1 EXISTING AIRPORT MECHANICAL AND ELECTRICAL SYSTEMS

1.1 General

1.1.1 The Kelowna airport was constructed in many phases from the original 1967 building to the airport today. The mechanical systems have varied over the course of these expansions as technologies and design philosophies have changed. There has been a mix between indoor and outdoor mounted equipment, with several expansion areas served by rooftop units instead of providing internal mechanical rooms. The original internal mechanical systems installed in 1967 and 1971 did not provide for a full central plant concept with room for expandability.

1.1.2 The mechanical systems include multi-zone constant volume, single-zone constant volume rooftop units, fan coils with dedicated outdoor air units, and packaged split system cooling units. The cooling systems include direct expansion (DX) in the majority of the units, a single chiller/tower system to supply fan coils and air handling units.

1.1.3 The existing record drawings were reviewed to determine current mechanical and electrical system configuration, existing equipment installation dates, and potential replacement requirements.

1.1.4 The scope of work for electrical systems was limited to a Lighting Survey to determine potential to reduce lighting energy use and heat gains to the space.

1.2 Existing Ventilation Systems

1.2.1 The East mechanical room 090 was part of the original 1967 construction and originally contained a multi-zone air handling unit, a single boiler, and a centrifugal Trane Torrivent condenser unit. This was revised in 1994 when the single boiler was replaced with two Fulton pulse combustion boilers and the Torrivent unit was replaced with a roof mounted condenser unit. The East mechanical room was renovated again in 2001 when the multi-zone was converted to an outdoor air makeup unit and two additional Buderus Boilers were added. The new outdoor air unit 090 has a hot water heating coil and chilled water cooling coil.

1.2.2 The existing Control Tower room 226 constructed in 1971 contains a dedicated single zone air handling unit with a hot water coil and split DX cooling coil, a single boiler serving the air handling unit and a unit heater, and two outdoor condensing units. The condensing units were replaced in 2001 as part of the major expansion.

1.2.3 The West mechanical room 030 constructed in 1982 contains a multi-zone air handling unit with DX cooling and a dedicated boiler serving the multi-zone heating coil only. This system is constant volume and primarily serves the central original main concourse areas. The DX cooling is served by a roof mounted condensing unit. This mechanical room has not been renovated and the mechanical air handling unit, boiler, and condenser all are beyond their service life.

1.2.4 Mechanical room 223 (unit 045) contains a constant volume mixed air handling unit dedicated to the feature departure lounge area. This unit has a

hot water heating coil and chilled water cooling coil. This unit provides outdoor air directly to the departure lounge area.

1.3 Existing Heating Systems

1.3.1 West mechanical room 030 has one 1350 MBH A.O. Smith 80% efficient atmospheric boiler that only serves the multizone unit. The multizone hot deck provides building heat for these zones.

1.3.2 East mechanical room 090 has two 1438 MBH 84% efficient conventional Buderus G515 forced draft boilers that provide primary building heating for the portion of the airport served by fan coils and terminal heating systems. Two 875 MBH Fulton pulse combustion heating boilers are only used for backup. The primary hot water heating loop is constant volume with two-way valves on fan coils and air handling units. Fan coils provide heating or cooling to each zone. Unit heaters, radiation, and force flow units are also served by this heating loops with unit heaters and force flow units on wild loops and radiation served by two-way control valves.

1.3.3 The Control Tower is served by a single 350 MBH Bryan forced draft 80% efficient conventional boiler serving the air handling unit and a single unit heater.

1.3.4 There are various gas fired rooftop single-zone units located throughout the airport facility that can provide heating and cooling for the zones served.

1.3.5 Electric heat is utilized where hydronic heating is not practical or warranted. Gas fired infra-red heaters are used in the baggage drop-off areas.

1.4 Existing Cooling Systems

1.4.1 West mechanical room 030 is served by a DX refrigeration unit.

1.4.2 The East mechanical room 090, Mechanical room 223 (unit 045), and fan coils located throughout the airport are served by chilled water from the central chiller system.

1.4.3 The Control Tower is served by a DX refrigeration unit.

1.4.4 There are substantial numbers of packaged DX cooled rooftop constant volume units serving various expansion areas.

1.4.5 The chiller located in room 121A consists of a 155 ton McQuay R-22 centrifugal chiller and associated external fluid cooler. The chilled water loop has two 100% redundant pumps serving a constant volume chilled water loop with three way valves. The condenser loop has two 100% redundant pumps serving the fluid cooler coil. Free-cooling switchover valves provide winter operation without the chiller.

1.5 Control Sequences

1.5.1 The only control sequences available from Kimco controls were related to the PBS expansion phase of the airport.

1.5.2 The PBS expansion rooftop units RTU 1 to 7 did incorporate some energy conservation measures such as CO2 control of outdoor air, full recirculation during unoccupied periods, temperature turndown to 15 C during unoccupied periods, and economizer modes. However, it was noted that a very low CO2

setpoint of 500 ppm was utilized for the CO2 control which would be ineffective to reduce outdoor air quantities, since a low setpoint will increase outdoor air flow.

1.5.3 Screenshots of all controlled systems are included in Appendix A to provide an overview of the DDC system capabilities. Most mechanical equipment in the airport has some form of central DDC control.

1.5.4 Several trend logs from the control system included in Appendix B were utilized to determine system operating parameters.

2 LIGHTING SURVEY

2.1 Lighting Survey

2.1.1 A lighting survey was conducted between May 26 and May 27, 2010. This survey included a survey of fixture types, hours of use, potential for daylighting, lamp wattage, and illumination levels.

2.1.2 The lighting survey was conducted under daylight and nightime conditions to determine actual artificial lighting levels.

2.1.3 Several existing areas did have occupancy controls to control lighting operation.

2.1.4 Refer to Appendix C for lighting survey data and luminaire schedules.

2.2 Lighting Energy Conservation Strategies

2.2.1 The existing lighting in the Airport has been installed over the past 40 years with some upgrades occurring during expansion phases. Most of the existing T12 fixtures have been replaced with T8 fixtures, but some areas of T12 fixtures remain.

2.2.2 Lighting efficiency has increased substantially with current technologies and Lighting Power Densities lower than 1.0 W/sq.ft. are readily achievable.

2.2.3 The general illuminance levels can be reduced to the minimum necessary to perform the tasks required.

2.2.4 Occupancy sensors can be extended to more areas of the airport.

2.2.5 Daylight harvesting can be implemented in day lit areas, preferably in conjunction with daylight sensors.

3 EXISTING AIRPORT HEATING AND COOLING LOADS

3.1 Design Assumptions

3.1.1 The winter design temperature is -18.1°C.

3.1.2 The summer design temperature is 35.1°C DB, 19.1°C WB.

3.1.3 Occupancy loads based on ASHRAE 62.

3.1.4 Natural gas was approximately $11.18/GJ.

3.1.5 Electricity blended rate was approximately $0.069/kWhr.

3.2 Load Model

3.2.1 IES Virtual Environment was used to model the existing building and the proposed concept design of the new expansion areas.

3.2.2 Refer to Appendix D for a summary of heating and cooling loads based on the block model.

3.3 Heating and Cooling Loads

3.3.1 The calculated cooling load for the existing building based on the block load is approximately 196 tons. The block load is based on the entire building on a system level without individual room by room calculations. This calculation accounts for variation of cooling loads throughout the day as the solar load moves around the building.

3.3.2 Refer to Appendix E. The installed cooling capacity is approximately 378 tons, which is almost double the block load. This is typical of packaged rooftop unit installations, since the cooling units are rated in nominal sizes and provide a fixed amount of cooling. It was also found the existing chiller was not operating at 100% load.

3.3.3 The calculated cooling load for the expansion based on the Concept drawings is 203 tons. However, this cooling load will be reduced based on sustainable design concepts and reduction of proposed window areas.

3.3.4 The calculated heating load for the existing building based on the block load is approximately 3150 MBH.

3.3.5 Refer to Appendix E. The installed heating capacity is approximately 6,100 MBH which is oversized for the application. However, the packaged rooftop units have more heating capacity than is required for the application, which artificially makes the heating system appear oversized.

3.3.6 The heating and cooling systems are slightly oversized, but at the rooftop unit locations.

4 MECHANICAL ENERGY REDUCTION STRATEGIES

4.1 Right-Sizing Heating and Cooling Loads

4.1.1 The existing mechanical systems are oversized particularly in areas with rooftop units. Packaged rooftop units can be replaced with correctly sized hydronic units when life cycle replacement is due.

4.1.2 The new areas will be correctly sized with mechanical units suitable for the application.

4.2 Demand Based Ventilation

4.2.1 The use of CO2 and occupancy based sensors is highly recommended. The current dedicated outdoor air unit serving the fan coils has variable inlet vanes but should be responding to changes in building occupany.

4.2.2 The CO2 setpoints should be set at 1000 ppm.

4.3 Heat Recovery

4.3.1 Heat from exhaust should be recovered back to the inlet of the dedicated outdoor air system. Heat recovery systems include energy recovery wheels, runaround coils, and heat pipe systems that recover heat from the exhaust air stream for use in the intake air stream. This reduces energy consumption for pre-heating of outdoor air to the air handling units.

4.3.2 The exhaust systems in the existing airport area are widely distributed and smaller in scale. Therefore, significant recovery of exhaust heat would be difficult and will not payback. The new exhaust systems will be designed to provide central heat recovery.

4.4 Peak Capacity Reductions

4.4.1 The reduction of cooling load by reducing the source heat gain can be a very effective strategy to reduce energy use. The use of external shading devices, operable external dampers, and overhangs help to provide this reduction.

4.4.2 The Rotunda area has a very high cooling load due to the large glass areas facing Southwest. The glazing is quite dark, but substantial quantities of cooling air are still required. Therefore, solar control of this area should be evaluated.

4.4.3 The existing East facing passenger corridors also have substantial glass to allow passengers to view airside areas. However, large numbers of split system air conditioning units are required to cool these corridors. It is recommended that glazing be minimized or external shading incorporated.

5 SERVICE LIFE UPGRADES

5.1 West Mechanical Room - Boiler Replacement

5.1.1 The existing boiler serving the multi-zone unit 030 requires life-cycle replacement. This boiler's only purpose is to serve the multi-zone unit and provide heating to each zone.

5.1.2 ECO: The new West Mechanical room air handling unit should be connected to a new heat pump located in the mechanical room. The temperatures required to serve an air handling unit pre-heat function are compatible with temperatures from a heat pump unit. The heat pump unit would be water to water to allow a centralized installation to serve the multi-zone unit.

5.2 West Mechanical Room – Air Handling Unit Replacement

5.2.1 The existing constant volume multi-zone air handling unit requires life cycle replacement due to age of the unit. It was also noted by operational staff that the existing outdoor air intake for this unit is in a very poor location and is subject to vehicle fume entrainment.

5.2.2 ECO: The new air handling unit should be variable volume with variable volume control of each zone. Occupancy or demand based control (CO2) can be used to control volume delivered to each zone as well as outdoor air requirements from the unit. It is also proposed that the air handling unit intake and exhaust be reversed so that outdoor air is drawn from the roof area and exhaust is directed towards the taxi stand areas.

5.3 R-22 Screw Chiller

5.3.1 The existing McQuay dual rotary screw chiller is 10 years old and is using R-22 refrigerant which is slated for phase-out in 2020. This chiller utilizes two single-rotor screw compressors operating in parallel on a single evaporator and condenser. The efficiency of this existing chiller is approximately 0.70 kW/ton, new chillers are more efficient and can achieve better than 0.5 kW/ton, particularly when using variable speed control. Variable speed chillers are more efficient at part load since the variable inlet vanes found on constant speed chillers are eliminated. The variable speed operation of the compressor provides much more efficient operation at part-load as the chiller motor operates at a slower speed.

5.3.2 ECO: Replace the existing chiller when the 2016 mechanical room build out occurs by installing a new more efficient and HCFC free chiller in the new mechanical room.

5.4 Packaged Rooftop Units

5.4.1 There are several packaged rooftop units that will require replacement over the course of the expansion project. These units are not as efficient as a central cooling system with typical performance of 1.25 kW/ton on cooling. Packaged rooftop units are also typically single zone and don't provide consistent temperature control in the space. However, some rooftop units have been recently installed and the Owner should continue to obtain the value from these units until replacement is necessary.

5.4.2 ECO: Allow provision to connect replacement rooftop units into the central heating and cooling system when replacement becomes necessary.

5.5 East Mechanical Room – Boilers

5.5.1 The existing Buderus boilers were only installed in 2001 and these boilers are cast iron style with a long potential service life. The hydronic system is also designed for the higher temperatures provided by these boilers. Therefore, these boilers should continue to provide peak loading and backup to a potential geothermal system. The existing Fulton boilers should be removed to provide space for future heat pumps.

5.5.2 ECO: The investment and embodied energy in the Buderus boilers would be wasted if these boilers were replaced. These boilers should be operated to the end of their life cycle.

5.6 Control Room – Boilers and Air Handling Units

5.6.1 The existing control room is no longer being utilized as a control tower. Therefore the small boiler and air handling unit should be demolished and the system connected to the main loop.

5.6.2 ECO: Provide a new hydronic air handling unit with heating coils and chilled water coils served by a heat pump.

6 FUTURE EXPANSION CONSIDERATIONS

6.1 External Geothermal Field

6.1.1 It is proposed to take advantage of the landscape of the airport by utilizing the infield areas for a closed loop geothermal field. The proximity of Mill Creek and Okanagan Lake to the airport suggests that good ground conditions or an aquifer may be available in the area to provide good borehole performance.

6.1.2 Provide primary heating and cooling base loads by utilizing an economically sized geothermal field (to be determined during the expansion project). Provide central heat pumps located in central mechanical rooms to provide heating and cooling to serve loads. Provide geothermal loop distribution throughout the airport to allow heat pumps to draw or reject heat to the loop. Peak load and backup heating and cooling to be provided by central boilers and chillers.

6.2 Distributed Chiller System

6.2.1 Provision of distributed chiller systems will provide more efficient cooling operation since the chillers would be water cooled. The chillers would be located in each main mechanical room: a new north mechanical room, the existing chiller mechanical room, and the new expansion mechanical room.

6.2.2 Provide efficient variable speed chiller systems to provide chilled water to the building and reduce electrical load. Chillers shall be operated whenever required to provide peak capacity and backup.

6.3 Distributed Boiler System

6.3.1 Provision of distributed boiler systems to provide backup and peak heating for the geothermal system. The boilers would be located in each main mechanical room: a new north mechanical room, the West mechanical room, the existing East mechanical room (existing boilers), and the new expansion mechanical room.

6.3.2 Provide condensing boilers to take advantage of new low temperature heating systems and allow interconnection with the geothermal system.

6.4 Utility Transformer

6.4.1 In order to expand the existing Air Terminal Building more power will be needed from the existing utility transformer. By reducing the lighting power density of the existing Air Terminal Building capacity can be freed up from the transformer for use in the expansions to come. As a result, by reducing the lighting power, not only significant energy can be saved but the cost of revising the utility transformer and electrical distribution equipment can be mitigated.

6.4.2 Reduce lighting and cooling power in the existing building to reduce electrical load and accommodate expansion.

7 ENERGY CONSERVATIONS MEASURES – LOW OR NO COST

7.1 Mechanical Equipment Schedules

7.1.1 Mechanical Equipment should be shut down when the building is unoccupied. It was noticed during review of the control system that the majority of equipment does not shut down.

7.1.2 ECO: Utilize equipment scheduling feature to shut down equipment when not required, typically during unoccupied periods.

7.1.3 Energy Savings: as much as $14,000/year, some units may not be shut down or require a longer rebound period.

7.1.4 Capital Cost Estimate: $0

7.1.5 Simple Payback = immediate.

7.2 Chilled Water Pumps

7.2.1 The existing chilled water pumps are running continuously even when the chillers and cooling towers have shut down.

7.2.2 ECO: Shut down the chilled water pumps when not in use.

7.2.3 Energy Savings: $2,000/year

7.2.4 Capital Cost Estimate: $0

7.2.5 Simple Payback = immediate.

7.3 CO2 Control

7.3.1 The existing CO2 control setpoints are set too low. Exterior ambient CO2 levels are typically 400 ppm, ASHRAE 62 recommends that CO2 sensors be set a maximum of 700 ppm over the ambient which corresponds to a comfortable level of ventilation and odour control.

7.3.2 ECO: Revise CO2 setpoints to 400 + 700 ppm = 1100 ppm maximum. We would recommend 1000 ppm as the setpoint with an alarm at 1100 ppm.

7.3.3 Energy savings are hard to quantify but outdoor air volumes should be reduced.

7.3.4 Capital Cost Estimate: $1300. This capital cost estimate is based on programming time for the DDC system vendor.

7.3.5 Simple Payback = immediate.

7.4 Bypass Water Filtration

7.4.1 Domestic water is current being filtered at each entry location by substantial filtration units. These units consume power and are costly to maintain. The current status of domestic water supply quality should be re-evaluated to confirm these filters are necessary. If they are found to be necessary, a separate unfiltered supply should be connected to fixtures such as toilets, urinals, and hose bibs. The cost consultant identified an extra cost of $103,200 to provide these additional plumbing lines, this cost would make this bypass uneconomical.

8 ENERGY CONSERVATIONS MEASURES – MECHANICAL

8.1 Condensing Boilers

8.1.1 Replacement boilers in the West Mechanical room and possibly the Control Tower mechanical room should be condensing style to provide up to 95% seasonal efficiency. The heating system can be modified in both of these

areas to a low temperature design relatively easily since air is used for heating. Condensing boilers will complement a future geothermal loop as well.

8.1.2 The East Mechanical room could also have one condensing boiler installed to operate in the summer and partial load seasons. The existing hot water loop to the fan coils, radiation, and unit heaters is difficult to revise to low temperature operation since this equipment was all sized at high temperatures. However, the reset schedule can be lowered as much as possible to encourage condensing operation.

8.1.3 ECO: Install condensing boilers for all replacement boilers. Condensing boilers are cost effective and have a short payback period.

8.1.4 Capital Cost Estimate: The opportunity to install condensing boilers is at life-cycle replacement of existing conventional boilers. There will be an up-charge for condensing boilers and the associated stainless steel flues, but this charge will be minimal. Estimated up-charge from a conventional boiler for the West mechanical room would be $30,000 for a condensing boiler system. Note: This cost estimate is the delta for condensing boilers over conventional only, this estimate does not include the entire project cost for boiler replacement.

8.1.5 Energy Savings = $15,019/year. Simple Payback = 2.0 years

8.1.6 Greenhouse Gas savings = 67.5 tCO2.

8.2 Centralized Chilled Water Systems

8.2.1 The existing systems are a mix of direct expansion (DX) condensers, packaged DX units, and a chilled water loop for internal fan coils. The existing direct expansion equipment should be replaced whenever possible with water cooled chillers or as part of a geothermal heat pump loop.

8.2.2 ECO: Provide water cooled chillers for peak loading and as backup for the geothermal system.

8.2.3 Capital Cost Estimate: The capital cost for central chilled water systems can be budgeted in the capital upgrades of each expansion. The intent is to provide geothermal piping mains from the north end of the airport to the south end of the airport to allow connection of heat pump units. The central chillers will be located at the North and South end to support the heat pumps. There will be a capital cost premium between provision of packaged rooftop DX units and central chillers with wet coil units and hydronic piping. The cost premium based on a 200 ton chiller and associated equipment was estimated at $108,700. Note: this cost premium is a the delta between packaged rooftop DX units and central chillers only, not the cost estimate for the entire chilled water system.

8.2.4 Energy Savings = $9500/year. Simple Payback = 11.4 years.

8.2.5 Greenhouse Gas savings = 2.8 tCO2.

8.3 Variable Speed Pumping Systems

8.3.1 The existing heating and cooling pumps serving the hot water and chilled water loops are constant volume. All fan coils and air handling units have 3-way valves and systems are primary only.

8.3.2 ECO: Provide variable speed drives on distribution pumps, add constant volume primary pumps on boilers and chillers complete with a decoupling bridge.

8.3.3 Capital Cost Estimate: There are large numbers of fan coils, approximately 60, that will require replacement of the 3-way valves with 2-way valves to provide variable flow in the system. It is possible to retrofit the 3-way valves to 2-way valves by blocking off one port, which would be significantly less expensive than trying to convert all the existing valves. The capital cost assuming retrofit or maintenance replacement of the 3-way valves is approximately $122,000. Note: this cost estimate assume that the fan coil valves will be replaced as part of the renovation work in each area, therefore ceilings will be accessible for replacement.

8.3.4 Energy Savings = $6,200/year. Simple Payback = 19.7 years.

8.3.5 Greenhouse Gas savings = 1.8 tCO2.

8.4 Geothermal Ground Source Systems

8.4.1 The potential for geothermal ground source systems is being evaluated as part of the Concept design for the airport expansions. There is sufficient land area on the airport infield to accommodate a closed loop system. There is also potential of utilizing standing column geothermal wells, this should be evaluated in the design phase. The geothermal field will not provide the entire heating and cooling load for the airport, with peak loads accommodate by boilers for heating and chillers for cooling.

8.4.2 ECO: Provide a geothermal energy loop throughout the airport connecting the North and South ends to an open or closed ground source heat pump system. This system will allow movement of heat from year round internal load areas to perimeter areas and will provide substantially better performance than the air side condensers typically used. Split systems are available to allow connection of the heat pump loop to existing refrigerant coils or provide cooling to service rooms.

8.4.3 Capital Cost Estimate: The capital cost estimate for the geothermal field will be highly variable based upon open versus closed loop, disturbance to the runway, and overnight premiums for well drilling. However, it is estimated that the geothermal field to support the existing airport block cooling load of approximately 200 tons would be $532,500. Note: this cost estimate is based on 2 tons/well, approximately 100 - 76 m deep vertical bore wells, and 150 mm supply and return piping c/w with manifolds and branch piping connecting to each well.

8.4.4 Energy Savings are approximately $30,000/year over an equivalent condensing boiler system. Simple payback = 17.7 years.

8.4.5 Greenhouse Gas Savings = 283 tCO2.

9 ENERGY CONSERVATION MEASURES – ELECTRICAL

9.1 ASHRAE 90.1 Energy Compliance

9.1.1 The existing lighting system in the building is consuming 1.31 W/ft2. ASHRAE 90.1 specifies lighting power densities for specific spaces within airports and

further states that a transportation building should have Lighting Power Densities (LPD) lower than 1.0 W/ft2. With LEED Certification in mind ASHRAE 90.1 would have to be further reduced by 10%. Therefore the Lighting Power Density target for the airport would be 0.9W/ft2. While the airport may not file for LEED certification this Lighting Power Density reduction represents a LEED pre-requisite minimum and should be considered a best practice whenever Energy Conservation is being pursued. A combination of techniques would be used to achieve the LPD of 0.9W/ft2. Examples are replacing light fixtures, de-lamping the existing fixtures, revising branch circuits, and revising the Lighting Control system program.

9.1.2 ECO: Re-lamp and re-fixture as necessary to surpass ASHRAE 90.1 by 10%.

9.1.3 Energy Savings: 31% of total lighting power, 292615 kW*h/year based on 18hour/day operation, or $20200 at $0.069/kW*h.

9.1.4 Capital Cost Estimate: $27390.

9.1.5 Simple Payback = 1.4 year.

9.2 Administration Open Office Area General Illuminance Levels

9.2.1 The existing lighting system in the open office area is to provide 550 lux on average to the working surface. Providing 550 lux on the desktop in an environment with 4 foot partitions is ineffective due to shadowing. Reducing the area lighting illuminance level to 350 lux will provide a comfortable work environment as well as introduce cost savings through reduced energy consumption, fixture maintenance and re-lamping. Using supplemental task lighting at each workstation will ensure that the occupants receive a comfortable amount of light where they require it.

9.2.2 ECO: Redesign open office area lighting to 350 lux with supplemental task lighting.

9.2.3 Energy Savings: Energy savings and costs for this option are grouped in with the Ashrae 90.1 Energy Compliance Option.

9.2.4 Capital Cost Estimate: Included above.

9.3 Occupancy Sensing in Private Offices

9.3.1 Each private office space uses one or two local switches to control the lights in the space. By installing wall mount occupancy sensors to replace the local switches the lights will always be turned off when the spaces are not occupied. Semi-Automatic Occupancy Sensing is recommended. If there are special requirements of a particular office that require a manual "lights on" override, that feature can be provided with the wall mounted occupancy sensor.

9.3.2 ECO: Install wall mounted occupancy sensors in private office to reduce lighting energy consumption in unoccupied spaces.

9.3.3 Energy Savings: 50% of office lighting energy, 87000 kW*h per year, or $6000 at $0.069/kW*h per year.

9.3.4 Capital Cost Estimate: $14775

9.3.5 Simple Payback = 2.5 years

9.4 Occupancy Sensing in Baggage Claim

9.4.1 Due to the nature of arrival times, the baggage claim area remains inactive for large periods of time during the airports daily operation. Using occupancy sensors in the airside corridor and CBSA area with manual override switches in the Baggage Claim area, the lights could be automatically turned off for a significant period of time each day. A reduced lighting level would be provided during the inactive mode to allow occupants to safely move about the space.

9.4.2 ECO: Install ceiling mounted occupancy sensors in airside corridor and CBSA processing area to reduce amount of time Baggage Claim light fixtures are turned on.

9.4.3 Energy Savings: 50% of Baggage Claim lighting energy, 40000 kW*h per year, or $2750 at $0.069/kW*h per year.

9.4.4 Capital Cost Estimate: $8100

9.4.5 Simple Payback = 2.9 years.

9.5 Washrooms, Locker, Janitor and Storage Rooms Occupancy Sensing

9.5.1 Many Janitor Rooms and Storage rooms often have the lights left on. Wall and ceiling mount occupancy sensors in semi automatic operation would ensure these lights are turned off when the rooms are not in use. The public and staff washrooms are currently turned on all day. Ceiling mounted occupancy sensors in fully automatic mode could effectively turn these lights.

9.5.2 ECO: Install ceiling mounted occupancy sensors in common all washrooms, Janitor Rooms, and Storage Rooms to turn lights off when not in use.

9.5.3 Energy Savings: 50% of room lighting energy or 29500 kW*h at $0.067/kW*h per year, or $2000 at $0.069/kW*h per year.

9.5.4 Capital Cost Estimate: $2175

9.5.5 Simple Payback = 1.1 years.

9.6 Concourse Daylight Harvesting

9.6.1 The Central Concourse has both skylights and clerestories. These features introduce large amounts of daylight into the space and during daytime hours the daylight dominates the lighting in the space. The electric lighting in the concourse could be turned off in the morning when the sun rises and turned on in the evening when the sun sets based on an outdoor photocell.

9.6.2 ECO: Commission existing photocell sensor to turn off concourse lighting during daylight hours.

9.6.3 Energy Savings: 12 hours of daylight harvesting per day for 206000 kW*h, or $14250 at $0.069/kW*h per year.

9.6.4 Capital Cost Estimate: $15,000.

9.6.5 Simple Payback = 1.1 years.

9.7 Rotunda Lounge Daylight Harvesting

9.7.1 The Rotunda Lunge has tall glazing on the West side. These windows introduce large amounts of daylight into the space and during daytime hours the daylight dominates the lounge area lighting in the space. The electric lighting in the upper Rotunda Lounge could be turned off during daylight hours, although the lower Rotunda area where passengers pass through en route to pre-board screening should remain on. The lighting system in the Rotunda Lounge area should be re-evaluated for energy efficiency. The Metal halide indirect lighting system shining upwards on the painted grey perforated curved mesh panel is extremely inefficient. A different ceiling type, or down lighting fixture could allow for a decrease the Lighting Power Density in the area.

9.7.2 ECO: Commission existing photocell sensor to turn off Rotunda Lounge lighting during daylight hours and re-evaluate indirect lighting system to further reduce the lighting power density.

9.7.3 Energy Savings: 12 hours of daylight harvesting per day. Calculated with Concourse lighting above.

9.7.4 Capital Cost Estimate: Included above.

9.8 Daylight Sensing to Control Air Side Corridor Lighting

9.8.1 The Air Side Corridor has large windows approximately every 8 feet. These windows provide ample daylight in the corridor during daytime hours. The electric lighting in the Air Side Corridor could be turned off where ever there are windows during daylight hours.

9.8.2 ECO: Install East facing photocell and commission turn off Air Side Corridor lighting during daylight hours.

9.8.3 Energy Savings: 12 hours of daylight harvesting per day. Calculated with Concourse lighting above.

9.8.4 Capital Cost Estimate: $1300.

9.9 Building Lighting Control System

9.9.1 The Douglas Relay System controls the lighting circuits throughout the building and allows for great lighting flexibility. By revising the time clock and photocell schedules, a more stringent control scheme could be implemented. In general the light fixtures are connected to a large number of small zones. This affords great flexibility although some wiring may need to be revised to allow for maximum implementation of the above strategies. Reducing the hours that exterior light fixtures are turned on by turning them off during the late night period would add further savings.

9.9.2 ECO: Re-commission Time clock and Photocell Schedules for interior and exterior light fixtures. Revise wiring of light circuits as necessary to allow for implementation of daylight harvesting.

9.9.3 Energy Savings: Difficult to quantify.

9.9.4 Capital Cost Estimate: $2000

9.10 Building Luminaire Retrofit

9.10.1 The building has had almost all Fluorescent T12 lamps replaced with Energy Saving T8 lamps however there are a number of T12 lamps still in operation,

most notably in the exterior canopy. These fixtures have high mercury content, are inefficient, and should be replaced or re-lamped to T8.

9.10.2 ECO: Retrofit the remaining T12 lamps to be T8 lamps.

9.10.3 Energy Savings: 20% of fixture lighting energy or 1260 kW*h per year, or $90 at $0.067/kW*h per year.

9.10.4 Capital Cost Estimate: $6900

9.10.5 Simple Payback = 76 years.

9.11 Branch Wiring Revisions

9.11.1 In order to facilitate the above options, minor revisions to the electrical branch wiring may be necessary. These changes may be required in order to create the daylight harvesting schemes and revise fixtures to meet ASHRAE 90.1 depending on the existing conditions.

9.11.2 ECO: Facilitate technical completion of above ECO's

9.11.3 Capital Cost Estimate: $16398

10 SUMMARY

10.1 Mechanical ECO Summary Table

#	Description	ECO	Energy Savings	Capital Cost	Simple Payback	tCO2
.1	Revise Mechanical Schedules	Shut Down Air Handling Units Overnight	$ 14,000	None	Immediate	4.1
.2	Chilled Water Pumps	Shut Down Chilled Water Pumps Overnight	$ 2,000	None	Immediate	0.6
.3	C02 Control	Revise setpoints to 1000 ppm	Difficult to quantify	$1,300	Immediate	-
.4	Bypass Water Filtration	Remove or bypass water filtration, check water quality, provide dedicated piping to water closets	Difficult to quantify	$0 - if water quality is bad, $103,200	Immediate	-
.5	Condensing Boilers	Install condensing boilers when upgrading	$15,000	$30,000	2.0 years	67.5
.6	Central Chillers	Install central water cooled chillers instead of DX units	$9,500	$108,700	11.4 years	2.8
.7	Variable Speed Pumping	Install variable speed drives and 2-way valves on fan coils	$6,200	$122,000	19.7 years	1.8
.8	Geothermal Heat Pump System	Install a ground source geothermal system in conjunction with future expansions	$30,000	$532,500	17.7 years	283

10.2 Electrical ECO Summary Table

#	Description	ECO	Energy Savings	Capital Cost	Simple Payback	tCO2
.1	ASHRAE 90.1 Compliance	Revise lighting from 1.31 W/sq.ft. to 0.9 W/sq.ft.	$20,200	$27,390	1.4 years	5.9
.2	Administration Office Illumination	Reduce illumination to 350 lux	Included item .1	Included item .1	Included item .1	
.3	Occupancy sensors in Private Offices	Add Occupancy Sensors in all private offices	$6,000	$14,775	2.5 years	1.7
.4	Occupancy sensors in Baggage Claim	Add Occupancy Sensors to Baggage Claim	$2,750	$8,100	2.9 years	0.8
.5	WR, LR, JR, and Storage Room Occupancy Sensors	Add Occupancy Sensors to Misc Rooms	$2,000	$2,175	1.1 years	0.6
.6	Concourse Daylight Harvesting	Commission existing photocell to turn off concourse lighting during the day	$14,250	$15,000	1.1 years	4.1
.7	Rotunda Lounge Daylight Harvesting	Commission existing photocell to turn off concourse lighting during the day	Included item .6	Included item .6	Included item .6	
.8	Daylight Sensing for Control Air Side Corridor	Daylight sensing to Air Side Corridor	$1,300	Included item .6	Included item .6	0.3
.9	Building Lighting Control System	Recommisson time clock and photo-cells to exterior light fixtures	Difficult to quantify	$2,000	Immediate	
.10	Building Luminaire Retrofit	Retrofit remaining T12 lamps to T8 lamps	$ 90	$6,900	76 years	
.11	Branch Wiring Revisions	Allowance to complete ECO's 1-10		$16,398		

11 PHASING

11.1 PHASE 1- CBSA PIL and Transborder Holdroom Modification

#	Description	Phase 1 ECO Description	Phase 1 Capital Cost
.1	Revise Mechanical Schedules	Shut Down Air Handling Units Overnight	None
.2	Chilled Water Pumps	Shut Down Chilled Water Pumps Overnight	None
.3	C02 Control	Revise setpoints to 1000 ppm	$1,300
.4	Bypass Water Filtration	Remove or bypass water filtration, check water quality	$0
.5	Condensing Boilers	Install condensing boiler in PIL mechanical room for backup. Install condensing boiler in West mechanical room for life cycle replacement.	$15,000
.6	Central Chillers	Install backup water cooled chiller and tower in PIL mechanical room	$40,000
.7	Variable Speed Pumping	Install variable speed drives and 2-way valves on fan coils in Transborder renovation area.	$61,000
.8	Geothermal Heat Pump System	Install two heat pumps in PIL mechanical room, main underground piping and partial geothermal field	$175,000
#	**Description**	**Phase 1 ECO Description**	**Phase 1 Capital Cost**
.1	ASHRAE 90.1 Compliance	Mockup areas created for areas that will require new fixturing, De-Lamping in areas where this option can be achieved.	$6,825
.2	Administration Office	Reduce illumination to 350 lux	Included

	Illumination		item .1
.3	Occupancy sensors in Private Offices	Add Occupancy Sensors in all private offices	$14,775
.5	WR, LR, JR, and Storage Room Occupancy Sensors	Add Occupancy Sensors to Misc Rooms	$2,175
.6	Concourse Daylight Harvesting	Testing only	$15,000
.7	Rotunda Lounge Daylight Harvesting	Commission photocell sensors	Included item .6
.8	Daylight Sensing for Control Air Side Corridor	Daylight sensing to Air Side Corridor	$1,300
.9	Building Lighting Control System	Recommisson time clock and photo-cells to exterior light fixtures	$1,000
.10	Building Luminaire Retrofit	Retrofit remaining T12 lamps to T8 lamps	$6,900
.11	Branch Wiring Revisions	Allowance to complete ECO's 1-10, as required in Phases 1, 2, 3, 4	$4,373

Total: $ 344,648

11.2 Phase 2 - Outbound Baggage Hall and Modifications to Air Side Corridor / Generator Facility

#	Description	Phase 2 ECO Description	Phase 2 Capital Cost
.8	Geothermal Heat Pump System	Install geothermal pipes through new airside corridors	$107,500
#	**Description**	**Phase 2 ECO Description**	**Phase 2 Capital Cost**
.1	ASHRAE 90.1 Compliance	Revise lighting from 1.31 W/sq.ft. to 0.9 W/sq.ft by re-lamping in existing terminal	$10,328

		building concourse air and ground-side where it is required (up to and not including the Rotunda)	
.6	Concourse Daylight Harvesting	Commission and implement after fixture up-grades	None
.11	Branch Wiring Revisions	Allowance to complete ECO's 1-10	$4,373

Total: $ 122,201

11.3 Phase 3 – Domestic Bag Claim / Meeter Greeter / Holdroom Expansion / Loading Area

#	Description	Phase 3 ECO Description	Phase 3 Capital Cost
.5	Condensing Boilers	Install condensing boilers when upgrading	$15,000
.6	Central Chillers	Install new central chiller and cooling tower in new mechanical room	$68,700
.7	Variable Speed Pumping	Install variable speed drives and 2-way valves on fan coils in renovated areas	$61,000
.8	Geothermal Heat Pump System	Install ground source heat pumps in new penthouse and extend source piping to penthouse	$250,000
#	**Description**	**Phase 3 ECO Description**	**Phase 3 Capital Cost**
.7	Rotunda Lounge Daylight Harvesting	Lighting Fixture Improvements	Included item .6
.11	Branch Wiring Revisions	Allowance to complete ECO's 1-10	$4,373

Total: $399,073

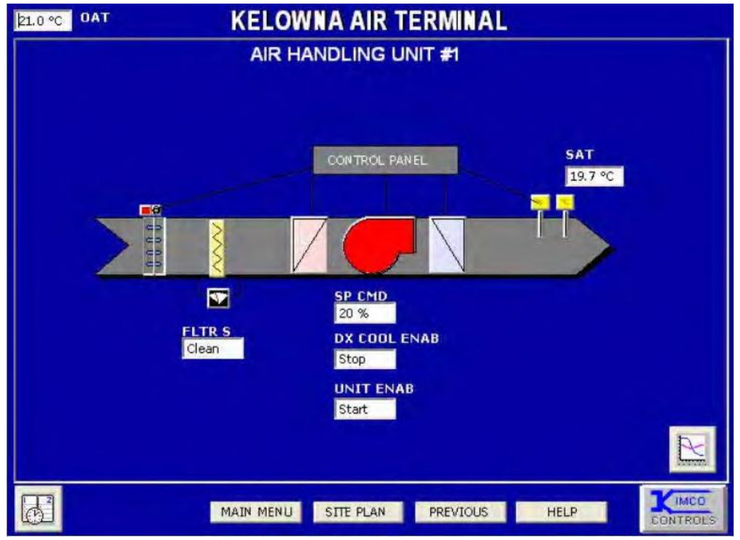
11.4 Phase 4 - International Bag Claim / Meeter Greeter Modifications / CBSA Secondary Expansion

