APPENDIX A

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YLW
Kelowna International Airport

Kelowna International Airport Master Plan 2045 Volume 1: Report

Second Draft

2 September 2016

1-5533 Airport Way
Kelowna, BC V1VL5L
TEL 250-765-5125
FAX 250-317-0213
airport@kelowna.ca

ylw.kelowna.ca

Notice to Readers

The *Kelowna International Airport's Master Plan 2045 (Second Draft)* will serve as a framework to guide future development of the Airport and its related facilities in service to the community. Justification of any potential projects and programs contained herein will be subject to the established review and approval processes of the City of Kelowna and the Kelowna International Airport.

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1.0 Introduction

1.1 Background

The Kelowna International Airport (YLW) is a significant community asset for the City of Kelowna (the City), and the Okanagan Valley. With approximately 1.6 million passengers in 2015, a 17% increase since 2007, the airport continues to generate benefits for the City and region in terms of supporting business activities, increased tourism and air access for its residents. It also contributes significantly to the economy through direct and indirect employment, and enables expanded market access for the Okanagan's agrifood and wine industry.

The *Kelowna International Airport Master Plan 2045* is a critical airport planning document that will guide YLW's development to 2045. It describes the optimum development options and the facilities and systems needed to meet YLW's strategic objectives and forecasted levels of passenger and aircraft activity over the next thirty years.

The airport's vision statement ***"to be YLW the best mid-sized airport in North America"*** establishes the overall direction of the Master Plan. As a municipally owned and operated airport, this vision statement is closely aligned with the vision for the City of Kelowna itself and highlights YLW's important role in contributing to quality of life and the economy of the Okanagan Valley.

The approach adopted for this Master Plan focuses on updating analyses, recommendations and programming contained in the previous *Master Plan 2025* and other planning and development activities that have been completed since then, including the *Drive to 1.6 Million Passengers* and more recent *Flight to 2020* development programs. It also supplements previous plans and analyses with a fresh look at demand, operational, business and regulatory requirements that have changed since approval of the last Master Plan in 2007.

The Kelowna International Airport, under the direction of the Kelowna City Council and the Airport Advisory Committee, has worked with its industry recognized experts and consultants to outline a coherent and phased plan that will support future demands on the airport and its infrastructure.

A glossary of terms used in this document is provided in *Appendix A*.

1.2 YLW and Kelowna's Official Community Plan

The Official Community Plan (OCP) provides a policy framework for City Council by addressing issues such as housing, transportation, infrastructure, parks, economic development and the natural and social environment. It deals with issues expected to arise over a twenty-year period.

The current *Kelowna 2030 Official Community Plan: Greening Our Future* (Bylaw 10500) was adopted in 2011. It contains specific policies pertaining to sustainable development and compatible land uses surrounding the airport. These are detailed later in this Master Plan document in *Section 13 – Land Use Planning*.

The OCP is typically reviewed/refined approximately every five years to ensure that it continues to meet community needs. The City of Kelowna anticipates initiating the next update in 2017. YLW's *Master Plan 2045* will provide guidance to the aviation component and compatible land use planning of the upcoming OCP update.

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1.3 Planning for the Future

The City of Kelowna and YLW have invested considerably in the expansion and upgrades to airport facilities since completion of *Master Plan 2025*. The airport's overall development program will continue through validation and updating of projects in this Master Plan. Considerable foresight and innovative approaches to airport development are essential to ensuring the successful implementation of this Plan. They are also critical to ensure that capital investments are 'future ready' in terms of addressing upcoming changes in the community and trends that are expected within the aviation and airport industry. What YLW will look like in the future and how Kelowna and the Okanagan will grow as a business centre and tourist destination are important for this Master Plan. Creating an airport that minimizes Greenhouse Gases and maximizes a host of community benefits are equally important as they will provide the highest return on investment in the future. Key considerations for YLW's future and how airport facilities can play a role in addressing them are discussed below.

Airport Role

Regional Intermodal Hub Development

Airports around the world are expanding their reach as hubs of transportation activities through direct connectivity to other transportation networks, such as municipal transit and regional bus and train systems. The diversification of ground access options enables airports to reduce the number of single occupancy vehicle movements, to minimize demand for parking surfaces over the long-term period and to support realization of sustainability objectives.

Providing for and encouraging use of alternate transportation services to and from the airport is a cornerstone of YLW's Greenhouse Gas strategy. For YLW, increasing connectivity and modal choice between the airport, Kelowna and the Okanagan Valley as a whole will create a critical mass of people movements using alternate transportation options, which in turn will improve the efficiency and viability of transit and regional bus routes. YLW will work with regional transportation organizations to increase current service levels and plan for the establishment of dedicated transit facilities such as a dedicated transit/regional bus station and a future light rail corridor through the airport property.

Connectivity of these transportation services with the Air Terminal Building itself is equally important. Planning for associated ground transportation stations will need to consider accessibility, proximity and visibility of the station from main Terminal access points, as well as ease of access from main road networks to and from the airport site.

Local and Regional Tourism Partnership

Alignment of airport planning, development and business strategies must align with regional tourism to create synergies to support sustainable growth of the industry. The promotion at the airport of the broad offerings found throughout the Okanagan can create unique opportunities to promote tourism in the region. Kelowna and the Okanagan Valley are renowned as all season destinations, with high quality recreational, wine and agricultural products. Promotion of these offering within the Terminal represents important opportunities for partnerships with local industries. YLW's current 'Farm to Flight' program that offers fresh local produce for sale in carry-on sized packaging in the Departures Lounge, is a good example of this approach.

In addition, development of trail systems that connect the airport with the Okanagan Valley can encourage creation of 'Flight to Bike' programs, opportunities that truly represent the spirit of the

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Okanagan. The trail systems may not at first blush seem to have an obvious link to the airport, but it highlights the importance of how the airport can play an integrated role for innovation in the regions tourism industry.

YLW prides itself on being a positive tool for its community and the region. The ability to facilitate additional avenues of business success is important to YLW. The ability to support the Okanagan's founding industry is critically importance. YLW is focused on these new connections and opportunities as a partner to the business community. The Master Plan considers the facilities, infrastructure and strategies to support growth ideas like "Farm to Flight."

Air Terminal Building

Air Carrier Process Improvements

Introduction of check-in kiosks and online check-in options over the past few decades have greatly improved the efficiency of air carrier operations and have provided some enhancements to the overall airport passenger experience. Implementation of these technologies have also contributed to an increased efficiency of airport check-in areas, with more passengers being processed per square meter than what was previously achieved under traditional check-in operations.

On-line check-in options have also reduced reliance on airport check-in facilities, in particular for passengers travelling with carry-on baggage only. Based on available industry intelligence and surveys, approximately 25%-45% of passengers currently bypass the check-in area through use of on-line options depending on traffic segment (i.e., leisure/business, short/long-haul). This has relatively offset some of the growth in demand for check-in facilities in recent years.

The kiosk check-in process has recently incorporated bag tag printing, which has resulted in faster processing through a more streamlined self-bag drop process. The Government of Canada has recently announced changes in air carrier regulations that will permit the printing of bag tags at home during the on-line check-in process. This would involve insertion of a printed barcode into reusable pouch affixed to each bag. Although this process is currently offered in some European countries by a limited number of foreign carriers, Canadian carriers have not yet introduced this service in Canada. Wider-scale implementation of the home bag tagging options will contribute to further enhance the check-in process and to the additional streamlining of the self-bag drop process. This could include introduction of integrated self check-in and bag drop equipment in the near future, with a resulting reconfiguration of portions of existing check-in halls. The impacts on space utilization will depend on future bag-drop processes and the type of equipment introduced for these operations.

In addition, self-boarding gates are also influencing the departures process at an increasing number of international airports. The self-boarding gates involve scanning of boarding passes and travel documents at turnstile-type podiums prior to boarding bridge access. This process generally involves installation of multiple self-boarding turnstiles at each departure gate. The process generally provides improved air carrier boarding efficiency, and reduces ground staff requirements; but, inversely, expands the footprint of boarding podium areas.

YLW intends on implementing innovative solutions that are emerging in the airport industry for these processes to maximize the efficiency of future facilities and increase the quality of the passenger experience. The Terminal expansion program is being prepared with these advancements in mind.

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Efficient Airport Layouts

As air traffic grows, airports have traditionally expanded their Terminal footprints to accommodate increased flows and air carrier operations. While needed, expansion must consider ways to make more efficient use of existing and planned spaces to minimize environmental footprints, and operational and capital costs. Layout efficiency also provides opportunities to enhance levels of services and customer experience through reduction of walking distances and introduction of automated passenger processes described above that will create more streamlined departures flows. The planning for future Terminal expansion at YLW will prioritize these objectives.

The Future of Preboard Screening (PBS)

Passenger screening has become an increasingly critical component of airport operations and a defining element of the airport passenger experience. Preboard screening processes have increased significantly over the past few decades, in particular since the events of 9/11 in the U.S. The increased security measures that have been put in place since this period have resulted in more passenger screening procedures at Preboard Screening checkpoints, increased staffing requirements, greater demands on Air Terminal floor space and generally longer wait times for passengers. Consequently, long lines at Preboard screening checkpoints are often cited as a major irritant for airport passenger.

In Canada, the screening of passengers and bags is the responsibility of the Canadian Air Transport Security Authority (CATSA), under regulations established by Transport Canada. Working with other air transport screening agencies around the world, CATSA works to improve the overall speed of the Preboard Screening process to reduce wait times and improve staff utilization, while maintaining the highest level of security. New screening lane designs and equipment have been tested and introduced at various airports across the country, including YLW.

A more comprehensive review of checkpoint operations, layouts and processing equipment is also underway and will likely be introduced as CATSA+ facilities in Canada over the next few years. While these enhanced checkpoints will aim to improve operational effectiveness and enhance passenger experience, continued future air traffic growth, along with continuously shifting security threats, will require renewed approaches to passenger screening in the future. Ultimately, the goal will be to make the entire airport experience seamless. This could eventually mean technology improvements that enable flow-through screening areas with little or no interruption in passenger movements between terminal arrival and aircraft boarding. Airports will need to consider the potential for these enhancements to occur during the lifecycle of their planning and capital projects.

Until these initiatives are developed to ensure the highest level of security and the best customer experience, YLW will continue to work with CATSA to improve operational practices that consider the passenger characteristics of each airport (e.g., queue management, peak traffic characteristics, etc.) as well as minimizing impacts of internal operating practices that impact the speed of screening operations and queue lengths (e.g., the scheduling of training activities outside peak hours).

Retail/Food and Beverage Services Theming

As gateways to the communities they serve, airports provide the first and last impressions to travelers visiting for tourism, business or family reasons. Creating a high quality experience for airport visitors is important towards promoting YLW as an airport of choice in the region and encouraging return visits for tourists and business people. Sense of place and local themes are increasingly becoming commonplace in airport design and retail development. For YLW, the development of local themes, imagery and mythology into the retail and food and beverage offering

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is a critical element of the commercial strategy. This involves integration of design elements that evoke local natural elements such as mountain stone, greenery, and woodwork; and attraction of commonly-known local-based retail offerings such as local pubs, shops and restaurant outlets.

Theming requires updates over time, however, as markets shift and tastes change. YLW will need to build in flexibility in its retail and concession program to provide for future introduction of new in-demand regional and product sales, as renewal becomes needed.

Ground Access/Parking

Multiplication of Parking Products

Airports have increasingly been adopting a tiered approach to the supply of on-site parking products. This is resulting in a multiplication of airport parking lot products, each geared to specific user segments and fee structures. In addition to traditional Short- and Long-term parking lots, airports across North America and around the world have also been adding:

- *Valet services* for car drop off and retrieval along the Terminal Curb, including options for auto-detailing and minor servicing while the customer is away.
- *Premium lots* with direct or close-in terminal access, offering convenience to the frequent traveller at a higher daily/hourly rate.
- *Airport-operated on site remote parking* that can offer closer remote long-term parking than typically possible through private off-site operations and remote check-in and bag drop to expedite passenger transfer to the Terminal.

Adoption of this approach to the offering of airport parking products enables airport operators to ensure consistency of the branding and marketing of the overall services. It also provides opportunities for enhanced airport revenues through a more targeted approach to meeting diversified user requirements and expectations.

The segmentation of these products typically results in a slightly higher land take-up than would otherwise be required through traditional Short- and Long-term lots. For YLW, the allocation of parking surfaces needed to meet long-term demand will have to be flexible so that the airport can address future evolutions in the local and regional marketplace. This includes future increases in alternative modes of transportation, such as transit and regional bus use, and the positive impact these can have on a reduction in airport parking surface requirements.

Ridesharing Services

Ridesharing services have experienced significant growth around the world over the past five years. As an alternative to traditional taxi and limousine services, companies such as Uber, Lyft and TappCar have emerged as significant competitors to commercial hired driver companies and have been shifting the transportation landscape. While these services continue to face hurdles in terms of regulatory compliance and insurance capabilities, government authorities are slowly adopting more flexible regulations to address the popularity of the companies among local populations.

For airports, introduction of ridesharing services locally means that traditional taxi operations, typically involving a passenger pick up area preceded by a vehicle queuing area (i.e., taxi coral), may eventually require a rethink. Local taxi services may incorporate more on-demand based applications similar to those used by ridesharing services that may eventually reduce the need for vehicle queuing areas. This may also create needs for expanded dedicated vehicle pick-up and drop off areas on terminal curbs and increase traffic on the curb roadways themselves.

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The arrival of ridesharing services at YLW may contribute to enhancing the availability of ground transportation options to and from the airport, and enhance the overall passenger experience. This increased competition with traditional taxi and limousine services may also render the latter less viable at the airport. The taxi permit policies may need to be reviewed therefore to ensure revenues are captured from all commercial transportation services operating to and from the airport. As part of YLW's objectives to meet user expectations, enhance customer experience and expansion of businesses, it will need to adopt a flexible approach to the planning of ground transportation infrastructure and work towards achieving a balance between the potential for increased commercial ground transportation options, enabling the viability of services providers and the associated impacts these will have on demand for groundside infrastructure in the future.

Car Sharing Services

Car sharing services have emerged over the past few decades as alternatives to traditional car ownership in urban centres. Services such as Car Coop, Zipcar and Car-to-Go have been established in cities around the world. These services typically allow members to rent vehicles on an hourly basis from any city where the individual service provider is available. For airports, this means that car sharing services can provide alternatives to traditional taxi and ridesharing services, particularly for short business meeting trips from the airport or for those services that allow one way trips to other locations in the city.

To date, some car sharing services have established agreements with major car rental companies to offer hourly car rental services from major airports such as Toronto-Pearson, Vancouver and Ottawa, in Canada, and over 50 airports in the U.S. As service membership levels continue to grow, smaller airports will need to eventually provide for introduction of these services to meet customer expectations.

For YLW, this is not expected to significantly impact infrastructure demand since most of the car sharing services use car rental facilities or available surface lots. Designation of specific stalls may be required however.

Green Transportation

YLW is in a unique position in the community to advance and showcase emerging forms of sustainable transportation. Providing opportunities for and encouraging use of electric vehicles, cycling and transit are important components of the airport's transportation strategy.

Electric and hybrid vehicles are increasing in popularity around the world due to improved battery technologies and lower production costs, and the public's desire to reduce their carbon footprint. The proliferation of electric vehicles sales is an important consideration for the airport Master Plan. Studies have predicted that global electric vehicles (ev) sales will represent 35% of all vehicles sales by 2040. British Columbia, Quebec and Ontario currently lead sales of electric vehicles in Canada. The market growth of these vehicles will drive the need for related infrastructure. YLW will need to prepare for this reality.

Cycling is also gradually becoming a more popular transportation option to get to work and school, even in cold climates. Cyclo-tourism is destined to become a more popular tourism product in regions with a strong recreational offering such as the Okanagan Valley.

Supporting green transportation initiatives is important for minimizing Green House Gas emission and climate change impacts. For YLW, this involves rendering these modes of transportation more accessible and user friendly to and from the airport site. Long-term planning will integrate access to green corridors, secure and comfortable bicycle parking, transit linkages and the utility infrastructure need to provide vehicle charging stations in the various parking lots.

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1.4 YLW's Strategic Plan

The Strategic Plan is a critical part of YLW's planning process, influencing not only Master Plan direction but also marketing, human resource, business and capital planning decisions. The *YLW Strategic Plan*[1] covers a five-year period and was developed as an integral part of the *Master Plan 2045* process. It reflects the examination of the macro-economic environment, key aviation industry trends that impact the airport, a SWOT analysis of strengths, weaknesses, opportunities and threats, quality service assessment of current air services and a review of airport development opportunities. Based on the results of this assessment, along with input from stakeholders, provided through workshops and surveys, the key strategic direction for YLW is defined.

This section provides a brief overview of YLW's Vision and the Key Success Drivers that guide the development of *Master Plan 2045*. The full *YLW Strategic Plan* is provided in *Appendix B*.

Vision and Mission

The overall strategy is to develop the Kelowna International Airport as 'best in class' to meet its vision of "being the best mid-size airport in North America". This will be achieved by responding to the needs of the local community, serving the region's evolving transportation and business demands and optimizing the growth of a wide range of aeronautical and other non-aeronautical businesses at the airport.

Our Vision

> *We are the best mid-size airport in North America.*

This vision forms a target for the alignment of all other plans. The mission statement defines YLW's purpose and supports the achievement of the vision, while highlighting the role it plays as a hub in the interior of BC for the movement of goods and people.

Our Mission

> *Provide safe, secure, customer-friendly, affordable services and facilities that promote the Okanagan.*

Core Values

The foundation of the mission and vision is built upon specific core values. YLW's core values are intrinsic beliefs that all airport employees are expected to use, live by and demonstrate on a daily basis while executing their work responsibilities. These also influence how YLW works in the Okanagan community and how it approaches its plans for the future.

Our Core Values

> *Excellence in Safety, Security and Environmental Performance*

[1] *Kelowna International Airport Master Plan 2045, Strategic Development Plan*; SNC-Lavalin (November 2015).

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We ensure that the safety and security of our customers, staff, facilities and environment is a primary concern in all aspects of doing business.

Economic Development and Fiscally Responsible Ownership

We are committed to responsibly managing all of our assets in a fiscally responsible, commercially focused manner to advance the region's social well-being and economic prosperity.

Quality Customer Experience

We are motivated by customer expectations in providing quality facilities and services in a customer-sensitive and service-driven manner.

Integrity

We are accountable for all our actions, act honestly and respectfully in our business relations, usage of our resources, treatment of our customers and each other, and in the general conduct of our business.

Teamwork and People

People are our most important resource; we work together to foster an open and cooperative environment that encourages teamwork, communication and mutual respect.

Innovation

We champion innovation and entrepreneurship that drive efficiencies to create new value for our stakeholders.

Key Success Drivers

Key success drivers (KSDs) are the focus areas that help our team organize goals and objectives to achieve the short-term and long-term strategic direction of the airport.

Our Key Success Drivers

Operate and maintain safe and secure best in class facilities and services.

Foster economic development for the region.

Act in a financially responsible and sustainable manner considering both the short- and long-term consequences of our actions.

Exceed the customer service expectations of the travelling public in collaboration with airport partners and the community.

YLW subscribes to a culture and operating philosophy where its results are measured and applied against specific objectives that support the delivery of its mission and vision. YLW's success depends on these fundamental synergistic relationships. It is part of its corporate philosophy and the way it operates and conducts business.

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Strategic Development Objectives

A number of key business objectives are established by YLW to achieve its Vision and Mission. The objectives for developing the airport are as follows:

Objective 1: Develop Kelowna International Airport as the international gateway and multi-modal transport hub serving the Thompson Okanagan Region.

Objective 2: Ensure that the design of the airport reflects its role as a gateway to the Thompson Okanagan Tourism Region.

Objective 3: Maximize the economic growth of the Airport and the surrounding region.

Objective 4: Support a business environment that allows YLW and its associated businesses to reach their potential.

Objective 5: Develop non-aeronautical land to support future aeronautical infrastructure development.

1.5 Master Plan Guiding Principles

The following principles were developed to guide the planning process. The Master Plan aims to:

- Provide high quality airport facilities in a safe and cost effective manner;
- Support the municipality's sustainability objectives (social, economic & environmental);
- Develop the capability and flexibility to meet future changes in air transportation, technology and operations;
- Promote economic growth through aviation, aerospace and tourism development and other transportation related initiatives;
- Maintain low cost structure while meeting customer demand and satisfaction; and
- Provide a 'Made in Kelowna' solution to airport development and expansion requirements.

1.6 Master Plan 2045 Timeframe

Master Plan 2045 covers a thirty-year timeframe, extending from 2016 to 2045. It picks up where the previous *Master Plan 2025* left off in terms of planning timeframe and provides updated reviews of the long-term planning concepts contained in the previous plan.

This Master Plan is organized to describe three (3) planning timeframes within its overall framework based on typical forecasting periods:

- Short-term period, covering the year 2016 to 2025;
- Medium-term period, covering the year 2026 to 2035; and
- Long-term period, covering the years 2036 to 2045.

Consideration is also given to the period beyond the 2045 planning horizon to ensure that, where possible, proposals do not constrain foreseeable development requirements beyond the period covered by this Plan.

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2.0 The Consultation Process

2.1 Background

Of particular importance to the success of *Master Plan 2045* is strategic communication and engagement with Stakeholders and the public not only in Kelowna but in the Central Okanagan Regional District (RD). One key objective of YLW's *Master Plan 2045* was to **'encompass input from the communities and stakeholders served by YLW and ensure it is reflected in development.'**

To meet this objective, our team developed a *Master Plan 2045 Communication and Engagement Plan* containing a three-phased framework to strategically inform and engage Stakeholders and the public about the long-term growth and development of YLW, and more acutely understand the current and future interests and priorities of those served by YLW in the region. *The Communications and Engagement Plan* was developed in accordance with the City's *Engage Policy* in collaboration with City and YLW communications staff.

This framework identified emerging issues, opportunities and key recommendations that extend beyond *Master Plan 2045*, and that will support the airport's 5-year Strategic Plan, the City's OCP updates and other capital, planning and infrastructure initiatives in Kelowna and the RD. Stakeholder outreach included input from Government agencies, Regional Districts, business and community partners, Chambers of Commerce, the University of British Columbia Okanagan (UBCO) and other key organizations where the overlap of capital, community and master planning exists.

In summary, from March 2015 through September 2016, our *Master Plan 2045* communication and engagement program included:

- Over 25 Stakeholder meetings, presentations and workshops were held and two open houses were hosted;
- Print and electronic advertising and materials, including newspaper and social media ads/posts, display boards, surveys, postcard and presentations;
- Over 300 feedback forms submitted;
  - 103 submitted online; and
- Advertising and posts on YLW's Website, Facebook, Twitter and Instagram.

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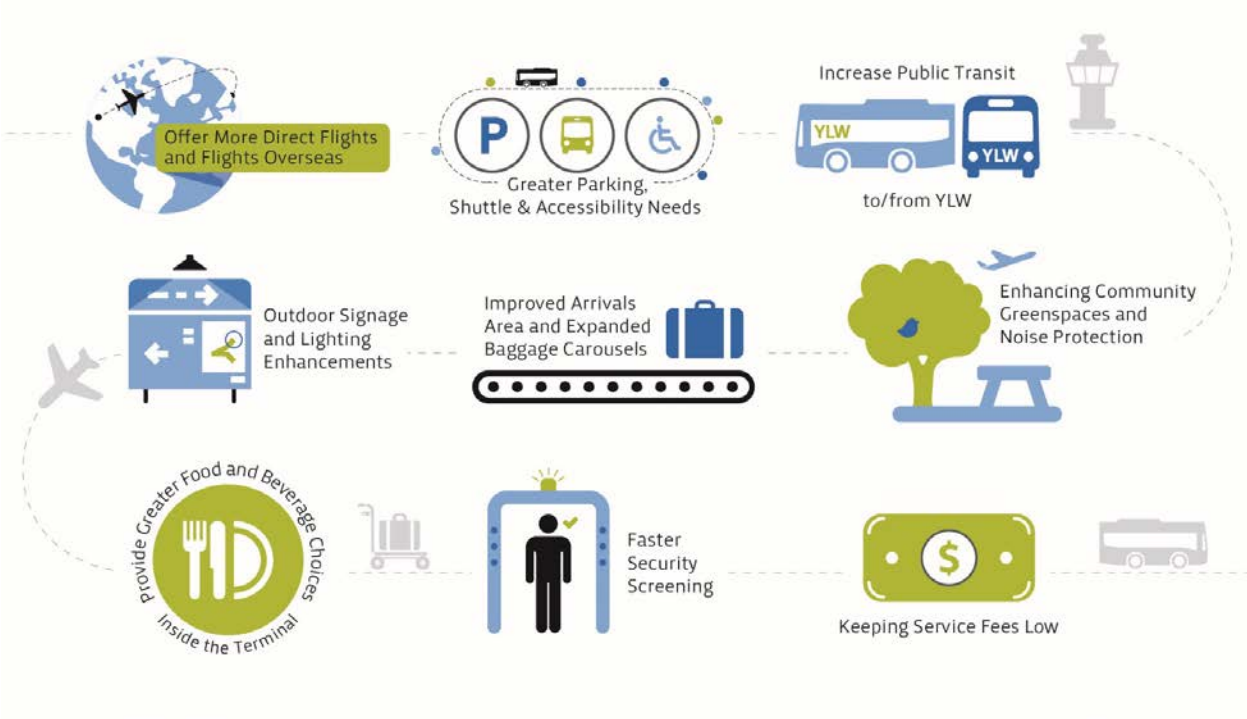
2.2 What We Heard: The Top Priorities

Figure 1 (below) is a summary of the top priorities the public recorded on their surveys at meetings and open houses (print survey responses), and online (electronic survey responses).

Figure 1: Consultation Results - Top Priorities



Along with their recommendations about what's important to sustain and/or improve, the public expressed their satisfaction with the services that YLW offers.

Services out of the control of YLW, such as security screening (CATSA) and flight offerings (Airlines), will be discussed and tracked with each agency so YLW can provide updates about improvements to tenant services.

Detail of the consultation results are provided in *Appendix C: Master Plan 2045 Consultation Summary Report.*

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3.0 Airport Background

3.1 History

An important context for *Master Plan 2045* is to understand the dynamics that have shaped development of the airport throughout its 70-year history.

YLW's official history began in 1946, when Kelowna residents voted 466 to 460 in favour of purchasing the 320-acre Dickson Ranch in Ellison for $20,000. In 1947, the grand opening of 'Ellison Field' showcased a small terminal building, a 3,000-foot-long grass airstrip, and a variety of small aircraft.

During the '50s, increasing demand for better service prompted the federal Department of Transport to help gravel the airstrip and pave the parking lot and aircraft parking apron. In 1958, Canadian Pacific Airlines introduced daily, scheduled DC-3 service to Vancouver, which enabled the City to initiate negotiations with the federal government for a longer, paved airstrip.

After buying the land needed for expansion, the City extended and paved the runway to 5,350 feet and expanded the taxiway and apron in 1960. Then Mayor Dick Parkinson, an avid supporter of aviation and its economic benefits to the Okanagan, spearheaded the $312,000 upgrade.

Increasing aircraft and passenger movements during the early 1960s prompted local leaders to seek community support and funding for construction of a new Air Terminal Building (ATB) at the south end of the runway. The original air traffic control tower was built on the flat deck of a truck.

The early 1970s marked the introduction of an air traffic control tower and an on-site weather office. In 1975, a Track Guidance Localizer was installed to reduce poor weather operating limits and improve flight reliability.

During the 1980s and early 1990s, more than $10 million was invested in upgrading the terminal building, runway, and airline operating facilities. Increasing passenger and cargo volumes spawned growth in the airport's commercial sector. New businesses located on airport property, which in turn helped establish Kelowna as a serious contender in the aviation industry.

By 1997, annual passenger volumes had risen to more than 800,000, making it one of the fastest-growing airports in North America. To prepare for anticipated volumes, the City of Kelowna embarked on a $20 million expansion program in 1998. The ATB was doubled in size to 76,000 square feet, parking was increased to more than 1,200 paved stalls, and airside facilities were expanded to accommodate additional aircraft. From 150 to 450 passengers per hour, these upgrades tripled the number of passengers the airport could service.

At the same time, work began on evaluating the capability of the airport to improve reliability of services. This led to the installation of NAV CANADA's Instrument Landing System (ILS) in February 2003 that significantly improved the reliability of service during conditions of reduced visibility and low cloud ceilings. Subsequent growth of air services have greatly benefited from the landing approach, particularly during the months of January and February.

Since completion of the last Master Plan in 2007, passenger traffic at YLW has increased by approximately 17% (over 250,000 annual passengers) to approximately 1.6 million annual enplaned and deplaned passengers in 2015.

In 2010, YLW embarked on a $92 million capital investment program. To date several key projects have been completed under this program, including:

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- Extension of the runway surface to 2,712 m (8,900 ft);
- Expansion of the main aircraft apron to the north, adding two additional aircraft gates;
- Construction of a new Preboard Screening area and expansion to the existing Departures Lounge at the southern end of the Air Terminal Building;
- Construction of a new Customs and Immigration facility at the north end of the ATB;
- Expansion of the long-term vehicle parking lot;
- Reconfiguration and expansion of the terminal curb to provide additional capacity and improve the operational efficiency of buses and shuttle services
- Construction of a new Glycol and Acetate Storage Facility;
- Renovations to Departures Lounge retail area; and
- Construction of initial phase of the multi-year Outbound Baggage Hall Expansion project which, after completion in late 2017, will provide a new baggage system, airline offices and check-in areas.

In 2016, the City acquired the Shadow Ridge Golf Course property in support of the long-term strategy for the airport. The golf course will continue to operate until required to accommodate airport expansion in the future.

The recent agreement to transfer ownership of the adjacent CN Rail corridor to the municipalities in the Okanagan Valley will also provide opportunities for cycling and other recreational linkages to and from the airport to the benefit of the community and visitors alike.

3.2 Location and Geography

Kelowna is situated in the interior of southern British Columbia in the Okanagan Valley as shown in Figure 2. The province shares its southern border with the states of Washington, Idaho and Montana. It is surrounded to the east and west by Alberta and the Pacific Ocean, respectively. Within the city, the Kelowna International Airport is located approximately 15 kilometers north and east of downtown Kelowna, as demonstrated in Figure 3.

Figure 2: Kelowna and Surrounding Region

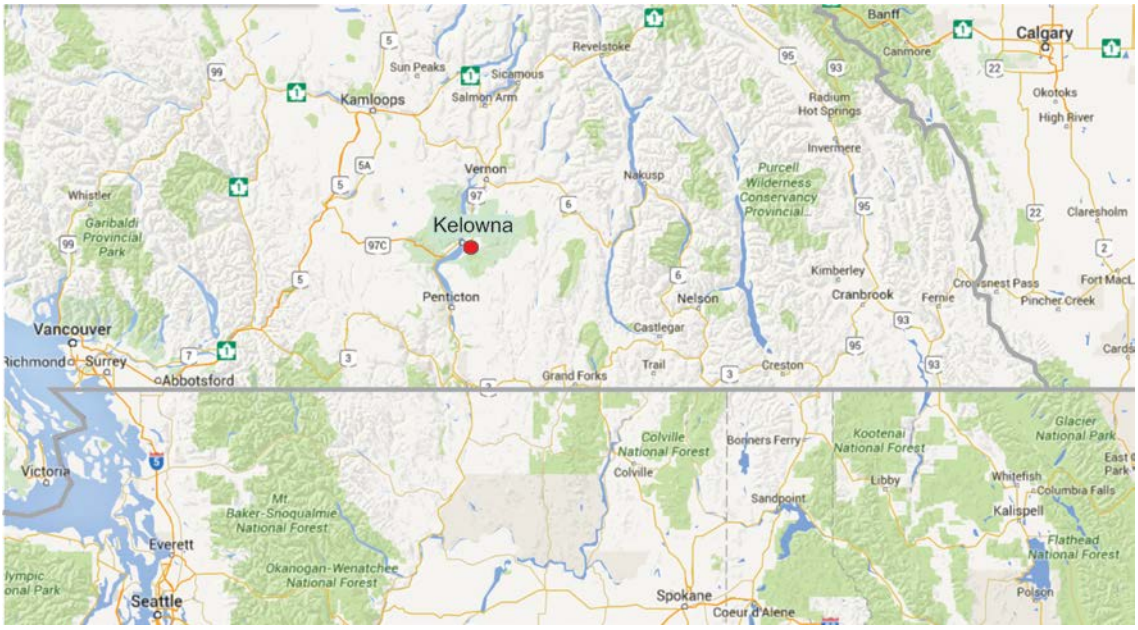

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Figure 3: Kelowna International Airport and City of Kelowna

The airport occupies a total surface area of 269 hectares and lies at an elevation of 433 m (1,421 ft) above sea level in a valley surrounded by mountains. Mountain peaks as high as 758 m (2,488 ft) are situated within a 3 nautical miles (nm) (6 km) radius of the airport. [2]

Lands in the vicinity of the airport are predominantly agricultural and wooded with built-up areas nearby, including Ellison and the University of British Columbia, Okanagan Campus, located south of the airport, Quail Ridge to the west and Winfield to the north.

Relevant water bodies include Ellison Lake located 2 km north of the airport and Mill Creek, which traverses airport lands from the north to the south of airport lands. Scotty Creek flows westward south of the airport.

Major roadways include Highway 97 to the west, Old Vernon Road to the north and east and Bulman Road to the south.

3.3 Current Layout

YLW's current layout is shown in Figure 4 (following page). The airport layout is structured around the airport's one runway – Runway 16-34. Most development is situated to the west of the runway. The Air Terminal Building (ATB) complex comprised the Terminal itself, main aircraft apron (Apron I), and associated public parking lots. Airport Way, extending from an intersection with Highway 97 to the south west and Old Vernon Road to the north, constitutes the main access route through the western side of the airport site.

[2] Canada Air Pilot – Night Circuit Procedures – Kelowna.

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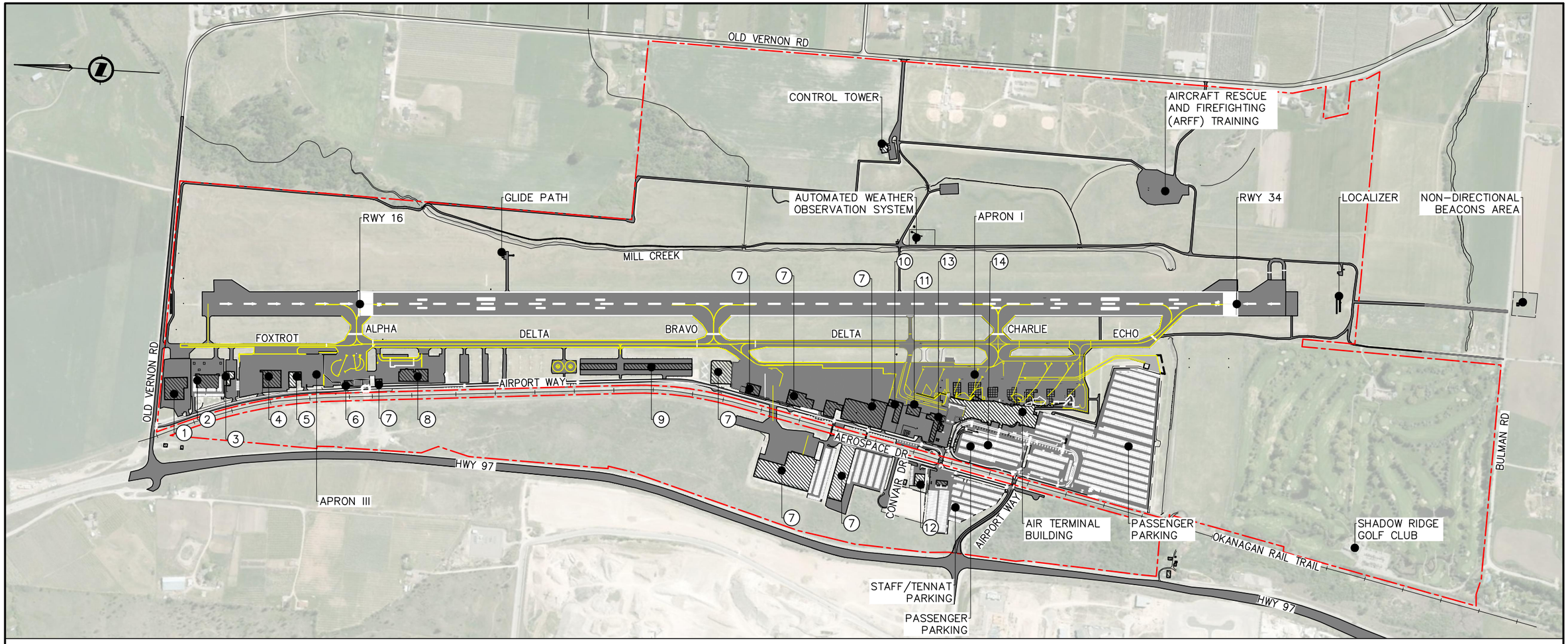

LEGEND

- PAVEMENTS
- BUILDING STRUCTURE
- AIRPORT BOUNDARY

LEGEND

1 CARSON HANGAR 4 & SOUTHERN INTERIOR FLIGHT CENTRE
2 SKYLINE
3 GREAT SLAVE
4 CARSON AIR/SHELL AEROCENTRE
5 CARSON AIR & FEDEX
6 KELOWNA FLYING CLUB
7 KF AERO
8 CARSON AIR HANGAR 3
9 KELOWNA T-HANGARS
10 CARGO ONE
11 YLW HEAVY EQUIP. STORAGE BUILDING
12 OKANAGAN AERO ENGINE
13 YLW COMBINED OPERATIONS BUILDING
14 CAR RENTAL SERVICE CENTRE

SCALE 1:10 000
@11x17
0 200 500m

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
2	PB	2016-09-02	ISSUED FOR INFORMATION
1	PA	2016-03-14	ISSUED FOR INFORMATION

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

REVISION REGISTER * DESIGNED ** APPROVED

PROFESSIONAL SEAL

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Airports & Aviation Group
500-745 Thurlow Street, Vancouver British Columbia, Canada. V6E 1V8
Tel: 604-662-3555

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YLW Kelowna International Airport

DESIGNED
DRAWN
CHECKED
APPROVED
DATE 2016-03-14
SCALE 1:10 000

PROJECT
YLW MASTER PLAN

TITLE
FIGURE 4
CURRENT AIRPORT LAYOUT (2016)

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 DK	0001	PB

The airport's maintenance facilities and Fire Hall are situated immediately north of the ATB. Existing commercial development is situated on leased lots located further north between the runway and Highway 97.

The Nav Canada Air Traffic Control Tower is situated near approximately midway along the length of the runway on land located on the eastside of the airport property. The remainder of the land to the east of the runway is undeveloped.

3.4 Obstacles

Airport zoning regulations for Kelowna International Airport are enacted by the Government of Canada as the *Kelowna Airport Zoning Regulations* (see http://laws-lois.justice.gc.ca/eng/regulations/C.R.C., c. 89/). These regulations apply to all the lands, lands under water including public road allowances, adjacent to or in the vicinity of the airport. The extent of these lands is described in Part II of the Transport Canada Zoning Regulations and comprises the YLW Obstacle Limitation Surface Area.

Man-made objects (buildings, communications towers, power lines) and natural features (trees) within this area are not permitted to exceed in height the relevant overlying Obstacle Limitation Surface. These comprise the take-off/approach surfaces, the outer surface and the transitional surfaces. These serve the function of maintaining obstacle free airspace in the vicinity of the airport to protect aircraft operations. They are also used in defining the height of manmade and natural objects in the vicinity of an airport that are not compatible with aircraft activity.

YLW's Airport Operations Manual (AOM) identifies the following differences between the zoning surface dimensions protected in the regulations, and the Obstacle Limitation Surfaces for which the airport is currently zoned:

- Runway 16-34 is currently certified as a 4D non-instrument runway, but maintains obstacle limitation surfaces to 3C non-precision standards. It is protected in the zoning regulations to approximately Code 3 non-precision standards. The zoned runway strip length is 2,560 m (8,400 ft), whereas the certified runway strip length is 2,347 m (7,700 ft).
- The Runway 34 zoned strip length protects for a further 213 m (700 ft) runway extension on Runway 34 while maintaining the required 60 m (200 ft) distance from threshold to commencement of approach surface.
- The AOM makes a note of significant obstacles in the vicinity of the airport. Obstacles are also noted in the airport's ICAO Type A Obstacle Chart and Flightway Obstruction Charts in *Appendix D*, and listed in Figure 5.

Figure 5: Obstacles

Runway	Obstacle[1]
16	Obstacle #4 – Mobile Obstruction
16	Obstacle #8 – Trees on hill
16	Obstacle #9 – Transmission Tower
34	Obstacle #27 – Utility Pole

(1) Obstacle identification numbers as given in the Flightway Obstruction Charts.

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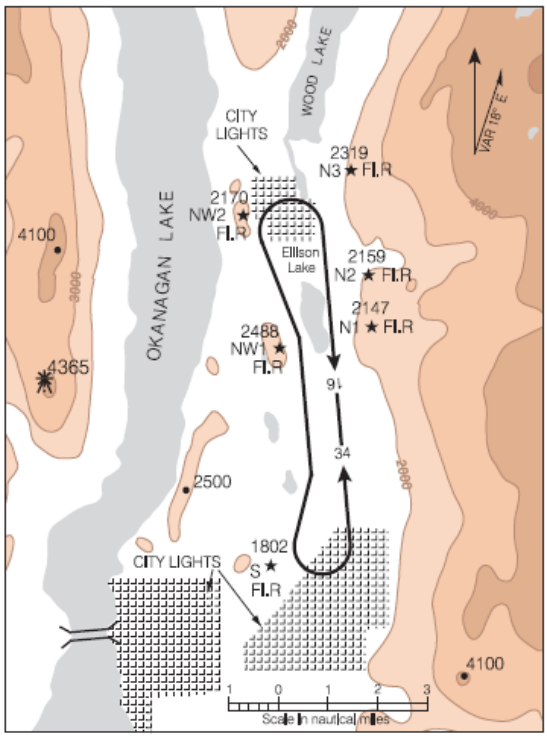
The Canada Air Pilot also publishes night circuit procedures due to the mountainous terrain (Figure 6, following page). Pilots are advised not to use the airport during the hours of darkness unless familiar with the local area. Night operations are not recommended unless all six hazard beacons are operating and all turns are to be completed within the perimeter of the hazard beacons.

