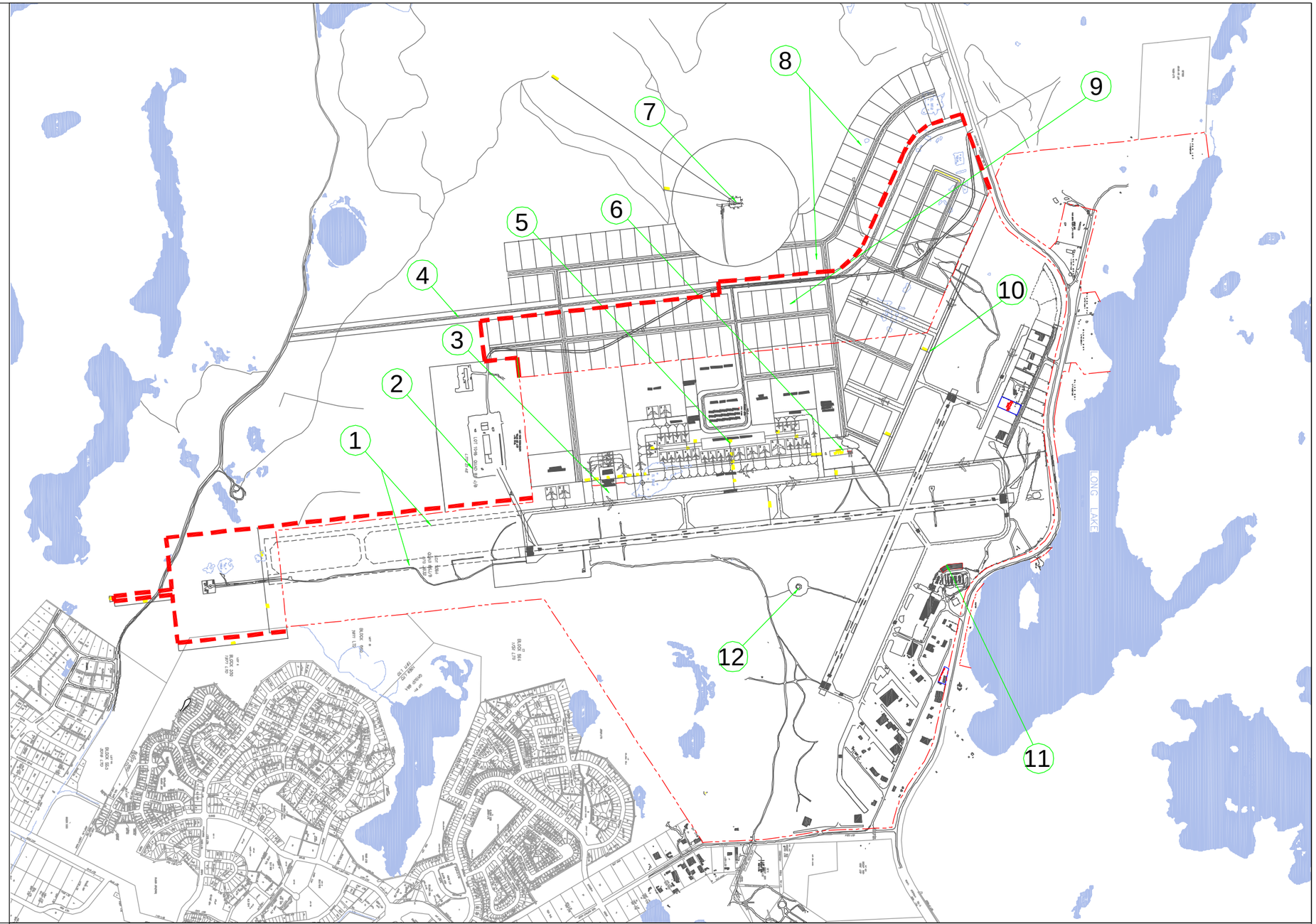
Key to the future configuration and operation of the airport site will be the development of the west-side land area. By 2023, it is envisioned that this area will accommodate new passenger terminal facilities, airport maintenance and Emergency Response Services, aircraft de-icing and fuel facilities, as well as substantial aviation and complementary industrial tenanted development. The site will represent a new development node for the airport, and provide an anchor for adjacent municipal expansion aimed at increasing northern economic activities and providing additional residential space for the community.

The long-term airport layout also illustrates the layout resulting from the implementation of the proposals to extend Runway 15-33 with a western parallel taxiway, and a southern parallel taxiway to Runway 09-27 to access the west-side development. In addition, new subdivision concepts are shown for unoccupied land areas.

Development of this site will occur in stages consistent with growth in air traffic demand (passenger and cargo), tenanted land development and operational requirements. Subject to the availability of funding, initial projects could occur as soon as 2005 with the proposed development of the Combined Services Building, and the initial phase of the new PTB and ancillary facilities commencing in the following years.. Pending agreement with the City of Yellowknife and the GNWT, Department of Transportation, the west-side project will be made possible through a realignment and extension of the FOL access road to service the site.

LEGEND

- Existing Airport Boundary
- Proposed Airport Boundary
- 1 Proposed runway and taxiway development
- 2 Existing FOL site
- 3 Long-term aircraft de-icing facility
- 4 Proposed Airport West by-pass
- 5 Ultimate passenger terminal complex build-out
- 6 Proposed Combined Services Building
- 7 Independent Secondary Surveillance Radar (ISSR) site
- 8 Off-site industrial development
- 9 New west-side tenanted lots
- 10 Proposed taxiway development
- 11 Existing PTB to be converted to other uses
- 12 VORTAC site



Northwest Territories Transportation

Figure 16-1: Proposed Long-term Airport Layout

DATE: November, 2004

For planning purposes only

16.2.2 The Existing Facilities

The transfer of the passenger terminal complex and maintenance facilities to the west-side of the site will not signal the end to activities that currently occur in the northern quadrants, particularly in the northwest quadrant. With the exception of a few tenants that may wish to relocate to the new site to support future PTB operations, existing operations may continue to occur in the northern quadrants. Of particular importance will be the preservation of the NAV CANADA Air Traffic Control Tower and other air navigation services in the existing PTB building. Although no decision has been made regarding future use, the latter facility could be converted into a Fixed Based Operation for use by the airport's charter service providers – further maximizing the use of existing assets and enhancing the level of service provided at the airport.

16.3 Summary of Individual Development Proposals

Based on the system assessments provided in the previous sections of this document, a number of proposals addressing future airport development have been made. A summary of specific facility and land development requirements, along with the proposed timeframe for individual implementation, are provided in Table 16-1 (following pages).

Table 16-1: Summary of Development Proposals

Proposal	2004 – 05	2006 – 07	2008 – 13	2014 – 23
Runways and Taxiways				
Runway 15-33 Extension				
Application to acquire 32ha of Commissioners land and establishment of easement for relocated approach lighting	■			
Submission to revise Yellowknife Airport Zoning Regulations applicable to Runway 15-33		■		
Market analysis of Yellowknife international air service market potential		■		
Review approach aid requirements with NAV CANADA and provision of precision capability to Runway 15			■	
Phase I extension – 760m extension (to a length of 3,050m)			■	
Phase II extension – 450m extension (to a length of 3,500m)			When justified by demand	
Taxiway System Expansion				
Phase I Runway 15-33 parallel taxiway– from Runway 09-27 intersection to mid-point (675m extension)	In association with PTB development			
Phase II Runway 15-33 parallel taxiway– from mid-point to existing threshold (780m extension)			When justified by demand	
Phase III Runway 15-33 parallel taxiway – to the extended 3,500m threshold (additional 1,213m extension)			When justified by demand	
Runway 09-27 taxiway – southwest quadrant (580m)	In association with adjacent development			
Existing Passenger Terminal Complex Redevelopment				
PTB Redevelopment				
Northern building expansion (1,000m^2) for Hold Baggage Screening area and adjacent improvements	■			
Installation of portable structures for relocated airport admin offices and unscreened passenger hold room	■			
Reconfiguration of original portion of structure for expanded arrivals and retail area		■		
PTB Apron				
PTB apron reconfiguration (9 positions)	■			
Parking				
PTB public and employee lot surfacing and reconfiguration	■	■		
Aircraft De-icing				
Expand Apron I (3,600m^2) for de-icing surface	■	■		