#	Description	Phase 4 ECO Description	Phase 4 Capital Cost
.7	Variable Speed Pumping	Install variable speed drives and 2-way valves on fan coils	$30,000
#	**Description**	**Phase 4 ECO Description**	**Phase 4 Capital Cost**
.1	ASHRAE 90.1 Compliance	Revise lighting from 1.31 W/sq.ft. to 0.9 W/sq.ft. Complete re-lamping in areas that were affected by renovation or new construction during Phase 3.	$10,237
.4	Occupancy sensors in Baggage Claim	Add Occupancy Sensors to Baggage Claim	$8,100
.9	Building Lighting Control System	Re-commission time clock and photo-cells to exterior light fixtures	$1,000
.11	Branch Wiring Revisions	Allowance to complete ECO's 1-10	$3,279

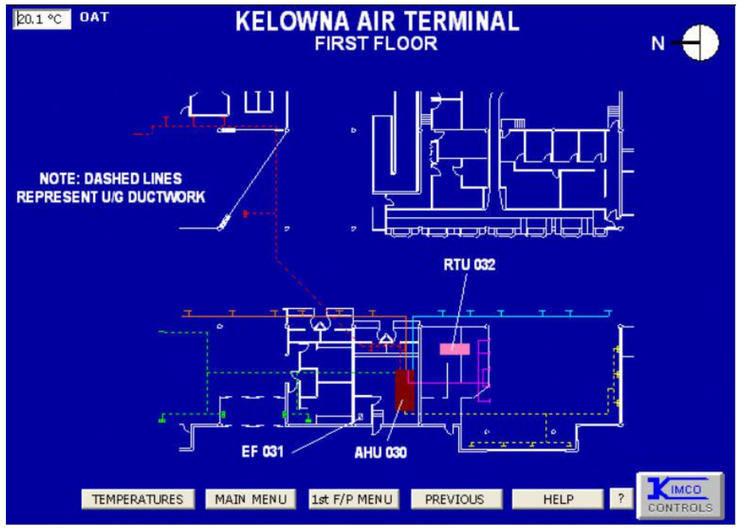
Total: $ 52,616

APPENDIX A

EXISTING MECHANICAL SYSTEMS



AHU-1



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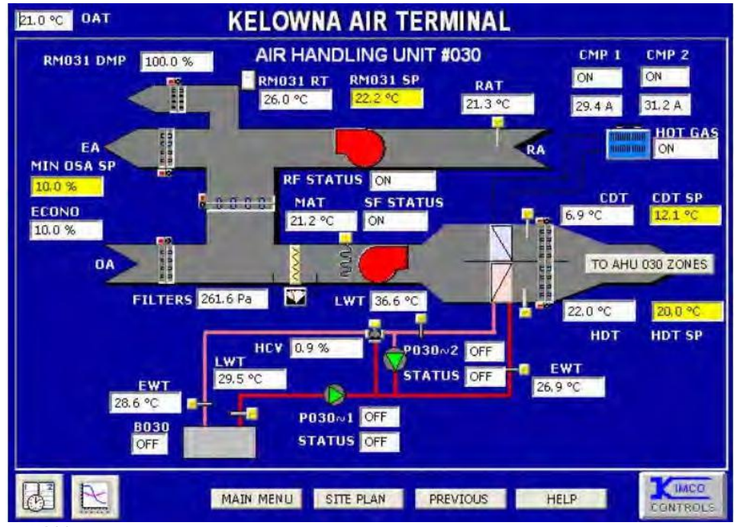

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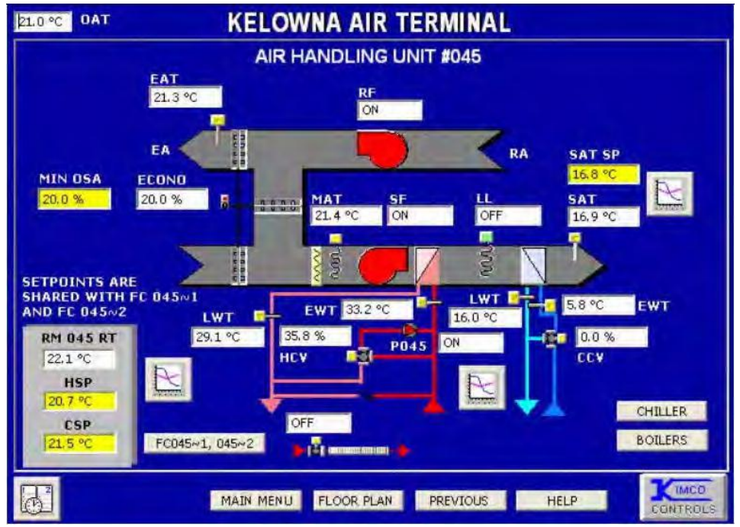

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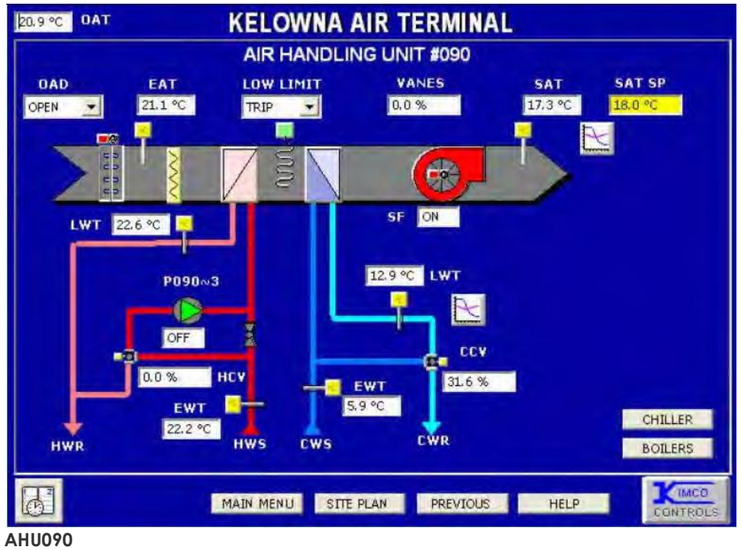

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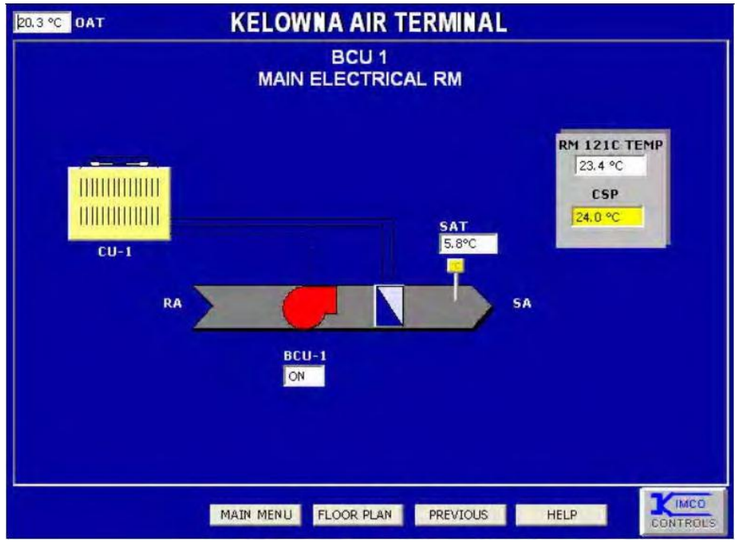
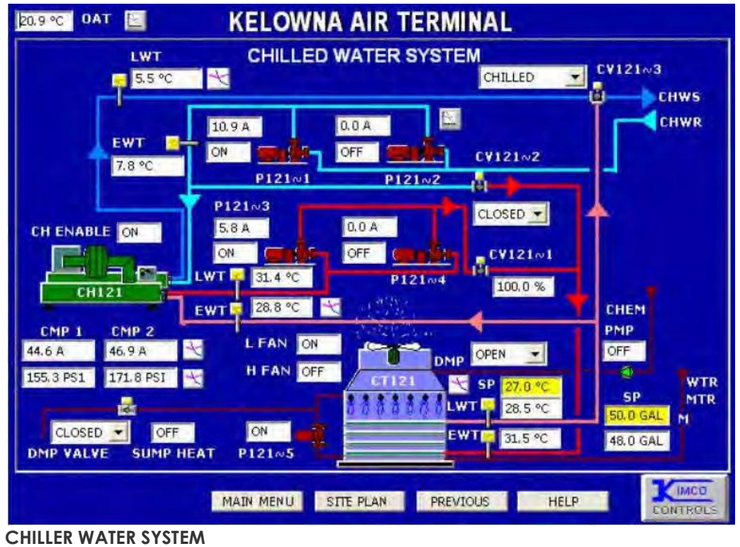
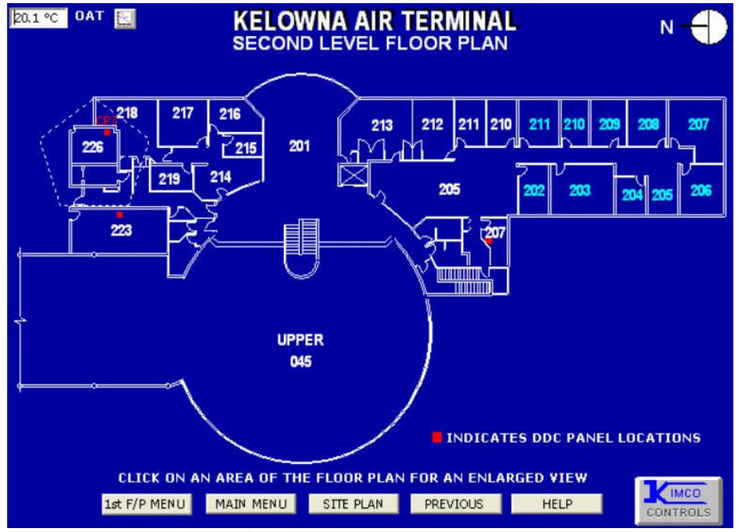


BCU1



CHILLER WATER SYSTEM



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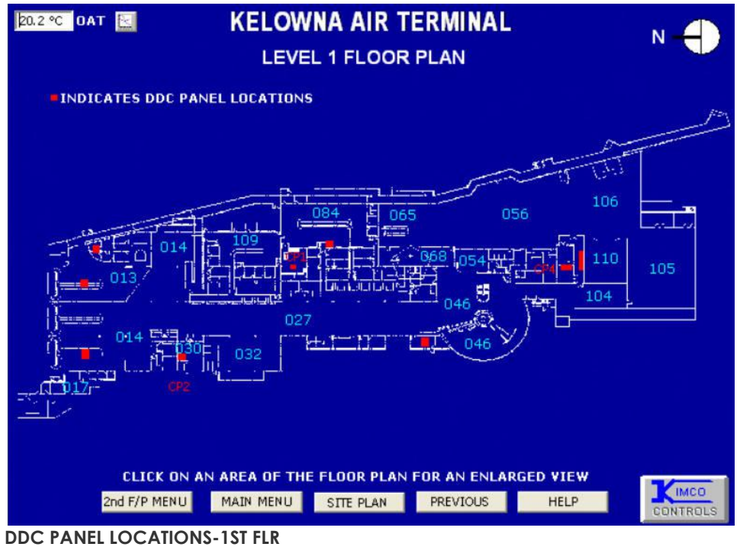

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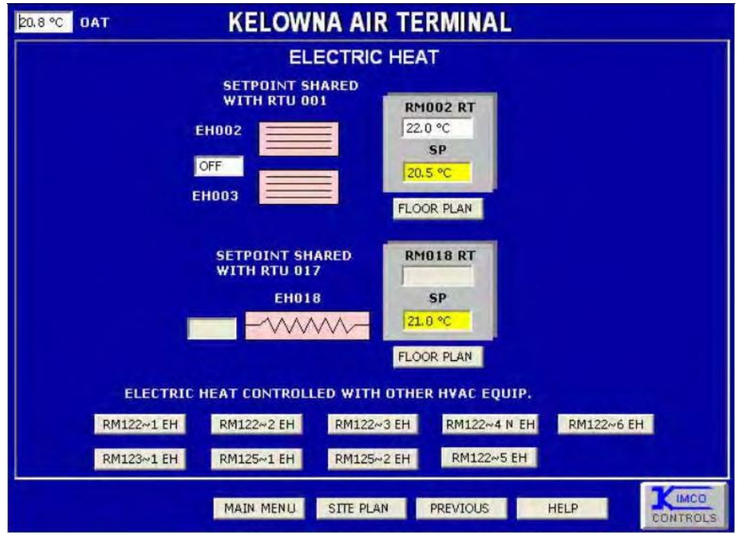

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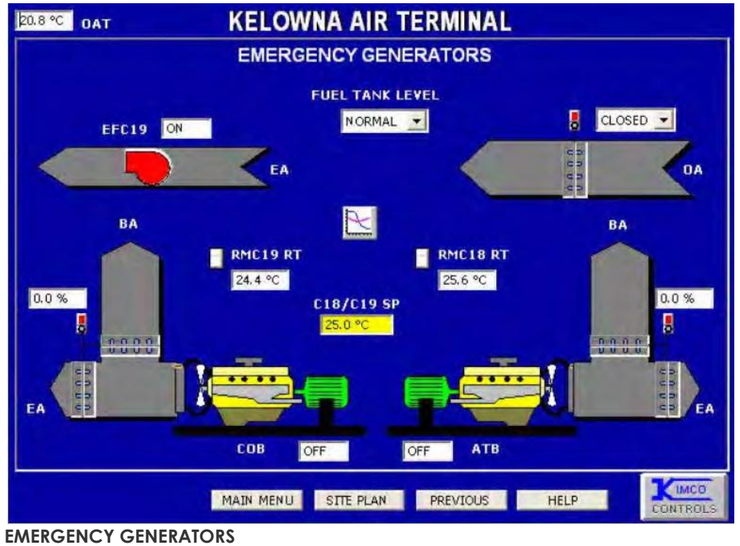

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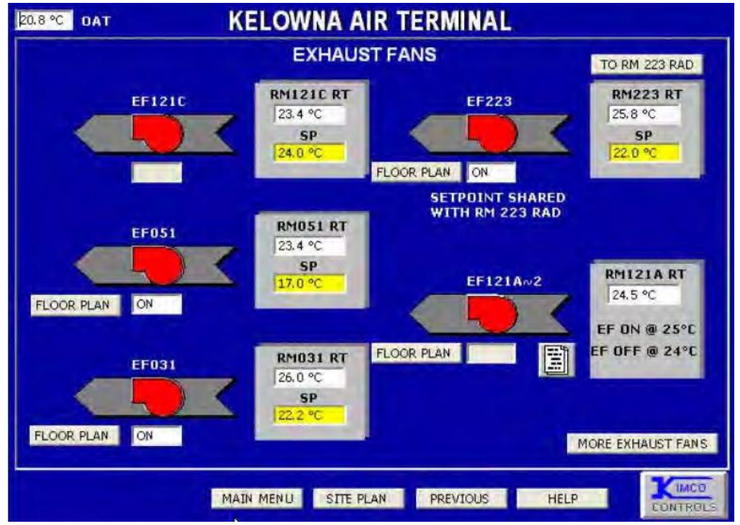

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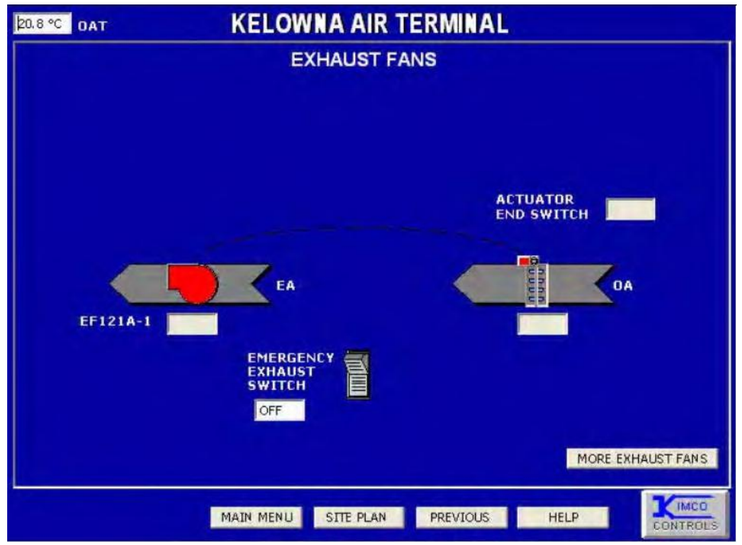

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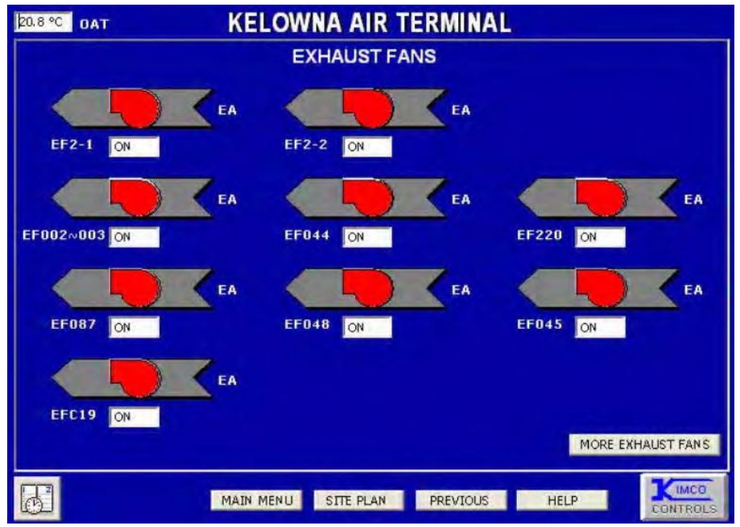

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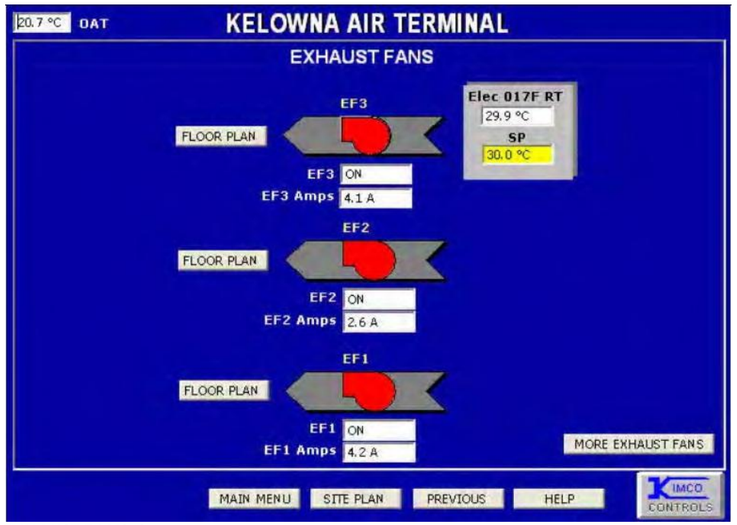

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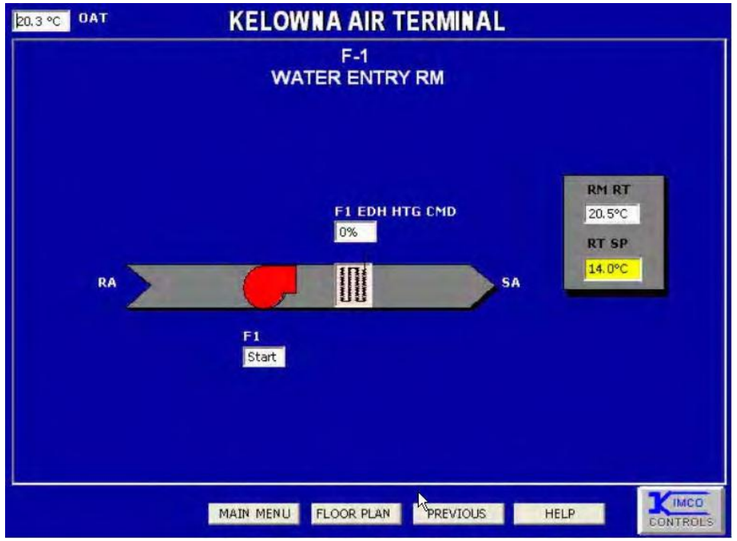


F1 WATER ENTRY

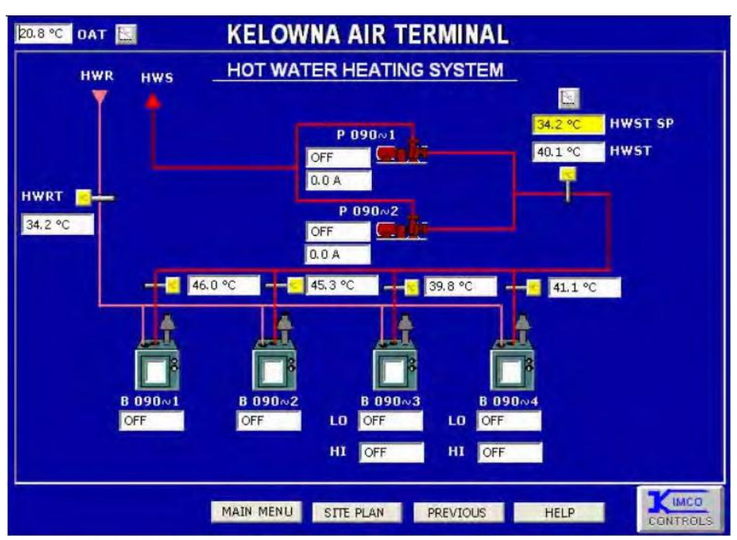
FAN COIL PBS EXPANSION

FAN COIL MENU 1

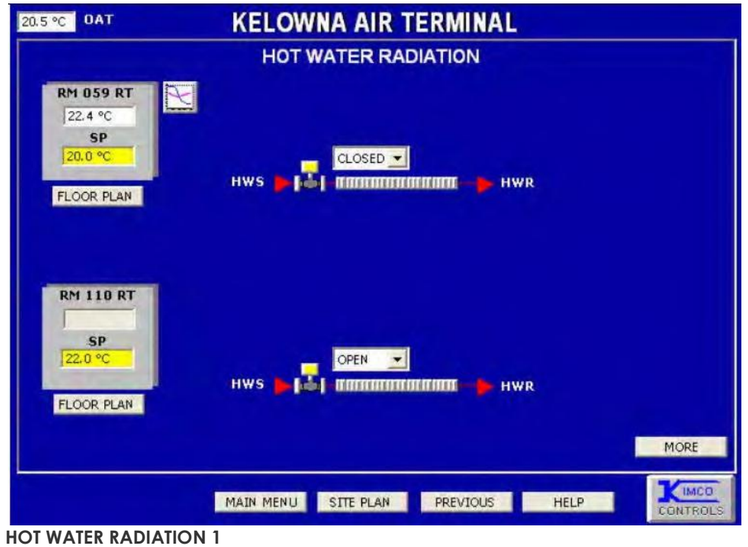
FAN COIL MENU 2

FAN COIL MENU 3

FORCE FLOW MENU



HOT WATER HEATING SYSTEM



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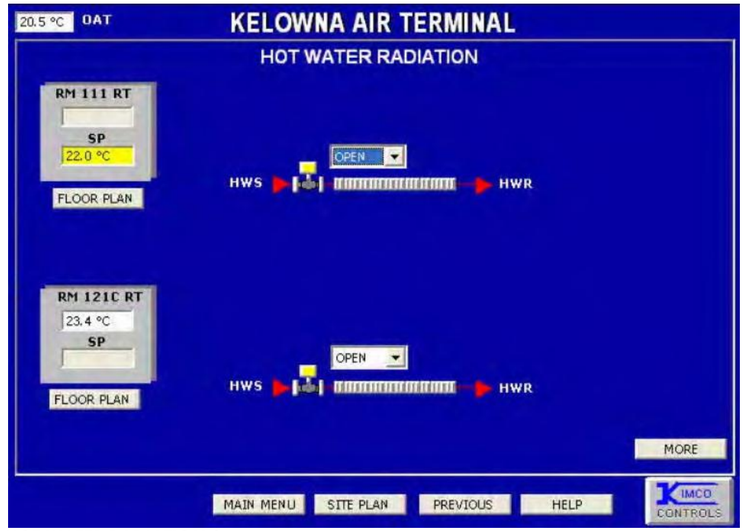
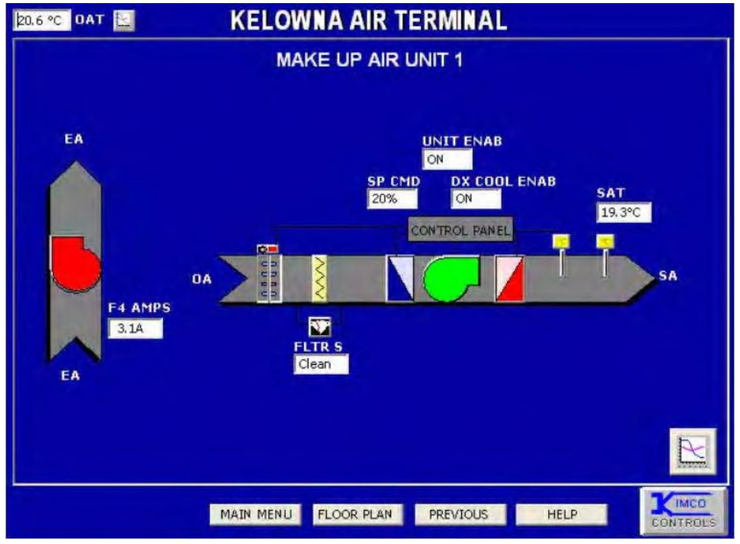
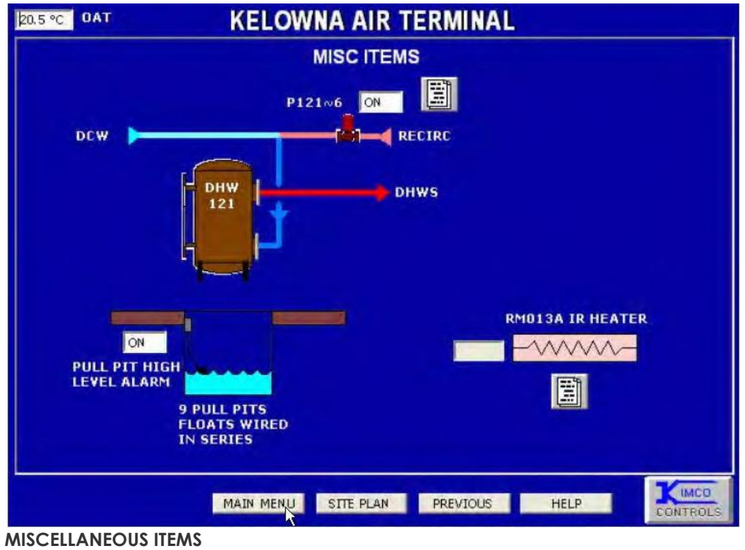


HOT WATER RADIATION 2

HOT WATER RADIATION 3

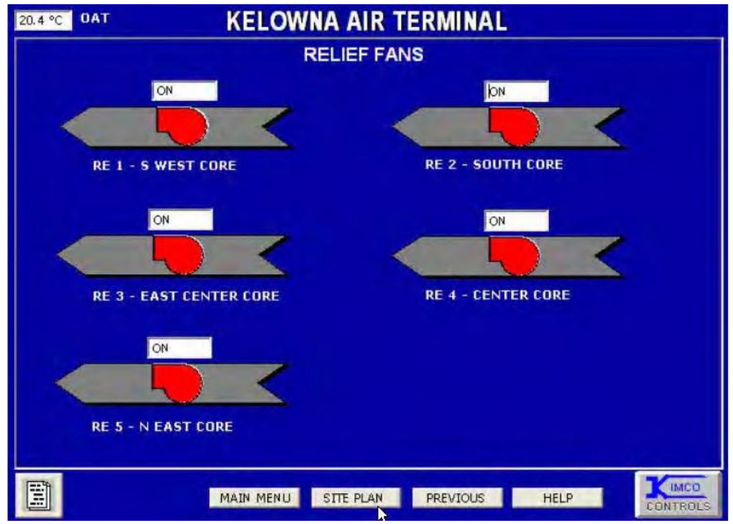


MAKE UP AIR UNIT 1-PBS



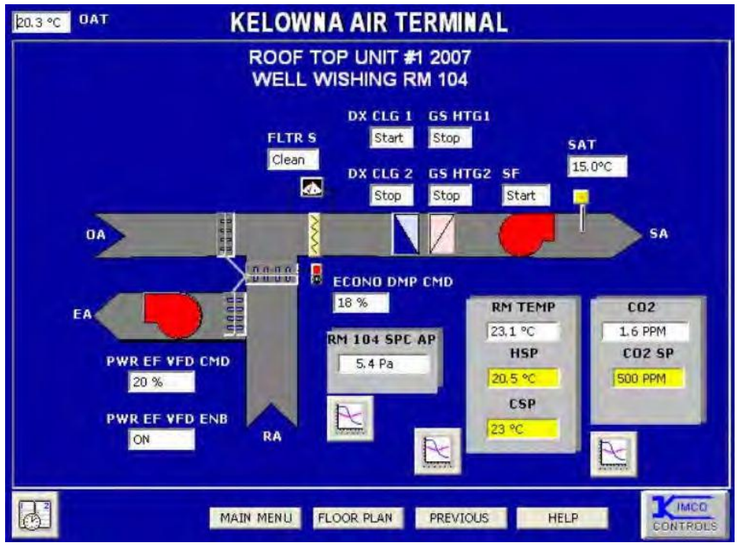
MISCELLANEOUS ITEMS

MISCELLANEOUS PBS EXPANSION



RELIEF FANS

RTU001



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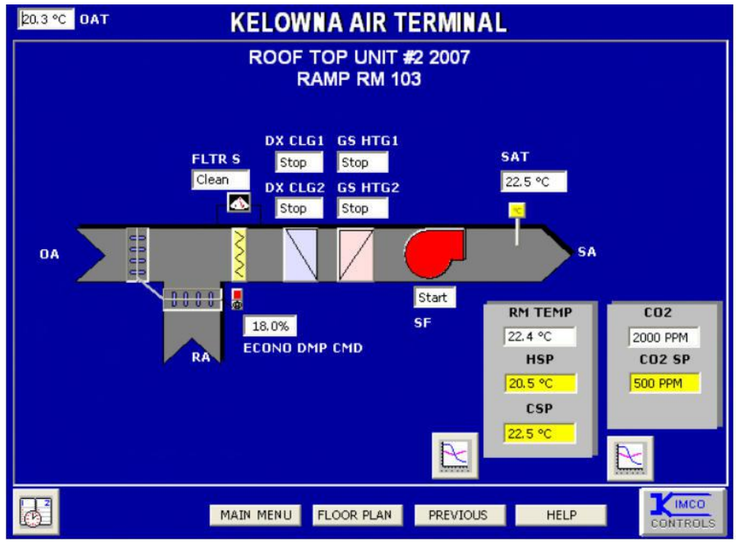

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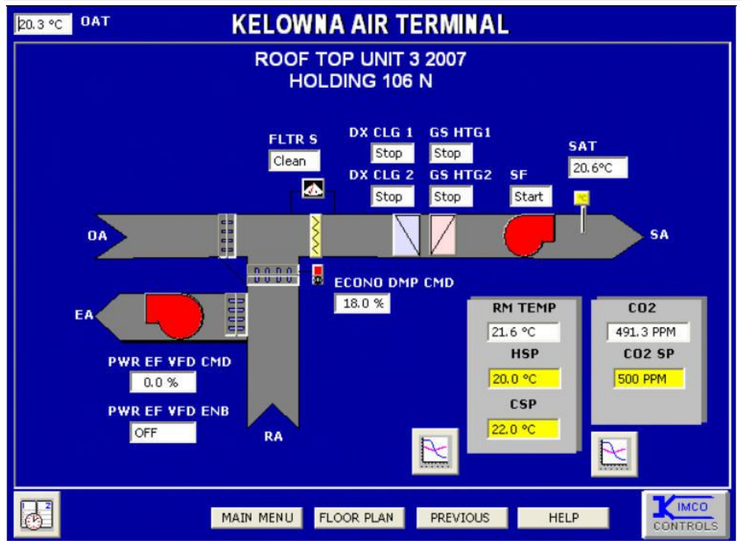

RTU003 2007

RTU004

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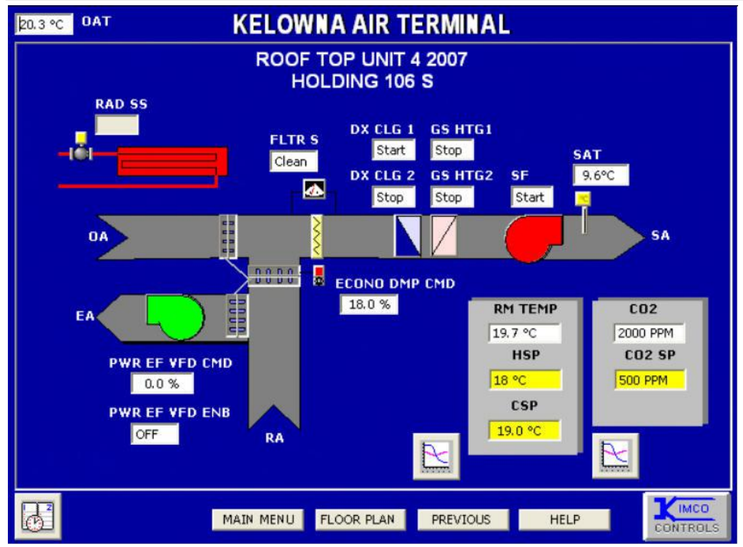

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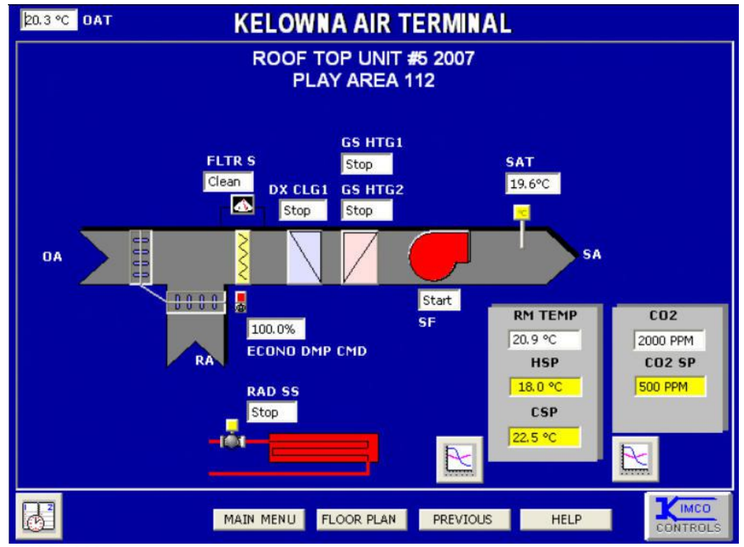

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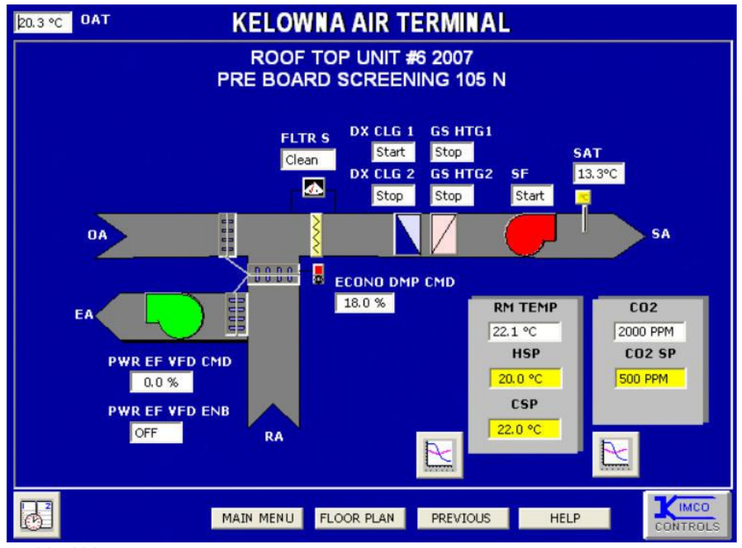

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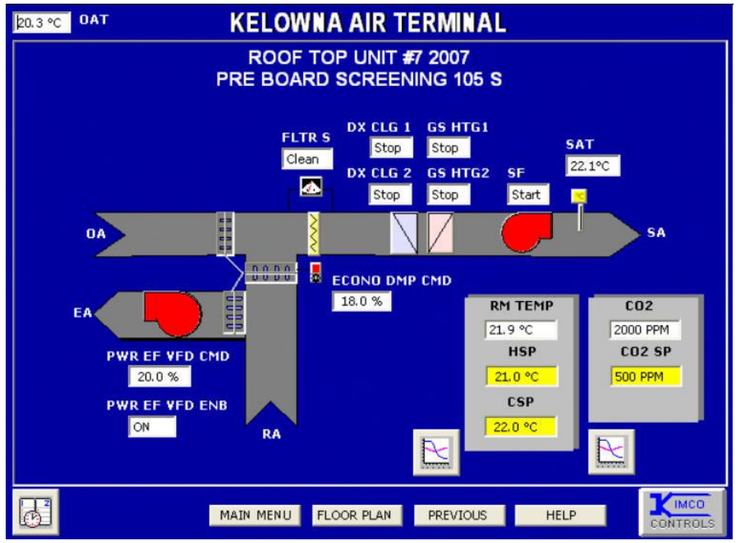