Figure 6: Night Circuit Procedures



Source: Canada Air Pilot – Night Circuit Procedures – Kelowna.
*Night Circuit Altitude shown – 3,000 ft Above Sea Level (ASL).

3.5 Meteorology

The airport is equipped with an Automatic Weather Observing System (AWOS) that occupies approximately 2,600 m^2 of land located on the east side of the runway between the control tower and the runway (see Figure 4, page 15).

According to climate records for the airport published for the 1981 to 2010 period by Environment Canada, average daily maximum temperature peaks at 27.9^{o}C in the month of July. Winds prevail from the north for most of the year, but the strongest gusts tend to have a southern component.

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4.0 Environment

City of Kelowna is committed to operating YLW sustainably by taking into consideration its economic, social and environmental responsibilities with every business decision. Excellence in environmental performance is one of YLW's core values; an element of how YLW views its fundamental partnership with the community and how it approaches operational and development decisions.

4.1 Sustainability Objectives

As specified in the City's OCP 2030, "*to be sustainable, infrastructure must be efficient and durable, while creating minimal impacts on the environment*". This means that the City will explore infrastructure plans from both a life cycle analysis (i.e., the long-term costs and benefits of a project) and from a multiple bottom line approach (i.e., considering how infrastructure projects can meet as many sustainability objectives as possible). YLW and its future development are a clear part of the City's sustainable infrastructure strategy. *Master Plan 2045* aims to adhere to OCP sustainability objectives as they apply to an airport site in terms of the planning process, development and operational practices.

Key sustainability objectives that are primary considerations in this Plan include:

Objective 7.1	*Apply sustainable decision-making approaches in infrastructure planning and procurement.*
Objective 7.2	*Design infrastructure to deliver maximum benefit.*
Objective 7.3	*Invest infrastructure funds to deliver on community goals.*
Objective 7.6	*Place increased emphasis on sustainable modes of transportation (walking, cycling, transit) while maintaining automobile, commercial goods and emergency vehicle mobility.*
Objective 7.9	*Ensure efficient and effective transit infrastructure and facilities.*
Objective 7.13	*Provide a city-wide linear park and trail network.*
Objective 7.19	*Ensure efficient, sustainable and context sensitive implementation of utilities.*
Objective 7.23	*Manage storm water and run-off to reduce risk of flooding and erosion.*

4.2 Environmental Management Policy

To reflect YLW's commitment to the protection of the environment, YLW's Environment Policy Statement is as follows.

> *YLW management and staff will apply an effective environmental management system to all activities we directly control or have influence over. We all have the responsibility to work in a manner to ensure the protection of the environment.*

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As such our collective commitment is to:

- *Comply with applicable legislative and regulatory requirements and designated industry standards;*
- *Continuously promote a culture across all our activities that recognizes the importance of protecting the environment and the value of effective environmental management;*
- *Ensure all airport staff and tenants are aware of their accountability and responsibility in the execution of, and participation in, the environmental management process;*
- *Proactively manage environmental risks in an effort to reduce and prevent pollution;*
- *Provide all of our staff with adequate and appropriate environmental information & training, to ensure they are competent in the performance of their duties;*
- *Measure our environmental performance against objectives and targets on a regular basis, and take preventive and corrective actions when appropriate;*
- *Strive to continually improve our environmental performance;*
- *Be prepared and accountable for managing environmental incidents; and*
- *Communicate and promote YLW's environmental performance.*

4.3 Environmental Management Plan

The *Kelowna International Airport Environmental Management Plan* (EMP)[3] is a component of an overall Environmental Management System (EMS) and demonstrates that environmental protection and due diligence will continue to be an integral part of the YLW management philosophy.

The objective of YLW's EMP is to:

- Provide an overview of key environmental aspects (i.e., risks, impacts, sensitive habitats);
- Determine how the airport will manage environmental risks and impacts through all phases of airport operations, activities, and projects; and
- Verify that all activities at the airport are proactively managed in consideration of the safety of airport Reference Safety Management System.

Current Situation and Practices

The airport is governed by numerous federal and provincial legislation and city bylaws. The OCP specifically identifies an objective of 'no net loss' of aquatic and terrestrial habitat without sufficient compensation. This is a critical factor that drives YLW's development planning as it pertains to environmentally sensitive areas.

Current environmental conditions at the airport were reviewed as part of the assessments completed for the EMP. The following provides an overview of the assessment.

Wildlife Management

Wildlife on airport properties can pose a risk to aviation activities due to potential aircraft bird strikes or wildlife incursion on aircraft movement areas. A key YLW objective is to limit the attractiveness of the area for wildlife for safety purposes. It is important to note that this objective conflicts with current OCP policy and City bylaws/regulations pertaining wildlife protection and habitat enhancement. The safety and security of aircraft operations is YLW's top priority as such it is

[3] Tetra Tech (2014).

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recommended that the upcoming revision to the OCP provide considerations for these airport-specific operational requirements. YLW is committed to work through issues that arise be treated on a case by case basis to ensure a compromised approach is achieved.

YLW has a standalone Wildlife Management Plan that identifies the processes and procedures required for wildlife management in accordance with Transport Canada regulations.

Measures in the Wildlife Management Plan aim to make the airport unattractive to wildlife by:

- Improving the drainage system and removing low lying and swampy areas;
- Keeping grass around aircraft manoeuvring and movement areas at a length to attract the smallest number of birds; and
- Application of rodenticides to reduce prey species for predators;
- Monitoring of the perimeter fence for wildlife burrows; and
- Use of scaring techniques to scatter wildlife that may gather on or near the airport property.

It is important to note that all pesticides and rodenticides are applied in accordance with regulations by a licensed applicator and products are applied in a manner to ensure protection against contaminating water systems and non-targeted species.

Water Quality

Toxic substances from industrial, agricultural, and domestic use are some of the main pollutants in found in water in Canada. A variety of activities at airports can contribute to storm water pollution. These activities include, but are not limited to, fuelling, de-icing/anti-icing, construction, maintenance, and tenant activities. A large in-ground oil/water separator is located immediately adjacent to Apron 1. The separator ensures oil and fuel are separated from the water prior to discharging to the storm drainage system.

Although potable water is provided by the City, YLW manages a storm water runoff monitoring program which is designed to ensure that storm water discharged from the airport does not contribute to the degradation of downstream water sources. Water is sampled using a 24-hour automated water station.

Air Quality

YLW is a contributor to regional Greenhouse Gas emissions. At the airport, direct sources include aircraft emissions during landing and take-off, aircraft fuelling, and building emissions (i.e., heating, ventilation, air conditioning operations). Indirect air emission sources are primarily restricted to motor vehicles transporting passengers and freight to and from the airport and vehicles used in support of airport and aircraft operations.

YLW is an active participant in the City of Kelowna Energy Management Committee, which aims to encourage energy conservation. YLW also targets the Leadership in Energy and Environmental Design (LEED) principles in all new building design and existing renovation projects. The Kelowna International Airport ATB Expansion Energy Audit/Energy Model and Sustainability Analysis prepared by Dialog to support the terminal expansion program was recognized with an Award of Excellence in 2011 from the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) in the category of Concept and Assessment. The design proposal evaluated by the in the model concluded that the expanded ATB to produce 60% less CO2 emissions over the existing building even though it will double in size.

The City of Kelowna also works with senior governments, local residents and businesses, non-government organizations (NGOs), external agencies, and utility providers to work towards reducing community GHG emissions by 33% by 2020. Although City efforts focus on residential

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initiatives and ground transportation strategies, it strives to meet the BC Climate Action Charter targets for the reduction of GHG emissions from municipal infrastructure.

Glycol Management

Airlines are required to remove frost and/or ice from aircraft critical surfaces to ensure the safe operation of aircraft. The most commonly used method of de-icing and anti-icing aircraft is the use of glycol, which is heated before being applied to the aircraft. The heat from the fluid serves to melt the ice and snow, while the glycol prevents the formation of ice on the aircraft. The introduction of glycol into surface waters can create damage to the ecosystems through depletion of oxygen in the water.

Glycol is normally used at YLW between October and April. The glycol is sprayed on aircraft at the operational stands on Aprons I or on leasehold property. Residue that ends up on the pavement eventually runs off the apron into drainage ditches

Aircraft operators must ensure that glycol is not released into the environment at unacceptable levels. Avoiding unacceptable levels of runoff into Mill Creek is of particular importance. Through YLW's storm water monitoring program, samples are taken to monitor glycol levels during those months when glycol is applied. A glycol blending unit was acquired by airport tenants in 2013, which allows for the blend of glycol/water concentrations to meet weather conditions and results in less glycol being used.

It is recommended that YLW develop a glycol collection system that would allow water that is contaminated with glycol to be intercepted and discharged to a waste water treatment system prior to being discharged into downstream receiving waters. The existing storage facilities and the proposed collection system are outlined later in this Master Plan document in *Section 10 – Operations and Support.*

4.4 Environmental Management System

An Environmental Management System (EMS) is a process for developing environmental policies that include a commitment to both compliance with environmental laws and pollution prevention. YLW intends on providing leadership in this area and is currently developing its own EMS.

An independent environmental Compliance Audit of YLW and select tenants was completed by Tetra Tech EBA Inc. in 2014[4]. The audit reports identify actions that are serving the development of EMS and to improve regulatory compliance at individual airport facilities.

YLW initiated the development of its EMS in 2015, with full implementation in 2017. It will be the overarching system for managing all environmental issues.

[4] *Environmental Management Plan*; Tetra Tech EBA Inc. (2014)

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4.5 Mill Creek

Current Situation

Mill Creek is one of the primary water courses that run through the airport property. Its watershed is part of a larger drainage system in the Kelowna area. It enters the property in its north end, approximately 300 m southeast of the Runway 16 threshold, and then parallels Runway 16-34 on the east side, before crossing the runway approximately 200 m from the Runway 34 threshold. It then flows directly west before turning south, following Highway 97 towards the City of Kelowna. It exits the property at the south west corner of the Shadow Ridge Golf Course, and ultimately discharges to Okanagan Lake to the west.

The Creek contains a number of indigenous fish species. Those that are known to be present in the creek include rainbow trout, kokanee, brook trout, burbot, largescale sucker, northern pikeminnow, peamouth chub, prickly sculpin, redside shiner, and carp. There are no records of fish being present in Whelan Creek or Scotty Creek.

Woody vegetation along the creek banks is scarce and is composed primarily of Cottonwood, willows (*Salix spp*), prickly rose (*Rosa acicularis*), Common Snowberry, and Orchard Grass. Water levels fluctuate greatly during the year. Vegetation growing throughout the streambed, suggests that extended dry periods are not uncommon.

The creek's channel through the airport has been extensively modified over the years to minimize the risk of bank erosion and flooding on the runway and improve airport safety. Vegetation along the creek is controlled to reduce its attractiveness to birds and other wildlife for aviation safety reasons. The City of Kelowna dredges accumulated sediments to reduce the incidence and severity of flooding by reinstating channel capacity within the airport property.

Water levels fluctuate during the year. There is water retention in the Creek from late fall to spring, with occasional flooding during the latter period. During the summer, however, the creek can experience extended dry periods. The section of channel through the airport is occasionally dry, even when there is flow immediately upstream and downstream. In general, therefore, fish habitat in Mill Creek through most of the airport property is of poor quality. Higher value habitat generally exists upstream of the channelized section and downstream of the existing right-angle turn in the channel adjacent to the ATB parking lot.

Environmental Management and Mitigation

The Creek has been the subject of considerable study over the years to identify measures to protect the natural habitat along its entire course, mitigate impacts associated with existing or future development along its banks, and identify flood management strategies for the entire watershed (including land situated outside YLW boundaries).

The City of Kelowna has established a Riparian Management Area (RMA) for the Creek. Defined in the Official Community Plan, the RMA consists of a non-development buffer zone extending 30 m on each side of the upper edge of the bank. This constitutes a major consideration for the location of future airport infrastructure expansion and development proposals.

The City has also implemented a Floodplain Bylaw to protect the Mill Creek floodplain area by establishing Flood Construction Levels (FCL). A FCL is the elevation of the lowest habitable floor of a building under construction. The FCL sets the minimum level whereby protection of a property may be reasonably assured in the event of a major flood event. All of the airport property is within the floodplain protection area.

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The airport has developed ongoing management strategies for Mill Creek (i.e., bank armouring to prevent sedimentation) and a regular water sampling program for storm waters prior to entering Mill Creek to identify potential contaminants in the waters.

Since completion of *Master Plan 2025*, YLW has also completed a number of studies to assess the feasibility of realigning or relocation the Mill Creek corridor to mitigate potential environmental impacts of increased development on the airport site. Options that were assessed included:

- Diversion of the around the entire runway, taxiway and Terminal apron system;
- Partial diversion to the east of the runway, and installation of culverts under existing and proposed taxiways to reach the creek's current western end on the property;
- Preservation of the Creeks main channel, and installation of culverts under existing and proposed taxiways to reach the creek's current western end on the property; and
- Preservation of the existing creek alignment.

Where portions of the existing Creek were retained in the options, future expansion of airfield pavements would require positioning to respect RMA areas. Analyses concluded that the cost benefits associated with relocation of the Creek's existing channels would not be favorable. It is recommended therefore that the existing channel be retained and that future airside projects situated east of the runway be situated beyond allowable distances from the Creek. Channels situated in proximity to future Terminal apron expansion areas will be further reviewed during later design and engineering processes that will result from expansion proposals contained in this Master Plan document.

Mill Creek's environmental protection strategy requires however a more holistic approach to the management of its water flows, flood plain and adjacent habitats given its inclusion in the Okanagan Valley's broader hydrologic basin and the effects other regional sources have on its watershed. As such, it is recommended that management and control strategies be coordinated regionally, including cost sharing of mitigation initiatives as necessary.

4.6 Noise Exposure

Noise Exposure Forecasts (NEF)

The Noise Exposure Forecast (NEF) is the generally accepted and recognized industry standard for aircraft noise measurement at Canadian airports. NEFs produce noise contours that are typically used to encourage compatible land use planning in the vicinity of airports in Canada through Transport Canada guidelines[5].

The NEF is not a direct measurement of noise generated by single aircraft operations, such as decibel-based acoustical measurements. Instead, it is based on a compendium of factors including traffic volumes, frequency, aircraft type and mix, and time of day operations. It represents a weighted average of continuous exposure to aircraft noise in the vicinity of airport runways, approach and departure paths. Of particular note in the production of a NEF is the increased weight of nighttime operations – weighted seven times higher than similar daytime operations to account for the higher degree of perceived disturbance of nighttime noise events.

[5] *Land Use in the Vicinity of Airports, TP1247*; Transport Canada (2005).

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Community response to aircraft noise will typically vary according the level of exposure within an individual noise contour area. Figure 7 provides an overview of typical community response to aircraft noise exposure based on location within different NEF contour areas.

Figure 7: Community Response Prediction within Noise Exposure Forecast Areas

Response Area	Response Prediction
1 (over 40 NEF)	Repeated and vigorous individual complaints are likely. Concerted group and legal action might be expected.
2 (35-40 NEF)	Individual complaints may be vigorous. Possible group action and appeals to authorities.
3 (30-35 NEF)	Sporadic to repeated individual complaints. Group action is possible.
4 (below 30 NEF)	Sporadic complaints may occur. Noise may interfere occasionally with certain activities of the resident.

Source: *Land Use in the Vicinity of Airports*, TP1247; Transport Canada, 2014.

Transport Canada's *Land Use in the Vicinity of Airports* guidelines recommend compatible land uses within various NEF contour zones. In particular, Transport Canada recommends no new residential construction in areas situated within NEF 30 or higher at existing airports.

YLW's Noise Exposure Forecasts

NEF Contours were prepared for *Master Plan 2045* to examine current (2015) traffic conditions, as well as those forecast to occur towards the end of the planning period, based on updated traffic forecasts. The contours were prepared by Urban Aerodynamics, and lead by the original developer of the NEF model for Transport Canada.

Figure 8 (following page) depicts the 2015 NEF contours, based on current traffic levels. For comparison purposes, the 2005 NEF contours presented in *Master Plan 2025* are shown in Figure 9 (following page). When compared against the 2005 noise exposure, the 2015 contours are generally narrower than those previously developed which is reflective of the trend of quieter aircraft operating at YLW. The contours extend further north and south of the runway, generally as a result of an increase in the number of aircraft and changes to approach and departure paths that have occurred since 2005.

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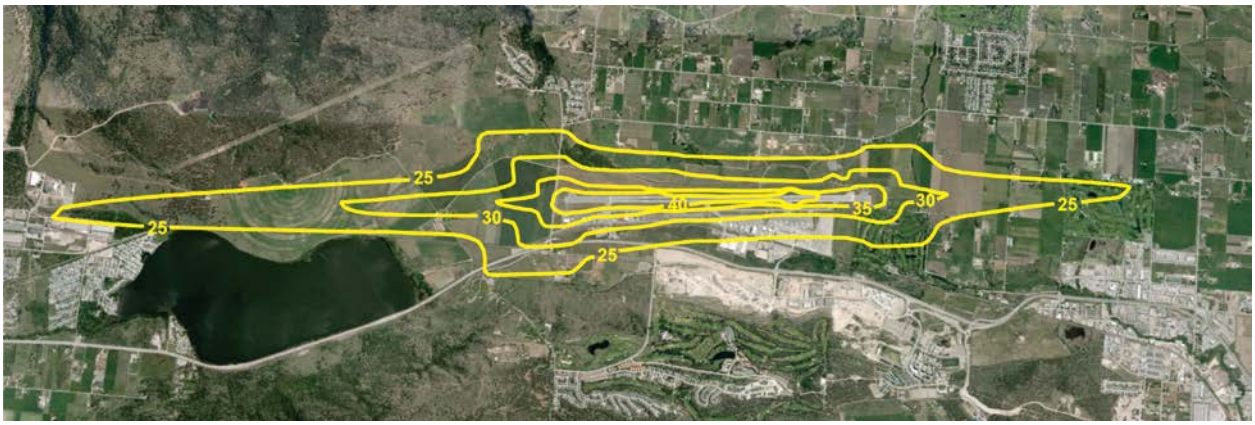
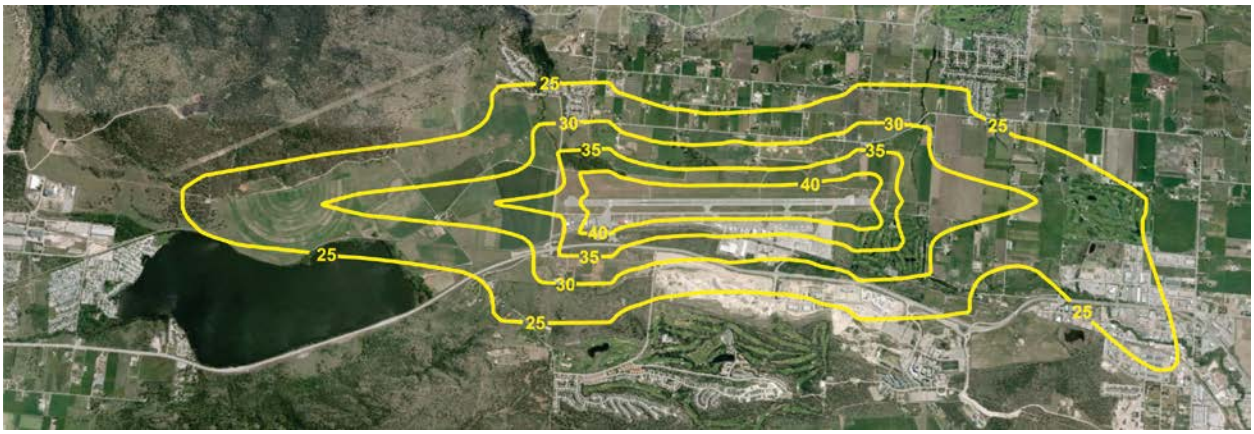
Figure 8: 2015 (Current) Noise Exposure Contours



Source: Urban Aerodynamics, 2015.

Figure 9: 2005 Noise Exposure Contours



Source: InterVISTAS Consulting, 2005.

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5.0 Air Traffic Forecasts

5.1 Background

Aviation traffic forecasts are the cornerstone of the airport master planning process. Credible forecasts define the demand for infrastructure by sector and the likely capacity requirements that will need to be met – airside, groundside and everywhere in between. They help define the trigger conditions for infrastructure investment in a way that is measurable by airport management, who must make investment decisions, and those that finance those capital investments. They also form the basis of revenue projections, both aeronautical and non-aeronautical, which in turn help define the debt that will be incurred in any CapEx activity.

Air traffic forecasts were prepared for *Master Plan 2045* through data analysis and consultation with key stakeholders. These include:

- Annual forecasts of passengers and aircraft movements in aggregate and by sector and segment for 2016 to 2045;
- Forecasts of peak planning day/hour passengers by direction and sector, aircraft movements by segment and future flight schedules;
- Aircraft gate and stand requirements by ICAO code and sector; and
- Air cargo forecasts.

The forecasts are used to support the technical analyses undertaken for this Master Plan. They are based on information made available to the Master Plan team between Spring 2015 and Spring 2016; and reflect industry conditions in effect during this time. Actual traffic values through to May 2016 are also incorporated.

The forecasts are detailed in the *Appendix E: Kelowna International Airport Master Plan Technical Report – Air Traffic Forecasts Report (March 2016, Updated August 2016)*, and summarized in this section.

5.2 Historical Aviation Activity

Passenger Traffic

YLW handled 1.594 million passengers in 2015, slightly less than 2014, but an increase of 6.0% over 2013. Domestic passengers totaled 1.432 million, 89.9% of the total.

Figure 10 (following page) presents the passenger traffic growth at YLW from 1998 to 2015. Key characteristics include:

- Passenger traffic at YLW increased slowly in the late 1990's and early 2000's;
- From 2005 to 2008, traffic grew significantly related to strong economic growth;
- Traffic declined in 2009 with the global financial crisis and recession, then recovered slowly in 2010 and 2011; and
- In 2012 to 2014, traffic growth again grew at a faster pace.

YLW's first transborder service began in 2004 and since then transborder has accounted for 6.5% to 10% of total traffic while other international traffic has fluctuated between 0.3% and 3.5% of total traffic.

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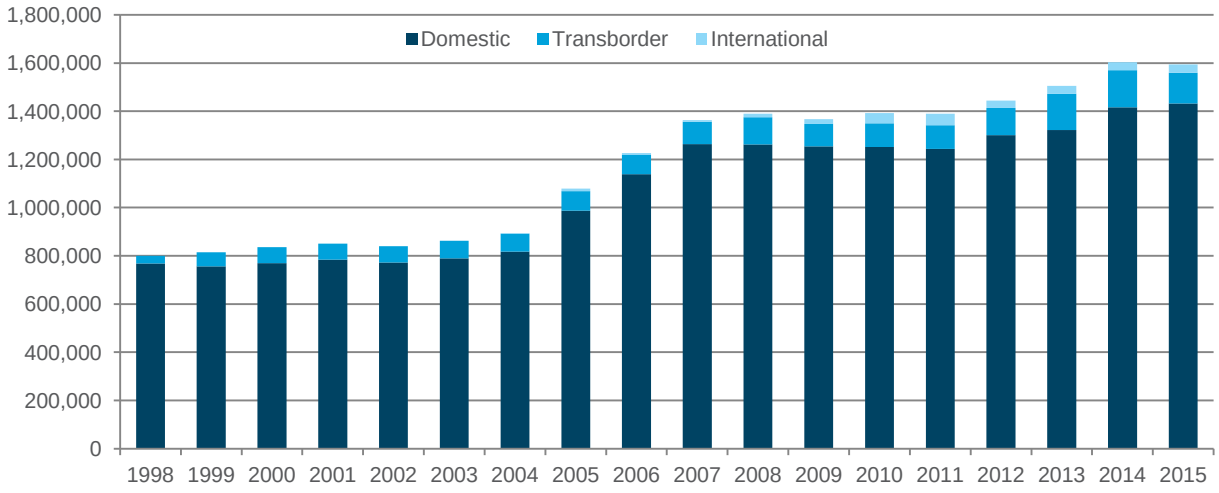
Annual growth rates have varied from a high of 20% in 2005 to a decline of 1.6% in 2009, generally fluctuating with the ebbs and flows of the economy. For the aggregate periods, growth rates fluctuated significantly. Over the past 17 years, growth in total traffic averaged 4.1%, but averaged only 2.8% over the past five years. Growth has been much higher for the transborder sector at 5.2% versus domestic which grew by 2.7% per year, and other international which declined between 2010 and 2015. (International includes transborder unless otherwise stated throughout this report.)

Figure 10: Annual Enplaned/Deplaned Passengers by Sector, 1998 to 2015



The busiest month for total passengers is August, while for transborder and other international passengers it is March. December is the second busiest month in total traffic and March is typically the third busiest. April and November are the least busy. The seasonal variation in traffic has been very consistent over the years.

YLW has very few connecting passengers, less than 1% of the total, thus almost all passengers have YLW as either their origin or destination. Approximately 20% of flights are through-flights which could carry transit passengers, but almost all are flights between Vancouver (YVR) and Calgary (YYC) and, as there are many non-stop flights per day between those cities, people would only use flights stopping over at YLW when the non-stop flights are full.

Air Service

In June 2016, YLW was served by seven airlines providing scheduled or major charter service: Air Canada, WestJet, Alaska, Sunwing, Air Transat, Pacific Coastal and Central Mountain Air. These carriers link Kelowna to eight destinations year-round, including seven domestic (Vancouver, Calgary, Toronto, Edmonton, Victoria, Cranbrook, Prince George), and one U.S (Seattle). YLW also has service to six seasonal destinations, including two in the U.S. and four in Mexico. A number of charter carriers also provide domestic passenger service from the Air Terminal Building (ATB) in 2014/2015, including Air North, Flair Airlines and Canadian North, and the private operator, Suncor, although this segment of traffic declined in the second half of 2015.

Over the past 12 years, WestJet accounted for 65% of the available seat capacity at YLW, but its share is anticipated to drop to 62% in 2016 (based on published schedules), its lowest level since at least 2004, as shown in Figure 11 (following page).

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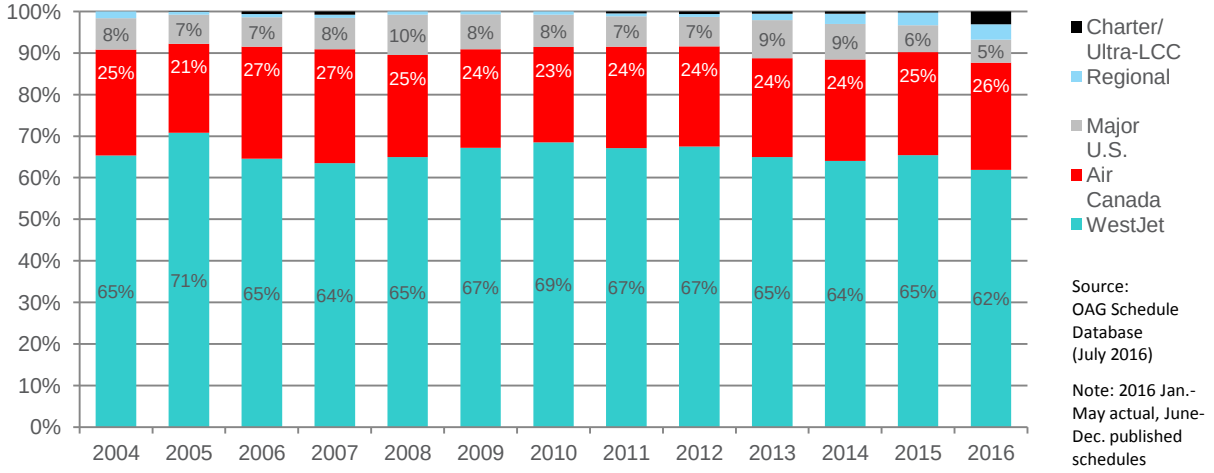
Figure 11: Market Share of Departing Seats from YLW by Airline Group, 2004-2016



Note: Ultra-LCC carrier services started in 2016.

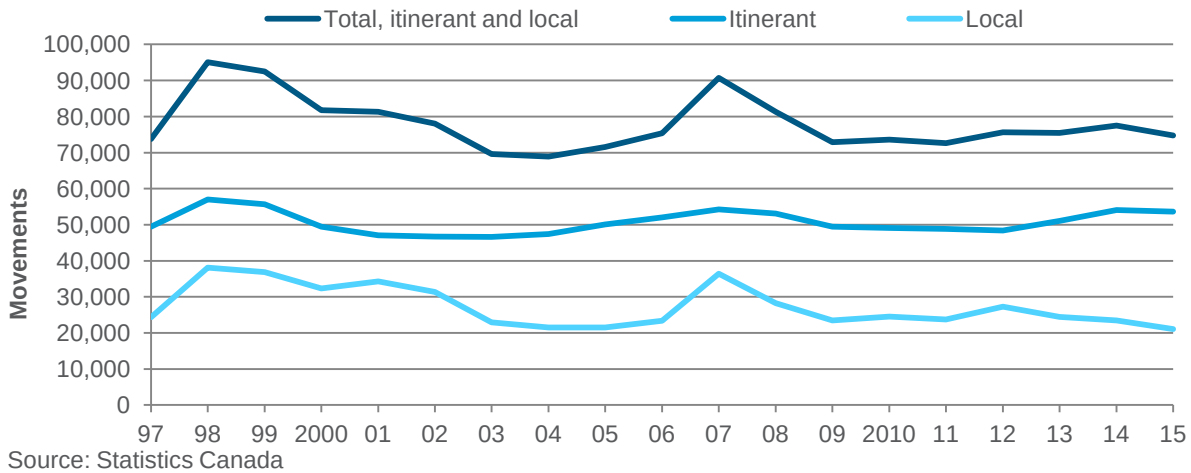
Air Canada's share has remained at around 25% during that period, while the share for U.S.-based airlines has fallen from 7-10% of capacity to an expected value of 5% in 2016. Regional carriers account for 3-4% of seats, up from 1% in the past 10 years, and charter/ultra low-cost carriers' share of seats is anticipated to be 3% of the total in 2016 with the commencement of service by NewLeaf.

Aircraft Movements

In 2015, YLW had 74,789 aircraft movements, 53,669 being itinerant and 21,120 being local. The number of aircraft movements at YLW has fluctuated over the past 19 years, as shown in Figure 12, but has not changed significantly over that period. The variation generally follows periods of economic growth in the region.

The variation in total movements is largely due to changes in local movements (essentially recreation and flight training aircraft movements) which account for 30-40% of all movements. Over most of the 19-year period, itinerant movements showed a similar trend as local movements, but with less variation. However, since 2012, itinerant movements have increased strongly (3.5%/yr), while local movements have declined significantly (-8.1%/yr).

Figure 12: Annual Itinerant and Local Aircraft Movements, 1997 to 2015



Source: Statistics Canada

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Commercial air carriers are the predominant operator of aircraft at YLW, accounting for 79% of itinerant movements in 2015. The larger air carriers (classified as Levels I-III) accounted for most of these itinerant movements (37,519, 70% of the total). These include 25,406 movements on scheduled service, accounting for 47% of itinerant movements. Private is the next largest operator segment accounting for 13% of itinerant movements. Other Commercial (aerial photography, remote sensing, etc.) accounted for 7% of itinerant movements, down from 21% in 2005, while Government accounted for only 2% in 2015. Large air carriers (Levels I-III) are the only segment of operators whose movements have increased significantly over the past 15 years, with an average growth rate of 2.7% per year.

The number of itinerant movements for each engine type has fluctuated significantly over the 19-year period. Turboprops were the most common type in the late 1990s. Their prominence declined greatly in 2001, but their numbers have increased significantly since 2011. In 2015, with the use of Q400s by both Air Canada and WestJet, turboprops were again the most common engine type, accounting for 46% of itinerant movements.

Jet aircraft accounted for 28% of itinerant movements in 2015 and have grown by an average of 2.1% per year since 1997. Piston aircraft movements declined steadily between 1997 and 2015, averaging decline of 2.4% per year, and their share of itinerant movements has fallen from 34% to 20% in that period. This is consistent with a general trend in the industry.

Cargo Traffic

In 2015, YLW handled 1,757 tonnes of air cargo, 23% less than in 2014, and well below its peak of 2,971 tonnes in 2012. Approximately 60% of the cargo is inbound and unloaded at YLW. Belly hold capacity for cargo shipments out of YLW has been limited over recent years due to the operation of smaller turboprop (Dash-8) aircraft by Air Canada and the limited focus on air cargo activities by WestJet. The drop in traffic in 2015 coincides with the locally based carrier KF Aerospace losing a large contract with Canada Post to transport mail.

Based Aircraft

Two-thirds of the based aircraft were owned by commercial operators and included 17 narrow-body jets, 4 wide-body jets, 30 turboprops and 9 helicopters in March 2015. All 33 privately owned aircraft were piston. The operators with the most based aircraft were Carson Air with 33, KF Aerospace with 20, and Flair Airlines with 7.

5.3 Drivers of Air Traffic Growth

There are a number of drivers of air passenger traffic at YLW. These are summarized in the following pages.

Strong Population Growth

The population growth between 1986 and 2011 in Kelowna and the surrounding region was nearly double the provincial average over the same time frame. While growth is expected to slow somewhat over the next 25 years, a 1.4% average annually rate of growth is predicted. This is approximately 36% higher than the average growth forecast in the province for the same period. The growth is related to people moving to the Okanagan region. However, the increase in the proportion of the population over 65 years of age represents a risk factor that may slow demand in the future.

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Strong and Well-diversified Regional Economy

The Central Okanagan is the economic hub of the valley. Key drivers of its economy include health care, education, construction, high technology, manufacturing, agriculture and tourism. Kelowna boosts the most small businesses per capita in Canada and the degree of disposable income among workers in the region is above average. Each of these factors stimulates air travel for business or leisure purposes.

In addition, the Okanagan had approximately 5,000 workers that commuted to work in Northern B.C. or Alberta in 2014. This segment alone represented approximately one hundred thousand passengers per year travelling through YLW in 2014. While the recent downturn in the oil prices has dampened this demand significantly, work on hydro projects, along with possible investments in other large resource-based projects in northern B.C. are encouraging signs that this traffic segment may continue to drive considerable traffic at the airport in the coming years.

Tourism as a Major Industry

Tourism in itself is a significant and growing component of the regional economy as it attracts visitors from across Canada and around the world. In 2014, approximately 1.7 million tourists visited the Kelowna area. Kelowna Tourism and the Thompson Okanagan Tourism Association (TOTA) possess targeted marketing programs to sustain and grow this market. While B.C. and Alberta residents constitute a large majority of the visitors, who are more likely to drive to the region, the success of marketing programs aimed at attracting visitors form secondary and emerging tourism markets outside of Western Canada are also likely to drive future air traffic demand.

Travel Costs

Reductions in the cost of travel have been a significant driver of increases in air travel over the past 20 years. 'Real' airfares for travel within Canada were 30-35% lower in 2015 than in the early 1990s despite the increase in fuel costs. The emergence of the low-cost airline model catering primarily to non-business travellers has reduced airfares and stimulated new demand for air travel. This has particularly benefited markets such as Kelowna which have a high proportion of leisure travellers. Leisure travellers are more price sensitive than other travellers and would travel more due to availability of low-cost air service. Increases in airport and air navigation charges and ancillary fees (for checked bags, meals, seat selection, etc.) have however offset some of this decline in airfares.

Without the emergence of a new sustainable model for pricing in the aviation industry, it is uncertain if the relative price of air travel may continue to decline. Factors such as the price of oil, inflation and potential increases in carbon taxes domestically and internationally could constrain future growth in demand for air services.

Competition from Nearby Airports

The Central Okanagan is the primary catchment area for YLW. The airport also competes to various degrees with other airports in the region and Vancouver (YVR) for air traffic.

A 2011 market study conducted by YLW found that 20% of Kelowna catchment area passengers used other airports. The largest share of traffic leakage is via YVR.

It was estimated that 27% of travelers between Kelowna and Europe, the Middle East and Asia use YVR and travel by car or bus to/from Kelowna. Without direct service to these regions, this is

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unlikely to change significantly. Leakage of domestic passengers was much smaller, 17.3%, and will decrease as traffic grows and air services improve at YLW.

The leakage that would occur via other airports in the region is not significant and would be offset by a wider and growing air service network, greater frequencies and larger aircraft available at YLW.

Exchange Rate

Changes in exchange rates can significantly affect the total cost of an international trip. With the number of local resident travellers typically exceeding the number of visitors by a factor of 2:1 in Canada, fluctuations in the Canadian dollar affect the cost of travel for local residents visiting other countries, such as the U.S.

The Canadian dollar has fallen to below US$0.80 in the past year. To some degree, this discourages international travel for Canadian residents, but also may contribute to stimulating demand for domestic travel to and from the region.

5.4 Annual Traffic Forecasts

Forecasting Model

Passenger traffic in future years is forecast using an estimated value for 2016 and forecasting changes in traffic due to changes in various factors for future years (e.g., GDP and population growth, changes in airfares based on oil prices, environmental charges, airline efficiency improvements and the exchange rate). Elasticity parameters are used which provide estimates of the percentage change in passengers due to a given percentage change in a specific parameter. In addition, adjustments are made which incorporate the effects of other factors which could not be included in the mathematical model calibrated on historical traffic.

Aircraft movements were forecast separately for itinerant (air carrier, private, government, etc.) and for local movements. Commercial movements were determined based on the forecast number of enplaned/deplaned passengers, average load factors and average number of seats on flights. The other movement categories were forecast based on previous trends at the airport, economic forecasts, industry outlook and input from major carriers.

Scenarios

The annual forecasts are prepared under three scenarios:

- Medium (Base) Case with continuation of strong growth but gradually slowing; and
- High Case with continued strong growth and little slowing; and
- Low Case with continuation of recent 5-year growth but slowing afterwards.

Details of the scenario inputs are provided in the *Appendix E: Kelowna International Airport Master Plan 2045 Technical Report – Air Traffic Forecasts (March 2016, Updated August 2016)*.

Note that scenario inputs are based on publicly available information, data and announced air services as of June 2016.

A summary of the forecast results are presented in the following pages. Derived forecasts, such as those for Planning Peak Hour Passengers and aircraft gate requirements are presented later in this document.

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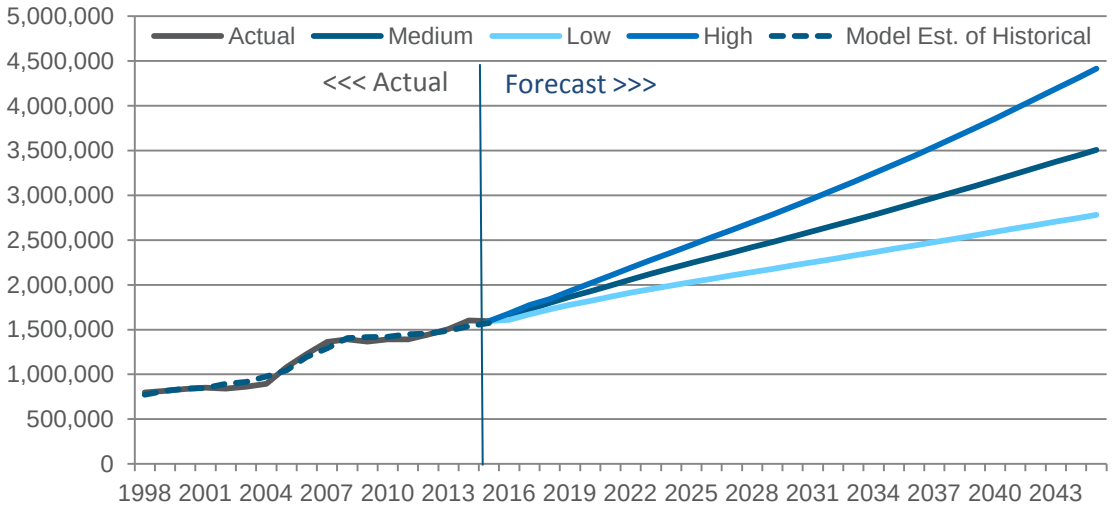
Passenger Forecasts

Enplaned/Deplaned (E/D) passenger forecasts under the Low, Medium and High Case Scenarios are presented in Figure 13 (below) together with historical traffic, both actual and estimated, using the model. The forecasts show that traffic is expected to continue to grow at a rate of 3.4% in 2016, following a decline of 0.6% in 2015 under the Medium Case Scenario. By 2020, total annual enplanements and deplanements at YLW are forecast to almost reach the 2 million mark, averaging a 3.9% annual growth during this period.

Annual growth slows gradually after that period to an annual average of 3.1% to 2025 and below 3% for the rest of the forecast period to 2045. Total annual E/D traffic under the Medium Case Scenario is expected to reach 2.25 million passengers in 2025, 2.85 million passengers in 2035 and surpass 3.5 million passengers by 2045. Under a High Case Scenario, annual passenger traffic could surpass 2.0 million in 2020, 2.5 million in 2025, 3.3 million in 2035 and 4.4 million by 2045.

Note that the Medium Case Scenario forecasts do not consider the impacts of the introduction of new ultra-low-cost carrier services. This provides a conservative reflection of initial service growth at YLW. Strong growth in air service, including an ultra-low-cost carrier, is included in the High Case forecasts.

