Runway 08/26 RESA Alternatives Study

PortsToronto / Billy Bishop Toronto City Airport

AviaNG.ca

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AVIA • NG
AIRPORT CONSULTANTS

Stephen Denes, Project Lead - RESA
207 Queen's Quay West, Suite 500
Toronto, ON M5J1A7
T: 416-863-2006 | C: 647-209-8816
Email: sdenes@portstoronto.com

RE: Billy Bishop Toronto City Airport
Runway 08/26 RESA Alternatives Study - Final Report Submission
Avia NG Project No. 23-0153

Stephen:

Please find attached our ***Final Report*** that explores a series of runway end safety area alternatives for Runway 08/26 to achieve regulatory compliance in accordance with Canada Gazette ***Regulations Amending the Canadian Aviation Regulations (Parts I, III and VI — RESA): SOR/2021-269.***

This report captures the results of a comprehensive technical review and analysis combined with inputs from the PortsToronto technical advisory team, your Board of Directors and a presentation to the City of Toronto, Transport Canada and PortsToronto Working Group.

Should you have any questions, please do not hesitate to contact the undersigned.

Sincerely,
AVIA NG INC.

Bernhard Schropp P. Eng
Senior Project Director, President

c: File

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0	March 15, 2024	B. Schropp	Draft Final Report for Client Review
1	April 19, 2024	B. Schropp	Final Report

Property and Confidentiality

SIGNATURES	
Prepared by:	**Reviewed by:**
Bernhard Schropp, P. Eng **Project Director** LICENSED PROFESSIONAL ENGINEER B. G. SCHROPP PROVINCE OF ONTARIO **Avia NG Inc.** 23 Albert Street N, Southampton, ON NOH 2L0 O: +1.519.483.3434 x230 C: +1.519.832.0551 www.AviaNG.ca In association with: SHOREPLAN MORRISON HERSHFIELD	**Edward Abreu, M.A.Sc., EIT** **Project Designer, Avia NG Inc.** **Joshua Horst, MAvnMgt, AvMP** **Senior Aviation Planner, Avia NG Inc.**

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1. INTRODUCTION

1.1 BACKGROUND

Billy Bishop Toronto City Airport is located on the northwest end of Centre Island, the largest of a group of islands that form the Toronto Islands, just offshore of Toronto's downtown business and tourism districts. To the east, the airport is bounded by the Inner Harbour, to the west by Lake Ontario, and to the north by the Western Gap, a 120m wide, 700m long waterway that connects the Inner Harbour with Lake Ontario. The airport focuses on its Tripartite Mandate of general aviation, medical transport (Ornge) and scheduled passenger air carrier aircraft, consisting mostly of De Havilland Aircraft of Canada Dash 8-400 (Q400) twin-engine turboprop aircraft. Porter Airlines and Air Canada Jazz are currently the two main air carriers at the airport flying the Q400 which typically carries up to 78 passengers and serves markets up to approx. 500-700 nautical miles including destinations like Thunder Bay and Halifax. The airport is a key driver for Toronto's economy, generating more than $2.1 billion in total economic output and supporting 4,450 jobs, including 2,080 directly associated with the airport's operations.[1]

On January 5, 2022, Transport Canada published updated ***Canadian Aviation Regulations in the Canada Gazette, Part II: SOR/2021-269***[2] that require Canadian, certified aerodromes to extend their current Runway End Safety Areas (RESAs) from the existing 60m to a minimum length of 150m for existing and future runways. This requirement applies to only those runways that serve scheduled air service for the purpose of carrying passengers.

Section 302.600 (1) of the amendment states the following:

> *302.600 (1) The operator of an airport shall ensure that a runway that is used for the take-off or landing of commercial aeroplanes engaged in a scheduled air service for the purpose of carrying passengers has a RESA that meets the requirements of section 302.602 if, according to the statistics referred to in subsection (2) or (3), the total of the number of passengers that are emplaned and the number of passengers that are deplaned at the airport is at least* ***325,000 per year during a period of two consecutive calendar years****, the first period beginning the year in which this section comes into force.*

Section 5 of CARs 302.600 outlines the obligations of the airport operator with respect to implementation of RESA:

> (5) *The operator of an airport shall comply with the requirements of subsection (1)*
>
> *(a)* ***within three years of the day on which the statistics referred to in subsection (2) are published in respect of the last year of a period referred to in subsection (1); or***
>
> *(b) within three years of the day on which the Minister notifies the operator under subsection (4).*

Billy Bishop Toronto City Airport continues to recover from COVID 19 reaching close to 1.7 million passengers in 2022 versus 2.8 million pre-COVID in 2019[3]. Based on these statistics, the airport is on track to reach well over 325,000 annual passengers for two consecutive years by December 31, 2023. Official air passenger statistics will be released by Statistics Canada sometime in the spring or early summer of 2024 after which the three-year RESA compliance requirement will begin with an implementation and commissioning target of mid-2027.

[1] *PortsToronto "2022 Annual Report", May 3, 2023*
[2] *Canada Gazette, https://www.gazette.gc.ca/rp-pr/p2/2022/2022-01-05/html/sor-dors269-eng.html*
[3] *PortsToronto "2022 Annual Report", May 3, 2023*

PortsToronto initiated this ***Runway 08/26 RESA Alternatives Study*** to continue its efforts to understand the impacts of RESA compliance for Runway 08/26. PortsToronto has planned for and anticipated the need for RESA on Runway 08/26 which was captured in the Airport Master Plan ***(Figure 1)*** published in 2018[4].

Runway 08/26 meets the definition of a runway for which RESAs are required since it is *"…engaged in a scheduled air service for the purpose of carrying passengers…"* as defined in the regulatory amendment. The Airport's other Runway 06/24 does not meet this definition and as such does not require RESAs.

Figure 1: RESA Concept 2018 Airport Master Plan

Refer to ***Figure 2*** for a general location of the proposed Runway 08/26 RESA study areas and key local airport and adjacent land use features including the Marine Exclusion Zones (MEZ) off both runway ends