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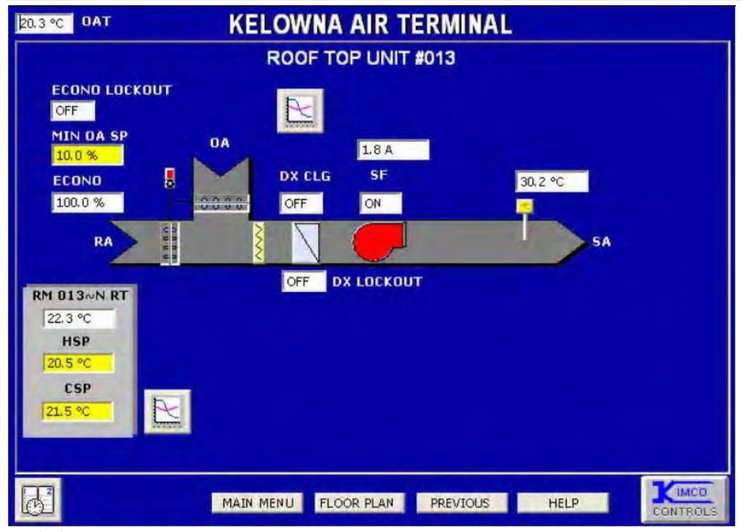

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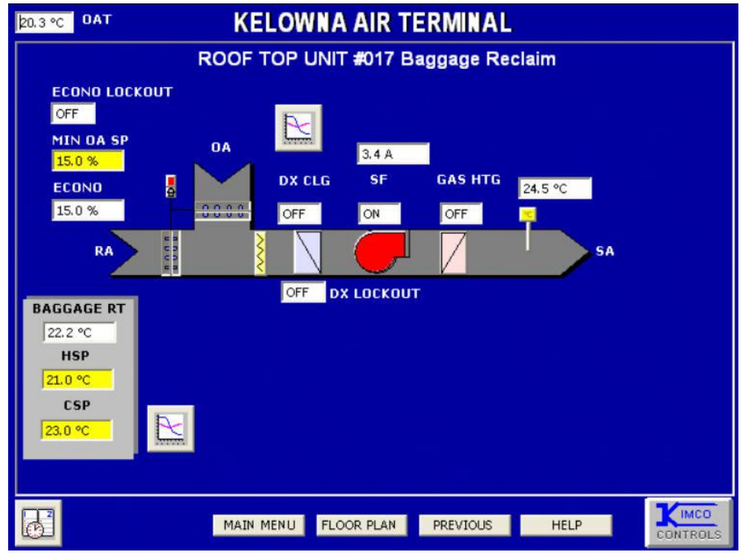

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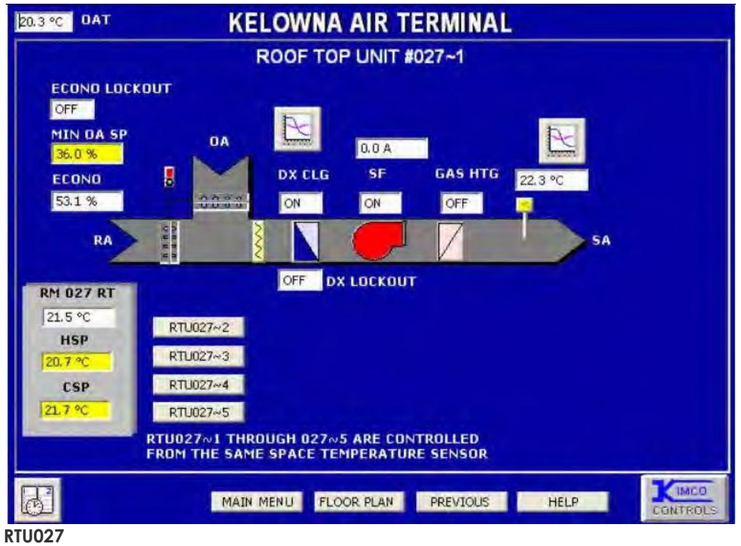

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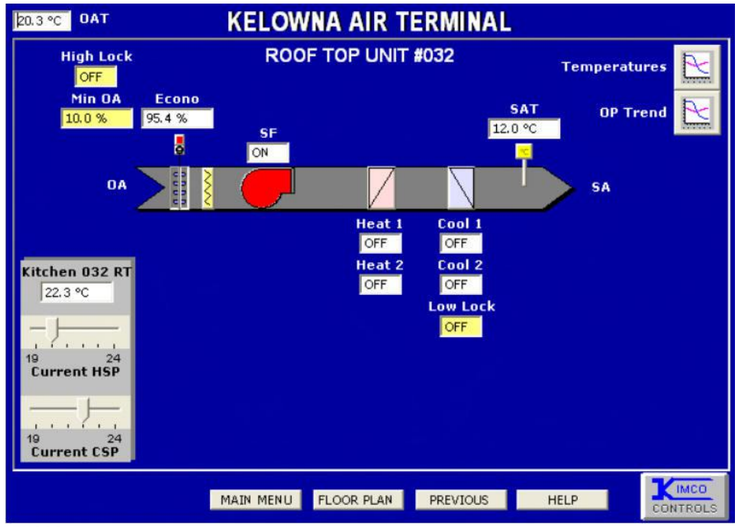

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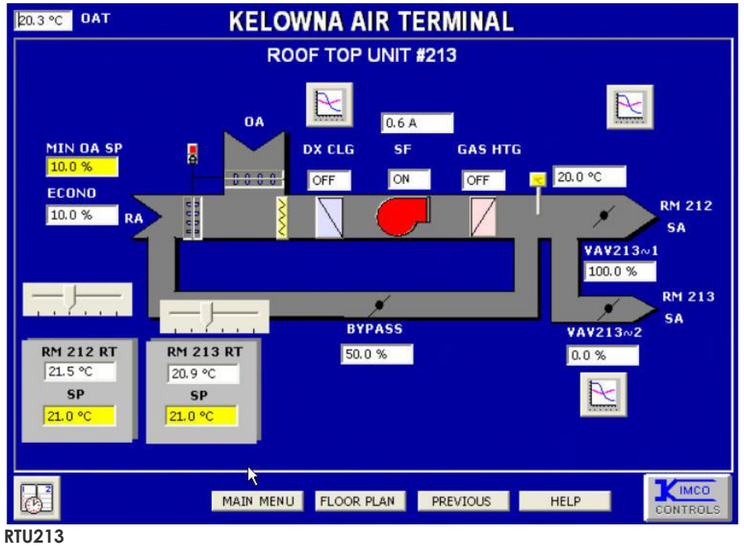

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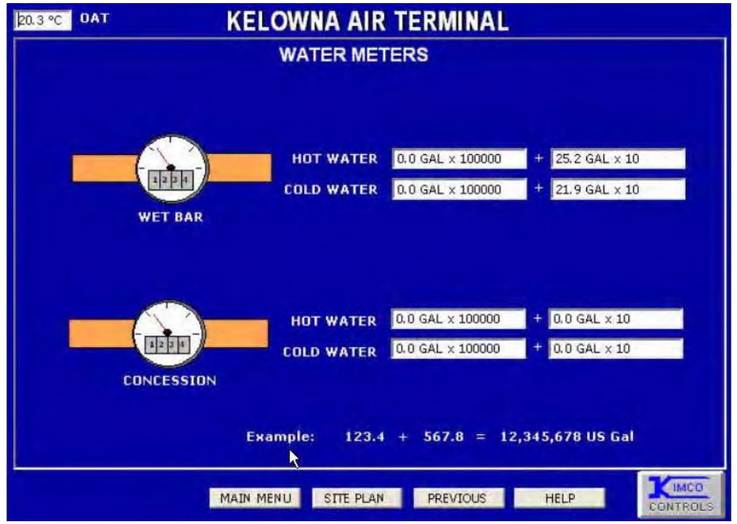
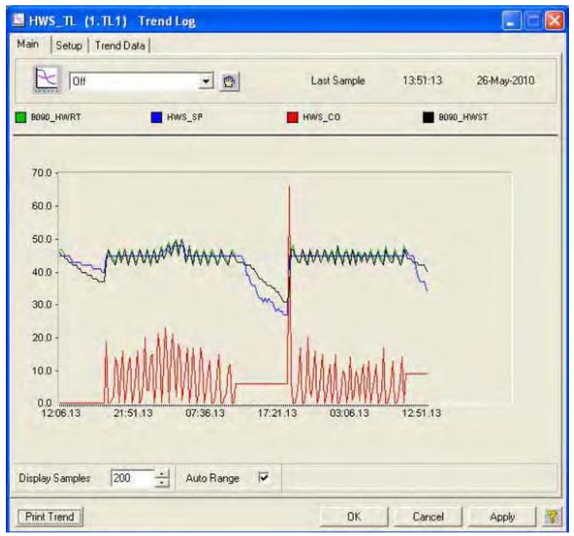


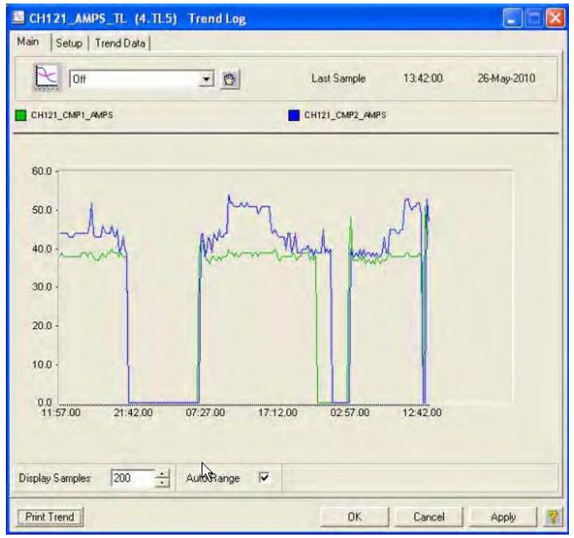
WATER METERS 1

APPENDIX B

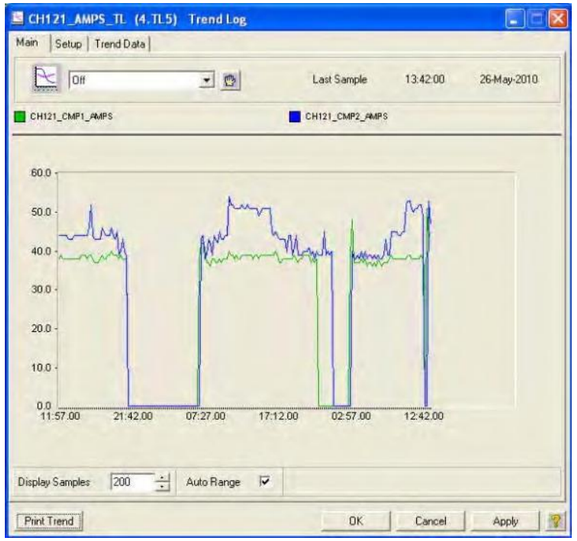
TREND LOGS



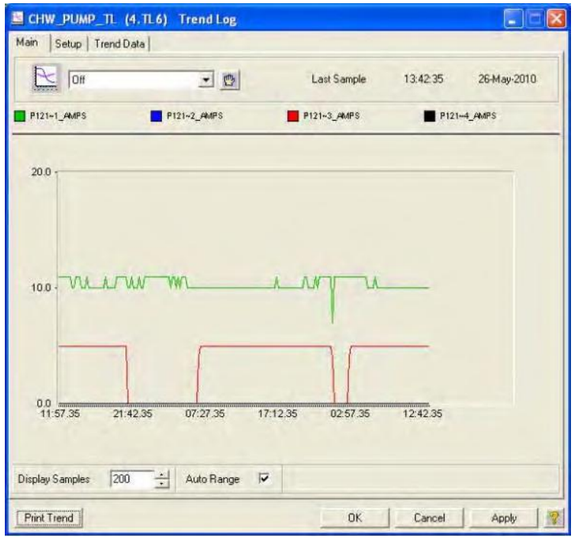
BOILER TREND



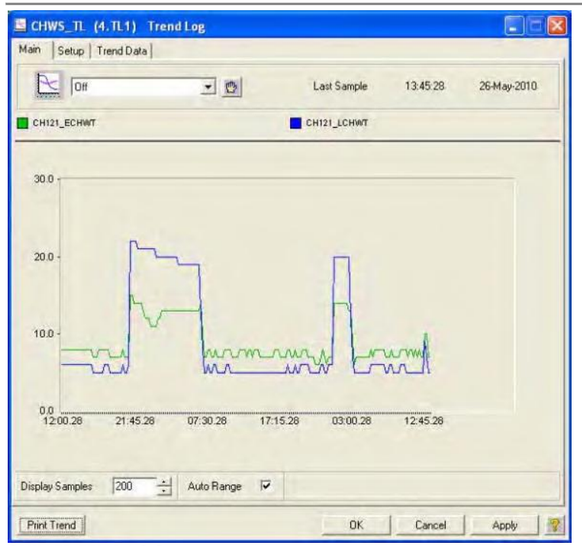
CHILLER LOG



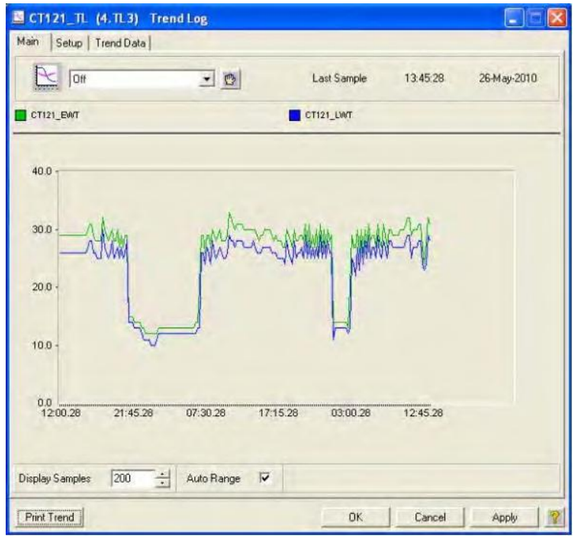
CHILLER TREND LOG



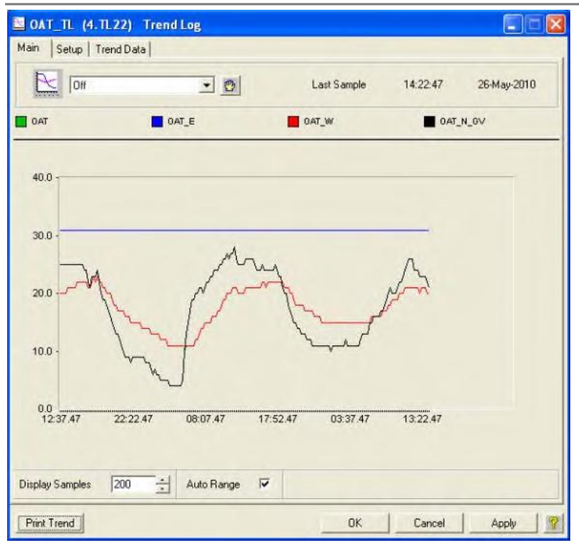
CHILLER PUMPS



CHILLER TEMP LOG



COOLING TOWER TEMP



OAT TREND

APPENDIX C

LUMINAIRE AND LIGHTING AUDIT DATA

Luminaire Schedule		Kelowna Airport Lighting Audit		C03048				
	Luminaire Configuration	Lamps Per Fixture	Lamps max	Lamp Type	Lamp Wattage	Mounting Type	Image Number	
A	2x2 Parabolic	2	2	Twin Tube	40	Rec	411	
A1	2x2 Parabolic	3	3	Twin Tube	40	Rec/Sus	410	
A2	2x2 Lensed	2	2	Twin Tube	40	Rec		
A3	1x4 Lensed	2	2	T8	32	Wall	420	
A4								
A5	Downlight with Cross Baffle	1	1	DTT CFL	32	Rec		
A6	Downlight with Cross Baffle	2	2	DTT CFL	26	Rec		
A7	4' Lensed Vandal	2	2	T8	32	Rec	425	
A8	2x4 Parabolic	3	3	T8	32	Rec	430	
A9	1x4 Lenses	2	2	T8	32	Rec	431	
A10	Downlight Cross Baffle	2	2	DTT CFL	13	Rec		
A11	2x4 Lensed	3	3	T8	32	Rec	436	
A12	1x4 Lensed	2	2	T8	32	Rec	437	
A13	2x4 Lensed	3	3	T8	32	Rec	438	
A14	2 lamp Strip	2	2	T8	32	Sus	439	
A15	Downlight - No lens	2	2	DTT CFL	26	Rec	455	
A16	4" Linear with Cross Baffle	1	1	T8	32	Rec	501	
A17	2x4 Lensed	4	4	T8	32	Rec	582	
A18	Downlight	1	1	Inc	75	Rec		
A19	Wall Light	1	1	Inc	100	Wall		
B	4' Wraparound	2	2	T8	32	Sur	419	
B1	4' Vanity	2	2	T8	32	Wall	421	
B2	4' Strip in Cove	2	2	T8	32	Wall	433	
B3	4' Vanity	2	2	T8	32	Wall	441	
B4	4' Strip	2	2	T8	32	Sur		
B5	4' Vanity	2	2	T8	32	Wall	442	
B6	4' Strip	1	1	T8	32	Sur		
B7	4' Linear	2	2	T8	32	Sus		
B8	4' Indirect/Direct	2	2	T8	32	Sus	460	
B9	4' Indirect/Direct	2	2	T8	32	Sus	461	
B10	4' Indirect/Direct	2	2	T8	32	Sus		
B11	1x4 Surface Lensed	2	2	T8	32	Sur	463	
D1	Metal Halide Canopy	1	1	MH	100	Sur	574	
D2	Metal Halide Canopy	1	1	MH	100	Sur	575	
D3	Weather Proof 4' Strip	2	2	T12	40	Sur	576	

Project #	03048C04	Project Name:	Kelowna Aiport	Project Location:	Kelowna, BC																	Date:	May 26, 2010 - May 27, 2010		
Existing Room Information							Existing Luminaire Information																Illumination Levels (lux)		
Room Number	Room Name	Room Type	Room Description	Room Dimensions	System Voltage	Switching Controls	Luminaire Type	Luminaire Condition	Luminaire Quantity	Luminaire Configuration	Hours of Use Day time	Possible Hours of Daylight Harvesting	Lamps per Luminaire	Lamps per Fixture Max	Lamp Type	Lamp Wattage	Mounting Type	Luminaire Height	Ceiling Type	Ceiling Condition	Between	Under	Wall Margin
new arrivals	Baggage pick up				120		A	Good	48	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	10	T-Bar	Good	420	520	
					120		A5	Good	2	Downlight with Cross Baffle	18		1	1	DTT CFL	32	Rec	10	Drywall	Good			
existing arrivals	Baggage pick up				120		A1	Good	110	2x2 Parabolic	18	6	3	3	Twin Tube	40	Rec/Sus	10	T-Bar	Good	650	810	
					120		A2	Good	4	2x2 Lensed	18	6	2	2	Twin Tube	40	Rec	12	Arch	Good			
022	West Jet Baggage Services	Office			120	L-Switch	A	Good	3	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good		330	
021	Jazz Baggage Services	Office			120	L-Switch	A	Good	3	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good	450	550	
019	Commissionaire Security	Office			120	L-Switch	A1	Good	2	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good		700	
020	Commissionaire Storage	Storage			120	L-Switch	A2	Fair	1	2x2 Lensed	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good	350	500	
017	Customs Office	Office			120		A	Good	20	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good	600	700	
	Customs Storage	Storage			120	Occ Sen	A2	Good	1	2x2 Lensed	18		2	2	Twin Tube	40	Rec	8	Drywall	Good		480	
	Customs Lunch Room	Office			120	L-Switch	B	Good	2	4' Wraparound	18		2	2	T8	32	Sur	8	Drywall	Good	370	530	
	Mens Locker Room	Locker Room			120	Occ Sen	B1	Good	1	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good	440	525	
	Mens Locker Room	Locker Room			120	Occ Sen	A3	Good	3	1x4 Lensed	18		2	2	T8	32	Wall	8	Drywall	Good			
	Mens Locker Room	Locker Room			120	Occ Sen	A6	Good	1	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	Drywall	Good			
	Womens Locker Room	Locker Room			120	Occ Sen	A3	Good	2	1x4 Lensed	18		2	2	T8	32	Wall	8	Drywall	Good	430	500	
	Womens Locker Room	Locker Room			120	Occ Sen	B1	Good	1	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good			
011	Process	Office			120	L-Switch	A1	Good	11	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	200	625	
010	Office	Office			120	L-Switch	A	Good	3	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good	200	530	
009	DOC	Office			120	L-Switch	A	Good	2	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good	380	440	
012	Detention				120		B2	Good	2	4' Strip in Cove	18		2	2	T8	32	Wall	8	Drywall	Good	410	520	
008	Hold				120		A7	Good	2	4' Lensed Vandal	18		2	2	T8	32	Rec	8	Drywall	Good	330	380	
005	Storage	Storage			120	L-Switch	A2	Fair	1	2x2 Lensed	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good		470	
006	Comms Room	Service			120	L-Switch	A2	Good	2	2x2 Lensed	18		2	2	Twin Tube	40	Rec	8	T-Bar	Fair	460	640	
004	Corridor				120	L-Switch	A	Good	3	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good		400	
027	Main Concourse	Lobby			120		A1	Good	172	2x2 Parabolic	18	12	3	3	Twin Tube	40	Rec/Sus	25	Arch	Good	1200	1500	
027	Main Concourse	Lobby			120		Signage	Good	39		18	12	2	2	T12	40	Wall	12	Arch	Good			
102	Airline Counter	Office			120		A1	Good	19	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	Open	Fair	950	1000	
104	Air Canada Office	Office			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	7.5	T-Bar	Good	500	730	
105	Lockers	Locker Room			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	7.5	T-Bar	Good	1100	1300	
106	Lunch Room	Office			120	L-Switch	A8	Good	4	2x4 Parabolic	18		3	3	T8	32	Rec	7.5	T-Bar	Good	600	1000	
107a	Air Canada	Storage			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	7.5	T-Bar	Good	680	760	
107b	Office	Office			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	7.5	T-Bar	Good	650	850	
107c	Office	Office			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	7.5	T-Bar	Good	750	1000	
103	Corridor	Corridor			120	L-Switch	A9	Good	4	1x4 Lenses	18		2	2	T8	32	Rec	7.5	T-Bar	Good	100	500	
107d	Office	Office			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	7.5	T-Bar	Good	580	1000	
100	Handi-Cap Washroom	Washroom			120	L-Switch	B	Good	1	4' Wraparound	18		2	2	T8	32	Sur	8	Drywall	Good	350	650	
100	Handi-Cap Washroom	Washroom			120	L-Switch	B2	Good	2	4' Strip in Cove	18		2	2	T8	32	Wall	7	Drywall	Good			
099	Mens Washroom	Washroom			120	L-Switch	B	Good	2	4' Wraparound	18		2	2	T8	32	Sur	7	Drywall	Good	160	350	
099	Mens Washroom	Washroom			120	L-Switch	B2	Good	2	4' Strip in Cove	18		2	2	T8	32	Wall	7	Drywall	Good			
099	Mens Washroom	Washroom			120	L-Switch	A10	Good	1	Downlight Cross Baffle	18		2	2	DTT CFL	13	Rec	8	Drywall	Good			
101	Womens Washroom	Washroom			120	L-Switch	B	Good	3	4' Wraparound	18		2	2	T8	32	Sur	7	Drywall	Good	160	350	
101	Womens Washroom	Washroom			120	L-Switch	B2	Good	2	4' Strip in Cove	18		2	2	T8	32	Wall	7	Drywall	Good			
101	Womens Washroom	Washroom			120	L-Switch	A10	Good	1	Downlight Cross Baffle	18		2	2	DTT CFL	13	Rec	8	Drywall	Good			
098	West Jet Airline	Office			120		A1	Good	43	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	200	1600	
073	Land Lines	Storage			120	L-Switch	A8	Good	1	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	320	580	
072	Telecom	Service			120		B	Good	8	4' Wraparound	18		2	2	T8	32	Sur	7	Open	Fair			
	First Aid	Examination			120	L-Switch	A11	Good	2	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good	900	1000	
075	Office	Office			120	L-Switch	A1	Good	2	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	500	1000	
078a	Office	Office			120	L-Switch	A11	Good	3	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good	390	550	
007	Bond Room	Storage			120	L-Switch	A2	Fair	2	2x2 Lensed	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good	260	310	
078	Lunch Room	Office			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	630	840	
080	Storage	Storage			120	L-Switch	A12	Good	1	1x4 Lensed	18		2	2	T8	32	Rec	8	T-Bar	Good	270	400	
081	Training Room	Office			120	L-Switch	A8	Good	3	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	420	560	
082	Office	Office			120	L-Switch	A8	Good	3	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	600	1050	
083	Office	Office			120	L-Switch	A8	Good	3	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	620	950	
077a	Corridor	Corridor			120		A13	Good	3	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good		760	
079	Corridor	Corridor			120		A13	Good	2	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good		460	
077	Corridor	Corridor			120		A12	Good	2	1x4 Lensed	18		2	2	T8	32	Rec	8	T-Bar	Good		460	
096	Corridor	Corridor			120		A9	Good	2	1x4 Lenses	18		2	2	T8	32	Rec	8	T-Bar	Good		480	
097	Lunch Room	Office			120	L-Switch	A8	Good	4	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	820	1100	
094	Retail Storage	Storage			120						18												
092	Lunch Room	Office			120	L-Switch	A13	Good	2	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good	200	630	
091	Security Office	Office			120	L-Switch	A8	Good	2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	630	720	
093	CBSA	Office			120	L-Switch	A8		2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	490	1000	
095	Locker Room	Locker Room			120	L-Switch	A8		4	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good		1400	
021	KAO Comms	Service			120	L-Switch	A14		4	2 lamp Strip	18		2	2	T8	32	Sus	8	Open	Good			
128	Black and Mac Office	Office			120	L-Switch	A1		4	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	1000	1300	
070	Black and Mac Office	Office			120	L-Switch	A8		2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	550	1500	
048	Mens Washroom	Washroom			120		A6		7	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	Drywall	Good	250	350	
048	Mens Washroom	Washroom			120		B3	Poor	2	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good			
052	Janitor	Service			120		B4		1	4' Strip	18		2	2	T8	32	Sur	8	Drywall	Good			
049	Handi-Cap Washroom	Washroom			120	Occ Sen	B5		1	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good	250	400	
050	Womens Washroom	Washroom			120		A6		8	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	Drywall	Good	350	400	
050	Womens Washroom	Washroom			120		B3		3	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good			

051	Elevator Machine Room	Service			120	Occ Sen	B6		2	4' Strip	18		1	1	T8	32	Sur	7	Drywall	Good		360	
	South Water Feature Pump room	Service			120	L-Switch	A14		1	2 lamp Strip	18		2	2	T8	32	Sus	7	Open	Good			
046	Lounge	Lounge			120		D1		24	Metal Halide Canopy	18	12	1	1	MH	100	Sur	20	Arch	Good	See Plans for detailed analysis		
046	Lounge	Lounge			120		A6		60	Downlight with Cross Baffle	18	12	2	2	DTT CFL	26	Rec	25	Drywall	Good			
046	Lounge	Lounge			120		A14		12	2 lamp Strip	18	12	2	2	T8	32	Sus	8	T-Bar	Good			
046	Lounge	Lounge			120		A1		27	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good			
	Lounge Bar	Restaurant			120		B7		4	4' Linear	18		2	2	T8	32	Sus	7	Open	Fair			
	Lounge Bar	Restaurant			120		A6		2	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	Open	Good			
	Skyway Gourmet	Storage			120		A8		2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good			
036	Duty Manager	Office			120		A1		2	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	800	1000	
035	RCMP	Office			120		A1		2	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	800	1000	
034	Airport Ambassodor	Office			120		A1		2	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	800	1000	
028/029	Car Rentals	Office			120		A1		13	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus						
075	Janitor	Service			120		A14		1	2 lamp Strip	18		2	2	T8	32	Sus	7	Open	Good			
026	Mens Washroom	Washroom			120		B2		3	4' Strip in Cove	18		2	2	T8	32	Wall	7	Drywall	Good	250	950	
026	Mens Washroom	Washroom			120		A15		7	Downlight - No lens	18		2	2	DTT CFL	26	Rec	8	Drywall	Good			
024	Womens Washroom	Washroom			120		B2		3	4' Strip in Cove	18		2	2	T8	32	Wall	7	Drywall	Good	250	750	
024	Womens Washroom	Washroom			120		A15		7	Downlight - No lens	18		2	2	DTT CFL	26	Rec	8	Drywall	Good			
	Control Tower	Office			120		A18		14	Downlight	18		1	1	Inc	75	Rec	8	T-Bar	Good			
	Control Tower Washroom	Washroom			120		A19		1	Wall Light	18		1	1	Inc	100	Wall	6	Drywall	Poor			
218	Weather Office	Office			120	L-Switch	B8		6	4' Indirect/Direct	18		2	2	T8	32	Sus	8	T-Bar	Good	630	1000	
230	Storage	Storage			120	Occ Sen	A13		2	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good	230	350	
	Washroom	Washroom	2xT8 Vanity, 1x32 Surface Round, and		120	Occ Sen					18												
220	Corrridor	Corridor			120	L-Switch	A		8	2x2 Parabolic	18		2	2	Twin Tube	40	Rec	8	T-Bar	Good	350	600	
214	General Office	Office			120	L-Switch	B8		7	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	470	810	
	General Office Closet				120	L-Switch	A6		1	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	T-Bar	Good			
216	Operations Super Intendant	Office			120	L-Switch	B8		4	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	550	730	
216	Operations Super Intendant	Office			120	L-Switch	A6		2	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	T-Bar	Good			
217	Tower Manager	Office			120	L-Switch	B8		4	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	500	950	
217	Tower Manager	Office			120	L-Switch	A6		2	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	T-Bar	Good			
219	Training Room	Office			120	L-Switch	B8		2	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	550	600	
206	Office	Office			120	L-Switch	B9		4	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	700	1400	
207	Office	Office			120	L-Switch	B9		6	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	700	1900	
208	Office	Office			120	Occ Sen	B9		4	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	550	1250	
205	Office	Office			120		B9		2	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	570	100	
204	Office	Office			120	Occ Sen	B9		2	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	500	850	
209	Office	Office			120	Occ Sen	B9		2	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	500	1000	
203	Lunch Room	Office			120	Occ Sen	B9		4	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	800	1000	
210a	Office	Office			120	L-Switch	B9		4	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	500	1000	
210b	Office	Office			120	L-Switch	B9		2	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	600	750	
211	Office	Office			120	L-Switch	B9		2	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	600	750	
213	Boardroom	Office			120	L-Switch	A6		5	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	T-Bar	Good	460	640	
213	Boardroom	Office			120	L-Switch	A8		4	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good			
213	Boardroom	Office			120	L-Switch	B9		3	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good			
205	Storage	Storage			120	L-Switch	A8		2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	650	850	
205	Comms Room	Service			120	L-Switch	A13		2	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good		500	
205	General Office	Office			120	L-Switch	B10		17	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	550	810	
205	General Office	Office			120	L-Switch	A13		2	2x4 Lensed	18		3	3	T8	32	Rec	8	T-Bar	Good			
205	General Office	Office			120	L-Switch	A10		3	Downlight Cross Baffle	18		2	2	DTT CFL	13	Rec	8	T-Bar	Good			
201	Corridor	Corridor			120	L-Switch	B10		6	4' Indirect/Direct	18		2	2	T8	32	Sus	7	T-Bar	Good	150	650	
203	Mens Washroom	Washroom			120	Occ Sen	B11		1	1x4 Surface Lensed	18		2	2	T8	32	Sur	7	Drywall	Good	150	650	
204	Womens Washroom	Washroom			120	Occ Sen	B11		2	1x4 Surface Lensed	18		2	2	T8	32	Sur	7	Drywall	Good	300	420	
	CATSA Screening	Examination			120		A16		50	4" Linear with Cross Baffle	18		1	1	T8	32	Rec	8	T-Bar	Good	220	300	
	CATSA Screening	Examination			120		A10		20	Downlight Cross Baffle	18		2	2	DTT CFL	13	Rec	8	T-Bar	Good			
	Ground Side Exterior				120		D1		14	Metal Halide Canopy	18		1	1	MH	100	Sur	8					
	Ground Side Exterior				120		D2		1	Metal Halide Canopy	18		1	1	MH	100	Sur	8					
	Ground Side Exterior				120		D3		33	Weather Proof 4' Strip	18		2	2	T12	40	Sur	12					
	Ground Side Exterior				120		A6		11	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	10					
	Boarding Lounge				120		A1		128	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	See plans for detailed analysis		
	Boarding Lounge				120		A6		80	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	Drywall	Good			
121	Airside Corridor 1 and 2				120		A1		34	2x2 Parabolic	18	12	3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	550	950	
	Airside Corridor 3				120		A1		15	2x2 Parabolic	18	12	3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	550	1200	
	Airside Corridor 4				120		A1		27	2x2 Parabolic	18	12	3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	700	1600	
	Airside Corridor 5				120		A1		10	2x2 Parabolic	18	12	3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	200	700	
	International Departures				120		A1		26	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good			
	International Departures				120		A6		42	Downlight with Cross Baffle	18		2	2	DTT CFL	26	Rec	8	Drywall	Good			
113	Arrivals Ramp (high)				120		A1		15	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good	250	700	
113	Arrivals Ramp (low)				120		A1		10	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	Open	Good		900	
	Baggage Hall				120		A14		94	2 lamp Strip	18		2	2	T8	32	Sus	10	Open	Good		460	
112	Visual Inspection	Office			120		A1		2	2x2 Parabolic	18		3	3	Twin Tube	40	Rec/Sus	8	T-Bar	Good			
086	Storage	Storage			120	Occ Sen	A14		2	2 lamp Strip	18		2	2	T8	32	Sus	10	Open	Good			
085	Storage	Storage			120	Occ Sen	A14		11	2 lamp Strip	18		2	2	T8	32	Sus	10	Open	Good			
087a	Baggage Hall Mens Washroom	Washroom			120	Occ Sen	B5		1	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good		250	
087b	Baggage Hall Womens Washroom	Washroom			120	Occ Sen	B5		1	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good		250	
114	Corridor	Corridor			120		B5		7	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good		470	
115	Office	Office			120	L-Switch	A17		2	2x4 Lensed	18		4	4	T8	32	Rec	8	T-Bar	Good	450	1000	
116	Storage	Storage			120	L-Switch	A17		2	2x4 Lensed	18		4	4	T8	32	Rec	8	T-Bar	Good	370	680	
117	Office	Office	2 of 3 lamps turned off		120	L-Switch	A8		2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	280	350	
	Comms Closet	Service			120	L-Switch	A14		1	2 lamp Strip	18		2	2	T8	32	Sus	7	Open				
119	Airline Lunchroom	Office			120	L-Switch	A8		4	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good		720	
118	Airline Office	Office			120	L-Switch	A8		2	2x4 Parabolic	18		3	3	T8	32	Rec	8	T-Bar	Good	560	720	
	North Baggage Drop Off	Service			120	Occ Sen	A14		10	2 lamp Strip	18		2	2	T8	32	Sus	7	Open				
	North Baggage Vestibule	Service			120		B5		2	4' Vanity	18		2	2	T8	32	Wall	7	Drywall	Good			
089	Storage	Storage			120	Occ Sen	A14		2	2 lamp Strip	18		2	2	T8	32	Sus	7	Open	Good			
088	Storage	Storage			120	Occ Sen	A14		2	2 lamp Strip	18		2	2	T8	32	Sus	7	Open	Good			
	Under Ramp Storage	Storage			120	Occ Sen	A14		5	2 lamp Strip	18		2	2	T8	32	Sus	5	Open	Good			
	N. Baggage Room Built Out Storage	Storage			120	L-Switch	A14		2	2 lamp Strip	18		2	2	T8	32	Sus	7	Open	Good			
	S. Baggage Room Built Out Storage	Storage			120	L-Switch	A14		2	2 lamp Strip	18		2	2	T8	32	Sus	7	Open	Good			

APPENDIX D

HEATING AND COOLING CALCULATIONS

	Peak Date	Peak Time	Air temperature (°C)	Space conditioning sensible (kW)	Internal gain (kW)	Solar gain (kW)	External conduction gain (kW)	Internal conduction gain (kW)	Air system input sensible (kW)	Infiltration gain (kW)
Multi-Zone	Jul	15:30	26	-110.6	68.3	33.1	5.3	0.4	10.7	3.5
Pre-Screening 105	Jul	14:30	26	-20.0	17.9	0.0	1.3	0.1	2.5	0.7
Well Fishing Area 104	Jul	17:30	26	-41.1	15.2	28.2	-2.1	-0.8	2.2	0.6
Departure Concourse 045	Jul	16:30	26	-60.3	28.0	30.2	0.4	-0.2	4.4	1.8
Check-In Area	Jul	16:30	26	-57.4	24.9	27.5	3.0	-0.3	12.7	2.3
International Arrival 013	Jul	14:30	26	-40.6	36.3	0.1	2.3	0.6	5.2	1.4
Airline Operation	Jul	15:30	26	-15.9	12.0	0.0	0.3	2.6	4.8	1.0
Baggage Makeup 084	Sep	5:30	30.0	-8.7	32.1	0.0	-10.0	-1.8	-8.7	-12.1
International Departure Floor	Jul	15:30	26	-36.9	32.7	0.3	2.4	0.0	5.1	1.4
Top Secret Room	Jul	14:30	26	-12.5	13.9	0.1	-2.4	0.5	2.0	0.5
Airside Corridor	Jul	8:30	26	-27.9	4.9	29.2	-5.9	-0.3	-0.4	-0.1
Airside Corridor	Jul	9:30	26	-74.5	28.0	63.5	-19.3	3.5	-1.3	-0.4
Custom General Office 017	Jul	17:30	26	-11.2	4.0	7.0	0.2	-0.3	1.4	0.3
Departure Floor 062	Jul	14:30	26	-65.6	63.6	0.0	-1.8	1.7	9.0	2.1
Office	Jul	15:30	26	-48.0	17.3	12.9	13.5	3.4	7.0	1.0
Total Existing Cooling Loads (kW):				**-631.1**					**56.6**	
Total Existing Cooling Loads (tons):				**-179.5**					**16.1**	
North Expansion	Jul	15:30	26	-91.4	55.0	7.4	26.4	0.2	8.6	2.4
Baggage Hall Expansion	Sep	5:30	34.1	-9.4	27.4	0.0	-8.3	-1.3	-9.4	-8.7
North Expansion - Beyond Plan	Jul	17:30	26	-58.1	26.7	28.4	2.0	-0.1	3.8	1.1
South Expansion - Beyond Plan	Jul	15:30	26	-102.9	52.1	34.4	14.2	-0.1	8.2	2.3
South Expansion	Jul	16:30	26	-406.4	216.5	107.8	72.6	0.1	33.9	9.4
Total Existing Cooling Loads (kW):				**-668.3**					**45.1**	
Total Existing Cooling Loads (tons):				**-190.1**					**12.8**	