Figure 13: Historical and Forecast E/D Passengers–
Low, Medium and High Case Scenarios



Aircraft Movement Forecasts

The number of aircraft movements under the Low, Medium and High Cases are summarized in Figure 14. Total movements are forecast to reach over 98,000 by 2045 under the Medium Case Scenario, but range from 83,000 to 120,000 under the Low and High Case Scenarios.

Under the Medium Case Scenario, the number of itinerant aircraft movements is expected to increase by approximately 1.3% per year over the next 15 years, with air carriers accounting for most of this growth.

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Little growth in private movements is forecast as the increase in private jet and turboprop movements is offset by the decline in piston movements. Little growth is forecast in Local movements over the next 30 years. Total movements are forecast to increase by about 0.9% per year over that period.

Figure 14: Forecast Aircraft Movements under the Medium, Low and High Case Scenarios

Year	Medium Case			Low Case			High Case		
	Itinerant	Local	Total	Itinerant	Local	Total	Itinerant	Local	Total
2015 Act'l	53,669	21,120	74,789						
2020	57,170	21,143	78,313	55,645	20,378	76,022	59,890	21,949	81,840
2025	61,161	20,942	82,103	57,930	19,728	77,658	66,243	22,290	88,533
2030	65,543	20,638	86,181	59,844	19,039	78,883	73,117	22,494	95,611
2035	69,684	20,304	89,988	61,800	18,354	80,154	80,566	22,652	103,218
2040	74,251	19,942	94,192	64,016	17,675	81,691	88,725	22,764	111,489
2045	78,902	19,555	98,457	66,194	17,005	83,199	97,384	22,831	120,215
Average Annual Growth Rates									
2015-2020	1.3%	0.0%	0.9%	0.9%	-0.5%	0.5%	2.0%	0.6%	1.6%
2020-2025	1.4%	-0.2%	0.9%	0.8%	-0.6%	0.4%	2.0%	0.3%	1.6%
2025-2030	1.4%	-0.3%	1.0%	0.7%	-0.7%	0.3%	2.0%	0.2%	1.6%
2030-2045	1.2%	-0.4%	0.9%	0.7%	-0.8%	0.4%	1.9%	0.1%	1.5%
2015-2045	1.3%	-0.2%	0.9%	0.7%	-0.7%	0.4%	2.0%	0.2%	1.6%

Cargo Forecasts

Total air cargo is forecast to grow by an average of 2.0% per year reaching almost 3,200 tonnes by 2045. Outbound cargo is forecast to increase more slowly averaging 1.8% per year, while inbound cargo is forecast to grow at a moderate rate of 2.3% per year. With the strong economic growth in the region and possible increases in air shipments of time-sensitive agricultural products, cargo volumes are expected to recover from the decline in 2015 over the next 5-10 years, and then grow slowly over the longer term. The increase in size of aircraft used on passenger services, particularly with more jet services to Toronto and the transition from DH8-300s to Q400s by Air Canada, should increase the cargo capacity at YLW.

Based Aircraft Forecasts

Total based aircraft are forecast to increase from 101 in 2014 to 125 in 2045 with most of the growth being in turboprop aircraft. Under the Low Case scenario, the numbers of based aircraft are forecast to increase to 106 by 2045 with the numbers of narrow-body and wide-body jets declining, while under the High Case based aircraft are forecasts increase to 153 by 2045.

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6.0 Economic Impacts

The previous economic impact study conducted for YLW was completed in February 2011 using data from calendar year 2010. Since that time, YLW has continued to experience strong growth with passenger traffic increasing by 15%. As part of the *Master Plan 2045*, an updated Economic Impact Study was undertaken. The following section provides an overview of results. The updated study primarily uses data from calendar year 2014, although the study was completed in 2015. Details of the analyses and results are provided in the *Appendix F: Kelowna International Airport Master Plan 2045 Economic Impact Study Update (December 2015)*.

The economic impact of an airport is a measure of the level of economic activity, such as employment, personal income, business output and value added, that is associated with activity at the airport. It typically includes three separate effects:

- **Direct Impacts** result from activities carried out by firms and others with a direct involvement in the operation and management of the airport and associated aviation related services. The distinguishing feature of a direct impact is that it is an immediate consequence of airport activities. Most direct impacts are generated on-site.
- **Indirect Impacts** are those attributable to non-aviation industries, largely off-site, that supply or provide services to businesses and other groups operating at the airport; i.e., in support of direct airport activities. Examples include travel agents, and suppliers to airport-based organizations.
- **Induced Impacts** occur when employees directly or indirectly linked to the airport spend their wages.

In addition, the airport provides benefits to residents and businesses in the region by facilitating air travel to/from the region. These benefits are commonly referred to as catalytic benefits and, although difficult to quantify, can be at least as important to the region as the direct, indirect and induced impacts. The impact of the airport on tourism is a good example of one of the catalytic impacts.

Employment

There were 46 organizations operating at YLW in 2014 with 1,305 full time equivalent (FTE) direct jobs, plus another 96 FTE direct jobs attributable directly to operations at YLW and 10 volunteer FTE positions. This is an increase of 10% or 123 new jobs since 2010. Figure 15 (following page) shows the distribution of direct employment at YLW with Charter Operators and Aircraft/Aviation Services being the largest components at 28.6% and 26.8%, respectively. As shown in Figure 16, total employment including indirect and induced employment is 2,661 FTEs, an increase of 6% from 2,520 in 2010.

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Figure 15: Distribution of Direct Employment at YLW (2014)

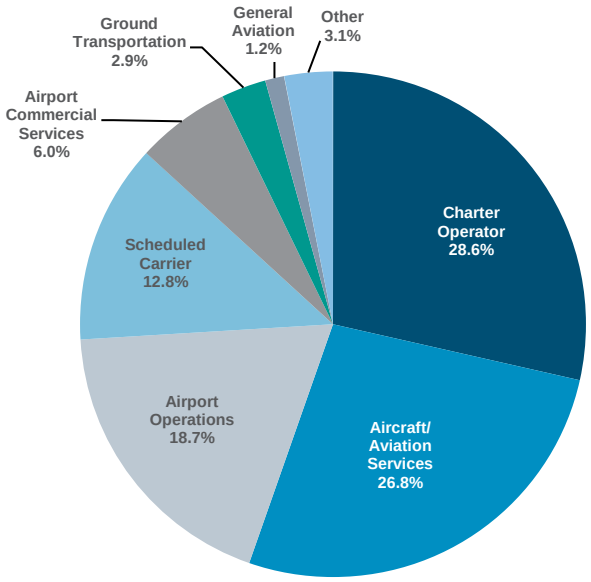

Figure 16: Employment Impacts at YLW (2014)

Activity Category	# Organizations	Direct	Indirect	Induced	Total
Charter Operator	7.5	403	334	185	922
Aircraft/Aviation Services	4.5	378	98	98	575
Airport Operations	9.0	263	100	114	477
Scheduled Carrier	9.0	180	150	83	413
Airport Commercial Services	4.0	85	20	14	119
Ground Transportation	4.0	40	9	4	54
General Aviation	4.0	17	14	8	39
Other	4.0	44	9	9	61
Total	**46**	**1,411**	**735**	**516**	**2,661**

Labour Income

It is estimated (Figure 17, following page) that activity at YLW directly contributes $83 million in labour income (including benefits unless otherwise stated). This is an increase of 7.5% since 2010 (excluding benefits). Total labour income including indirect and induced effects is $142 million. On average direct labour income is $58,610 per FTE at YLW. Figure 18 shows the distribution of labour income amongst the various airport activity categories. Consistent with the direct employment distribution, Charter Operators and Aircraft/Aviation Services are the largest components at 30.9% and 26.8% respectively.

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Figure 17: 2014 Distribution of Labour Income (2014, millions)

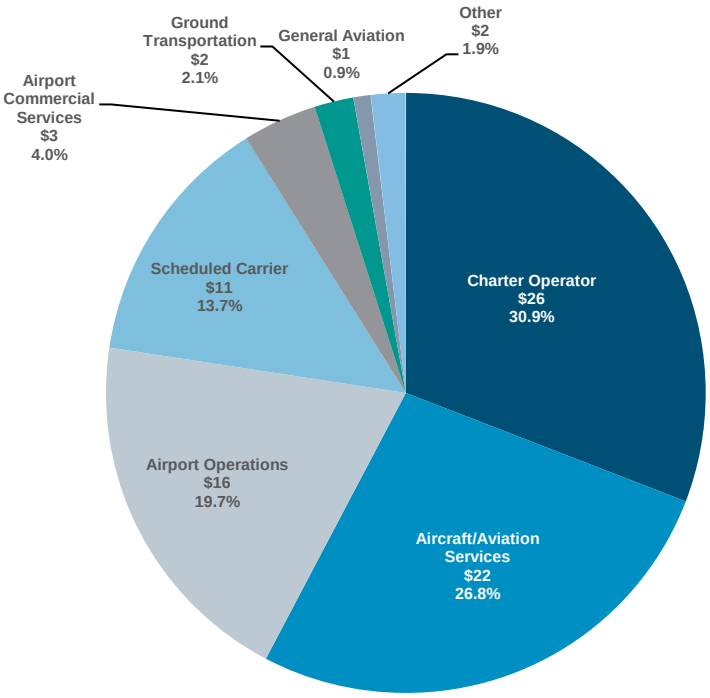

Figure 18: Labour Income Impacts at YLW (2014, millions)

Activity Category	Direct	Indirect	Induced	Total
Charter Operator	$26	$17	$8	$51
Aircraft/Aviation Services	$22	$6	$5	$34
Airport Operations	$16	$3	$3	$23
Scheduled Carrier	$11	$8	$4	$22
Airport Commercial Services	$3	$1	$1	$6
Ground Transportation	$2	$1	$0	$3
General Aviation	$1	$1	$0	$2
Other	$2	$0	$0	$2
Total	**$83**	**$37**	**$22**	**$142**

Economic Output

It is estimated that activity at YLW contributes $336 million in direct output (see Figure 19, following page). This is an increase of 12% since 2010. Total output including indirect and induced effects is almost $600 million, similar to that in 2010. The distribution of the Direct Output is found in Figure 20. Once again, Charter Operators and Aircraft/Aviation Services are the most significant contributors.

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Figure 19: 2014 Distribution of Direct Output (2014, millions)

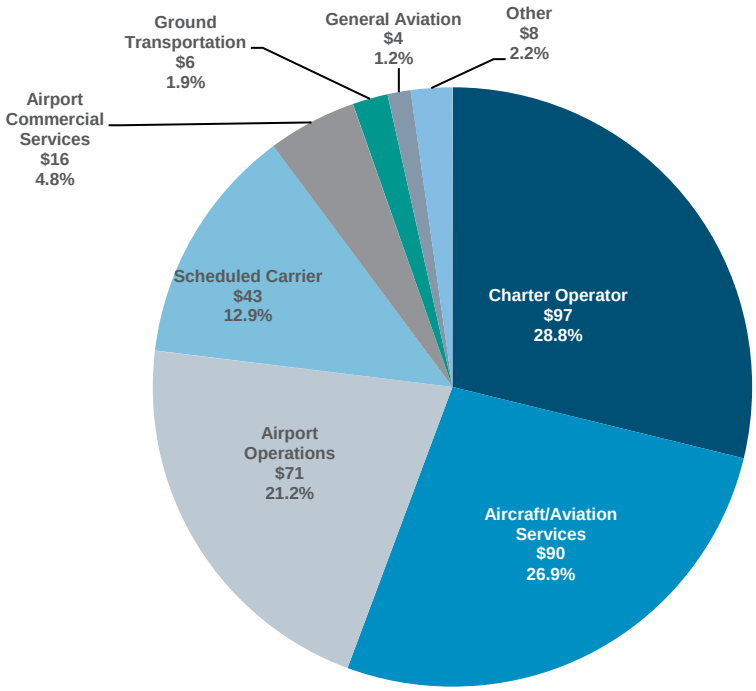

Figure 20: Gross Output Impacts (2014, millions)

Activity Category	Direct	Indirect	Induced	Total
Charter Operator	$97	$55	$20	$172
Aircraft/Aviation Services	$90	$34	$34	$159
Airport Operations	$71	$41	$21	$133
Scheduled Carrier	$43	$25	$9	$77
Airport Commercial Services	$16	$6	$5	$28
Ground Transportation	$6	$3	$2	$11
General Aviation	$4	$2	$1	$7
Other	$8	$3	$2	$13
Total	**$336**	**$169**	**$94**	**$599**

Gross Domestic Product

Gross Domestic Product (GDP) is calculated using Statistics Canada economic multipliers for B.C. applied to direct output. Different multipliers were used for different activity categories. $336 million in direct output is estimated to produce $152 million in direct GDP, an increase of 26% from 2010. As shown in Figure 21 (following page) Total GDP including indirect and induced effects is over $306 million, an increase of 22% from 2010.

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Figure 21: GDP Impacts (2014, millions)

Activity Category	Direct	Indirect	Induced	Total
Airport Operations	$49	$12	$21	$82
Charter Operator	$36	$27	$19	$81
Aircraft/Aviation Services	$35	$17	$23	$75
Scheduled Carrier	$16	$12	$8	$36
Airport Commercial Services	$7	$4	$4	$15
Ground Transportation	$3	$1	$1	$5
General Aviation	$2	$1	$1	$3
Other	$5	$1	$2	$8
Total	**$152**	**$75**	**$79**	**$306**

Taxes

There are many taxes associated with activities at the airport. Passengers pay some; others are paid by companies operating at the airport and by their employees. Total taxes collected in 2014 were $45.6 million:

- Total Federal Taxes $36.2 million
- Total Provincial Taxes $ 8.0 million
- Municipal taxes $ 1.4 million

Air Service Growth Impact

Each additional flight at YLW will require additional employee time for a range of personnel from flight crew, air traffic controllers, baggage handlers, airline check-in and departure lounge staff, aircraft cleaners and maintenance providers, security screeners, and airport operations, ground transportation and airport concessions staff. Many employees are employed full-time and are not working at full capacity all the time and, depending on the time of day of the additional flight, may be able to provide services for these flights without requiring additional employment. In other situations additional staff may need to be employed.

With each additional daily B737-700 flight out of YLW, the economic impact analysis concludes that 16 Full Time Equivalent (FTE) jobs directly relating to air carrier and supporting services are created. When all passenger-related activities are considered, a higher range of 38 FTE jobs are created. This confirms the importance that expansion of existing routes and development of new air services have in the local economy through job creation and derived benefits.

Catalyst Impact

Tourism is one of the major catalytic impacts associated with the airport. In 2014, the number of tourists was expected to reach 1.7 million, with 440,000 using YLW. The impacts of visitors to the region travelling by air are significant, equating to roughly 70% of the employment impact of the airport and between 26% and 36% of the income, output and GDP impacts of the airport. The economic impacts to the region of visitors travelling by air, excluding the airport component, are summarized in Figure 22 (following page).

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Figure 22: Tourism Economic Impact of Visitors Travelling by Air, Excluding Airport Component (2014)

Impact Component	Employment		Wages	GDP	Gross output
	Jobs	Person-yrs	($ Million)	($ Million)	($ Million)
Direct Impacts					
Accommodation	528	372	$13	$22	$37
Net Other Tourism Industries	671	387	$15	$38	$77
Visitor Spending	711	555	$16	$25	$47
Total Direct Excl. Airport Component	**1,910**	**1,314**	**$44**	**$85**	**$161**
Net Indirect	494	247	$3	$3	$11
Net Induced	587	312	$4	$5	$18
Total Impact	**2,991**	**1,874**	**$51**	**$94**	**$190**

Summary

With 1,411 FTEs and $336 million (Figure 23, below) in direct output, YLW is a powerful economic generator for the City of Kelowna and the Okanagan Region. The airport is a gateway to the Region and plays a major role in supporting industry, tourism and the overall quality of life.

Figure 23: Summary of Economic Impacts (2014)

Activity Category	Associated with Airport Activity				Catalytic
	Direct	Indirect	Induced	Total	Tourism
Employment (Person/yrs)	1,411	735	516	2,661	1,874
Wages (million)	$83	$37	$22	$142	$51
Output (million)	$336	$169	$94	$599	$190
GDP (million)	$152	$75	$79	$306	$94

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7.0 Airside System

The airside system is defined by the runways, taxiways and aprons that enable aircraft to land and circulate to terminals and other buildings at the airport. To meet future demands and to support the role of the airport, plans over the next thirty (30) years must provide for the ability to serve anticipated aircraft types. This section provides an overview of the analyses conducted to identify current conditions and future requirements for YLW's airside infrastructure.

7.1 Airfield Characteristics

The existing airport site plan is illustrated in Figure 24 (following page). Existing airside infrastructure is summarized in the following sections.

Runway

The airport is equipped with a single runway, Runway 16-34, that is paved with asphalt and measures 2,713 m (8,900 ft) in length and 60 m (200 ft) in width. The runway is currently certified as a Code D non-instrument runway, which permits the operation of aircraft as large as the B767-300 and the A310-300. The largest aircraft currently providing year round passenger services is the B737-800, which is categorized as a Group III/Code C aircraft. The runway is equipped with navigational and visual aids in support of non-precision and precision approaches[6].

The runway is oriented in a north-south direction with Runway 16 pointing south (157^{o} magnetic) and Runway 34 pointing north (337^{o} magnetic). The runway's declared distances are listed in Figure 25 (page 42). These distances are used by pilots to determine if there is sufficient runway length available for take-off and landing, the requirements of which change with each flight according to weather conditions and weight (passengers and fuel carried).

Runway 16-34 has a clearway at each end. The clearway is a rectangular area beyond the end of the paved section of runway that represents a suitable area over which an aircraft may make a portion of its initial climb during take-off. The clearway at the end of Runway 16 is slightly longer than the clearway at the end of Runway 34, which translates into a slightly longer Take-off Distance Available (TODA) to aircraft (see Figure 25, page 42).

[6] As noted on pages 12 and 13 of the Airport Operations Manual, Edition #6, "*Restricted ILS and RNP instrument procedures are authorized for use with a decision height down to 251 feet HAA/HAT by aircraft with wing-spans up to 36 m, and for use with a decision height down to 501 feet by aircraft with wing-spans of 36 m or greater, which are conditional upon maintaining Code 3C non-precision physical characteristics and OLS*."

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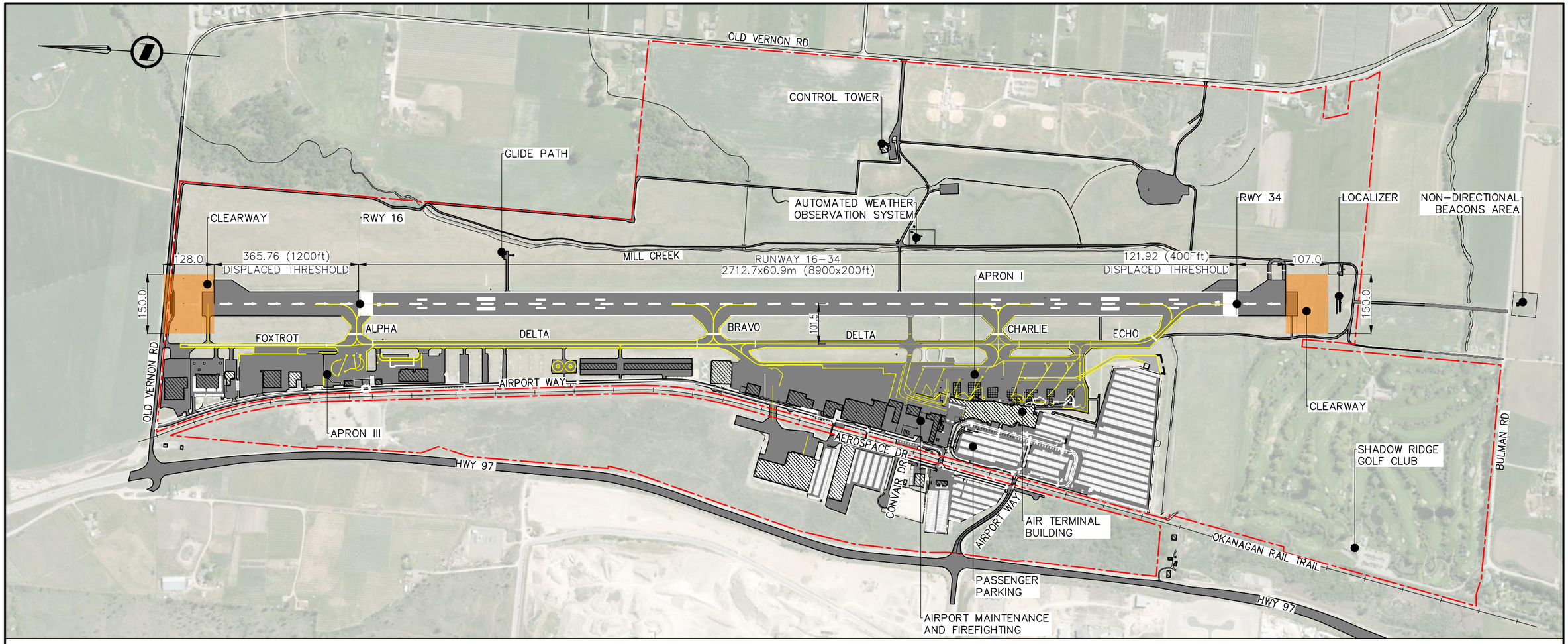

LEGEND

- PAVEMENTS
- BUILDING STRUCTURE
- CLEARWAY
- AIRPORT BOUNDARY

LEGEND

TAXIWAY	TAXIWAY CODE	PAVEMENT WIDTH	STRIP WIDTH	GRADED AREA
TAXIWAY A	D	30m (100')	40.5m (133')	19m (62')
TAXIWAY B	D	30m (98.3')	43.0m (140')	12m (40')
TAXIWAY C	D	23m (75')	43.0m (140')	18.5m (60')
TAXIWAY D	C*	18m (59.1')	27.8m (91.2')	12m (40')
TAXIWAY E	C*	18m (59.1')	27.8m (91.2')	12m (40')
TAXIWAY F	B	9.0m (29.5')	26.0m (85.3')	12m (40')

APRON	DIMENSIONS	SURFACE TYPE
APRON #1	350x82m (1148x269')	ASPHALT WITH CONCRETE PARKING PADS AIRCRAFT OPERATIONS STANDS
APRON #2	90x42.5m (295x140')	ASPHALT
APRON #3	122x65.5m (400'x215")	ASPHALT

HELICOPTER	INNER CIRCLE RADIUS	OUTER CIRCLE RADIUS
PARKING POS. #1	4.56m (15')	13.68m (44.9')
PARKING POS. #2	4.56m (15')	13.68m (44.9')

* THE TAXIWAY HAS BEEN ASSESSED AND IT HAS BEEN DETERMINED THAT AN EQUIVALENT LEVEL OF SAFETY EXISTS FOR THE OPERATION OF AIRCRAFT WITH WINGSPANS UP TO 38.1M (125') TO OPERATE ON TAXIWAY 'D' . DETAILS OF THIS ASSESSMENT ARE LOCATED IN ADC #8.

NOTE: ALL UNITS ARE IN METER UNLESS OTHERWISE SPECIFIED

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Airports & Aviation Group
500-745 Thurlow Street, Vancouver British Columbia, Canada. V6E 1V8
Tel: 604-662-3555

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PROJECT
YLW MASTER PLAN

TITLE
FIGURE 24
CURRENT AIRFIELD LAYOUT

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 DK	0002	PB

Figure 25: Declared Distances

Declared Distance	Runway 16	Runway 34
Take-off Run Available (TORA)	2,712 m (8,900 ft)	2,712 m (8,900 ft)
Take-off Distance Available (TODA)	2,840 m (9,320 ft)	2,820 m (9,251 ft)
Accelerate-Stop Distance Available (ASDA)	2,712 m (8,900 ft)	2,712 m (8,900 ft)
Landing Distance Available (LDA)	2,347 m (7,700 ft)	2,590 m (8,500 ft)

Each end of the runway also has a displaced threshold. The threshold of a runway is that portion of the paved runway that is available for landing of aircraft. It is normally located at the extremity of the runway, but is displaced when an obstacle in the final approach area infringes the approach surface.

The threshold at Runway 16 is displaced due to vehicle traffic on Old Vernon Road. Moving vehicles on the road represent a mobile obstruction that must not infringe the airport's imaginary flight protection surface for approaching aircraft (the approach surface). The displacement of the threshold towards the south permits the unrestricted movement of traffic on Old Vernon Road without any impact on the approach surface. The existing displaced threshold, however, means that the Landing Distance Available (LDA) to aircraft is shortened to 2,347 m (7,700 ft.)

The threshold at Runway 34 is also displaced, but it is due to utility poles on Bulman Road. The existing displaced threshold ensures that the approach surface is not infringed by the poles, but the LDA is shortened to 2,590 m (8,500 ft) (Figure 25, above).

Taxiways

The taxiway system at YLW is made up of six taxiways as shown in Figure 24 (page 41) and summarized in Figure 26 (below).

Figure 26: Taxiways

Taxiway	Code	Width (m)	Strip Width (m)	PLR
Alfa	Group IV	30	40.5	10
Bravo	Group IV	30	43	10
Charlie	Group IV	23	43	10
Delta	Group III*	18	27.8	10
Echo	Group IV	23	40.5	10
Foxtrot	Group II	9	26	10

*Includes Group III aircraft plus the B757-200.

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Taxiway Delta plays a leading role as parallel taxiway to the runway. Although this taxiway is designated as a Group III (Code C) taxiway, it can be used by aircraft with wingspans up to 38.1 m (125 ft), which permits aircraft up to the B757-200 in size[7]. The separation between this taxiway and the runway measures 101 m (331 ft) in accordance with Transport Canada standards for taxiways parallel to a non-instrument runway.

Taxiways Alfa, Bravo, Charlie and Delta also serve as a primary access to the aprons and other facilities, as well as access to the runway. Taxiway Echo connects Taxiway Delta with Apron I, while Taxiway Foxtrot connects airport tenants at the north end of the airport with taxiways Delta and Alfa.

Aprons

There are two designated aircraft apron areas at YLW.

Apron I

Apron I is located on the east side of the ATB and is accessed from Taxiways Charlie and Echo, which connect with Taxiway Delta and the runway. It was expanded in 2015-2016 to its current configuration by integrating the former Apron II. Apron I is currently equipped with a total of ten (10) aircraft parking stands, broken down as follows:

- Five (5) ground load aircraft parking stands consisting of the following:
  - Three (3) Group III (Code C) stands, Gates 1, 2 and 3 at the north end of the apron.
  - One (1) Group III (Code C) turbo-prop stand, Gate 5, centrally located west of Taxiway Charlie. This stand is limited to turbo-prop aircraft no larger than the Q400.
  - One (1) Group II (Code B) turbo-prop stand, Gate 10, located at the south end of the apron.
- Four Group III (Code C) bridged stands, gates 6, 7, 8 and 9.
- One Group IV (Code D) bridged stand, gate 4.

The existing layout is shown in Figure 27 (following page).Gates 1, 2, 3 and 4 are designated as ‘swing gates’, configured to handle international or domestic flights. In order to separate international arriving passengers from domestic passengers in the Terminal, doors can be closed to isolate a passage for international passengers from the gate to a corridor that leads to the Canada Border Services Agency (CBSA) Primary Inspection Hall.

The apron does not currently provide remote or off-gate parking positions.

The location and position of the ATB in relation to the airport’s runway and taxiway system impose some constraints on the layout of aircraft parking stands, in particular with regards to providing sufficient space in front of aircraft to allow for ground handling equipment movements, while preventing aircraft tails from protruding into obstacle clearance and transitional surfaces associated with the adjacent runway and taxiway.

Given the relationship between the capacity and layout with the configuration and expansion capabilities of the ATB, further analyses of Apron I requirements and development options are provided in *Section 8 – Air Terminal Building*.

[7] The B757-200 is classified as a Group IV aircraft. The Group III designation encompasses aircraft in the AGN III category including the B737 and A320 family of jets, with shorter wingspans than the B757-200. The airport has determined that an equivalent level of safety exists for the operation of the B757-200, but excluding the B757-200 equipped with winglets.

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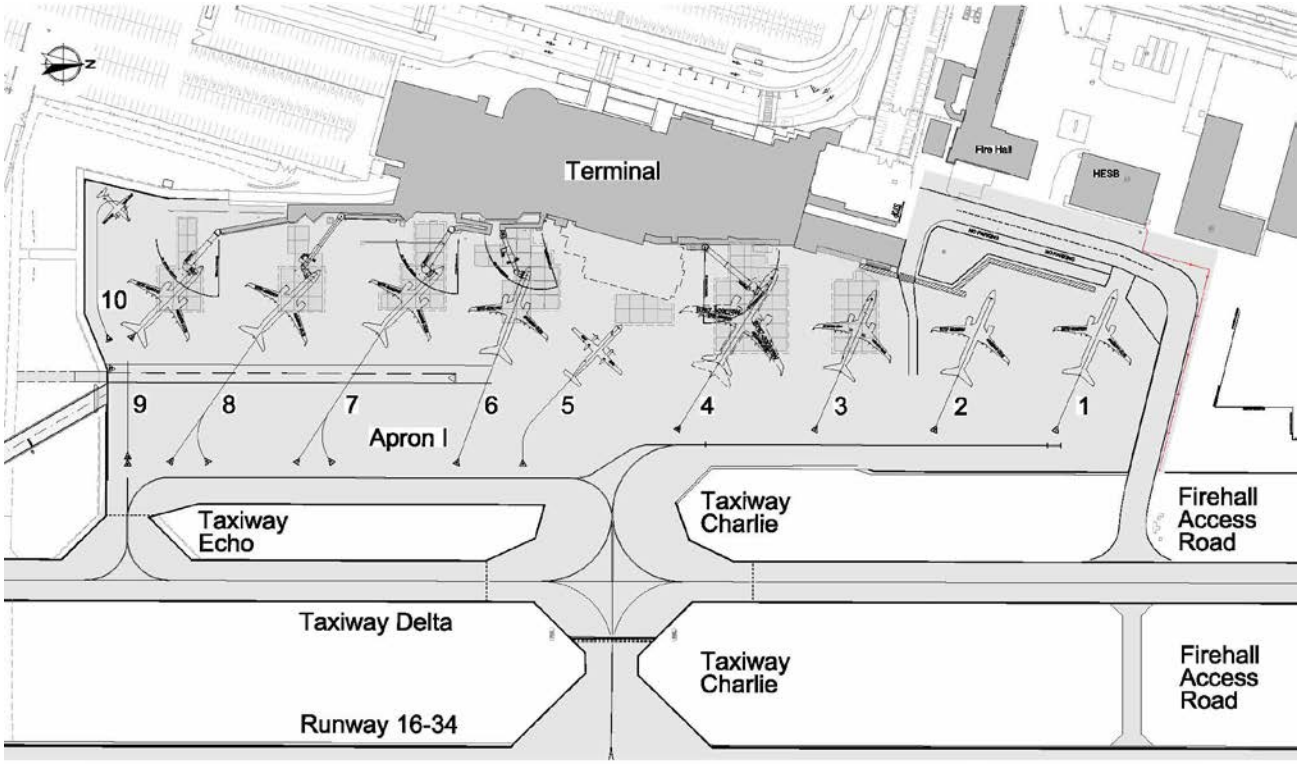
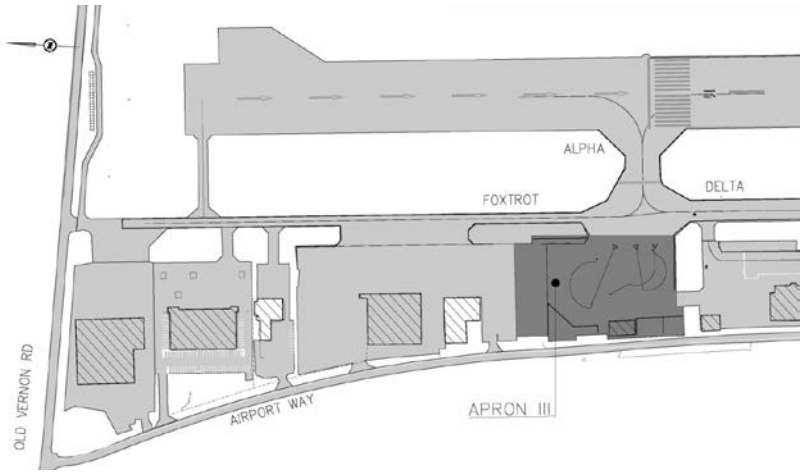
Figure 27: Apron I – Air Terminal Building Apron



Apron III

Apron III (Figure 28) is located at the north end of airport lands and is accessed from Taxiways Alfa, Delta and Foxtrot. This apron acts as a relief apron and provides two parking stands if there are overflow requirements for large aircraft. It also serves the Kelowna Flying Club and serves as a parking area for light aircraft when not used by large aircraft.

Figure 28: Apron III



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Other Aircraft Parking

The airport serves general and corporate aviation, including the following activities:

- Private and recreational flying;
- Flight schools and training;
- Charter services;
- Search and rescue;
- Air ambulance;
- Aircraft maintenance including aircraft overhaul; and
- Helicopter services.

A number of aircraft are based at the airport as highlighted in *Section 5 – Air Traffic Forecasts*. In 2015, this included 35 private piston engine aircraft, plus the following aircraft registered as commercial aircraft:

- 4 piston engine aircraft;
- 27 turbo-prop aircraft;
- 3 business jets;
- 15 narrowbody aircraft;
- 3 widebody aircraft; and
- 9 helicopters.

Facilities in place to serve these aircraft are primarily concentrated on airport lands north of Apron I on the west side of the runway, as summarized in the following paragraphs.

KF Aerospace

The KF Aerospace complex occupies a significant area of airport property north of Apron I. Access via Taxiway Bravo, the complex consists of hangars, building and apron parking space for aircraft that extends into lands west of Airport Way. This comprises a unique taxiway crossing at Airport Way that permits Group III/Code C aircraft to be parked on the west side of the road.

The KF Aerospace apron north of Apron I is typically used for the parking of Group III/Code C aircraft, but can also be used for the parking of Group IV/Code D aircraft, such as the B757-200 and B767-300.

T-Hangars

A lot north of the KF Aerospace complex, running parallel to Taxiway Delta, is occupied by T-hangars for the long-term parking of small aircraft. A larger hangar on the south side measures approximately 2,700 m^2. The apron on the north side measures approximately 1,450 m^2. Access to Taxiway Delta is provided via one taxiway connection.

Tie-down Aircraft Parking Stands

An area extending north of the helipad offers tie-down parking for over 50 light single and twin engine aircraft and gliders. A total of four paved taxiway connections to Taxiway Delta provide access to the tie-down stands. Approximately half of the tie-down stands are located on grass surface, with the remainder on pavement.

Air traffic forecasts prepared for *Master Plan 2045* call for growth in based aircraft, with turbo-prop aircraft experiencing the greatest increase numbers, followed by helicopters and business jets. North apron tenants are limited in their capacity to support this growth. Aprons occupied by Carson Hangars #3 and #6 are congested and offer limited space between hangars and Taxiways Delta

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and Foxtrot. This general aviation sector is an important component of YLW's activities. Given the recreational nature of this traffic, it is recommended that coordination with or formulation of complementary programs/uses with other airports in the region occurs to support private recreational aircraft activities and alleviate some of the current demand issues at YLW.

Helipads

The Airport Operations Manual notes that helicopters are expected to use the runway for landings and take-offs and proceed to one of seven locations on airport lands for parking. As illustrated in *Figure 24: Current Airfield Layout (2016)* (page 41), these include the following:

- Helicopter touchdown pads on the west side of Taxiway Delta and north of the Kelowna T Hangars (restricted to helicopters with maximum overall length of 75');
- KF Aerospace apron;
- Northern Air Support apron;
- Skyline Helicopters apron;
- Southern Interior Flight Centre apron; and
- Training area located on the east side of the runway.

Aerodrome Lighting

YLW is equipped with visual aids for day and night-time operations in support of the airport's published instrument approaches, use of the taxiways and take-off in visibility conditions down to ¼ Statute Mile (1200 RVR).

Approach Lighting

Runway 16 is equipped with a Medium Intensity Approach Lighting System with runway alignment indicator lights (MALSR) in support of the runway's ILS/DME approach.

Runway 34 is equipped with an Omni-Directional Approach Lighting (ODAL) system to support night-time operations and to provide pilots with circling guidance during visual approaches to the airfield.

Runway Lighting

The runway is equipped with medium intensity runway edge lights required for ILS/DME precision approaches on Runway 16 during the day or night.

Runway end lights exist at each end of the runway in support of the runway edge lights. Runway threshold lights are located at the end of Runway 16. Runway wing bar lights are located at the displaced threshold of Runway 34.

Precision Approach Path Indicators

Each runway is equipped with a Precision Approach Path Indicator (PAPI) P2 installation to assist pilots during final approach. The P2 designation accommodates aircraft with eye-to-wheel height of 6.7 m (22 ft).

Taxiway Lighting

All taxiways are equipped with blue edge lights and double blue lights at all intersections with the runway and other taxiways. Double amber lights mark the intersection between Taxiways Charlie and Echo and Apron I.

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Other Lighting

A rotating aerodrome beacon, required in support of night-time operations, is located on top of the Air Traffic Control Tower. Due to the mountainous terrain in the vicinity of the airport, a total of six hazard beacons are located at key high points within a 3nm radius of the airport to define night circling limits (Figure 6: Night Circuit Procedures, page 17).

Windsocks are lighted and obstruction lights identify both blast fences and high mast apron floodlighting units.

Air Traffic Control Tower

An Air Traffic Control Tower is located on the east side of the runway (see Figure 24: Current Airfield Layout (2016), page 41). It is operated by Nav Canada between the hours of 06:00 and 22:30 daily. The ground frequency is 121.7MHz and the Tower frequency is 119.6MHz. Outside Tower operations hours, frequencies are provided from Nav Canada's Penticton Flight Service Station.

Navigational Aids and Electronic Zoning

Electronic navigational aids are required in support of instrument procedures that are used to assist pilots in finding the airport when visibility conditions are poor. Instrument procedures at YLW make use of three Non-Directional beacons (NDB), a localizer with Distance Measuring Equipment (DME) and a magnetic glide path. The NDB stations are located off airport lands. The localizer and glide path installations are located within airport lands and serve as an Instrument Landing System (ILS) for Runway 16. Figure 31 (following page) illustrates the location of these navaids and the electronic zoning in place to protect their function and operation from objects and activities.

Figure 29: Navigational Aids

Electronic Navigational Aids	Location
NDB (Kelowna NDB)	Off airport
NDB (Rutland NDB)	Off airport
NDB (Westbank/Gellatly Point NDB)	Off airport
Localizer with DME	On airport
Glidepath	On airport

Relocation of the localizer array is proposed to a site located 387 m towards the south near Bulman Road.

Instrument approach procedures published in the Canada Air Pilot are presented in Figure 30.