Table 16-1 (cont'd)

Proposal	2004 – 05	2006 – 07	2008 – 13	2014 – 23
West-side Development				
New Passenger Terminal Development				
Planning for west-side PTB development				
PTB construction				
PTB operation				
Potential expansion				As required
PTB Apron				
Initial west-side PTB apron surface (12 positions)				
West-side PTB apron expansion				As required
Aircraft De-icing Facilities				
Develop west-side de-icing apron				
Access and Internal Circulation				
Realign and extend the FOL access road for west-side access				
Develop internal west-side road network		As required		
Parking				
West-side PTB public parking lot development				
Operations and Support Elements				
Combined Service Building development (airport maintenance facility and ERS relocation)	Subject to funding schedule			
Relocate fuel service providers to new west-side location				
Connect west-side site to City of Yellowknife water distribution and sewage collection system	Not scheduled – subject to development levels west of the airport site and availability of funding			

Table 16-1 (cont'd)

Proposal	2004 – 05	2006 – 07	2008 – 13	2014 – 23
Northern Quadrant Development				
Access and Internal Circulation				
Archibald Street extension (~ 150m)				
Surface and reconfigure Bristol / Taxi E lot	Not scheduled			
Operations and Support Elements				
Water reservoir/pumphouse intake and supply line replacement				
PTB tile file decommissioning and sewage holding tank installation				
Electrical services study to identify current and required load capacity on the site				
Connect northern quadrants to City of Yellowknife water distribution and sewage collection system	Not scheduled – subject to finding availability			

16.3.1 Capital Requirements

Table 16-2 (below) identifies the specific capital projects associated with the proposals contained in the *Yellowknife Airport (YZF) Development Plan*. The total cost of these proposals is estimated to be in the order of $100 million, spread out over the next 20 years. These include approximately $10-$15 million for the redevelopment of the existing passenger terminal complex (funds for this project have already been approved) and approximately $40-$45 million for the proposed west-side passenger terminal complex development.

All costs are identified as Class D estimates, in current dollars, and do not include contingency, engineering or ancillary consulting expenses. The estimates are provided for general planning purposes only and will require more detailed evaluation before individual projects are approved by the GNWT. Final capital programming will be subject to approval of individual development items.

Table 16-2: Development Plan Capital Requirements – Class D Estimates

Items	$ (Thousands)
Runway 15-33 Extension(1)	
Phase I – 760m extension (to a length of 3,050m)	12,000
Phase II – 450m extension (to a length of 3,500m)	7,000
Taxiway System Expansion	
Phase I R15-33 parallel taxiway – from R09-27 to mid-point (675m)	1,800
Phase II R15-33 parallel taxiway – from mid-point to existing threshold (78m)	2,100
Phase III R15-33 parallel taxiway – to the extended 3,500m threshold (additional 1,213)	3,200
R09-27 taxiway – southwest quadrant (580m)	1,600
Existing Passenger Terminal Complex Redevelopment	
Northern PTB expansion and reconfiguration of original portion of structure	10,000 – 15,000
PTB apron reconfiguration	
PTB apron expansion for de-icing facility	
PTB public and employee lot surfacing and reconfiguration	
West-side Development	
New Passenger Terminal Building	40,000 – 45,000 (2)
New PTB apron	
West-side aircraft de-icing facility	
West-side PTB public parking lot	
West-side internal road network	
Combined Services Building	6,000 – 8,000

Table 16-2 (cont'd)

Items	$ (Thousands)
FOL access road realignment and extension[3]	Cost estimates require more detailed technical assessment
Connection to City of Yellowknife water distribution and sewage collection system	
Northern Quadrant Development	
Archibald Street extension	80
Surface and reconfigure Bristol / Taxi E lot	100
Water reservoir/pumphouse intake and supply line replacement	500
Northern quadrant connection to City of Yellowknife water distribution and sewage collection system	8,000 – 10,000
Total[4]	**$92,380 - $106,380**

(1) Estimate does not include revision to the Registered Aeronautical Zoning as costs depend on extent of legal research and land surveying required.
(2) Preliminary estimate.
(3) Project cost potentially shared with other organizations.
(4) Portion of total potentially shared with other organizations.

17.0 Land Use

17.1 About this Chapter

The implementation of the proposals put forward in this document will have considerable impacts on the airport layout and the location of specific activities on the airport site. This chapter describes the land use implications of the Development Plan, notably through identification of land requirements and land use designations on the airport site.

17.2 Airport Boundary

Consistent with the proposals contained in Chapter 6.0 – Runways and Taxiways, the potential extension of Runway 15-33 will require expansion of the airport boundary. In addition, the proposed development of the west-side quadrant of the airport, driven by the proposed relocation of the passenger terminal complex and the development of a Combined Services Building, will require some additional land to support effective management of the land area situated to the west of the current boundary by both the GNWT and the City of Yellowknife.

With the aim of ensuring that appropriate allowances are provided for long-term development of the Yellowknife Airport, the Airports Division wishes to expand the airport's boundaries through the acquisition of adjacent parcels of Commissioners Land.

Figure 17-1 (page 17-2) proposes specific land areas for the expansion of the airport boundary. Definition of the expanded land area is derived from the land use requirements obtained through the analyses and proposals contained in this plan. The land areas are designated according to their importance to the realisation of the proposals contained in this document.

- **Area I** – Land area required to accommodate the proposed extension of Runway 15-33. Acquisition of this land area is essential to the realisation of this project.
- **Area II** – Secondary land area intended to provide flexibility in accommodating long-term aviation-related and industrial tenants at the airport to leverage the provision of roads and services to the site. Although acquisition of this land is preferable, it is not essential to protecting the long-term operational viability of the site, since the land would be zoned for industrial purposes. The affected area could also be subject to a cost-sharing/joint development agreement between the GNWT and the City of Yellowknife established to ensure land use compatibility with the airport site and future development of this land.