	Air temperature (°C)	Space conditioning sensible (kW)	External conduction gain (kW)	Internal conduction gain (kW)	Air system input sensible (kW)	Infiltration gain (kW)	Dry resultant temperature (°C)	Aux vent gain (kW)	Natural vent gain (kW)	DHW heating demand (kW)
Multi-Zone	21	85.1	-70.9	0.2	-43.8	-14.4	23.1	0.0	0.0	0.0
Pre-Screening 105	21	15.2	-12.1	0.1	-11.5	-3.2	22.9	0.0	0.0	0.0
Well Fishing Area 104	21	28.5	-25.9	0.1	-9.7	-2.7	22.8	0.0	0.0	0.0
Departure Concourse 045	21	52.8	-45.6	0.2	-17.9	-7.5	22.9	0.0	0.0	0.0
Check-In Area	21	73.1	-63.3	-0.5	-51.9	-9.3	24.5	0.0	0.0	0.0
International Arrival 013	21	31.6	-25.1	-0.1	-23.3	-6.5	23.1	0.0	0.0	0.0
Airline Operation	21	20.1	-16.5	0.5	-19.7	-4.1	23.1	0.0	0.0	0.0
Baggage Makeup 084	21	55.6	-25.1	-0.8	-21.4	-29.7	24.6	0.0	0.0	0.0
International Departure Floor	21	28.9	-23.3	0.2	-21.0	-5.8	23.0	0.0	0.0	0.0
Top Secret Room	21	6.0	-4.1	0.1	-8.9	-2.1	22.9	0.0	0.0	0.0
Airside Corridor	21	20.0	-19.3	0.2	-3.2	-0.9	22.3	0.0	0.0	0.0
Airside Corridor	21	83.5	-79.3	0.8	-17.9	-5.0	22.6	0.0	0.0	0.0
Custom General Office 017	21	13.8	-12.5	0.1	-6.4	-1.3	22.9	0.0	0.0	0.0
Departure Floor 062	21	44.1	-34.7	0.1	-40.8	-9.4	23.3	0.0	0.0	0.0
Office	21	40.1	-35.8	-0.3	-28.5	-4.0	23.7	0.0	0.0	0.0
Total Existing Heating Loads (kW):		**598.5**			**-325.9**					
Total Existing Heating Loads (MBH):		**2043.2**			**-1112.5**					
North Expansion	21	85.0	-75.0	-0.2	-35.3	-9.8	23.4	0.0	0.0	0.0
Baggage Hall Expansion	21	51.3	-34.0	-0.4	-18.3	-16.9	24.6	0.0	0.0	0.0
North Expansion - Beyond Plan	21	45.9	-41.1	0.0	-17.1	-4.7	23.1	0.0	0.0	0.0
South Expansion - Beyond Plan	21	80.9	-71.6	0.0	-33.4	-9.3	23.4	0.0	0.0	0.0
South Expansion	21	346.0	-307.0	-0.4	-138.8	-38.6	23.6	0.0	0.0	0.0
Total Existing Heating Loads (kW):		**609.0**			**-242.9**					
Total Existing Heating Loads (MBH):		**2079.1**			**-829.3**					

APPENDIX E

EXISTING MECHANICAL EQUIPMENT

TAG	Equipment	Make	Cooling Capacity (btu)	Cooling Capacity (tons)	Cooling Capacity (kW)	Heating Capacity (btu)
BLR-01/02	Buderus Boiler	Buderus	0	0		2,876,000
BLR-03/04	Fulton Boiler	Fulton	-	0		-
DHW-01	State Turbo Sand Blaster DHW	State	-	0		
BLR-05	Atmospheric Boiler	A.O. Smith	-	0		1,350,000
DHW-02	Atmopheric Water heater (DHW)	0	-	0		
BLR-06	Bryan Boiler	Bryan	-	0		350,000
CHL-01	Chiller	Mcquay	1,860,000	155	93	-
DHW-03	Domestic Hot water boiler	A.O.Smith	-	0		
SPLT-01/14	Split unit	Mr. Slim	336,000	28	33.6	-
RTU-1	RTU-1	Lennox	48,000	4	4.8	120,000
RTU-2	RTU-2	TRANE	36,000	3	3.6	-
RTU-4	RTU-4	Lennox	36,000	3	3.6	90,000
RTU-5	RTU-5	Lennox	48,000	4	4.8	120,000
RTU-6	RTU-6	TRANE	600,000	50	60	-
RTU-7	RTU-7	Lennox	-	0	0	-
RTU-8	RTU-8	TRANE	150,000	12.5	15	250,000
RTU-9	RTU-9	TRANE	150,000	12.5	15	250,000
RTU-10	RTU-10	TRANE	60,000	5	6	130,000
RTU-11	RTU-11	TRANE	120,000	10	12	250,000
RTU-12	RTU-12	TRANE	120,000	10	12	250,000
RTU-13	RTU-13	TRANE	150,000	12.5	15	250,000
RTU-14	RTU-14	TRANE	180,000	15	18	350,000
RTU-027-04	RTU-027-04	Lennox	150,000	12.5	15	375,000
RTU-15	RTU-15	TRANE	24,000	2	2.4	50,000
ENG-A-1	ENG-A-1	ENG-A	108,000	9	10.8	250,000
ENG-A-2	ENG-A-2	ENG-A	360,000	30	36	350,000
	TOTAL		**4,536,000**	**378**	**361**	**7,661,000**
		Tons	**378**		**MBH @ 80%:**	**6,129**

Black & McDonald

Here is a list of the fan and pump we would like to have a amperage reading on:

WEST MECHANICAL ROOM
1. PUMP P-1: water pump – 120volt, 5.1amps
2. F1: Return Fan – 575volt, 3-phase (4.7A, 4.6A, 4.8A)
3. MZ1: Multi-Zone Unit – 575volt, 3-phase (12.1A, 12.2A, 12.1A)

EAST MECHANICAL ROOM
1. P-90-1 – 575volt, 3-phase (7.5A, 7.3A, 7.3A)
2. P-90-2 – pumps 1&2 alternate and share the same load

3. AHU-090: Supply fan – 575volt, 3-phase (4.3A, 4.4A, 4.4A)

2ND FLOOR MECHANICAL ROOM (CONTROL TOWER)
1. CC-1 : SUPPLY – 208volt, 1-phase, 6.7amps

CHILLER ROOM
1. P-121-1: Evaporator pump – 575volt, 3-phase (10.3A, 10.4, 10.7A)
2. P-121-2: Evaporator pump - pumps 1&2 alternate and share the same load
3. P-121-3: Condenser pump – 575volt, 3-phase (5.9A, 5.4A, 5.7A)
4. P-121-4: Condenser pump - pumps 3&4 alternate and share the same load

ROOF MECHANICAL ROOM
1. AHU-045-SUPPLY – 575volt, 3-phase (9.1A, 9.1A, 10.1A)
2. AHU-045-RETURN – 575volt, 3-phase (3.8A, 3.9A, 3.8A)

● Page 1

APPENDIX F

ENERGY CONSERVATION MEASURES

Operating Schedule Revision

Reduce operation time of ventilation units to match Aiport operating time.

		Estimated Fan Power (kW)	Estimated CFM
	RTU-1	2.22	2,222
	RTU-2	1.67	1,667
	RTU-4	1.67	1,667
	RTU-5	2.22	2,222
	RTU-6	27.78	27,778
	RTU-7	-	-
	RTU-8	6.94	6,944
	RTU-9	6.94	6,944
	RTU-10	2.78	2,778
	RTU-11	5.56	5,556
	RTU-12	5.56	5,556
	RTU-13	6.94	6,944
	RTU-14	8.33	8,333
	RTU-027-04	1.39	1,389
	RTU-15	1.11	1,111
	ENG-A-1	5.00	2,256
	ENG-A-2	16.67	3,000
	P-90-1	7.50	
	AHU-90	4.5	7,500
	Pump P-1	0.60	
	MZ-1 Supply	12.2	12,000
	MZ-1 return	4.50	
	CC-1	1.4	1,500
	P-121-1	10.40	
	P-121-3	5.4	
	AHU-045 S	9.10	1,000
	AHU-045 R	3.9	
	TOTAL	162.28	108,367

Hours	168	hrs/week
Yearly Consumption	1,134,127	kWh/yr
Monthly Consumption	94,511	kWh/mth
Reduced Hours	112	hrs/week
Yearly Consumption	756,085	kWh/yr
Monthly Consumption	63,007	kWh/mth

Control Saving (Fans)		
Yearly Energy Saving	**378,042**	**kWh**
Yearly Cost Savings	**26,121.23 $**	
Heating Reduction		
Yearly Energy Saving	**1,264**	**gj**
Yearly Cost Savings	**14,129 $**	

RETScreen Energy Model - Energy efficiency measures project

Fuels & schedules ☑ Show data

Fuel		Fuel type 1	Fuel type 2	Fuel type 3	Fuel type 4	Fuel type 5	Fuel type 6
Fuel type		Electricity					
Fuel consumption - unit		MWh					
Fuel rate - unit		$/kWh					
Fuel rate		0.069					
Schedule	**Unit**	**Schedule 1**	**Schedule 2**	**Schedule 3**	**Schedule 4**	**Schedule 5**	**Schedule 6**
Description		24/7					
			Occupied	Occupied	Occupied	Occupied	Occupied
Temperature - space heating	°C	21.0					
Temperature - space cooling	°C	25.0					
Temperature - unoccupied	+/-°C						
Occupancy rate - daily		h/d					
Monday		24					
Tuesday		24					
Wednesday		24					
Thursday		24					
Friday		24					
Saturday		24					
Sunday		24					
Occupancy rate - annual	h/yr	8,760					
	%	100%					
Heating/cooling changeover temperature	°C	16.0					
Length of heating season	d	252					
Length of cooling season	d	113					

Facility characteristics ☐ Show data

Summary ☑ Show data

	Fuel		Base case		Proposed case		Fuel cost savings	
Fuel type	**Fuel consumption - unit**	**Fuel rate**	**Fuel consumption**	**Fuel cost**	**Fuel consumption**	**Fuel cost**	**Fuel saved**	**Fuel cost savings**
Electricity	MWh	$ 69.000	185.0	$ 12,762	95.9	$ 6,615	89.1	$ 6,147

Project verification Fuel type	**Fuel consumption - unit**	**Fuel consumption - historical**	**Fuel consumption Base case**	**Fuel consumption - variance**
Electricity	MWh		185.0	

Energy	**Heating GJ**	**Cooling GJ**	**Electricity GJ**	**Total GJ**
Energy - base case			666	666
Energy - proposed case			345	345
Energy saved			321	321
Energy saved - %			48.2%	48.2%

Benchmark		
Energy unit	GJ	
Reference unit	m²	

Emission Analysis

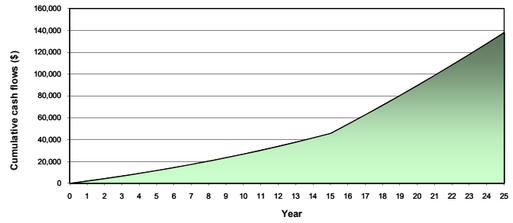
Base case electricity system (Baseline) Country - region	Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Canada	All types	0.196	10.0%	0.218

GHG emission					
Base case	tCO2	40.3			
Proposed case	tCO2	20.9			
Gross annual GHG emission reduction	tCO2	19.4			
GHG credits transaction fee	%				
Net annual GHG emission reduction	tCO2	19.4	is equivalent to	3.6	Cars & light trucks not used
GHG reduction income					
GHG reduction credit rate	$/tCO2				

Financial Analysis

Financial parameters			
Inflation rate	%	2.0%	
Project life	yr	25	
Debt ratio	%	100%	
Debt interest rate	%	3.00%	
Debt term	yr	15	
Initial costs			
Energy efficiency measures	$	50,000	100.0%
Other	$		0.0%
Total initial costs	$	50,000	100.0%
Incentives and grants	$		0.0%
Annual costs and debt payments			
O&M (savings) costs	$	0	
Fuel cost - proposed case	$	6,615	
Debt payments - 15 yrs	$	4,188	
Other	$		
Total annual costs	$	10,803	
Annual savings and income			
Fuel cost - base case	$	12,762	
Other	$		
Total annual savings and income	$	12,762	
Financial viability			
Pre-tax IRR - equity	%	positive	
Pre-tax IRR - assets	%	6.9%	
Simple payback	yr	8.1	
Equity payback	yr	immediate	

Cumulative cash flows graph



RETScreen Energy Model - Heating project

Heating project

		Base case	Proposed case		Incremental initial costs
Heated floor area for building	m²	9,900			
Energy efficiency measures			0%		
Heating load for building	W/m²	94	94		
Domestic hot water heating base demand	%	10%	10%		
Total heating	MWh	2,164	2,164		
Base load heating system					
Technology		Conventional	Boiler		
Capacity	kW	925.7	925.7	100.0%	$ 30,000
Heating delivered	MWh	2,164.1	2,164.1	100.0%	
Fuel type		Natural gas - GJ	Natural gas - GJ		
Seasonal efficiency	%	80%	93%		
Fuel consumption - annual	GJ	9,738	8,377	GJ	
Fuel rate	$/GJ	11.180	11.180	$/GJ	
Fuel cost	$	108,876	93,657		
Peak load heating system					
Technology					
Suggested capacity	kW		0.0		
Capacity	kW			0.0%	
Fuel type			Natural gas - m³		
Seasonal efficiency	%				
Fuel consumption - annual	m³		0		
Heating delivered	MWh		0.0	0.0%	
Fuel rate	$/m³				
Fuel cost	$		0		

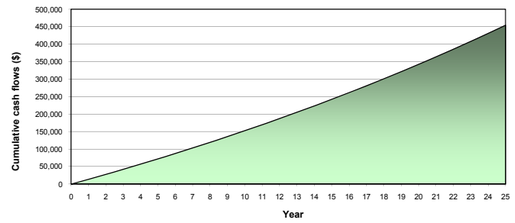
Emission Analysis

GHG emission					
Base case	tCO2	484.2			
Proposed case	tCO2	416.5			
Gross annual GHG emission reduction	tCO2	67.7			
GHG credits transaction fee	%				
Net annual GHG emission reduction	tCO2	67.7	is equivalent to	12.4	Cars & light trucks not used
GHG reduction income					
GHG reduction credit rate	$/tCO2				

Financial Analysis

Financial parameters				
Inflation rate	%	2.0%		
Project life	yr	25		
Debt ratio	%	100%		
Debt interest rate	%	3.00%		
Debt term	yr	25		
Initial costs				
Heating system	$	30,000	100.0%	
Other	$		0.0%	
Total initial costs	$	30,000	100.0%	
Incentives and grants	$		0.0%	
Annual costs and debt payments				
O&M (savings) costs	$			
Fuel cost - proposed case	$	93,657		
Debt payments - 25 yrs	$	1,723		
Other	$			
Total annual costs	$	95,379		
Annual savings and income				
Fuel cost - base case	$	108,876		
Other	$			
Total annual savings and income	$	108,876		
Financial viability				
Pre-tax IRR - equity	%	positive		
Pre-tax IRR - assets	%	48.2%		
Simple payback	yr	2.0		
Equity payback	yr	immediate		

Cumulative cash flows graph



RETScreen Energy Model - Cooling project

Cooling project

		Base case	Proposed case		Incremental initial costs
Cooled floor area for building	m²	10,000			
Energy efficiency measures			0%		
Cooling load for building	W/m²	63	63		
Non-weather dependant cooling	%	0%	0%		
Total cooling	MWh	785	785		
Base load cooling system					
Technology			Compressor		
Capacity	kW	631.0	631.0	100.0%	$ 75,000
Cooling delivered	MWh	784.7	784.7	100.0%	
Fuel type		Electricity	Electricity		
Coefficient of performance - seasonal		2.90	7.00		
Fuel consumption - annual	MWh	271	112	MWh	
Fuel rate	$/kWh	0.069	0.069	$/kWh	
Fuel cost	$	18,670	7,735		
Peak load cooling system					
Technology					
Suggested capacity	kW		0.0		
Capacity	kW			0.0%	
Fuel type			Electricity		
Coefficient of performance - seasonal					
Fuel consumption - annual	MWh		0		
Cooling delivered	MWh		0.0	0.0%	
Fuel rate	$/kWh				
Fuel cost	$		0		

Emission Analysis

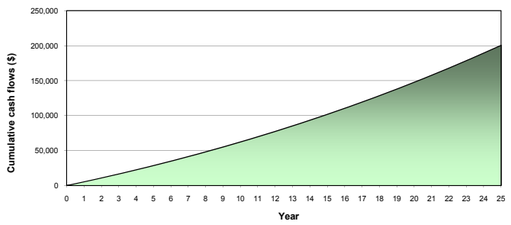
Base case electricity system (Baseline) Country - region	Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Canada	All types	0.196	10.0%	0.218

GHG emission					
Base case	tCO2	59.0			
Proposed case	tCO2	24.4			
Gross annual GHG emission reduction	tCO2	34.6			
GHG credits transaction fee	%				
Net annual GHG emission reduction	tCO2	34.6	is equivalent to	6.3	Cars & light trucks not used
GHG reduction income					
GHG reduction credit rate	$/tCO2				

Financial Analysis

Financial parameters			
Inflation rate	%	2.0%	
Project life	yr	25	
Debt ratio	%	100%	
Debt interest rate	%	3.00%	
Debt term	yr	25	
Initial costs			
Cooling system	$	75,000	100.0%
Other	$		0.0%
Total initial costs	$	75,000	100.0%
Incentives and grants	$		0.0%
Annual costs and debt payments			
O&M (savings) costs	$	1,500	
Fuel cost - proposed case	$	7,735	
Debt payments - 25 yrs	$	4,307	
Other	$		
Total annual costs	$	13,542	
Annual savings and income			
Fuel cost - base case	$	18,670	
Other	$		
Total annual savings and income	$	18,670	
Financial viability			
Pre-tax IRR - equity	%	positive	
Pre-tax IRR - assets	%	8.1%	
Simple payback	yr	7.9	
Equity payback	yr	immediate	

Cumulative cash flows graph



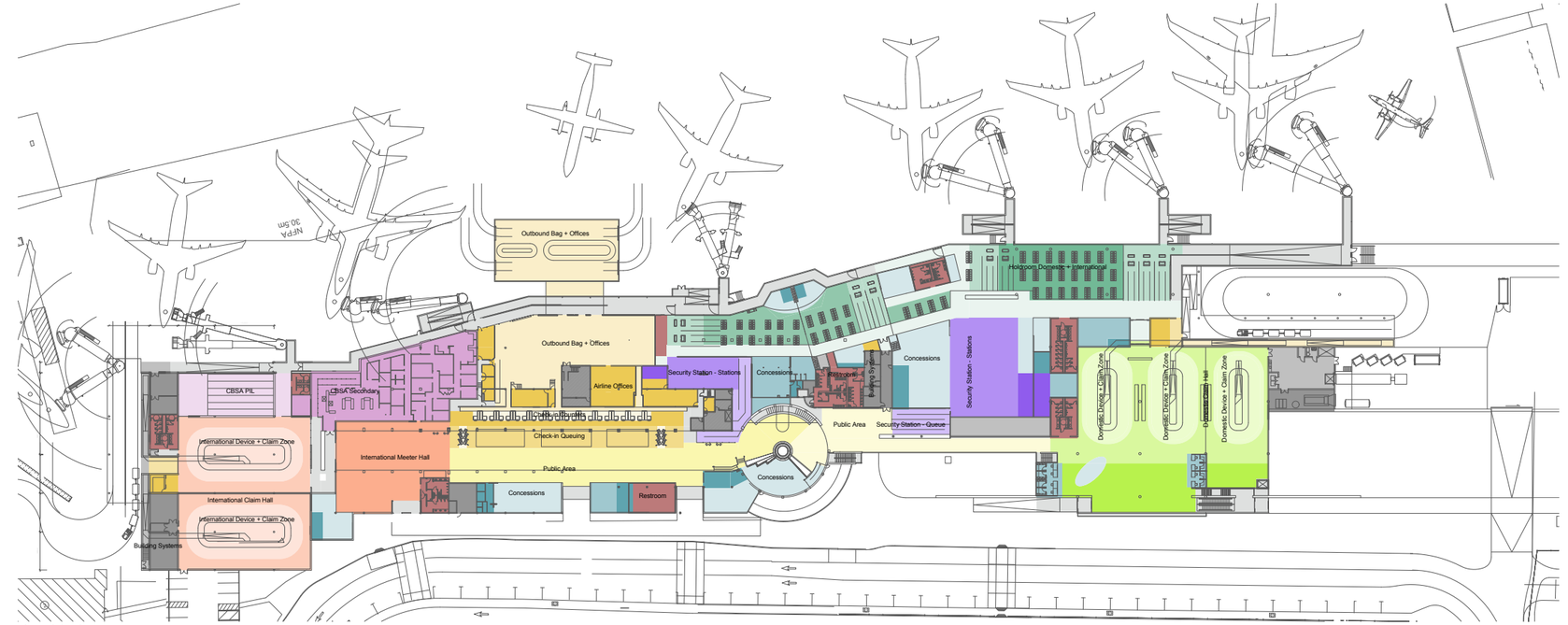
Building Area Legend

- 1A Check-in Counters
- 1B1 Check-in Queueing
- 1B2 Outbound Bag + Offices
- 1B3 Airline Offices
- 1B4 Check-in circulation
- 1C Public Area
- 1D1 Security Station - Queue
- 1D2 Security Station - Stations
- 1D3 Security Station - Offices
- 2A CBSA PIL
- 2B CBSA Secondary
- 2E1 International Device + Claim Zone
- 2F International Claim Hall
- 2G International Meeter Hall
- 2H1 Domestic Device + Claim Zone
- 2H3 Baggage Service Offices
- 2I Domestic Claim Hall
- 2J Domestic Meeter Hall
- 3A1 Holdroom Domestic + International
- 3A2 Holdroom Trans Border
- 3A3 Podium & Gate Control
- 3B Holdroom Circulation
- 4A Restroom
- 4B Concessions - Food
- 4C1 Concessions - Retail
- 4C2 Concessions - Support
- 5A Administrative / Operational Spaces
- 6A Building Systems
- Circulation
- Public Area

YLW 2025 Building Area	
Name	Area
1 Departures	
Check-in Counters	141 m²
Check-in Queuing	320 m²
Outbound Bag + Offices	1427 m²
Airline Offices	436 m²
Check-in circulation	120 m²
Public Area	808 m²
Security Station - Queue	207 m²
Security Station - Stations	608 m²
Security Station - Offices	116 m²
2 Arrivals	
CBSA PIL	334 m²
CBSA Secondary	772 m²
International Device + Claim Zone	781 m²
International Claim Hall	582 m²

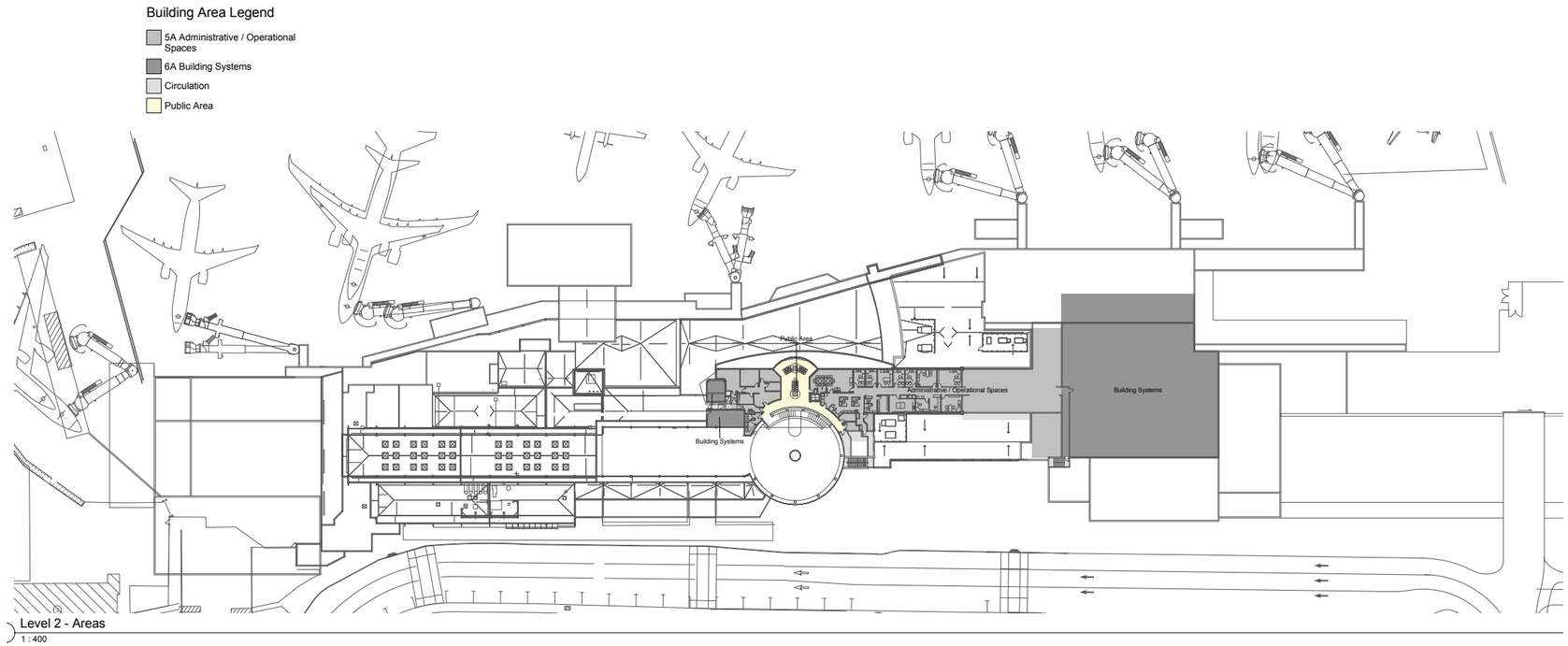
YLW 2025 Building Area	
Name	Area
International Meeter Hall	611 m²
Domestic Device + Claim Zone	844 m²
Baggage Service Offices	58 m²
Domestic Claim Hall	668 m²
Domestic Meeter Hall	458 m²
3 Concourses	
Holdroom Domestic + International	449 m²
Holdroom Trans Border	455 m²
Podium & Gate Control	461 m²
4 Public Spaces	
Concessions	1026 m²

YLW 2025 Building Area	
Name	Area
Concessions	499 m²
Concessions	222 m²
5 Aviation Dept	
Administrative / Operational Spaces	1582 m²
6 Building Systems	
Building Systems	2364 m²
N/A	
Circulation	1964 m²
Public Area	569 m²
Structure & Features	86 m²



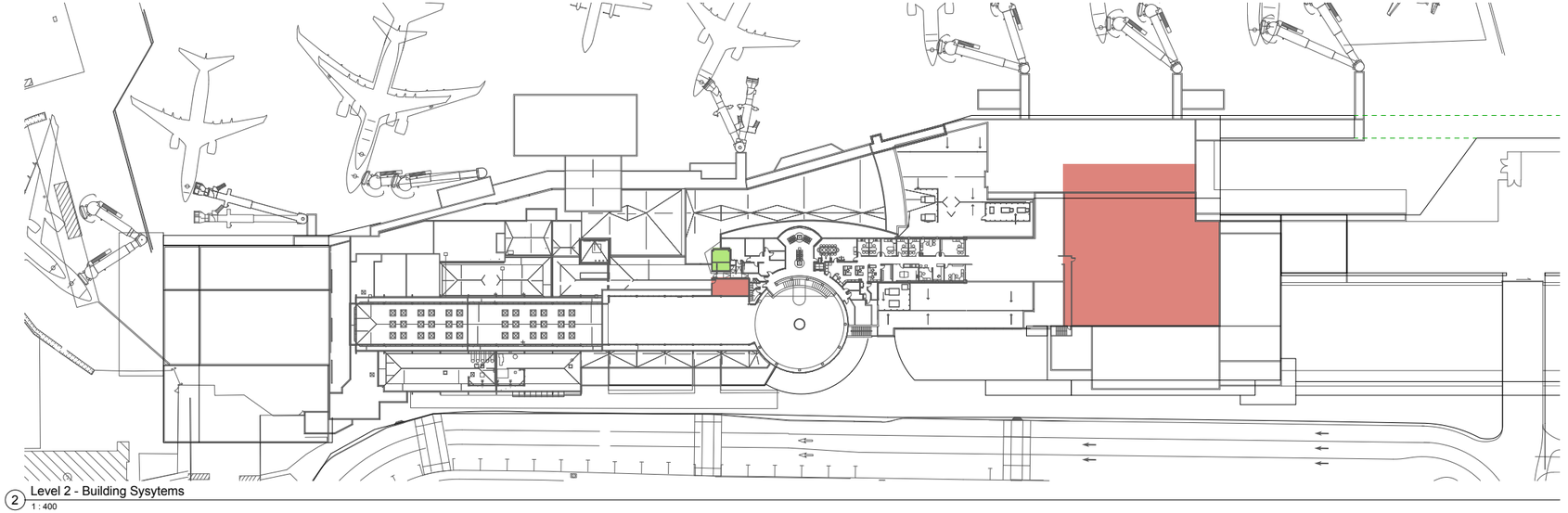
Level 1 - Areas

Concept Plan Area Reconciliation



Level 2 - Areas
1 : 400

Concept Plan Area Reconciliation

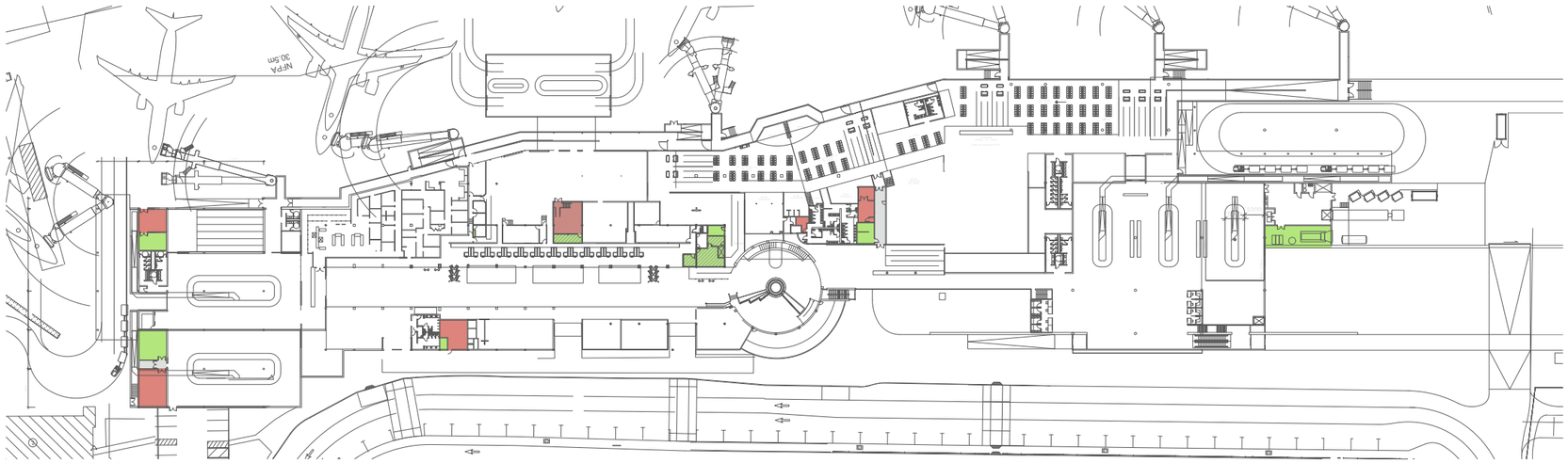


2 Level 2 - Building Sysytems
1 : 400

Building Area Legend

- Circulation
- Electrical
- Mechanical

Building system areas			
Util Sub Type	Level	Area	Name
Circulation	Level 1 - Areas	62 m²	Building Systems
		62 m²	
Electrical	Level 1 - Areas	317 m²	Building Systems
Electrical	Level 2 - Areas	31 m²	Building Systems
		348 m²	
Mechanical	Level 1 - Areas	283 m²	Building Systems
Mechanical	Level 2 - Areas	1671 m²	Building Systems
		1954 m²	
		2364 m²	



Level 1 - Building Sysytems

Concept Plan Area Reconciliation

JACOBS Consultancy

Memorandum

To: **Janice Liebe**

From: **Jim Slavin**

CC.: **Henry Castorf**

Date: **12 May 2010**

Re: **Primary security line-Kelowna Development program**

Attached please find a mark-up of the concept diagrams that shows the security line between airside and groundside. Any portal at this line will be subject to security control requirements and CCTV/access control equipment is implied.

The design team will need to attend to staff crossing points for:

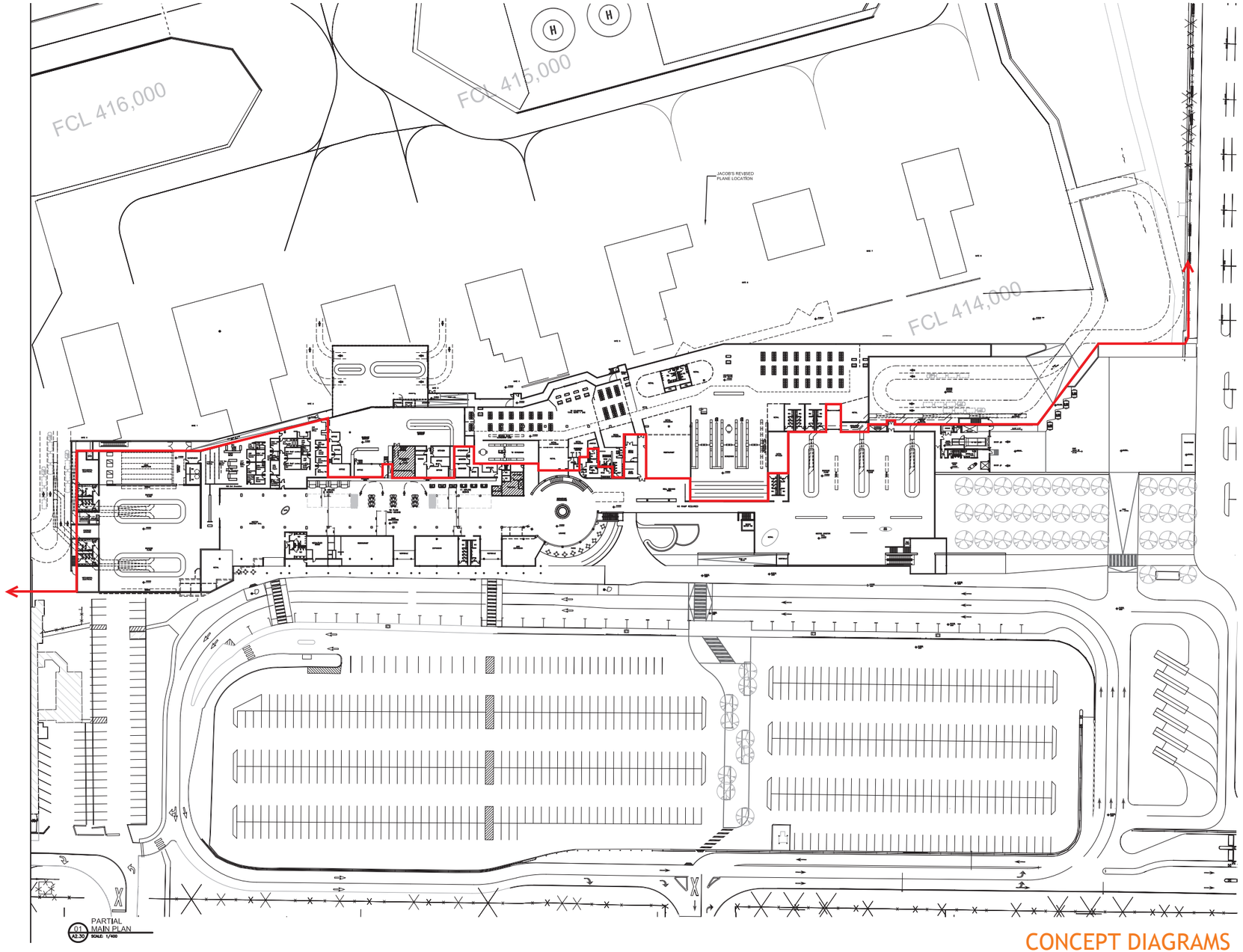
- Baggage agents- they will need to pass across the passenger corridor to get to their work locations and return.
- Airline agents-they will need an access to the domestic holdroom and return.
- Concession staff-and more importantly materials/logistics for post security locations.
- CBSA security-they have their own access/entry control requirements and the blue line denotes their similar, but separate, boundary. If we recall the statement of requirements correctly, CBSA are entitled to an apron access location and nearby vehicle parking site.