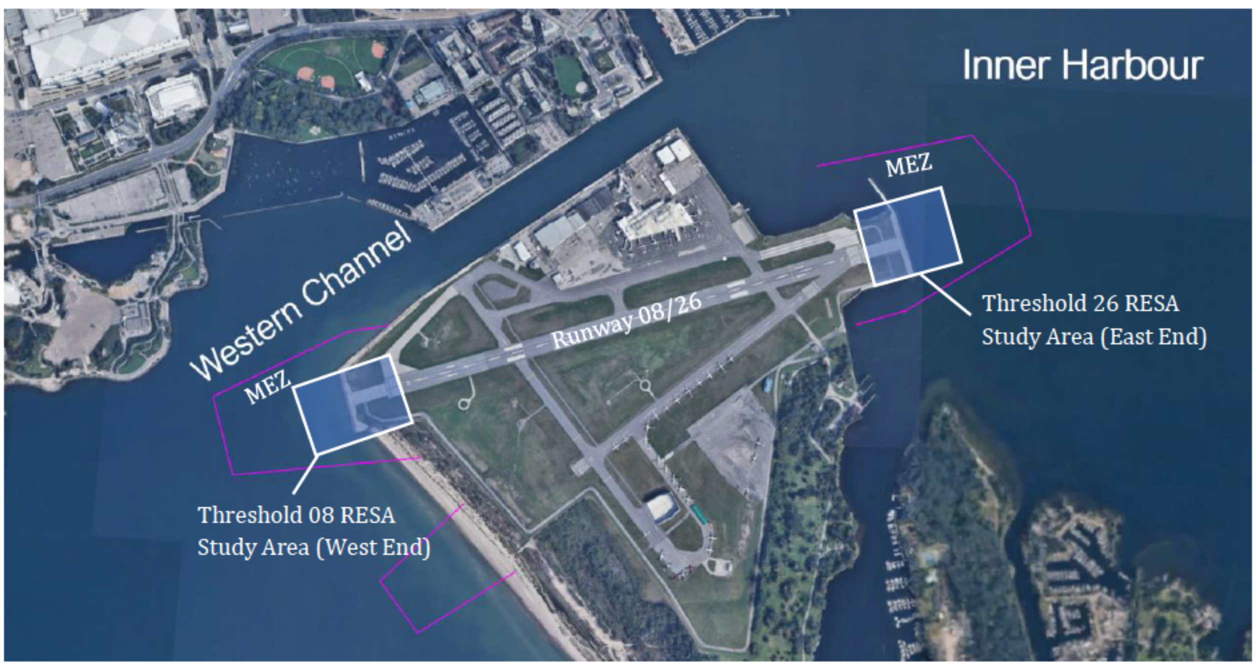

Figure 2: Billy Bishop Toronto City Airport (2024) and RESA Study Areas

[4] *PortsToronto "2018 Airport Master Plan", 2018*

1.2 WHAT IS A RESA?

In accordance with Transport Canada standards, a ***Runway End Safety Area (RESA)*** *"….is to have an area free of objects, other than frangible visual and navigational aids required to be there by function, so as to reduce the severity of damage to an aircraft overrunning or undershooting the runway and to facilitate movement of rescue and fire fighting vehicles."*[5]*.* RESAs are generally located at both ends of a runway which is generally captured by the study areas shown in ***Figure 2*** for the Billy Bishop Toronto City Airport.

Transport Canada has established design standards for open space RESAs which are generally summarized below and apply to this study.

- *has a minimum width twice of the associated runway;*
- *is centred on the runway centreline line or extended runway centreline, as applicable; and*
- *has a minimum length of 150m;.*
- *has no abrupt slope changes or open ditches;*
- *has an adequate slope to prevent the accumulation of water;*
- *beyond the runway strip, has maximum transverse and longitudinal slopes of 5% downwards;*
- *does not protrude into an obstacle limitation surface (OLS); and*
- *under dry conditions, is of sufficient strength to reduce the severity of structural damage to the critical aircraft overrunning/undershooting the runway.*
- *Alternative arresting systems including engineered material arresting systems (EMAS) may be considered acceptable alternatives to open space design.*

1.3 PURPOSE AND LIMITATIONS OF THIS STUDY

The purpose of this study was to explore a series of technical alternatives that would meet Transport Canada standards for Runway End Safety Areas (RESA) for Runway 08/26. The alternatives were assessed considering their respective attributes and constraints using evaluation factors such as complexity of design and implementation, marine navigation, environmental and community impacts, permitting, cost, schedule, impacts during construction, and operational and maintenance practices. The technical outputs from this study were considered indicative and of sufficient accuracy to establish Class D[6] cost estimates and to reasonably capture the principal design details and requirements.

The study considered previous RESA conceptual design studies, the 2018 Airport Master Plan, site reviews, airport staff interviews, NAV CANADA consultations, and access to the airport's technical datasets and libraries. A supplemental topographic survey was completed off both runway ends to establish an accurate base map of existing conditions from which to develop the technical analysis and conceptual design drawings.

Ultimately, this study was intended to guide PortsToronto in their selection of a preferred alternative from which a detailed project definition document (PDD) can be developed. This PDD would guide the next phase of implementation involving further environmental impact studies, community engagement, Tripartite Agreement compliance, scheduling, and preliminary and final design efforts which must all be closely coordinated together.

The RESA alternatives explored as part of the study did not consider runway extensions nor were they intended to have any effect on normal runway operations, runway capacity, or aircraft types using the runway.

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[5] Transport Canada, TP312 5the Edition, Amendment 1, "Aerodrome Standards and Recommended Practices", January 15, 2020

[6] Class D Cost Estimates: Based upon a comprehensive statement of requirements, an outline of potential solutions and/or functional program, this estimate is to provide an indication of the final project cost that will enable ranking to be made for all the options being considered. This cost estimate shall be prepared in elemental analysis format. The level of accuracy of a Class D cost estimate shall be such that no more than a 20% design allowance is required. (Public Services and Procurement Canada)

1.4 TECHNICAL REPORT EXHIBITS

Technical Exhibits 1 to 7 have been consolidated and presented in ***Appendix A*** and show detailed conceptual design layouts of all the alternatives explored in this study. These technical drawings should be reviewed and considered as part of the overall review of this report. The report also presents the alternatives using three-dimensional Google Earth visualizations in various figures which have been produced using the same technical base data from Technical Exhibits.

2. RESA ALTERNATIVES

The RESA alternatives that were evaluated for this study explored several solutions including a non-physical approach to compliance, optimization of existing landmass availability off both runway ends, and new landmass and breakwater expansions to accommodate the physical space required to comply with the RESA requirements. This approach provided a full spectrum of solutions with progressively increasing complexity and overall impact on the physical built environment, costs, environmental and community impact and construction and implementation schedules. Each alternative is presented and evaluated in greater detail in subsequent sections of this report however as an introduction, the alternatives are briefly described below along with their respective design and performance objectives and rationale. It should be noted that all RESA alternatives evaluated comply with Transport Canada standards and that a ***Do Nothing Alternative*** was not considered as implementation of RESA is a mandatory requirement under federal regulation.

2.1 ALTERNATIVE 1: REDUCED DECLARED DISTANCES[7]

This alternative does not involve any physical construction or modifications to existing airfield infrastructure. Transport Canada RESA design standards permit the declaration of parts of an existing runway and graded areas off runway ends as part of a RESA. The term "Virtual RESA" is commonly used to describe this approach. This alternative would involve only changes in published declared runway lengths to accommodate the RESA requirements which in this case would effectively reduce the runway length available for use by flight departments and pilots for regulatory flight planning purposes.

Refer to ***Technical Exhibit 2*** in ***Appendix A*** for a graphical summary of key features.

2.2 ALTERNATIVE 2: RECONFIGURED THRESHOLDS/PRE-THRESHOLD AREAS

This alternative explored ways to introduce the potential for physical modifications to accommodate RESAs off both ends of the runway by using available open space between the existing seawalls and the existing runway ends. Approximately 108m of open space is available off both runway ends which could be potentially used for RESA. The objective of this alternative was to mitigate any expansion of landmass into the lake through reconfiguration of pavements or a combination of reconfigured pavements, open space and the use of the Alternative 1 "Virtual RESA" concept.