Figure 30: Existing Instrument Approaches and Minima

Runway	Type	Minima	
		MDA (ft AGL)	Visibility (Statute Miles)
16	RNAV (RNP 0.10) X RWY 16	447	$1^{1/2}$
	RNAV (RNP 0.30) X RWY 16	1,048	3
	ILS/DME X RWY 16 (Code C)	251	1
	ILS/DME X RWY 16 (Code D/E)	501	1

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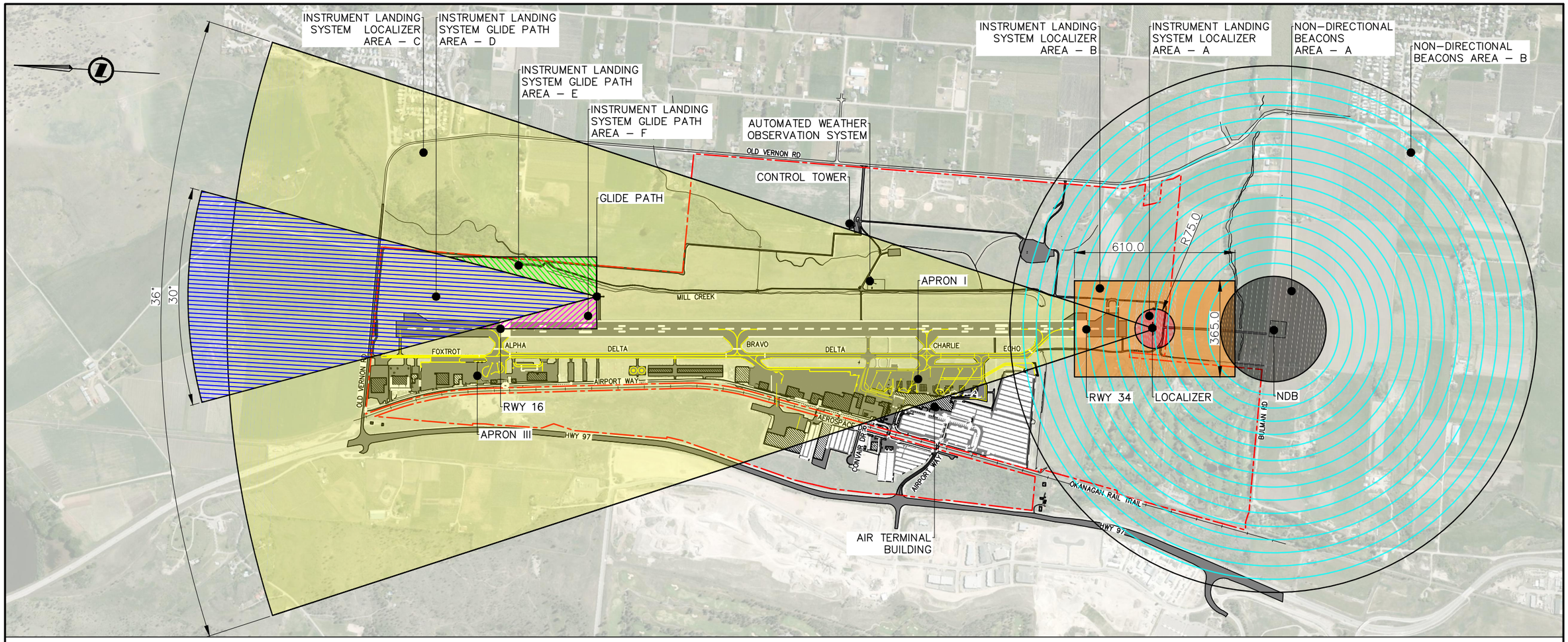

ILS LOCALIZER

NO SERVICE ROADS WITHIN 180m OF THE LOCALIZER ARRAY		
AREA A	CIRCLE 75m RADIUS	NO OBJECTS >1.2m
AREA B	365 x 610m	NO METALLIC OBJECTS >1.2m NO NON–METALLIC OBJECTS > 2.5m
AREA C	36° ARC (18° EACH SIDE OF RUNWAY CENTRE LINE) OUT TO: 6100m/OR DISTANCE SPECIFIED FOR TAKEOFF/APPROACH SURFACE	NO METAL WALLED STRUCTURE > 0.8 DEGREES SUBTENDED NO STRUCTURAL STEEL WORK > 1.6 DEGREES SUBTENDED NO NON–METALLIC OBJECT > 2.4 DEGREES SUBTENDED

ILS GLIDE PATH

NO SERVICE ROADS WITHIN 180m OF THE LOCALIZER		
AREA D	30° ARC 15° EACH SIDE OF A LINE PARALLEL TO THE RUNWAY CENTRE LINE	NO METALLIC FENCES, POWER LINES, TELEPHONE LINES BUILDINGS, ROADS, RAILROADS APPROACH LIGHTING HORIZONTAL BARS TO BE AVOIDED WITHIN 600m
AREA E	AREA E AND TRIANGLES BASE 150m AWAY FROM GLIDE PATH ANTENNA	SAME RESTRICTIONS AS AREA D
AREA F	AREA F AND TRIANGLES BASE 150m AWAY FROM GLIDE PATH ANTENNA	SAME RESTRICTIONS AS AREA D

NON–DIRECTIONAL BEACONS (NDB)

THE FOLLOWING TYPES OF STRUCTURES SHOULD BE ASSESSED PRIOR TO CONSTRUCTION TO DETERMINE THE POTENTIAL IMPACT ON NAVIGATION SIGNALS FROM AN NDB:	
AREA A	ALL PROPOSED STRUCTURES WITHIN 200 M OF AN NDB ANTENNA
AREA B	ALL PROPOSED STEEL TOWERS, POWER LINES, METAL BUILDINGS, ETC., WITHIN 1,000 M OF AN NDB ANTENNA, FOR WHICH THE SUBTENDED VERTICAL ANGLE MEASURED FROM THE BASE OF THE NDB ANTENNA STRUCTURE EXCEEDS 3°

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TITLE
FIGURE 31
NAVIGATIONAL AIDS

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 DK	0003	PB

7.2 Status and Current Issues

Aerodrome Standards and Recommended Practices

The layout of YLW's existing runway strip and the configuration of the associated Obstacle Limitation Surfaces have been based on guidelines provided in Transport Canada's *Aerodrome Standards and Recommended Practices (TP312), 4th Edition.* An updated 5th Edition of the *Aerodrome Standards and Recommended Practices (TP312)* was adopted in September 2015, and brings some changes to airport development standard including the following:

- A redefinition of previously used runway Codes 1 through 4 with new reference Groups – ranging from Group I to VI.
- Categorization of Group III (Code C) aircraft with high approach speeds (B737 and A320) to a new category of aircraft, Group IIIB where they are subject to an increased level of safety than previously.
- Segregation of the Take-off/Approach surface into two separate Obstacle Limitation surfaces (OLS) when there is a clearway or a displaced threshold.

Compliance with the new standards is required when the following changes occur:

- Improvements to the level of service affecting any part of the movement area. This would include an upgrade in the runway from non-instrument to non-precision.
- Change of the critical aircraft affecting the dimensioning of OLS. This would include a change in critical aircraft from Group III (Code C) to Group V (Code E) aircraft.

The characteristics of the runway strip and OLS have also been redefined with important changes, as outlined in the following sections.

Runway Strip

A runway strip is a defined area surrounding the runway that is obstacle free and intended to reduce the risk of damage to aircraft running off the runway and protect aircraft flying over it during take-off and landing operations. The layout of YLW's existing runway strip is based on guidelines for a non-instrument Code 4D runway as defined in Transport Canada's *Aerodrome Standards and Recommended Practices (TP312), 4th Edition*. Key characteristics include:

- A width of 75 m as measured from each side of the runway centreline (total 150 m); and
- A length extending 60 m beyond each runway end (total Runway 16-34 length of 2,863 m).

Under the revised *TP312 5th Edition* guidelines, YLW falls under reference Group IV characteristics. As applicable to Runway 16-34, these new guidelines are as follows:

- No changes to the existing runway strip characteristics if the runway remains designated as non-instrument.
- If the runway is re-designated as non-precision, the runway strip's characteristics would need to change as follows:
  - Increase in width to 122 m as measured from each side of the runway centreline (total strip width 244 m); and
  - Increase in extent beyond each runway end to 61 m.

Note that the runway strip configuration characteristics for reference Group IV are the same as those for reference Group V, applicable to larger aircraft such as those expected to fly at YLW in the future.

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For planning purposes, it is recommended that YLW protect for a Group V non-precision runway, following the guidelines defined in *Aerodrome Standards and Recommended Practices (TP312), 5th Edition*.

Obstacle Limitation Surfaces

Obstacle Limitation Surfaces are imaginary surfaces that establish the limit to which objects, such as buildings and natural objects (trees), can project into the airspace associated with an airport. These surfaces are intended to reduce the risk of damage to aircraft during landing, take-off and flyover.

YLW's existing OLS are based on Code 3C non-precision characteristics, as per *TP312 4th Edition* guidelines. These OLS permit instrument approaches and departures to be conducted with the aid of visual aids, ground based navigational aids or satellite based aids that are available at YLW during poor visibility conditions[8]. Approaches to a decision height of 251 feet above ground level can be operated by Group III (Code C) aircraft. This height represents the decision point at which pilots must have the runway within sight or otherwise perform a missed approach. For larger aircraft in the Group IV (Code D) and Group V (Code E) categories, the decision height is 501 feet above ground level. The difference in decision height is due to the characteristics of the OLS, which do not provide sufficient coverage of airspace to ensure obstacle free approaches for aircraft larger than Group III (Code C) aircraft during poor visibility conditions.[9]

As noted previously under updated TP312 5th Edition guidelines, Code C aircraft with high approach speeds, including the A320 and B737 family of aircraft, transition to a reference code Group IIIB. The associated characteristics of OLS for Group IIIB aircraft operating approaches during low visibility conditions encompass a larger area of airspace to match OLS applicable to Groups IV (Code D) and V (Code E) aircraft. This translates into more restrictive height limits on objects over a larger area of airspace surrounding the runway than currently exists.

The updated TP312 5th Edition also introduces the concept of the Take-off Surface as a standalone OLS to apply height restrictions for take-off from a clearway or on the displaced portion of a runway. As noted in Section 7.1, Runway 16-34 is equipped with a clearway at each end and there are two displaced portions.

Currently, there is an OLS (the take-off/approach surface) that extends from each displaced threshold. Aircraft on approach use the displaced threshold to complete a landing clear of obstacles. Departing aircraft are also provided with a take-off climb clear of obstacles if the take-off occurs before the displaced threshold. This would occur under the following scenarios:

- Aircraft taking off on Runway 34 using the distance between the southern end of the runway and the north displaced threshold. This equals 2,406 m (7,895 ft) (Figure 32, following page).
- Aircraft taking off on Runway 16 using the distance between the northern end of the runway and south displaced threshold. This equals 2,650 m (8,694 ft) (Figure 33, following page).

[8] As previously described in Section 7.1, visual aids include the MALSR and medium intensity runway edge lights; ground based navigational aids include the ILS installation and NDB stations. Satellite based aids are based on the Global Navigational Satellite System (GNSS) and are approved by Nav Canada for use by qualified pilots.

[9] Kelowna International Airport, Airport Operations Manual, Edition #6; Section 1.5

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Figure 32: Obstacle Approach Surface for Runway 16 That Can Be Used as a Take-Off Surface for Runway 34

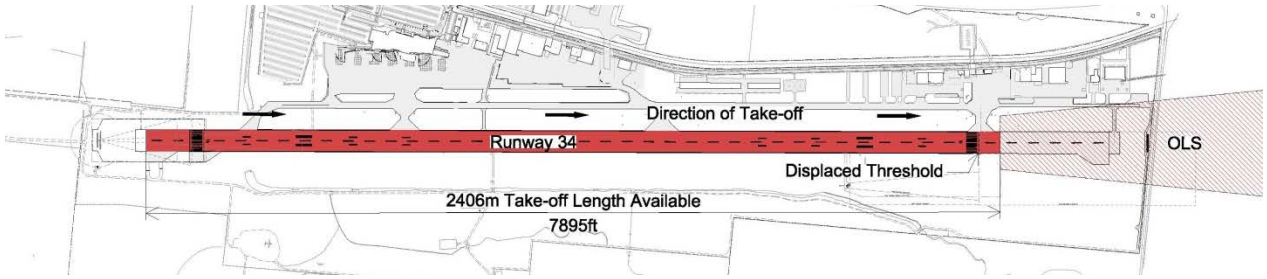
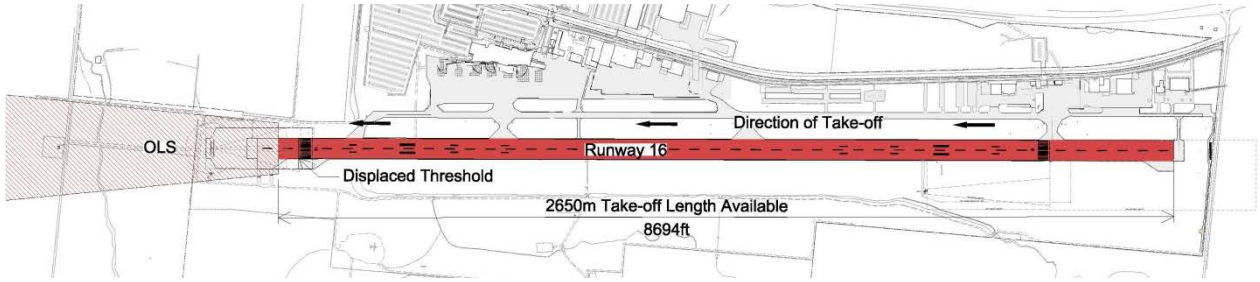


Figure 33: Obstacle Approach Surface for Runway 34 That Can Be Used as a Take-Off Surface for Runway 16



Pilots using the displaced portion of the runway for take-off, however, do not have an associated OLS providing for a take-off climb clear of obstacles[10]. YLW's currently published declared distances (see Figure 25, page 42, for TORA, ASDA and TODA) would result in take-offs occurring within the displaced portions of Runway 16-34 in the following instances:

- Aircraft taking off on Runway 34 that make use of the runway's full length of TORA (8,900 ft) or TODA (9,251 ft).
- Aircraft taking off on Runway 16 that make use of the runway's full length of TORA (8,900 ft) or TODA (9,320 ft).

For planning purposes, and consistent with existing OLS and the recommended runway strip designation discussed earlier, it is recommended that YLW allow for a Group V non-precision OLS and adopt the Take-off Surface standards following the guidelines defined in TP312 5th Edition. (Note that Group V Take-off Surface characteristics are the same as for Group IIIB and IV aircraft.) The wider runway strip and OLS will enable all aircraft to make use of the 251 ft decision height. More importantly, the grouping of B737s and A320s in the Group IIIB category means that these aircraft will require the same runway strip width and object height restrictions as Code E (Group V) aircraft.

[10] As noted in Advisory Circular AC-302-018 Issue 01, Grandfathering at airports pursuant to Canadian Aviation Regulation (CAR) 302.07, "*an Obstacle Limitation Surface applicable to the take-off of an aircraft provides for a standard climb profile that is clear of obstacles and is compatible with the performance characteristics defined as part of the aircraft certification process*".

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Existing Runway Length

Figure 34 summarizes the maximum permissible take-off weight from YLW's existing runway length of 2,713 m (8,900 ft) (under 27.9° C temperature), along with the associated flying range of aircraft that can be expected to operate at the airport over the next thirty (30) years. Figure 35 (following page) provides a graphic representation of the associated geographic distances that can be currently achieved.

On a hot day (27.9°C)[11] at the airport, with the current take-off run available (TORA) of 2,713 m (8,900 ft), most Group IV (Code D) aircraft (A310, B767) and Group V (Code E) aircraft (A330, B787) that could serve YLW cannot take off at full design Maximum Take-off Weight (MTOW)[12]. However, most of these aircraft can reach many destinations in Europe, Asia and South America non-stop, including Frankfurt (4,250 nm), with a full passenger load (i.e. without a cargo payload).

Figure 34: Runway 16-34 Maximum Take-off Weight vs. Range from Runway Length of 8,900 ft

Aircraft	Take-off Weight (lb)[1]	% of Aircraft MTOW	Range (nm) Max Payload Passengers + Cargo	Range (nm) Max Passengers
A310-300	326,000	90.2%	-	-
A330-200	465,000	90.5%	-	-
B767-300ER	384,000	93.2%	3,000	4,800[2]
B787-8 Typ.	440,000	87.5%	3,100	5,500[3]
B787-8 HI Thrust	463,000	92.1%	4,050	6,400[3]
B787-9	490,000	87.9%	2,900	5,900[4]

1. Based on FAA/EASA take-off runway length requirements, standard day + 27°F (STD + 15°C) as published in the Airplane Characteristics for Airport Planning manuals by Boeing and Airbus.

2. 290 passengers all economy class seating configuration as published in the 767 Airplane Characteristics for Airport Planning.

3. 242 passengers mixed class seating configuration as published in the 787 Airplane Characteristics for Airport Planning.

4. 280 passengers mixed class seating configuration as published in the 787 Airplane Characteristics for Airport Planning.

[11] This represents the average maximum temperature for the hottest month of the year (July) at YLW according to Environment Canada weather records for the period 1981-2010.
[12] MTOW includes full passenger, cargo payloads and fuel.

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Figure 35: Runway 16-34 Maximum Geographic Ranges from Expected AGN IV/Code D and AGN V/Code E Aircraft at Runway Length of 8,900 ft

Inner Contour 4,800 nm (B767-300ER)
Outer Contour 6,400 nm (B787-8 HI Thrust)

If take-offs are to be undertaken with the protection of the take-off surface from the existing displaced thresholds, the maximum permissible take-off weight decreases with corresponding reductions in payload or range. A B767-300ER taking off from Runway 16-34 will experience a reduced take-off weight depending on which runway is used:

- A take-off weight of 368,000 lbs (range of 4,200 nm) when departing from Runway 34.
- A take-off weight of 384,000 lbs (range of 4,700 nm) when departing from Runway 16. As noted previously, this runway offers a slightly longer length of runway to the displaced threshold.

With a full passenger load, the reduction in weight will mean taking on less fuel and a reduction in range (Figure 36, following page).

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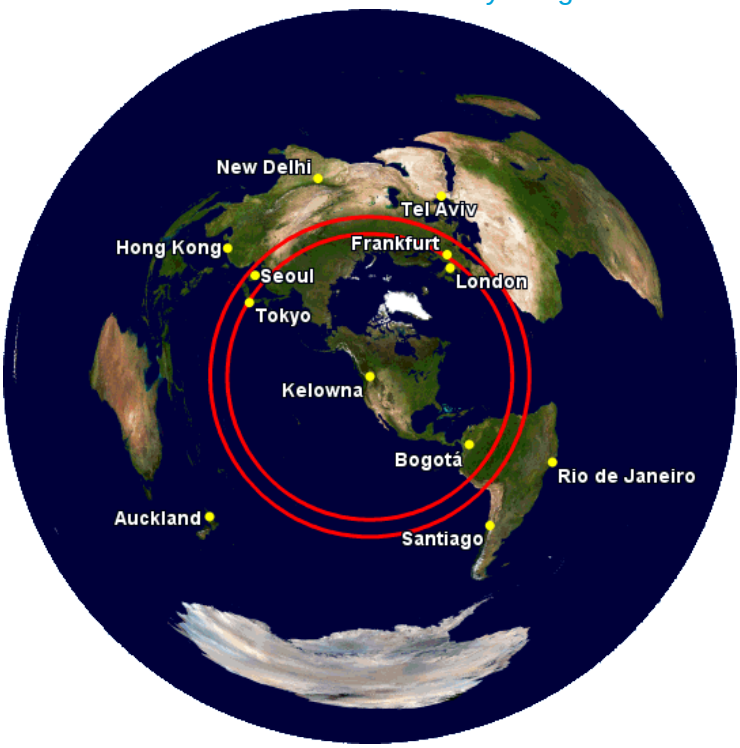
Figure 36: Runway 16-34 Maximum Geographic Ranges for B767-300ER Take-offs from OLS Protected Runway Lengths



Inner Contour 4,200 nm (Runway 34)
Outer Contour 4,700 nm (Runway 16)

For planning purposes, it is recommended that YLW continue to allow for an extension of the runway to position itself for future implementation of the take-off surface and minimize loss of take-off length available to aircraft. The length of the proposed runway extension is discussed later in this section.

Runway End Safety Areas (RESA)

A Runway End Safety Area is a defined area, within the runway strip and at each end of the runway that is intended to reduce the risk of damage to an aircraft running off the runway.

Runway 16-34 is currently not equipped with RESAs since it was not required under TP312 4th Edition. Under TP312 5th Edition guidelines, however, a RESA measuring 150 m in length by 90 m in width would be required at each end of the runway.

For planning purposes, it is recommended that a RESA be implemented at each end of the runway.

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Taxiways

YLW's existing taxiway system is dimensioned to meet Group III (Code C) and Group IV (Code D) aircraft specifications, as well as aircraft specific wingspans as noted in Section 7.1.

Under TP312 5th Edition guidelines, aircraft reference Groups IIIB and IV characteristics will be applicable at YLW for taxiway design. These new guidelines are as follows:

- No changes to previous guidelines if the runway remains designated as Non-instrument and the existing location of Taxiway Delta would remain compliant.
- If the runway is re-designated as non-precision, the strip would need to increase separation distances between the runway centre line and the adjacent taxiways to 122 m. This would mean that Taxiway Delta would not be in compliance and would require relocation towards the west by a distance of 21 m.

For planning purposes, and consistent with the runway designations presented earlier, it is recommended that new taxiway development should provide separations between the runway centreline and the taxiways themselves that are consistent with Group V non-precision runway guidelines defined under TP312 5th Edition. Grandfathering of existing taxiways will require no changes to their configuration.

Long-Term Parking of Aircraft and Parking of Large Aircraft

The airport offers limited space for the long-term parking and storage of aircraft and the parking of Group IV (Code D) aircraft or larger. Based on site visits to the airport, a number of aircraft are typically seen parked in close proximity to each other on the KF Aerospace apron. At times, aircraft are also parked on grass surfaces on the east side of the runway south of the fire training site.

The occasional visit by non-passenger charter Group IV (Code D) aircraft or larger cannot be accommodated on Apron I due to the parking needs of air carriers and their schedules. The use of Apron III is limited by the lack of apron depth and proximity of the transitional surface that requires special attention to ensure non-infringement by aircraft tails. The KF Aerospace Hangar #6 also infringes on wingtip clearances of Group IV (Code D) aircraft or larger entering the KF Aerospace apron via Taxiway Bravo. It is recommended that additional parking be provided at YLW to support Group IV (Code D) aircraft or larger long-term parking activities in the future.

7.3 Runway Demand-Capacity

Analysis of the runway system's current capacity against forecast demand was conducted to confirm adequacy of the existing system against future demand. Runway demand-capacity is a direct function of peak hour aircraft activity. Aircraft mix, approach and take-off procedures and airfield characteristics (e.g., navigational aids, the number of runway exits and availability of taxiway surface) will all influence an airport's ability to meet demand during peak times.

Airfield capacity is largely dependent on the capacity of the airport's approaches and departure routings. In early 2016, Nav Canada replaced two Standard Terminal Arrival Route (STARS) with three new ones, which was expected to increase the capacity of approaches to the airport[13]. Airfield capacity is also dependent on the aircraft mix. An aircraft mix comprised of a high proportion of smaller aircraft permits a closer spacing of aircraft during approach and departure,

[13] According to Nav Canada Customer Briefing Document March 31, 2016.

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which results in a higher airfield capacity. An aircraft mix comprised of larger aircraft requires increased spacing, which decreases capacity. Airfield characteristics including the availability of a parallel taxiway and the number of taxiways also play a key role in airfield capacity since they have a direct effect on runway occupancy times. A runway equipped with a parallel taxiway permits exit taxiways to be positioned at different points along a runway that help reduce the time spent on the runway.

Hourly demand at YLW is significantly driven by pilot training activity and light aircraft flown during the airport's busy periods. Analysis of Nav Canada Aircraft Movement data (NCAMs) obtained for the March 2014 to February 2015 period indicates that:

- 68% of peak hour traffic consisted of local movements (those that remain within the local air traffic circuit);
- 16% of peak hour traffic consisted of FAA Class C aircraft movement (encompassing aircraft with maximum certified take-off weights between 12,500 lbs and 300,000 lbs, including the B737, A320 and Dash 8 families of aircraft); and
- 16% of peak hour traffic consisted of FAA Classes A and B aircraft movements (encompassing aircraft with maximum certified take-off weights less than 12,500 lbs).

These results were further validated by discussions with Air Traffic Controllers at the airport, who confirmed that YLW typically experiences approximately thirty (30) touch-and-go movements per hour during peak hours.

According to FAA Capacity and Delay guidelines published in AC 150/5060-5, an airport with a single runway configuration and aircraft mix representative of the mix at YLW has the following capacity:

- Annual capacity: 230,000 movements
- Hourly capacity:
  - 107 movements per hour under Visual Flight Rules (VFR) conditions; and
  - 56 movements per hour under Instrument Flight Rules (IFR) conditions

Based on the air traffic forecasts summarized earlier in this document, local aircraft movements are not expected to grow substantially over the course of the current planning period:

- Total annual movements are forecast to increase from 74,789 movements in 2015 to just over 114,000 by 2045; and
- Planning peak hour activity for VFR movements is forecast to increase from 42 movements to 49 by 2045. [14].

ICAO recommends developing additional airfield components when forecasts predict a demand greater than 60% of capacity within a five-year period. This is not expected to occur at YLW during the planning period. Therefore, no additional runway capacity-related enhancements are required, such as a second runway or additional exit taxiways including rapid exit taxiways. If aircraft movements start creating capacity constraints beyond 2045, this can be expected to be offset by the use of larger aircraft and the introduction of a parallel taxiway on the east side of the runway, which is planned to provide access to commercial aviation development on the east side of airport lands. Major commercial airports with a single runway configuration are common throughout the

[14] Records of aircraft movements by air traffic controllers do not identify which movements take place during IFR visibility conditions.

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world and handle a significant number of aircraft movements and passenger traffic. Some examples are given in Figure 37.

Figure 37: Single Runway Airports and Aircraft Traffic

Airport	Runway Length (ft)	Annual Aircraft Movements	Annual Passenger Traffic (million)
London-Gatwick Airport, UK	10,879	267,760 (2015)	40.3 (2015)
Xiamen-Gaoqi Airport, China	11,155	180,112 (2015)	20.8 (2015)
London-Stansted Airport, UK	10,003	168,629 (2015)	22.5 (2015)
Fukuoka Airport, Japan	9,186	171,000 (2014)	20.0 (2014)
San Diego-Lindbergh Airport, US	9,400	191,761 (2014)	20.1 (2015)

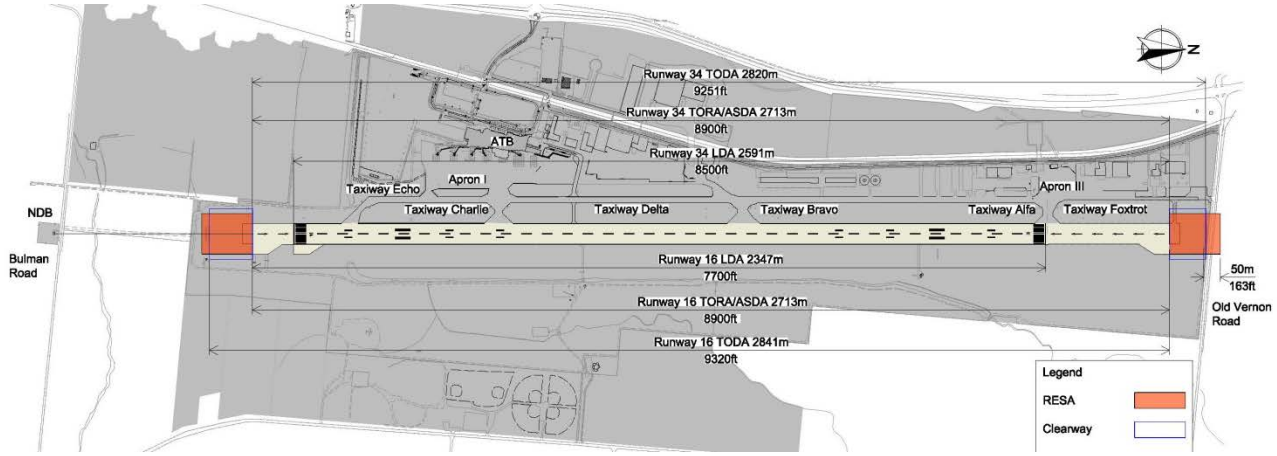
Source: Wikipedia and San Diego International Airport

7.4 Proposed Enhancements

Runway End Safety Areas (RESA)

The introduction of a RESA at each end of the runway is recommended in the short-term period to meet TP312 5th Edition requirements. The existing airport property does not provide sufficient space for a RESA within airport lands north of the runway. This RESA would extend north of the boundary where it would be infringed by obstacles including Old Vernon Road, security fencing, the blast fence and the gravel airside roadway (Figure 38).

Figure 38: RESA Resulting from Implementation on Existing Runway



In order to eliminate these issues, an extension of the runway towards the south by approximately 50 m (164 ft) is recommended. This extension plus the addition of the RESA at the southern end of the runway, in turn, will require an additional land area measuring 1.2 hectares (2.9 acres) outside the current airport boundary (Figure 39, following page).

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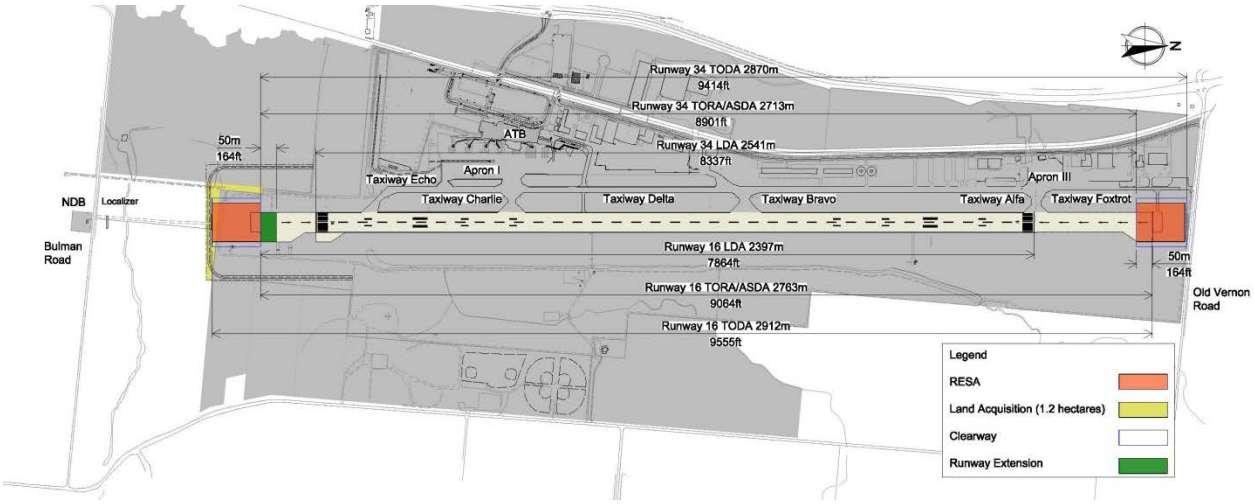
Figure 39: Proposed RESA Implementation



Runway Extension

Master Plan 2025 recommended a runway extension to 10,000 ft, for implementation by the 2020-2025 period. Since adoption of the last Master Plan, YLW has completed partial extensions, including extension of Runway 16 by 396 m (1,300 ft) and extension of Runway 34 by 122 m (400 ft). These extensions were completed by 2008. YLW has continued to plan for the last extension phase. Analyses presented earlier in this section indicate that the previously proposed extension continues to be valid. The extension could be required at an earlier point depending on the grandfathering of the existing characteristics of the runway and OLS. As discussed later, the extension of the runway could help the airport with the implementation of the take-off surface when this OLS becomes a requirement.

Runway analysis reveals that an extension to 3,048 m (10,000 ft) would increase the maximum permissible take-off weights on a hot day (27.9^{o} C temperature) for the aircraft that can expect to operate at the airport over the next thirty (30) years, as summarized in Figure 40 (following page). This would also increase the associated flying range for a full passenger load to include all of Europe.

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Figure 40: Runway 16-34 Maximum Take-off Weight vs. Range from Runway Length of 10,000 ft

Aircraft	Take-off Weight (lb)[1]	% of Aircraft MTOW	Range (nm) Max Payload Passengers + Cargo	Range (nm) Max Passengers
A310-300	335,000	92.6%	-	-
A330-200	476,000	92.7%	-	-
B767-300ER	401,000	97.3%	3,600	5,700[2]
B787-8 Typ.	460,000	91.5%	3,900	6,300[3]
B787-8 HI Thrust	485,000	96.5%	4,900	7,200[3]
B787-9	512,000	91.9%	3,700	6,700[4]

1. Based on FAA/EASA take-off runway length requirements, standard day + 27^{O}F (STD + 15^{O}C) as published in the Airplane Characteristics for Airport Planning manuals by Boeing and Airbus.

2. 290 passengers all economy class seating configuration as published in the 767 Airplane Characteristics for Airport Planning.

3. 242 passengers mixed class seating configuration as published in the 787 Airplane Characteristics for Airport Planning.

4. 280 passengers mixed class seating configuration as published in the 787 Airplane Characteristics for Airport Planning.

Figure 41: Runway 16-34 Maximum Geographic Ranges from Expected Group IV (Code D) and Group V (Code E) Aircraft at Runway Length of 10,000 ft

Inner Contour 5,700 nm (B767-300ER)
Outer Contour 7,200 nm (B787-8 HI Thrust)

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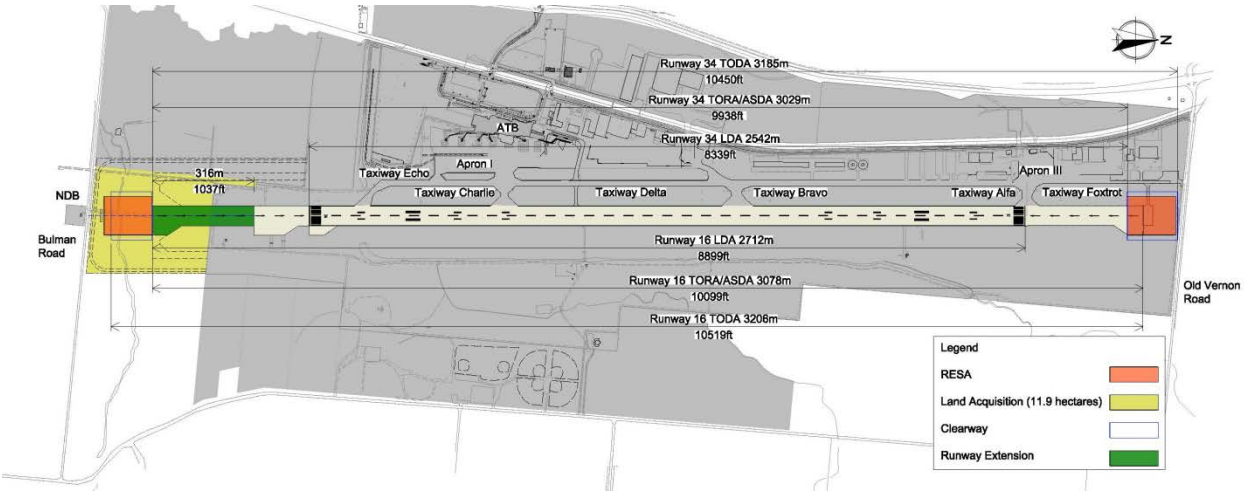
Taking into account the need for a RESA at each end of the runway means that the maximum runway length that can be accommodated between Old Vernon Road and Bulman Road is 3,029 m (9,938 ft). The initial 50 m (164 ft) runway extension towards the south is required to make up for the 50 m (164 ft) of runway length that is occupied by the RESA at the north end. This means an additional 316 m (1,037 ft) extension of the runway is required towards the south to reach 3,029 m (9,938 ft) (Figure 42). This extension would require another relocation of the RESA at the south end, but no further relocation of the localizer on the north side of Bulman Road[15].

Figure 42: Proposed Future Runway Length



Take-off Surface

Implementation of the take-off surface as a new OLS is mandated by Transport Canada when the runway experiences a change in the level of service or change in critical design aircraft, as noted in Section 7.2. Since an upgrade of the runway to non-precision is recommended in this Master Plan, but timing of implementation is uncertain depending on the grandfathering of the existing runway strip and OLS characteristics, it is recommended that YLW allow for implementation of the take-off surface by the end of the planning horizon.

Use of each clearway as a starting point for the take-off surface would protect for take-offs using a clearway. However, due to the proximity of the clearways to the blast fences at each end of the runway and vehicles on Old Vernon Road and Bulman Road, infringement of the take-off surface would require relocation of the clearways to a point near the existing displaced thresholds. This would result in a significant reduction in take-off distance available to aircraft.

Use of the TORA as the starting point instead, would also result in infringement of the take-off surface by the same obstacles. In order to clear the obstacles, the TORA for each runway direction would be shortened to the runway's existing displaced thresholds to ensure non-infringement[16].

[15] Relocation of the localizer to a location 43 m north of Bulman Road will have been completed by the time the runway extension occurs in the long term.
[16] The locations of the existing displaced thresholds is based on obstacle clearance by the approach surface sloped upwards 2.5% towards the approach path of aircraft from a point 60 m from the displaced threshold.

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This was highlighted in Section 7.2 where the resulting TORA for each runway direction was given as follows:

- 2,406 m (7,895 ft) for Runway 34 (Figure 32, page 51); and
- 2,650 m (8,694 ft) for Runway 16 (Figure 33, page 51).

Nevertheless, use of the TORA instead of the clearway as a starting point for the take-off surface allows for a longer take-off length. For this reason, removal of the clearways is recommended once the take-off surface is implemented. Runway analysis has established that take-offs by B767-300ER aircraft using these TORAs would not suffer significant reduction in take-off weight and could still reach western Europe with maximum passenger loads.

If an increase in the TORA is to be achieved, it is recommended that YLW undertake an extension of the runway and/or removal of obstacles, as summarized in the following options in Figure 43.

Figure 43: Options for Implementation of Take-off Surface and Increase in TORA (1)

Option	Runway Extension	Obstacle Removal	TORA[1]	Special Notes
1 (Figure 44)	None	**At north end**: - Lowering of Old Vernon Rd - Removal of blast fence - Lowering of trees **At south end**: - Lowering of Bulman Rd - Removal of blast fence - Lowering of utility poles or burying of utility line - Lowering of trees - Relocation of Rutland NDB station	Runway 16: 2,763 m (9,064 ft) (2) Runway 34: 2,712 m (8,900 ft)	- Further study is recommended to assess obstacle environment north of the runway including hilltop trees and a transmission tower noted in Section 3.4.
2 (Figure 45)	Southward: 316 m (1,037 ft)	None (use of existing displaced thresholds)	Runway 16: 2,650 m (8,694 ft) (2) Runway 34: 2,772 m (9,093 ft)	No change in TORA for Runway 16 because take-off surface still commences at existing southern displaced threshold to clear obstacles to the south.
3 (Figure 46)	Same as in Option 2	Same as in Option 1	Runway 16: 3,078 m (10,099 ft) (2) Runway 34: 3,029 m (9,937 ft)	Same as in Option 1

(1) The options assume that RESAs have been implemented.

(2) Assumes use of runway within the RESA at the north end as a starter strip.

The take-off surface is also sloped upwards at 2.5% and would share the same slope as the approach surface to a point 3,000 m from the starting point.

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Figure 44: Option 1 for Implementation of Take-off Surface and Increase in TORA

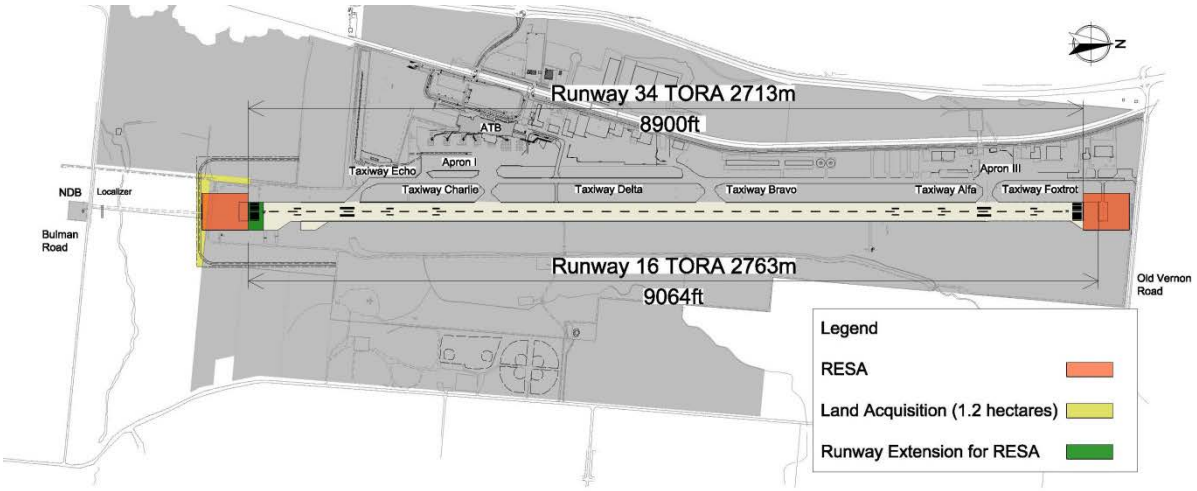


Figure 45: Option 2 for Implementation of Take-off Surface and Increase in TORA

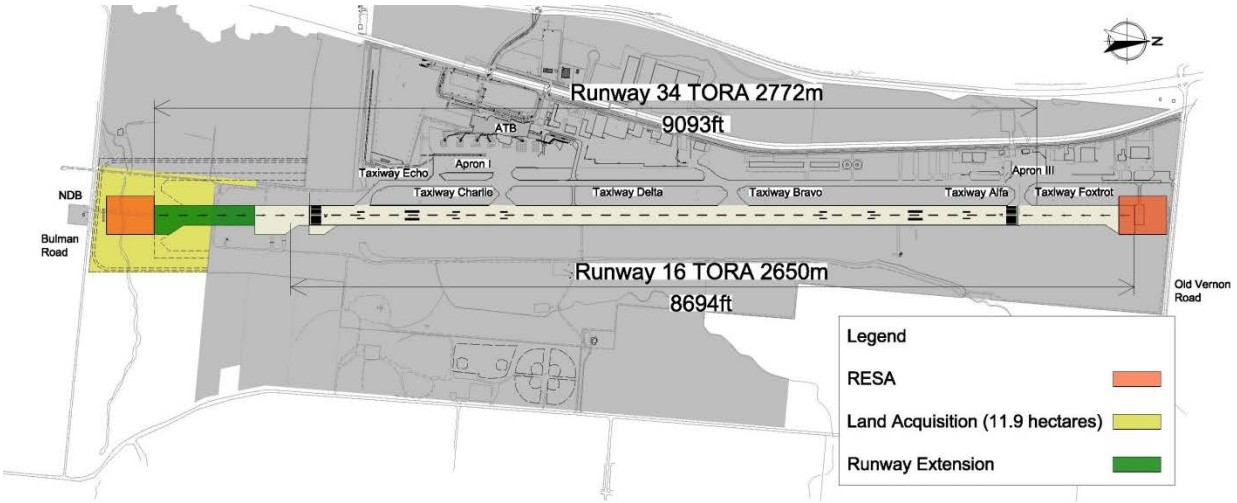
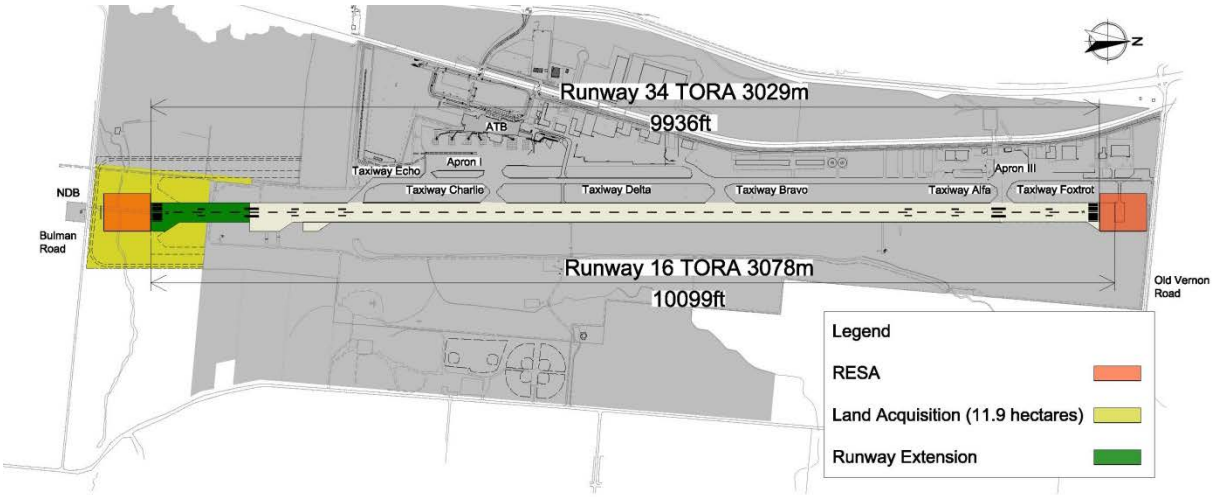


Figure 46: Option 3 for Implementation of Take-off Surface and Increase in TORA



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Until implementation of the take-off surface is required, it is recommended that YLW control the nature of manmade and natural obstacles north and south of the runway to ensure that taller obstacles are not introduced. A plan to remove obstacles should also be considered starting with relocation of the Rutland NDB station and burying of the utility line on Bulman Road. Once the take-off surface is required, it is recommended that YLW adopt Option 2, which would increase TORA for Runway 34 without any need for removal of obstacles on non-airport lands. This option would also enable the airport to concentrate on removal of obstacles south of the runway to regain TORA for Runway 16 as opposed to removing obstacles at both ends of the runway.