Sincerely,

Jim Slavin

Associate Director

Jacobs Consultancy



CONCEPT DIAGRAMS

Appendix H : YLW Master Plan Parking Demand Analysis Technical Report

Interfleet

Member of the SNC·LAVALIN Group

YLW MASTER PLAN
PARKING DEMAND ANALYSIS

13 July 2015

B

Study Overview

The Parking Demand and Supply Analysis is a sub-task of the Ground Access and Parking Requirements component of the development of the YLW Master Plan 2045.

Although parking traffic data was included in the 2014 Airport Traffic Study, more detailed analyses of lot utilization patterns is needed to fully project short, medium and long-term parking requirements, in particular to identify the potential need and triggers for a parkade facility at the ATB.

This Parking Demand and Supply Analysis provides a more detailed and up-to-date portrait of future parking requirements at the airport, including public, car rental, and employee parking.

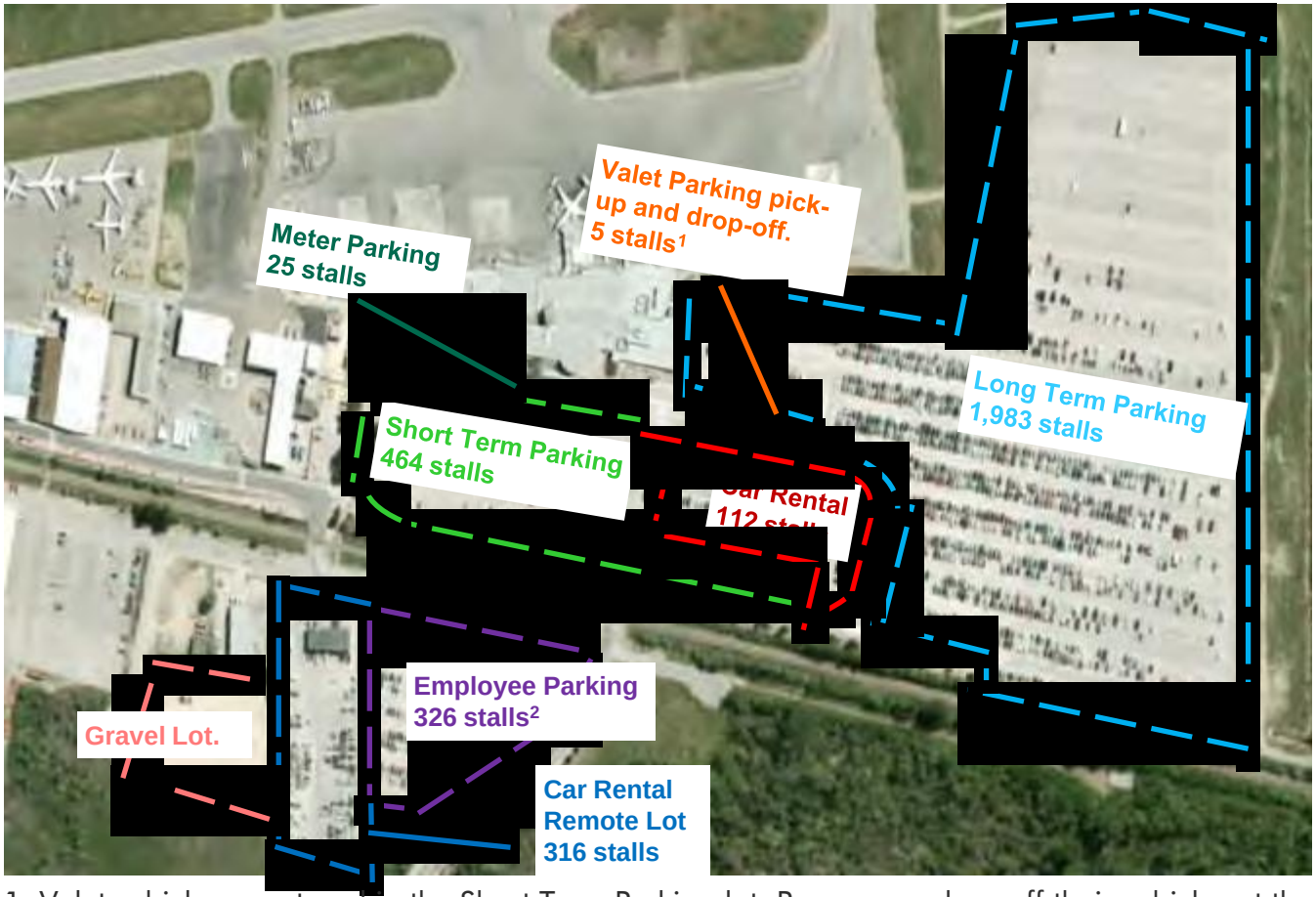
A 3-Step Approach

This Parking Demand and Supply Analysis is subdivided into three steps as follows:

List of Data Reviewed

Data	Source
1. Peak parking demand	Kelowna International Airport Traffic Study, MMM Group, September 2014
2. Ground access mode	Kelowna International Airport Ground Access Study, InterVISTAS Consulting Inc., October 2010 Kelowna Airport Service Quality Study 2014 Annual Report, Airports Council International, 2015
3. Air passengers forecast	Kelowna International Airport Master Plan 2045, SNC-Lavalin, April 2015
4. Parking duration	Preliminary Feasibility Study for a Public/Private Partnership for the Construction of a Parkade at Kelowna Airport, Airport Performance Group, May 1998
5. Parking profile	Vehicle Activity Report Summary, 2014
6. Flight schedule	Gate scheduling March 2015
7. Air passengers statistics	Statistics and Concessions

Existing Parking Inventory



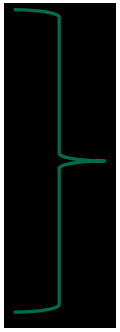
Source: Kelowna International Airport Traffic Study, September 2014

1. Valet vehicles are stored in the Short Term Parking lot. Passengers drop off their vehicles at the kiosk located at the south end of the terminal building. Vehicles will be ready in the same location when passengers return home from their flight.

2. During Christmas peak, employee parking will become overflow parking. The employees will park at the gravel lot.

Ground Access Mode Survey Results 2009

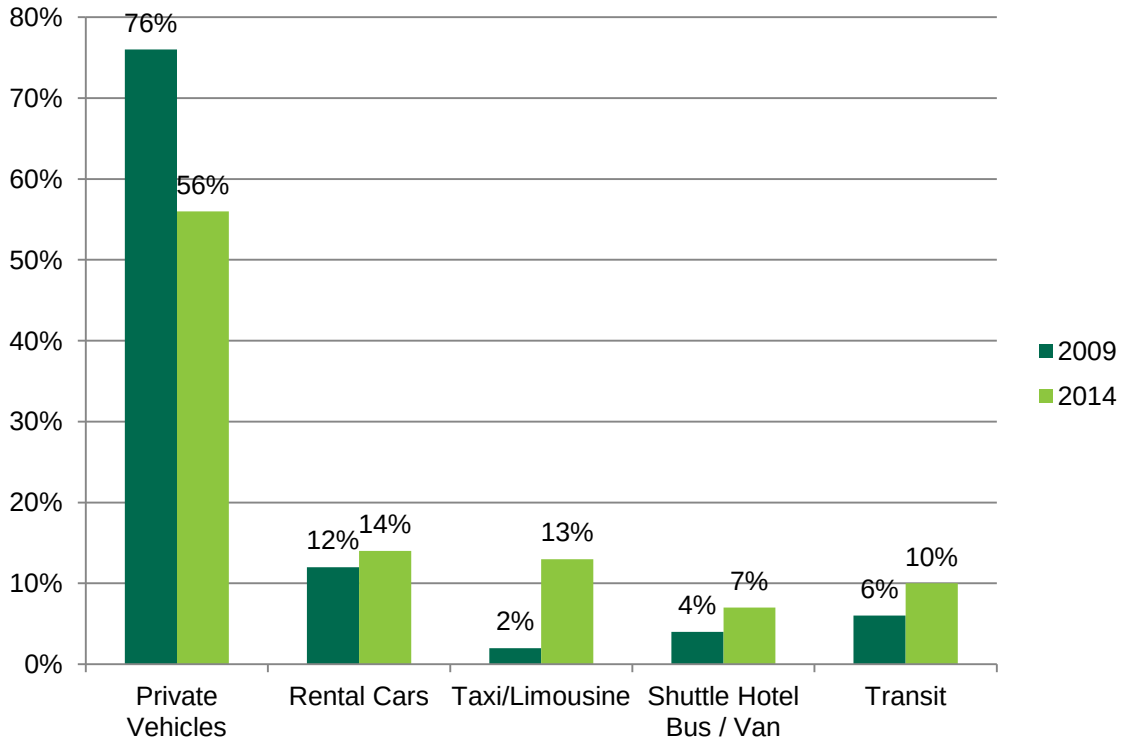
Mode	Percentage
Long Term Parking	17%
Short Term Parking	29%
Valet Parking	1%
Metered Parking	7%
Dropped off / Picked up	22%
Car Rental	12%
Taxi / Limousine	2%
Shuttle Hotel Bus / Van	4%
Transit	6%
Total	100%



Private vehicles accounted for 76% in 2009 and have dropped down to 56% in 2014

Source: 2009 Kelowna International Airport Customer Satisfaction and Benchmarking Survey

Ground Access Mode



Sources: 2009 Kelowna International Airport Customer Satisfaction and Benchmarking Survey
2014 Kelowna Airport Service Quality Study

Parking Rate

Type of Parking	Parking Rate
Long Term Parking	First 15 minutes are free $1.50 per hour part thereof (includes first 15 minutes, to a maximum of $12.00 per 24 hours and a weekly maximum rate of $62.00)
Short Term Parking	First 15 minutes are free. $1.50 for the 1st hour or part thereof (include first 15 minutes) $2.50 for each additional hour or part thereof to a maximum of $18.50 per 24 hours
Metered Parking	$ 1.75 for 30 minutes
Valet Parking	A one-time fee of $15.00 is added to your normal parking cost, such as daily, weekly or Gold Pass service
Reserved Permit Parking	$900.00 for 6-month period

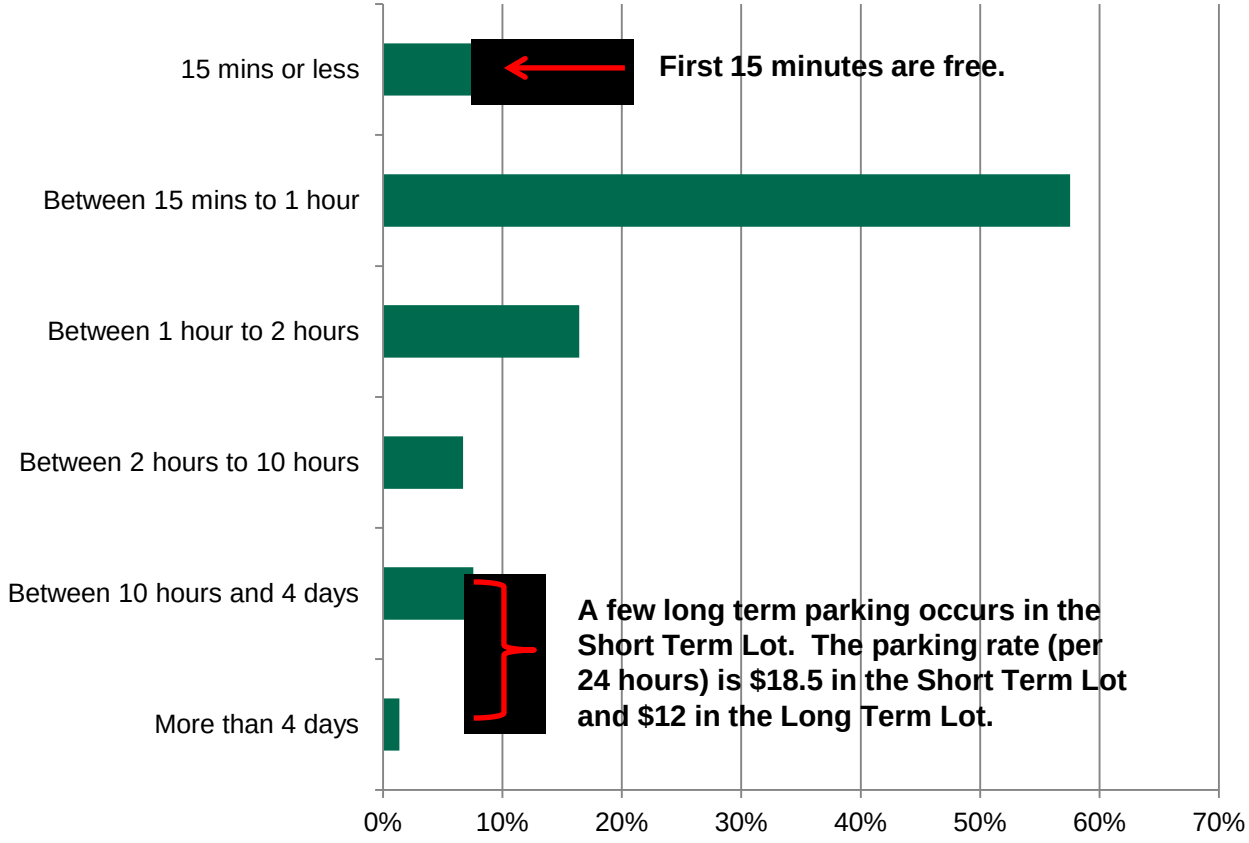
Parking Duration – Metered Parking

The maximum duration for metered parking is 30 minutes.

In the past, the metered parking stalls were full, occupants of private vehicles would tend to circle around until a metered parking stall became available or until the party they were picking up presented themselves at a curb-side location.

Since the airport has permitted free use of the short and long term for first 15 minute interval, occupants of private vehicles can use the lots while waiting for arrival passengers instead of using metered parking.

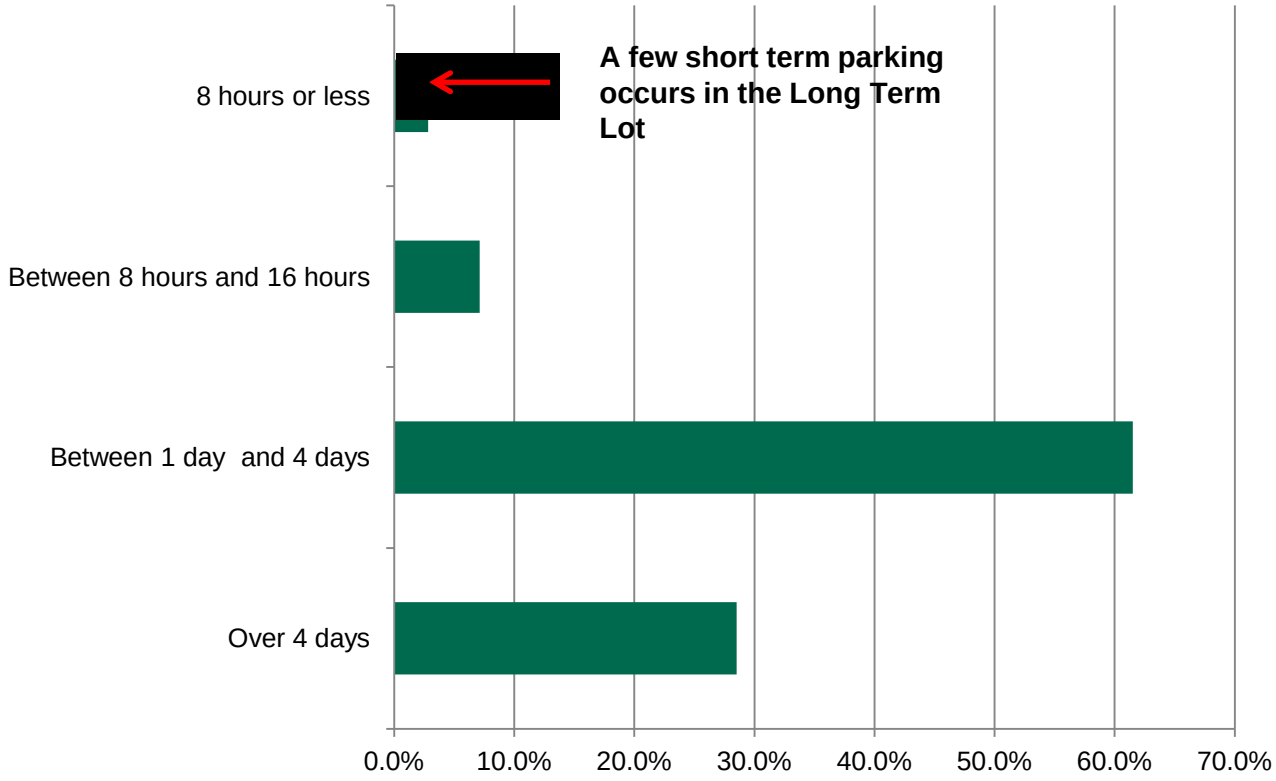
Parking Duration – Short Term Lot



*A total of 16,041 parking tickets were analyzed over a four week period.

Sources: Preliminary Feasibility Study for a Public/Private Partnership for the Construction of a Parkade at Kelwona Airport, 1998

Parking Duration – Long Term Lot



*A total of 1,725 parking tickets were analyzed over a four week period.

Sources: Preliminary Feasibility Study for a Public/Private Partnership for the Construction of a Parkade at Kelwona Airport, 1998

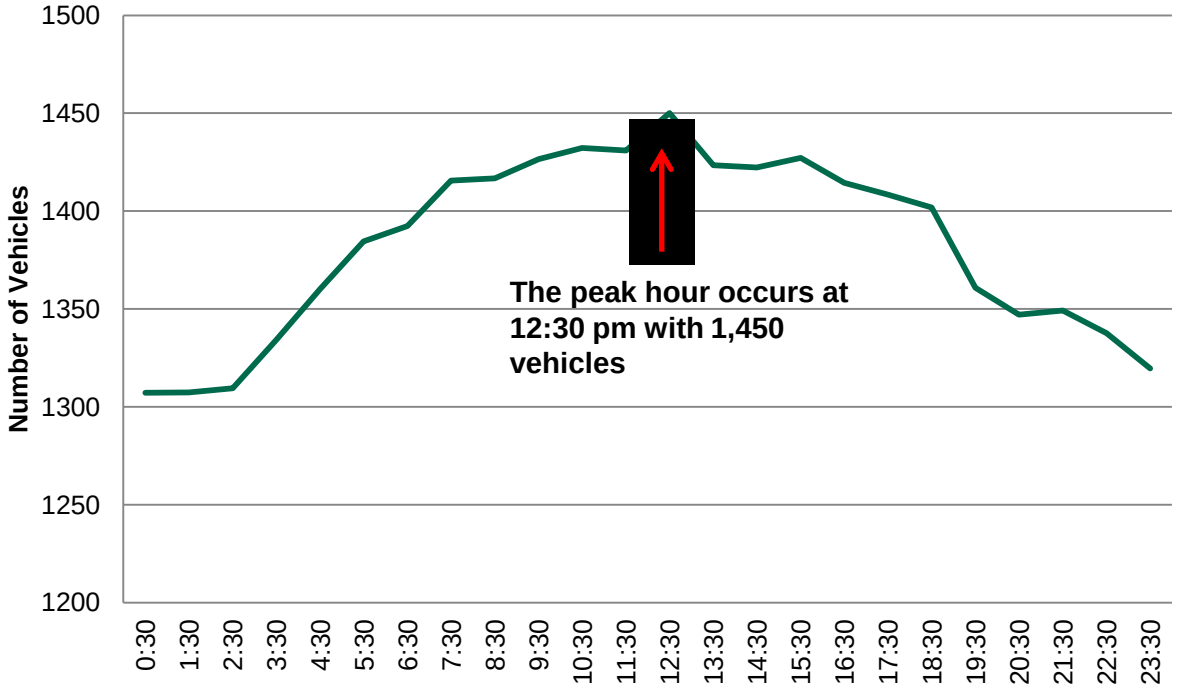
Peak Parking Utilization in May 2014

Parking	May 2014		
	Number of Parked Vehicles	Total Number of Stalls	% Occupied
Long Term	1,230	1,983	62 %
Short Term	220	464	47 %
Employee	100	326	31%

Valet parking is estimated to be equal to 72 based on the existing ratio between Valet Parking and Long Term Parking (1:17). This ratio is observed from the 2009 Kelowna International Airport Customer Satisfaction and Benchmarking Survey.

Source: Kelowna International Airport Traffic Study, September 2014

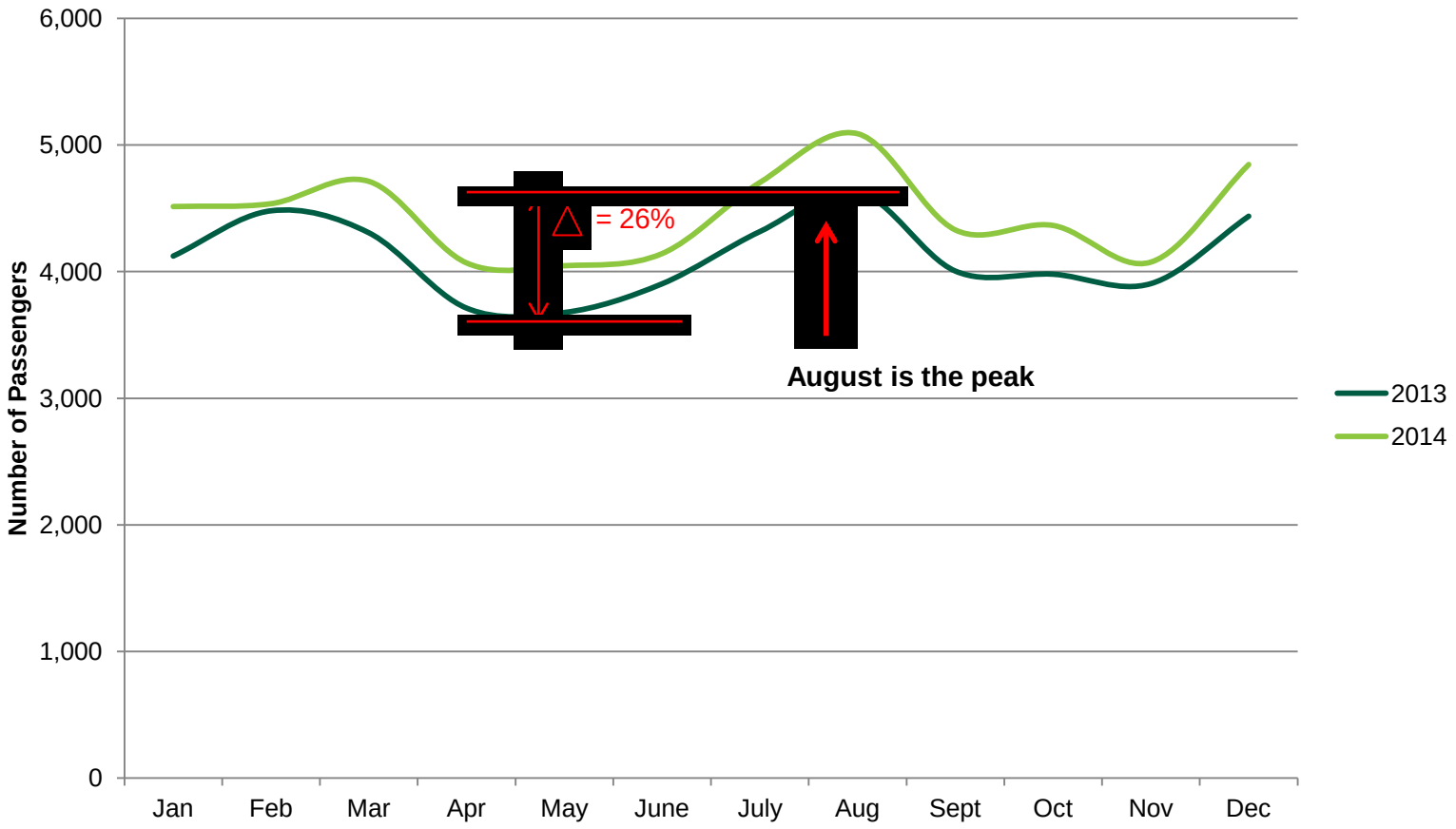
Hourly Volumes for Short Term and Long Term Parking in May 2014



The profile is derived from the Vehicle Activity Report Summary 2014. The number has been adjusted to match with the parking demand in May 2014

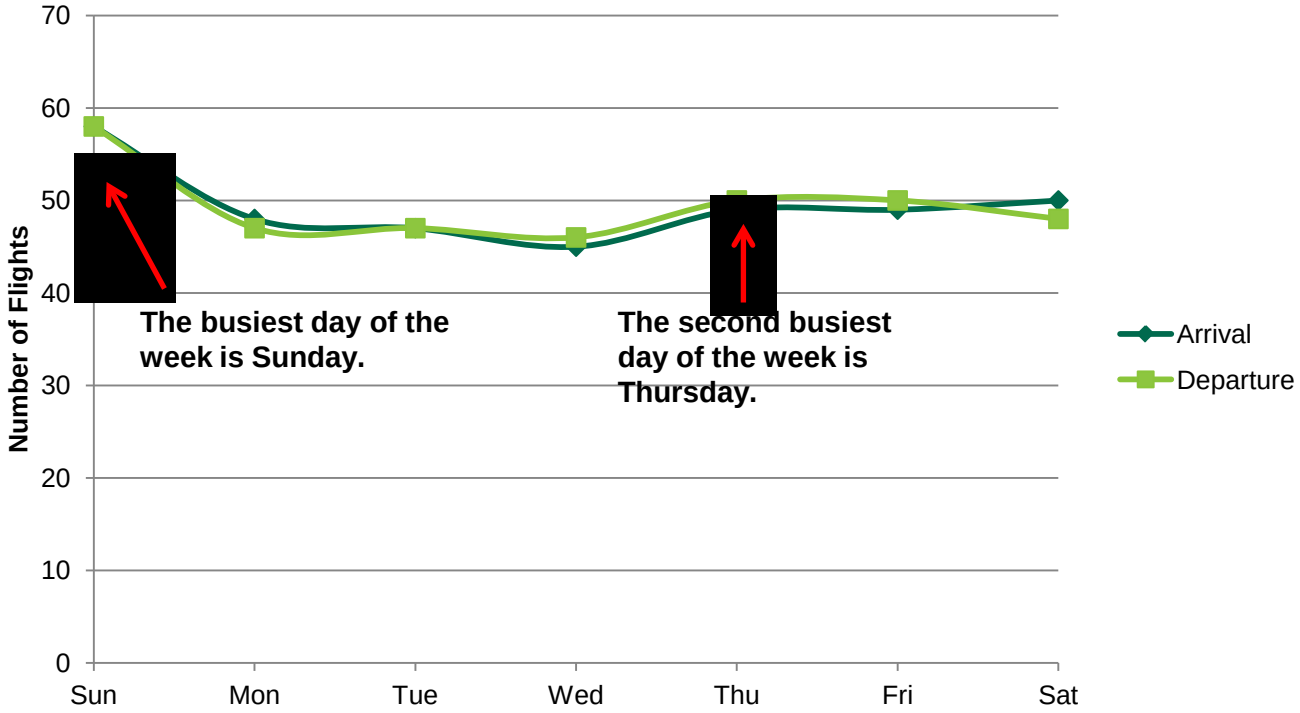
Source: Kelowna International Airport Traffic Study 2014.

Average Daily Passenger Profile



Weekly Profile of Flights

Sunday has 17% more flights compared to average daily number of flights.



The Busy Day is a Thursday. It is the second busiest day of the Busy Week and is representative of the 95% busiest day over the year.

Sources: March 1 – 31 (2015) Flight Schedule

Air Passenger Forecasts

	May 2014	Aug 2014	2015	2020	2025	2030	2035	2040**	2045**
	Daily Average		Busy Day Traffic*						
Air Passengers (Embark and Disembark)	4,047	5,089	5,460	7,077	8,375	9,255	10,136	11,193	12,136

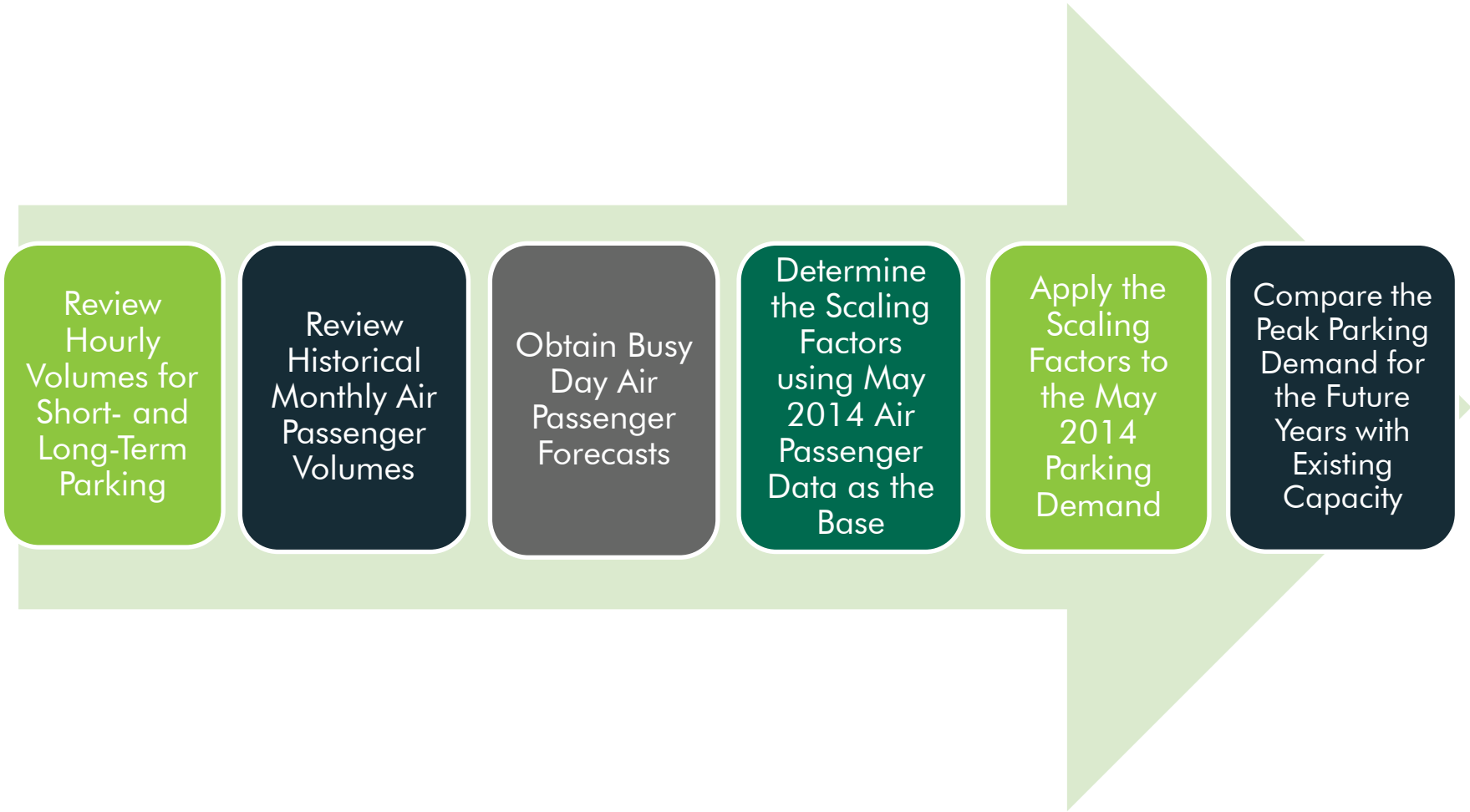
*The Busy Day is the second busiest day of the Busy Week and is representative of the 95% busiest day over the year. The Busy Day is Thursday.

**Busy Day Traffic for 2040 and 2045 are not provided. It is estimated using the growth rates from the E/D annual passengers forecasts.

Source: Kelowna International Airport Master Plan 2045 Technical Report – Air Traffic Forecasts

Statistics and Concessions

Estimation of Peak Parking Demand



Peak Parking Demand

	Number of Available Stalls	May 2014	Aug 2014	2015	2020	2025	2030	2035	2040	2045
		Daily Average		Busy Day Traffic***						
Scaling Factor*		1.00	1.26	1.35	1.75	2.07	2.29	2.50	2.77	3.00
Long Term Parking	1,983	1,230	1,547	1,659	**2,151**	**2,545**	**2,813**	**3,081**	**3,402**	**3,689**
Short Term Parking	464	220	277	297	**385**	**455**	**503**	**551**	**608**	**660**
Valet Parking	Integrated with Short Term Parking	72*	91	98	**127**	**150**	**166**	**181**	**200**	**217**
Employee Parking	326	100	126	135	175	207	229	250	277	300
Metered Parking	25	25	**31**	**34**	**44**	**52**	**57**	**63**	**69**	**75**
Total	**2,798**	**1,647**	**2,072**	**2,223**	**2,882**	**3,409**	**3,768**	**4,126**	**4,556**	**4,941**
Additional Stalls Required (if only the overflow from Long Term Parking can use the Employee Parking)		n/a	n/a	n/a	**67**	**404**	**741**	**1,078**	**1,481**	**1,843**

** Short Term Parking Lot will be over capacity by 2020 since the spaces are shared with Valet Parking.

***The Busy Day is the second busiest day of the Busy Week and is representative of the 95% busiest day over the year. The Busy Day is Thursday.

Comparison with Airbiz Parking Demand

Parking	Airbiz Analysis			Our Analysis		
	Existing Capacity	2014 Demand	2025 Demand	Existing Capacity	2014 Demand	2025 Demand
Staff Lot	(integrated with Long Term Parking)	100	196	326	100	207
Rental Ready Lot	230	113	222	n/a	n/a	n/a
Rental Staging / Storage	300	316	620	n/a	n/a	n/a
Short Term Parking	345	220	320	464	220	455
Long Term Parking	1,900	1,230	2,411	1,983	1,230	2,545
Admin. Lot (Valet Parking)	54	54	75	(integrated with Short Term Parking)	72	150
Metered Parking	n/a	n/a	n/a	25	25	52
Total excl. Rental Vehicles	2,299	1,604	3,002	2,798	1,647	3,409
Total incl. Rental Vehicles	2,829	2,038	3,844	n/a	n/a	n/a

Note: "Admin Lot" is not shown on the YLW airport parking facilities map sourced from the YLW official website. We suspect "Admin Lot" indicated in the Airbiz analysis refers to Valet Parking Drop-offs and Pick-ups.

Comparison with Airbiz Parking Demand

Existing Capacity

- For existing capacity, Airbiz report has indicated the lot south of the terminal contains 230 rental ready lot stalls and 345 short term parking stalls. Staff parking is integrated with Long Term parking and 54 stalls for the admin lot.
- Further to our verification with the Airport operations manager, it is confirmed that our number of stalls for the rental ready lot and short term parking are correct. Staff parking is separated from the Long Term parking, located south of the Short Term Parking Lot. Valet parking vehicles are stored in the Short Term Parking Lot.

Demand Forecast

- Our analysis utilizes a 2.07 growth factor for 2025, whereas the Airbiz report stated it utilizes a 1.96 growth factor for 2025. Nevertheless, the Airbiz analysis didn't apply the growth factor for the Short Term Parking and Admin Lot.
- If 1.96 growth factor was applied, 431 stalls for the Short Term Parking would be projected. It would be closer to our 2025 parking demand forecasts.
- It is recommended to design the future parking facility using our demand forecast since it is representative of the 95% busiest day over the year.

Summary

- The demand for metered parking is already over the capacity during the busiest month (August) in 2014. It is assumed that the overflow went to the short term and long term parking lots.
- Air passenger is expected to increase significantly in the future. Compare with the busiest month (August) in 2014, volumes per day are expected to grow from 5,100 passengers to 7,100 passengers (39%) in 2020 and 10,100 passengers (almost double) in 2035 during the 95% busiest day of the year.
- By 2020, the short term (together with valet parking) and metered parking demand will be over capacity during the 95% busiest day of the year. 48 additional spaces would be required for the short term parking and 19 additional spaces would be required for the metered parking. The Employee parking lot would be needed to provide sufficient capacity for the overflow of long term parking whereas airport employees would need to park their vehicles at the gravel lot.
- By 2025, about 400 additional spaces would be required even with the use of the Employee Parking Lot as overflow parking.
- The availability of existing parking spaces is not meeting the ultimate demand, particularly for long term parking. YLW should consider building a multi-storey parkade that can accommodate the future parking demand by 2025.

Next Steps

- Further analysis of the 2014 Vehicle Activity Report Summary to identify the different time occurrences of the long term and short term peak parking demands.
- Further analysis of the daily variations in terms of peak parking demands, particular in March (Spring Break), August (summer vacation time) and December (Christmas).
- Verification of the valet parking demand with YLW staff.
- Develop curb-side management and strategy to accommodate terminal expansion and valet parking demand
- Identify potential sites for long term overflow parking by 2025, e.g. expand the existing long term parking lot further to the east
- Further analysis of the parking demand elasticity to the parking charges
- Identify potential sites and phasing strategy required during the construction of a multi-story parkade in the long term
- Develop parking circulation plans for both short term and long term parking lots

Appendix I : Kelowna International Airport Landside Redevelopment Plan

YLW
Kelowna International Airport

Kelowna International Airport

Landside Redevelopment Plan

08 DECEMBER 2015

AIRBIZ

EXECUTIVE SUMMARY

The purpose of this planning study is to provide a Landside Master Plan for the Kelowna Airport. The preferred plan was created through a series of workshops. It defines a general layout of the roadway system, parking lots, terminal curbside and the number of parking stalls needed for development in 2025.