Refer to ***Technical Exhibit 3*** in ***Appendix A*** for a graphical summary of key features.

2.3 ALTERNATIVE 3: ENGINEERED MATERIALS ARRESTING SYSTEM (EMAS)

Given the limited landmass off both ends of Runway 08/26, another alternative available to airports under RESA design standards is the use of an ***Engineered Materials Arresting System (EMAS)***. An EMAS installation absorbs the kinetic energy of runway excursion aircraft in less space and time than traditional turf or paved safety areas. The material used for EMAS effectively *"crushes"* under the weight of the excursion aircraft, slowing it down considerably faster than open space. A typical EMAS will bring a runway's critical

[7] "Declared Distance" is an aviation term describing available runway lengths for the purpose of flight planning and aircraft operational performance calculations.

aircraft to a complete stop when it enters the EMAS at a speed of 70 knots or less.[8] Transport Canada design standards permit the use of EMAS where an airport may lack adequate space for traditional open space safety areas.[9].

Refer to ***Technical Exhibit 4*** in ***Appendix A*** for a graphical summary of key features.

2.4 Alternative 4: RESA Minimum Landmass Expansion

This alternative considered that possibility that Alternatives 1 through 3 would not result in a feasible solution using the existing available landmass and airfield facilities. Alternative 4 explored the design of open space RESAs off both runway ends to provide the regulatory minimum 150m RESA length. Given that only 108m of existing landmass and seawall infrastructure exists off both ends, expansion of landmass into Lake Ontario and the Inner Harbour was required. Understanding the potential for environmental and operational impacts of this work during and after construction, this alternative only considered the minimum expansion required to comply with the regulatory RESA requirements.

Refer to ***Technical Exhibit 5*** in ***Appendix A*** for a graphical summary of key features.

2.5 Alternative 5: RESA Plus Partial Safety & Environmental Benefits

This alternative expanded upon Alternative 4 by considering ancillary airfield improvements in conjunction with the RESA work off both runway ends. In this case, improvements to Taxiways B (west end) and Taxiway D (east) are contemplated based on improving operational efficiency and safety at the airport. Refer to ***Figure 3*** which shows the master plan airfield layout and the proposed taxiway enhancement locations.

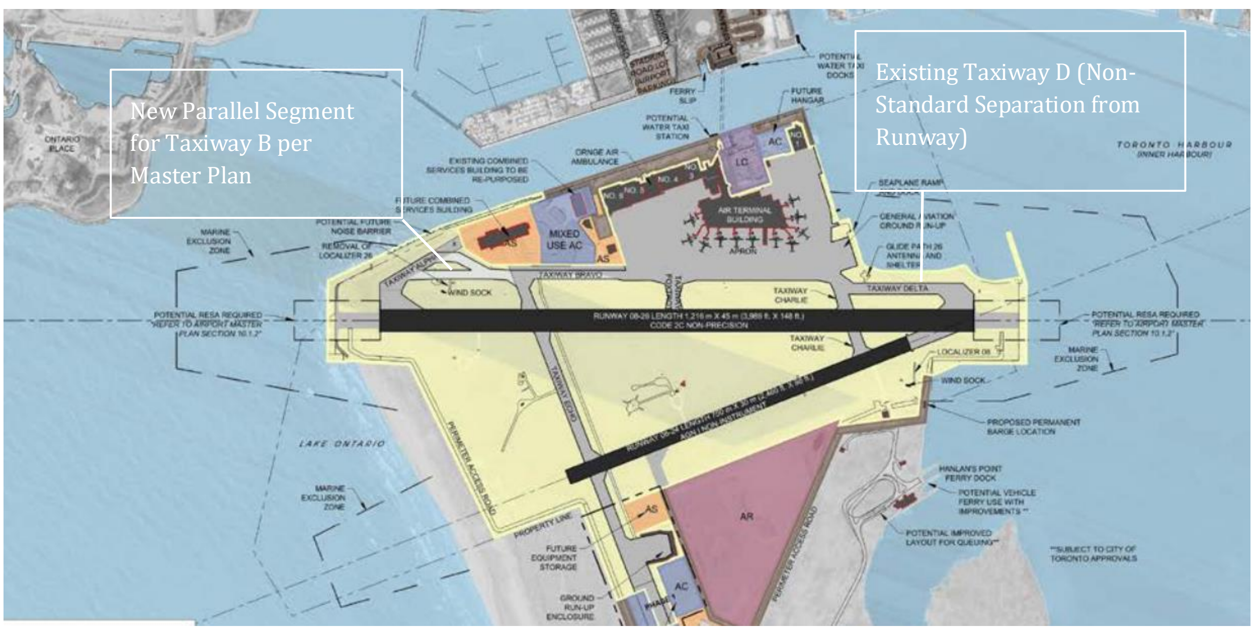

Figure 3: 2018 Airport Master Plan Taxiway B Reconfiguration and Taxiway D

Improvements to the western end Taxiway B parallel taxiway system was contemplated in the 2018 Airport Master Plan which involves about 200m of new taxiway connecting the western Threshold 08 with the main

[8] FAA, Engineered Materials Arresting Systems (EMAS) | Federal Aviation Administration (faa.gov)
[9] Transport Canada, TP312 5th Edition, Amendment 1, "Aerodrome Standards and Recommended Practices", January 15, 2020

apron. This new configuration is possible because of an opportunity to relocate a navigational aid, i.e. Localizer 26, on the runway centreline within the new western RESA landmass to be constructed under this alternative. This new Taxiway B parallel segment would:

- Enhanced efficiency through reduced number of aircraft turns between the apron and Threshold 08.
- Enhanced community benefits through reduced noise (distance from shoreline and orientation of aircraft in a west to east alignment) and reduced taxi times resulting in lower emissions.
- Permit redevelopment of the lands currently required for Taxiway A for airport operational purpose as shown in the 2018 Airport Master Plan and in ***Figure 3*** above including construction of noise barriers to further reduce noise impacts on the community.