Non-Precision Runway Strip

As noted earlier, Runway 16 is equipped with an Instrument Landing System that permits landing limits of 250' AGL for AGN I, II and III aircraft (Codes A, B and C) and 501' AGL for Group IV aircraft (Code D). It is a priority to maintain these landing limits. Consistent with the analysis presented earlier in this section, it is recommended that YLW position itself for a re-designation of Runway 16-34 to a non-precision type runway in the event that the existing 4D non-instrument designation of the runway and 3C non-precision zoning of the OLS are not grandfathered by Transport Canada.

As noted previously, the airport's non-precision approach surface is larger under TP312 5th Edition because Code C aircraft with high approach speeds transition to Group IIIB (to encompass the B737s and A320s)[17].

A widening of the runway strip will be required to match the width of the inner edge of the non-precision approach surface. This will maintain continuity of the area that is clear of obstacles between the approach surface and the runway strip. The new extents of the runway strip and approach surface will result in a new location of the starting edge of the transitional surface that is further away from the runway. Based on the existing location of the displaced thresholds, this will introduce the following obstacle infringements of the transitional surface:

- Hangar on lands occupied by Carson Air, Shell Aerocentre and Fedex;
- Hangar on lands occupied by Skyline Helicopters; and
- Hangar on lands occupied by Southern Interior Flight Centre.

Further investigation of the height of Hangar #6 (KF Aerospace) is recommended to determine if it would infringe the transitional surface. The height of the infringing hangars can be overcome by relocating the Runway 16 displaced threshold and corresponding approach surface to the north end of the runway. This can be achieved by removing the blast fence and lowering of Old Vernon Road to an elevation that ensures that vehicles do not infringe the approach surface. Further study, however, is recommended to assess infringement by hilltop trees and transmission towers north of the runway.

The increased strip width will require that the south end of the airport's boundary be extended to the south and west of the existing strip and the associated perimeter fencing be relocated. .

[17] Specifically, TP312 5th Ed. categorizes AGN IIIB aircraft to include those with an approach speed of 121 knots – 166 knots. This encompasses aircraft that approach the runway at higher approach speeds than other aircraft in the same wingspan category. The AGN IIIB category encompasses primarily jet powered aircraft such as the A320 or B737. The wider runway strip and inner strip width of the approach surface allows for greater deviations that may be experienced by aircraft approaching the runway at high approach speeds.

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Taxiways

Parallel Taxiways

Allowing for the designation of the runway to non-precision will require a separation distance of 122 m between the runway centreline and the centreline of new taxiways to comply with TP312 5th Edition standards.

Taxiway Delta

Analyses completed for *Master Plan 2045* considered a western shift of the entire length of Taxiway Delta from Taxiway Echo to Taxiway Alfa to meet 122 m separation distance from the runway. It was determined however that this could not be accommodated north of Taxiway Charlie due to infringement of the taxiway strip by tenant lots and to avoid costly reductions in lands occupied by the airport tenants.

An alternative option is recommended in which the section of Taxiway Delta extending north of Taxiway Charlie would remain unchanged, subject to operational restrictions in which it would be closed to traffic during poor visibility conditions, requiring instrument approaches to Runway 16. The section of Taxiway Delta between Taxiways Charlie and Echo, however, would be widened to a Group V/Code E width of 23 m with taxiway strip width of 43.5 m and re-aligned to meet the 122 m separation distance to the runway between Taxiways Charlie and Echo to remain open to aircraft during poor visibility conditions. Southward extension of the taxiway to the existing southern end of the runway and extension of the runway to 3,029 m (9,938 ft) would follow this new alignment. This will require relocation of a portion of the long-term public parking stands, but can be incorporated as part of a southern expansion of the terminal building and Apron I.

The re-alignment and re-design of Taxiway Delta would follow the proposed expansion of Apron I and the ATB. Although no change in the taxiway's existing configuration would be needed in the short term, the need for a fourth additional aircraft parking stand in the medium term (2030) would trigger re-alignment and widening of the taxiway as described above. A new taxiway link south of Taxiway Echo would provide an alternative routing to Taxiway Delta and the runway to minimize the risk of congestion at Taxiway Echo.

East Parallel Taxiway

A parallel taxiway on the east side of the runway is also recommended for the future based on a minimum separation distance of 122 m to the runway centreline and a pavement width of 23 m and taxiway strip width of 43.5 m to meet Group V/Code E standards. This taxiway would be required to serve as the parallel taxiway open to traffic north of Taxiway Charlie during instrument approaches to Runway 16. This would make up for the loss of Taxiway Delta north of Taxiway Charlie during operational restrictions during poor visibility conditions. This taxiway would also access commercial development on lands east of the runway as discussed further in *Section 11 – Commercial Development*.

The alignment of the taxiway is impacted by Mill Creek and its Riparian Management Area (RMA). The Mill Creek RMA is designated by the City of Kelowna as a means of protecting the biological diversity and fish and wildlife habitat of the creek. It extends outwards from the top of bank to a distance of 30 m on either side of the creek. The building of permanent structures and removal of vegetation is prohibited within this zone. Currently, airport lands within the Mill Creek RMA are relatively level and vegetation is controlled to deter bird activity as part of the airport's bird hazard mitigation effort. A gravel surface road and weather measuring equipment lie within the RMA on the east side of the creek. A section of runway strip and the glide path antennae array and sensitivity zone also lie within the RMA on the west side of the creek.

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Following discussion with the City of Kelowna, a study was undertaken to determine the siting of the taxiway. Two options were considered as follows:

- Overlapping of the taxiway strip with the Mill Creek RMA; and
- No overlapping between the taxiway strip and the Mill Creek RMA.

The options were intended to assess the impacts of the Mill Creek RMA on the siting of the taxiway. The overlapping of the taxiway strip and the RMA is preferred as it permitted a closer separation distance to the runway centreline and also allowed for a siting of the taxiway on level terrain leaving a significant area of level terrain available for development. It also entailed less non-airport lands within the taxiway strip requiring acquisition.

Conceptually, the development of this taxiway could be broken down into the following phases:

- Introduction of the taxiway in the short-term period connecting with the runway at the southern end of the runway and extending northward to the displaced threshold. This would be required to meet the airport's short-term objectives to develop commercial and general aviation support services on southeast airport lands. Separation distance from the runway would meet the 122 m requirement.
- Northward extension of the taxiway during the medium-term period to a connection with the runway at its intersection with Taxiway Bravo. A new direct connection with Apron I would also be provided north of Taxiway Charlie. Separation distance from the runway centreline would be 189.7 m, which would exceed the 122 m requirement, but would be necessary due to the Mill Creek RMA. This extension would be driven by commercial development of lands on the east side of the runway and would position the airport for an eventual change in the level of service of the runway to a non-precision runway.
- Northward extension of the taxiway during the long-term period to the north end of the runway would complete the taxiway as a full parallel taxiway to the runway. A further extension towards the south would match a southward extension of the runway in the long term.

Development segments will be defined in more detail as determined by YLW.

Other Taxiways

A new taxiway connection between Apron I and Taxiway Delta and the runway is recommended to serve Group V/Code E aircraft taxiing between the runway and Gate 2, which serves as the only gate dimensioned for Group V/Code E aircraft throughout the Master Plan period. This new taxiway, coupled with an expansion of Apron I toward Taxiway Delta, will provide access to Gate 4 by Group IV/Code D aircraft. This will permit closure of Taxiway Charlie in the long-term period.

Extension of this new taxiway to the east parallel taxiway in the medium-term connects Apron I with the east parallel taxiway to minimize runway occupancy time.

Planning to Group V/Code E Standards for Future Expansions

Given the implementation of Transport Canada's new Aerodrome Standards and Recommended Practices, it is recommended that future expansion be planned to Group V/Code E standards.

This will provide the flexibility to accommodate Group V/Code E aircraft, such as the B787 and A350, which represent a growing number and percentage of widebody aircraft worldwide. Larger Group IV/Code D aircraft, such as the A310-300 and B767-300, are aging and will be phased out during the course of the master plan period. Replacement of these aircraft is likely to involve Group V/Code E aircraft.

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8.0 Air Terminal Building

8.1 Current Situation

The current layout of the ATB is depicted in Figure 47 (following page). The overall configuration is characterized by a north-south orientation, with passenger check-in and the public Departures Concourse occupying most of the western side of the building, the passenger Departures Lounge is situated in the southeast quadrant of the building, and domestic/international arrivals bag claim and the CBSA inspections facility occupying the northern end of the structure.

The existing facility incorporates the original 1960's structure and a series of expansions that have occurred to meet the demands of increasing passenger traffic. The most significant expansion occurred in 2000 when the footprint of the original facility was doubled, resulting in the overall layout that is present today. A new Preboard Screening (PBS) checkpoint and food and beverage facilities were added to the building's southern end in 2008; and a new CBSA inspections facility was constructed at its northern end in 2014.

The Terminal currently provides access to ten (10) aircraft stands, five (5) of which are bridged. The most recent apron expansion was completed in 2016 and added two new Code C (B737/A320) aircraft positions at the north end of the building that can also be modulated to accommodate one Code D (B767/A330) aircraft. Passenger access to the two new aircraft stands occurs via a pathway delineated by barriers on the apron from the north end (Gate 3) of the Terminal. Wayfinding and weather protection to these positions has been cited as inconvenient by YLW passengers and air carriers. A new baggage make-up and screening facility is also being constructed as an expansion of the current facility and is expected to be operational by late 2016.

A unique characteristic of the existing ATB is the use of an airside corridor, running along the entire eastern face of the building that provides access from a central boarding area to all individual aircraft gates. The corridor is approximately 200m in length, excluding boarding bridge lengths, and is mostly situated at ground level, with access to boarding bridges via switchback ramps to the bridges themselves. Arriving passengers currently circulate within the same airside corridor and access the baggage claim/public arrivals concourse via a ramped egress point situated toward the north end of the facility. International arrivals require that the associated passenger flows be segregated from other traffic in the corridor via implementation of operational controls and security procedures.

Air carrier check-in activities are located in the central portion of the building. The current configuration partially reflects legacy air carrier check-in processes (check-in counters and baggage belts), while incorporating Common Use Self-Service (CUSS) check-in kiosks. The introduction of kiosks and associated bag drop practices have provided some economies in terms of overall space required for check-in activities, but the functionality of the layout can be strained during peak traffic periods. The current *Flight to 2020* development program will result in a reallocation of space within the existing concourse by 2020. Coupled with additional enhancements to air carrier practices, including upcoming home bag tag printing options and potential introduction of RFID tags in the future, improved functionality and a moderate increase in circulation space will be available.

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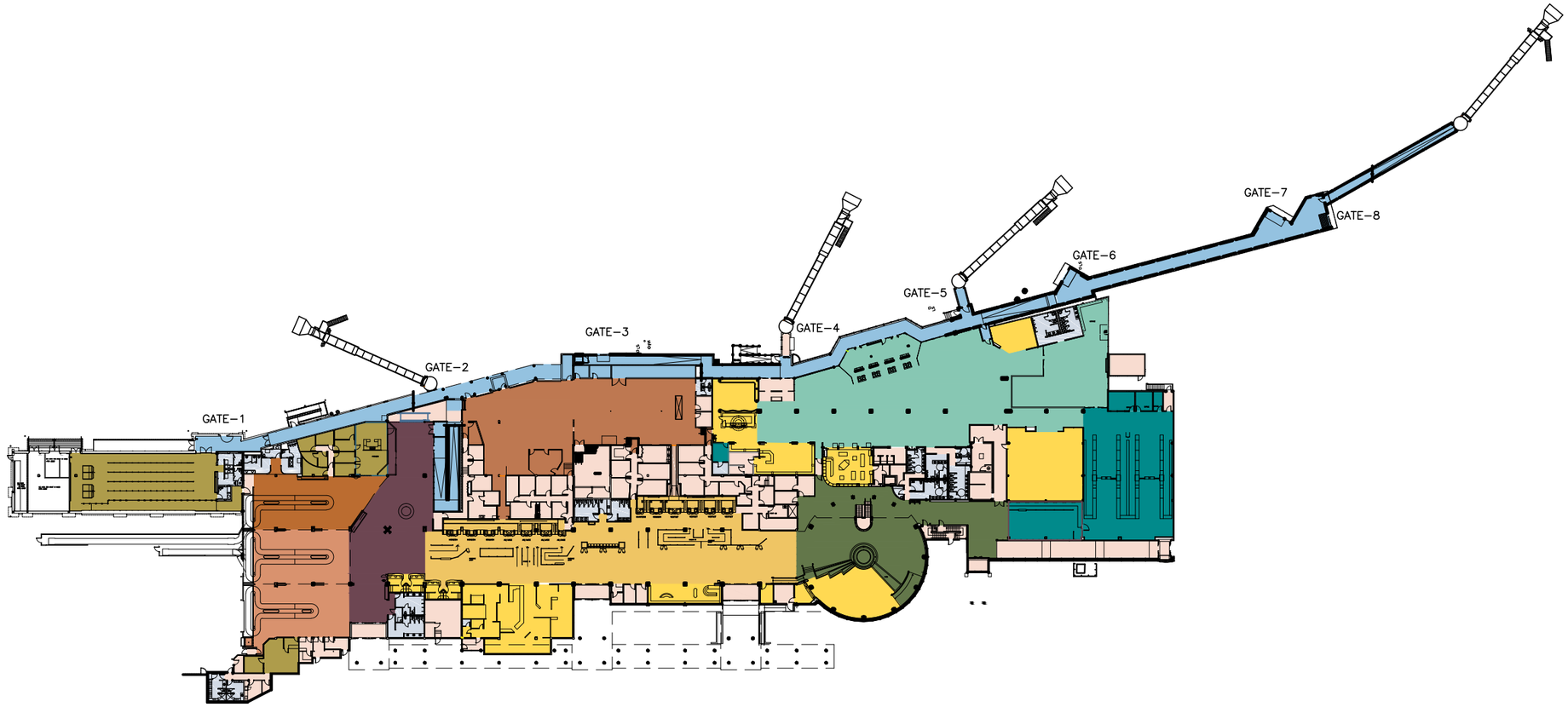

LEGEND

- OFFICES AND INTERNAL CIRCULATION
- DOMESTIC BAGGAGE CLAIM
- INTERNATIONAL BAGGAGE CLAIM
- ARRIVALS MEET AND GREET
- OUTBOUND BAGGAGE MAKE–UP
- CHECK–IN COUNTERS
- CONCESSION
- CUSTOMS AND IMMIGRATION (CBSA)
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- DEPARTURE LOUNGE
- PRE–BOARD SCREENING (CATSA)
- RESTROOMS
- AIRSIDE CORRIDOR

SCALE 1:1000
@11x17

0 25 50m

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
2	PB	2016–09–02	ISSUED FOR INFORMATION
1	PA	2016–07–21	ISSUED FOR INFORMATION

ISSUE REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	*	**

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Airports & Aviation Group
500–745 Thurlow Street, Vancouver British Columbia, Canada. V6E 1V8
Tel: 604–662–3555

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PROJECT
YLW MASTER PLAN

TITLE
FIGURE 47
CURRENT ATB LAYOUT
(2016)

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
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The Departures Lounge is configured around a central boarding area that provides access to the airside corridor. Passenger flows into the Lounge occur via the CATSA Preboard Screening checkpoint at its southern end. The Departures Lounge is significantly undersized for current traffic levels based on demand-capacity analyses completed for this Master Plan (see Figure 55: Updated ATB Functional Program Requirements (2016), page 76). It also presents a relatively cluttered seating arrangement due to its overall configuration and passenger flow characteristics. The positioning of the central boarding area results in crowding in part of the Lounge, while portions are underutilized.

Three baggage claim devices are available in the Arrivals Hall at the north end of the Terminal. One of the latter can be partitioned-off for international arrivals and is directly accessed by the CBSA inspection facility. The existing Hall is characterized by low ceilings and limited circulation space around the baggage claim devices. Under current traffic conditions, the Arrivals Hall also shows signs of congestion and limited functionality during peak periods.

The ATB currently offers food and beverage, retail as well as car rental and tour operator spaces. These are located both in public groundside and airside (Departures Lounge) areas. The layout of the original structure has dictated the location and size of most these concession spaces. As a result, limited space is currently available to expand existing retail activities. A renovation of Departures Lounge concession spaces was completed in 2016. Additional food and beverage spaces and kitchen modifications are scheduled for completion in 2017.

8.2 ATB Aircraft Apron

Aircraft Stand Requirements to 2045

Given the relationship between aircraft stand positioning and boarding gate location, planning for the future expansion/reconfiguration of YLW's existing terminal must consider the capabilities of the aircraft apron to which it provides access.

Nominal schedules for each of the forecasting threshold years (2020, 2025, 2030, 2035, 2040 and 2045) were used to determine future aircraft gating requirements. Nominal schedules represent the most likely aircraft arrivals and departures schedules that can be expected to occur at an airport for peak travel periods (e.g., summer, Christmas time). For the purpose of *Master Plan 2045*, these are based on air carrier schedule information and service strategies available as of June 2016.

Figure 48 (following page) shows the minimum number of required gates by ICAO Code, those that must have swing gate capabilities (capable of handling international arrivals in addition to domestic operations as needed) and the number of remote stands by forecast year. Nominal schedule methodology, gate and aircraft stand requirements are discussed in detail in *Appendix E: Kelowna International Airport Master Plan 2045 Technical Report – Air Traffic Forecasts (March 2016, Updated August 2016).*

The minimum number of gates required to gate aircraft for each of the years was determined considering the number of aircraft requiring a gate over the day. Gate charts with aircraft assigned to particular gates were created to assess stand occupancy on the busiest days. The gate charts allow for buffer times between flights and aircraft removal from gates if aircraft schedules require long ground times or encroach in the minimum buffer times between flights.

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Figure 48: Minimum Gate/Stand Requirements by ICAO Code and Loading Bridge Requirements

Type of Gate / Stand	ICAO Size Code	Existing (2016)	2016	2020	2025	2030	2035	2040	2045
Gates for Aircraft Not Requiring Bridges	B	1	1	1	1	1	1	1	1
	C	3 (+1) [1]	1	1	1	1	1	1	1
Requiring Loading Bridges (or capable of accommodating bridges in the future) [2]	B+ [3]	0	0	0	0	0	0	0	0
	C	4	6	6	6	6	7	8	8
	D (E)	1	0	0	1	1	1 (E)	1 (E)	1 (E)
Total Terminal Gates		9 (+1) [1]	8	8	9	9	10	11	11
Terminal Gates which Must Accommodate International and Domestic Arrivals (Swing Gates)		*2*	*2*	*3*	*3*	*3*	*3*	*3*	*4*
Off-gate Parking Stands Code C		0	0	1	3	4	4	4	5
Total Gates + Stands		9 (+1) [1]	8	9	12	13	14	15	16

[1] One Code C stand for aircraft up to size of Q400 is closed until 2017

[2] Indicates the number of bridges that currently exist, or gates that could be needed for bridge-capable aircraft (such as B737). Bridge-capable aircraft may also be accommodated via ground loading until funding for additional loading bridges is available.

[3] B+ aircraft are ICAO Code B aircraft which use a loading bridge (e.g., CRJ, CR7)

With the currently closed gate becoming operational in 2017, there will be ample gate capacity until after 2020.

With completion of the North Apron expansion in 2016, no new terminal gates are expected to be required until beyond 2035. However, as Terminal gates become increasingly utilized over the next few years, a need will emerge sooner to remove aircraft from gates at certain times of the day to free capacity for active operations. This will create requirements for new remote (off-terminal) stands starting in the 2021-2025 period. The analysis considers most recently available flight schedules, including those for Winter 2017. The current supply of stands takes into account overnight parking as well as requirements for use of north gates for international arrivals.

The Table above also identifies the maximum number of bridges that could be provided, based on the aircraft expected to operate in the nominal schedule that are capable of bridging (e.g. B1900 and Dash 8's are not considered as bridge-capable). This number is provided to identify the maximum bridges that would be needed in the future to guide future capital expenditure decisions. As is the case today, passenger enplanement and deplanement can still easily be accommodated via ground loading operations. Addition and upgrading of loading bridges are to be considered for passenger comfort and level of service purposes in the future.

In addition to these requirements, the Terminal will need to accommodate the arrival of three simultaneous international flights by 2020, with a fourth simultaneous international arrival expected by 2045. This will drive requirements for implementation of dedicated swing gates at the Terminal and corresponding apron layout allocations for corresponding aircraft types.

A summary of total incremental requirements beyond existing capabilities in 2016 is shown in Figure 49 (following page).

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Figure 49: Summary of Incremental Gate and Stand Requirements – 2016-2045

Planning Period	Total Terminal Gates	Total Remote Stands	Total Gates	Incremental Requirements (1)	
				Terminal Stands	Remote Stands
2016-2020	8	1	9	0	0
2021-2025	9	3	12	0	2
2026-2030	9	4	13	0	1
2031-2035	10	4	14	0	1
2036-2040	11	4	15	1	0
2041-2045	11	5	16	0	1
Total Incremental Requirements				1	5

(1) Incremental requirements are those that will existing beyond the total gate requirments identified in the previous five-year period. Some remote stand requirements may be accomodated at existing terminal gates until these are needed for scheduled arrivals or departures.

Long-Term Apron Expansion Options

The existing ATB site is constrained by the location of KF Aerospace's complex of facilities and the existing Combined Operations Buildings (COB) to the north, Mill Creek to the south and the location of the runway/taxiway system to the east.

The last Master Plan provided protection for apron expansion to the south and north of the existing Terminal. Since completion of the last Master Plan, YLW has completed the northern expansion.

The land reserve identified for future apron expansion in *Master Plan 2025* south of the existing Apron is sufficient to meet additional aircraft parking requirements to 2045 and generally remains valid. Expansion of the apron towards the south will however occupy a portion or all of the existing Long-term Parking Lot, depending on configuration.

Two concepts have been developed to address long-term 2045 demand. These are shown in Figure 50 and Figure 51 (following pages). Consideration of environmental issues relating to the floodplain, storm water drainage and glycol management as these pertain to Mill Creek will need to be considered in the overall apron expansion program.

The remote gates can also be used for non-sterile arrivals on small commercial aircraft if needed in the future (i.e., arrivals from small airports that do not have Preboard Screening). This could potentially involve segregating arrivals and departures flows for these flights via a small modular building accessed separately from the ATB – at the south end of the apron for example. The specific location for this operation will be subject to operational demands and will be identified as needed in the future.

Concept 1 (Wraparound Expansion) accommodates the long-term parking stand requirements on the land area reserved for southern apron expansion in *Master Plan 2025*, as mentioned earlier in this section. This configuration involves full displacement of the existing long-term parking lot and avoids infrastructure development over Mill Creek. The wraparound concept also dictates the layout of any future long-term expansion to the ATB beyond to the 2045 period through an L-shaped pier extending around the Terminal curb. While this configuration minimizes impacts with Mill Creek, it also restricts the very long-term potential for further Terminal expansion and

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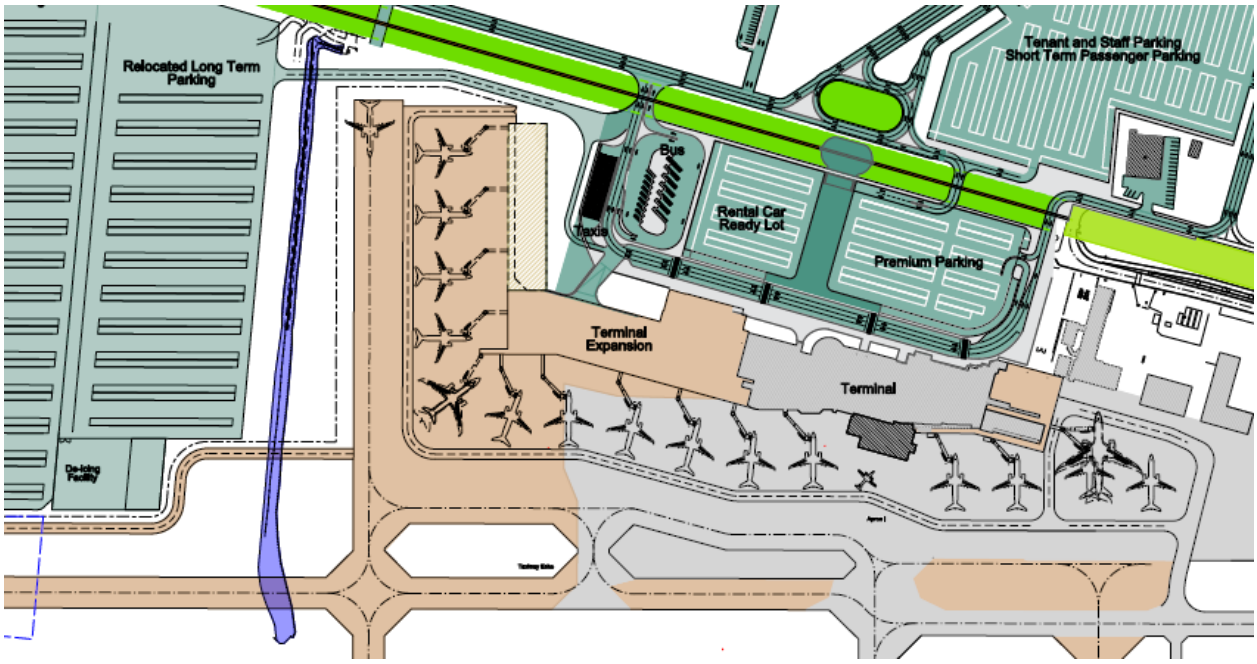
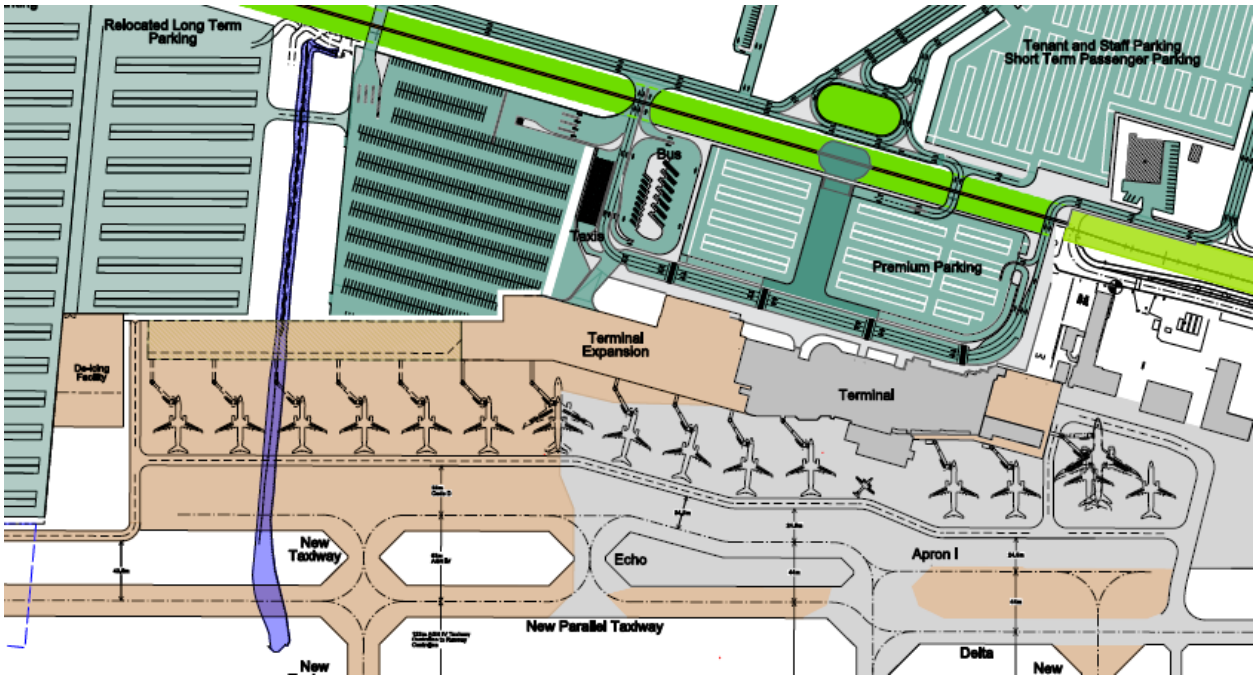
groundside development due to its adjacency to the ATB curb/parking facilities and the future Okanagan Rail Trail on the former CN Rail line.

Figure 50: Apron Expansion Wraparound Expansion - Concept 1



Concept 2 (Linear Expansion) builds upon the existing apron configuration through a linear southern extension. The resulting expanded apron would maintain a portion of the existing long-term parking lot but would require a culvert over Mill Creek, potentially involving further environmental mitigation measures.

Figure 51: ATB Apron Linear Expansion – Concept 2



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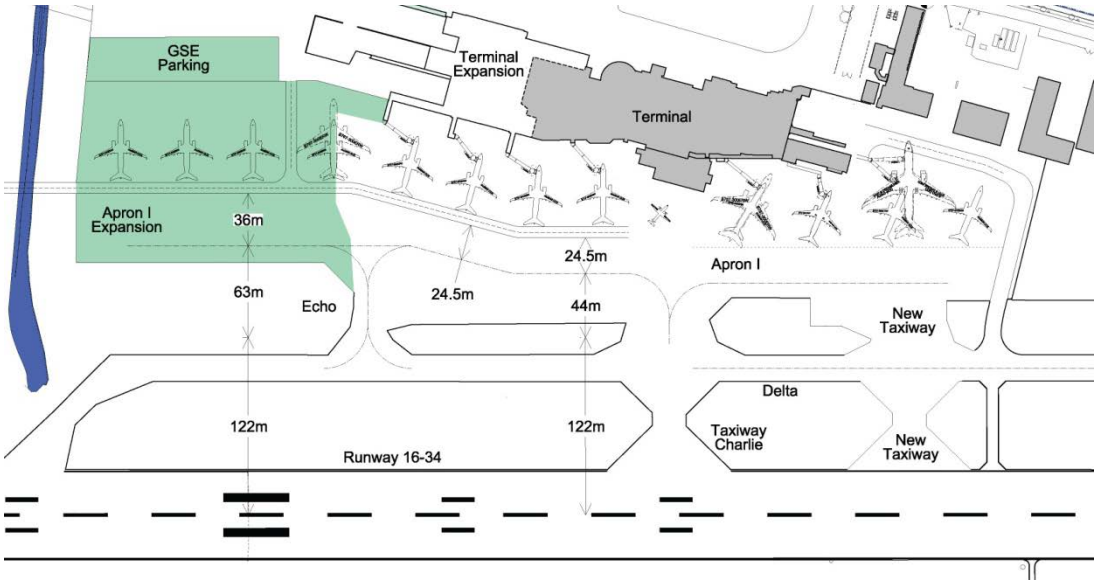
Given the flexibility the Option 2 provides for future terminal expansion, it is recommended that the linear apron expansion option be adopted. Further design and analyses of associated detailed layout concepts will be undertaken following adoption of *Master Plan 2045* to identify the preferred apron and Terminal configuration, in particular taking into account future impacts on Mill Creek.

Short-Term Expansion (Phase 1)

It is recommended that two to three remote aircraft parking stands developed by 2025 to address short-term demand. These can be accommodated through an initial linear expansion of the apron surface up to Mill Creek shown in Figure 52 (below). The initial expansion will be required during the 2020-2025 period to meet forecast demand. YLW will evaluate further options that consider how to mitigate environmental impacts on Mill Creek as part of the more detailed technical planning for the long-term terminal expansion project.

It is also recommended that YLW consider options to improve access to the two new north apron aircraft stands (Gates 1 and 2), including installation of a covered walkway, and addition of a Passenger Boarding Bridge at Gate 3 to enhance the customer experience for users of this end of the terminal.

Figure 52: Phase 1 Apron Expansion



8.3 ATB Expansion

YLW's Current Terminal Expansion Plan

Master Plan 2025 defined the overall concept for development of the ATB to the year 2025 – identifying a southern direction for Departures Lounge and aircraft apron expansion in the future. This strategy has been further refined since adoption of the previous Plan through the *Air Terminal Facilities Program Analysis* (Cohos/Suehiro, 2010), and the *Air Terminal Building Expansion Schematic Design* (Dialog, 2010). The latter is provided in *Appendix G*, these have formed the basis of most terminal projects adopted or planned under the *Drive to 1.6 Million Passengers* and the current *Flight to 2020* development programs. The overall concept that has been adopted by YLW for the long-term development of the facility and displayed to the public in recent years is shown in Figure 53 (following page).

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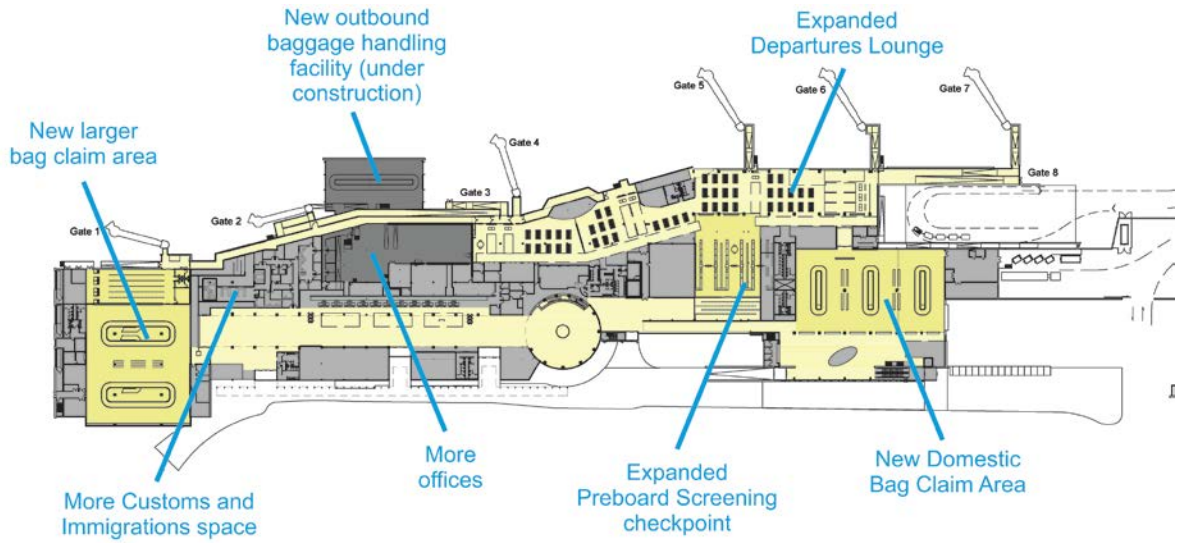
As stated earlier in this document, an Energy Audit/Energy Model and Sustainability Analysis was prepared by Dialog to support the terminal expansion program in 2011. The analysis concluded that the design proposals for the expanded ATB, including internal heating and cooling systems, to produce 60% less CO2 emissions over the existing building even though it will double in size.

Figure 53: Original ATB Expansion Schematic Design (2010)



Source: Dialog (2010)

To ensure the original Terminal concept is capable of meeting changing traffic characteristics and operational demands, validation of the program has been undertaken for *Master Plan 2045*.

Functional and space analyses of the Terminal expansion concept indicate that it continues to hold validity in terms of addressing overall requirements. The staging and sizing of individual expansion components requires updating however to reflect expected demands outlined in the updated air traffic forecasts, and changing operational requirements resulting from changes to air service levels, aircraft types, etc.

The following section presents the results of the updated requirements analyses, along with an updated expansion/reconfiguration to meet demand over the next thirty years.

Demand-Capacity Analysis of Existing ATB

Level of Service

Air Terminal Building planning is typically predicated on the desired Level of Service to be provided by the various elements of the facility (e.g., check-in areas, departure lounge, and arrivals area). 'Level of Service' is a defined planning parameter that is commonly used for Air Terminal planning by the International Air Transport Association (IATA). Within this framework, six (6) levels are defined:

- **Level of Service A** (Excellent Level of Service): Conditions of free-flow, no delays and excellent levels of comfort;
- **Level of Service B** (High Level of Service): Conditions of stable flow, very few delays and high levels of comfort;
- **Level of Service C** (Good Level of Service): Conditions of stable flow, acceptable delays and good levels of comfort;

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- **Level of Service D** (Adequate Level of Service): Conditions of unstable flow, acceptable delays for short periods of time and adequate levels of comfort;
- **Level of Service E** (Inadequate Level of Service): Conditions of unstable flow, unacceptable delays and inadequate levels of comfort; and
- **Level of Service F** (Unacceptable Level of Service): Conditions of cross-flows, system breakdowns and unacceptable delays; an unacceptable level of comfort.

The IATA *Airport Design Reference Manual* (2004) recommends Level of Service C "as the minimum design objective [for terminal planning], as it denotes good service at a reasonable cost".

Many planners have found that six (6) Levels of Service are too detailed and believe that their use creates a false sense of precision. For instance, a passenger is unlikely to notice the difference if a room is operating at Level of Service B or Level of Service C. A more flexible approach is therefore frequently used by airport planners, defining three Levels of Service ranges:

- **Operating below the target level of service**, with delays and congestion that are perceived to be unacceptable (Levels of Service D and F);
- **Operating at or near the target level of service**, with delays and congestion levels that are acceptable (Level of Service C); and
- **Operating above the target level of service**, with few delays and little or no congestion (Level of Service A and B).

For the purpose of the demand-capacity assessment undertaken for *Master Plan 2045*, the more flexible Level of Service range approach is been adopted.

Planning Peak Hour Forecasts

Planning Peak Hour forecasts for 2016, 2020, 2025, 2030, 2035 and 2045 are used as direct inputs for Demand-Capacity analyses and the definition of space requirements for Terminal processors and operational areas. Figure 54 (following page) presents the recommended PPHP values that were identified from analyses of the various peaking characteristics at YLW.[18] The peak hour forecasts developed for *Master Plan 2045* are lower than the peak hours originally used for the Terminal development concept that were developed in *Master Plan 2025*. Those presented below are based on the updated nominal schedules developed to support the air traffic forecasts presented earlier and are believed to be more appropriate for future planning purposes.

[18] These are presented in more detail in *Appendix E: Kelowna International Airport Master Plan 2045 Technical Report – Air Traffic Forecasts; SNC-Lavalin (March 2016).*

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Figure 54: Planning Peak Hour Forecasts 2016-2045

	2015	2020	2025	2030	2035	2045
Annual Enplaned / Deplaned Traffic (millions)	1.65	1.92	2.25	2.54	2.85	3.5
All Enplaning	425	485	560	605	675	780
All Deplaning	445	565	600	630	660	770
Domestic Deplaning	420	485	520	545	565	610
International/Transborder Deplaning	185	235	280	325	340	405

Note: 'All Deplanning' does not represent the sum of 'Domestic Deplaning' and 'International/Transborder Deplaning' as individual traffic sector peaks to not occur at the same time. 'All Deplaning' represents when combined arrivals from the different sectors create a distinct peak that is higher than individual sector peaks.

Updated Functional Program Requirements

The functional program for YLW's Terminal development concept was derived from the modeling of peak hour traffic through various terminal processors. The original functional program for the Terminal concept was detailed in the *Air Terminal Facilities Program Analysis* (2010, Cohos/Suehiro, 2010) and the *Air Terminal Building Expansion Schematic Design* (Dialog, 2010) (*Appendix G*).

An update of the functional program was conducted to validate the existing Terminal development concept for *Master Plan 2045*. A formula-based model (ProTerm) was used for this purpose. The model was developed primarily from the definitions contained in IATA's *Airport Development Reference Manual (2004)*, and was augmented where necessary by formulas developed in other jurisdictions and the experience of the Master Plan team. It is composed of the requirements to achieve Level of Service C, as described earlier.

Figure 55 (following page) provides the results of the updated functional analyses against the current space allocation (including the new Bag Make-up/HBS facility to be completed in 2017). The colour coding on the table results from comparing the requirements in each selected year to the existing facilities:

- **Green** indicates that the level of service provided by the existing facilities is above the target level of service;
- **Yellow** indicates that the level of service provided by an area or processor will be at or near the target level of service (from-5% to plus +10%); and
- **Red** indicates that the level of service provided by the existing processor or area will be well below the target level of service.