Each item within this study is expected to be further developed in later works by YLW. This study utilizes the following documents as its primary reference material:

- YLW Traffic Study Report 2014 (MMM)
- YLW ATB Schematic Design Report 2010 (Dialog)
- YLW Airport Master Plan 2025 (c.2007 InterVistas)

In consultation with the YLW Management, the study defined a series of planning parameters for use in the development of parking and roadway options. It also considered a variety of industry best practises, parking programs and related cost structures, future parking offers, lot usage and walking times/distances in the development of the landside concepts. These discussions are seen as part of the continuous development of a specific business case and implementation plans by YLW as they identify opportunities to diversify their parking offer and develop the parking lots/roadways. The preferred plan is anticipated to be realized as a phased process which has been articulated in the following report.

RECOMMENDATIONS

Over and above the physical aspects of the landside redevelopment plan itself the study considered the impact to the parking business. As such there are a series of recommendations that should be considered in additional detail within the further infrastructure design and the parking business model which are detailed below:

INFRASTRUCTURE

- Develop oversize vehicle parking areas within the various lots. The quantity and location of these stalls is not reviewed in this study; and
- Removal of the meter parking at the terminal curb and the short term redevelopment of the curbside parking allocations in line with the long term vision.

PARKING BUSINESS MODEL

- Oversize vehicle stall management model to be considered and implemented. Management style range from active to passive enforcement of the stall use;
- Expansion of online parking services;
- Consideration of stall booking services within the online product; and
- Consideration of data driven services by the wants/needs of the passenger.

YLW
Kelowna International Airport

BACKGROUND MATERIAL & PROJECT CONTEXT

PRICE VS DISTANCE

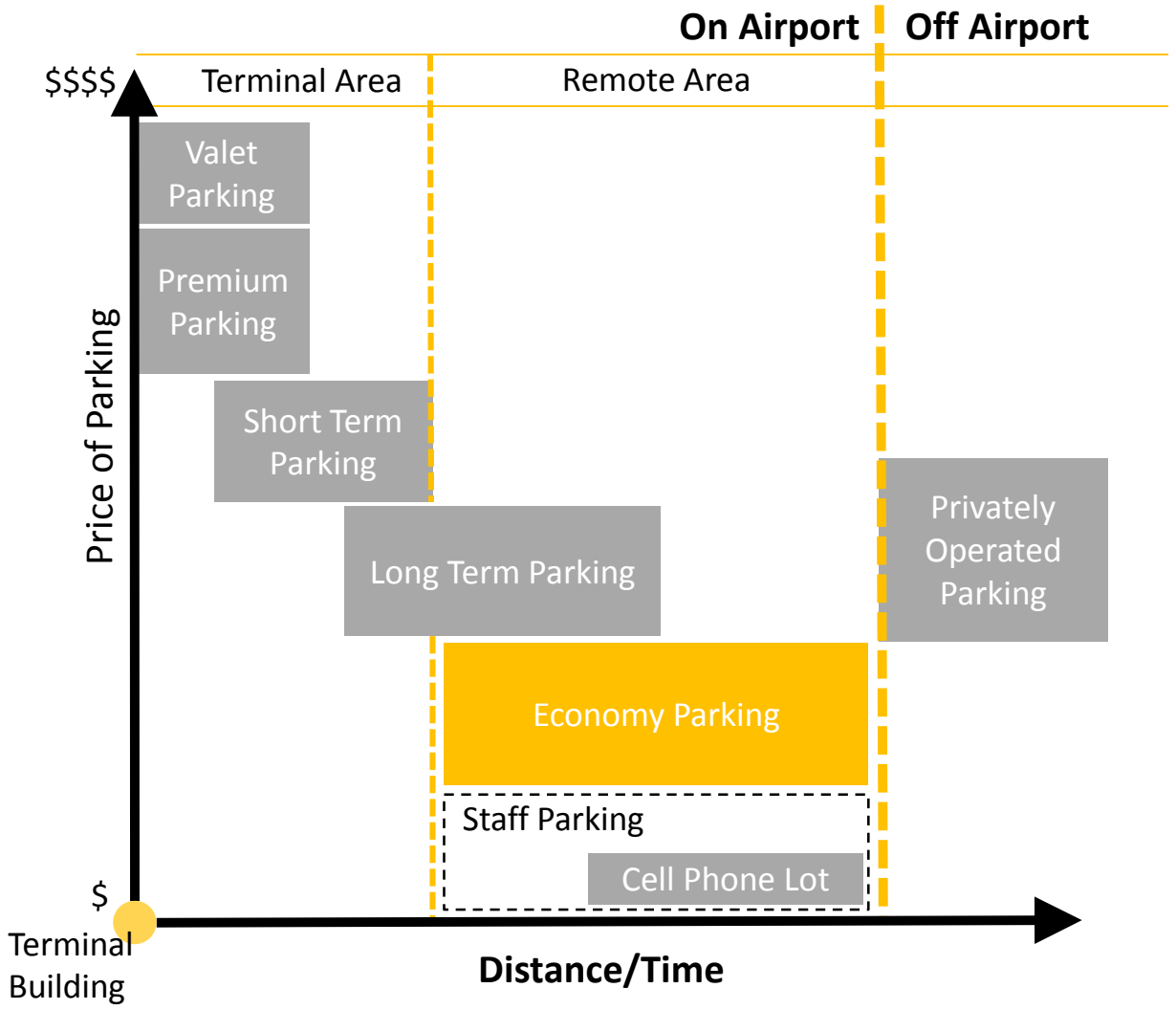
Airports generally offer parking via two products:

- Short-term; and
- Long-term.

Each is priced using a regressive strategy based on the length of stay.

Diversification of the parking offer considers the passenger's propensity to pay for proximity to the terminal (refer to image on the right). Product diversification should be carefully considered via business case development, demand/capacity assessments, pricing strategies, customer surveys and limited pilot programs to test the concept prior to a larger scale launch of a service.

The YLW parking system is flexible and will allow for a wide array of products to be explored with little infrastructure change. This places YLW in a positive position with respect to re-evaluating their parking offer.



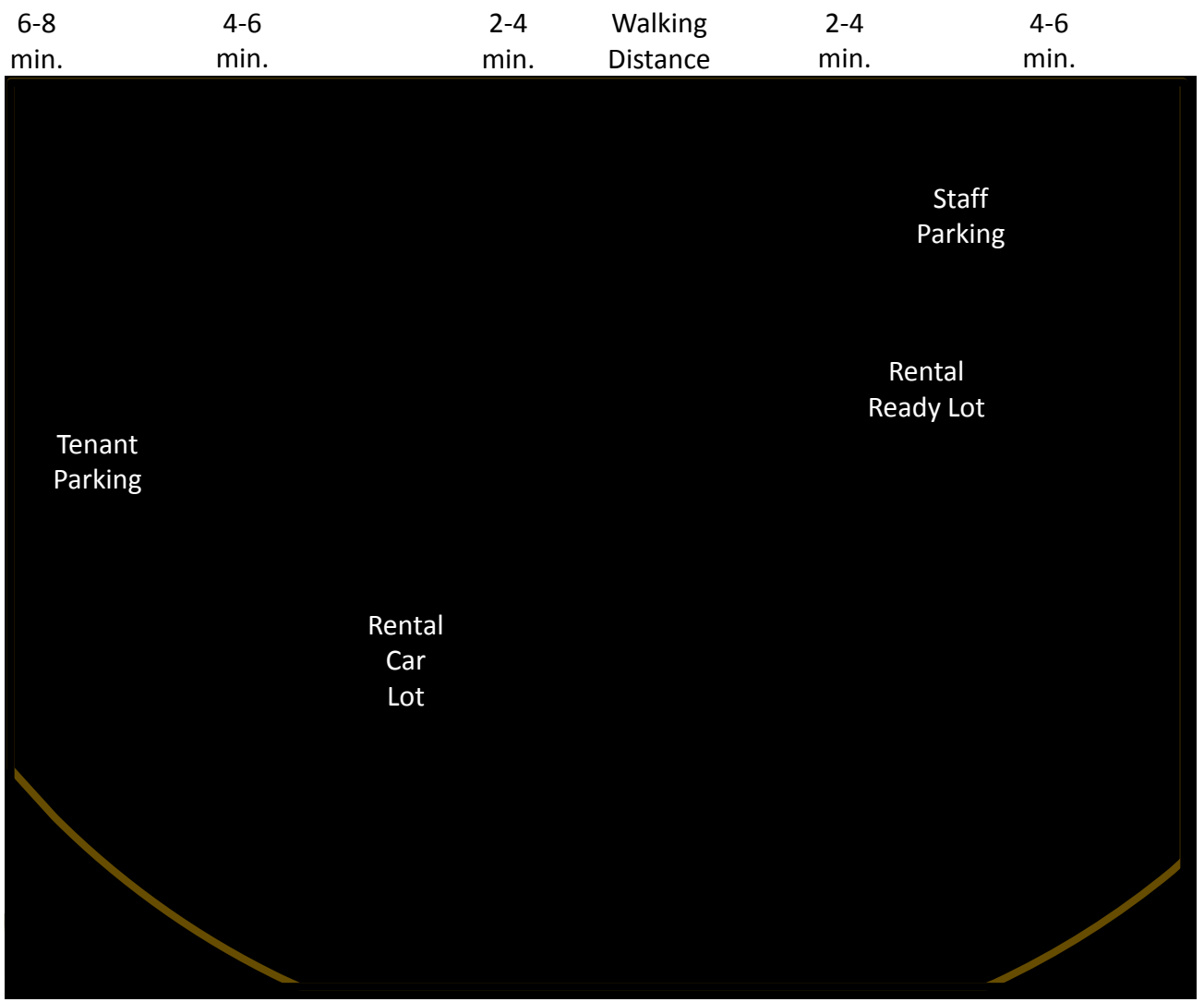
WALKING TIMES

Utilizing similar planning assumptions of the walking speed of passengers within the terminal, we have allocated a range of walking times from the parking lots to the main entry points of the terminal building.

WALKING RATES
800mm/sec to 1m/s

This overlay allows for the passenger experience and parking products to be considered when defining the function and potential pricing for each lot. Proximity to the terminal generally equates a higher level of passenger experience and a higher parking fee.

As the airport grows, this overlay may assist in developing a commercial parking model that reflects the best mix of passenger experience and acceptable parking pricing.



PARKING STANDARDS

The existing parking standards at YLW were used throughout this study. More detailed planning work may require a review of the dimensions utilized within this study. Larger new vehicle sizes have caused other Canadian Airports to consider larger than average standard stall sizes in new parking lot developments. As a baseline, we have provided the existing parking standards that existing at the Kelowna Airport.

The chart below compares typical minimum standards with current average stall dimensions in YLW's main lots. The short and long term lots have the same stall size with the aisle width being less in the short term lot that the long term lot.

Parking Standards	Typical Minimum Requirements	Existing Short & Long Term Lots
Stall Width	2.6 m	2.67 m
Stall Depth	5.8 m	5.64 m
Aisle Width	7.6 m	7.5 to 7.62 m

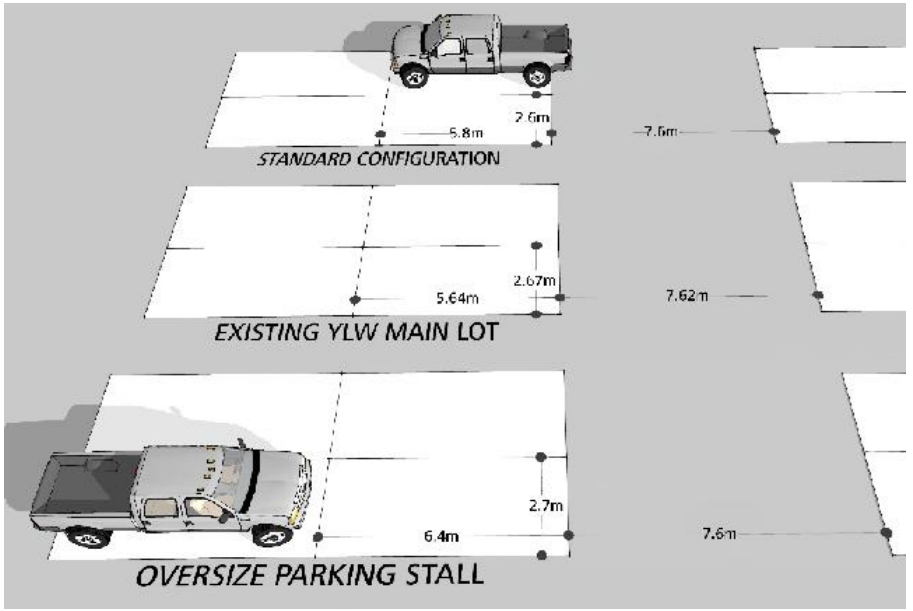
PARKING STANDARDS

Oversize parking stalls are allocated at many airports where there is a high degree of large vehicles such as pick-up trucks, vans or SUV's. Small motorhomes and similar type vehicles may also require consideration. The number, size and location of these stalls requires additional review and will need to be coordinated with the YLW parking management practises.
Airports vary in management of their parking lots from active to passive. Oversize stall is managed most often with signage, leading vehicles to dedicated areas. This is an example of a passive approach. An active approach involves surveillance and enforcement practises.

Lane width is also a consideration with a high degree of oversize vehicles.

The chart below compares typical minimum standards with oversize stall dimensions. It is anticipated that oversize stalls may be provided in both the short and long term lots.

Parking Standards	Typical Minimum Requirements	Oversize Requirements
Stall Width	2.6 m	2.7 m
Stall Depth	5.8 m	6.4 m
Aisle Width	7.6 m	7.6 m



INDUSTRY BEST PRACTICE

Airports are creating "value-added services" that allow passengers and tenants to benefit from an increased level of service or choice in exchange for a fee. Diversification segments the parking product based on duration and cost, of their stay. A comprehensive signage program is necessary to direct travellers to their desired parking product.

Public parking activities are a significant revenue source to the airport. As such, any development initiative should be assessed against a base case scenario associated with maintaining the car parking facilities as they stand. The existing public parking spaces at YLW (2245 short and long term stalls combined) have a theoretical maximum daily or annual revenue. An annual baseline estimate provides one method to evaluate parking performance, multiple parking options, and can serve to balance lot segregation against lot utilization in an effort to maximize each lot's revenue potential.

The planning work undertaken in this study did not address the commercial model at YLW directly. However, some of the commercial aspects of the existing and anticipated future operations in developing parking concepts and the preferred option were considered. A more in-depth study is required to fully realize the commercial opportunities that are possible within the YLW parking program.

The following best practise items were reviewed with YLW through this planning exercise and may form part of a future business plan on the parking services at the airport:

Parking Services by:
- Duration
- Maximum charge by duration
- Proximity to terminal
- Data driven parking services

Parking Service by Product Offering:
- Short Term (ST)
- Long Term (LT)
- Valet Parking
- Staff Parking
- Reserved Permit

Other Existing Parking Services:
- Shuttle Service

Possible Future Services:
- Park and Fly
- Express Covered Parking
- Premium Parking
- VIP Parking
- Remote Check-In/Baggage Drop
- Covered Rental Ready Lot
- Online Parking
- Cell Phone Lot

INDUSTRY BEST PRACTICE

Airport Web Site

Airports are widely utilizing their web sites to:

- communicate with airport users
- offer access to special parking programs
- offer time sensitive promotions
- provide parking rates, contact numbers, maps and other items to enhance the passenger experience

A short listing of airport web sites are listed below, providing examples of different ways in which an airport explains their parking offer:

- Dublin Airport - http://www.dublinairport.com
- Schipol Airport - http://www.schiphol.nl/
- Cincinnati Airport - http://www.cvgairport.com/park/options

In general larger airports worldwide offer a wider variety and a more complex parking product line, however passengers are increasingly more familiar to accessing parking web pages for information and bookings.

Data Driven Parking Products

In particular, Dublin Airport is using passenger data to define and organize parking products. Through the use of frequent traveller vehicle ID and real time analysis of parking stall use, Dublin Airport are offering a variety of products and offerings that align to the needs of their passengers (refer to their platinum service on the web site above for more detail).

Airport Product Offering

There are a number of unique programs and offers that are being promoted at airports around the globe. Below is a listing of items for YLW to consider within their planning for diversifying or promoting airport parking:

- Frequent flyer discounts or programs
  - Airport frequent flyer program
- Additional services (special assistance, bicycles, etc.)
- Online booking discounts
- Business product offerings
- Parking cost estimator
- Parking stall availability

It should be noted that not all of the industry best practice technologies, offers or programs will be directly applicable at YLW. Each initiative will need to be assessed on its own merit to determine its fit with YLW's infrastructure, passenger needs and weather conditions.

CAR RENTAL FACILITY - REQUIREMENTS

A previous report by MMM identified the rental car parking demand as follows:

	Budget	Avis	National	Enterprise
Ready Lot	44	20	27	22
Remote Lot	120	60	80	56

Based on a review of a sample of rental-days transactions and the baseline passenger traffic growth forecasts from the 2025 Kelowna International Airport Master Plan, the following projected ready lot and maintenance remote parking requirements combined for all operators was identified as follows:

	Ready Lot Parking	Maintenance / Remote Parking
2015	160	280
2020	190	350
2025	230	420

While these requirements should be vetted by car rental companies, they form the baseline of our review for the time being.

Source: Des Moines International Airport, Quick Turnaround Facility (PGAL)

PARKING LOT DEMAND FORECAST

	Existing Capacity	2015 Demand	2025 Demand	Capacity Change
***Staff Lot**	(integrated with Long Term Parking)	100	196	create dedicated staff parking with 196 stalls
Rental Ready Lot	230	160	230	none
Rental Staging/storage	300	280	420	add 120 stalls
***Short Term PAX**	345	220	320	subtract 25 stalls (negligible)
***Long Term PAX**	1,900	1,230	2,411	add 855 stalls
***Admin. Lot**	54	54	75	add 21 stalls (negligible)
TOTAL	**2829**	**2,044**	**3,652**	

This table assumes that staff parking will be separated from long term parking in the future.

**based on the MMM Group Traffic Report from Sept. 2014 and utilizes a 1.96 growth factor for design year 2025.*

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PREFERRED CONCEPT

PREFERRED CONCEPT OVERVIEW 2025

Kelowna International Airport

Phase 1, 2015-2018

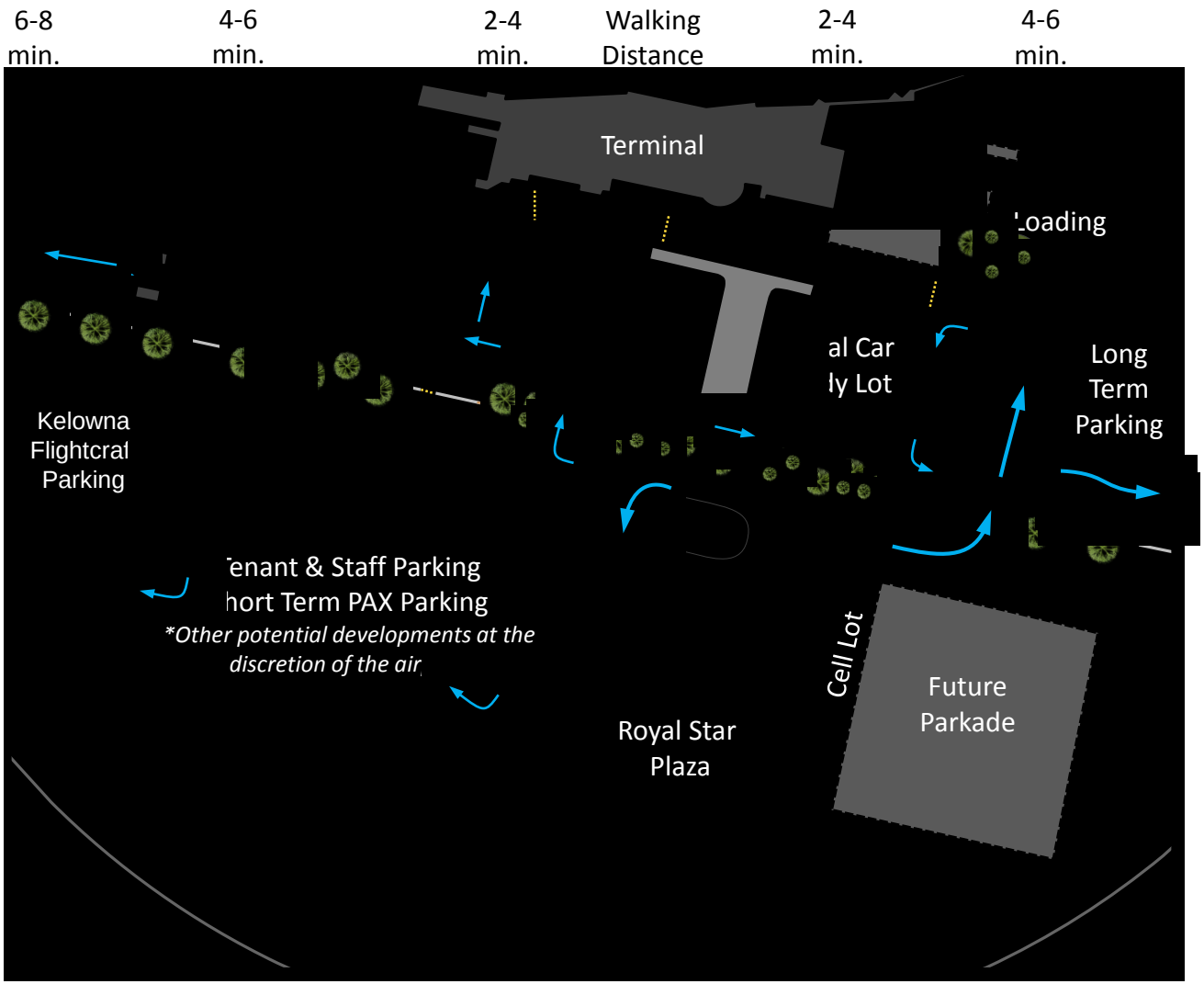
- Staff parking
- Royal Star Plaza (by others)
- Cell phone lot
- Greenway (at grade)
- Expanded Rental Lot

Phase 2, 2018-2022

- Airport way expansion
- Airport circle development
- Short term lot redevelopment
- Taxi rank expansion (to 35)
- Long term parking lot/exit plaza
- Rutland road (partial)
- Rental Car Ready Lot Redevelopment
- Western loop road

Phase 3, 2022-2025+

- Bus and shuttle lot development
- South terminal expansion
- Parking structure
- Terminal curb redevelopment
- Taxi rank expansion (to 45)
- Remote QTA



PREFERRED CONCEPT PHASING OVERVIEW

YLW Kelowna International Airport

Phase 1 | 2015-2018

- Royal Star Plaza (by others)
- Cell phone lot
- Greenway (at grade)
- Expanded rental car4 lot development
- Tenant & staff parking lot development

Phase 2 | 2018-2022

- Airport way expansion
- Airport circle development
- Premium lot redevelopment
- Taxi rank expansion (to 35)
- Long term parking lot/exit plaza
- Rutland road (partial)
- Ready lot redevelopment
- Short term parking relocation
- Western loop road

Phase 3 | 2022-2025+

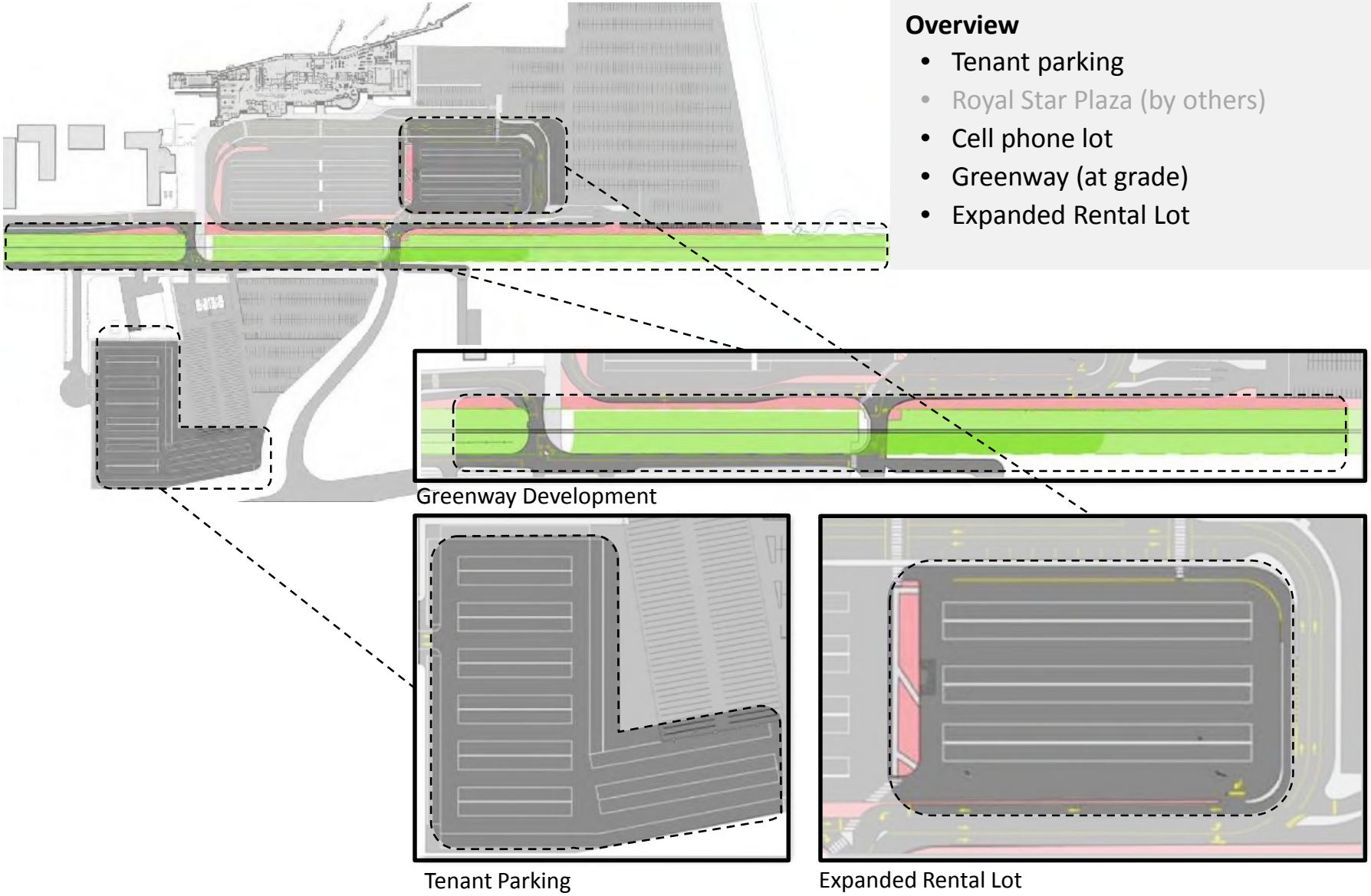
- Bus and shuttle lot development
- Ready lot redevelopment
- South terminal expansion
- Parking structure
- Terminal curb redevelopment
- Taxi rank expansion (to 45)
- Remote QTA facility

Phase 1|2015-2018

Kelowna International Airport

Overview

- Tenant parking
- Royal Star Plaza (by others)
- Cell phone lot
- Greenway (at grade)
- Expanded Rental Lot



Greenway Development

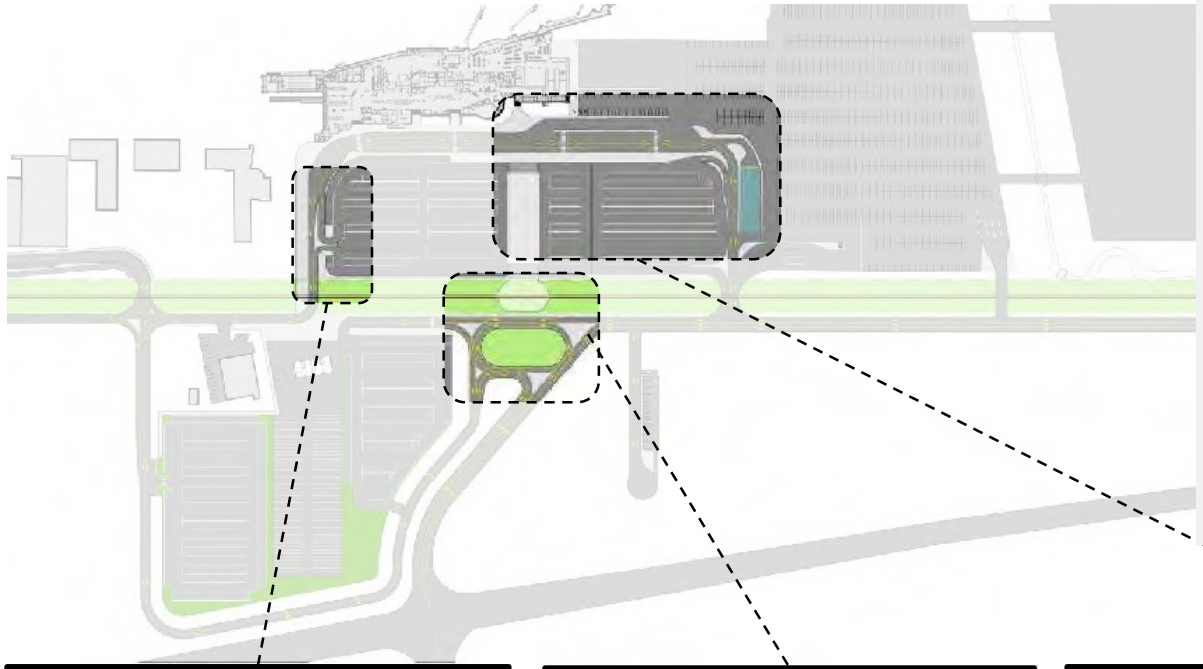
Tenant Parking

Expanded Rental Lot

YLW LANDSIDE REDEVELOPMENT PLAN

Phase 2|2018-2022

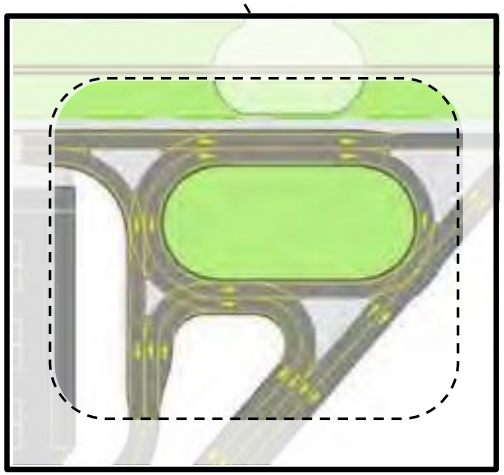
Kelowna International Airport



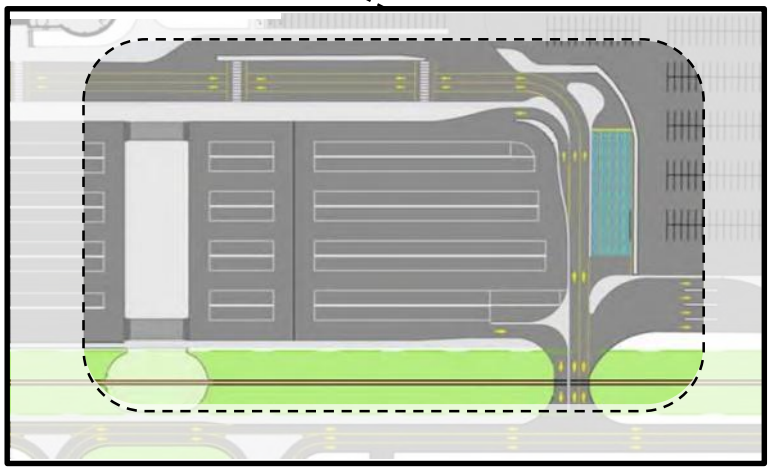
Overview

- Airport way expansion
- Airport circle development
- Premium lot redevelopment
- Taxi rank expansion (to 35)
- Long term parking lot/exit plaza
- Rutland road (partial)
- Rental Car Ready Lot Redevelopment
- Western loop road
- Pedestrian plaza

Short Term Lot Redevelopment



Airport Circle development



Short Term Lot Redevelopment

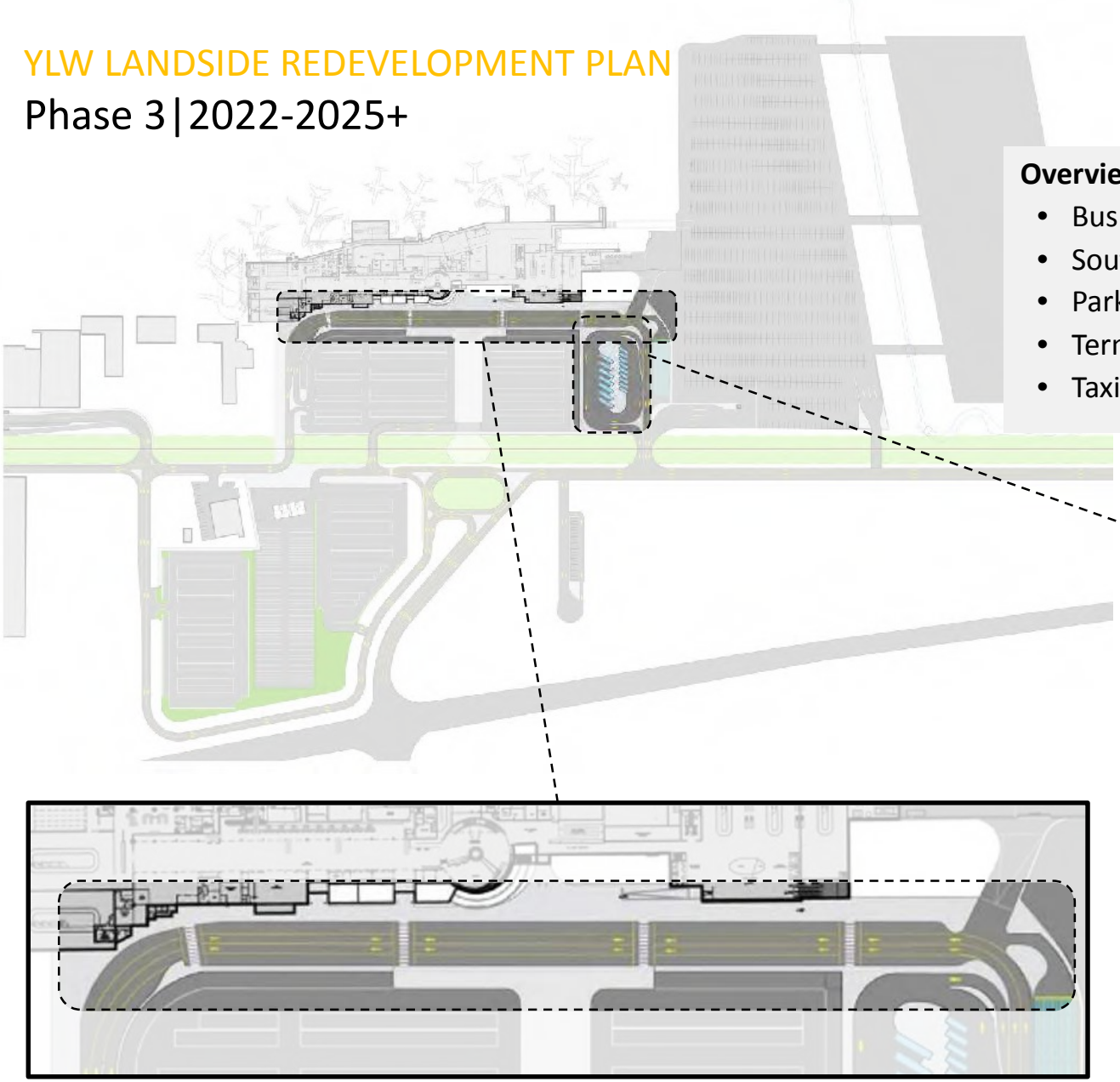
YLW LANDSIDE REDEVELOPMENT PLAN

Phase 3|2022-2025+

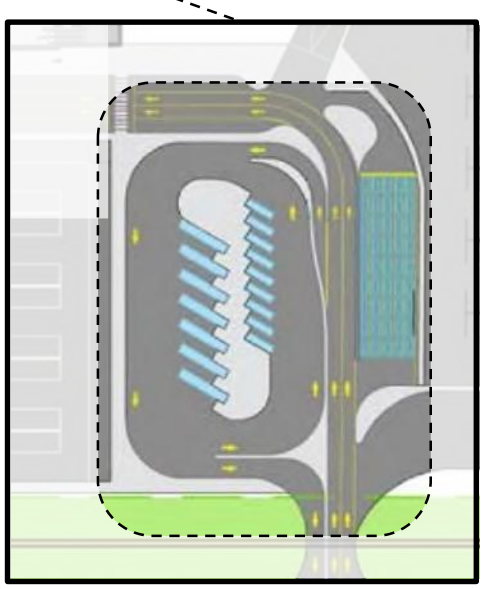
YLW Kelowna International Airport

Overview

- Bus and shuttle lot development
- South terminal expansion
- Parking structure
- Terminal curb redevelopment
- Taxi rank expansion (to 45)