The proposed RESA land mass expansion on the east end of the airport on the Inner Harbour side of the airport offers an opportunity to consider a marginal increase to the landmass area along the northeastern limits of the airport to facilitate the relocation of Taxiway D further away from the runway. The existing Taxiway D layout is non-standard and imposes restrictions and unusual aircraft taxi procedures from the apron to the eastern Threshold 26. The existing operational and environmental deficiencies associated with Taxiway D are summarized below, all of which could be rectified through the proposed increase in runway-taxiway separation:

- Under certain weather conditions, aircraft must hold on the main apron until they are cleared for takeoff on Runway 26. This leads to congestion on the apron, delays and increased emissions, as a result of the extra taxi time to the threshold i.e. about 300m.
- The existing hold lines at Taxiway C and D, while compliant with the airport operating certificate, are unusual in that aircraft must cross the hold line as part of their taxi routing to the Threshold 26. Normally aircraft only cross a runway hold line when they are cleared to enter the runway itself. The proposed relocation of Taxiway D would correct this unique arrangement at the airport contributing to improved safety and flight crew familiarity.
- Taxiway D is low-lying and directly adjacent to the shoreline of the Toronto Inner Harbour. The taxiway has been subject to flooding during high water levels that has occurred over the recent years during which emergency flood protection measures had to be implemented. This flooding can significantly impact operations on the Runway 08/26 through the closure of the taxiway. This alternative would enable additional filling and grading to mitigate future flood risks and impacts on airport operational efficiency.
- The increased separation of Taxiway D from the runway will also permit an enhanced visual glide slope indicator (VGSI) system to be installed for Runway 26. Currently this runway end is served by an *"abbreviated"* Precision Approach Path Indicator (APAPI) system comprised of two light units. With the proposed Taxiway D relocation, a more accurate four light unit PAPI could be installed consistent with the system installed for the other end of the runway i.e. Runway 08. This will enhance safety for aircraft approaching from the east by providing more precise approach slope guidance.

Through these additional enhancements, overall airfield efficiency and safety improvements could be realized.

Refer to ***Technical Exhibit 6*** in ***Appendix A*** for a graphical summary of key features.

2.6 ALTERNATIVE 6: RESA PLUS FULL SAFETY, COMMUNITY AND AIRFIELD EFFICIENCY BENEFITS

This alternative expanded upon Alternative 5 by considering incremental enhancements that would further benefit airport safety of operations and offer added community benefits. Like Alternative 5, through incremental landmass expansion new benefits arise that would offer improve airfield safety through unrestricted access via a perimeter airfield road between the north and southsides of the airport without the need to coordinate crossing on an active runway. PortsToronto continues to look for opportunities to reduce the need for Runway 08/26 vehicular runway crossings which supports the Transportation Safety Board of Canada (TSB) Watchlist priority to reduce the risk of runway incursions. It is important to note that current runway crossings are done for both airport operational needs as well as the needs of the residents and businesses located on the Toronto islands for whom crossing the runway is the only means of vehicular access at times.

On the east side of the airport, this airfield perimeter road would be separated by a security fence and a portion of the landmass outside the airport boundary would be allocated for public pedestrian/vehicular access between the north and south ends of the airport. The objective of this concept would be to protect this opportunity for the future implementation as there are still several challenges to be overcome to connect this public right-of-way to both the north and south side of the airport lands. It would however be prudent, if practical, to make provisions in the landmass at this time as part of the RESA to minimize future disruptions to both airport operations and the environment.

This alternative also considered the installation of another noise mitigation wall to shield ground-based noise from aircraft holding and taxing along the new relocated Taxiway D. This noise wall would be similar in size at about 6m in height and effectiveness as the existing noise attenuation wall located at the west end of the airport adjacent to Taxiway A.

Refer to ***Technical Exhibit 7*** in ***Appendix A*** for a graphical summary of key features.

3. DESIGN AND ENVIRONMENTAL CONSIDERATIONS

3.1 AIRPORT DESIGN STANDARDS

Design standards for RESAs were used in the conceptual design of the alternatives as outlined in the following documents:

- *Transport Canada Aerodrome Design Standards per TP312 5th Edition, Amendment 1, January 15, 2020.*
- *Transport Canada Advisory Circular AC 300-007, Engineered Materials Arresting Systems for Aircraft Overruns, Rev 03, Effective Date: 2017-04-24.*
- *Transport Canada Advisory Circular AC 302-015, Runway End Safety Area Bearing Strength Requirements, Rev 1, Effective Date 2013-04-10.*
- *By reference in Transport Canada Advisory AC 300-007, Transport Canada also accepts FAA AC 150/5220-22B Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns for guidance and standards for the planning, design, installation, and maintenance of EMAS.*
- *By reference in FAA AC 150/5220-22B above, additional applicable FAA documents related to EMAS include FAA Order 5200.9-Financial Feasibility and Equivalency of Runway Safety Area.*

3.2 DESIGN AIRCRAFT

The design aircraft for this study was the De Havilland Aircraft of Canada Dash 8-400 (Q400) as shown in ***Figure 4*** with key design parameters outlined in ***Table 1***. In context of this study, a design aircraft is considered the most critical aircraft for purposes of design and planning. The Q400 is defined as the critical design aircraft in the airport's approved Airport Operations Manual (AOM). Furthermore, the Q400 also meets FAA AC 150/5220-22B and FAA Order 5200.9 criteria for the design aircraft for Engineered Material

Arresting System (EMAS) design purposes based on a minimum of 500 annual movements and its weight category which exceeds the minimum of 11,300 kg (25,000 lbs).

Figure 4: Design Aircraft - De Havilland Aircraft of Canada Dash 8-400 (Q400)[10]

Table 1: Design Aircraft Key Planning and Design Parameters

Aircraft	OMGWS (m)	Wingspan (m)	Tail Height (m)	Overall Length (m)	AGN Runway**	MTOW (kg)	Pax Typical Seats	Typical Aircraft Load Rating (ALR)
DHC8-402	9.54	28.42	8.38	32.83	IIIA	29,250	78	6.4

**** Note: AGNs shown for the Q400 are based on those published in the Transport Canada approved Airport Operations Manual.*

The propellers on the Q400 can generate relatively high wind speeds behind the aircraft during takeoff power settings. These wind speeds were modelled and presented in ***Figure 5*** to assess the potential impacts on features that may be considered within or just beyond the proposed RESAs off the runway ends.

Figure 5 depicts the typical position of the aircraft as it begins its takeoff roll at full power settings. Based on ***Figure 5***, the critical wind speeds of 80-160 km/hour remain within the runway environment. Even if these wind speeds projected beyond the runway, all airfield facilities within the RESA are designed for these conditions. As such the Q400 propeller wind speeds were not considered a constraint in the conceptual design and evaluation of the various RESA alternatives.

