Waterloo Airport Runway Project

Runway 14-32 Extension Detailed Project Description

English Summary

Following the Requirements of the Impact Assessment Act

Region of Waterloo INTERNATIONAL AIRPORT ONTARIO, CANADA

MTE

September 14, 2021
MTE File No.: 44941-100

Waterloo Region International Airport

ENGLISH SUMMARY

Introduction

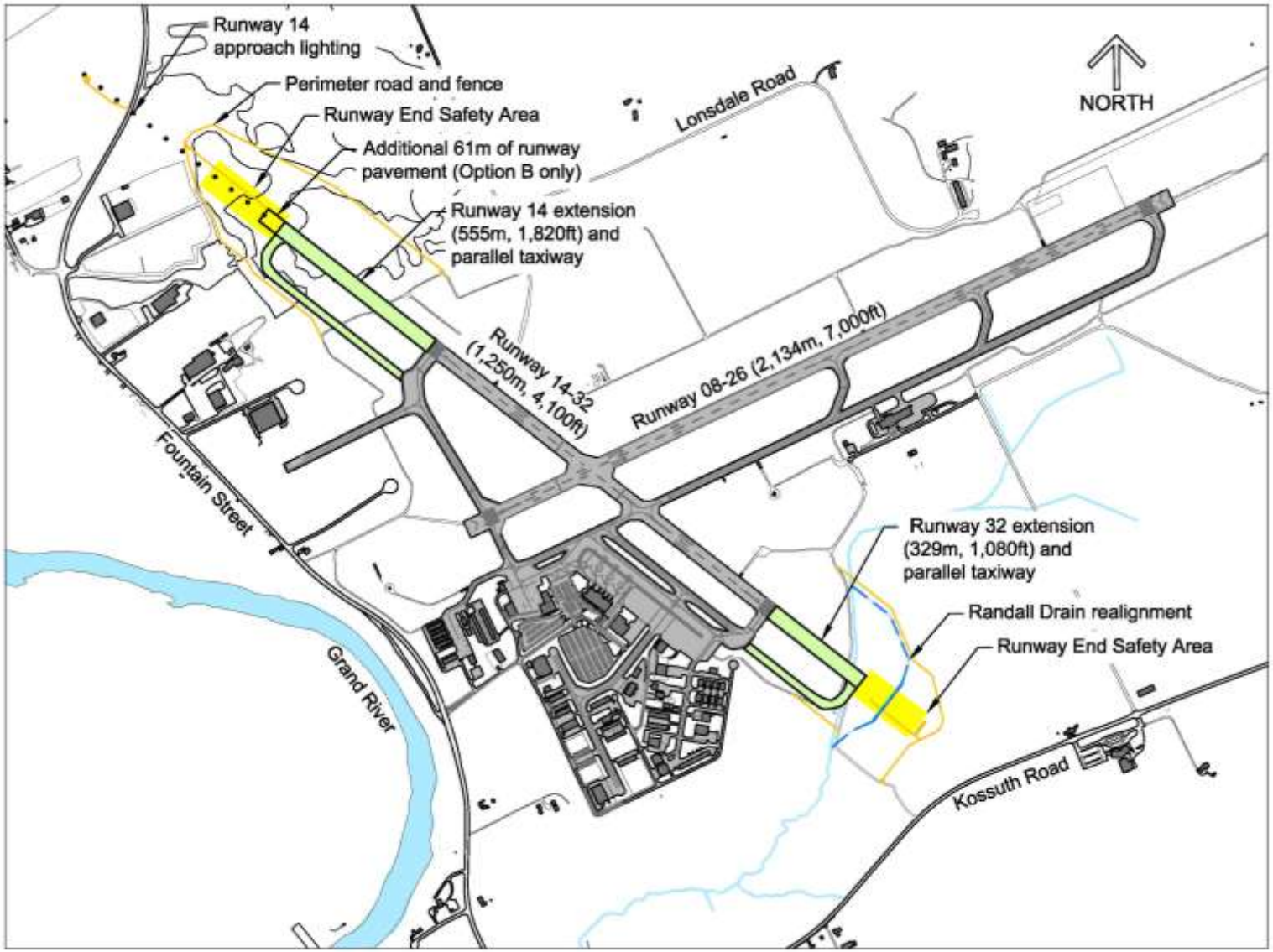
The Regional Municipality of Waterloo (Region) is planning the Runway 14-32 Extension Project (Project) at the Region of Waterloo International Airport (YKF). YKF is located in a mainly rural area of Woolwich Township, just north of Cambridge and east of Kitchener and the Grand River.

The Project generally includes runway extensions on the north and south ends, parallel taxiways, Runway End Safety Areas, visual aids, perimeter roads and fencing, stormwater management, realignment of a municipal drain and environmental controls. The following Figure (Runway 14-32 Extension Project) illustrates the main components of the Project.

The Project will result in increased safety and level of service for passengers and airlines. Currently AGN IIIB aircraft, such as the Boeing 737 and Airbus 320 series, can only operate on Runway 08-26. Extending Runway 14-32 will provide these aircraft with an alternate runway to use during poor weather and high crosswind conditions. This will increase safety and reduce delays, cancellations and the need to divert aircraft to alternate airports during inclement weather. Diversions to other airports are costly, but also result in more fuel being used and additional aircraft emissions due to the increased flight time and alternate transportation required for passengers and freight. The Project will also allow YKF to close one of the runways for maintenance, snow clearing or emergencies while ensuring continuous service for passengers and airlines.

This Detailed Project Description (DPD) documents the studies, findings and consultation undertaken as part of the planning process for the Project.

Figure: Runway 14-32 Extension Project



1.0 Project Name

Waterloo Airport Runway Project

Transportation Sector

Region of Waterloo International Airport (YKF)

1-4881 Fountain Street North, Breslau, Ontario, N0B 1M0

2.0 Proponents Name

Chris Wood, BSC., AAE, General Manager

Region of Waterloo International Airport (YKF)

1-4881 Fountain Street North, Breslau, Ontario, N0B 1M0

cwood@regionofwaterloo.ca

519-648-2256 ext. 8502

3.0 Summary of Engagement

Public engagement has been an important part of the Project. Engagement was initiated through the development of the Airport Master Plan, when two Public Consultations Centres (PCC) were held in 2016. The Airport Master Plan was officially approved by Regional Council in 2017.

YKF completed additional public consultation for the Project in 2019, as part of an Environmental Assessment process. Two PCC's were held, one at the Breslau Mennonite Church and second within the YKF Air Terminal Building. The Impact Assessment Agency of Canada (IAAC) also organized public engagement sessions in 2020.

Summary of Community Engagement

Type	Attendance	Date/Time
Master Plan PCC 1	458 people combined	May 25, 2016
Master Plan PCC 2		November 10, 2016
Class EA PCC 1	108 people	June 20, 2019
Class EA PCC 2	57 people	October 24, 2019
IAAC Session 1	12 people	September 8, 2020 at 3 p.m.
IAAC Session 2	10 people	September 8, 2020 at 6 p.m.