LEGEND

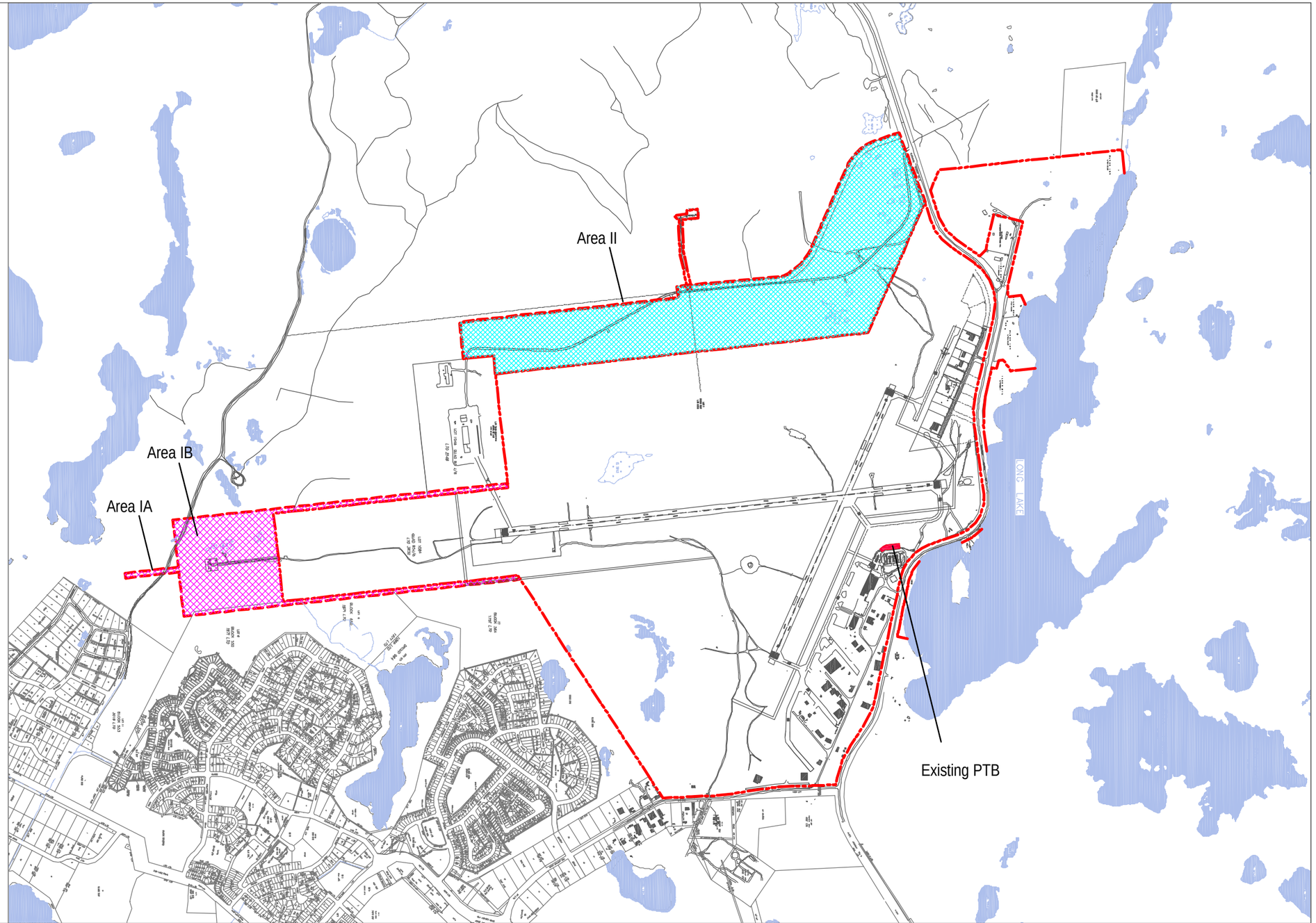
Existing Boundary

Proposed Boundary Extension

Area IA
Land required for approach light relocation (approximately 0.7 ha)
276 m from proposed boundary
12.5 m on each side of the runway centre line

Area IB
Future runway and taxiway extension (approximately 32 ha)
519 m south of existing boundary
250 m on each side of the runway centre line

Area II
Additional land required to support west-side development (approximately 95 ha)



Northwest Territories Transportation

Figure 17-1: Proposed Airport Boundary

DATE: November, 2004

For planning purposes only

17.3 Airport Land Use Plan

17.3.1 Background

Transport Canada defines an Airport Land Use Plan as a document that provides a rational and comprehensive framework for the development and use of airport lands, and that permits the balanced fulfilment of present, short and long-term future needs. It is used to guide the development of airport land through the designation of individual areas to accommodate expansion of existing or development of new facilities, infrastructure or services on the site. The Airport Land Use Plan is not intended to serve as a subdivision plan. However, the designation of land use areas consider the location of primary critical aviation infrastructure such as the airport's runways, taxiways and air and ground navigational aids, along with related Obstacle Limitation Surface restrictions, and designates appropriately-sized land areas to accommodate necessary airport structures, such as hangars and aprons.

The Yellowknife Airport has a well-organized land use system that results form recommendations made in previous Master Plan, Development Plan and Land Use Plan documents. The Airport Land Use Plan was last updated as part of the 1998 Airport Development Plan Update and built upon the Land Use Plan prepared by Transport Canada in 1994. (The latter drove the overall land use pattern and permissible activities within the airport's boundaries until 1998.) The more recent update provided guidance for the development of the airport's northern quadrants and some initial framework for the eventual development of the airport two southern quadrants. Copies of these plans can be found in the 1994 *Yellowknife Airport Development Plan*[1] and the 1998 *Yellowknife Airport Development Plan Update*[2] documents.

17.3.2 Yellowknife Airport, Land Use Plan, 2004-2023

The *Yellowknife Airport, Land Use Plan, 2004-2023* is based upon a land use hierarchy to provide required protection for current and forecast future demand requirements for:

- Aircraft operational facilities such as runways, taxiways, aircraft parking aprons and their associated obstacle limitation surfaces and radio navigational aids;
- Passenger, freight and mail facilities such as passenger and cargo terminal facilities, associated access road and vehicle parking;
- Aviation related commercial facilities such as aviation fuel, aircraft maintenance and storage hangars, freight forwarders, aircraft and helicopter operators, that require access to the airside (runway and taxiway system); and
- Landside commercial facilities that do not require airside access but are located on airport property and contribute to the financial viability of the airport.

The location and configuration of all infrastructure situated within each land use area (including buildings, circulation areas, fences, etc.) must comply with prevailing Obstacle Limitation Surface standards as defined in Transport Canada's *Aeronautical Standards and Recommended Practices (TP312E),* and protection areas for radio navigational aids as defined in *Land Use in the Vicinity of Airports (TP1247E)*.

Designated land uses are generally consistent with those adopted by Transport Canada for airport planning purposes. Definitions of the designated land uses are as follows:

- **Airside System** – defines the aircraft operating area that includes the runway and taxiway systems, aircraft parking aprons, air and ground navigational aids, aircraft fire fighting and (proposed) airport maintenance facilities, and non-public airside service roads that are compatible with prevailing Obstacle Limitation Surfaces and protection areas for radio navigation aids.
- **Passenger Terminal Complex** – accommodates existing and proposed PTB facilities and related areas.
- **Ground Transportation System** – includes the public access roads and parking areas coming to or from the regional or municipal road system.
- **Airside Commercial** – generally accommodates commercial aviation support functions and airport industries that require direct airside access. These include passenger and freight expeditors, air cargo, aircraft maintenance facilities, Fixed Base Operators, commercial aircraft fuel facilities, aircraft forest fire fighting operations, DND air transport supply and search and rescue, helicopter operations and maintenance facilities, hangers, etc.
- **Landside Commercial** – accommodates light industrial, commercial or other transportation facilities that do not require direct airside access and may accommodate flight kitchens, hotels, car rental service areas, ground fuelling stations and other complementary commercial activities. Individual Landside Commercial sites may be converted to Airside Commercial uses if direct airside access is eventually provided.

The proposed *Yellowknife Airport, Land Use Plan, 2004-2023* is illustrated in Figure 17-2 (page 17-5). The existing land use allocations in the Northeast, Northwest and Southeast quadrants will continue. This land use plan proposes the designation of long-term developments of the Southwest Quadrant (west-side of Runway 15-33) for future airport infrastructure to meet the growing aviation traffic demands and revenue generation potential from commercial facilities.

17.4 Vicinity Land Uses

Given the importance of airport operations to the community and the costs associated with relocating airport infrastructure to minimize noise impacts on existing residential areas, safeguarding the airport vicinity from encroachment of incompatible urban development is critical for ensuring the long-term operational viability of the airport facility. Transport Canada, via the document *Land Use in the Vicinity of Airports*[3], recommends that no new residential construction occur in areas situated within the NEF 30 contour and above. (See Section 5.5.2 – Noise Exposure for details on the Yellowknife Airport noise environment.)

As mentioned previously in this Development Plan, the existing land use pattern and the potential encroachment of additional residential activities to the south and southeast of Runway 15-33 pose a considerable threat to the long-term viability of airport operations. In particular, plans to eventually extend the primary runway will result in considerable changes to noise exposure in the Kam Lake subdivision.