[10] Dehavilland Aircraft of Canada, https://dehavilland.com/en/media

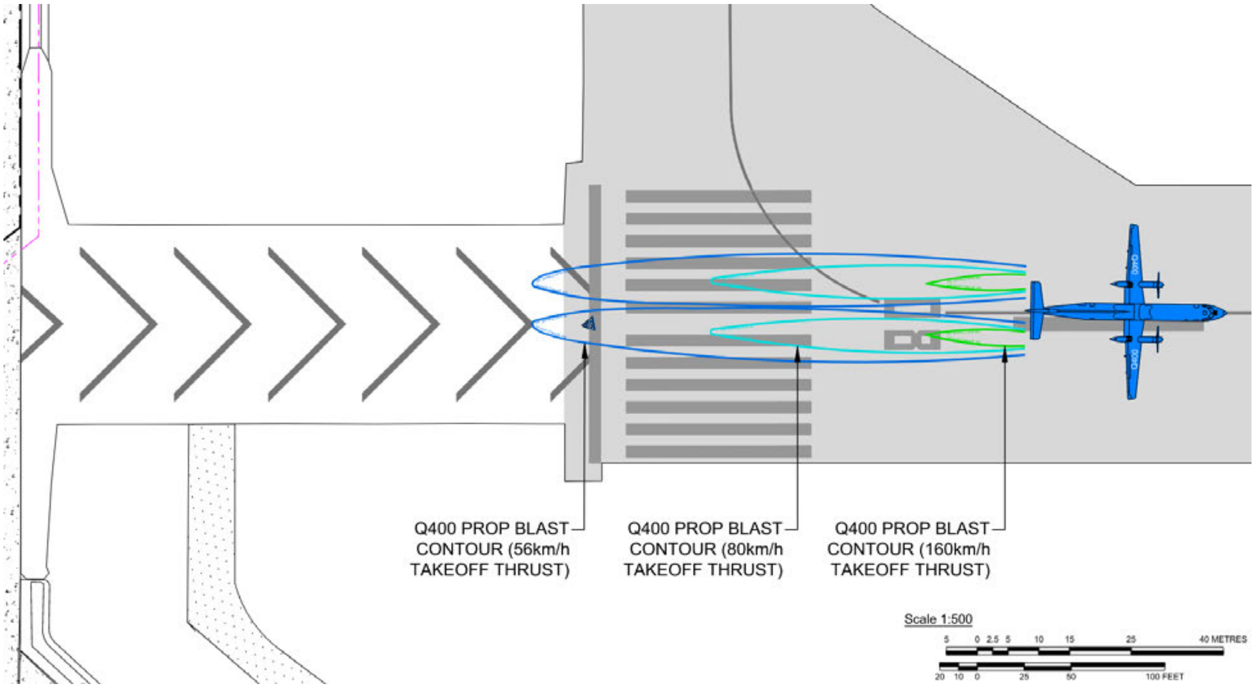

Figure 5: Maximum Propellor(PROP) Wind Speeds during Full Power Takeoff for the Q400

3.3 TRANSPORT CANADA GRANDFATHERING AT AIRPORTS

This study does not propose any change in the level of service for Runway 08/26 or the critical design aircraft. To this end, the runway would be subject to, as applicable, to the grandfathering provisions in accordance with the ***Transport Canada Advisory Circular (AC) No. 302-018 - Grandfathering at Airports Pursuant to Canadian Aviation Regulation (CAR) 302.07, Section 4.1 Level of Service or Critical Aircraft.*** Runway 08/26 will remain certified to TP312 3rd Edition, Code 2C, non-precision instrument standards as documented in the Transport Canada approved Airport Operations Manual and the critical design aircraft will remain the Q400.

3.4 AIRPORT CERTIFICATION AIRSPACE PROTECTION

Runway 08/26 is protected by a series of imaginary surfaces that project along its centreline and off the runway ends. These imaginary surfaces protect the airspace for the safe operation of aircraft during takeoff, landing and emergency operations. These surfaces are described by Transport Canada as Obstacle Limitation Surfaces (OLS), Clearways or Obstacle Protection Surfaces (OPS). The proposed RESA alternatives and all associated new infrastructure respect these existing protection areas and do not introduce changes to their level of protection or geometrics. ***Table 2*** outlines the primary existing obstacle limitation protection surfaces that were considered and their associated dimensions.

Table 2: Airport Operational Obstacle Limitation Surfaces (OLS)[11]

OBSTACLE LIMITATION SURFACES		08	26
Approach Surface	Length of Inner Edge	45m (148 ft.)	45m (148 ft.)
	Distance from Threshold	60m (197 ft.)	60m (197 ft.)
	Divergence	10%	10%
	Length	2,500m (8,202 ft.)	2,500m (8,202 ft.)
	Slope	4.80%	5.42%
Transitional Surface	Slope	14.3% (1:7)	14.3% (1:7)
Outer Surface	Elevation	152m (499 ft.) ASL	152m (499 ft.) ASL
	Dimensions	4,000m (13,123 ft.) from Airport (South of Runway 08/26)	

3.5 MARINE EXCLUSIONS ZONES (MEZ)

Marine Exclusion Zones (MEZs) have been established off the runways into Lake Ontario and the Inner Harbour to protect arriving and departing aircraft at the airport from marine vessels that would otherwise present an unacceptable hazard or risk of collision with aircraft. The MEZ are marked with buoys within which no vessel shall enter for any purpose without authorization of PortsToronto. The MEZs are designed to provide sufficient clearance between aircraft on approach to landing and marine vessels transiting the bay. The proposed RESA alternatives and all associated new infrastructure respect the MEZ protection areas and introduce no changes to the geometry and the level of protection provided by the MEZs.

3.6 NAV CANADA NAVIGATIONAL AIDS AND MARINE RADAR

The airport is served by several electronic air navigational aids, communication, weather reporting and marine radar systems to facility the safe and efficient movement and coordination of air traffic. NAV CANADA is responsible for the provision and operation of these facilities. Any work proposed on the airfield requires close coordination and approvals from NAV CANADA through their Land Use Approvals Program. Discovery and technical consultations were initiated at the beginning of this study with NAV CANADA to inform and seek early technical guidance. Additional consultations and technical guidance and approvals will be required from NAV CANADA as part of the implementation of the final preferred alternative.

Figure 6 captures the primary NAV CANADA facilities that will influence the conceptual and final design of the RESAs. The most significant impact on NAV CANADA facilities will be from the western RESA off Threshold 08 in Lake Ontario.

[11] Source: Billy Bishop Toronto City Airport, "Airport Operations Manual", 2022. Clearway and Obstacle Protections Surfaces (OPS) for PAPI and APAPI not shown here but are not affected by the proposed RESA alternatives.