As part of the Initial Project Description (IPD) process, additional public consultation was conducted in 2021. Details of these IPD consultation can be found on the IAAC website at https://iaac-aeic.gc.ca/050/evaluations/proj/81452/contributions.

One of the major concerns from the Public Feedback during the Initial Project Description was the impacts on the Kossuth Wetland Complex, and the associated tree canopy reduction with the south Flight Pathway Area located south of Kossuth Road.

YKF has developed options to reconfigure the Runway 14-32 extension to eliminate these tree impacts. The preferred option involves requesting an exemption from Transport Canada regulations, to increase the standard approach slope. This will not impact aircraft and approach procedures, but will allow obstacles such as trees to be slightly closer to the aircraft upon approach. Since approval of a Transport Canada exemption can take considerable time, a second option has also been developed which involves extending the paved portion of Runway 14-32 at the north or Threshold 14 end by 61m. This will result in some reduced, but acceptable usability of Runway 14-32. These pavement extensions will not increase the footprint of the runway extensions as they will be constructed within the proposed Runway End Safety Area (RESA)

In summary, the tree impacts in or near the Kossuth Wetland Complex will be avoided by reconfiguring the Runway 14-32 Extension or the standard approach slope requirements with Transport Canada. Both options will result in a cost savings, as it eliminates the tree impacts and power lines along Kossuth Road will not need to be buried.

4.0 Indigenous Engagement

YKF is located within Blocks 1 and 2 of the Haldimand Tract of Six Nations of the Grand River (Six Nations).

In addition, the Mississaugas of the Credit First Nation (MCFN) agreed to share lands in south-central Ontario, including Waterloo Region, as part of Treaty 3, Between the Lakes Treaty, to help facilitate the Haldimand Tract.

YKF's proposed runway extensions were presented to Six Nations leaders as part of a review of the 2017 Airport Master Plan. Additional Indigenous engagement was completed as part of the Region's Class EA process and during the initial IAA process.

Summary of Indigenous Engagement

Indigenous Group	Attendance	Date	Initiated By
Six Nations	5 representatives	April 9, 2020	Region
MCFN	2 representatives	April 16, 2020	Region
Métis Nation of Ontario (MNO)	Copy of presentation provided by email	Response received from MNO on June 2, 2020	Region

Indigenous Group	Attendance	Date	Initiated By
Six Nations	Not recorded	July 22, 2020	IAAC
MNO	Not recorded	July 22, 2020	IAAC
MCFN	Not recorded	July 29, 2020	IAAC

Additional informal consultation has been held with Indigenous groups by the Region of Waterloo, including involving Six Nations and MCFN monitors to be on site during the Stage 2 Archaeological Investigation undertaken for the Project.

5.0 Relevant Studies

Several projects were initiated in 2018 based on Stage 1 of the Airport Master Plan. At that time, the Runway 14-32 Extension fell under the jurisdiction of the 2012 Canadian Environmental Assessment Act (CEAA). Section S84(a) of the CEAA states that runway extensions of less than 1,500 m are not subject to the CEAA. Since the total length of the proposed Runway 14-32 Extension was only 884 m long, the Project was exempt from the CEAA planning process as per Section S84(a).

However, the Region choose to complete an environmental assessment following Municipal Class EA guidelines, to exercise due diligence and good stewardship, and identify the environmental legislative requirements to be met during construction.

Before this Class EA process was completed, it was determined that the Project was to be subject to the Impact Assessment Act, which came into force on August 28, 2019. Following consultation with the IAAC, an Initial Project Description (IPD) was prepared. The investigations completed as part of the Class EA process was incorporated into the IPD, as well as this DPD.

Technical and environmental studies undertaken as part of the Class EA process include:

- Screening Level Environmental Site Assessment Phase 1
- Stage 1 Archaeological Investigation
- Built Heritage and Cultural Heritage Landscape Assessment
- Environmental Impact Study

6.0 Relevant Studies

The Strategic Assessment of Climate Change is a strategic assessment under Section 95 of the IAA. A detailed greenhouse gas (GHG) and criteria air contaminants (CAC) emission inventory was created for YKF and this Project. YKF's GHG emissions are under the Strategic Assessment for Climate Change (SACC), 2020 threshold of 500 kt

CO2e/year for an upstream assessment. YKF also currently meets the threshold going forward to 2050.

7.0 Purpose and Need of the Project

Waterloo Region and surrounding communities need convenient access to affordable aviation and airline services. As one of Canada's most innovative and successful urban regions, the Region depends on efficient connectivity to national and global economies. YKF's catchment area is an exporting region, driven by creative, capital intensive companies that sell into and pull talent and product from diverse markets. The Region's residents travel extensively, both for business and recreation.

Runway 14-32 can currently only accommodate light general aviation aircraft and flight training activity. Runway 08-26 can accommodate larger narrow-body aircraft (i.e. Boeing 737 aircraft with one aisle). Wide-body aircraft (i.e. Boeing 767 aircraft with two aisles) cannot use the airport at this time, and there is no secondary option for narrow-body aircraft.

Extending Runway 14-32 to a length of 2,134 m (7,000 ft.) will improve the safety and reliability of YKF. When Runway 08-26 has strong cross-winds from the north or south combined with wet or icy conditions, larger narrow-body aircraft would be able to land on Runway 14-32. Additionally, scheduled air service could use Runway 14-32 when Runway 08-26 is closed for repairs.

In summary, the overall purpose and need for the Runway 14-32 Extension Project is as follows:

- Enhance safety and reliability for aircraft.
- Improve the level of service and overall customer experience.
- Improve overall use and flexibility for scheduled air service.

8.0 Project Description – Physical Activities Regulation

Runway 14-32 is currently capable of serving aircraft up to Aircraft Group Number (AGN) IIIA, and is proposed to be upgraded to serve aircraft of AGN IIIB.

Paragraph 47(b) of the Physical Activities Regulations (SOR/2019-285) applies to this project. It states: "The operation of an existing runway that was capable of serving aircraft of an AGN IIIA or higher and becomes capable of serving aircraft of any higher Aircraft Group Number."

9.0 List of Permanent/Temporary Activities Infrastructure and Physical Works

The Runway 14-32 Extension Project includes:

- Runway 14-32 extended 884 m to a total of 2,134 m, with 555 m to the “north” (towards Breslau) and 329 m to the “south” (towards Cambridge).
- Taxiways parallel to the extended runway.
- Perimeter road and security/wildlife fencing.
- Runway End Safety Areas be established at each runway end.
- Drainage infrastructure.
- Enhanced runway visual aids including Runway 14 approach lighting.
- Instrument Landing System and low visibility departure equipment

During construction, there will be temporary facilities to accommodate construction including site trailers, and material and equipment storage yards. Temporary access roads to accommodate construction delivery of materials and worker access will also be constructed utilizing existing on-site roads as much as possible. All construction activities, locations of stockpiles, equipment and material yards must follow strict regulations regarding their distance and height from any airside facilities.