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Figure 55: Updated ATB Functional Program Requirements (2016)

	Note	Existing, Incl. New Bag Make Up /HBS (m2)	Updated ATB Functional Program Requirements (m^2)					
			2016	2020	2025	2030	2035	2045
Enplaning								
Departures Concourse Area (incl. check-in queue)		1,447	756	854	968	1,031	1,151	1,321
Check-in Counters (excl. queuing)		175	124	138	152	166	179	195
Preboard Screening Checkpoint		457	429	429	572	572	572	715
Departures Lounge (Usable)	1	793	969	1,105	1,274	1,375	1,544	1,770
Departures Lounge (Underutilized)	1	396						
Concessions, including storage		1,104	1,113	1,358	1,601	1,824	2,041	2,451
Bag Make-up/HBS		1,042	448	511	589	636	714	819
ATO Support/Airline Offices		648	612	712	819	928	1,346	1,553
Deplaning								
Domestic Bag Claim	2	595	691	1,012	1,012	1,012	1,012	1,012
International/Transborder Bag Claim	2	248	321	321	642	963	963	963
CBSA PIL, Secondary and Support		488	371	455	594	632	688	688
All								
Arrivals Lobby Landside		294	236	276	299	305	313	348
Car Rentals/Tour Operators		44	263	320	363	388	401	453
Total All Spaces		**7,731**	**6,333**	**7,491**	**8,885**	**9,832**	**10,924**	**12,288**

Demand less than 95% of Capacity
Demand within 95% and 110% of Capacity
Demand > 110% of Capacity

Notes

1. Existing Departures Lounge measures 1,189 m2, of which 396 m2 at the southern end is underutilized due to layout issues (and no access to boarding gates). This area is not included in the existing useable area but is considered recovered when the Departures Lounge is reconfigured/expanded in the future.

2. Assumes inbound bag operations will be located outside (not included in terminal space requirements).

Key Findings

The updated program requirements, taking into account the new bag make-up / HBS area, confirm that a number of existing Terminal components require expansion by 2025. Critical requirements consist of:

- Expansion of the existing Departures Lounge and bag claim areas (domestic and international);
- More concessions (retail, food and beverage);
- Additional office space for terminal operations and air carrier operations;
- Considerably more space to accommodate car rental and tour operator activities; and
- Expansion of the CATSA PBS checkpoint and the CBSA inspection facility (notably to accommodate additional secondary and support space).

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8.4 ATB Expansion

Validity of the Terminal Development Program

As stated previously, the Terminal development program initiated by YLW since adoption of *Master Plan 2025* has been based on the *Air Terminal Facilities Program Analysis* (Cohos/Suehiro, 2010) and the *Air Terminal Building Expansion Schematic Design* (Dialog, 2010) – see *Appendix G*. Phase 2 of this program consists of the new bag make-up / HBS facility, which has been considered in the previous assessment.

Analysis of the updated ATB Program Requirements prepared as a part of this Master Plan against the Functional Program proposed in 2010, indicates that most Terminal processor and space requirements can be met through to 2045 via the continuation of the original Terminal development concept adopted earlier by YLW. As outlined earlier in this document, this is due to the revised Planning Peak Hour Passenger forecasts adopted for this Master Plan.

Phase 3 Terminal Development

YLW is considering implementing Phase 3 of the ATB Development Program to address the critical requirements presented above. The program currently under consideration would consist of an updated version of the overall Terminal development concept.

A southern expansion of the Terminal building, plus a repurposing of the north end of the facility is recommended as Phase 3 of the Terminal Development program. The updated layout for Phase 3 development is shown in Figure 56 (following page). Completion of this project will generally provide sufficient capacity to address requirements to approximately 2045.

Key elements of the updated program include:

South Expansion

- An expanded Departure Lounge, with improved distribution of individual boarding gate areas;
- Elimination of the existing airside corridor adjacent to the Departures Lounge space and provision of additional boarding gate areas;
- A new domestic arrivals area to provide a more direct flow for domestic arriving passengers through the Terminal and shortened walking distances;
- A new and larger car rental and tour operator counter lobby;
- Increased space for retail, food and beverage outlets in the Departures Lounge;
- Expanded CATSA Preboard Screening area;
- New shipping area receiving area for deliveries; and
- Opportunities to provide additional operations and air carrier office space above the expanded Departure Lounge.

North End Repurposing

- Conversion of the existing Domestic Bag Claim area into a dedicated International Arrivals Hall via portioning of the existing space;
- Expansion of the CBSA facility, when needed, to accommodate larger Secondary Inspection and more office spaces; and
- Creation of a dedicated meet and greet space for international arrivals.

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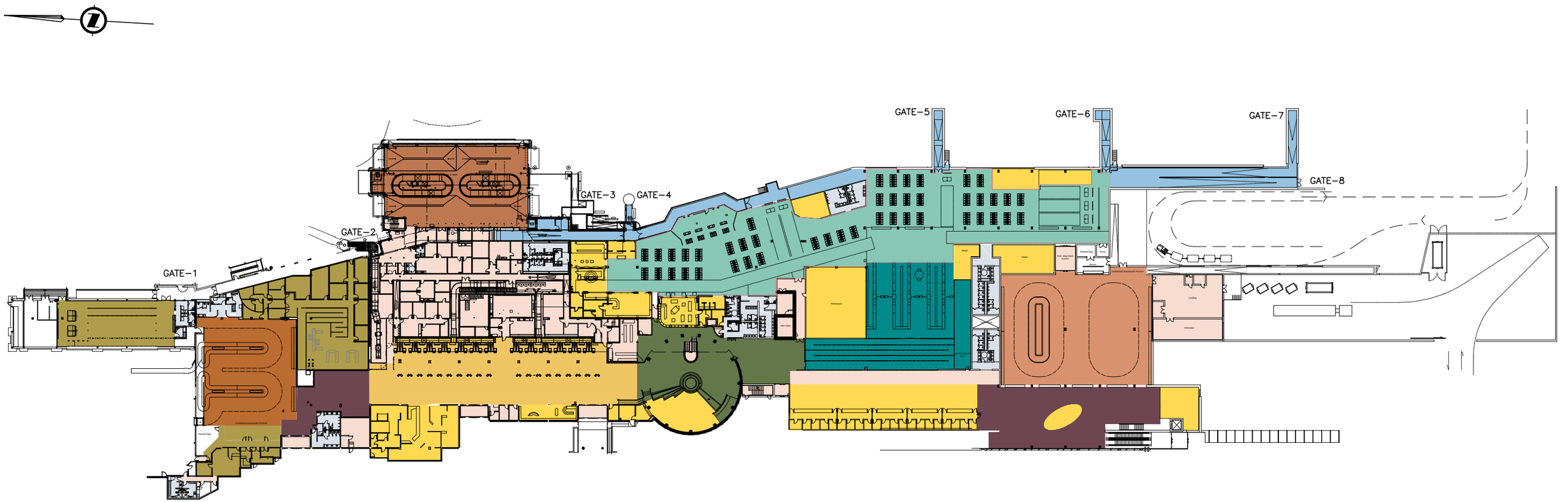

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FIGURE 56
UPDATED TERMINAL DEVELOPMENT CONCEPT

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Completion of the plan will provide improved departures and arrivals flow through the resulting segregation of flows in the airside corridor. This will in turn enable more effective management of domestic and international passenger flows and facilitate establishment of additional 'Swing' gates (domestic/international arrivals) as the needs emerges. New or refurbished Passenger Loading Bridges are also being considered to improve comfort levels and to ensure long-term equipment reliability.

Continued improvements in air carrier check-in processes, including potential home bag tag printing, RFID tags in the future and enhanced bag drop operations, are expected to offset foreseeable increases in space requirements for these activities. It is also recommended that YLW consider a widening of the Departures Concourse in the future to improve circulation and add opportunities for additional food, beverage and retail services

Beyond Master Plan 2045

Beyond completion of Phase 3 of the Terminal development program, the overall configuration of the expanded Terminal can incorporate future expansion beyond the 30-year timeframe of this Master Plan. Provisions are provided in the overall concept to enable further southward expansion of the Departures Lounge (as shown earlier in the apron expansion Options in Figure 50 and Figure 51).

In addition, as shown in the original development concept that has served as a basis to current projects, the Terminal site can also integrate a future north end expansion beyond the planning period to incorporate a larger International Arrivals area. This northern expansion is not expected to be required until after 2045.

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9.0 Access and Parking

9.1 Background

Improving transportation options for travelers, meeters and greeters and airport employees is a priority for YLW and is a cornerstone of its transportation strategy. Expansion of Rapid Bus, ride share and car pool services can reduce the number of single occupant vehicle movements to and from the airport, directly reduce vehicle loads on access roads and demand for surface parking and, consequently, reduce GHG emissions in the region.

Since adoption of *Master Plan 2025* in 2007, however, roadway traffic and parking demand has continued to rise since the increase in transportation options has not followed the strong increase in air traffic at the airport. As a result, YLW has undertaken a number of initiatives to expand capacity of parking infrastructure and improve efficiency of the ground access network in proximity to the ATB. Projects completed over the last few years include:

- An expanded long-term parking lot;
- New employee parking areas;
- Reconfiguration of the Terminal frontage roadway; and
- A relocated/expanded bus and shuttle curb.

With sustainability objectives in mind, YLW has also work to implement other initiatives that will have long-term benefits in terms of Greenhouse Gas reduction and enhanced alternate transportation and recreational opportunities in the region. Cycling trails and walkways have been enhanced along Airport Way, between the ATB and Old Vernon Road, to improve access by alternate access modes for airport and tenant employees.

In addition, the City of Kelowna, other Okanagan municipalities and the Province of British Columbia purchased the discontinued CN railway running from Coldstream to Kelowna in 2015 with a long-term objective of developing it into a multi-modal regional transportation corridor. Named the Okanagan Rail Trail, the project will increase transportation options to the airport site for airport workers and travellers, and create opportunities for integrated recreational tourism products originating directly from YLW. Integration of a regional light rail line within the corridor may also be considered in the future by regional and the provincial governments to increase transportation options within the Okanagan Valley and provide an alternative to vehicle access to the airport.

In the immediate future, it is recommended that YLW encourage usage of other alternative transportation modes, such as electric vehicles and car pooling through provision of charging stations, dedicated drop-off/pick-up points and other incentives. It is also recommended that improvements to rapid transit service to and from the airport be prioritized with the City of Kelowna and BC Transit.

Current Facilities and Infrastructure

Access to the airport is primarily made via Airport Way that connects to Highway 97. The Airport Way/Highway 97 intersection is controlled by traffic lights with one left-hand turn lane from Airport Way southbound on to Highway 97, and with a second lane providing through-access to the Pier Mac development site west of the airport and to Highway 97 northbound. Airport Way also connects to Old Vernon Road, bordering the northern edge of the airport site, which provides an alternate secondary routing into the airport.

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YLW currently offers over 3,200 parking stalls, distributed between the public Short- and Long-Term, Employee and Car Rental lots. Access and egress to all lots and the ATB Curb are provided via Airport Way.

Within YLW's boundaries, commercial lots north of the ATB are accessed via Airport Way, which partially extends west of the former CN Rail corridor until it crosses to the east, north of the current ATB Short-term parking lot. Commercial lots located west of the former CN Rail corridor are accessed via Aerospace Drive that extends north from where Airport Drive crosses over the corridor. A controlled aircraft crossing exists over Airport Way to provide aircraft access to KF Aerospace's lot situated west of the former rail line. Aerospace Drive ends in a cul-de-sac in proximity to the KF Aerospace campus.

Figure 58 (following page) depicts the current layout of YLW's parking facilities.

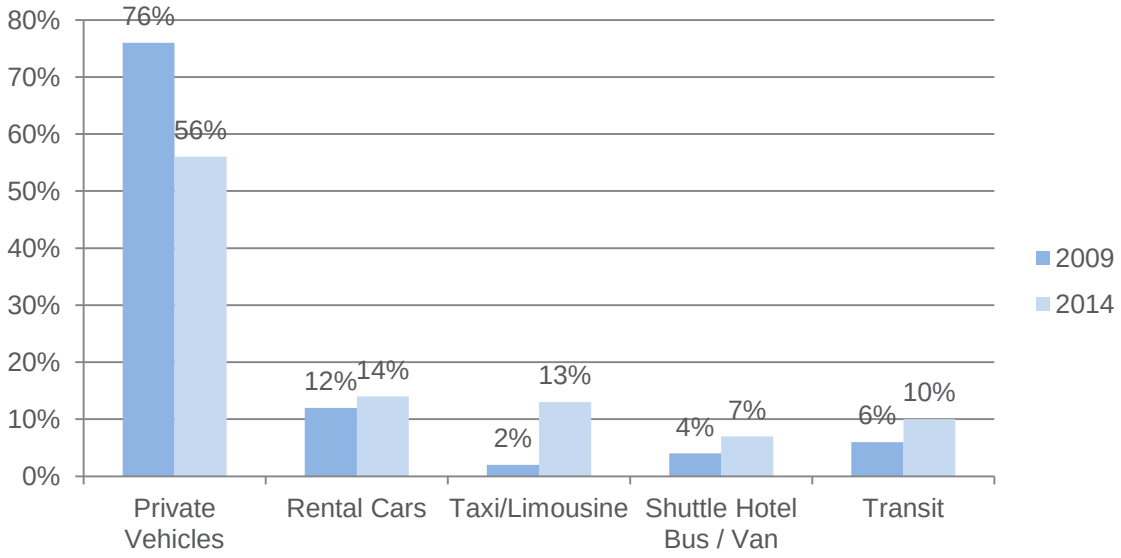
9.2 Demand

Modal Choice

Demand for access and parking infrastructure is largely linked to the degree to which various modes of transportation are used to and from the airport. As depicted in Figure 57 (below), a considerable shift has occurred in the use of private vehicles at YLW over the past five (5) years.

More specifically, the share of private vehicle usage has declined from 76% of total modal choice in 2009 to 56% of total modal choice in 2014. Consequently, all other modes of transportation have seen their shares of total modal choice increasing over the same period. This shift would likely reflect increased tourism traffic through the airport, and some enhancements that have occurred to the offering of public transportation options.

Figure 57: YLW Ground Access Modal Choice 2009-2014



Source: *Kelowna International Airport Customer Satisfaction and Benchmarking Survey* (2009); and *Kelowna Airport Service Quality Study* (2014)

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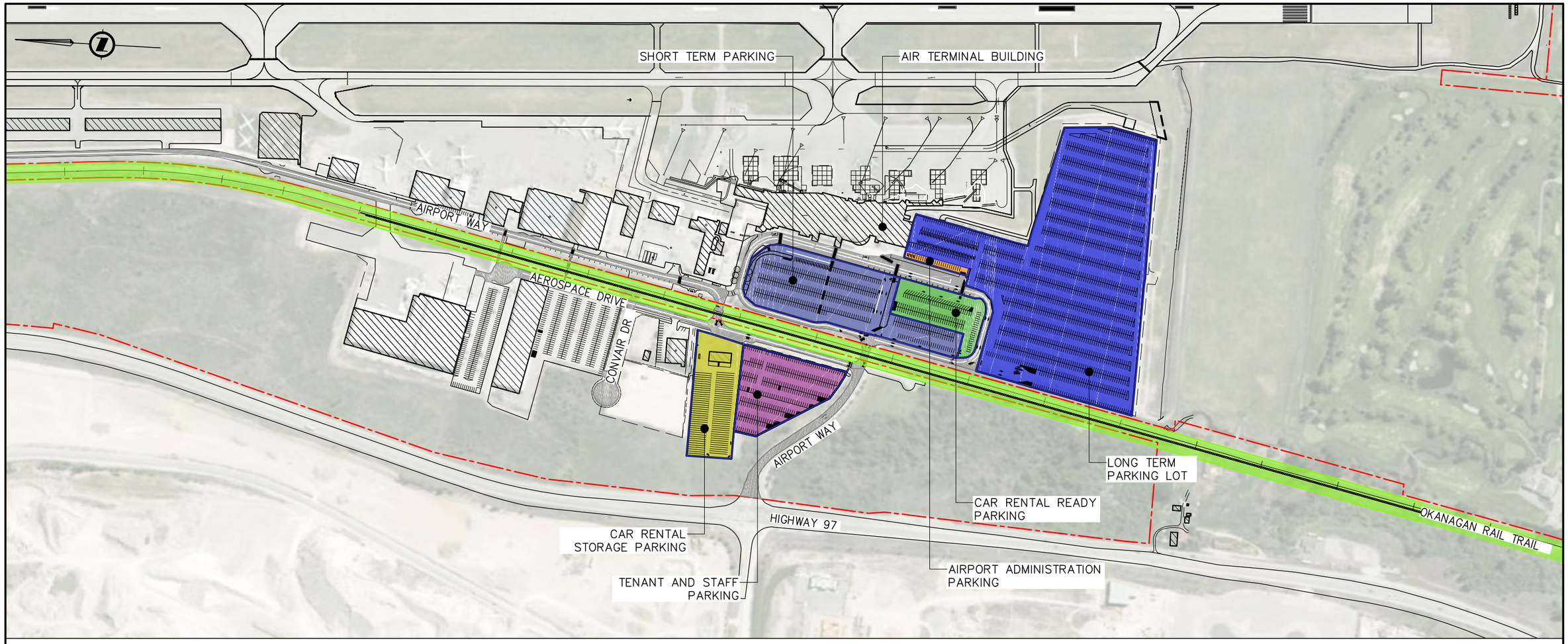

LEGEND

- PAVED ROADS – GROUND SIDE
- BUILDING STRUCTURE
- AIRPORT BOUNDARY

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
2	PB	2016-09-02	ISSUED FOR INFORMATION
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Airports & Aviation Group
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PROJECT
YLW MASTER PLAN

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FIGURE 58
EXISTING ACCESS AND PARKING FACILITIES (2016)

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
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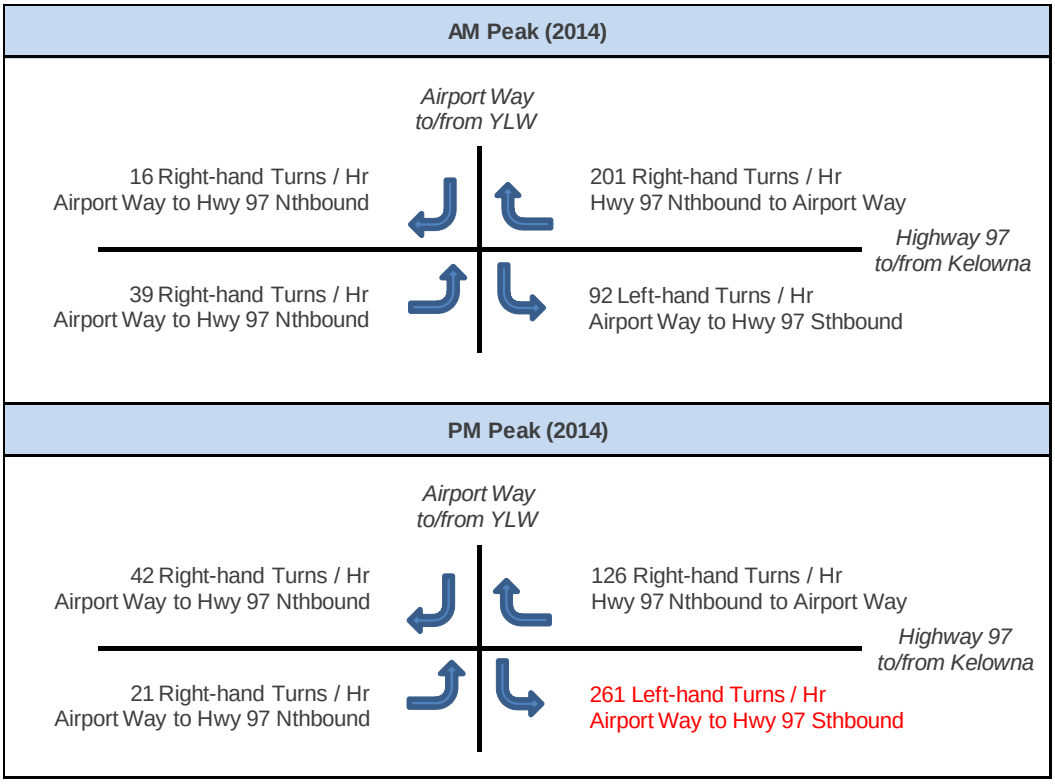
Road Access Demand

The Highway 97/Airport Way intersection is a critical access point to the airport site. During peak periods, congestion occurs at this intersection, in particular during the afternoon rush hour when passenger traffic merges with end of workday traffic from airport tenants. As air traffic grows and additional commercial development occurs at the airport, this congestion and delays can be expected to grow.

A key consideration for future planning is the traffic volume turning from Airport Way on to Highway 97 and vice-versa. Based on traffic counts taken in 2014, on average 350 vehicles used the intersection to access or leave YLW to/from Highway 97 during the morning peak hour, and an average of 450 vehicles used the intersection during the afternoon peak hour.[19] The predominant flow of vehicular traffic is to and from Kelowna. Peak traffic volumes using the intersection for airport access and egress in 2014 are shown in Figure 59.

The existing single turn lanes between Airport Way and Highway 97 provide a theoretical capacity of approximately 300 vehicles per hour. Based on current average usage of the southbound turning lane of 260 vehicles per hour (see below), the existing configuration is approaching capacity limits during afternoon peaks. Given this traffic volumes, it is recommended that a reconfiguration of the intersection be undertaken over the short-term period to ensure that appropriate levels of service continue to be provided, and that traffic delays to and from the airport are minimized.

Figure 59: 2014 Peak Hour Traffic Volumes – Airport Way and Highway 97



Source: MMM Group Limited (2016)

[19] Excludes traffic that originates from the Pier Mac site.

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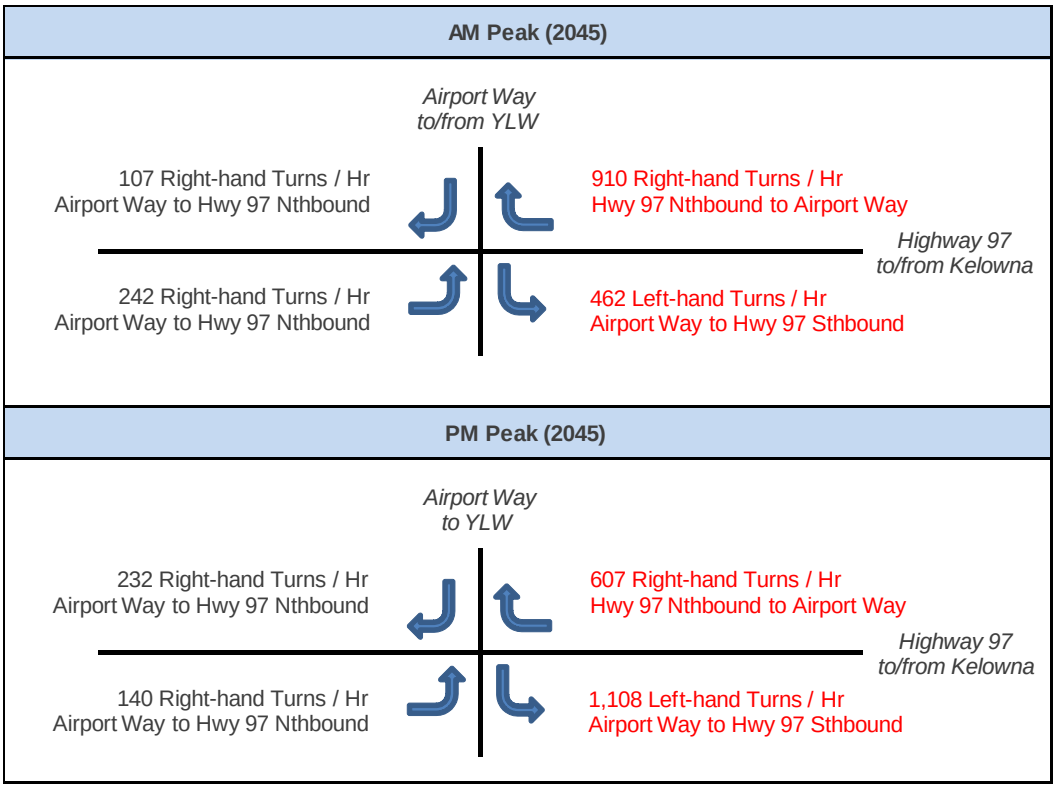
By 2045, Highway 97 traffic is expected to double during peak periods. This will be accompanied by even greater growth of traffic on the Airport Way intersection given forecast air traffic growth, expanded aviation activities and new groundside commercial activities that are planned for the west side of the airport. Forecast peak traffic volumes using the intersection for airport access and egress in 2045 were calculated by MMM Group Ltd. to support initial analyses for future intersection upgrades. These are shown in Figure 60 (below). The forecasts are based on information currently available with regards to trip generators in the region and known transportation projects, and exclude scenarios where potential expansion in rapid transit services (i.e., Rapid Bus service, Light Rail) and shared transportation options may considerably shift modal choice.

Overall traffic volumes using the intersection to access or leave the airport are forecast to reach up to 2,000 vehicles per hour during peak periods, with approximately 1,000 vehicles per hour accessing or departing the airport during these periods. Without significant improvements to rapid transit services to and from YLW in the near future, the intersection will require a considerable reconfiguration over the medium-term period to ensure it meets long-term demand to the end of the 2045 planning period and beyond. Detailed traffic modeling will be required however to determine the effects of transit improvements on associated YLW road and parking demand.

Figure 60: 2045 Forecast Peak Hour Traffic Volumes – Airport Way and Highway 97



Source: MMM Group Limited (2016)

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Forecast Parking Demand

Although the share of public modes of transportation has increased over that of the private mode in relative terms, absolute demand for Short-, Long-term and Employee parking continues to increase as a reflection of growth in passenger traffic and employee levels.

Figure 61 (below) provides a summary of forecast parking demand at YLW to 2045, and highlights, in red, when shortfalls are expected to emerge based on existing capacities. The forecasts were developed based on a review of the existing utilization patterns, annual traffic growth, and anticipated peak period traffic characteristics, and exclude scenarios where significant improvements to rapid transit or shared transportation services occur at YLW. The methodology and inputs are outlined in the *Appendix H: YLW Master Plan Parking Demand Analysis Technical Report (SNC-Lavalin, July 2015).*[20]

Figure 61: Forecast Parking Demand 2016-2045

	Current Capacity	Forecast Demand						
		2016	2020	2025	2030	2035	2040	2045
Long Term Parking	1,983	1,550	1,860	2,175	2,400	2,650	2,925	3,230
Staff and Tenant Parking	326	125	150	175	195	215	240	265
Administration Lot	54	To be integrated with Staff and Tenant Parking when Terminal is expanded						
Short Term Parking	464	275	330	385*	425*	470	520	575
Premium / Valet Parking	Integrated with Short Term Parking	70	85	100*	105*	115*	125*	140*
Rental Car Ready	113	160	190	225	255	280	310	340
Rental Storage	316	To be relocated north of KF Aerospace (excluded from Total)						
Total	**3,256**	2,180	2,615	3,060	3,380	3,730	4,120	4,550
Total Forecast Shortfall (Over Existing)		n/a	n/a	n/a	124	474	864	1,294

* Assumes capacity shortfall for a combined Short-Term and Premium/Valet Parking lots operation. Individually, Short-Term parking requirements can be accommodated in existing lot up to approximately 2035, but relocation of Premium/Valet parking as of 2025.
Note: 'Red' text denotes when forecast demand is expecedt to exceed current capacity.

Based on this analysis, without significant enhancements to rapid transit or shared transportation services to and from YLW, demand for existing parking infrastructure can be expected to start exceeding existing capacity as of 2025:

- An additional 200 parking stalls will be needed in the Long-Term Lot by 2025. This will be exacerbated by the proposed south apron expansion into portions of the existing lot during the 2020-2025 period. Expansion of the Long-Term lot south of Mill Creek will be needed to take into account demand requirements and the encroachment from the apron expansion.

[20] Note that the demand forecasts originally outlined in the July 2015 report were further refined during the subsequent development of more detailed analyses for this Master Plan report.

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- The combined Short-Term and Premium/Valet lot operation will experience capacity strains by 2025 as well. Extraction of Premium/Valet usage from this lot would theoretically create sufficient Short-Term parking capacity in the existing lot up to approximately 2035. Relocation of the Premium/Valet parking to an alternate location is not recommended since ATB proximity is a major driver for the enhanced revenue stream this product provides to YLW. Re-allocation of the surface lots located within proximity to the ATB for highest and best usage will be needed to ensure levels of service afforded by each parking product reflect location, terminal access and associated parking fees for each lot.
- The rental car ready lot is already over capacity during peak periods. Congestion in this lot is currently managed by the car rental companies that operate at the airport. This requires additional personnel to transfer cars to and from rental car storage lots in a timely manner. A larger and more efficient layout is required.

While some reallocation of existing surface lots could provide some interim solutions to forecast shortfalls, the reallocation will not address overall requirements by the medium-term planning horizon, between 2026 and 2035. To ensure YLW provides the necessary capacity, enhanced revenue streams and the augmented levels of services that are important to the community, it is recommended that a comprehensive parking infrastructure redevelopment program be implemented by this period. The proposed redevelopment program is outlined in Section 9.3 (below).

Minimizing Future Ground Access Movements

As stated previously, a pillar of YLW's Greenhouse Gas strategy is to actively reduce demand for single occupancy vehicles by making their alternatives more attractive. Improved transportation options such as enhanced rapid transit services, and expanded ground transportation services (e.g., shuttles, ride sharing, etc.) will contribute to reducing overall demand in the future. YLW will work towards enhancing modal choices, will continue to monitor how expansion of these options may reduce vehicular demand to and from the airport, and minimize Greenhouse Gas emissions that originate from airport-related vehicular traffic.

It is recommended that additional transportation demand modelling be undertaken in the future with regional authorities, including BC Highway and BC Transit, to identify how these services may traffic levels on Highway 97, reduce access and parking infrastructure requirements.

9.3 Proposed Redevelopment

The expanded and enhanced parking facilities that YLW has completed since 2007 have addressed the strong passenger traffic growth that has occurred at the airport. As outlined above, the increased vehicle traffic has however strained access from Highway 97 and along Airport Way, and will soon result in greater demand for parking facilities than currently is available in the existing parking lots if alternate transportation modes are significantly expanded in the next few years. Consultation with the community has also indicated strong support for improving airport access and parking services at the airport. In parallel with Master Plan development, YLW has developed a detailed groundside redevelopment program to address expected requirements and the desired level of service enhancements for its access and parking infrastructure. As stated earlier, it is recommended that this program be implemented in the short-term period.

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Terminal Access and Proximate Parking

YLW's main access point and ATB environs are characterized by topographic limitations, the presence of the former CN Rail line that will be converted to the Okanagan Rail Trail and the location of the ATB itself. These elements significantly limit how and where access roads and parking facilities may be located and/or expanded. A groundside development plan has been proposed to address the requirements identified earlier in this report, taking into consideration prevailing site constraints. Details of the Plan are included in *Appendix I: Kelowna International Airport Landside Redevelopment Plan (Airbiz; December 2015, updated March 2016*).

Figure 62 (following page) depicts the preferred option and overall capacity of each proposed reconfigured/expanded lot. Highlights of the preferred option include:

- Reconfiguration of the road network accessing the terminal and parking lots;
- Segregation of terminal traffic from traffic accessing commercial lots on Airport Way and Aerospace Drive through implementation of two traffic circles west of the proposed Okanagan Rail Trail;
- Development of a highly visible and dedicated bus/shuttle loop in proximity to the Domestic arrivals area to accommodate increased transit services and tour shuttles in the future;
- Expanded Short- and Long-term Parking Lots; and
- Creation of a Terminal Plaza to facilitate pedestrian traffic through the front Terminal lot to the Okanagan Rail Trail;

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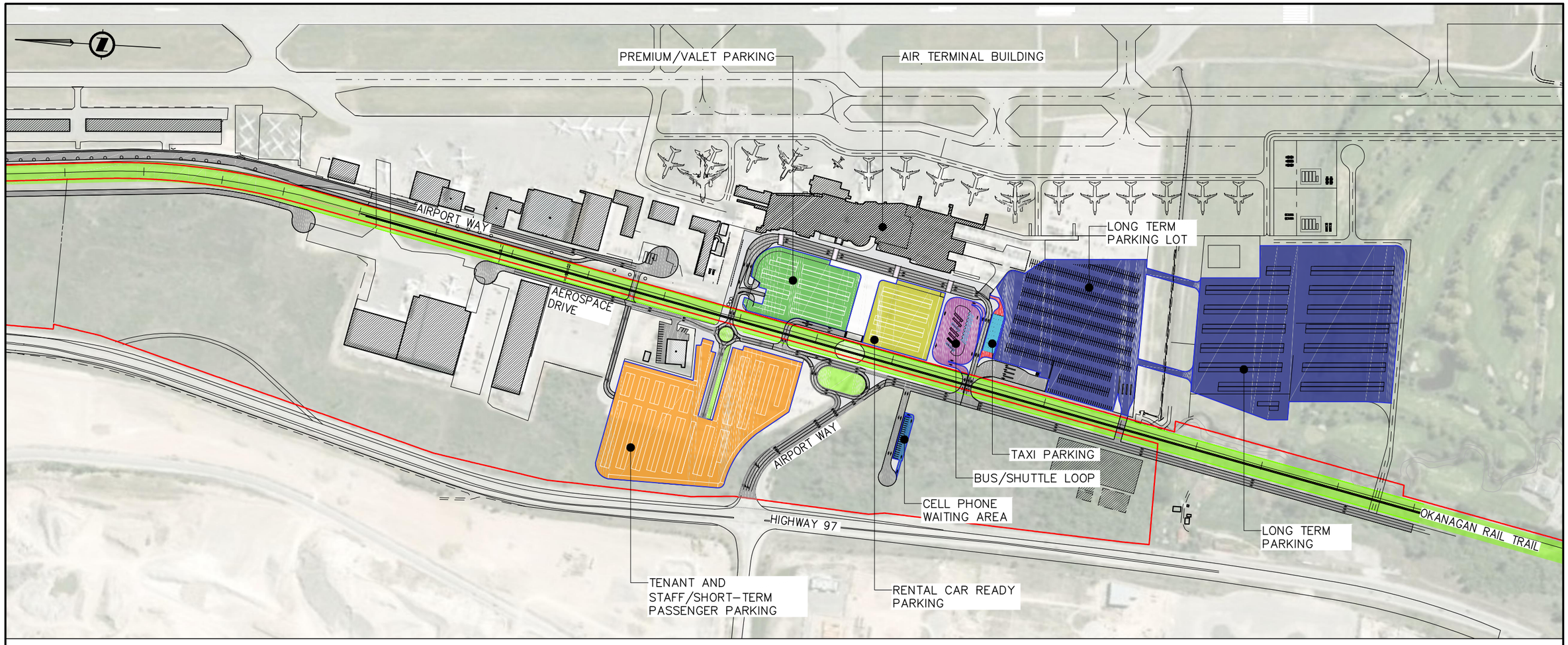

LEGEND

- PAVED ROADS – GROUND SIDE
- BUILDING STRUCTURE
- AIRPORT BOUNDARY

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Airports & Aviation Group
500–745 Thurlow Street, Vancouver British Columbia, Canada. V6E 1V8
Tel: 604–662–3555

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YLW MASTER PLAN

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FIGURE 62
PREFERRED GROUNDSIDE ACCESS AND PARKING DEVELOPMENT

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- Establishment of a cell phone lot to reduce vehicle idling on the existing ATB Curb; and
- More efficient and expanded Car Rental lot layout with a dedicated access in proximity to the main airport entry traffic circle.

The reconfigured roadway design provide options to better manage traffic flows to tenant lots on the west side of the airfield, to direct northbound traffic to Old Vernon road during peak traffic periods and reroute traffic away from the Terminal if necessary in times of increased vigilance.

It is recommended that YLW design the bus/shuttle loop as a central and integrated component of its Terminal frontage area to facilitate connectivity between the terminal, rapid transit and regional transportation options.

With an overall maximum build-out capacity of the proposed lots of close to 4,900 stalls, overall parking lot demand requirements can adequately be met to the end of the planning horizon in 2045 through staged implementation of the preferred layout. The staging of the development may however be reduced if YLW and regional transportation strategies successfully contribute to greater use of alternate transportation services and a resulting reduction in demand for surface parking.

The initial phase of development of the Landside Plan will consist of:

- The reconfiguration of the main access roads and creation of traffic circles;
- The implementation of the cell phone lot;
- The creation of an expanded West Lot that will eventually accommodate relocated Short-term and consolidated Tenant/Staff parking lots; and
- Relocation of the Car Rental Storage area to a new groundside location north of the KF Aerospace facilities that are west of Aerospace Drive.

The initial development phase will address the most pressing road access issues and will release the lot in front of the terminal for redevelopment to accommodate the dedicated bus/shuttle loop, and enhanced Premium/Valet and Car Rental Ready Lots during a second phase of development. All projects are anticipated to be completed by 2025.

Full build-out of the Terminal and West Lost will create approximately 1,900 stalls, compared against the 1,300 stalls currently available. The West Lot will be initially developed in a manner that matches forecast demand for combined Short-term and Tenant lot operations. It is recommended that, as part of the upcoming detailed planning to be undertaken, YLW assess optimal allocation scenarios for these parking functions across these two lots to ensure initial surfaces are adaptable to increased use of green and alternative transportation options and are not overbuilt. These include allocations for electric vehicle stalls and ride sharing pick up and drop off spaces in the proposed Premium Lot in front of the Terminal.

As YLW proceeds to more detailed technical planning and design of this development plan, it is recommended that vehicle charging stations, prioritization of ride-sharing and green vehicle parking areas (e.g., electric vehicles, cycling), and innovative pricing strategies that encourage use of alternate transportation modes be implemented.

Long-term Parking

Surface Lots

Accommodating demand for long-term vehicle parking continues to be important in addressing user expectations and revenue streams. Under its current configuration, YLW's Long-term lot is not expected to meet demand by 2025. This will be exacerbated by the requirement to expand the south apron into a portion of the existing facility to accommodate additional remote aircraft parking stands. The encroachment is expected to reduce the capacity of the existing lot by approximately

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800 stalls. Further, if significant improvements to rapid transit and regional transportation options to the airport are not achieved, YLW will need to ensure it can meet demand for approximately 3,200 long-term parking stalls by 2045.

To address forecasted short-term demand (to 2025) and release the portion of the existing Long-term lot for the apron expansion anticipated to occur during the 2021-2025 period, an expansion of the Long-Term parking lot via the development of a second lot south of Mill Creek and adjacent to the existing lot is recommended. The overall configuration of the lot is shown previously in Figure 62.

The reconfigured/expanded Long-term Lot will offer an initial capacity of 2,200 stalls, providing sufficient capacity to approximately 2025. The initial development should be undertaken in coordination with the proposed apron expansion, and should be completed as part of the *Landside Development Plan* outlined above by approximately 2025.

The Plan calls for an additional 450 stalls to be developed between 2026 and 2035, with another 580 stalls anticipated to be added by 2045. The expansion phasing is shown in Figure 63. Concerns about increased storm water runoff from surface lot development may be mitigated through use of materials that allow direct infiltration. Current technologies provide limited success in the use of these materials in climates that experience freezes in the winter time. It is recommended however that YLW monitor technological advancements in this field for potential use in future parking lot design and engineering.

Figure 63: Long-term Lot Expansion Phasing

Note that demand for long-term parking may also be addressed through the creation of Park and Fly/Jetset-type facilities. Current site constraints regarding potential lot locations within airport boundaries, such as earthworks requirements and/or extended shuttle routes, do not render this option optimal for implementation as a YLW-operated service.

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Parkade Feasibility

Consideration has been given to the development of a parkade in proximity to the ATB. Preliminary analysis indicate that a structure 5-7 stories in height would be required to meet demand requirement presented above, and would cost in the range of approximately $80 million. When compared against capital requirements associated with the development of surface lots, a parkade would be considerably more expensive to construct. Parkade development is therefore not recommended for pursuit as a YLW-paid initiative during the period covered by *Master Plan 2045* given the airport's objectives of maintaining cost efficiency. A parkade could however be developed in the future as part of an integrated groundside commercial project situated in proximity to the ATB.

Highway 97 and Airport Way Intersection

The demand analysis presented earlier in this section indicates that YLW's main access point, the Highway 97/Airport Way intersection, is currently close to reaching full capacity and that upgrades to the intersection will be required.

BC Highways is currently undertaking an upgrade to the Highway 97 corridor south of YLW between Highway 33 and Edwards Road by increasing the corridor to six (6) lanes and upgrading intersections along the project corridor. The project is slated for completion in 2017. Additional upgrades are in planning stages for the section extending past YLW to account for increased traffic to and from the airport site, as well as the expansion of the Pier Mac development to the west of YLW.

A diamond interchange was originally proposed for implementation at the Highway 97/Airport Way intersection by 2015 in *Master Plan 2025*. This project requires broader integration with BC Highways' strategy for Highway 97 upgrades and may be integrated into the future upgrade of this adjacent corridor. YLW will continue to provide input on the highway planning process to help ensure this future infrastructure reflects the evolving needs of airport users.

As an initial enhancement, it is recommended that YLW implement dual left-hand southbound and northbound turning lanes from Airport Way to Highway 97 to increase capacity of the intersection until a more extensive solution may be put on place. The upgraded intersection is depicted previously in *Figure 62: Preferred Groundside Access and Parking Development* (page 88). Based on projections taken from the 2045 forecasts of vehicular traffic at this intersection, and subject to more detailed forecasts, the dual left-hand turning lanes would provide sufficient southbound capacity until approximately 2025-2030.