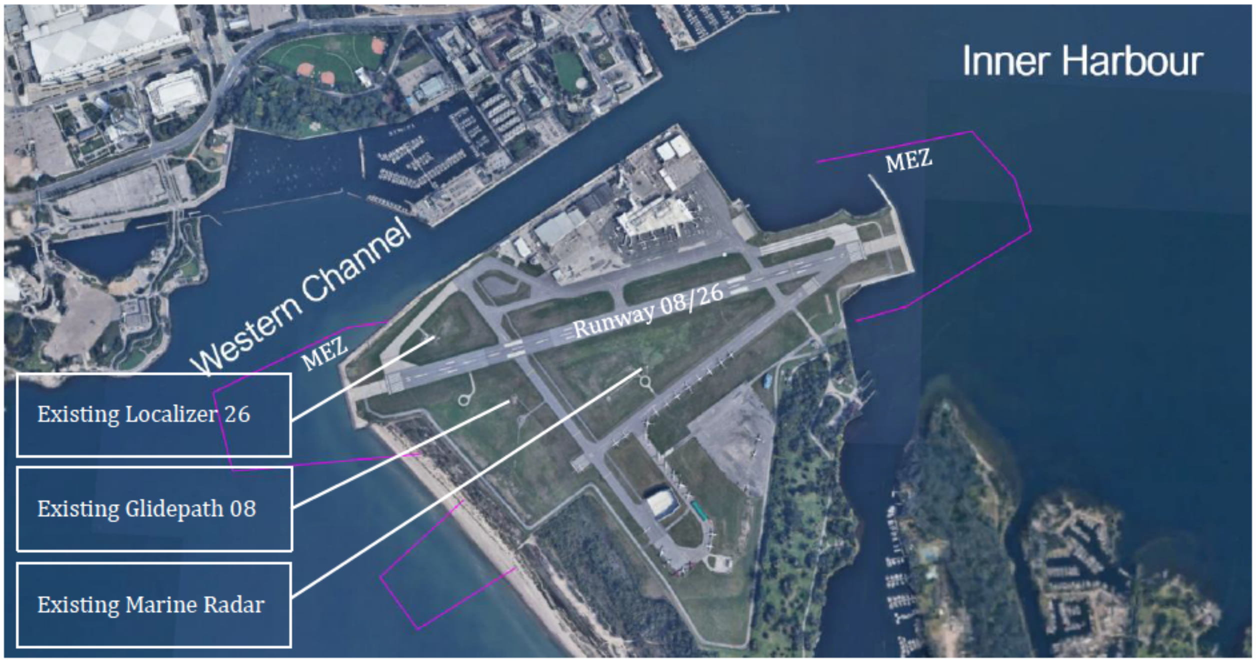

Figure 6: Primary NAV CANADA Facilities Influencing RESA Conceptual Design

Key constraints and opportunities considered in this study based on NAV CANADA technical inputs were:

- The existing Glidepath 08 electronic protection area may be impacted by implementation of a rock breakwater structure associated with RESA construction off the west end depending on its height above the water and shape. NAV CANADA must be engaged as part of future design activities to define acceptable geometry for the breakwater to avoid impacts on the glidepath signals.
- Existing marine radar facilities may require relocation or supplemental antennas depending on the height and shape of any proposed rock breakwater structure associated with the RESA off the west end. The height of the proposed breakwater may affect the radar line of sight and introduce blind spots/shadows west of a new breakwater structure. NAV CANADA must be engaged as part of future design activities to define and develop any marine radar mitigation work.
- The relocation of the Localizer 26 antenna to facilitate a new parallel Taxiway B segment is feasible and could be potentially coordinated to maximize cost and operational efficiency with NAV CANADA's modernization and facility replacement program that is scheduled to begin in 2026. This antenna would be installed in a more conventional location off the runway end and along the runway centerline. The final location would be subject to further review and analysis by NAV CANADA to optimize the approach efficiency and utility.
- If the Localizer 26 is relocated onto the new RESA landmass at the west end, it must be protected from water spray and ice accretion and offer a stable foundation. Refer to **Figure 7** which shows the existing Localizer 26 antenna which is about 2.2m in height. A similar height would be considered for the relocated antenna.
- A preliminary airspace analysis was completed and confirmed that a relocation of the Localizer 26 antenna on the runway centreline would not impact the existing runway utility and preserve the existing minimum descent altitudes and visibility. NAV CANADA will complete an independent analysis to confirm these findings and this input will inform the preliminary and final design phases of the preferred alternative.

Figure 7: Existing Localizer 26 Antenna at West End of Runway 08/26

3.7 COASTAL AND SHORELINE DESIGN CONSIDERATIONS

3.7.1 GENERAL

The coastal conditions that impact the RESA design alternatives include waves, water levels and ice. Wave conditions are dependent upon winds and overwater fetches and water depth. Consideration must also be given to the design's impacts on sediment transport and, to a lesser degree, currents. Shoreline protection structures are typically designed for the 100-year return period wave condition occurring at the 100-year return period water level.

3.7.2 WATER LEVEL

The design water level used while developing the RESA alternatives was 76.2m above International Great Lakes Datum of 1985 (IGLD1985). This is the 100-year instantaneous water level used by the Toronto Region Conservation Authority (TRCA), which is the approving agency for shoreline works along most of Toronto's waterfront. While TRCA does not have jurisdiction on this federal project, using a design water level of 76.2m is consistent with other work completed in this area. This design water level is the result of a combined probability analysis of Lake Ontario mean water levels and wind setup (storm surge) heights at Toronto. It includes an additional 0.07m allowance for the potential impacts associated with the most recent International Joint Commission water level regulation (IJC Plan 2014).

3.7.3 BATHYMETRY

Project bathymetry derived from a 2015 digital field provided by the Canadian Hydrographic Service (CHS) was used to develop the RESA alternatives. ***Figure 8*** shows the lakebed contours in the vicinity of the airport, expressed as metres below chart datum. Chart datum for Lake Ontario is 74.2m IGLD1985. Comparison of the CHS bathymetry to a hydrographic survey completed over a smaller area by PortsToronto showed similar depths and confirmed that the CHS data was sufficient for this study.

Depths offshore of the runway centreline increase more rapidly to the east, within Toronto Harbour, than to the west in open Lake Ontario. ***Figure 9*** shows lakebed profiles extending offshore of the seawalls at the east and west ends of Runway 08/26.