There are no incidental projects associated with the Project. Runway 14-32 is being extended solely for safety and reliability reasons to serve the same size of aircraft currently using YKF. No decommissioning will occur with the Project

10.0 Projects Estimated Maximum Production Capacity

Runway 14-32 would be upgraded from AGN IIIA to AGN IIIB following the extension. This will allow aircraft with wingspans up to 36 m and approach speeds above 121 knots such as the B737 series. The Project does not increase the size of aircraft that YKF can accommodate, as Runway 08-26 already serves AGN IIIB aircraft.

11.0 Anticipated Schedule

The current estimated construction schedule for the Project is as follows:

Phase	Schedule
Design	Late 2021
Tendering	As early as early 2022
Construction Start	As early as mid-2022
Construction Completion and Commissioning	End of 2024

12.0 List of Alternatives

Runway 14-32 is limited in the size and type of aircraft it can accommodate. Runway 14-32 needs to be extended in order to accommodate AGN IIIB aircraft during all weather conditions.

The following runway alternatives to accommodate larger aircraft were considered while minimizing the impacts to existing road networks and adjacent landowners:

1. Do Nothing.
2. Do Not Extend Runway 14-32.
3. Extend Runway 14-32 to accommodate AGN IIIB.
4. Extend Runway 14-32 to a maximum length based on existing Land Holdings.
5. Relocate the airport to an area where the maximum length and number of runways can be accommodated.

Based on discussions and analysis of alternatives that was undertaken as part of the Class EA process and the Initial Project Description, extending Runway 14-32 to 2,134 m (7,000 ft.) is the preferred approach.

Many aspects of the Project are inflexible due to Transport Canada regulations, including runway and taxiway physical characteristics, runway safety areas, visual aids and obstacle clearance requirements. However, based on public feedback YKF is committed to not requiring any tree clearing in the Kossuth Wetland Complex by implementing one of two additional options for extending Runway 14-32:

- Option A: Request and obtain an exemption from Transport Canada to raise the aircraft approach slope in the southern Flight Pathway Area, such that tree removal is eliminated south of Kossuth Road. The design does not change the original runway design details.
- Option B: If an exemption from Transport Canada through Option A is denied, then modify the preferred design by moving the south aircraft approach further north and introduce operational restrictions, such that tree removal is eliminated south of Kossuth Road.

Option B includes revising the standard approach slope and threshold displacement, downgrading Runway 32 to “non-instrument” certification, and adding an additional 61 m of runway pavement on the north end, such that tree clearing will not be required on private property south of the runway.

In addition, the design will consider alternate means in order to minimize impacts while maintaining compliance to the required design standards:

- Raising the runway elevation to minimize impacts to groundwater and treed areas.
- Realigning perimeter roads and fencing to minimize wetland impacts.

- Realigning the Randall Drain and minimizing the covered lengths, using fluvial biomorphological principles, open bottom culvert for fish habitat.
- Upgrading airport security fencing to ensure wildlife do not enter airside areas.
- Maximizing the use of onsite materials (i.e. asphalt millings, excavated material etc.);
- Improving drainage near runways to minimize wildlife and bird strikes; and,
- Implementing Runway End Safety Areas, Runway Safety Areas, instrument landing systems and additional visual aids to improve aircraft safety.

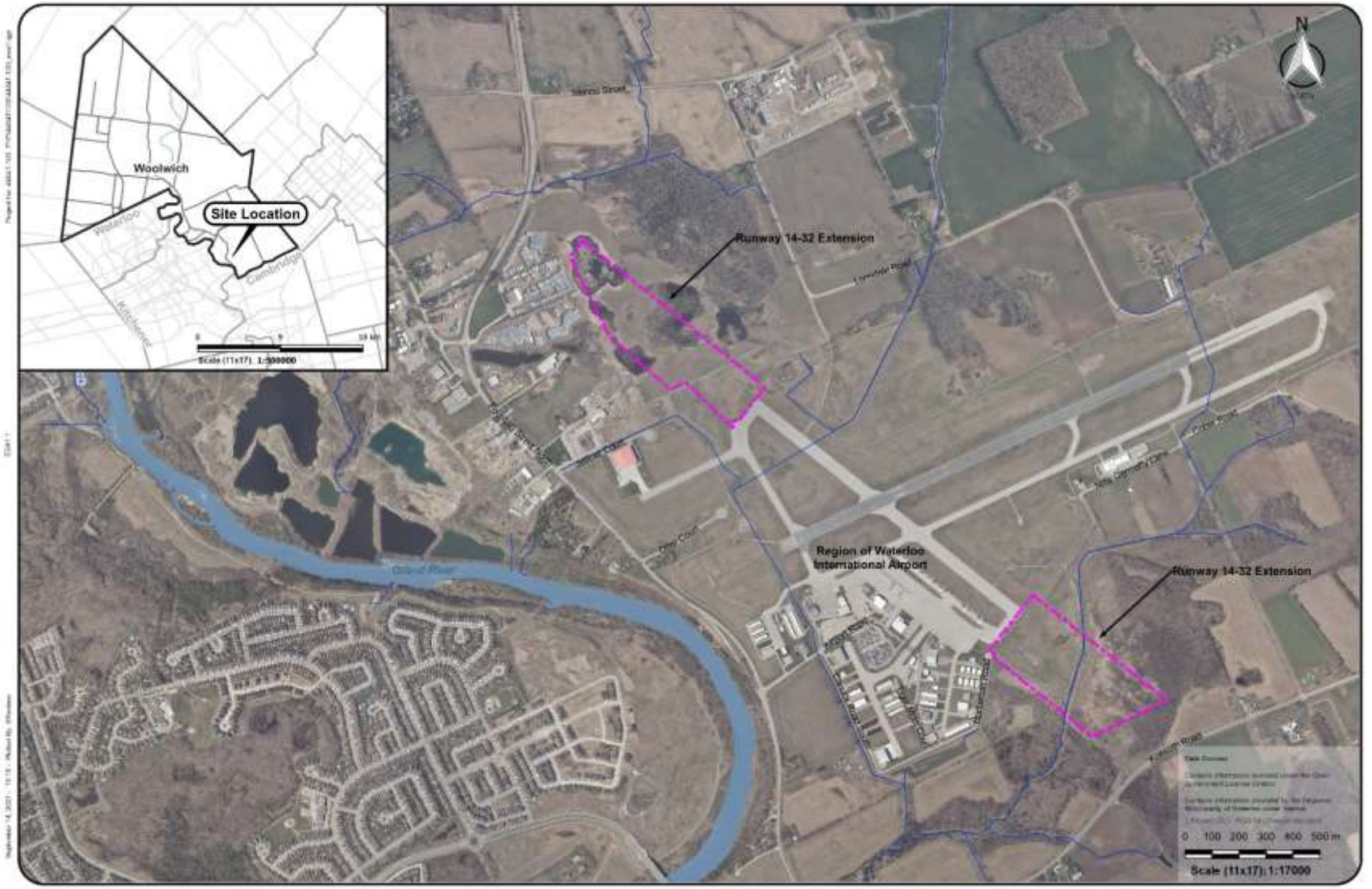
13.0a Geographic Coordinates

The co-ordinates of the Runway 14-32 Extension Project (Latitude/Longitude) are:

- New Threshold 14: Lat N43° 27' 56.19" Long W80° 23' 49.15"
- New Threshold 32: Lat N43˚ 27’ 13.20” Long W80˚ 22’ 34.78”

13.0b Site Maps

Figure: Location Map



13.0c Project Legal Description

The Region owns all the land required for the Runway 14-32 Extension Project. The complete legal descriptions of the YKF lands are detailed in the Detailed Description. The various Property Identification Numbers (PIN's) for the various YKF lands are as follows:

- 22254-0193 (LT)
- 22254-0023 (LT)
- 22253-0027 (LT)
- 22713-0110 (LT)
- 22254-0017 (LT)
- 22254-0209(LT)
- 22254-0038(LT)
- 22254-0106 (LT)
- 22713-0112 (LT)
- 22713-0111 (LT)

13.0d Proximity to Residences / Communities

The closest permanent residence is approximately 600 m from the south end of the Runway 14-32 Extension, located at 2515 Kossuth Rd. The closest farm (barn) used for agricultural purposes is approximately 170 m south of the Airport property off of Shantz Station Road.

The community of Breslau is approximately 1,600 m to the north of YKF, and the City of Kitchener is approximately 700 m to the west and is separated by the Grand River.

13.0e Proximity to Residences, Indigenous Lands, Federal Lands

Land	Response
Land used for traditional purposes by Indigenous peoples of Canada.	Consultation with Six Nations, MCFN and MNO did not identify any land used for traditional purposes that would be affected by this Project. An Archaeological Stage 2 Investigation is completed, with the Draft report recommending an area for a Stage 3 Investigation. The final Stage 3 report and review of the report by the Indigenous Groups may identify any traditional purposes for these lands.
Land in a reserve as defined in subsection 2(1) of the Indian Act.	Closest reserve is Six Nations Reserve in Oshwekan Ontario – Approximately 50 km southeast of YKF. MCFN indicated that their reserve outside Brantford was the closest to YKF, located approximately 65 km southeast of YKF.

Land	Response
First Nation land as defined in subsection 2(1) of the First Nations Land Management Act.	There are currently no such lands in Ontario (refer to https://www.rcaanc-cirnac.gc.ca/eng/1373385502190/1542727338550) Six Nations and MCFN did not identify any lands near YKF that is subject to a comprehensive land claim.
Land that is subject to a comprehensive land claim agreement or a self-government agreement.	Six Nations and MCFN did not identify any lands near the Airport set aside for the use and benefit of Indigenous peoples.

13.0f Proximity to Federal Lands

There is no known Federal Lands in proximity to YKF.

14.0 Physical and Biological Environment

A number of studies have been initiated for this Project, identifying and reviewing existing conditions and potential impacts on the physical and biological environment. The findings of these studies are summarized below. Areas noted as being impacted by the Project will be further refined and minimized as part of the detailed design process.

14.1 Natural Environment - Ecological

YKF lands are within the Grand River Watershed. The landscape surrounding YKF is predominantly agricultural with some industrial or commercial lands to the northwest and northeast, as well as individual rural residential properties. The Breslau and Kossuth Provincially Significant Wetland (PSW) Complexes, expansive areas of treed swamp and marsh, are also present to the north and south of YKF.

The south end of the proposed runway extends over the East Branch of the Randall Drain, which is a cool water stream. Rather than simply bury or “pipe” the Randall Drain in a culvert under the runway extension, the Region is proposing to minimize piping of the drainage system by realigning the Randall Drain around the end of the runway under the narrower grassed Runway End Safety Area (RESA). This stream realignment will utilize fluvial biomorphological design principles to maintain and enhance the watercourse’s environmental characteristics and habitat, and minimize the length of the Randall Drain enclosure. In addition, the runway extension general drainage will maintain the existing runway drainage systems and patterns by use of grassed swales which allow runoff to infiltrate into the groundwater

The Project will occur on YKF lands and will result in impacts to PSWs and the Randall Drain. There will also be impacts on private property immediately north of the runway (Flight Pathway Area). Environmental impacts from the Runway 14-32 extension will be minimized to the greatest possible extent. Proposed and potential mitigation, avoidance and compensation measures are outlined, and will be subject to various regional, provincial and federal agency permitting processes as summarized below.

Removal of Wetlands:

- Wetland restoration and offsetting/compensation activities will be identified in a Habitat Compensation Plan, in consultation with the Grand River Conservation Authority (GRCA) and Ministry of Environment, Conservation and Parks (MECP) applying the principals of "no net loss" of wetland function.
- Natural Heritage Management Plan will be developed for PSW habitat in the Flight Pathway Area, including recommendations for approaches to tree removal techniques and strategies for limiting canopy height in the Flight Pathway Areas over the short and long term.

Breslau Drain and Randall Drain

- A new access road culvert will be installed in the Breslau Drain.
- A portion of the Randall Drain will be realigned and converted to a partially open drainage feature and partially closed (culvert), representing a potential Harmful Alteration, Disruption or Destruction (HADD).
- An aquatic effects assessment summary table will be prepared, and a comprehensive realignment and restoration plan will be developed for the Randall Drain.
- Any required fish salvage and relocation, and construction schedules will adhere to in-water work timing windows (i.e. no work between March 15-June 30).
- The water balance will be maintained during all construction activities and post-development scenario.
- A Sedimentation and Erosion Control Plan will be developed.

Wildlife

- The species at risk Bobolink, Eastern Meadowlark and Blanding's Turtle have been documented to have habitat in the area.
- Candidate habitat for species at risk bats has been identified within the Breslau and Kossuth PSWs.
- Four species of conservation concern, the Eastern Wood-Pewee, Wood Thrush, Grasshopper Sparrow and Snapping Turtle have been documented in impacted areas.
- Impact Mitigation measures include:

- Timing windows for construction which result in the least amount of disturbance to wildlife and disruption of critical life stages such as breeding.
- Wildlife salvage and wildlife encounter plans.
- Best Management Practices (BMP) for Eastern Meadowlark, Bobolink, Grasshopper Sparrow and Blanding's Turtle and Snapping Turtle will be incorporated into the Airport's wildlife management plans to reduce impacts to these species from ongoing operations.
- Enhancements and additions to existing wildlife fencing around the airport to improve wildlife exclusion from these areas.
- Comprehensive Natural Heritage Management Plan for the Breslau PSW that will be impacted.
- Wetland habitat compensation plans will be implemented, providing at least a 1:1 area replacement of habitats.