It is recommended that a significant reconfiguration of the intersection be undertaken in this period to provide peak time capacity of up to 2,000 vehicles per hour arriving and departing the west side of the airport site. The projected demand is based on extrapolation of the 2045 forecasts prepared by MMM Group Ltd shown earlier in Figure 60: *2045 Forecast Peak Hour Traffic Volumes – Airport Way and Highway 97* (page 84). The original diamond interchange concept remains valid but some enhancements should be considered to accommodate the expected significant growth of southbound traffic. Two initial enhanced concepts are presented below for preliminary planning purposes:

- **Concept 1 – Southbound Flyover** (Figure 64) consists of a modified diamond interchange that incorporates a southbound flyover extending from the main airport traffic circle on Airport Way over Highway 97 to just north of University Way. The main Highway 97/Airport Way intersection would accommodate vehicular movements for all other directions and integrate an

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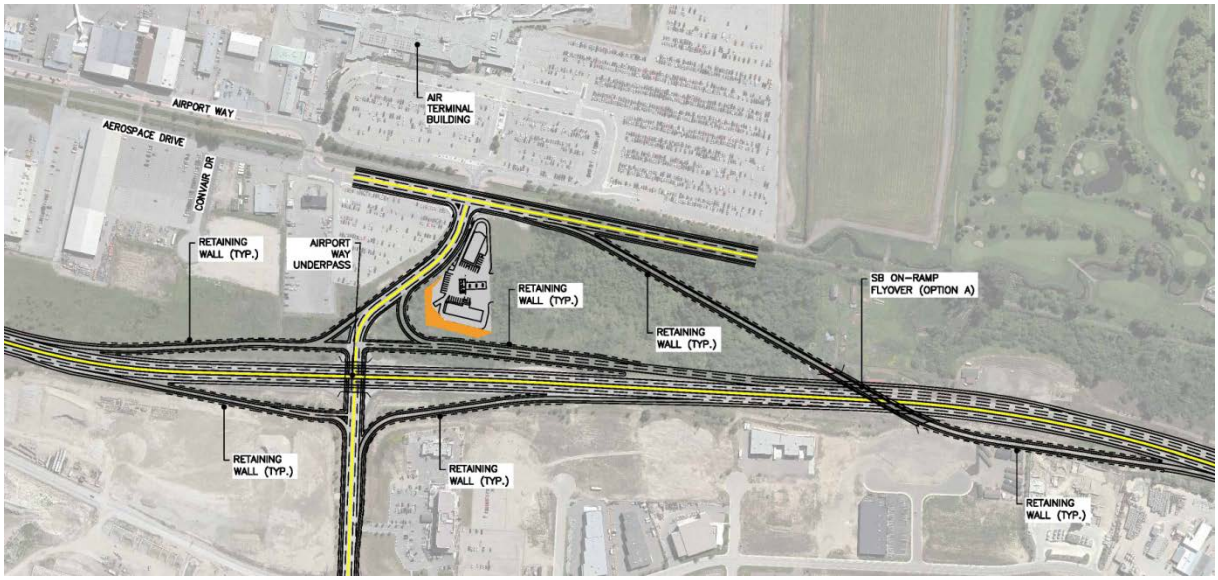
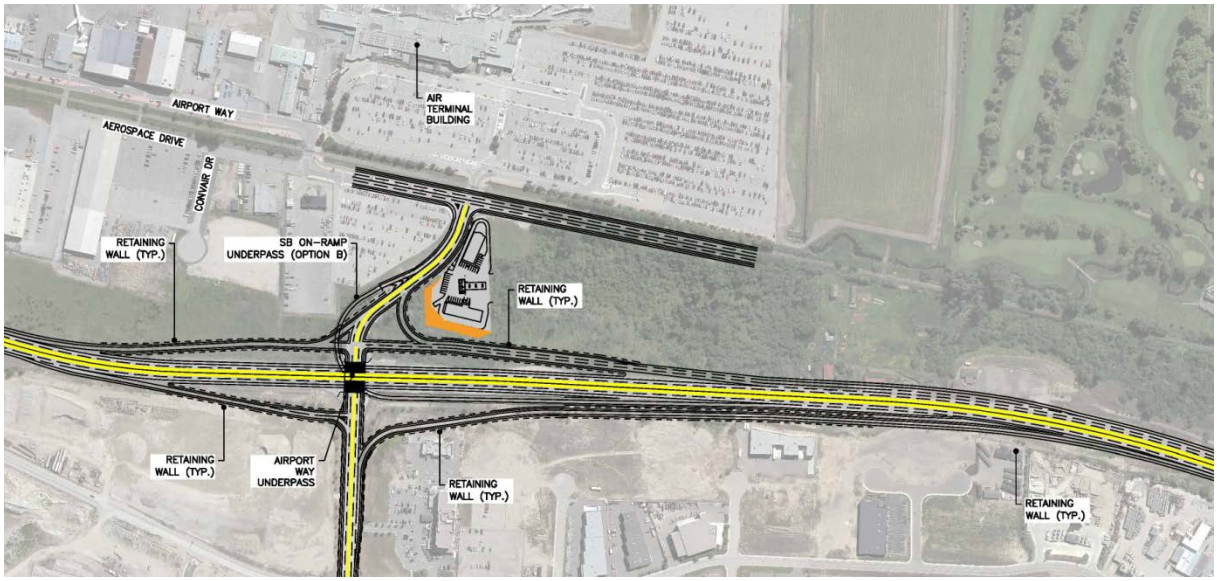
underpass under Highway 97 to facilitate flows originating north of YLW and to the Bow Mac site.

Figure 64: Highway 97 / Airport Way Intersection Upgrade Concept 1 – Southbound Flyover
(For preliminary planning purposes only)



› **Concept 2 – Southbound Tunnel** (Figure 65) replicates the overall intersection configuration described in Concept 1, but moves the southbound traffic flow to a tunnel that would be located below the Airport Way underpass. Southbound traffic would merge with Highway 97.

Figure 65: Highway 97 / Airport Way Intersection Upgrade Concept 2 – Southbound Tunnel
(For preliminary planning purposes only)



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10.0 Operations and Support

10.1 Current Characteristics

Airport Maintenance and Airport Rescue and Fire Fighting Facility

YLW's maintenance and Airport Rescue and Fire Fighting (ARFF) facility is locally referred to as the Combined Operations Building (COB). This complex is located north of the ATB, and west of Apron I. It occupies an area measuring approximately 9,200 m^2 and comprises the following buildings and facilities:

- A main building/fire hall with garage space for the parking of two fire trucks and one emergency response command vehicle;
- A garage for the parking of one Striker 3000 fire truck;
- A heavy equipment garage for the storage and servicing of heavy vehicles, including snow removal equipment;
- Paved parking and movement area for manoeuvring of large vehicles; and
- Fuel tanks and pumping facilities for fueling of YLW's Airport Operations fleet of vehicles.

The configuration of the existing compound is a legacy of the airport's historical development pattern and is currently not optimal as it does not provide the necessary equipment storage capacity required to address present day operational needs.

A key issue of the existing configuration is the current location of the Striker fire fighting vehicle garage. The existing location west of aircraft stands/Gates 1 and 2 has been the subject of study to ensure that rescue and fire fighting vehicles are capable of meeting emergency response times. These require that rescue and fire fighting vehicles achieve a response time not exceeding three minutes to any point of the runway in optimum visibility and surface conditions. Recommendations, however, call for two minutes to any point of the runway whenever possible and three minutes to any other part of the aircraft movement area.[21]

The recent north apron expansion has resulted in relatively circuitous routing of fire fighting vehicle out of the garage in the event of an aircraft emergency situation on the airfield. This entails a routing with two 90 degree turns around parked aircraft to access the runway and taxiways. While this provides an emergency response time to runway ends within the regulated three minutes, the routing is less than optimal.

Aviation Fueling Facilities

Aircraft refueling at the airport is undertaken by mobile fuel trucks. A fuel tank farm is located at the northwest corner of the airport property near the intersection of Airport Way and Old Vernon Road. Aircraft fuel trucks (bowsers) transport aircraft fuel to the ATB Apron (Apron I) via Taxiway Delta.

At many airports, fuel is supplied to aircraft stands via ground hydrants at each gate fed by an underground pipe system. The implementation of such a system is costly and limits the flexibility of

[21] Response time is defined as the time between the initial call and the time when the first responding vehicle is in position to apply foam.

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the apron layout to the location of individual hydrants. This system is therefore not recommended for use at YLW.

Aircraft De-icing Facilities

Aircraft de-icing takes place on-gate at Apron I, Apron III and other aprons operated by tenants.

Glycol storage tanks are situated south of Apron I, on the east facing perimeter of the Long-term Parking Lot. Glycol delivery to the storage area currently occurs via a routing through the existing Long-Term Parking Lot to a controlled access gate feeding the storage tank area.

Ground Service Equipment

Parking space for ground service equipment (GSE) on the airside has decreased since the Terminal and apron expanded towards the north. The terminal expansion introduced new space for CBSA primary inspection services, while expansion of the apron introduced two new aircraft parking stands for Code C aircraft, such as the B737. Prior to the undertaking of these expansions, approximately 2,400 m^2 of pavement surface was available for the parking of GSE. This includes designated parking spaces in front of the former ramp-ready room and the glycol storage tanks located between Apron I and former Apron II (the latter was integrated to the north expansion of Apron I). The loss of this area has been made up to a limited degree with a reconfiguration of GSE parking space at each of the gates adjacent to the Terminal building and at the south end of the Terminal apron in the vicinity of gate 10. Nevertheless, a dedicated parking space is required to recover lost parking spaces and provide additional space for future growth in GSE.

Non-Passenger Screening – Vehicles (NPS-V)

Transport Canada has mandated the enhancement of Non-Passenger Screening (NPS) to include the screening of vehicles and their passengers prior to entering the Critical Restricted Area (CRA). The NPS-V program is managed and operated by the Canadian Air Transport Security Authority (CATSA) across Canada to ensure the air transportation industry remains secure, competitive and in line with international standards. NPS-V introduces the random screening of vehicles, drivers, and occupants travelling airside to compliment non-passenger screening efforts in the terminals. NPS-V is operational at all times when the access to the CRA is required. The screening process occurs on a random basis with some exceptions that require full mandatory screening. Vehicles and people are screened separately. To meet the regulatory requirements, YLW has constructed a facility in a temporary location in the Combined Operations Building complex at Gate 2, and will be activating the long-term location on Airport Way in the coming years.

10.2 Proposed Development

Siting of COB/Fire Hall

The airport is completing an evaluation of the future site of the COB/Fire Hall. The study has identified three following options for future locations:

- Preservation of existing site;
- Reconfiguration of the existing site to include the Cargo One building next to the heavy equipment garage; and
- Relocation to a site on the east side of the runway.

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The current COB location is currently favored from an operational perspective given its proximity to the ATB, Apron I and other critical manoeuvrings areas. It also allows more rapid access for Emergency Response Service vehicles to access the ATB – the location of the majority of medical emergencies at the airport.

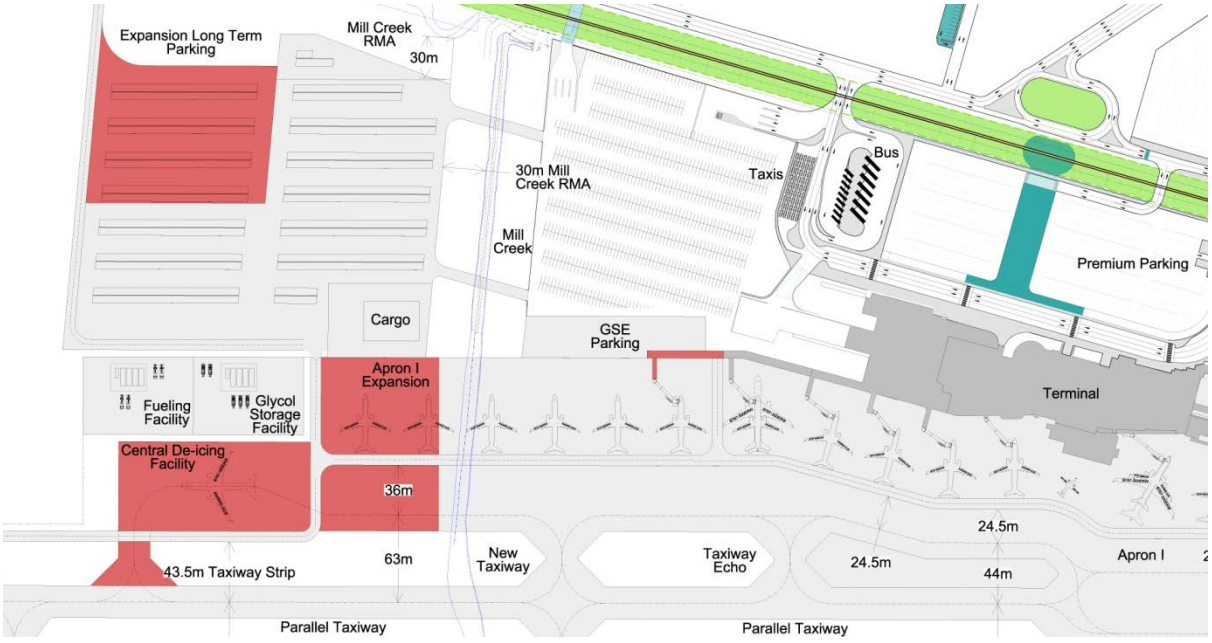
Preservation of the existing site is recommended. It should be reconfigured and expanded over the short-term period (2016-2025) to account for improved or more efficient response times. To provide for this expansion, it is also recommended that YLW work with the adjacent Cargo One owner to acquire the building.

To provide the expansion of the ATB complex beyond the planning period (beyond 2045), it is prudent to protect a land area that can accommodate a relocated COB/Fire Hall in the very long-term period. It is recommended that an area of land measuring 9,200 m^2 be reserved on the east side of the runway for this purpose.

Aircraft De-Icing

To improve glycol collection processes and minimize apron disruptions when de-icing operations are required, a Central De-icing Facility (CDF) is recommended over the long-term period. A location is proposed south of the recommended South Apron Expansion area. It is recommended that YLW reserve this location for CDF development in the future (see Figure 66).

Figure 66: Proposed CDF Location (Long-term Period)



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Glycol Capture System

Glycol does not naturally breakdown in the environment and requires capture and treatment. Following recent study into the treatment of glycol-contaminated storm water at the airport, it is recommended that YLW develop glycol capture system consisting of an engineered bioreactor as the method of treatment. The system consists of two aerated in-ground basins each measuring 10 m in width and 20 m in length. The system would capture any glycol runoff from the apron, ditches and Mill Creek and allow effluent, once treated, to be pumped back to Mill Creek or connected to the existing sanitary lift station nearby. The preferred location for this facility is on the west side of the Okanagan Rail Trail in the vicinity of the Long-term Parking Lot and Mill Creek. It is also recommended that land be protected for future expansion of the reactor, including a total footprint measuring 7,600 m^2 and an access road.

Ground Service Equipment Storage

A GSE storage area south of Gate 10, measuring approximately 3,900 m^2, is recommended. This would take place in the short term and would be located directly west of the proposed terminal and apron expansion. This would require the relocation of long term public vehicle parking spaces to a new location south of Mill Creek, but would maintain close proximity to aircraft operations and proposed inbound baggage facilities as part of the southward terminal expansion.

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11.0 Commercial Development

11.1 Current Status and Issues

YLW's commercial land areas are illustrated in Figure 67 (following page). Existing on-airport commercial development is currently concentrated on the west side of the airfield. Airside commercial lots occupy the strip of land situated to the north of the ATB, between the runway/taxiway system and the Airport Way, with an additional lot providing controlled airside access across Airport Way to the northwest of the airport's COB. The existing airside commercial development area is fully occupied and offers limited ability to accommodate expansion of aviation-related businesses.

Although additional airside development could be accommodated via a northern expansion of the existing area north of the KF Aerospace facility between Airport Way and Highway 97, expansion of these activities in this location would generate significant conflict and security issues over time as it would result in additional traffic at the controlled crossing over Airport Way and the Okanagan Rail Trail corridor.

Developed groundside lots occupy a large land area situated to the north of the existing Employee Parking Lot between Aerospace Drive and Highway 97. An additional groundside lot, situated to the southwest of the Airport Way/Okanagan Rail Trail intersection, will accommodate a gas/retail pad development by early 2017.

An area has been reserved for future groundside development north of the KF Aerospace facility between Highway 97 and the Okanagan Rail Trail corridor. This land is being serviced in 2016 to provide opportunities for groundside development

Aviation and Aerospace Activities

YLW is a hub of aerospace activities through the presence of a number of significant aviation-related businesses. These activities contribute to the airport's role as a significant employment generator and the economic benefits they brings to the region.

As outlined earlier in this document, commercial operators have a significant presence on the airport site. KF Aerospace, Carson Air and Flair Air occupy significant amounts of land through the operation of hangars, aprons, maintenance and ancillary facilities. These are accompanied by helicopter, courier, cargo handling and general aviation activities.

Together, these companies form a critical mass of aviation-related activities that provide significant economic benefits. While an array of these aviation and aerospace services are currently on site, further expansion of this industrial sector will require the growth of the existing tenant base and attraction of new businesses to further diversify these activities. Continued support of these industries, including general aviation and Fixed Base Operators (FBO), and their growth is important for the airport because of the economic benefit they bring to the region and the sustained lease revenues they bring. The limited availability of serviced land in the existing airside commercial land area west of the runway/taxiway system constrains YLW's ability to sustain growth of these businesses and of the airport itself.

The general aviation community is important to YLW as is the availability of services to support these activities in the region. To ensure this community continues to thrive in the region, it will be important that coordination of activities and services occur with all airports in the Okanagan Valley.

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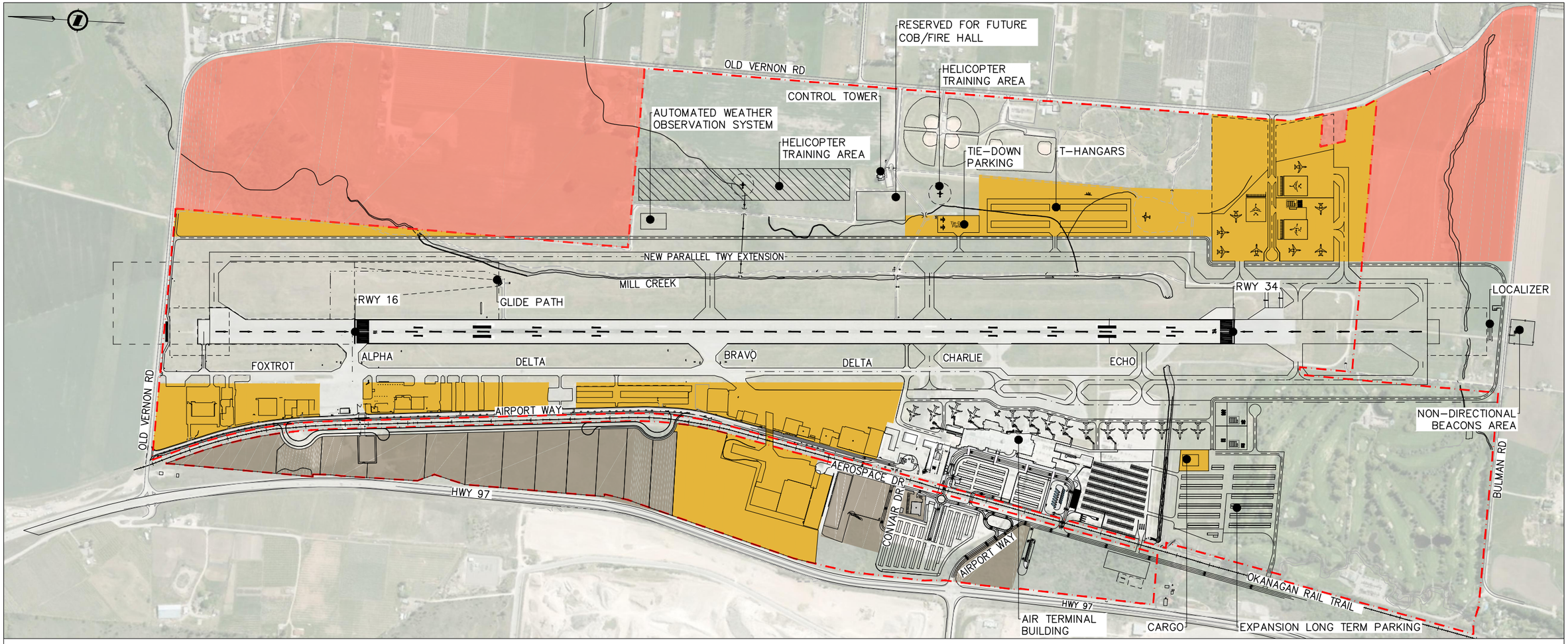

LEGEND

- AIRSIDE COMMERCIAL DEVELOPMENT
- GROUNDSIDE COMMERCIAL DEVELOPMENT
- FUTURE COMMERCIAL (FUTURE ACQUISITION)
- AIRPORT BOUNDARY

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Airports & Aviation Group
500–745 Thurlow Street, Vancouver British Columbia, Canada. V6E 1V8
Tel: 604–662–3555

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PROJECT: YLW MASTER PLAN

TITLE: FIGURE 67 COMMERCIAL DEVELOPMENT PLAN AREAS (2016)

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
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Air Cargo Activities

The airport is currently equipped with two facilities dedicated to the processing of air cargo. One of the facilities (Cargo One) is a multi-tenant facility, located adjacent to Apron I and the COB. This facility is not equipped with an apron for direct loading of cargo onto aircraft and generally supports the handling of cargo transported in the bellyhold of commercial passenger aircraft. Cargo is transported by vehicles between aircraft on Apron I and the Cargo One facility.

The other facility is located north of Apron III, where Fedex shares a building and apron space with other non-cargo tenants. Direct loading onto aircraft is achievable since this facility is equipped with an apron (non-designated).

The air cargo forecast presented earlier in *Section 3 – Air Traffic Forecasts* calls for slow growth in outbound cargo and moderate growth in inbound cargo. Some of this growth is based on the increase in size of aircraft operated by Air Canada, which has replaced some services previously operated by the DHC-300 with the Q400. This suggests that the total floor space of existing cargo buildings is sufficient for the current air cargo operation described earlier. However, the recommended redevelopment of the airport's Combined Operations Building requires take-over of the existing Cargo One building and will trigger development of a new dedicated cargo handling facility.

The airport is also keen to play a more active role in the shipping of agricultural products (i.e., produce) from the Okanagan Valley, especially, perishable shipments. This would require provision of greater expanses of, and more specialised, cargo handling space and the provision of additional apron parking space for air cargo shipments.

Groundside Development

YLW currently has limited groundside commercial tenants and services in spite of increased development opportunities that have derived from growth in passenger traffic and employment activities over the years. The proposed retail pad at the intersection of Airport Way and the Okanagan Rail Trail will address a demand that exists for retail gas and fast food for airport passengers and employees.

Significant development is currently underway adjacent to the airport site west of Highway 97 on the former Pier Mac site. The development currently includes a hotel and small retail pad, and will be expanded into a retail/office park in the near future.

Opportunities exist for similar types of commercial activities on airport property that support YLW's aviation role in the community and the region. Building upon the soon to be developed retail pad at the airport entrance, an integrated airport office and hotel development can contribute to the creation of an airport gateway, and serve to attract additional commercial services to the area.

In addition, the recommended redevelopment of the ATB road access and parking facilities will require that the existing Car Rental Storage area be relocated. This facility will be located within the existing groundside commercial land reserve north of KF Aerospace between Highway 97 and Airport Way. This development can be leveraged to accommodate new groundside development in this area, including light industrial business that support aviation activities such as avionics parts repair and storage, courier facilities, etc.

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11.2 Future Development

It is recommended that YLW increase its available airside commercial land inventory in the short- to medium-term periods given the current occupancy level of the existing airside commercial development area. This is needed to allow YLW to expand its role as a key aviation and aerospace centre in the region, and to compete effectively with other airports in the region for aviation-related investments.

The Land Use Plan included in *Master Plan 2025* identified the land area situated to the east of the airfield for future airside/groundside commercial development. The analyses presented earlier in this document indicate that the existing ATB development area and associated land reserves for future apron expansion will be sufficient to accommodate long-term operational requirements to the end of the planning period; and no relocation of ATB operations would be needed to the east of the airfield. The east side commercial land reserve identified in the last Land Use Plan remains valid.

The lack of utility services in this area has been the primary limiting factor of YLW's ability to expand its commercial land inventory beyond the existing commercial areas described above.

The existence of a strong aviation-related tenant base at YLW provides significant opportunities for continued growth and leveraging of existing activities on the site. Future eastside development should therefore prioritize aviation-related development or adopt a focus as an aerospace business park.

It is also recommended that groundside development continue to focus on expansion along Aerospace Drive, leveraging proximity to the Okanagan Highway Corridor; and south of the Airport Way/Okanagan Rail Trail intersection.

Aviation-Related and Aerospace Industries

South East Development

To address the existing airside land inventory shortfall, YLW has been reviewing development concepts for the south east sector of the airport site, in proximity to the Runway 34 threshold. The selection of this land area as the preferred location for first phase of additional airside development is based on the expanse of relatively level topography in this area, which is suitable for the development of airside commercial infrastructure including taxiways, aircraft parking aprons and hangars. The objective of the future development area is to accommodate the operation of FBOs and fueling facilities similar to those located at the northwest end of airport property.

Preliminary site analyses have resulted in the development of two layout options:

- Option 1 - Two cul-de-sac taxiways servicing three lots (Figure 68, page 101); and
- Option 2 - One cul-de-sac taxiway servicing three lots (Figure 69, page 102).

It is recommended that the development of this area occur over the short-term period (2016-2025), including addition of site services, to provide much needed airside commercial land to support aviation services and aerospace industry growth. (Utility requirements are discussed later in this document in *Section 12 – Utilities*.)

Acquisition of the adjacent land parcel extending to the east of the extended runway to Old Vernon Road and up to Bulman Road is also recommended to enable further expansion of this airside commercial area over the long-term period.

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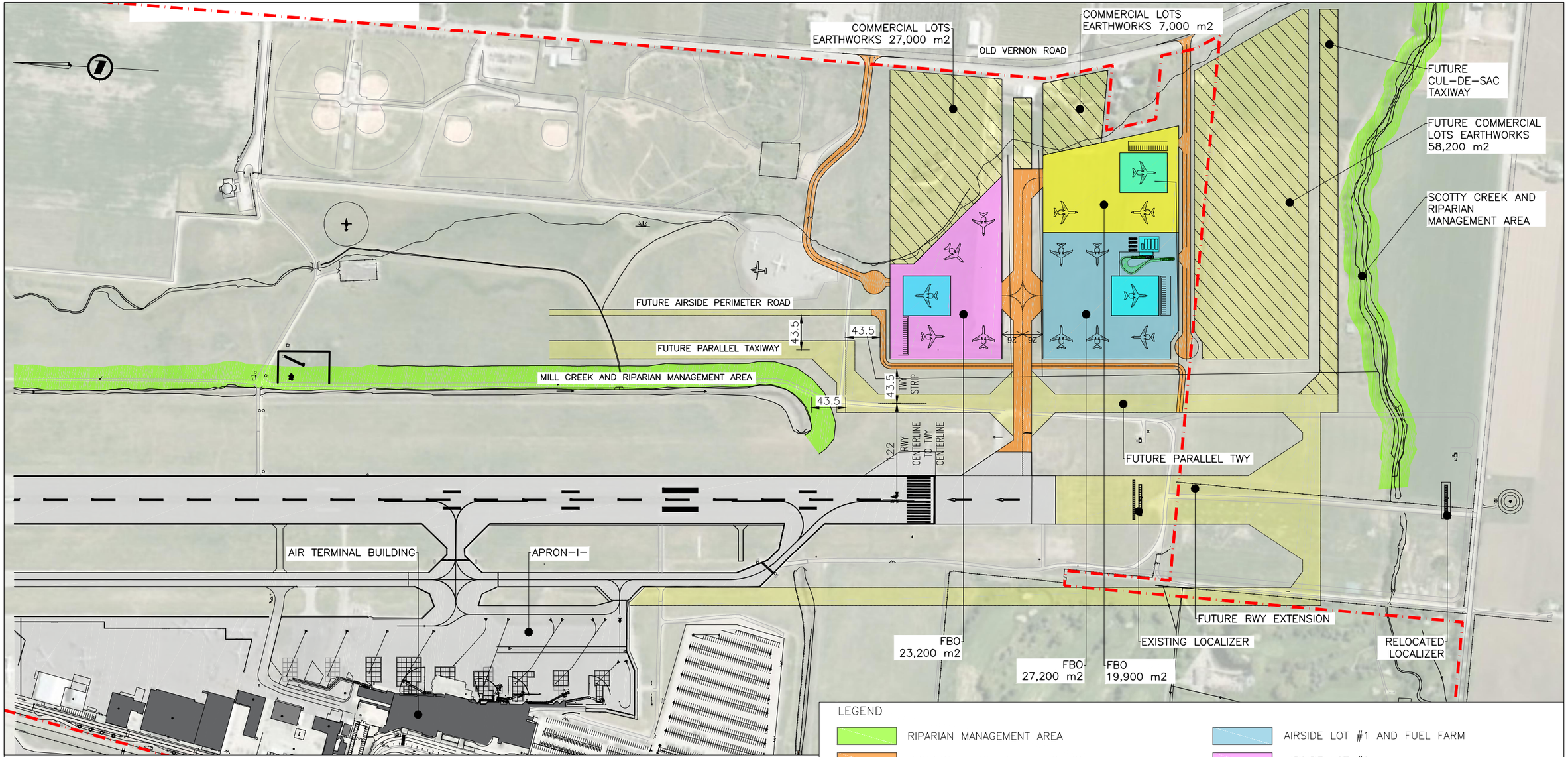

SCALE 1:5 000
@11x17

0 250m

LEGEND

- RIPARIAN MANAGEMENT AREA
- PROPOSED TAXIWAY AND ROADS
- SIGNIFICANT CHANGE IN TOPOGRAPHY
- MODERATE CHANGE IN TOPOGRAPHY
- AIRPORT PROPERTY BOUNDARY
- AIRSIDE LOT #1 AND FUEL FARM
- AIRSIDE LOT #2
- AIRSIDE LOT #3
- FUTURE RUNWAY/ PARALLEL TAXIWAY
- FUTURE TAXIWAY/LOTS WITH EARTHWORKS

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Airports & Aviation Group
500–745 Thurlow Street, Vancouver British Columbia, Canada. V6E 1V8
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PROJECT
YLW MASTER PLAN

TITLE
FIGURE 68
SOUTH EAST DEVELOPMENT OPTION 1
TWO CUL–DE–SAC TAXIWAYS

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
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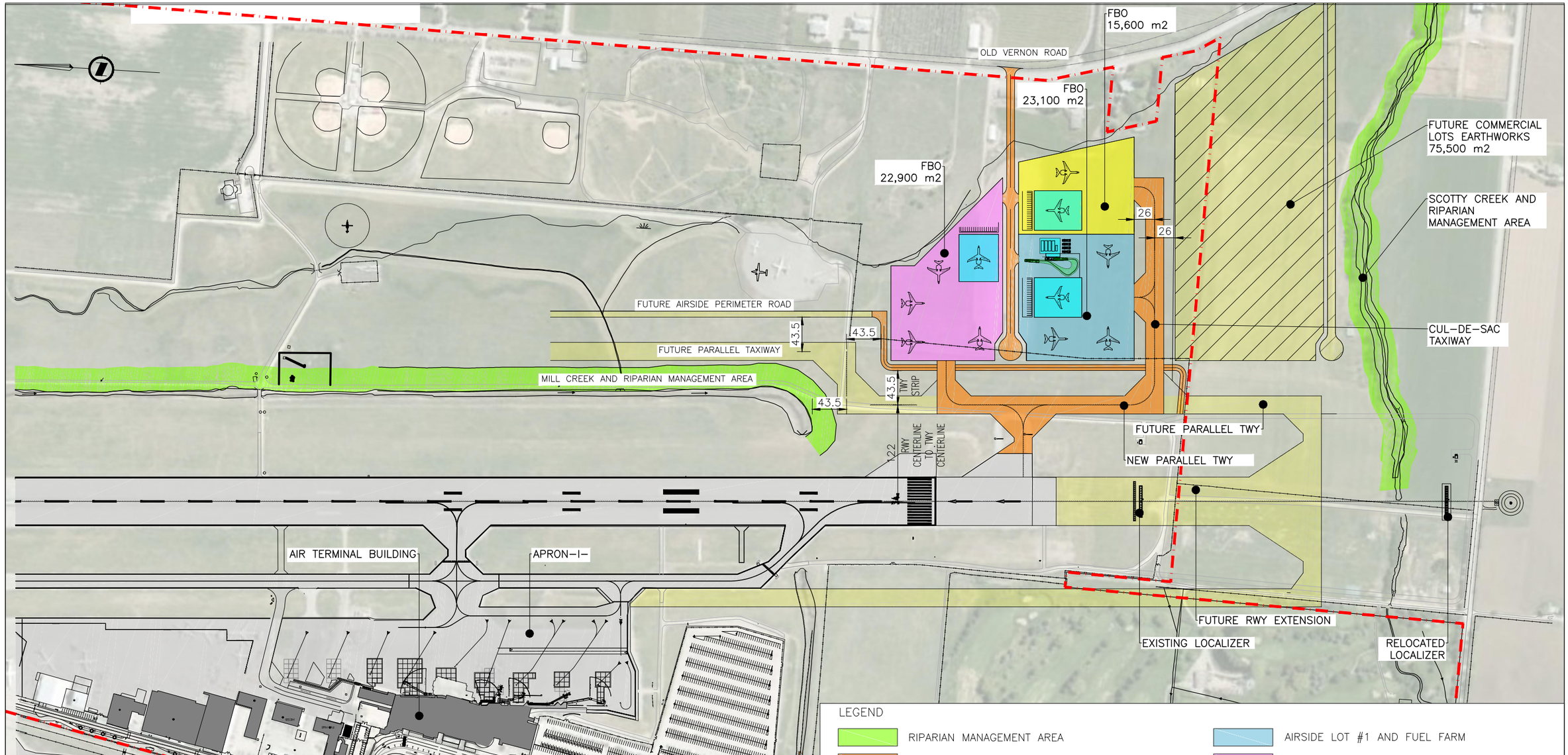

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LEGEND

- RIPARIAN MANAGEMENT AREA
- PROPOSED TAXIWAY AND ROADS
- SIGNIFICANT CHANGE IN TOPOGRAPHY
- MODERATE CHANGE IN TOPOGRAPHY
- AIRPORT PROPERTY BOUNDARY
- AIRSIDE LOT #1 AND FUEL FARM
- AIRSIDE LOT #2
- AIRSIDE LOT #3
- FUTURE RUNWAY/ PARALLEL TAXIWAY
- FUTURE TAXIWAY/LOTS WITH EARTHWORKS

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TITLE
FIGURE 69
SOUTH EAST DEVELOPMENT OPTION 2
ONE CUL–DE–SAC TAXIWAY

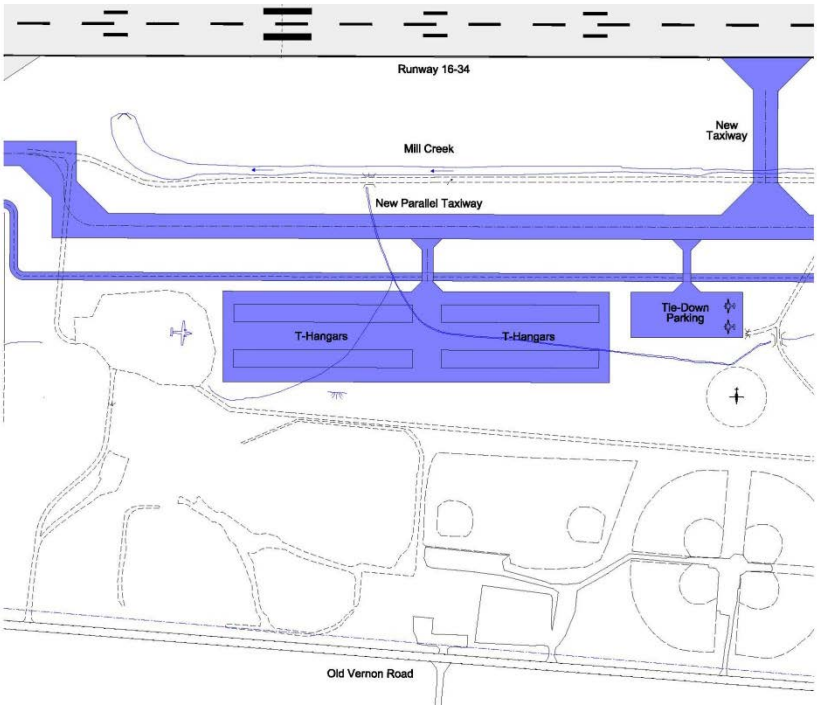
PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 DK	0031	PB

A key differentiator between the two options is the flexibility and cost effectiveness afforded for future expansion in the event the land parcel situated immediately south of this area is acquired for airport development in the future. The preferred option will be based on further detailed technical and cost-benefit analyses associated with site servicing and pavement construction costs.

East Side Development

It is recommended that additional expansion of general aviation facilities accompany the introduction of a first segment of the east parallel taxiway north of the recommended South East Development area. Figure 70 illustrates conceptually how the expanded development can be achieved.

Figure 70: Future East Side Development Concept
(For preliminary planning purposes only)



The availability of level topography north of the existing aircraft firefighting training grounds favours development in a northerly direction, but the need for an unobstructed view of the runway and taxiway from the Air Traffic Control Tower restricts development of aviation-related uses to low-lying structures, such as T-hangars and parking for light single and twin engine aircraft, which could be achieved with tie-down parking stands. It is recommended that this area also incorporate space for aircraft isolation spots, baggage search areas and bomb disposal areas, designed to meet regulatory requirements. These should be incorporated as final design and engineering occurs for this area.

Development towards the north would reduce the size of helicopter training areas that are currently located north and south of the control tower. In addition, an area measuring 9,200 m^2 between the control tower and the east parallel taxiway will be preserved to provide an option for a future relocation of the COB/fire hall if the current site is required for future ATB expansion in the beyond the 2045 period.

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Cargo Facilities

The current location and size of the Cargo One building is considered optimal in terms of meeting current and foreseeable cargo handling requirements, given its proximity to the ATB and Apron I. The options for the redevelopment of the Combined Operations Building call for use of the Cargo One site to allow for a new permanent NPS-V facility and potentially a relocated Fire Hall. The latter would enable a more direct and rapid response to the airfield by emergency vehicles.

Given the proposed COB redevelopment and expansion on its current site, including the acquisition of the Cargo One facility, it is recommended that a new cargo facility be constructed. A location south of the of the proposed south apron expansion recommended so as to not impede future terminal expansion beyond the 2045 period

Hotel Development

The development of an airport hotel can significantly add to the airport's user experience through availability of on-site accommodations for those passengers with late night arrivals or early morning departures, in addition to the expansion of restaurant and business meeting options on the site. It can also provide YLW with significant benefits in terms of additional revenues and opportunities to leverage this development with other groundside commercial projects. It is recommended that YLW explore implementation of this proposal through third-party investments and further business case analyses. No timeline is established for this project.

A future hotel may be located either above or adjacent to the proposed ATB southern expansion, or on the groundside commercial land situated immediately to the south of the retail pad at the Airport Way / Okanagan Rail Trail intersection. The latter location could eventually incorporate a parkade structure to alleviate demands for future expansions to the Long-Term parking lot, and additional airport retail and offices as part of an airport gateway development. Connection to the ATB would be required via overhead walkways.

West Groundside Development

YLW is making provisions to enable the attraction of new light industrial and commercial businesses that do not require direct airside access. It is recommended that YLW continue to reserve the groundside commercial land area situated north of the KF Aerospace facility between Highway 97 and Airport Way for groundside commercial purposes, as outlined earlier in this document. Ground works initiated in 2016 will allow for the future development of these lands, including the potential relocation of the Car Rental Storage and Quick Turnaround facility. These works will result in expansion of the developable groundside land area. Businesses targeted for this area include avionics parts repair and storage, trucking and courier facilities.

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12.0 Utilities

12.1 Current Infrastructures

With YLW bordered by Highway 97, Old Vernon Road, and Bulman Road, its major utilities are drawn and diverted along these arteries. Airport Way road serves as a landside connector through the property which also allows it to serve as a major connection point to most of the underground infrastructures. With the impending expansion of the airport, an extended understanding of the utility system is necessary to assure services can continue to meet the requirements of the proposed designs. No major concerns currently exist in regards to the existing infrastructure and its capacity to service the airport and its tenants. Existing utility network are shown graphically in *Appendix J – Existing Utility networks*.

12.2 Water Supply and Distribution

The airport's property is situated within the Glenmore Ellison Improvement District and is being serviced with potable and firefighting water. Its system runs along Old Vernon Road in the North; through Airport Way (ø300-350mm GEID CL150 PVC Watermain) and ties back across Highway 97 at the Airport Way Intersection. The latest water line works resulted in a line extension to the south of the airfield to service the glycol facility adjacent to the Long-Term Parking Lot. A separate water line also exists to service Nav Canada's Air Traffic Control Tower on the east side of the airport site, which ties back to Old Vernon Road to the east.

With new developments scheduled mostly to the south and east of the airport property, it recommended that YLW plan extensive works to provide a water loop to service these areas. Over 2 km of piping will be needed to complete a new loop from Airport Way to Old Vernon Road. This work must be coordinated with any planned infrastructure development to the south of the airport to avoid conflicts. Particular attention should be given to the implementation of the proposed RESAs, localizer and runway extension projects. Phasing this work earlier in the program development could provide some cost savings.

It is also recommended that the capacity of the current supply be reviewed in regards to the expansion of the existing terminal and facilities. The treatment system may need to be increased which will undoubtedly affect the operating costs. Refurbishing and the addition of lines from the new loop may be needed.