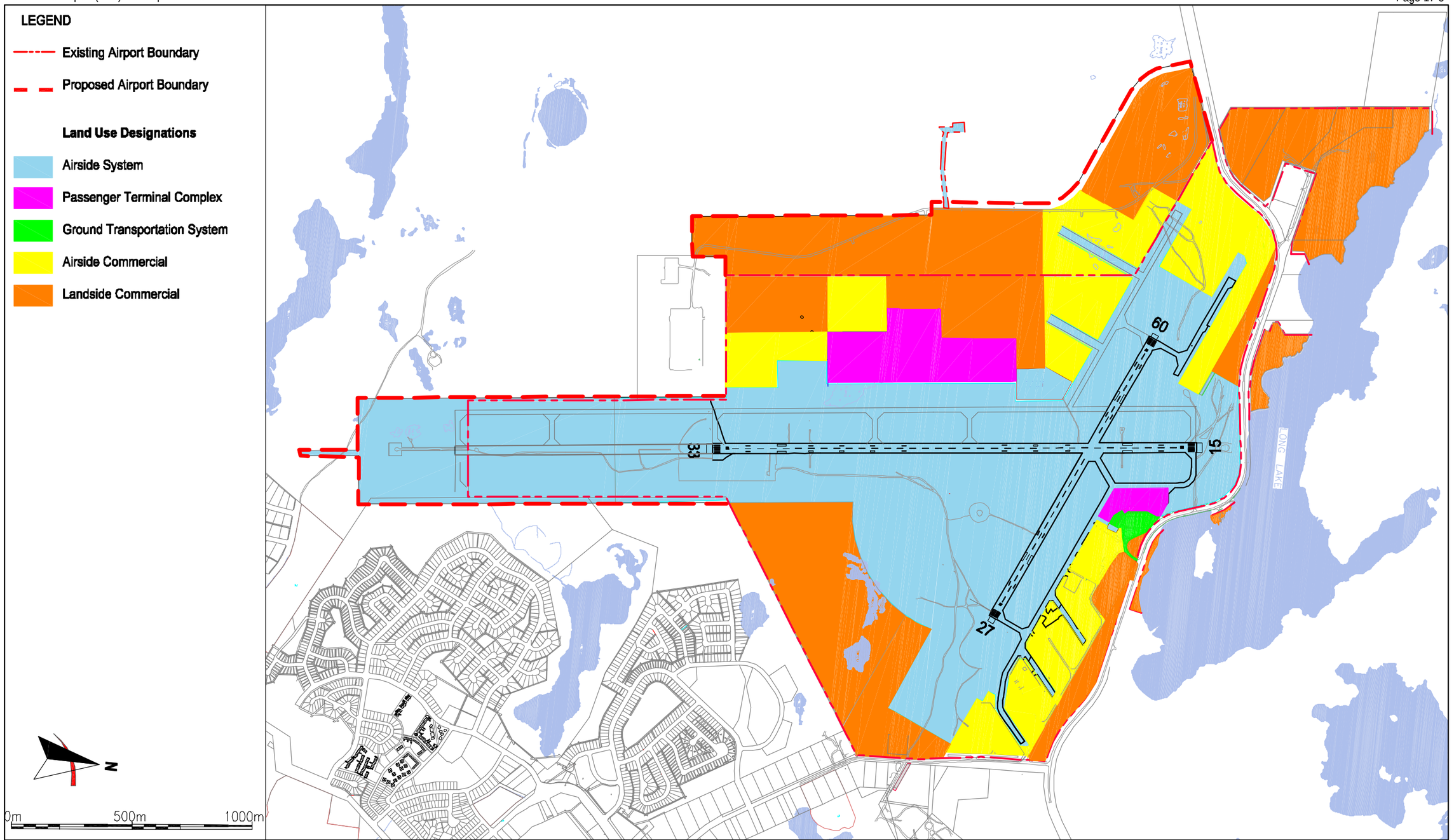


Figure 17-2: Yellowknife Airport, Land Use Plan, 2004-2023

Northwest Territories Transportation

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Jurisdictions around the world have adopted land use control and airport vicinity development schemes to ensure sustainability of airport operations and harmonious vicinity development.[4] The airport administration and the Airports Division are committed to working with municipal officials to encourage appropriate land uses in these areas. To ensure compatibility between current and future airport operations and long-term community development, appropriate land use controls should be put in place over the short-term period. Airport vicinity protections are proposed in this document to provide guidance with respect to the long-term land use pattern around the airport site.

The proposed protection area comprises three distinct zones that are loosely derived from the location of the 2021 NEF contours for the proposed extended Runway 15-33 presented in Chapter 6.0 – Runways and Taxiways. Table 17-1 (below) defines the restrictions proposed for each zone. The land use restrictions proposed for each zone are based on Transport Canada guidelines[5] and applicable restrictions derived from the Obstacle Limitation Surfaces resulting from the proposed extension of Runway 15-33.

Table 17-1: Proposed Airport Vicinity Protections

Zone	Proposed Restriction(s)
I	No new residential development, except for infill of currently subdivided areas. New residential owners to be informed of noise exposure area through annotation on Land Titles.
II	No new residential development, except for infill of currently subdivided areas. Height restrictions apply on all development in accordance with the displaced Approach and Transitional Surfaces resulting from the potential extended Runway 15-33.[6] New residential owners to be informed of noise exposure area through annotation on Land Titles.
III	New residential development permitted if accompanied by appropriate acoustic insulation consistent with Canada Mortgage and Housing Corporation (CMHC) and Transport Canada guidelines.[7] New residential owners to be informed of noise exposure area through annotation on Land Titles.

Figure 17-3 (page 17-7) illustrates the affected land area. The land use strategy adopted for the airport environs put forward in the *City of Yellowknife, 2004 General Plan (Draft)* generally follows these proposals.

LEGEND

- Area I - No new residential development
- Area II - No new residential development and height restrictions
- Area III - Acoustic Sound Insulation