14.2 Environmental Site Assessment - Contaminated Soil/Groundwater

A Screening Level Environmental Site Assessment was completed to identify known or potential environmental or contamination concerns related to the Project. The conditions outlined in Part IX Sections 41 and 43.1 of Ontario Regulation 153/04 indicate that the Runway 14-32 Extension area is considered to be sensitive due to the presence of regulated wetlands.

The Assessment identified potential environmental concerns in connection with the Project. These are considered areas of low to moderate environmental risk and are summarized below:

- There are various industrial properties that border the Site to the west and include activities such as metal fabrication, vehicle and equipment maintenance, bulk paint storage and use and commercial trailer storage.
- Hangers and the Airport were identified as having fuel storage tanks, registered waste generators, and spills on the property.
- An examination of pesticide residual on agricultural fields may be warranted.
- Fill of unknown quality may be present in connection with Airport development.

14.3 Randall Drain Fluvial Geomorphology

The Runway 14-32 Extension is to be extended past the existing Randall Drain channel. Three mitigation measure for the Randall Drain were considered:

- **Full Relocation of Randall Drain:** This option would result in a 1,150 metre relocation of Randall Drain that is similar, but longer than the existing alignment.

Given that the existing channel has a relatively low gradient and lengthening this channel would reduce that gradient even more (to 0.0005 m/m), this option is not desirable given the problems associated with flow and sediment transport. The channel will have to be oversized to convey flood flows and its required width/depth ratio would result in excessive bank erosion and in-channel deposition as the channel tries to naturalize between clean-outs.

- **Full Enclosure**: This option would connect the upstream channel to the downstream channel though a large pipe or culvert under the actual runway and taxiway. The slope of the pipe would be approximately 0.0013 m/m. As such, the pipe would have to be relatively large to accommodate this flow but the enclosure of over 400 metres of fish habitat is also problematic.
- **Partial Relocation and Enclosure:** This option would create a realigned channel and up to an approximately 140 metre enclosure under the proposed Runway End Safety Area (RESA). Since the RESA is less restrictive in size and structural conditions than the actual runway area (i.e. RESA's can be grassed but the underlying soils must be able to support the weight of an aircraft taking off or landing), the channel would only have to be enclosed through the RESA for a distance of approximately 140 metres while the total realignment would be approximately 580 metres in length. Given that this option provides for a minimal realignment as well as a minimal enclosure, this option is preferred.

The preferred Randall Drain solution is a partial relocation and enclosure of the Randall Drain under the new RESA portion of the runway extension.

14.4 Stormwater Management

A review of potential stormwater management quantity and quality controls was undertaken to determine suitability for this project. Constraints for the site include, but are not limited to, the following:

- Grading for the site is largely restricted due to the existing grades of the existing runways.
- High groundwater throughout the site.
- Ponds are to be avoided to discourage attracting birds to minimize the potential for aircraft bird strikes.

Due to the above constraints, typical stormwater management controls such as the use of dry or wet ponds, underground pipe networks, underground storage tanks, infiltration galleries and oil-grit separators are not reasonably feasible for this runway extension project. Any underground infrastructure would likely be firmly within the groundwater table and thus have to contend with buoyancy and excessive infiltration into the system, as well as construction challenges. Therefore, runoff from the runways will be directed towards grassed swales graded between 0.2% and 0.5%, maintaining the existing

drainage system. The gentle grading of the grassed swales is expected to provide quality control and encourage infiltration. Grass swales have been shown to remove 20 to 40% of total phosphorous.

No quantity controls are proposed as the gentle grading will reduce runoff rates and encourage infiltration thus reducing runoff volume. Grass swales have been shown to provide up to 40% reduction in runoff. The swales will drain to the Breslau and Randall Drains and since the Airport lands are just upstream of their outlets to the Grand River, any increase in runoff volume is not expected to negatively impact the Grand River upstream catchment area.

14.5 Hydraulic Assessment

The Runway 14-32 extension will encroach the floodplains of the Breslau Drain and the Randall Drain. The proposed design also includes the realignment of the Randall Drain. An assessment was undertaken to provide technical information and analysis regarding the proposed design from a hydraulic perspective, as well as to update the floodplain limit of the Breslau Drain and the Randall Drain.

The proposed runway design at the northwest or “Threshold 14” will not have direct impacts on the Breslau Drain, but will encroach into the floodplain. The encroached areas are generally the existing wetland areas. To better assess the flood conditions under existing conditions, an updated model was created.

Under proposed conditions, the runway extension at the northwest end near the Breslau Drain will occupy the storage provided by the wetland. A model of the proposed condition was created, and the results show that the storage provided by the wetland has limited impacts on the flood elevations. The flood elevations of the study area are mainly dominated by the backwater effect from the Breslau Drain creek crossing at Fountain Street North. Therefore, when the proposed runway extension occupies the storage provided by the wetland, the changes of flood elevations are negligible, causing little hydraulic impacts on the Breslau Drain and surrounding area.

The proposed design at the southeast (Threshold 32) end of the Runway 14-32 Extension includes the realignment of Randall Drain and the runway extension which will encroach into the floodplain and cause a Randall Drain creek crossing. The proposed realignment of Randall Drain will result in the drain having a longer channel length and a flatter slope. As a result of the runway extension, a box culvert with will be installed beneath the Runway End Safety Area (RESA). The culvert will be embedded 0.3m depth to form a low flow, natural channel inside.

A model of the proposed condition was created around the study area of Randall Drain under the Regional Storm event.

The results show that the proposed runway extension will cause minor flood elevation increases upstream of the runway crossing. Flood elevation changes downstream of the crossing are negligible. Although the increase of the flood elevations upstream of the crossing will lead to a slight expansion of the floodplain, the expansion is within the wetland area and therefore will not impact the current or future use of the adjacent property. As the floodplain was assessed under extreme flood conditions, this expansion will not have impact on the wetland under normal conditions. Generally, the proposed runway extension will have minor hydraulic impacts on the surrounding areas.

14.6 Water Balance

Both the Breslau Wetland Complex and the Kossuth Wetland Complex are located at the lower portion of their associated subwatersheds. As the Breslau and Randall Drains traverse wetland areas, the wetlands are sustained by water through the Drains and the overland runoff from the surrounding areas. Both Drains have significant upstream drainage areas. The proposed Runway Extension will not impact the upstream drainage areas, so the Water Balance Investigation focused on assessing the overland runoff from the surrounding areas of the wetland complexes.