12.3 Sanitary Sewer System

The City of Kelowna currently services the airport's property for wastewater management. A sewer main runs adjacent to Airport Way and ties to a lift station adjacent to the Okanagan Rail Trail. A review of the current capacity of the lift station is recommended prior to undertaking works that would increase discharge from new development. The City is currently planning to secure budgets for the design of a gravity main in 2017, with a scheduled construction start in 2018.

It is also recommended that additional system capacity be considered as part of any future new development, in particular on the east side of the airfield. A partial solution would consist of using an existing PVC sanitary main along Bulman Road. A thorough review of the system's lift station capacity is required prior to any designed connection. Capacity upgrades will need to be

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coordinated with the City's future wastewater management needs through Kelowna's Utility Planning department.

12.4 Storm Water Management / Drainage

The airfield runoff is currently collected through a culvert along Taxiway Delta, which ties to an Oil / Grit Separator (OGS) aligned with Gate 7 on the Main ATB Apron (Apron I). This OGS is currently maintained by the City of Kelowna through YLW's maintenance services. Runoff from the OGS is diverted through a collector that runs west and ties with the landside parking lot drainage system. This system in turn flows to Mill Creek at the south west side of the property. Tenant buildings situated to the north west of the airfield currently have roof drains, which flow to a series of dry wells.

It is recommended that future airport development planning manage airfield storm water runoff to a retention pond, which can be used for glycol, hydrocarbon, phosphorous and nitrogen limit mitigation. Conceptual designs have been put forward to schedule these works; however, more thorough review of the overall storm drainage plan should be considered to optimize solutions in light of future developments. This may highlight the realization that Mill Creek could flow beyond its current banks and that a mitigation plan should be put in place to allow multiple points of retention and infiltration. Engineering studies into the watershed could provide more insight into the capacity and prevention of impact to YLW operations.

The current airside outlet should be reconsidered as it is currently flowing under the ATB and through an active parking lot. It is recommended that this flow be eventually diverted directly to a mitigation site prior to its discharge into Mill Creek. Pending a review of the capacity of Mill Creek, Scotty Creek could offer an alternate discharge solution. It could be possible to design a retention pond near or within the Shadow Ridge Golf Course, which has been purchased by the City for future airport development purposes. This location would be sufficiently distanced from the airside activities and would not cause adverse consequences. The aim of all future design and implementation is to capture and treat all runoff from parking surfaces prior to discharge.

Concerns about increased storm water runoff from surface lot development may be mitigated through use of new integrated solutions and pavement material types which allow direct infiltration. Current technologies provide limited success in the use of these materials in climates that experience freezes in the winter time. As stated earlier in this document, it is recommended that YLW monitor technological advancements in this field for potential use in future parking lot design and engineering.

12.5 Gas, Power and Telecommunications

Existing electrical controls are fed from Electrical Room 090 in the ATB. This room controls all gates and parking lot lighting with the exception of Gates 1 to 3. This room also holds the contactors for these lights. The existing COB houses the controls for all floodlights on the commercial aircraft apron, the crash alarm relay and all other security systems.

Existing power is fed through the COB/Field Electrical Centre (FEC), with redundancy provided through a generator. There is a mix of voltages (120-347-480-600 & Airfield) including communication cables leaving the building for various unlabelled destinations. There is limited space for additional conduits and lines from the COB at the moment.

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Redevelopment of the COB will need to consider the addition of conduits and trenching to allow for distribution to the southern expansion of the airfield. The same can be said for communication lines fed from the COB. Due to the current state of the ducts leaving the COB, it is recommended that a general reorganization of the cabling be undertaken when the COB is redeveloped.

In regards to the South East Development of the airfield, it is recommended that a separate FEC developed and metered for tenant use. This FEC will need to be fed from an offsite source

A Fortis BC gas pipeline runs adjacent to Airport Way and ties back to Highway 97. YLW and all tenant buildings are serviced by this line. The planned expansion of the ATB can tie to this line without any major interventions on the system. However, the planned south east commercial expansion will need servicing. It is recommended connection to this service be made to a point situated off-property in proximity to the south east development area.

YLW currently has a geothermal field on the north side of the Apron I. It is recommended that new development incorporate to the extent possible new self-sufficient energy solutions. Additions to geothermal solutions are possible and other sources of natural power could be added to any new projects. The potential for solar panel energy is available and could be placed over top of the buildings and even at certain locations on the airfield. At a certain point, excess energy could even be sold back to the local grid for additional revenue. Future development plans should also consider new self-sufficient energy solutions.

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13.0 Land Use Planning

13.1 Official Community Plan Considerations

The City of Kelowna recognizes YLW's role as the Okanagan Valley's primary aviation gateway and its important role as employment generator for the region through the *Official Community Plan 2030*. The OCP establishes the framework needed to guide development of sustainable infrastructure and to protect the airport against encroachments by incompatible development. *Section 4.0 – Environment* outlines the City's sustainable infrastructure objectives. As stated previously in this document, YLW and its future development are clear parts of the City's sustainable infrastructure strategy. Proposals contained in this document have been made with the aim of meeting these objectives.

The OCP designates YLW is designated as an 'Airport' area for land use purposes. To accompany this designation, Area Specific Considerations apply, notably to ensure "development is compatible with surrounding land uses" (*OCP Objective 5.19*). This applies both to airport land and surrounding properties.

A valuable Area Specific Consideration in the OCP is a policy to avoid incompatible development adjacent to the airport and to minimize impacts of aircraft noise on future development is the prohibition of residential development within areas included in the NEF 25 contour zone. It is recommended that the Regional District of Central Okanagan adopt a similar policy given it's adjacency to the airport site. This policy is a valuable measure that will ensure harmonious co-existence of the airport and surrounding community.

Another Area Specific Consideration is the that all proposed development projects within the federal Aviation Zone include consultation with Kelowna Airport and Transport Canada with respect to building height as per Airport Zoning Regulations under the authority of the Aeronautics Act (1977). It is important that this policy should remain in place to protect the safe operation of aircraft to and from the airport.

Master Plan 2045 feeds the City's regular OCP review process.[22] The renewed planning focus for YLW will generate new development and expansion proposals on airport property. The proposed future runway extension will require some extension of airport boundaries; and the forecast passenger traffic growth will generate increased vehicle traffic on primary access routes to the airport. In addition, the proposed development of the east side of the airfield will also need to be adequately reflected in the Regional District of Central Okanagan's OCP.

While considerable consultation has been undertaken in the preparation of this Master Plan, YLW will continue to engage the community on the advancement of land development proposals and communicate its land uses and infrastructure development objectives to ensure adequate interface between this Plan and the vision outlined in the City of Kelowna and Regional District of Central Okanagan's OCPs.

Preservation of the natural environment and creation of walking paths and bicycle routes between key destinations are also elements of the OCP vision that are important for YLW as they directly influence airport activities. The environmental impact of airport operations/expansion on Mill Creek

[22] The BC Planning Act mandates the municipalities review their Official Community Plans every five years.

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through the airport site and the interface between the airport and planned Okanagan Rail Trail to the west side of the site will also be important considerations for the community. Wildlife attractors through these areas can pose a risk to aviation activities due to potential aircraft bird strikes or wildlife incursions on aircraft movement areas. As stated earlier in this document, limiting the attractiveness of the area for wildlife is important for safety purposes. This objective conflicts with current OCP policy and City bylaws/regulations pertaining wildlife protection and habitat enhancement. Again, it is recommended that the upcoming revision to the OCP provide considerations for these airport-specific operational requirements.

13.2 Agricultural Land Reserve

Portions of the airport property currently fall under the British Columbia Agricultural Land Reserve (ALR). The ALR is a provincial zone in which agriculture is recognized as the priority use. Farming is encouraged and non-agricultural uses are restricted.

Figure 71 (following page) depicts land areas within YLW boundaries that fall under ALR designation. These consist of the Shadow Ridge Golf Course and a large section of the land area situated east of the runway. The latter has not been farmed for many years due to restrictions relating to airport proximity. The intent is for the Golf Course to eventually be used for ATB terminal complex expansion over the long-term period and other airside uses, while property east of the runway will create opportunity for additional airside facilities including general aviation parking and hangars, described in *Section 12 – Commercial Development*.

To provide flexibility in the timing of future development on these land areas, it is recommended that YLW seek their exclusion from ALR designation with the British Columbia Agricultural Land Commission.

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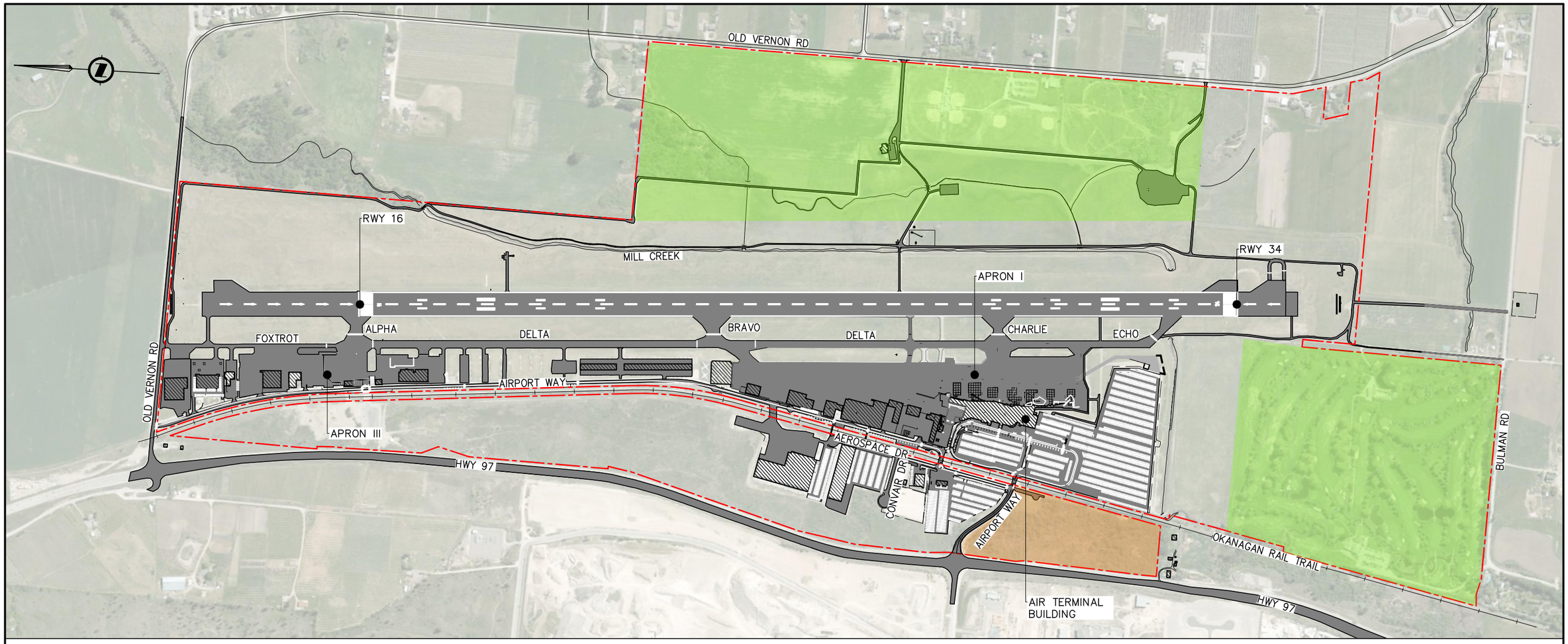

LEGEND

- ALR LAND
- ALR LAND ON FEDERAL LAND
- PAVEMENTS
- BUILDING STRUCTURE
- AIRPORT BOUNDARY

SCALE 1:10 000
@11x17

0 200 500m

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PROJECT
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TITLE
FIGURE 71
AGRICULTURAL LAND RESERVE WITHIN YLW BOUNDARIES

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627230	0000	40 DK	0025	PB

13.3 Airport Land Use Plan

The integration of the analyses and proposals contained in this document provide a sound basis for the update of the *Airport Land Use Plan* that was in place to guide the recent airport development program. It is recommended that updated *Airport Land Use Plan* presented in this section replace the Plan that was previously approved by the City of Kelowna in *Master Plan 2025*.

This update, as approved and controlled by YLW and the City of Kelowna, shall be used to guide the future development of the airport lands, in conjunction with regulations contained in the City of Kelowna Official Community Plan.

As shown in Figure 72 (following page), the airport lands have been divided into seven sub-areas described below. Note that these land use definitions are based upon, and generally do not differ from, those outlined in the *Airport Land Use Plan* contained in the previous *Master Plan 2025*. Changes have only been made to actual land allocations to reflect the updated development proposals contained in this current document.

Airside System

The Airside System means lands within the airport reserved for aircraft manoeuvring and associated utilities. It includes uses such as:

- Runways;
- Taxiways;
- Aprons;
- Meteorological installations;
- Electronic navigation/communications equipment; and
- Associated utilities.

Terminal

Terminal Reserve area means lands reserved for the Airport Terminal Building and associated infrastructure, including:

- Air Terminal Building; and
- Accessory uses (including adjacent hotel).

Ground Access and Parking

Ground Access and Parking are a means

- Access roads;
- Terminal curb;
- Parking lots and structures; and
- Ground transportation functions, such as transit stops, taxi staging, and car rental ready lots.

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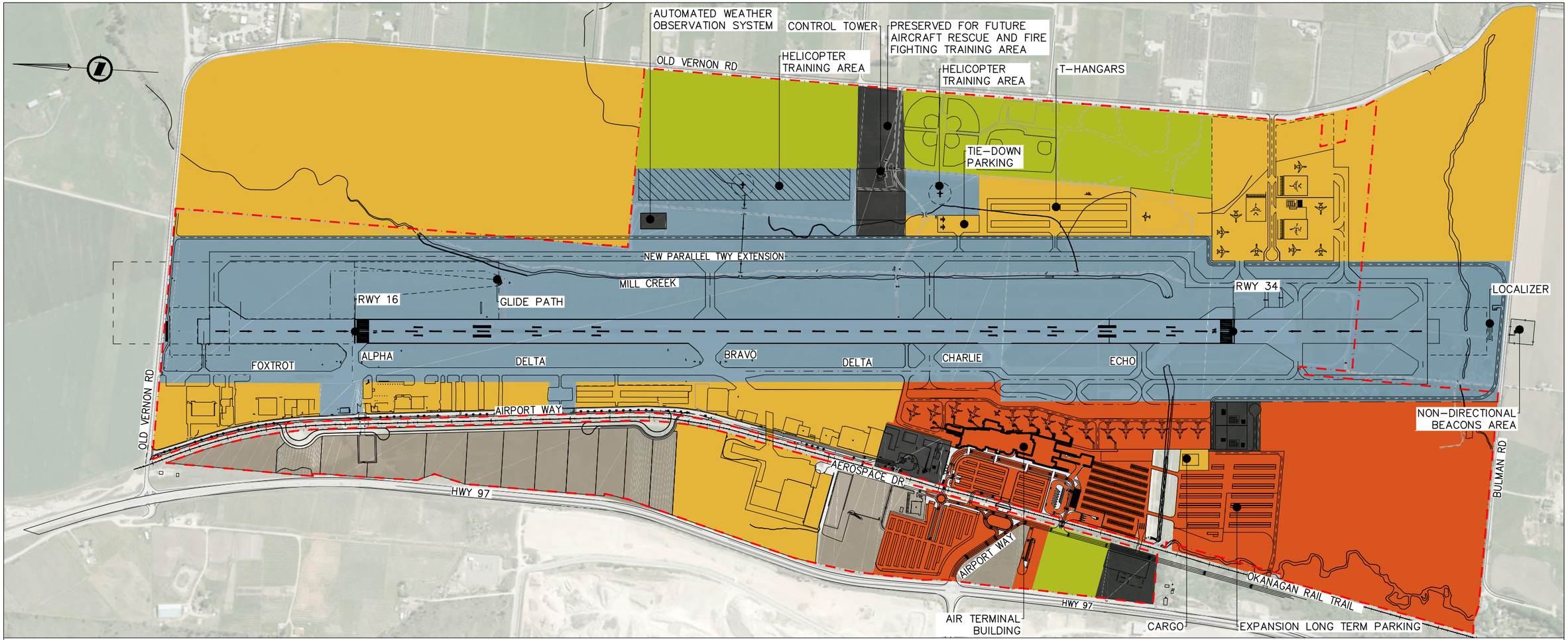

LEGEND

- AIRSIDE COMMERCIAL
- AIRFIELD SYSTEM
- GROUNDSIDE COMMERCIAL
- AIRPORT RESERVE
- TERMINAL AND GROUNDSIDE
- AIRPORT SUPPORT
- AIRPORT BOUNDARY

SCALE 1:10 000
@11x17

0 200 500m

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PROJECT
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TITLE
FIGURE 72
AIRPORT LAND USE PLAN

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 DK	0017	PB

Operations and Support

Airport Support area means lands reserved for functions including:

- Maintenance structures;
- Equipment storage sheds;
- Fire hall;
- Air traffic control towers; and
- Other airport-related supporting functions.

Airside Commercial

Airside Commercial area means lands reserved for commercial and light industrial development purposes which require direct access to the Airside System, including runways and taxiways.

Airside Commercial uses include the following:

- Regularly scheduled and charter airlines;
- Cargo operators;
- Fixed Base Operators (FBOs)
- Hangar development;
- Light aircraft manufacturing;
- Flying club;
- Aircraft storage;
- Air ambulance;
- Aircraft service and maintenance;
- Aircraft repair and sales;
- Flight training schools;
- Couriers;
- Aircraft fuel operators;
- Aerial tanker base;
- Fuel storage;
- Rotary wing operators; and
- Airport support facilities.

Groundside Commercial

Groundside Commercial area means lands within the airport, reserved for commercial and light industrial development purposes which do not require access to the airside. The intent of the Groundside Commercial areas is to promote commercial retail, business and light industrial uses that are complimentary to the functioning of the airport.

Groundside Commercial uses may include the following:

- Business servicing the air industry;
- Offices;
- Gas stations;
- Car washes;
- Car rental facilities;
- Hotel/motel;
- Food and beverage;
- Light manufacturing;
- Outdoor storage;

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- Retail sales;
- Distribution centres;
- Warehouses;
- Transportation services and facilities; and
- Public utilities.

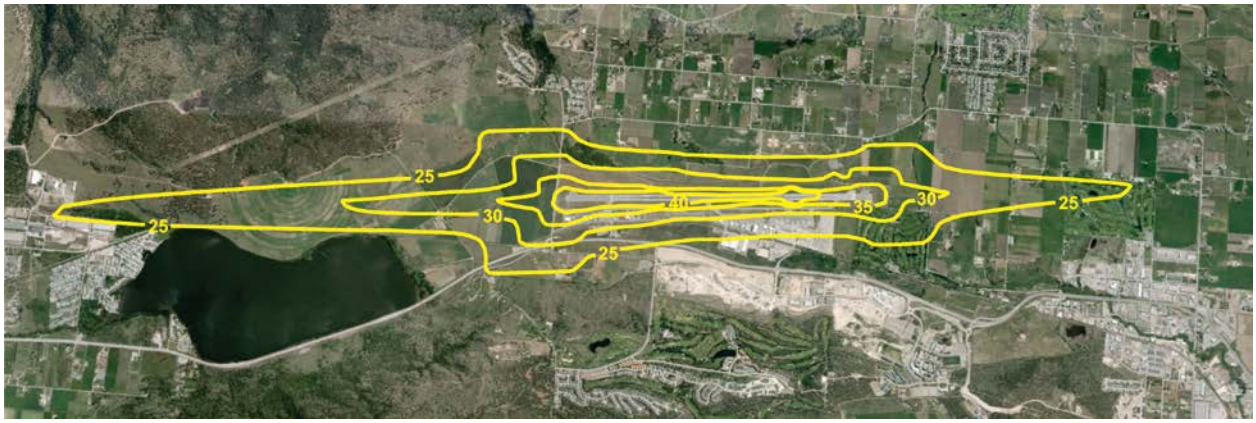
Airport Reserve

Airport Reserve area means lands within the airport not currently identified for a specific use but protected for future as a reserve. This may include lands which have no development potential due to terrain or water courses, etc.

13.4 Noise Exposure Forecasts

Noise Exposure Forecasts have been prepared to depict future noise exposure under the continued operation of the existing runway configuration, as well as under the most demanding of expansion scenarios detailed in *Section 7 - Airside*. These are presented in Figure 73 and Figure 74, respectively (below).

Figure 73: 2045 Noise Exposure Forecasts – Existing Runway Configuration



Source: Urban Aerodynamics, 2015

Figure 74: 2045 Noise Exposure Forecasts – Most Demanding Expansion Scenario

[Pending – under development to be inserted in Final Draft document]

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Consistent with the noise exposure areas that currently prevail and shown *in Figure 8: 2015 (Current) Noise* Exposure Contours (page 25), future noise exposure areas are expected to be narrower than those previously identified in *Master Plan 2025*. Exposure to aircraft noise has however been identified as a concern by the community. Although the narrowing of the noise exposure areas indicate less area exposed to aircraft noise, this issue is remains a concern for the community. Increased passenger activities in the future may be relatively offset by increased aircraft sizes and a relative reduction in the frequency of flights (and resulting noise occurrence) to certain to certain destinations such as Vancouver and Calgary.

The OCP policy relating to ensuring compatible land uses is important for minimizing impacts of aircraft noise exposure on residential development and for protecting the long-term operations of the airport. While the contours depict a narrowing of noise exposure areas, future traffic growth beyond the Master Plan period could result in future expansion of these areas to the previous wider coverage area. It is therefore recommended that the City to retain the existing land use and zoning regulations prohibiting residential development in within the NEF 25 contour and above. As stated earlier in this document, it is also recommend that the Regional District of Central Okanagan adopt a similar policy.

13.5 Land Acquisition

Master Plan 2025 identified land areas required outside YLW's boundaries that were required to accommodate future expansion of airport facilities and infrastructure. Since adoption of this Plan by the City of Kelowna, YLW has proceeded to acquire most of these land parcels as they became available for sale. The latest parcel to be acquired for future airport expansion is the Shadow Ridge Golf Course, which will continue to operate until the land is required for expansion.

The analysis presented in this Master Plan validates the requirement for outstanding lands in previously identified in Master Plan 2025 for expansion of the runway and taxiway system. To address long-term opportunities for expansion of commercial aviation facilities and related business activities, additional parcels of land adjacent to the southeast corner of the airport site and north east of the airport site bounded by Old Vernon Road are proposed for future acquisition. The proposed land areas that will be needed to accommodate future expansion are shown in Figure 75 (following page). In keeping with YLW's approach to land acquisition, it is recommended it works towards acquiring these parcels as they become available for sale.

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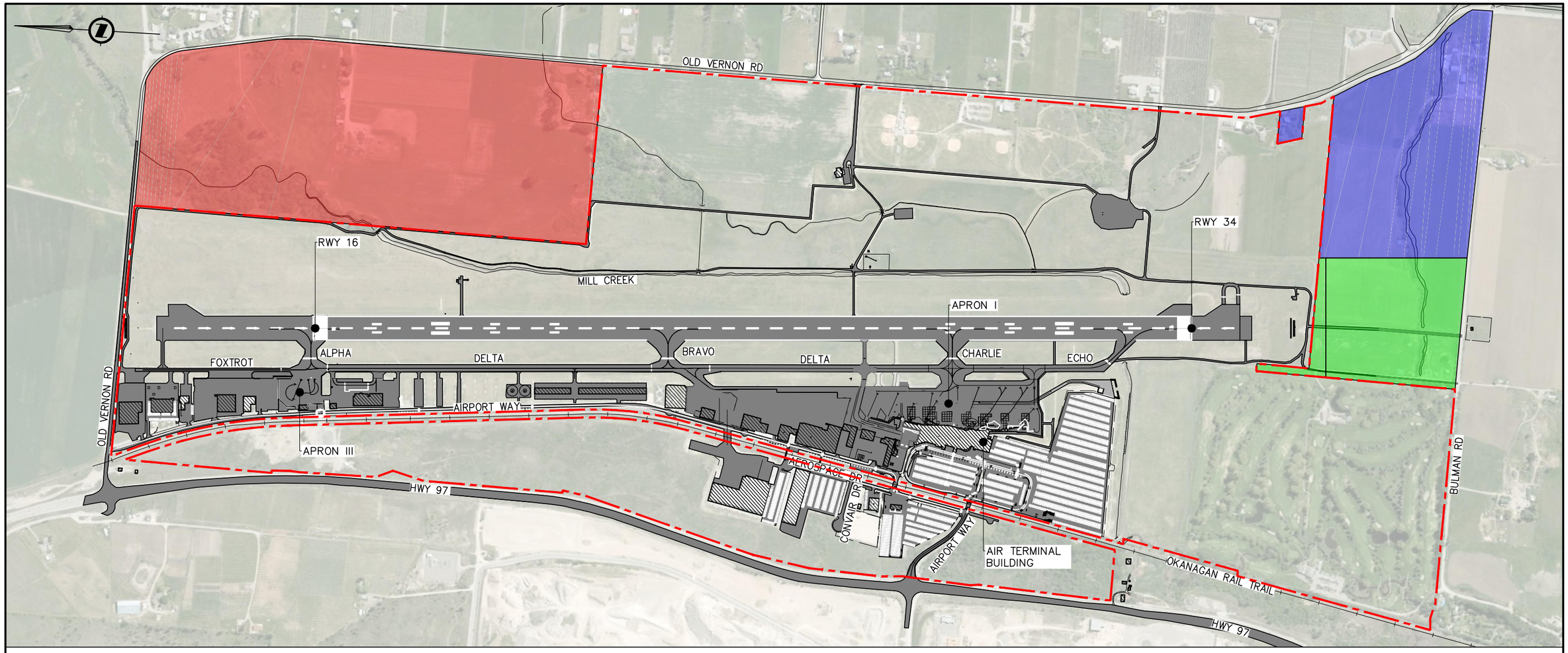

LEGEND

- BUILDING STRUCTURE
- AIRPORT BOUNDARY
- SHORT TERM
- MEDIUM TERM
- LONG TERM

SCALE 1:10 000
@11x17

0 200 500m

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TITLE
FIGURE 75
FUTURE LAND REQUIREMENTS

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627320	0000	40 DK	0025	PB

14.0 Implementation Plan

14.1 Airport Development Scheme

Master Plan 2045 is an overall requirement definition and coordination document that serves as the blueprint for future growth at the Kelowna International Airport. The recommendations summarized in this document have been formulated based on capacity, service level and revenue enhancement requirements and opportunities through to 2045.

Given this timeframe, the options and proposals presented in this document have been optimized to provide a framework for the overall development program at the airport for the short- (2016-2025), medium- (2026-2035) and long-term periods (2036-2045). The future airport layouts resulting from the optimization exercise are illustrated in Figures 76, 77 and 78, respectively (see following pages).

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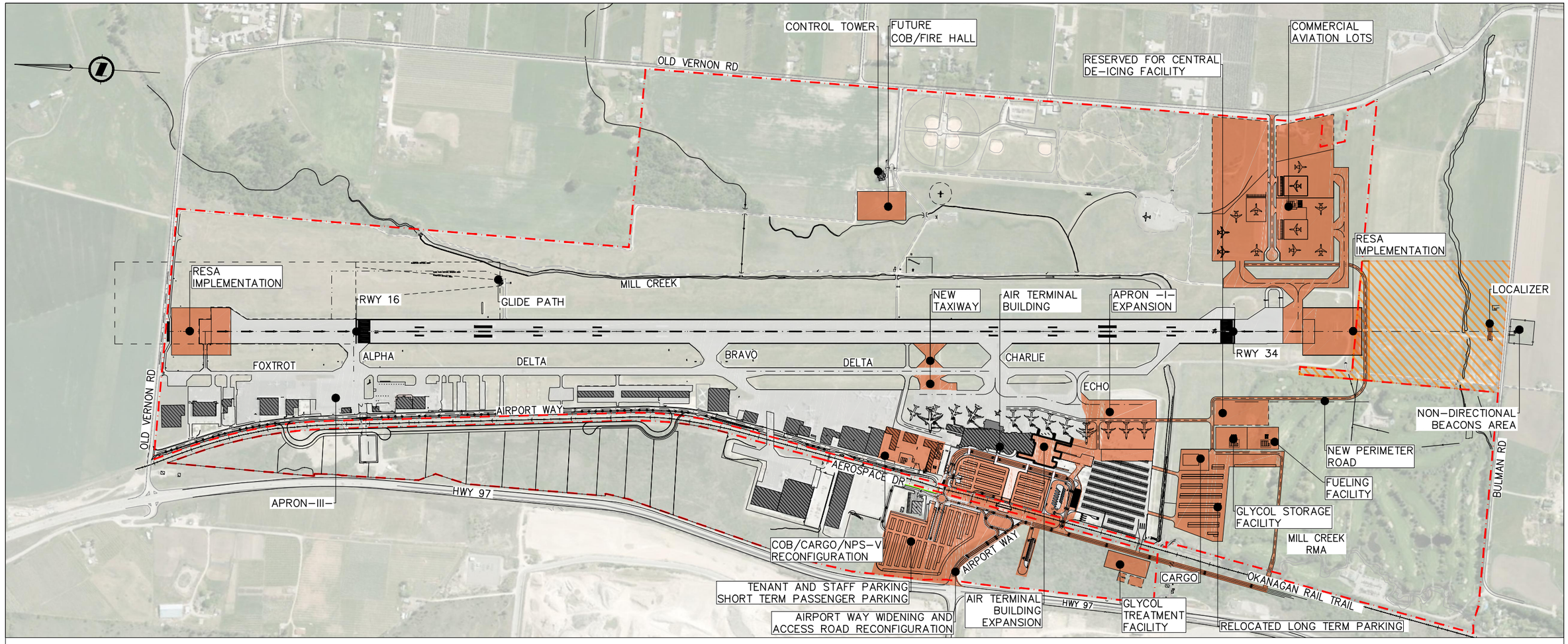

LEGEND

- SHORT TERM 2016-2025
- ACQUISITION
- BUILDING STRUCTURE
- AIRPORT BOUNDARY

SCALE 1:10 000
@11x17

0 200 500m

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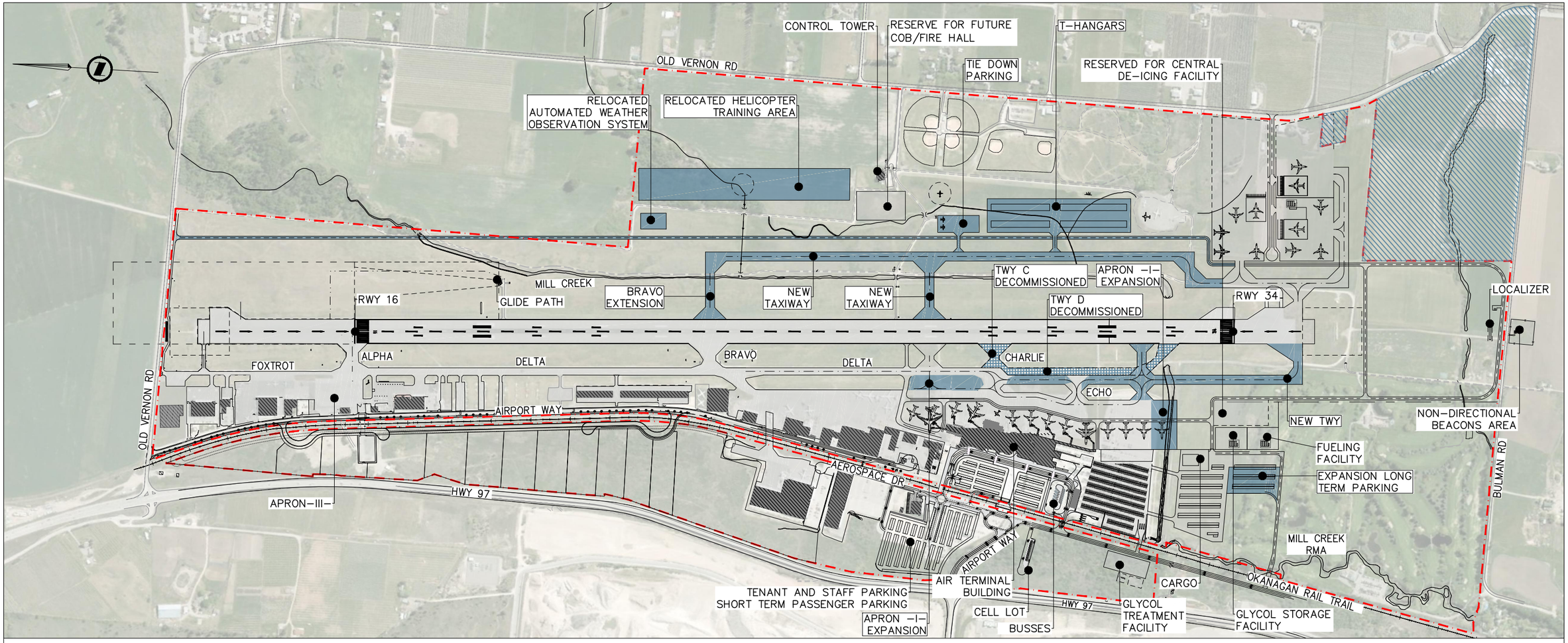
TITLE
FIGURE 76
AIRPORT LAYOUT - SHORT - TERM (2016-2025)

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 DK	0014	PB



LEGEND

- LONG TERM 2026-2035
- LAND ACQUISITION
- DECOMMISSIONING
- BUILDING STRUCTURE
- AIRPORT BOUNDARY

SCALE 1:10 000
@11x17

0 200 500m

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FIGURE 77
AIRPORT LAYOUT - MEDIUM - TERM (2026-2035)

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Figure 78: Airport Layout – Long-Term (2036-2045)

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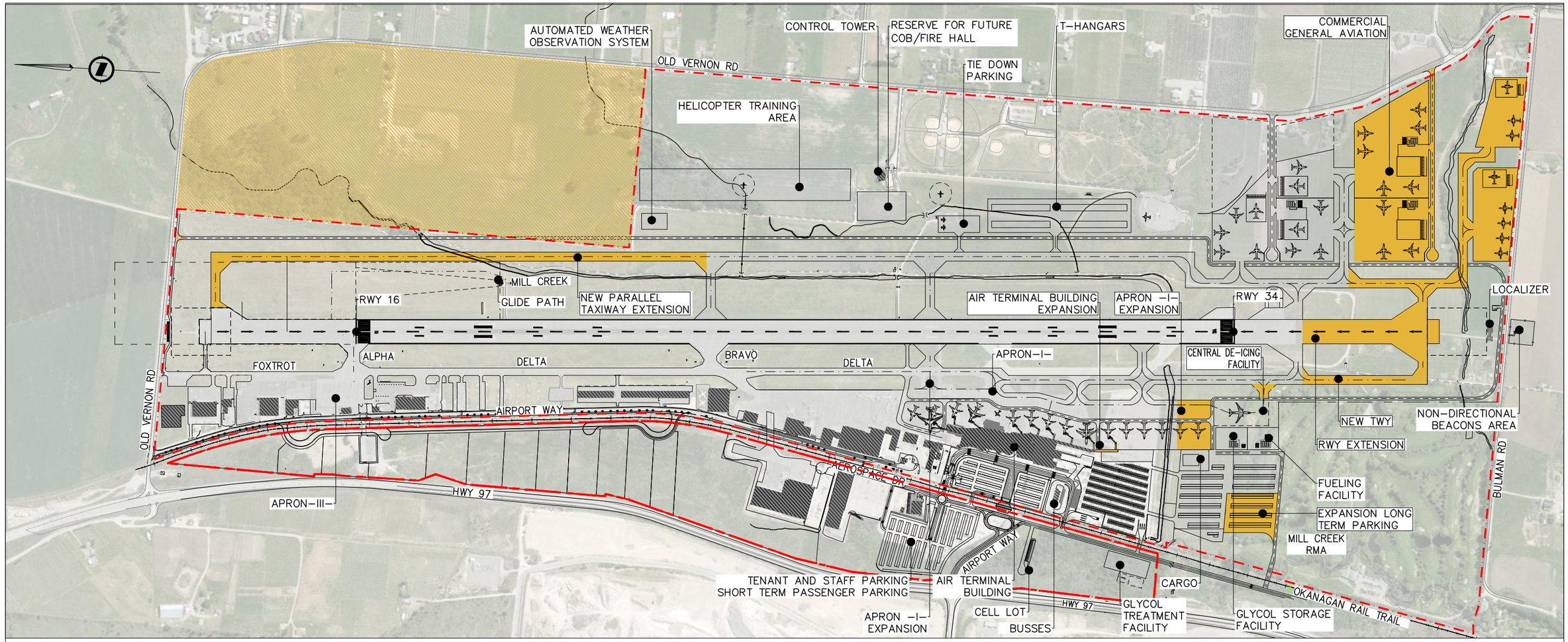

LEGEND

- LONG TERM 2036-2045
- LAND ACQUISITION
- BUILDING STRUCTURE
- AIRPORT BOUNDARY

SCALE 1:10 000
@11x17

0 200 500m

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FIGURE 78
AIRPORT LAYOUT - LONG - TERM (2036-2045)

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
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14.2 Phasing Program

Implementation of the projects outlined in this Master Plan will occur in accordance with established YLW business, operational, environmental and capital review and approval processes. Until the Master Plan is updated, these recommendations will drive YLW and the City of Kelowna's annual budgeting and capital planning initiatives.

The Phasing Program presented in Figure 79 (below) covers the long-term planning horizon. A significant number of projects will need to be undertaken over the next five to ten years to ensure YLW addresses critical capacity shortfalls, regulatory requirements and real estate demand at the airport, in accordance with its financial capabilities. Additional detailed engineering, costing and project planning will need to be conducted before implementation of any proposal takes place.

Figure 79: Master Plan 2045 Phasing Program

	2016-2025	2026-2035	2035-2045
Airside System			
RESA Implementation plus 50 m South Runway Extension			
Localizer Relocation			
Runway Extension to 3,048 m (+316 m)			
New South West Parallel Taxiway Development (South of Taxi C)			
East Parallel Taxiway Phase 2 (Centre)			
East Parallel Taxiway Phase 3 (North)			
Terminal Apron			
Addition of 2 Remote Aircraft Stands (Code C)			
Addition of 2 Remote Aircraft Stands (Code C)			
Addition of 1 Terminal Gate/Stand (Code C)			
Addition of 1 Remote Aircraft Stand (Code C)			
Air Terminal Building			
Check-in Lobby Reconfiguration			
BHS Completion and Conversion of Old Bag Room into Offices			
Departure Lounge Renovation			
Terminal Curb Redevelopment			
South End Expansion (Holdroom, Domestic Arrivals, Ground Transportation, PBS)			
Covered Walkways - Stand 1 and 2			
New Loading Bridge Gate 3			
Loading Bridge Refurbishing - Gates 4-9			
North International Arrivals Repurposing (incl. CBSA Secondary Expansion)			
Northern International Arrivals Hall Expansion			
Hotel Development	Subject to Third-Party Investment		

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Figure 79: Master Plan 2045 Phasing Program (Cont'd)

	2016-2025	2026-2035	2035-2045
Parking			
Cell phone lot			
Pedestrian Plaza			
Rental Car lot			
Tenant/Staff parking lot			
Premium Lot Development			
Taxi Rank Expansion			
Car Rental Facility			
Short-Term Parking Lot Relocation			
Bus and shuttle lot development			
Long-term Lot Reconfiguration/Expansion - Phase 1 Incl. New Exit Plaza (2,200 Stalls)			
Long-term Lot Expansion - Phase 2 (Add'l ~450 stalls)			
Long-term Lot Expansion - Phase 3 (Add'l ~580 stalls)			
Access			
Airport Way Widening and Dual Left-Hand Turning Lanes			
Main Roundabout - Airport Way			
Airport Way South Realignment (Through Okanagan Rail Trail)			
Highway 97 / Airport Way Intersection Dual Left Hand Turn Lanes			
Highway 97 / Airport Way Intersection Redevelopment			
Operations and Support			
Combined Operations Building Expansion			
NPSV - Phase 2			
GSE Storage Relocation			
Glycol Secondary Capture Facility			
Commercial Development			
Groundside Development (Airport Plaza - Retail Pad)			
Groundside Development (Westlands Development)			
South East Development			
South East Stub Taxiway (East Parallel Taxiway Phase 1)			
South East Access Road			
South East Apron			
South East Servicing			
South East Expansion			
East Development			
Eastside Access Road (Midfield)			
T-Hangar Development (Midfield)			

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14.3 Preliminary Capital Requirements

The implementation of project recommendations contained in *Master Plan 2045* will be subject to City of Kelowna and YLW funding capabilities and established procurement and approval processes. For planning purposes all major Airport projects are identified in YLW's 10-year Capital Plan, which requires review and approval by City of Kelowna Council.

Preliminary estimates of the capital projects recommended in this Master Plan for the 2016-2025 period are approximately $190 million, excluding Operations and Maintenance (O&M) expenditures. The largest capital projects consist of:

- South Terminal expansion;
- South Apron expansion; and
- Groundside roadway and parking redevelopment.

Prior to entering the City's funding approval process, projects must be advanced through an initial design development phase to establish more accurate cost for budgeting and to define project details, impacts and schedule requirements. It is not until these key parameters are understood that a project can be presented for approval.

Funding sources for these capital projects will generally be supported through the Airport Improvement Fee (AIF) and through incremental revenues derived from new land development.

The commercial success of the airport is directly attributable to the responsible development previously delivered in alignment with proper planning processes such as this Master Plan. It is the investment in developing thoroughly reviewed plans based on the critical and strategic thinking of industry leading professionals that provides the confidence drive YLW's true growth potential.

Offering safe, affordable, and efficient facilities to airport users and the community is a top priority for YLW. The airport remains a key economic driver of the Okanagan region and its responsible development a crucial element for the health of established and emerging industries.

As YLW proceeds with future expansion, it will also be important that appropriate workforce planning is undertaken to ensure the necessary human resource are available in the future to maintain and operate airport facilities and ensure targeted levels of service to its customers.

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