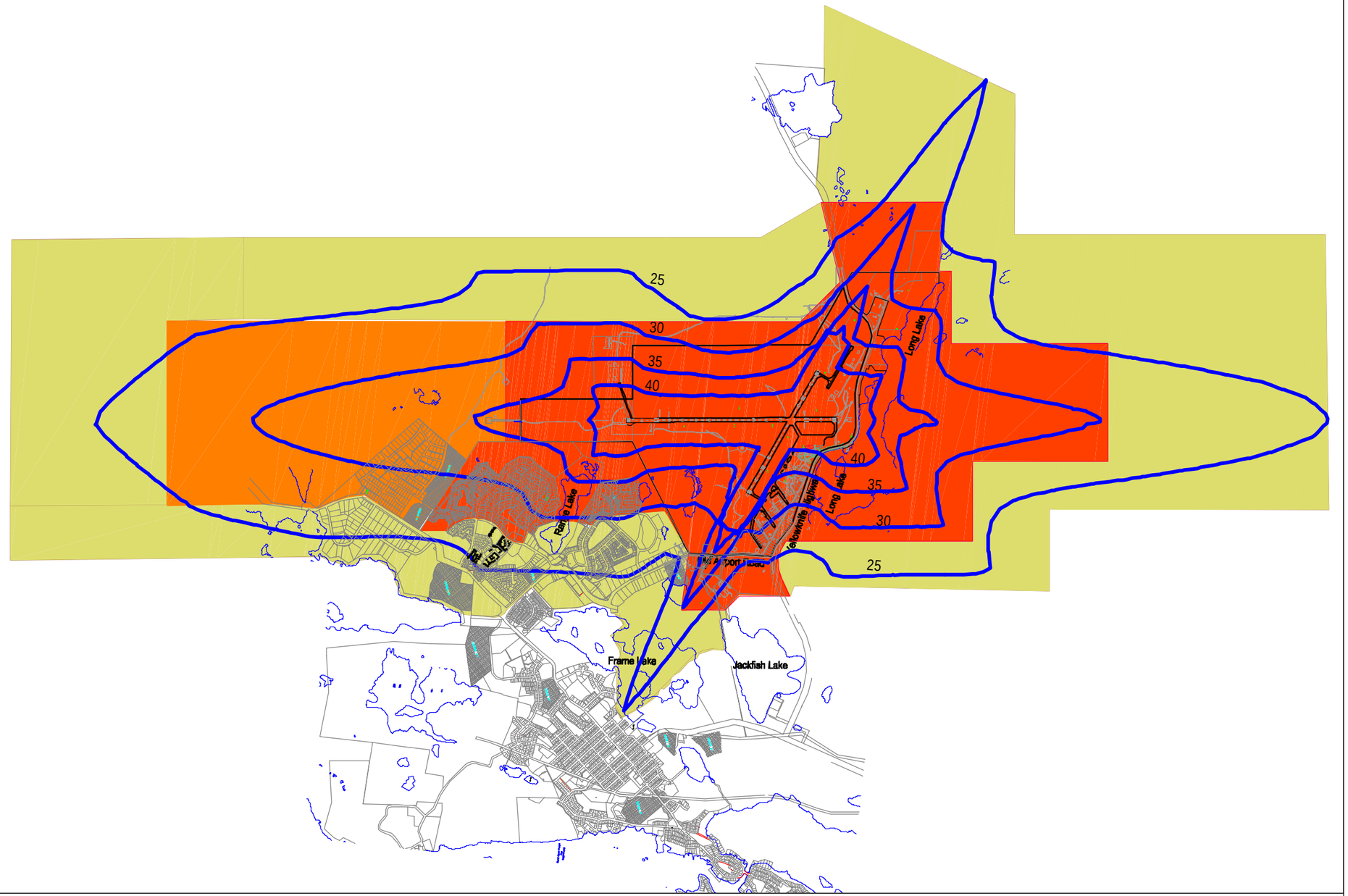

Figure 17-3: Airport Vicinity Protection Zones

Northwest Territories Transportation

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17.5 Notes and References

[1] *Yellowknife Airport Development Plan (TP 11741)*; Transport Canada, Western Region, Airports Group, 1994.

[2] *Yellowknife Airport Development Plan Update*; LPS Aviation Inc. and Ferguson Simek Clark; 1998.

[3] *Land Use in the Vicinity of Airports (TP 1247E), 7th Edition;* Transport Canada, 1996.

[4] In Canada, the Province of Ontario has a Policy Statement providing guidelines for airport vicinity development, while land uses around the Calgary and Edmonton International Airports are controlled by individual Airport Vicinity Protection Areas that are enshrined in provincial legislation.

[5] *Land Use in the Vicinity of Airports (TP 1247E)*, *7th Edition;* Transport Canada, 1993

[6] Approach and Transitional Surface specifications are consistent with Obstacle Limitation Surface (OLS) standards defined by Transport *Canada's Aerodrome Standards and Recommended Practices (TP312E)*.

[7] CMHC's *New Housing and Airport Noise Handbook* (NHA 5185 81/05) provides guidelines in determining appropriate noise insulation features for a particular residential development.

Appendix A – Letters of Approval and Support

File: ED 2000-A2

October 15, 2004 PC Docs: 96375

Marvin Ringham
Manager, Buildings & Planning
Airports Division
Department of Transportation
Government of the NWT
P.O. Box 1320
YELLOWKNIFE, NT X1A 2L9

Dear Mr. Ringham:

Yellowknife Airport Development Plan

Our senior management team has reviewed the Yellowknife Airport (YZF) Development Plan (August, 2004) and the draft Executive Summary. They are comprehensive documents, and from the Airports Division perspective, best practices for the airport community are well documented.

We agree with the Development Plan's preface, *"It serves as a framework within which future project proposals will be scrutinized."* We also appreciate the positioning statement in the Executive Summary, *"The airport must reflect the long-term planning and development needs of the City of Yellowknife and the whole Northern stakeholder community."*

We look forward to ongoing discussions and negotiations regarding the City's interests, concerns and requirements related to expansions or improvements at the Yellowknife Airport. We believe that a phased approach best suits our schedule, goals and objectives.

Thank you for the opportunity to review these documents.

Sincerely,

Peter Neugebauer
Director, Economic Development

c: Max Hall, City Administrator

Appendix B – Forecast Tables

Table B-1: Annual Enplaned + Deplaned Passengers

	Low	Medium	High
1981		129,400	
1982		124,800	
1983		123,000	
1984		135,512	
1985		143,400	
1986		151,400	
1987		164,400	
1988		186,300	
1989		211,988	
1990		211,454	
1991		197,372	
1992		191,410	
1993		198,988	
1994		192,498	
1995		217,169	
1996		213,287	
1997		217,744	
1998		271,635	
1999		265,143	
2000		278,000	
2001		290,841	
2002		291,596	
2003 *		320,000	
2008	**352,000**	**395,000**	**425,000**
2013	**387,000**	**440,000**	**493,000**
2023	**440,000**	**522,000**	**629,000**
Average annual growth rate			
2003-2008	1.9%	4.3%	5.8%
2003-2013	1.9%	3.2%	4.4%
2003-2023	1.6%	2.5%	3.4%

* Based on carrier reported data to GNWT/YZF

Statistics prior to 2003 based on Statistics Canada/Transport Canada published data.

Table B-2: Annual Total Aircraft Movements

	Total			Itinerant			Local		
1981		66,117			42,179			23,938	
1982		51,795			33,662			18,133	
1983		51,837			32,255			19,582	
1984		53,117			32,079			21,038	
1985		46,762			31,998			14,764	
1986		49,381			34,096			15,285	
1987		54,371			38,696			15,675	
1988		62,226			42,252			19,974	
1989		55,296			33,555			21,741	
1990		46,969			30,112			16,857	
1991		46,719			28,430			18,289	
1992		56,376			29,498			26,878	
1993		71,914			36,395			35,519	
1994		83,281			40,844			42,437	
1995		65,341			36,494			28,847	
1996		62,882			38,802			24,080	
1997		55,058			35,123			19,935	
1998		55,598			34,039			21,559	
1999		52,323			33,003			19,320	
2000		61,455			36,913			24,542	
2001		57,052			38,528			18,524	
2002		49,657			38,304			11,353	
2003		50,802			40,570			10,232	
2008	54,300	69,000	79,200	42,300	49,000	54,200	12,000	20,000	25,000
2013	59,200	76,000	90,300	45,200	54,000	61,300	14,000	22,000	29,000
2023	63,100	82,300	100,900	49,100	60,300	71,900	14,000	22,000	29,000
Average annual growth rate									
2003-2008	1.3%	6.3%	9.3%	0.8%	3.8%	6.0%	3.2%	14.3%	19.6%
2003-2013	1.5%	4.1%	5.9%	1.1%	2.9%	4.2%	3.2%	8.0%	11.0%
2003-2023	1.1%	2.4%	3.5%	1.0%	2.0%	2.9%	1.6%	3.9%	5.3%