A runoff water balance analysis was completed on 2 areas of the Breslau Wetland Complex (Wetland 1 and 2) and the Kossuth Wetland Complex (Wetland 3).

Under pre-development conditions, Wetland 1 receives an annual surface runoff volume of 101,823m^3 under pre-development conditions. Under post-development conditions, the total drainage area generates an annual runoff volume of 100,679m^3, making the surface runoff input 1.1% less than pre-development conditions.

Under pre-development conditions, Wetland 2 receives an annual surface runoff volume of 43,058m^3. Under post-development conditions, Wetland 2 receives an annual surface runoff volume of 43,001m^3. Hence, the annual surface runoff will be reduced by 0.1% under the post-development conditions.

Under pre-development conditions, the drainage area of Wetland 3 generates an annual runoff volume of 67,590m^3. Under post-development conditions, Wetland 3 has a drainage area (67,586m^3) that is essentially the same as the pre-development condition.

From an infiltration standpoint, the Runway 14-32 Extension will slightly increase the imperviousness of the airport area. However, compared with the total area of the airport (509.8ha) and the drainage areas of Breslau Drain and Randall Drain, the increase of imperviousness is very small. Furthermore, the runways are generally flat, with grades less than 2%. The runoff from the impervious area under most rainfall events (i.e. smaller than 25mm depth) will be infiltrated by the surrounding pervious areas and

swales. The post-development infiltration will be very similar with pre-development conditions.

As a result, the proposed Runway 14-32 Extension at the Region of Waterloo International Airport will not have significant impacts on the groundwater and surface water balance, as water inputs will be generally maintained in the post-development condition.

14.7 Geotechnical Investigation

A Geotechnical Investigation was completed including advancing 69 boreholes through the existing pavement structure and overburden in areas of the proposed runway extension. Laboratory testing and analysis concluded that the quality of the soil met Table 1 Standards and can be classified as non-hazardous. Removal of all areas of peat and topsoil in the runway extension areas is critical to reliable pavement performance over its design life.

14.8 Hydrogeological Investigation

A Hydrogeological Investigation was completed that recorded and analyzed subsurface groundwater conditions and completed laboratory testing, and a dewatering analysis. Dewatering for the pavement and RESA excavations and the Randall Drain re-alignment have been recommended, with final details to be finalized prior to commencing construction. The Project is located approximately 1 km from the nearest Municipal well, however the temporary dewatering activities during construction will not interfere with the operation of these wells.

A Provincial Permit To Take Water (PTTW) will be required for the temporary dewatering activities. The report recommends that any dewatering discharge should be managed as follows:

- Water should not be discharged directly to a water body, and should be discharged at least 30 m from the water body;
- Total Suspended Solids (TSS) should be controlled to provincial guidelines by use of a pre-treatment system such as Enviro-Tank, sediment bag etc.;
- Depending on the efficacy of the treatment system, additional treatment such as silt bags may be required downstream.

15.0 Health Social and Economic Context

15.1 General Health Social and Economic Context

A number of studies were completed for this Project, identifying and reviewing existing conditions and potential impacts on the health, social and economic conditions in the vicinity of the Project.

15.2 Health and Social Environment

A Health and Social Analysis provides a description of the existing social and economic environment and the analysis of health and social impacts of the Runway 14-32 Extension Project. Overall, the results of this analysis indicate that the Project will result in a net beneficial effect on health and community well-being. The Project will have major beneficial implications to the human and economic assets of the area, and the numerous major and minor beneficial effects on economic assets more than offset the impacts of increased community noise.

The analysis concluded that no residual adverse impacts on health and community well-being are anticipated due to changes in:

- Population and demographics
- Income and social status
- Employment, labour force and working conditions
- Education and literacy
- Built environment
- Access to health and safety services
- Access to community and recreational facilities and services

Beneficial impacts on health and community well-being are anticipated due to:

- Increased total labour and tax income generated during the construction phase. and enabled during the operations phase.
- Generation of new direct, indirect and induced employment opportunities during the construction phase and the enabling of additional employment opportunities during the operations phase. Increased employment will help maintain the skilled employment base of the Regional Study Area (RSA) in the short term and facilitate employment growth in the aviation and aerospace industry in the RSA over the long term.
- Increased aircraft safety and reduced risk to the built environment through the implementation of a runway end safety area, improved visual aids and better instrument landing systems, which allow commercial aircraft to land with reduced crosswind.

15.3 Noise

The potential noise increases resulting in the proposed runway extensions and other improvements at YKF were reviewed as part of the 2017 Airport Master Plan. The Master Plan projected the Noise Exposure Forecast (NEF) to 2035 which included the proposed runway extensions, and compared them to the current (2000) Noise Exposure Projection (NEP) which is currently in the Region of Waterloo Official Plan.

Several potential noise impact “receptors” around YKF were identified as part of the Health and Social Analysis Report. These noise receptors were identified based on whether they would experience changes in the aircraft noise environment because of the Runway 14-32 Extension Project. These receptors have been characterized as land uses that could be considered noise sensitive.

An analysis of these noise receptors was completed with the 2035 NEFs. It was concluded that while the aircraft related noise environment around YKF will change because of the Project, the change can be considered not significant when federal, provincial and local municipal planning guidelines and noise metrics are considered. All the sensitive land use receptors will remain below 30 NEF.

Provincial and local Municipal regulations apply to construction noise, while constructing the Runway 14-32 Extension. YKF will continue to monitor and address community concerns with all noise issues through its compliant management procedures.

15.4 Airport Zoning Regulations (AZR)

Section 5.4 of the Aeronautics Act permits AZRs, which protect the Airport’s airspace from future development and natural growth. Transport Canada creates and controls the process to update AZRs.

The purpose of AZRs is to:

- Protect aircraft from hazards (i.e. bird strikes and electronic signal interference);
- Protect existing Airport operations (i.e. airspace management and emergency response); and
- Ensure that future development near an Airport is compatible with the safe operation of aircraft and of the Airport itself.

YKF is planning to update their AZRs to ensure the airspace of the proposed runway extensions is adequately protected.

Transport Canada has been engaged to commence the AZR update process.

15.5 Economic Analysis

An Economic Assessment was completed for the Project. The report covers the economic benefits, potential impacts on users and providers of aviation services, and capacity impacts.

A roundtable meeting with local leaders in business, education and other community institutions was held on January 6, 2021 to gather further evidence on ongoing economic impacts of the Project. Key points raised by this group include:

- The Project was seen as a critical foundation of the overall Airport Master Plan.
- The expansion is important in supporting the knowledge economy and start-up community in Kitchener-Cambridge-Waterloo (KCW).
- There is an objective to create new bus routes and rail connections to YKF.
- Both the visitor economy in KCW, and inclusiveness of rural populations to the north of KCW, are hampered by limited air connectivity at present (long drive from Toronto Pearson).
- YKF reputation boosts enrolment in local aviation programs such as at University of Waterloo.
- Transportation and connectivity are seen as critical for attracting business investment.