Terminal Curb Redevelopment



Bus and Shuttle Lot Development

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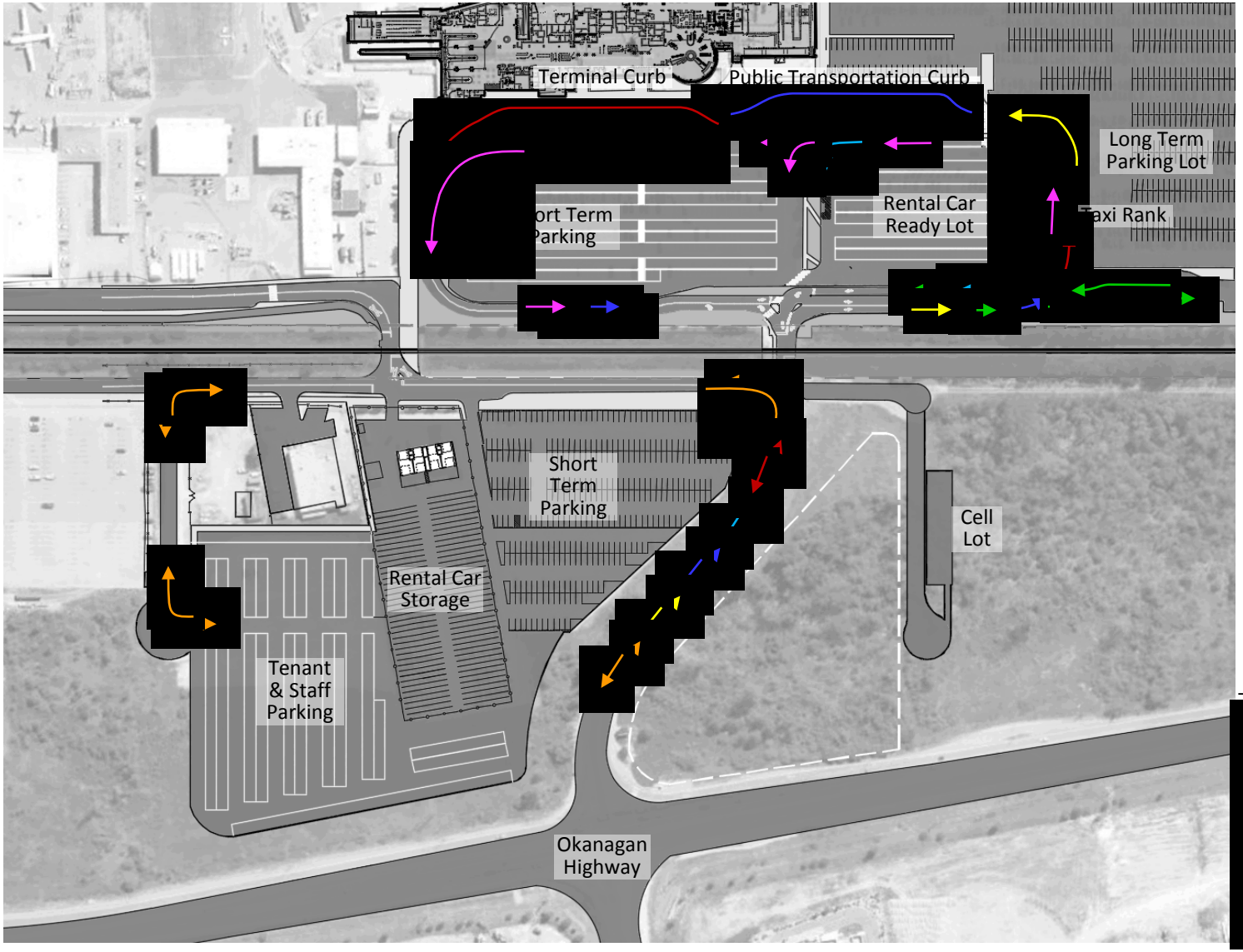
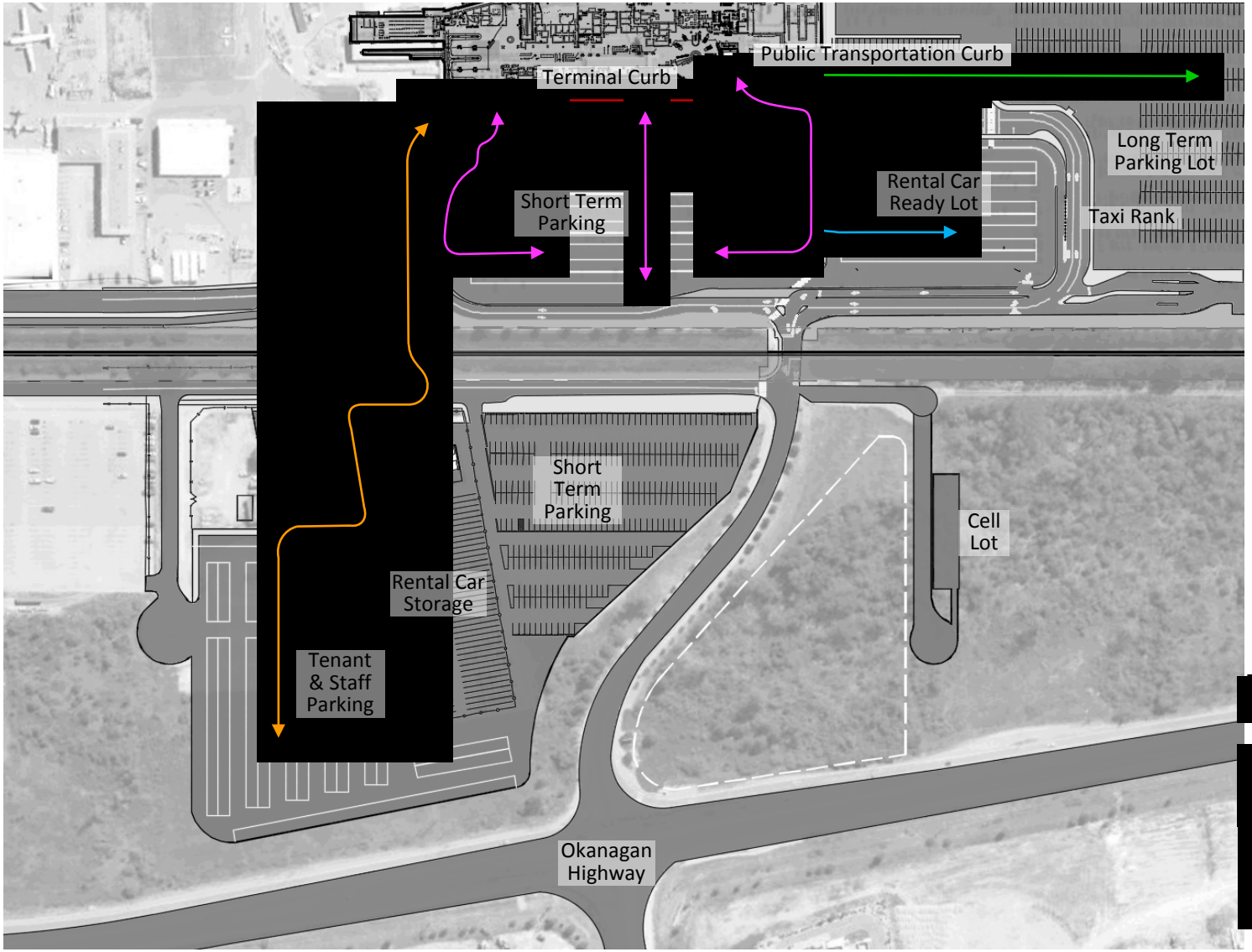
PASSENGER FLOWS

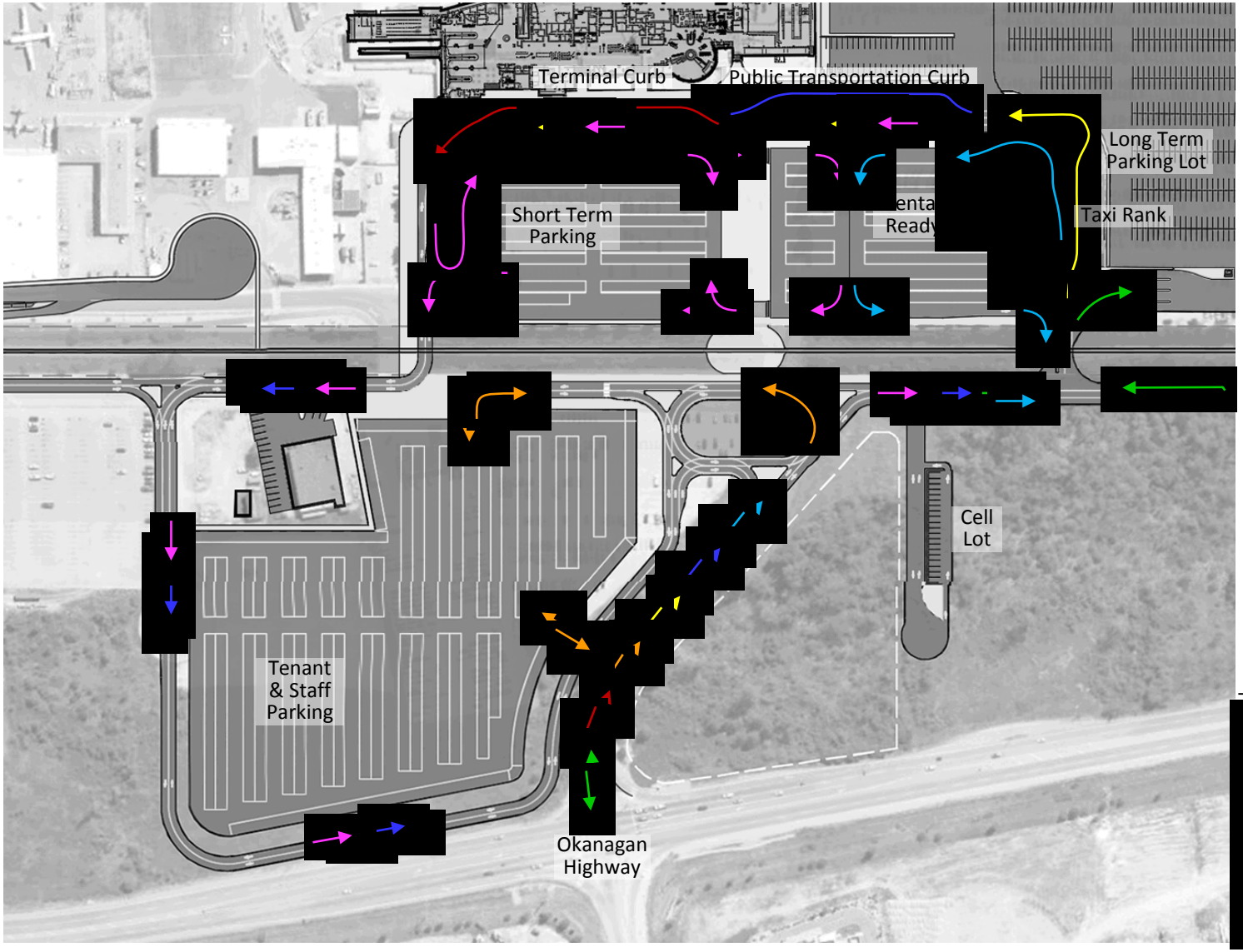
VEHICLE FLOW DIAGRAM PHASE 1 | 2015-2018



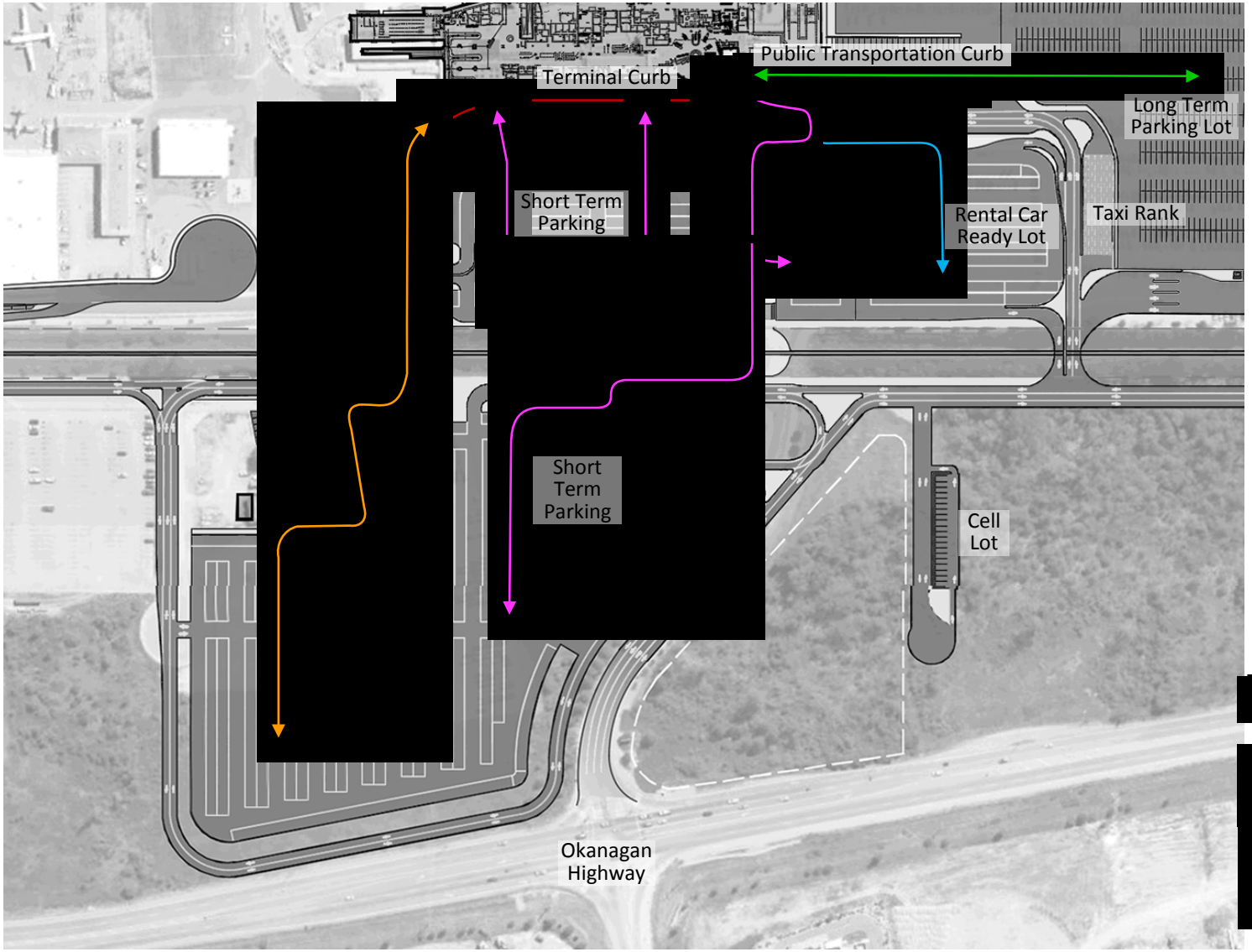
PEDESTRIAN FLOW DIAGRAM PHASE 1 | 2015-2018



VEHICLE FLOW DIAGRAM PHASE 2 | 2018-2022

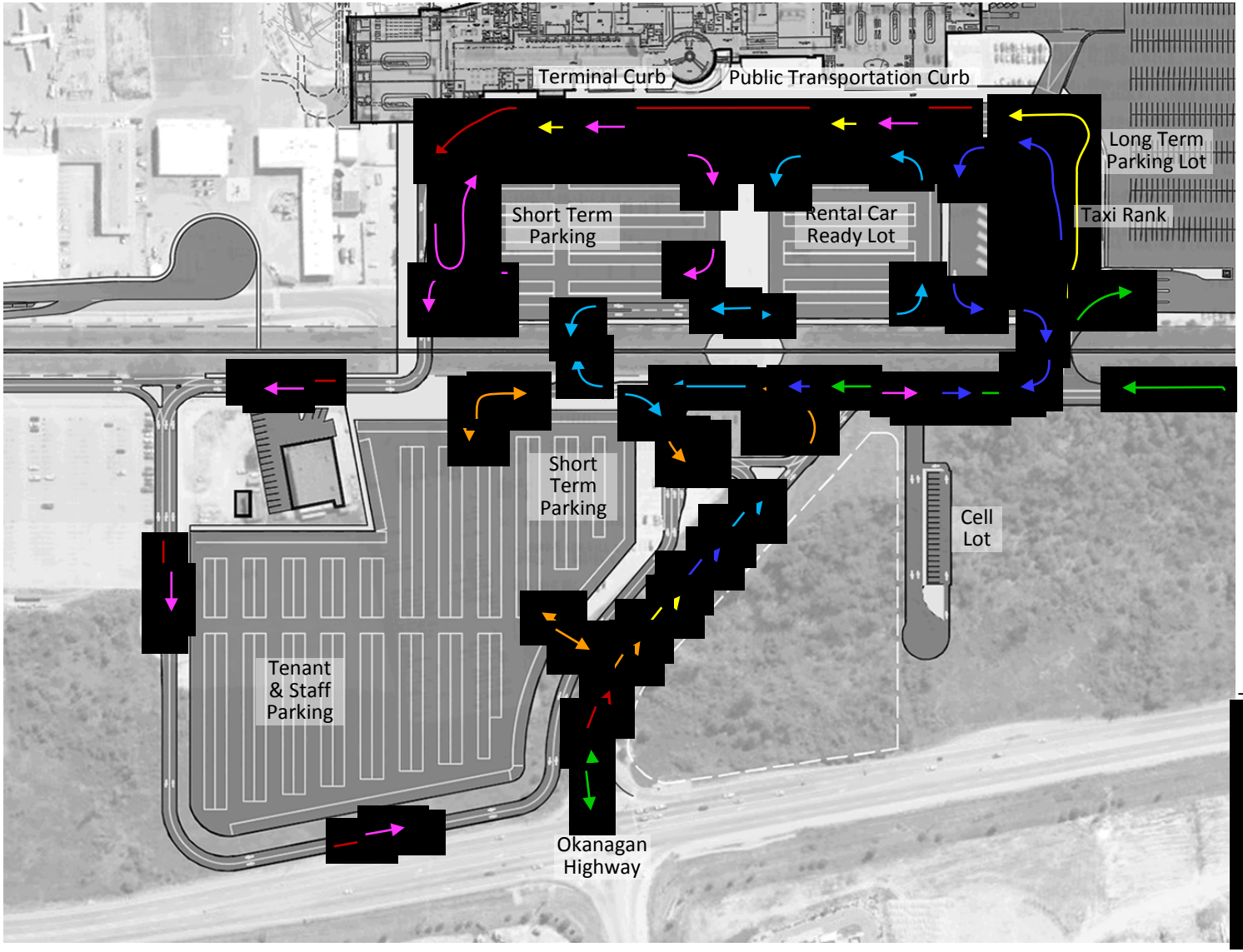


PEDESTRIAN FLOW DIAGRAM PHASE 2 | 2018-2022



VEHICLE FLOW DIAGRAM PHASE 3 | 2022-2025+

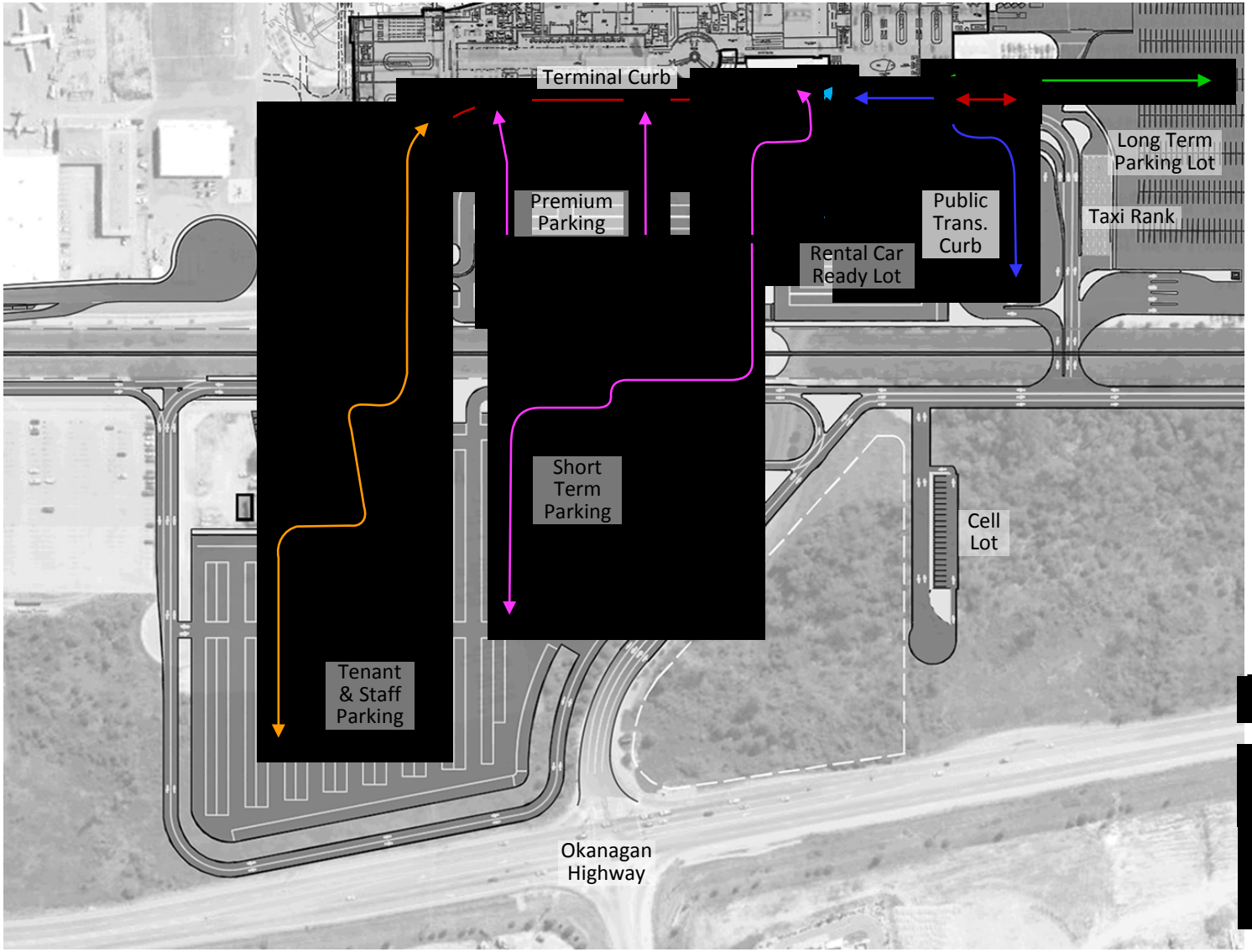
Kelowna International Airport



LEGEND

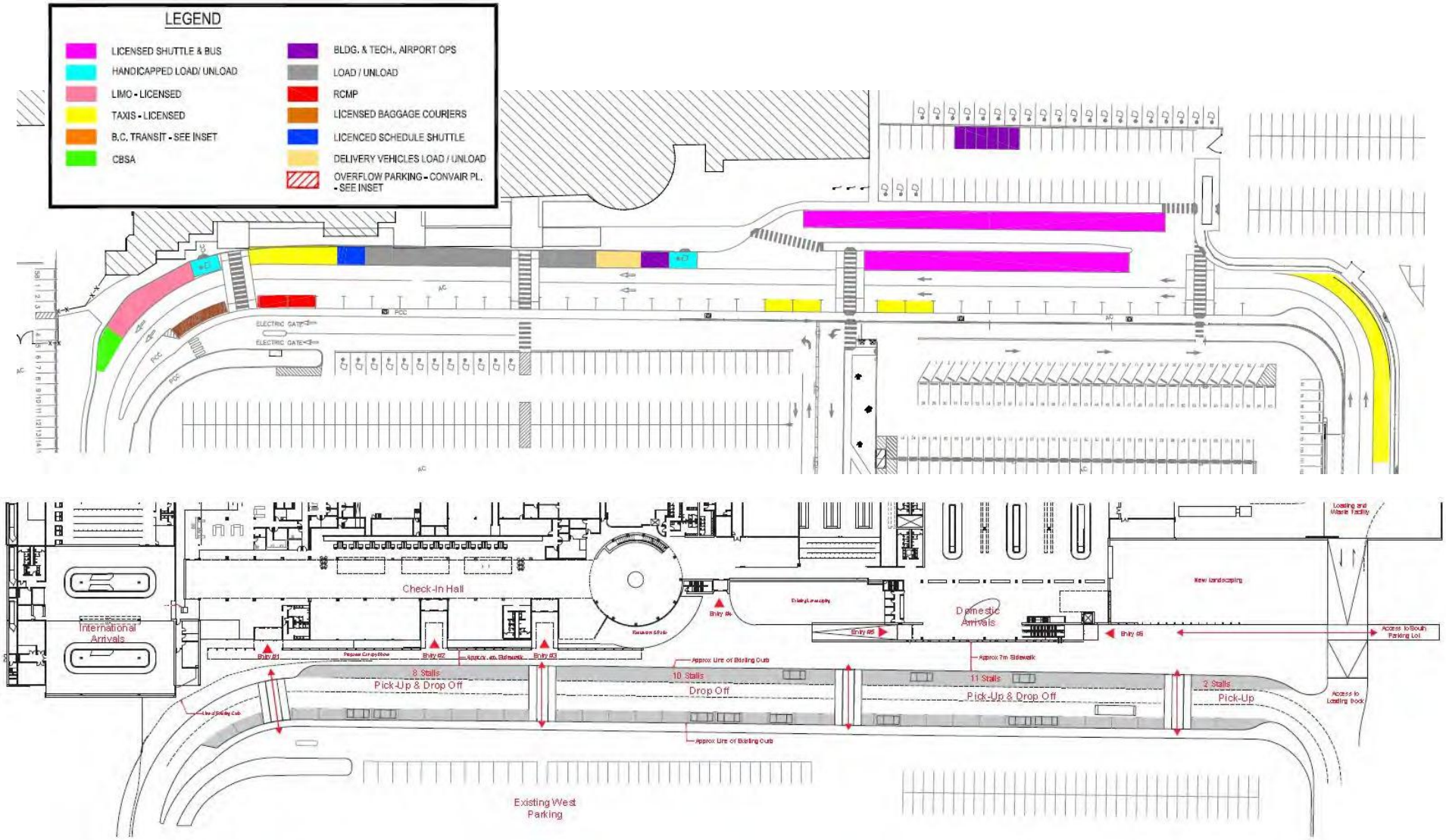
- PAX pickup/dropoff
- Car Rentals
- Taxis
- Public Transportation
- Short term Parking Lot
- Long term Parking Lot
- Staff Parking

PEDESTRIAN FLOW DIAGRAM PHASE 3 | 2022-2025+

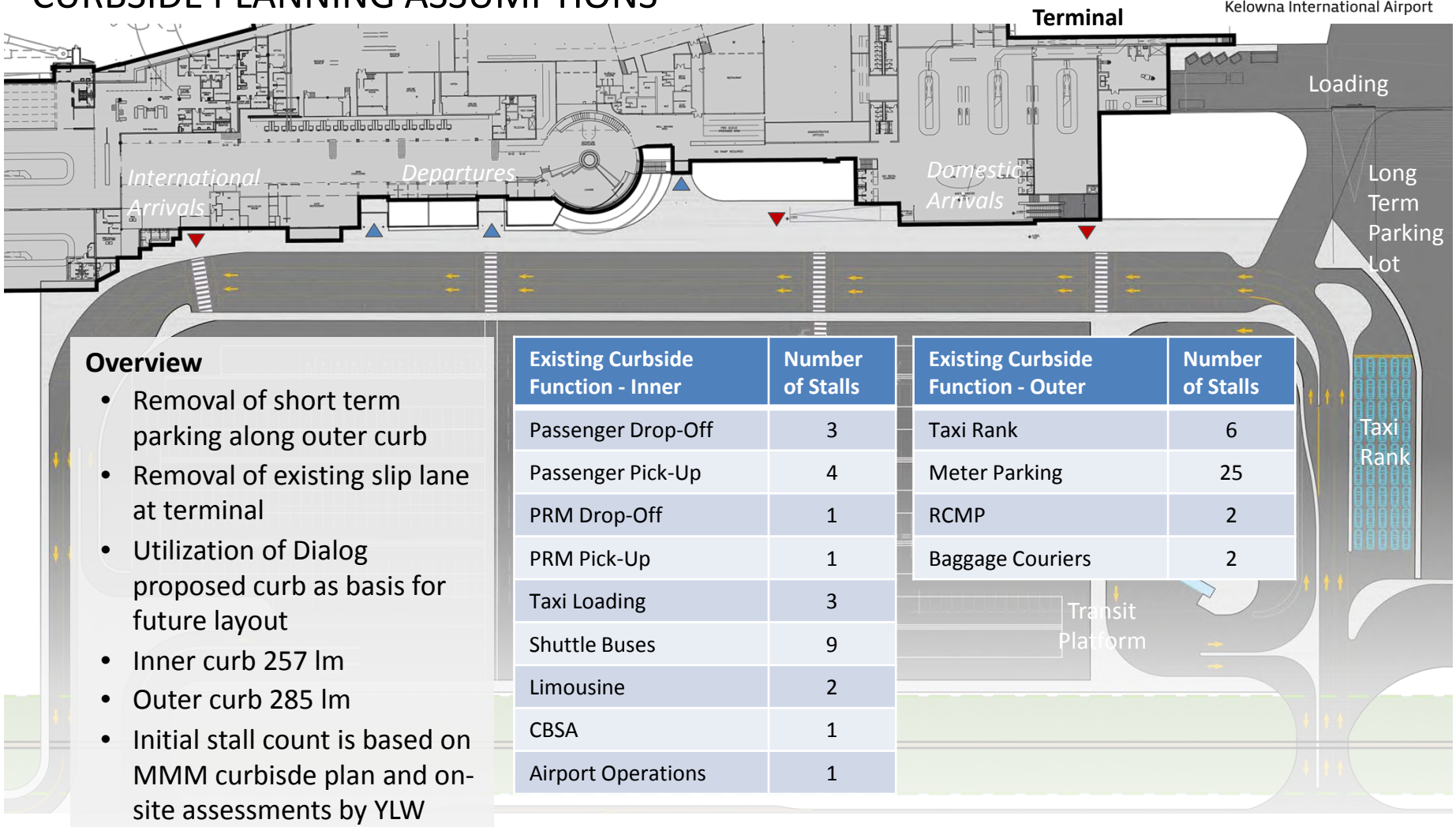


CURBSIDE PLANNING

EXISTING CURB DETAIL



CURBSIDE PLANNING ASSUMPTIONS



Overview

- Removal of short term parking along outer curb
- Removal of existing slip lane at terminal
- Utilization of Dialog proposed curb as basis for future layout
- Inner curb 257 lm
- Outer curb 285 lm
- Initial stall count is based on MMM curbisde plan and on-site assessments by YLW

Existing Curbside Function - Inner	Number of Stalls
Passenger Drop-Off	3
Passenger Pick-Up	4
PRM Drop-Off	1
PRM Pick-Up	1
Taxi Loading	3
Shuttle Buses	9
Limousine	2
CBSA	1
Airport Operations	1

Existing Curbside Function - Outer	Number of Stalls
Taxi Rank	6
Meter Parking	25
RCMP	2
Baggage Couriers	2

CURBSIDE PREFERRED OPTION (LONG TERM VISION)

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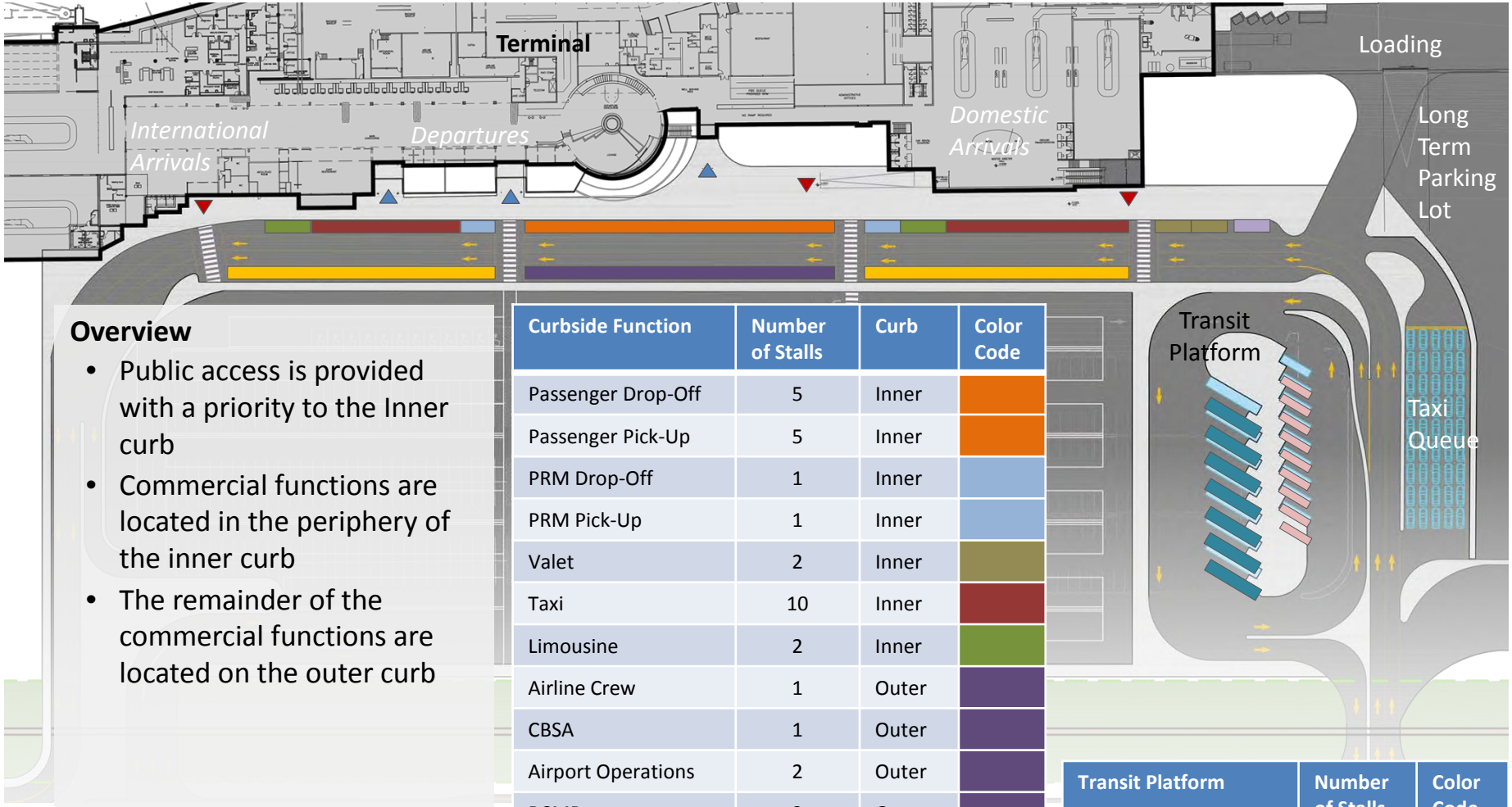

Overview

- Public access is provided with a priority to the Inner curb
- Commercial functions are located in the periphery of the inner curb
- The remainder of the commercial functions are located on the outer curb

Curbside Function	Number of Stalls	Curb	Color Code
Passenger Drop-Off	5	Inner	
Passenger Pick-Up	5	Inner	
PRM Drop-Off	1	Inner	
PRM Pick-Up	1	Inner	
Valet	2	Inner	
Taxi	10	Inner	
Limousine	2	Inner	
Airline Crew	1	Outer	
CBSA	1	Outer	
Airport Operations	2	Outer	
RCMP	2	Outer	
Baggage Courier	1	Outer	
Unallocated	-	Outer	
Emergency Vehicle	1	Inner	

Transit Platform	Number of Stalls	Color Code
Charter Bus	7	
Shuttle Bus	9	
Taxi Rank	45	

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Kelowna International Airport

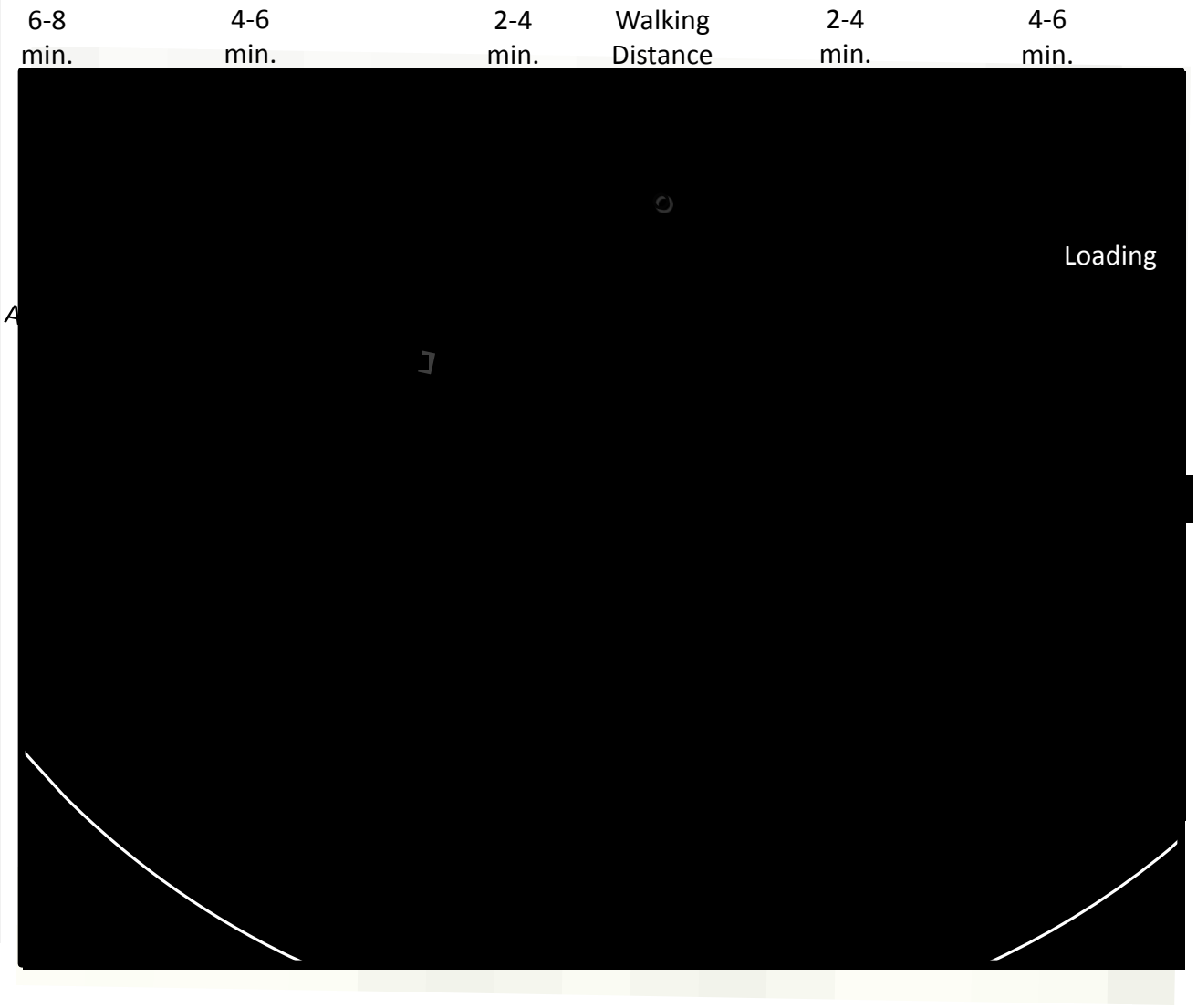
APPENDIX - CONCEPT DEVELOPMENT OPTIONS

YLW LANDSIDE REDEVELOPMENT PLAN

OPTION 1 – TRAFFIC CIRCLE

Overview

- Expansion of short-term parking lot
- Relocation of the rental car ready lot
- Remove rental car flows from the main traffic flow and allow for a single point of service at their current building location
- Introduction of a central traffic circle on Airport Way to improve traffic flows
- Municipal bus would access/exit the airport campus from Old Vernon Road
- Creation of a staff parking lot