Table B-3: Annual Itinerant Aircraft Movements

	Itinerant			Air Carrier			General Aviation		
1990		30,112			23,223			6,889	
1991		28,430			21,789			6,641	
1992		29,498			22,121			7,377	
1993		36,395			26,229			10,166	
1994		40,844			28,838			12,006	
1995		36,494			27,292			9,202	
1996		38,802			29,645			9,157	
1997		35,123			30,080			5,043	
1998		34,039			28,603			5,436	
1999		33,003			27,759			5,244	
2000		36,913			30,916			5,997	
2001		38,528			33,793			4,735	
2002		38,304			34,214			4,090	
2003		40,570			34,361			6,209	
2008	42,300	49,000	54,200	37,000	41,100	44,600	5,300	7,900	9,600
2013	45,200	54,000	61,300	39,300	44,900	49,800	5,900	9,100	11,500
2023	49,100	60,300	71,900	42,700	50,400	58,900	6,400	9,900	13,000
Average annual growth rate									
2003-2008	0.8%	3.8%	6.0%	1.5%	3.6%	5.4%	-3.1%	4.9%	9.1%
2003-2013	1.1%	2.9%	4.2%	1.4%	2.7%	3.8%	-0.5%	3.9%	6.4%
2003-2023	1.0%	2.0%	2.9%	1.1%	1.9%	2.7%	0.2%	2.4%	3.8%

Table B-4: Annual Enplaned + Deplaned Cargo (Tonnes)

	Low	Medium	High
1990		2,118	
1991		1,943	
1992		1,872	
1993		1,652	
1994		2,321	
1995		2,257	
1996		2,143	
1997		2,258	
1998		2,670	
1999		3,608	
2000		3,267	
2001 (e)		20,950	
2003 (e)		22,800	
2008	24,600	28,300	33,500
2013	26,400	31,900	40,000
2023	29,000	38,500	53,000
Average annual growth rate			
2003-2008	1.5%	4.4%	8.0%
2003-2013	1.5%	3.4%	5.8%
2003-2023	1.2%	2.7%	4.3%

Notes:

1. Reported air cargo statistics (1990 to 2000 from Statistics Canada) include only major carrier services. Regional/local carriers and smaller charter carriers do not file cargo data.

(e) - InterVISTAS estimates based on data/information provided by carriers/operators.

Appendix C – Sites of Environmental Concern and Remedial Action

Figure C-1: Sites of Environmental Concern and Remedial Action

Location	Environmental Concern		Action Plan	Year
	Nature	Source		
Apron III	Lead contamination in groundwater was observed at drainage.	Unknown	Two boreholes will be drilled and two monitoring wells will be installed. Soil and water samples will be taken to determine contamination.	2004
Maintenance Garage Septic Tank and Leaching Field	Faecal coliforms associated with sewage from the septic tanks and the leaching field may potentially be a source of environmental concern.		Soil sampling required.	2004/05
Snow Dump Area	Refuse including vehicle parts, tar and leaking drums have been identified at this location.	PAHs, and Hydrocarbons originating from refuse may have leaked into soil and groundwater.	Further sampling required before remedial measure can be identified undertaken, if required.	2004/05
Regulator Site and Adjacent Area	PCBs, metals and hydrocarbons may have potentially leached into soil and groundwater.	Previous storage of asbestos and PCBs, in addition to scrap metals, storage drums and other old equipment parts.	Transport Canada to investigate the NAV CANADA files to determine who is responsible	2004/05
North End of Main Apron	Potential surface water contamination from de-icing fluids (glycol and urea)	Absence of de-icing containment or collection system.	Air carriers responsible for clean-up. Potential installation of collection system.	2004/07
Near Northwest End of Runway 09-27	Buried materials may potentially contaminate soil and groundwater in the area.	Buried DC-3 and buried drums were discovered northwest of the end of Runway 09-27 in the Summer 1998.	Soil sampling required to determine if contamination is above applicable regulations.	2004
Near South End of Runway 15-33	'Agent Orange' is rumoured to have been used in the 1970s to defoliate vegetation around south end of runway.	The herbicide was known to contain dioxins, which are harmful to humans.	Soil sampling required before remedial measures can be identified, if required.	2004/05
Bulk Storage Tanks	Hydrocarbon contamination in soil and groundwater, as well as lead contamination in groundwater.	Operation of fuel pumps and USTs.	Additional information required on location and previous test results before remedial measures can be identified, if required.	2004

Appendix D – Runway Lengths at Selected Airports Across Canada

Table D-1: Summary Runway Lengths (3,000 – 4,000 Metres)

Province	Airport	Code	Runway	Length (metres / feet)
Alberta	Calgary	YYC	16-34	3,863 / 12,675
Alberta	Cold Lake, DND	YOD	13L-31R	3,840 / 12,600
Quebec	Montreal (Mirabel)	YMX	08-24	3,657 / 12,000
Quebec	Montreal (Mirabel)	YMX	11-29	3,657 / 12,000
Northwest Territories	**Yellowknife (Ultimate)**	**YZF**	**15-33**	**3,505 / 11,500**
Ontario	Toronto, (Pearson)	YYZ	15L-33R	3,368 / 11,050
Newfoundland/Labrador	Goose Bay	YYR	08-26	3,367 / 11,046
British Columbia	Vancouver	YVR	08R-26L	3,353 / 11,000
Quebec	Montreal (Trudeau)	YUL	06L-24R	3,353 / 11,000
Alberta	Edmonton International	YEG	02-20	3,353 / 11,000
Manitoba	Winnipeg International	YWG	18-36	3,353 / 11,000
Newfoundland/Labrador	Gander	YQX	02-22	3,200 / 10,500
Ontario	Toronto (Pearson)	YYZ	06L-24R	3,200 / 10,500
Alberta	Edmonton International	YEG	12-30	3,109 / 10,200
Northwest Territories	**Yellowknife (proposed)**	**YZF**	**15-33**	**3,080 / 10,000**
Alberta	Cold Lake, DND	YOD	13R-31L	3,048 / 10,000
Quebec	Bagotville, DND	YBG	11-29	3,048 / 10,000
Newfoundland/Labrador	Stephenville	YJT	09-27	3,048 / 10,000
Ontario	Hamilton	YHM	12-30	3,048 / 10,000
Ontario	North Bay, DND	YYB	08-26	3,048 / 10,000
Ontario	Trenton, DND	YTR	02-24	3,048 / 10,000
British Columbia	Comox, DND	YQQ	11-29	3,048 / 10,000
British Columbia	Vancouver	YVR	08L-26R	3,030 / 9,940

Table D-2: Summary Runway Lengths (2,000 – 3,000 Metres)

Country	Airport	Code	Runway	Length (metres / feet)
Ontario	Ottawa	YOW	14-32	2,941 / 9,651
Quebec	Montreal (Trudeau)	YUL	06L-24R	2,926 / 9,600
Newfoundland/Labrador	Goose Bay	YYR	16-34	2,920 / 9,580
Ontario	Toronto, (Pearson)	YYZ	06R-24L	2,895 / 9,500
Ontario	Toronto (Pearson)	YYZ	15R-33L	2,770 / 9,088
Quebec	Quebec (Jean-Lesage)	YQB	06-24	2,743 / 9,000
Newfoundland/Labrador	Gander	YQX	13-31	2,713 / 8,900
Nova Scotia	Halifax	YHZ	06-24	2,682 / 8,800
Ontario	London	YXU	15-33	2,682 / 8,800
Manitoba	Winnipeg International	YWG	13-31	2,652 / 8,700
Alberta	Cold Lake, DND	YOD	13R-31L	2,530 / 8,300
Saskatchewan	Saskatoon	YXE	09-27	2,530 / 8,300
Ontario	Ottawa	YOW	07-25	2,438 / 8,000
New Brunswick	Moncton	YQM	11-29	2,438 / 8,000
British Columbia	Abbotsford	YXX	07-25	2,438 / 8,000
Alberta	Calgary	YYC	10-28	2,438 / 8,000
Saskatchewan	Regina	YQR	13-31	2,408 / 7,900
Nova Scotia	Halifax	YHZ	15-33	2,347 / 7,700
Northwest Territories	**Yellowknife (Existing)**	**YZF**	**15-33**	**2,287 / 7,500**
British Columbia	Prince George	YXS	15-33	2,255 / 7,400
British Columbia	Vancouver	YVR	12-30	2,225 / 7,300
British Columbia	Kelowna	YLW	15-33	2,225 / 7,300
British Columbia	Victoria	YYJ	09-27	2,135 / 7,005
Quebec	Montreal (Trudeau)	YUL	10-28	2,133 / 7,000
PEI	Charlottetown	YYG	03-21	2,133 / 7,000
Manitoba	Winnipeg International	YWG	07-25	2,133 / 7,000
Ontario	Sudbury	YSB	04-22	2,012 / 6,600