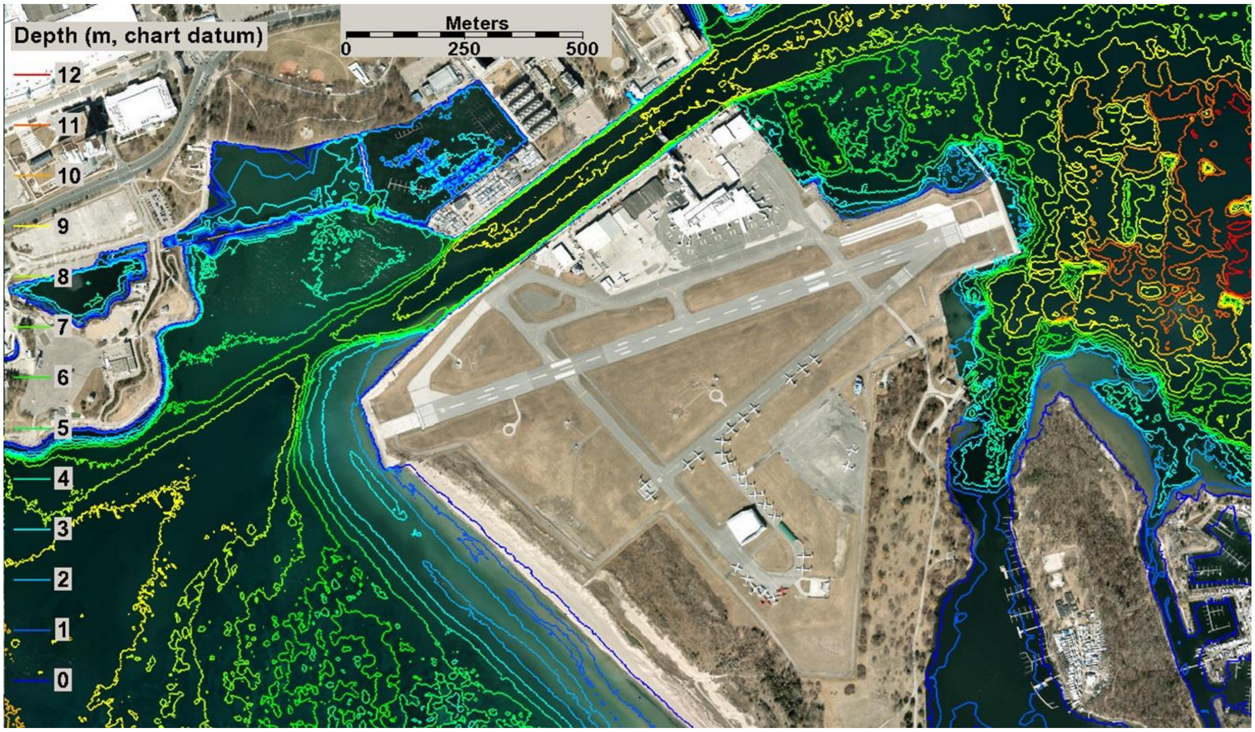

Figure 8: Lakebed 2015 Bathymetry

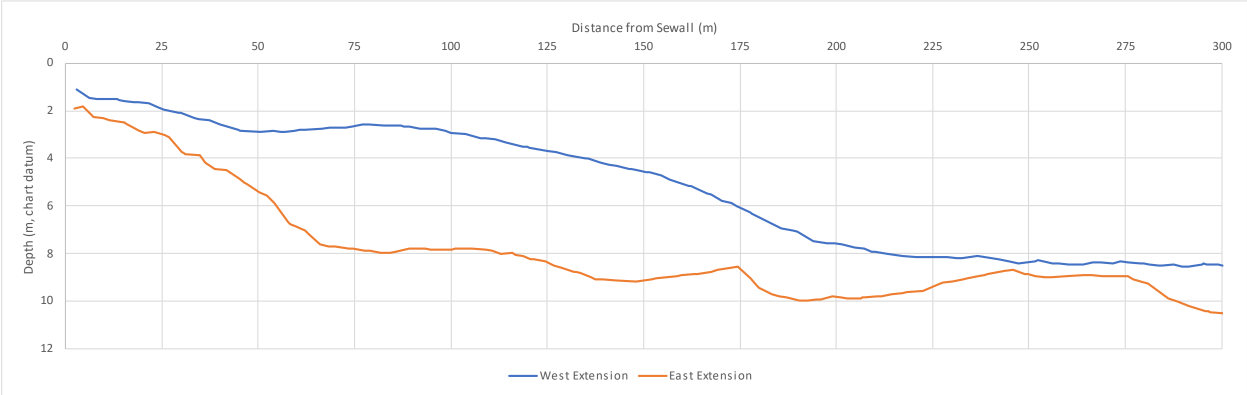

Figure 9: Lakebed 2015 Profiles Offshore of Runway 08/26 Centreline

3.7.4 WAVES

Wind generated waves dominate over ship/boat waves at both ends of Runway 08/26. Wind wave conditions were calculated with the SWAN two-dimensional spectral wave model using 100-year return period winds and lakebed bathymetry discussed in Section 3.7.3. ***Figure 10*** is a wave height contour and vector diagram showing the design wave for the west landmass extension. It has a significant wave height of 3.5m, a peak wave period of 8.3s, and was generated by a 107 kph south-southwest wind. ***Figure 11*** shows the design wave for the east runway extension. It has a significant wave height of 1.2m, a peak wave period of 3.5s, and was generated by a 100 kph east wind.

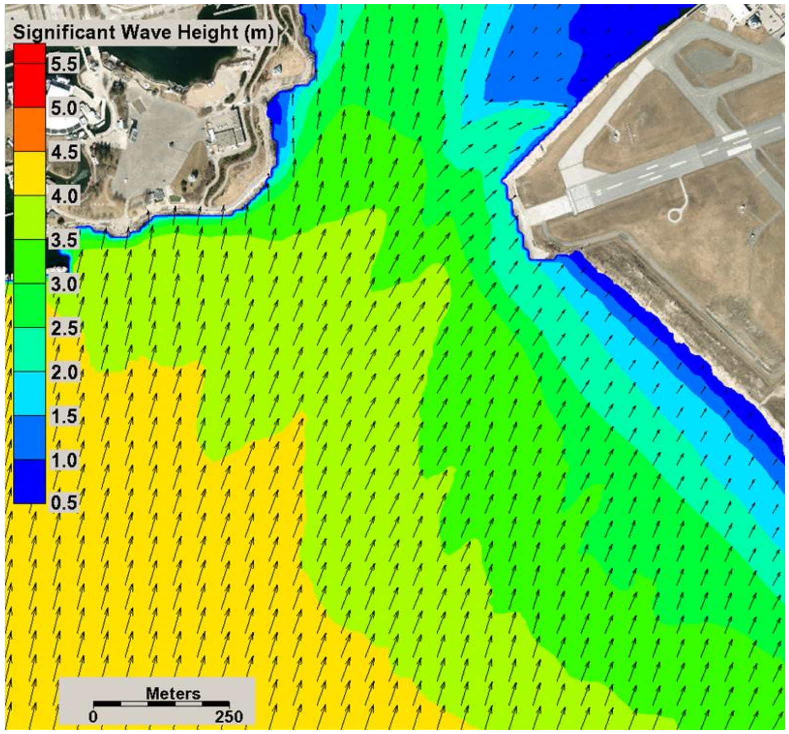

Figure 10: Design Wave Height for West Runway End

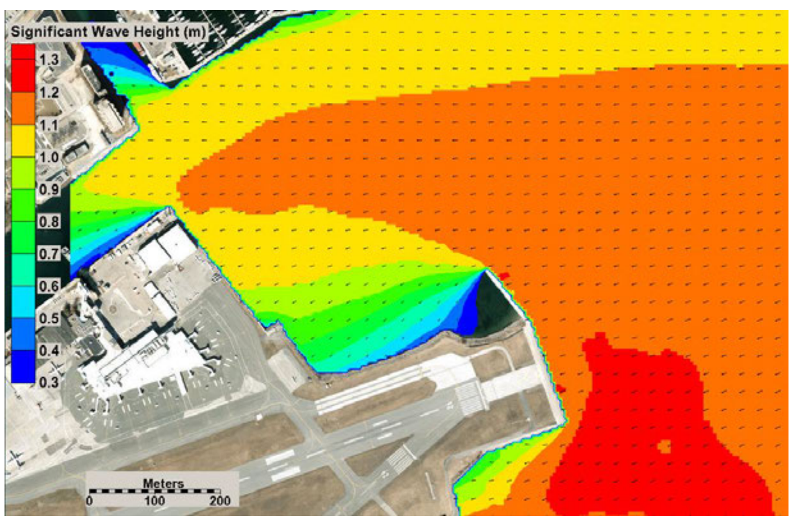

Figure 11: Design Wave Height for East Runway End

3.7.5 ICE

Ice forces acting on the structures are as described in the Canadian Highway Bridge Design Code (CAN/CSA S6-06), which are summarized as:

- dynamic ice forces from moving sheets or floes driven by wind or currents;
- static ice forces due to thermal movement of continuous stationary ice sheets;
- lateral thrust due to arching action resulting from ice dams or ice jams; and

- static or dynamic vertical forces due to the effects of fluctuating water levels or dynamic effects of colliding ice floes.