Overall, the results of the assessment suggested that there may be significant benefits arising from the Project, including up to $52.3 million in benefits from construction activity and up to $67.4 million in time and cost savings through mitigation of diversions and cancellations alone. Other aspects of potential economic impacts that are not quantified and could further increase these benefits are:

- Time savings for businesses and individuals who currently use Toronto Pearson.
- Additional cost savings through reduced delays and increased aircraft safety.
- Catalytic impacts from increasing the size of the visitor economy and encouraging business investment and trade.
- Increased enrolment in aviation programs at educational institutions.
- Improvements to talent attraction to the Region.

15.6 Archaeological Environment

A Stage 1 Archaeological Investigation completed in 2019, recommended that a Stage 2 Archaeological Investigation be completed in select areas for the Project. A Stage 2 investigation was completed in the Spring of 2021, including the use of archaeological field monitors from the MCFN and Six Nations. The Stage 2 Report is completed in Draft form, and recommends two areas that should undergo a Stage 3 Investigation, and one area where a Stage 2 Investigation must still be completed. These additional investigations will once again be completed in conjunction with arrangements with MCFN and Six Nations for field monitors.

15.7 Cultural Heritage Environment

A Built Heritage and Cultural Heritage Landscape Assessment of the overall study area was completed for the Project. Only one cultural heritage resource within the study area (4800 Fountain St. N.) can be considered a cultural heritage resource as its cultural heritage value or interest is recognized through its designation under the Ontario Heritage Act.

Two additional properties were identified during the site visit as having potential Cultural Heritage Value or Interest (CHVI), 4600 Fountain St. N. and 1995 Lonsdale Rd. However, their deteriorated state, lack of history and no indication of their historical or associative value, results no contextual value being identified. YKF lands do not have any potential CHVI.

Construction of the runway extension and associated taxiway extensions and access roads will take place at ground level, therefore these improvements will not cast shadows near any of the identified cultural heritage resources. Approach lighting is located a distance away from all identified and candidate cultural heritage resources, therefore no shadows will be cast on their heritage attributes as a result of the approach lighting.

The following are some of the mitigation strategies that are suggested as conservation recommendations to address the identified potential adverse impacts:

- During the planning and design phases, cultural heritage resources should be avoided where possible and any construction staging areas should be located on lands located well away from any of the identified or candidate Built Heritage Resources and Cultural Heritage Landscapes.

- Consider the installation of vegetation buffers similar to existing windbreaks to be compatible with the local character and to screen the runway extensions, access roads and fencing from the Built Heritage Resources and Cultural Heritage Landscapes.

15.8 Agricultural Impact Assessment

An Agricultural Impact Assessment was competed to assess impacts on agriculture, and ensure that farmland, farm operations and supporting infrastructure, services and assets are sustained to support a prosperous agri-food sector and a strong rural community.

The majority of the subject lands proposed for the Project are currently not in agricultural production, and there are no agricultural structures or improvements on the subject lands. Only the extension at the north end of Runway 14-32 will affect a small area of land that is currently cropped. However, this area of land is not large enough to sustain a viable farm operation.

The following Table provides a summary of recommended approached to minimize or mitigate impacts on surrounding agricultural uses.

Table: Proposed Agricultural Mitigation Measures

Objective	Mitigation Measure	Description
Minimize the loss of agricultural land.	Select areas with less agricultural land and lower priority agricultural lands.	The runway extension lands are not utilized for agricultural production. YKF lands are located within a prime agricultural area. As a result, expansion of the airport in any direction would not be able to avoid prime agricultural lands or lower priority soils.
Minimize the fragmentation of agricultural land.	Maintain Farm parcels	Existing farm parcels are maintained and the runway extension will not further fragment the agricultural landscape.
Minimize impacts on farmland and agricultural operations.	Edge Planting	Edge planting and vegetative buffering should be considered in the proposed development of the runway extensions.
	Minimum Distance Separation (MDS)	MDS is not applicable.
	Design future development to support agriculture.	Runway extensions will positively impact ability to transport agricultural products efficiently
Minimize and mitigate changes in water quality.	Implement a groundwater monitoring program.	No groundwater taking for potable water is proposed and therefore, no impacts on surrounding wells are anticipated. A groundwater monitoring plan will be implemented during and after construction to monitor groundwater impacts on the groundwater table and surrounding wetlands.
Mitigate Impacts during construction or operations.	Adjust operation procedures to accommodate agriculture in the area.	Construction activities will not impact ongoing agricultural production
Mitigate ongoing impacts from	Implement measures that can be in place	While salt is not permitted to be used on runways, if salt is permitted on other

Objective	Mitigation Measure	Description
new development.	post development to support compatibility	areas of YKF, best management practices will be adhered to
Maintain the functional and economic connections of the agri-food network	Plan and support the agri-food network.	YKF provides air transportation internationally. Expansion of the Airport provides additional opportunities to export local agricultural products.

In summary, the Project will have minimal negative impact on the long-term agricultural uses and operations on the subject lands and within the Primary and Secondary Study Areas. The local agri-food industry could have a net economic benefit as a result of an expanded transportation network, which may offer increased opportunities for exporting of local agricultural products and goods to a broader marker, thus promoting and enhancing the overall agricultural system.

16.0 Potential Federal Financial Support.

There are currently no known federal programs that will provide funding for this Project. There may be potential for government infrastructure or stimulus funding, however there are no federal funding programs announced to date that would apply to this Project. Applications will be made to any applicable federal or provincial infrastructure programs if they are enacted.

17.0 Federal Lands

The Project will be constructed entirely on YKF lands. No federal lands are required for the Runway 14-32 Extension Project.

18.0 Assessment Jurisdictions

The agencies that will be consulted and involved in the approvals process of the Project are:

Approving Agency	Approvals
Township of Woolwich	Site Plan Approval for changes to drainage and access Modifications to the Randall Drain under the Drainage Act
Region of Waterloo	Conduit required under Fountain Street for new runway lighting requirements Temporary construction access to Region Roads

Approving Agency	Approvals
Grand River Conservation Authority (GRCA)	Environmental Impact Assessment outlining the natural environment impacts and mitigation measure (specifically impacts on the floodplain and wetlands. As part of a GRCA "Fill" Permit: - Groundwater Balance - impacts and effects on wetlands - Randall Drain Re-alignment and culverts - Drainage and stormwater management
Ministry of Heritage, Sport , Tourism and Culture Industries (MHSTCI)	Archaeological Assessments
Ministry of Environment, Conservation & Parks (MECP)	Construction Temporary PTTW Stormwater management facilities Drainage pipe sizes Endangered Species Act
Department of Fisheries and Oceans	Potential HADD (Harmful Alteration, Disruption, or Destruction) of Fish Habitat – Randall Drain and wetlands
NAV Canada	Instrument Lighting Systems Land Use Approvals
Transport Canada	CARS 307 Plan of Construction Operations (PCO) Airport Zoning Regulations (AZR)

19.0 Changes to the Environment

A number of changes are anticipated to fish, fish habitat, aquatic species and migratory birds as summarized below. In addition to issues related to federal requirements, a number of the listed issues may be covered under provincial and local legislation and requirements.