Table D-3: Summary Runway Lengths (1,000 – 2,000 Metres)

Province	Airport	Code	Runway	Length (metres / feet)
Alberta	Grande Prairie	YQU	11-29	1,981 / 6,500
Northwest Territories	Ekati	YOA	02-20	1,948 / 6,392
Ontario	London	YXU	09-27	1,920 / 6,300
Ontario	Thunder Bay	YQT	07-25	1,890 / 6,200
Saskatchewan	Regina	YQR	08-26	1,890 / 6,200
Saskatchewan	Saskatoon	YXE	15-33	1,890 / 6,200
Ontario	Sault Ste. Marie	YAM	12-30	1,829 / 6,000
Newfoundland/Labrador	Deer Lake	YDF	07-25	1,829 / 6,000
Alberta	Fort McMurray	YMM	07-25	1,829 / 6,000
Ontario	Sault Ste. Marie	YAM	04-22	1,829 / 6,000
Quebec	Bagotville DND	YBG	18-36	1,829 / 6,000
British Columbia	Kamloops	YKA	08-26	1,829 / 6,000
British Columbia	Prince George	YXS	09-27	1,714 / 5,625
Ontario	Thunder Bay	YQT	12-30	1,615 / 5,300
Northwest Territories	Diavik	DK2	10-28	1,585 / 5,200
Northwest Territories	Yellowknife	YZF	09-27	1,524 / 5,000
Ontario	Sudbury	YSB	12-30	1,524 / 5,000
Ontario	North Bay, DND	YYB	08-26	1,364 / 4,474

Appendix E – Parking Operations Assessment

[Extract from *Revised Draft Yellowknife Airport Parking Study*, 2002]

Parking Management

Airport parking facilities are typically either self-managed or concession-based (contracted out) operations.

Self-managed parking facilities are generally operated at small and medium-sized airports that possess relatively low vehicle turnover. At these airports, parking is provided as an ancillary service with minimal focus on revenue generation, or cost recovery. Lot maintenance costs are typically incorporated within the airport's overall Operations and Maintenance budget. Short-term parking at these airports is generally free of charge or metered, and situated outside the main parking lot. Where passenger traffic and vehicle turnover are sufficient to provide sustained revenue streams at these airports, self-managed operations can command considerable overhead for staffing, maintenance and general administration.

Airports that serve as regional gateways with relatively high flight frequencies or that possess considerable low-cost carrier operations, possess higher vehicle turn-over than those with limited air services. For these airports, the concession-based (or contracted-out) management model can typically provide a simple solution to many parking issues.

In considering the concession-based approach, several contract options exist:

- **Management Contract** – the airport provides all infrastructure and equipment; contracts the staffing; and retains all net revenues. This is the approach currently adopted at the Yellowknife Airport.
- **Lease/Concession Agreement** – parking areas and related infrastructure are leased to an independent operator. The parking operator and airport typically share revenues.
- **Finance, Design, Build, and Operate** – operator takes on construction and risk under this arrangement and keeps the majority of the revenue take.
- **Landside Management Agreement** – a broader agreement integrating parking, enforcement and landside vehicle licensing/permit authority.

Table E-1 (following page) summarises the characteristics of each approach.

Table E-1: Parking Management Models

	Self-managed	Concession-based			
		Management Contract	Lease/Concession Agreement	Finance, Design, Build, Operate	Landside Management Agreement
Operational Responsibility	Parking facilities operated in-house by airport staff.	Airport ensures day-to-day operations. Staffing outsourced to private company. Fees established by and facilities maintained by airport administration.	Third-party leases infrastructure and operates (including staffing and maintenance) parking facilities under contract with airport administration.	Third-party takes control of all facilities and assumes all risks associated with investment and operation of facilities. Land provided under lease with airport administration.	Variable. Involves delegation of broader enforcement and permit issuance responsibility to third-party.
Equipment Ownership	Airport-owned	Airport-owned	Airport-owned	Operator-owned	Variable. Typically similar to Lease/Concession or Finance, Design, Build, Operate models.
Maintenance Responsibility	Airport	Airport	Third-party operator	Third-party operator	Variable. Typically, third-party operator.
Airport Revenues	All parking revenues	Incremental parking revenues beyond the cost to administer the management contract.	Shared revenues with operator and basic land rent.	Land rent. (Potential for some payment of small concession fee)	Variable. Generally, limited share of parking, enforcement and permit generated revenues.
Airport Costs	All operating costs, including staffing, maintenance, general administration.	Lot and equipment maintenance, contract administration.	Contract administration and revenue auditing	Contract administration	Contract administration.

Table E-1 (cont'd)

	Self-managed	Concession-based			
		Management Contract	Lease/Concession Agreement	Finance, Design, Build, Operate	Landside Management Agreement
Operational control	Airport administration	Airport administration	Third-party operator. Operational requirements defined within concession agreement with airport administration.	Minimal control due to risk undertaking by third-party operator. Operational requirements/ investment commitments defined within concession agreement with airport administration.	Third-party operator, under terms of concession agreement with airport administration.
Implementation Issues	Requires airport staff for extended hours of operation for fee collection and enforcement.	Operational responsibility remains with airport administration. Provides limited solutions for other parking issues such as regulation enforcement or permit issuance.	Continued airport administration capital investments for facility development Third-party responsibility for operations.	Operational and financial responsibility contracted to third-party. Involves limited airport capital investment for infrastructure development. Limited airport administration control.	Limited authority for passenger terminal curb enforcement and violation issuance. Operational and financial responsibility contracted to third-party. Limited airport administration control.

The annual operation of a parking facility can incur considerable Operations and Maintenance costs. In assessing management models, the cost of providing parking services must be outweighed by the financial benefit of the derived revenues. For small and medium-sized airports, the extended hours of operation, enforcement, violation issuance and on-going maintenance will typically generate higher per stall costs than at busier airports, where parking turnover and per stall incomes are higher. In addition, maintaining the parking product as part of the overall gamut of services provided by an airport commands considerable commitment from upper level management to invest the time necessary to assess and direct the associated operations. At smaller airports with relatively limited resources, both requirements are difficult to achieve without compromising investment capabilities or service levels in other operational areas.

Third-party operations, however, provide flexibility in ensuring that parking services are provided and maintained without significant daily involvement on the part of the airport administration. In addition, these operations provide the ability to ensure steady revenue streams through specific contract provisions guaranteeing minimum concession-based rents, and to minimize demands on human and financial resources. Under any third-party management system, however, effective and transparent revenue control systems are required to ensure that the airport administration preserves the ability to monitor utilisation and revenue generation from the parking operations.

At the Yellowknife Airport, contracting day-to-day operations to a third-party operator can provide considerable benefit given the current scale of operations and the capacity, curb and enforcement issues discussed previously in this chapter. The Airports Division has been reviewing options for the management of the Yellowknife Airport's parking facilities. Final decisions will be dependent on the amount of capital investment required to upgrade and/or maintain the existing infrastructure, as well as the amortisation period associated with the longer-term operation of the facility.