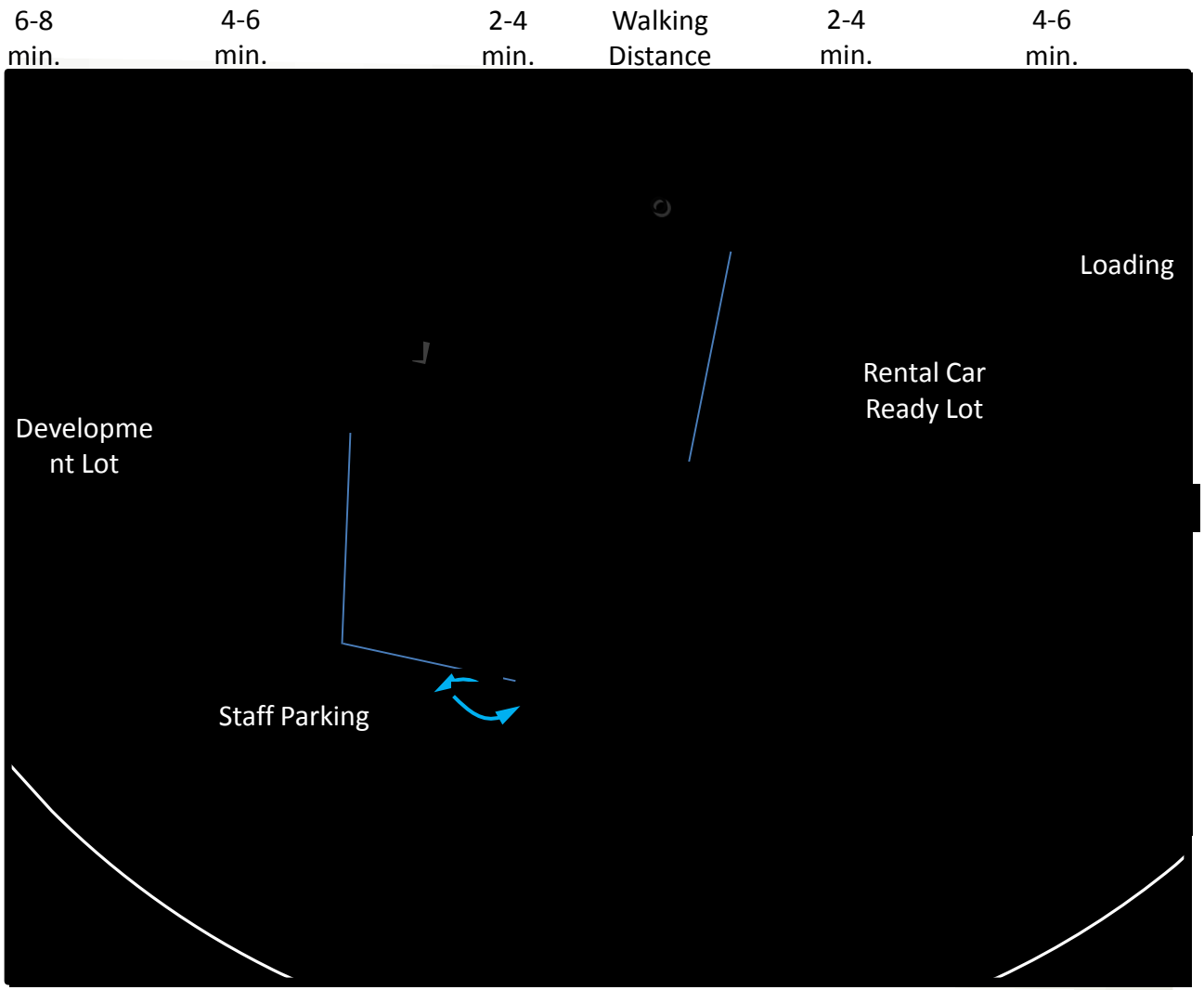


YLW LANDSIDE REDEVELOPMENT PLAN

OPTION 2 – EXPANDED PERIMETER ROAD

Overview

- The existing short-term parking lot to become a premium and rental car-ready lot
- The existing long-term and adjacent overflow parking lots to become a short-term and staff parking lots
- Introduction of traffic circles on Airport Way and Aerospace Drive to improve traffic flows
- Elimination of non-essential roads provides efficient traffic flows
- Creation of a perimeter roadway allowing for bypassing of the terminal area
- Rental car service incorporated into long term lot

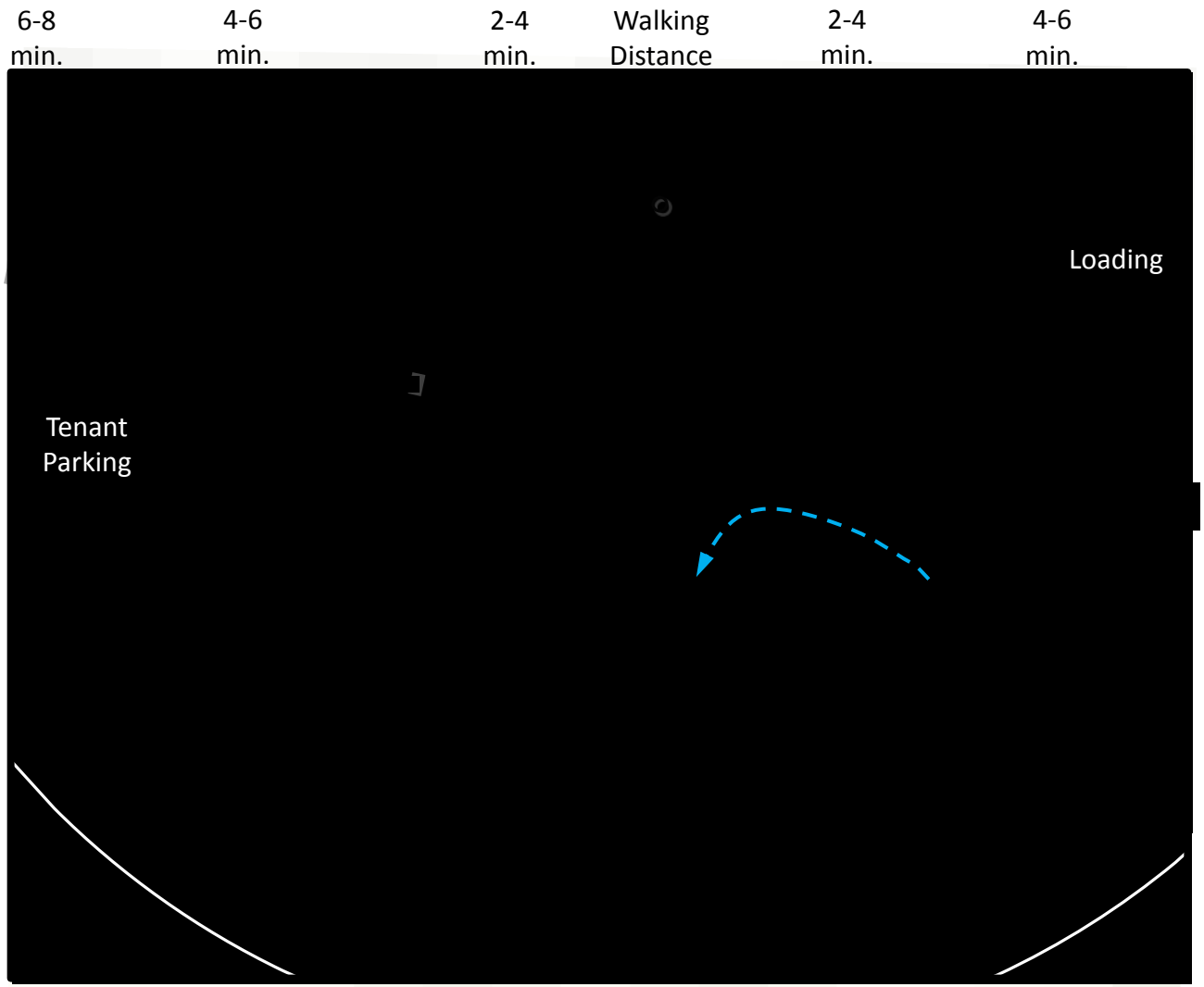


YLW LANDSIDE REDEVELOPMENT PLAN

OPTION 3 – LOOP ROAD

Overview

- Expansion of short-term parking lot
- Introduction of traffic circles on Airport Way to improve traffic flows
- New access road to the terminal separates the inbound and outbound traffic into a one way flow from Highway 97. Traffic study would be required to separate entry and exit flows
- Municipal bus would access/exit the airport campus from Old Vernon Road/Airport Way
- Car rental access via Old Vernon Road or via loop bypass. Options exist for review

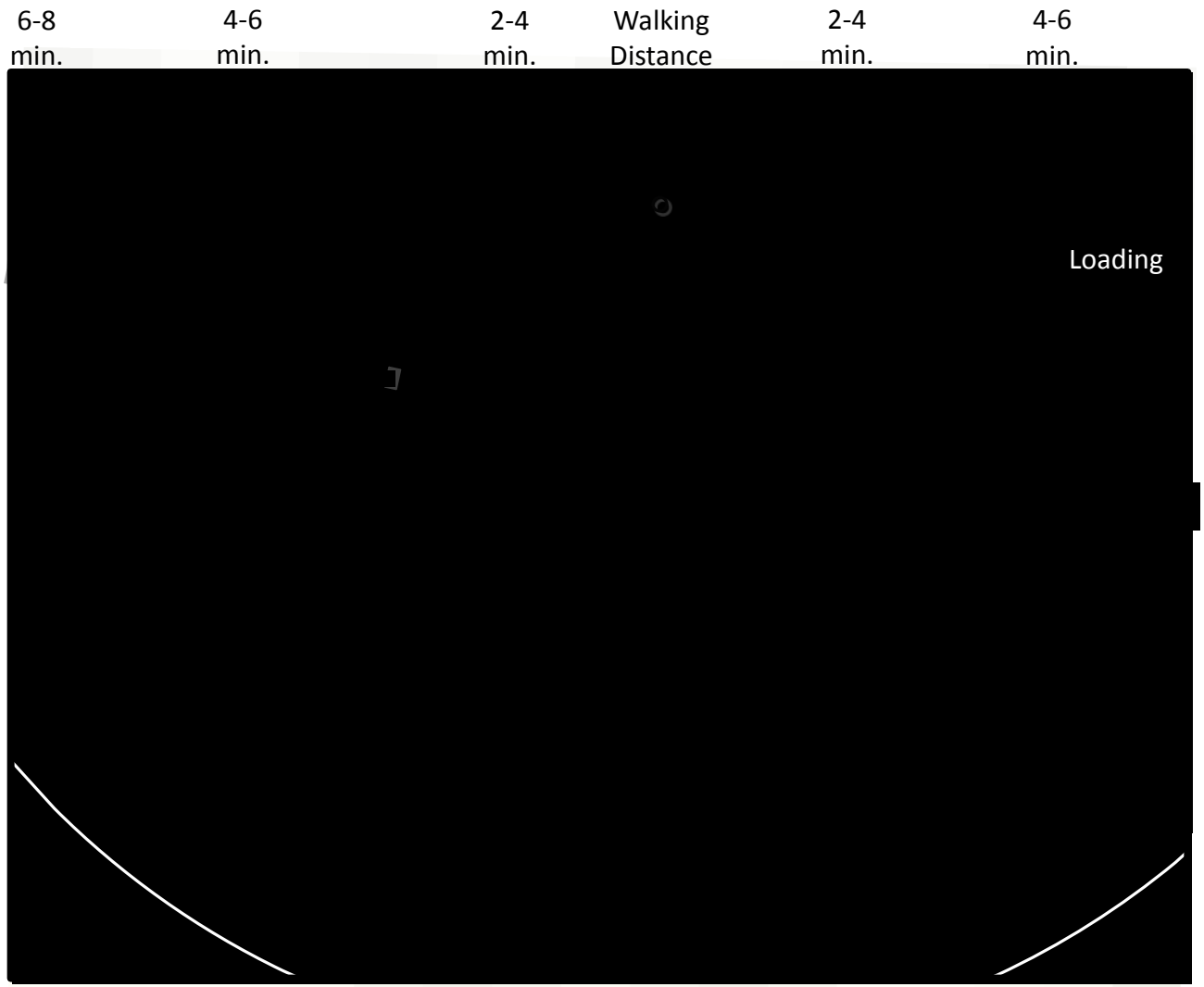


YLW LANDSIDE REDEVELOPMENT PLAN

OPTION 4 – PEDESTRIAN PLAZA

Overview

- Expansion of short-term parking lot
- Introduction of traffic circle on Airport Way to improve traffic flows
- Development of pedestrian plaza that allows for passenger, taxi, car rental, public bus staff and short term parking to be accessed without crossing an active roadway
- Pedestrian Plaza developed as public forecourt to the airport
- Municipal bus access/exit via Old Vernon Road/Airport Way

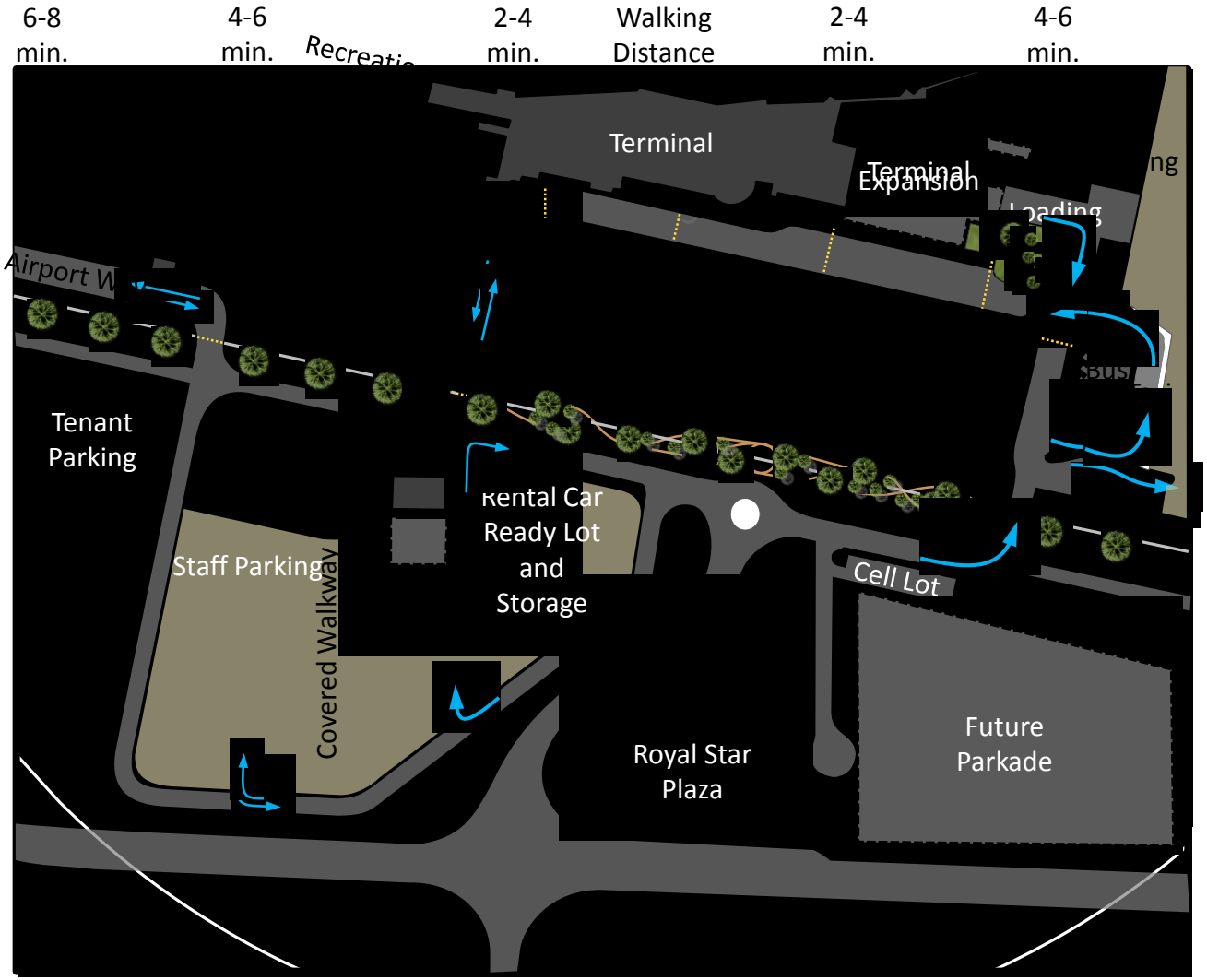


YLW LANDSIDE REDEVELOPMENT PLAN

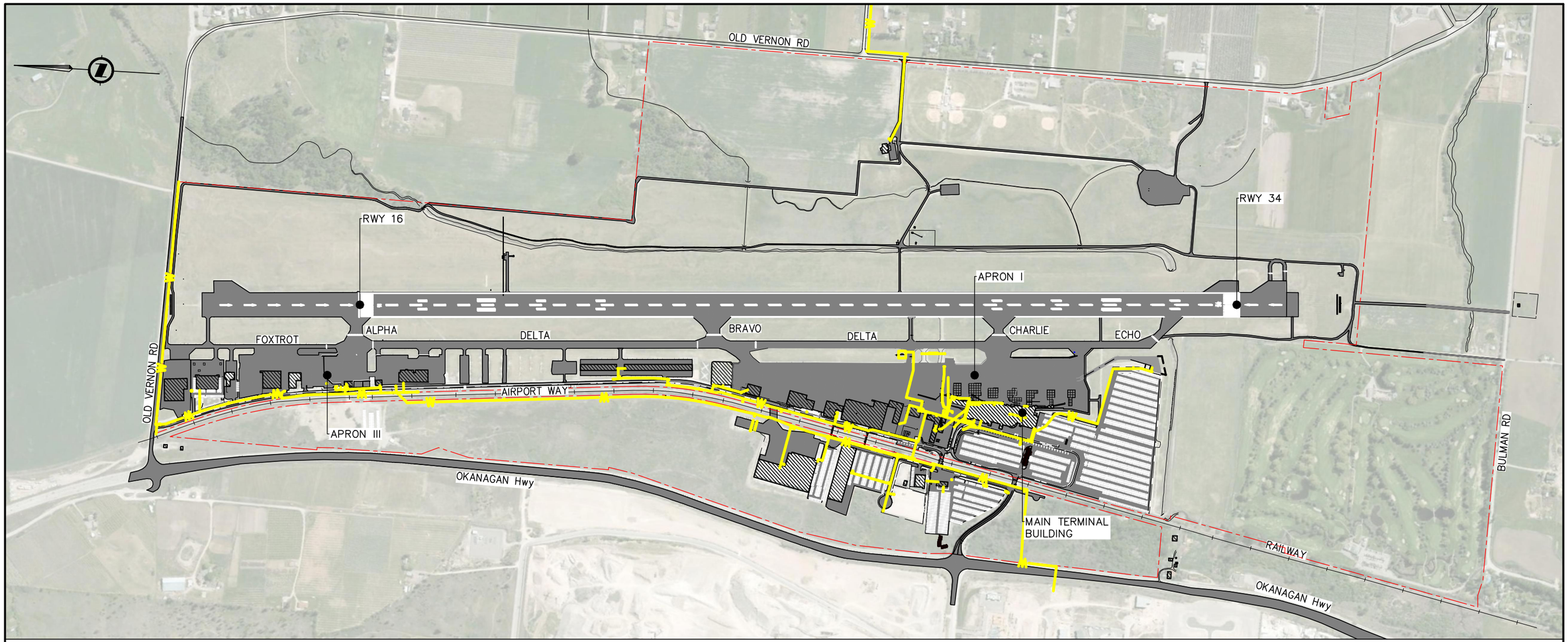
PREFERRED OPTION (Initial)

Overview

- Compilation of preferred ideas from earlier concepts
- Inclusion of Dialog proposed bus and loading areas that aligns to the terminal expansion program
- Proposed location for future parkade
- Identification of Royal Star Plaza development
- Introduction of recreation corridor right of way and pedestrian crossings



Appendix J : Existing Utility Networks



LEGEND

- PAVEMENTS
- BUILDING STRUCTURE
- AIRPORT BOUNDARY
- WATER LINE

SCALE 1:10 000
@11x17

0 200 500m

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
1	PA	2016-07-21	ISSUED FOR INFORMATION

ISSUE REGISTER

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

REVISION REGISTER * DESIGNED ** APPROVED

PROFESSIONAL SEAL

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

CLIENT
YLW
Kelowna International Airport

DESIGNED
DRAWN
CHECKED
APPROVED
DATE 2016-07-21
SCALE 1:10 000

PROJECT
YLW MASTER PLAN

TITLE
WATER SERVICES LAYOUT

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 | DK	0020	PA

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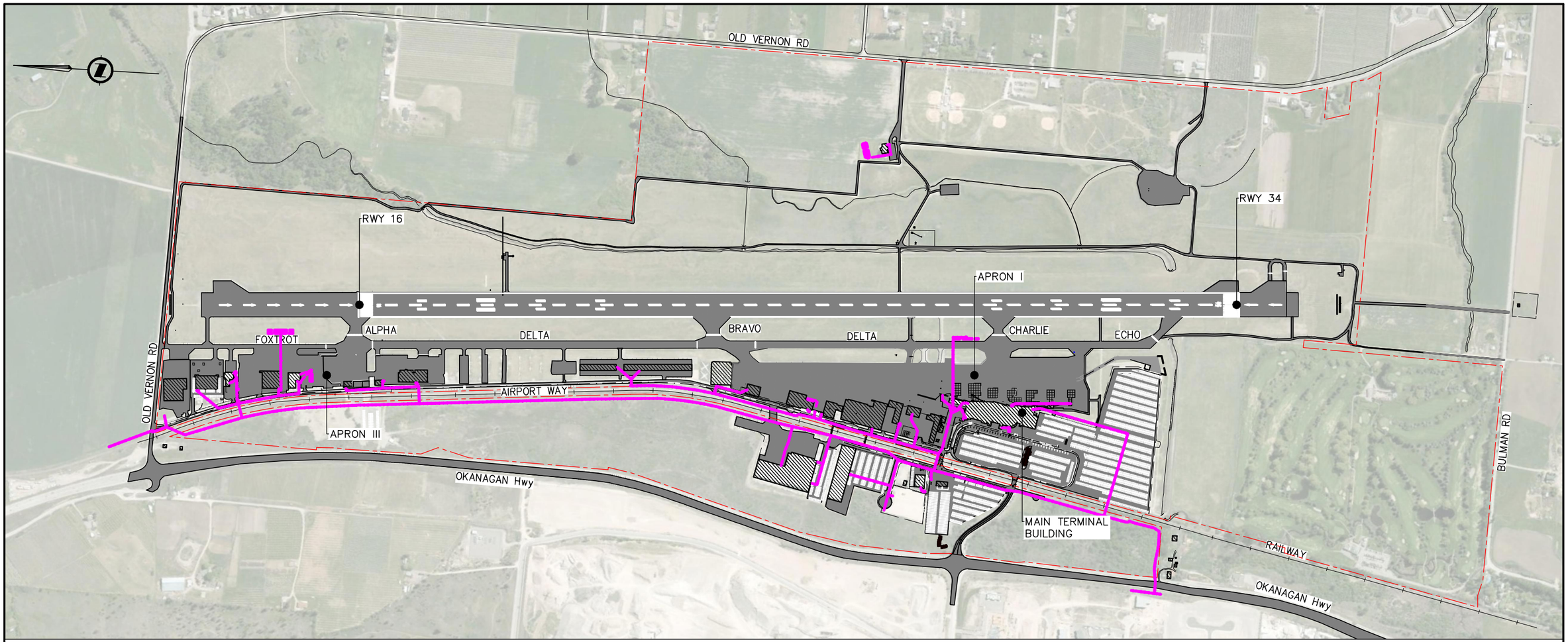

LEGEND

- PAVEMENTS
- BUILDING STRUCTURE
- AIRPORT BOUNDARY
- SANITARY LINE

SCALE 1:10 000
@11x17

0 200 500m

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
1	PA	2016-07-21	ISSUED FOR INFORMATION

ISSUE REGISTER

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

REVISION REGISTER * DESIGNED ** APPROVED

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Tel: 604-662-3555

CLIENT
YLW Kelowna International Airport

DESIGNED
DRAWN
CHECKED
APPROVED
DATE 2016-07-21
SCALE 1:10 000

PROJECT
YLW MASTER PLAN

TITLE
SANITARY SERVICES LAYOUT

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
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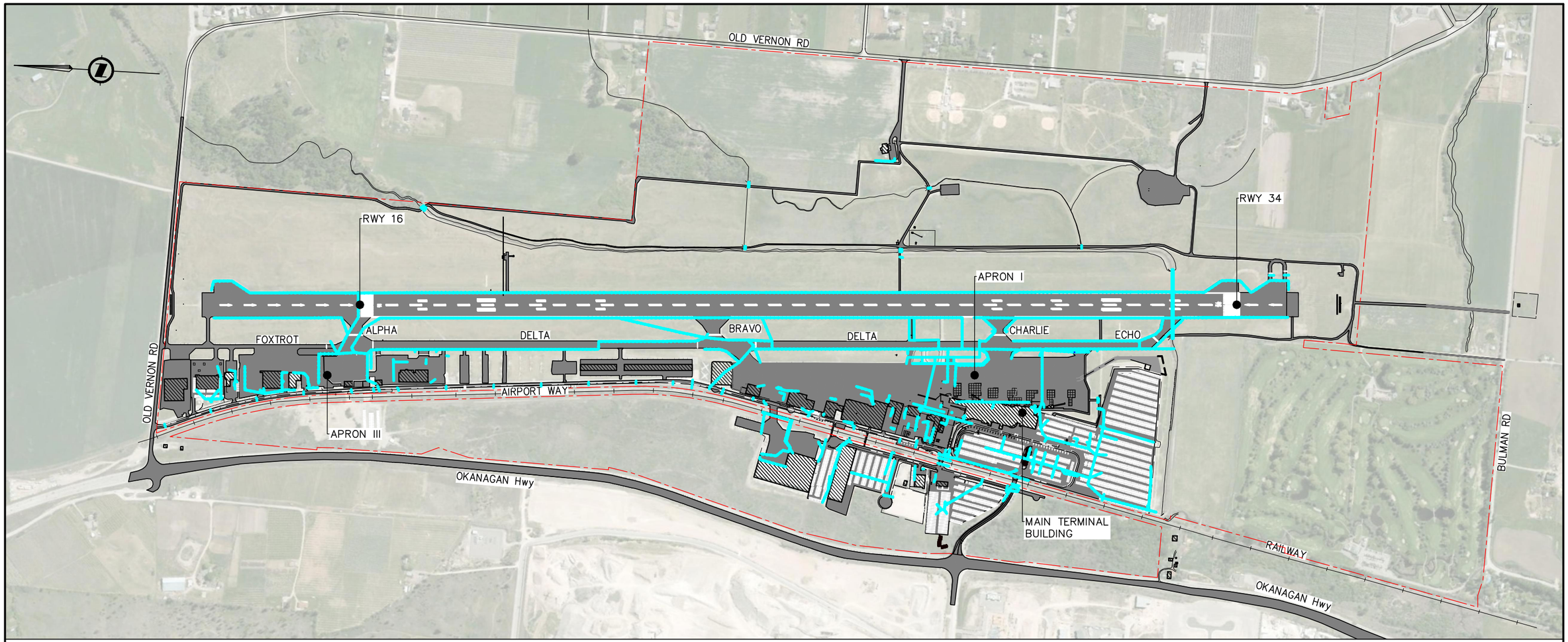

LEGEND

- PAVEMENTS
- BUILDING STRUCTURE
- AIRPORT BOUNDARY
- STORM DRAINAGE LINE

SCALE 1:10 000
@11x17

0 200 500m

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
1	PA	2016-07-21	ISSUED FOR INFORMATION

ISSUE REGISTER

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

REVISION REGISTER * DESIGNED ** APPROVED

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Tel: 604–662–3555

CLIENT

YLW
Kelowna International Airport

DESIGNED
DRAWN
CHECKED
APPROVED
DATE 2016-07-21
SCALE 1:10 000

PROJECT
YLW MASTER PLAN

TITLE
STORM DRAINAGE LAYOUT

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 | DK	0022	PA

STDSLI_BHEN – FRAME B IMPERIAL ENGLISH (11"x17")

DATE: 2016-07-26 – 2:53pm (ISLAF)
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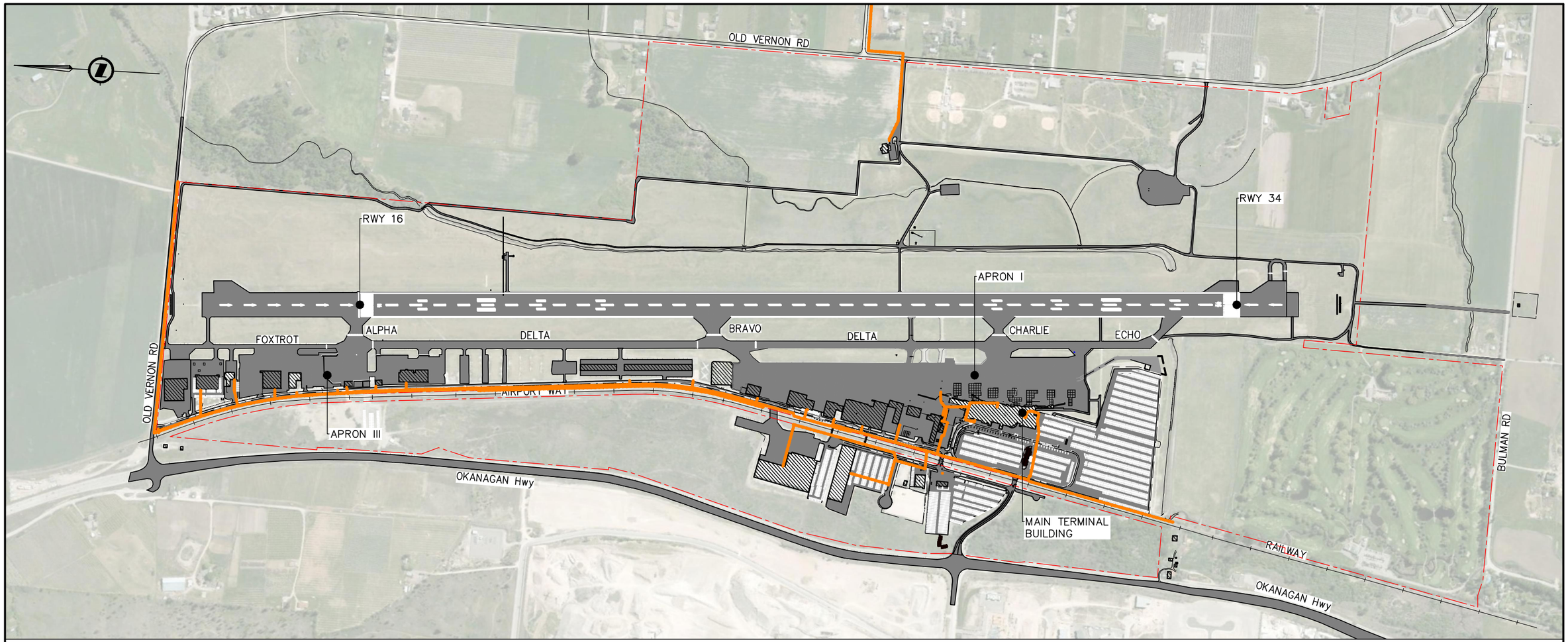
LAYOUT: 0022



LEGEND

- PAVEMENTS
- BUILDING STRUCTURE
- AIRPORT BOUNDARY
- GAS LINE

SCALE 1:10 000
@11x17

0 200 500m

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
1	PA	2016-07-21	ISSUED FOR INFORMATION

ISSUE REGISTER

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

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SNC·LAVALIN
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

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DATE 2016-07-21
SCALE 1:10 000

PROJECT
YLW MASTER PLAN

TITLE
GAS SERVICES LAYOUT

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 | DK	0023	PA

STDSLI_BHEN – FRAME B IMPERIAL ENGLISH (11"x17")

DATE: 2016-07-26 – 2:54pm (ISLAF)
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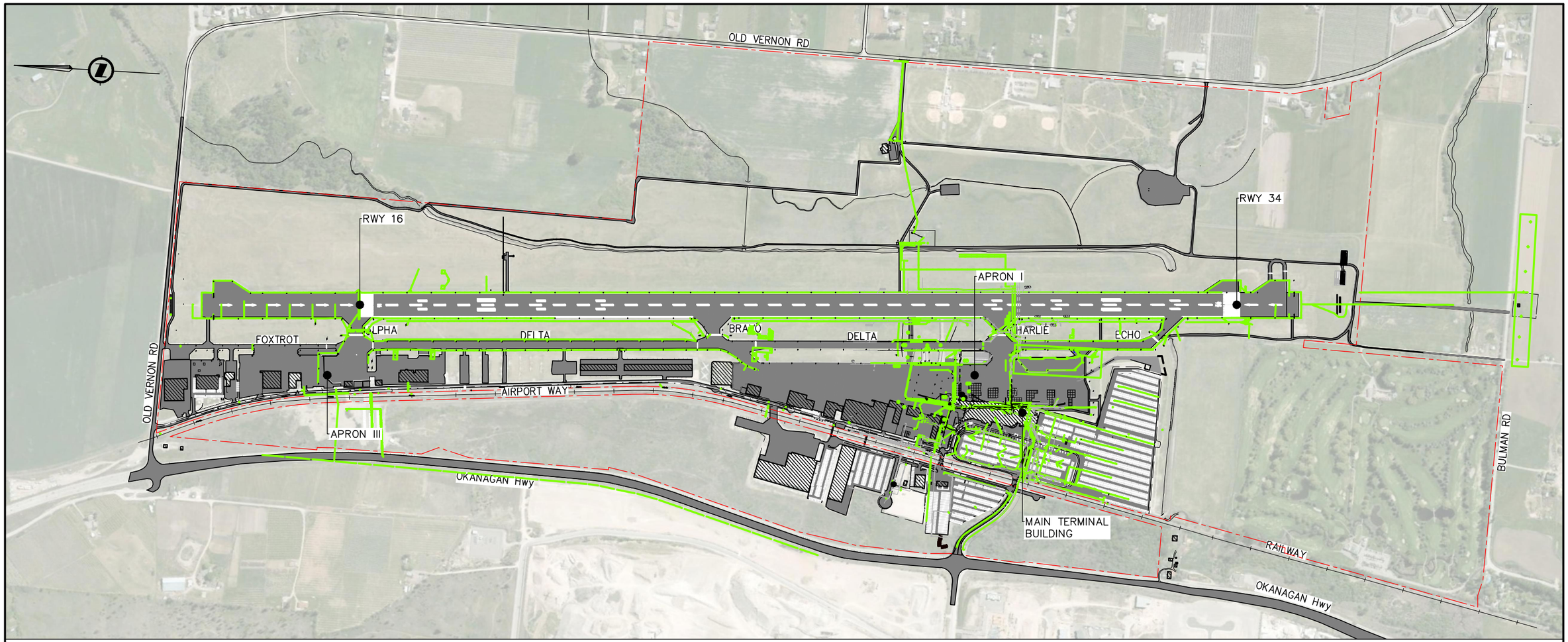

LEGEND

- PAVEMENTS
- BUILDING STRUCTURE
- AIRPORT BOUNDARY
- POWER AND TELECOM LINE

SCALE 1:10 000
@11x17

0 200 500m

ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE
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PROJECT
YLW MASTER PLAN

TITLE
POWER AND TELECOM LAYOUT

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
627320	0000	40 | DK	0024	PA

STDSLI_BHEN – FRAME B IMPERIAL ENGLISH (11"x17")

DATE: 2016-07-26 – 2:56pm (ISLAF)
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LAYOUT: 0024