Summary of Changes and Effects

Feature	Mitigation Measures
Impacts to Wetlands, including wetland removal or groundwater impacts that will affect the supply of groundwater to the wetlands	• Wetland compensation with creation in new areas and enhancement of existing wetland. • Wetland water balance to be maintained during and after construction
Impacts to Stormwater quality and quantity	• Implement a strategy to ensure that changes to surface water flow, groundwater and surface water quality are minimized. • Grading and stormwater management will be designed to minimize the risk of flood damage to upstream or downstream properties.
Sedimentation and erosion during construction due to earth grading and temporary vegetation cover removal	• Erosion and sediment control plans to be implemented during construction
Removal of vegetation during construction	• Disturbed areas outside the infrastructure footprint to be revegetated with an appropriate native seed mixture. • Vegetation activities to occur outside the core bird breeding season (May 1 to July 31). • Impacted plants identified as rare or significant, to be transplanted by a qualified individual as required.
Relocation of the Randall Drain (Municipal Drain)	• The realignment of Randall Drain will be designed using fluvial geomorphological principles to recreate the watercourse as a natural function system, while marinating the required drainage and flow requirements
Construction near a watercourse (Including Randall Drain)	• Measures to address impacts and site alteration within watercourses, their associated fish habitat, and floodplains to be submitted to DFO as well as the GRCA.

Feature	Mitigation Measures
	• Dewatering in the Randall Drain will occur outside the overwintering period for identified turtles.
Removal or disturbance of wildlife habitat	• Construction during the active season for significant wildlife species to be restricted to daylight hours only, when possible. • Necessary removals or alterations to habitats for Bobolink and Eastern Meadowlark to be done in compliance with the Endangered Species Act. • Potential to provide additional maternal roosting habitat for bat SAR in treed areas.

20.0 Changes to Environment on Federal Lands, in a Province other than Ontario, or Outside Canada

There will be no changes to the environment on federal lands, other provinces or outside Canada as a result of carrying out this Project.

21.0 Impacts to Indigenous People

The completion of the Stage 1 and Stage 2 Archaeological Investigation and ongoing consultation with Indigenous Groups, did not identify impacts to Indigenous heritage, traditional use of lands or items of historical, archaeological, paleontological or architectural significance have been identified. However, there are two areas recommended for a Stage 3 Investigation.

The Region has an established process for engagement with Indigenous groups and is working with these groups throughout the Runway Extension Project. Items to be discussed will be mitigation measures during construction and operation phases.

22.0 Changes to Indigenous Health, Social or Economic Conditions

No specific impacts to health, social or economic conditions have been identified through consultation with Indigenous Groups nor the Stage 1 and Stage 2 Archaeological Investigations. However, as part of the recommended Stage 3 Archaeological Investigation and ongoing Indigenous engagement, the health, social or economic impacts to the Indigenous people of Canada, will be monitored and reported as they become known. It is noted that MCFN currently have a claim on waters within all treaty lands.

23.0 Greenhouse Gas Emissions

A detailed greenhouse gas (GHG) and criteria air contaminants (CAC) emission inventory was developed as part of this Project. The criteria air contaminants assessed were:

- Air quality emissions of nitrous oxides (NOX) and particulate matter less than 2.5 microns in diameter (PM2.5);
- CO2, N2O and CH4 for GHG emissions, which are reported as total CO2 equivalent (CO2e)

The sources included in the assessment are categorized as follows:

- Aircraft;
- Auxiliary Power Units (APUs);
- Ground Support Equipment (GSE);
- Construction (construction scenario only);
- Traffic; and,
- Stationary Sources (e.g., boilers, diesel generators).

Emissions were modelled for an existing scenario in 2019, a construction scenario in 2024 and a future scenario in 2029.

The 2024 construction scenario was selected based on the highest overall emissions emitted during construction. It results in the highest overall emissions of PM2.5 and GHGs due to the added equipment usage during construction of the Project.

The 2029 future scenario was modelled based on estimated passenger traffic data, assuming 500,000 annual passengers. This scenario has the highest NOX, and higher PM2.5 and GHG emissions than 2019 conditions due to increased aircraft operations. However, some of the increased aircraft emissions in this scenario may potentially be offset by air passengers within the Region using YKF instead of other airports. Overall the future scenario has a small NOX emission increase, but a decrease in PM2.5 and GHG emissions when compared to the existing scenario, due to the reduced number of passengers travelling to Toronto Pearson.

YKF's GHG emissions are under the Strategic Assessment for Climate Change (SACC). YKF also currently meets the threshold going forward to 2050.

24.0 Types of Waste and Emissions

Table: Summary of Waste Sources

Source	Uses
Excavated soil and topsoil	To be reused wherever possible on the Airport site for fill or landscaping to create a "cut/fill balance".
Existing asphalt removal	Asphalt removal will be specified to be re-used on site as a compacted gravel base in current gravel areas to prevent erosion, and/or to be used as recycled asphalt pavement in asphalt design mixes on site or off site.
Contaminated soil	Any contaminated soil that is encountered and excavated will be tested and re-used or disposed of in accordance with Ontario Regulation 153/04 and 347.
Groundwater	Groundwater pumping required for excavations during construction will be outletted onto YKF lands in accordance with the requirements of a Permit to Take Water.

Table: Summary of Emissions Sources

Source	Details
Direct	
Ground Access Vehicles	Airport fleet vehicles, employee vehicles and general public vehicles travelling on Airport roads and within parking facilities.
Stationary Sources	Boilers, emergency generators etc.
Shuttles	Buses, taxis etc. travelling on Airport roads.
Equipment	Airport snow removal and maintenance equipment.
Refrigerants	
Indirect	
Electrical Usage	By Airport and tenant.
Indirect and Optional	
Aircraft	Taxiing landing/takeoff emissions up to 914 m (3,000 ft.).
Ground Access Vehicles	Onsite tenant vehicles, off-site vehicular activity associated with the Airport.
Public transit	Serving the Airport.

Conclusion

The Runway 14-32 Extension Project will provide significant benefits to the Airport, the aviation industry and the surrounding communities. The Project will increase safety and level of service for air passengers and the airlines, providing economic benefits for the broader community. While the Project will have some impacts on the local environment, these impacts have been identified through a number of studies and are being addressed through Project design and by implementing mitigation measures. Initial public and Indigenous consultation has occurred, with all inputs being documented and considered in the development of mitigation plans.