Revenue Collection

Several revenue collection options exist. These options typically consist of:

- **Staffed lot operations** – involves manning the exit collection booth during all airport operating hours.
- **Pay-on-foot (self-regulated)** – involves installation of entry ticket dispensers and exit readers, coupled with the use of automated payment machines/terminals (usually located within the PTB). Payment is made in advance of the exiting process.
- **Pay-at-exit (self-regulated)** – similar system to the Pay-on-foot, with the exception that automated payment is made at the point of exit.
- **Pre-paid Parking (meters or ticket dispensers)** – involves installation of parking meters at each stall, or centrally located ticket dispenser, and regular lot patrols.

Each system possesses individual challenges with respect to costs and anticipated returns. Table E-2 (following page) highlights the various characteristics of each option.

Table E-2: Operational Alternatives

	Staffed Lots	Self-regulated Lots		
		Pay-on-Foot	Pay-at-Exit	Pre-paid
Collection Equipment	One ticket dispenser per access lane.	One ticket dispenser/one ticket collector per access/exit lane. One or more automated payment machines.	One ticket dispenser/one payment machine per access/exit lane.	One meter per stall or one pre-paid ticket dispenser for the lot.
Infrastructure	Heated exit kiosk with gated access/exit lanes.	Gated access/exit lanes.	Gates access/exit lanes.	None
Manpower	One attendant per shift, staffed during extended hours of airport operations (two 8 hour shifts).	Attendant required for daily money collection and occasional maintenance.	Attendant required for daily money collection and occasional maintenance.	Regular (hourly) lot patrols for meter-stay/pre-paid ticket monitoring and administrative staff for violation collection.
Customer Service	Medium Service Levels – Slow exiting process.	High Service Levels – Through provision of heated kiosks, well-located and sufficient quantity of machines and good customer knowledge of collection system. Low/Medium Service Levels – With minimal equipment and limited customer knowledge of collection system.'	Low/Medium Service Levels – Slow exiting process; lack of assistance at exit (payment) location.	Low/Medium Service Levels – Additional parking step involved upon arrival (pre-payment); longer exposure to elements.
Implementation Issues	Relatively simple implementation. On-going staffing requirement may be difficult. Minimal equipment maintenance can be easily handled through on-site staff. Relatively high staffing costs vs. self-regulated lots.	Low operational impact during installation and start-up operations (location of collection machines in non-vehicle pathway limit exit congestion). Hardware and software maintenance require reliable local technicians.	System start-up disruptive to exit flow (customers unfamiliar with equipment operations slow payment and exit process). Requires on-site employee available to occasionally assist users or attend to equipment in case of breakdown.	Limited installation impacts. Metered systems equipment intensive (requires one meter per stall). Display of prepaid tickets through windshield hindered by snow accumulation during winter months. Simple on-going maintenance but involves relatively labour intensive coinage collection process. Meters hinder snow clearance operations.

A key item for consideration in the assessment of revenue collection methods is the value relationship that each collection product offers. Although the current contracted staff operation is contributing to improved enforcement and better turnover, the revenue shortfalls outweigh the benefits that the manned system inherently creates. For example, a typical staffed operation would involve providing manned service over extended hours – approximately 16 hours/day 365 days/year – at an annual average cost of approximately $100,000.[1] This cost is incurred directly by the parking lot operator (either the airport itself or third-party operator, depending on the management system adopted) and requires recovery through the revenues generated by the parking facility.

Prepaid meter or ticket dispenser operations present enforcement challenges relating the frequency of lot patrols, violation collection and climatic considerations. These systems are not appropriate for wide-scale use in Yellowknife. Ticket dispenser operations, for example, are difficult to patrol in winter months due to snow accumulation on windshields that obstruct views of pre-paid parking receipts.

Pay-on-foot and Pay-at-exit systems provide greater long-term and cost-efficient solutions. Installation of self-regulated automated systems for the existing Yellowknife PTB-parking facility would cost approximately $150,000. (A detailed cost estimate is provided later in this chapter.) Given the one-time capital expenditure and significantly lower ongoing labour costs associated with the operation of automated parking equipment, a self-regulated lot would provide a lower-cost option to a traditional manned or staffed operation. With the staffed lot involving in excess of $100,000 in annual labour costs to provide full coverage, compared to the one-time outlay for equipment and annual maintenance costs of the self-regulated pay-on-foot system, the latter would provide a two-year payback and amortisation of equipment costs.[2]

Pay-at-exit systems do not however provide appropriate levels of service given the requirement to make payments from the automobile at the lot exit point. This is of particular importance during winter months, or for users who would be unfamiliar with the system. The latter users take considerably longer time to use the equipment than those accustomed to their operation and slow the exit process. Implementation of a Pay-on-foot system should therefore be considered over the very short-term period.

Suppliers such as Skidata, Federal, and Amano market systems that are both suitable for this type of operation and provide good performance records in cold weather.

Parking Fees

A comparative review of the parking fees in place at other small and medium-sized Canadian airports was conducted for the purpose of this study. Table E-3 (below) identifies the rates in effect within the Yellowknife city market, and those at airports situated in Canadian provincial capital cities, or those that have similar traffic activity to that of Yellowknife Airport.

Table E-3: City of Yellowknife and Medium-sized Canadian Airport Parking Rates

Location	Type of Service	30 Minutes	1 Hour	Daily	Weekly	Monthly
City						
Downtown, City of Yellowknife, NT	Meters	0.25 (per 20 minutes)	1.00 (some meters)	-	-	-
Airports						
Abbotsford, BC	Parking Lot	-	-	-	-	-
	Frequent Flyer Reserved Stalls	-	-	-	-	30.00
Charlottetown, PE	Short-term	-	1.50	8.00	-	-
	Long-term	-	1.00	6.00	24.00	60.00
Edmonton, AB	Parkade	1.10	-	9.35	46.75	-
	Valet	1.15	-	7.00	32.75	100.00
Gander, NL	Meters	.25	.50	-	-	-
	Parking Lot	-	-	5.00	35.00	N/A
Halifax, NS	Meters	-	1.60	-	-	-
	Parking Lot	-	-	9.00	38.00	-
Moncton, NB	Parking Lot	-	1.50	8.50	43.00	150.00
Prince George, BC	Meters	.50	1.00	5.50	27.50	66.00
Regina, SK	Meters	.75	1.50	-	-	-
	Parking Lot	.80	1.60	6.50	38.50	-
St. John's, NL	Short-term	-	2.00	-	-	-
	Long-term	-	2.00	6.00	30.00	-
Sudbury, ON	Meters	-	1.00	-	-	-
	Long-term	-	1.05	5.90	23.10	-
Thunder Bay, ON	Short-term	0.85	1.70	28.80	-	-
	Long-term	-	-	6.50	39.00	-
Winnipeg, MB	Meters	1.00	2.00	10.00	-	-
	Parking Lot	-	1.50	8.00	40.00	160.00
Victoria, BC	Parking Lot		2.00	10.00		
	Economy	-			50.00	99.00
Windsor, ON	Parking Lot	-	1.25	8.50	42.00	-
Whitehorse, YT	Parking Lot	0.25	-	1.50	7.50	25.00
	Energised Stalls	-	-	3.00	14.00	48.00

Note: Parking rates as of May 2002.
Source: Inter*VISTAS* Consulting, 2004.

The airport administration recently revised the fee structure in place for the public lot to render charges more compatible with other Canadian airports, while remaining competitive with those of the local market.

Notes and References

[1] Cost based on hourly wage of $17.00/hr X 16 hours/day X 365 days/year = $99,280 year. This does not include the additional costs associated with the administration for shift scheduling, revenue collection efforts, benefits, and the costs of operating the booth, etc.

[2] Under both operating models, it is assumed that the revenues are based on the identical number of available spaces and rates charged.

This document was prepared by Inter*VISTAS* Consulting Inc.

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For further information regarding Inter*VISTAS* Consulting contact:

Tel: 604•717•1800
Fax: 604•717•1818
Website: www.intervistas.com
email: info@intervistas.com