Ice loads exerted on shoreline structures are directly related to the ice thickness and the ice strength. Design loads are typically required for piled structures, including steel sheet pile walls, but not for sloped revetments. Ice that rides up sloped structures typically bends and breaks without exerting design loads on the revetment, although that process can lead to ice inundation. The mechanisms of ice inundation can be broken into shoving, jamming, pile-up and ride-up, although events typically consist of combinations of these mechanisms. There are no specific calculations that can be carried out to accurately determine a particular site's vulnerability to ice inundation. The potential for ice inundation is site specific and is best assessed using site specific observations.

Ice pileups of 1 to 2m in height have been reported at the steel sheet pile wall on the west end of Runway 08/26. Ice inundation has not been reported for the east end of the runway. Freezing spray can also be an issue for airport operations. Spray has been reported to produce ice up to 0.3m thick extending onto the pre-threshold pavement on the exposed western shore. This is a common annual occurrence.

3.7.6 CURRENTS AND SEDIMENT TRANSPORT

Impacts on both currents and sediment transport will be greater for a landmass than a pile supported deck type extension (pile supported deck type was also considered in the study – see Section 3.9 below). Changes to currents and water circulation from both the east and west extensions could have some impact on water quality. The impacts on sediment transport for the east extension are not likely to be significant and would be subject to further environmental studies. A landmass extension to the west could have some impact on the adjacent sand beach.

Potential changes to current and sediment transport patterns were not a significant concern for the conceptual design phase of this study for any of the RESA alternatives, but the potential impacts of the selected design will have to be considered as part of future preliminary design and the environmental impact reviews.

3.7.7 CLIMATE CHANGE

The impacts of climate change are expected to lead to an increase in storm frequency and intensity, a decrease in ice cover, and greater uncertainty of future water levels. An increase in storm frequency will not have an immediate impact on the design of any shoreline protection structures but could increase future maintenance requirements. Increased storm intensity and a decrease of ice cover can be accounted for with sensitivity analyses during future preliminary and final design.

An increase in design water levels is likely to be the most significant climate change impact for shore protection design, but there is considerable uncertainty about both the likelihood and magnitude of future water level changes. The appropriate response to that uncertainty is to incorporate resiliency measures in the designs so that future modifications, should they become required, can be easily and effectively implemented. An example of this would be designing revetment crests such that additional stone can be easily added to increase crest heights while ensuring that an increase in crest height will not adversely impact airport operations. This study has considered the provision of additional breakwater heights to account for some influence of climate change impacts. Further review of this should be completed as part of future design work.

3.8 SHORELINE PROTECTION ALTERNATIVES – LANDMASS / SHORELINE STRUCTURES

Land extensions on either the west or east ends of the runway will be exposed to wind, wave and ice conditions and must be protected by an engineered structure to ensure long term stability. Currently, Runway 08/26 is approximately 0.3 m above the 100-year flood level. To ensure the RESA/ pre-threshold area is not frequently inundated by water from wave action and ice, the shoreline protection structure needs to be designed to shelter the landmass. In addition, wave spray during storm events should be minimized as much as possible.

Wave inundation can be addressed through several ways, ranging between a high crested structure or low crested wide structure. The structure crest elevation must also consider aeronautical considerations and be as low as possible to ensure safe landing and takeoff operations. Previous seawall enhancement studies included physical modeling offered some detailed insights into optimal breakwater structure heights to control wave and spray actions. This information was used to establish shoreline structure alternatives and design elevations and shapes. Three typical shoreline structures that were considered for this study included:

- Armour stone breakwater/ revetment (see ***Figures 12 and 13***);
- Vertical retaining wall (steel sheet pile wall or combi wall) with concrete parapet wall (see ***Figures 14 and 15*** and
- Pile supported pier with concrete parapet wall (See **Figure 16**)

Several structure heights and widths were considered based on the type of structure considered for the west end of the runway which experiences high wave action. A design crest elevation of 81m ASL[12] was established which considered past studies and adjusted for recent design high water levels.

All options for the east extension were developed for a crest elevation of 77m ASL which corresponds to the crest elevation of other recent shore structure projects in Toronto Harbour.

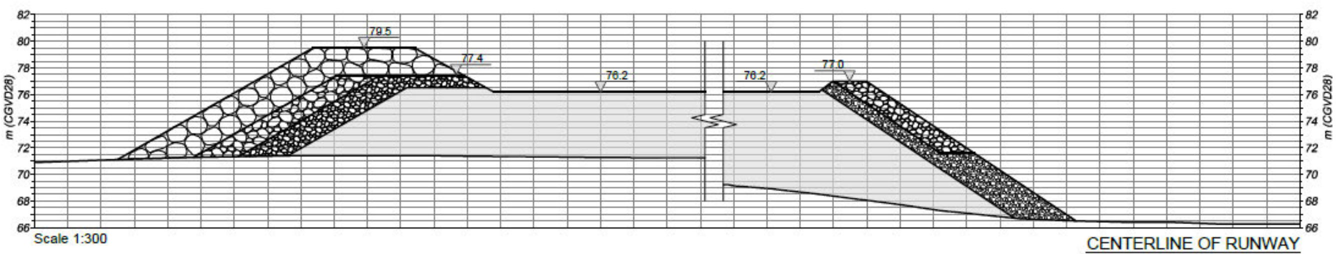

Figure 12: Typical Armour stone Breakwater/Revetment Technical Section

Figure 13: Typical Armour stone Breakwater/Revetment - Jim Tovey Park, Mississauga

12 ASL: Above Sea Level

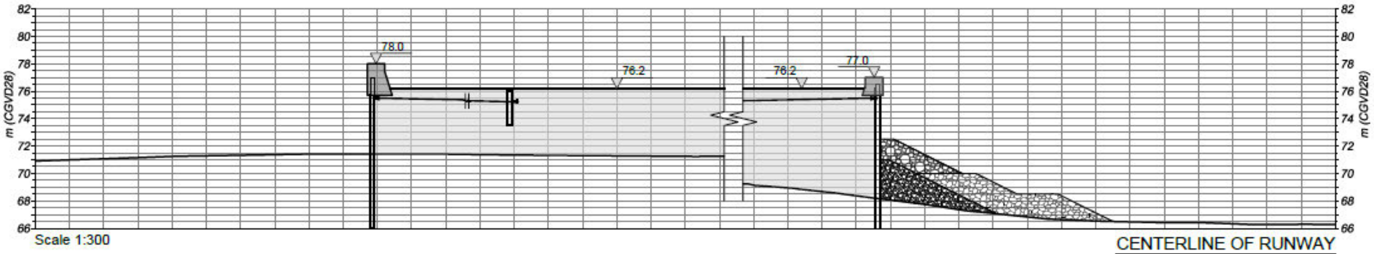

Figure 14: Typical Vertical Retaining Wall (Sheet pile) Technical Section

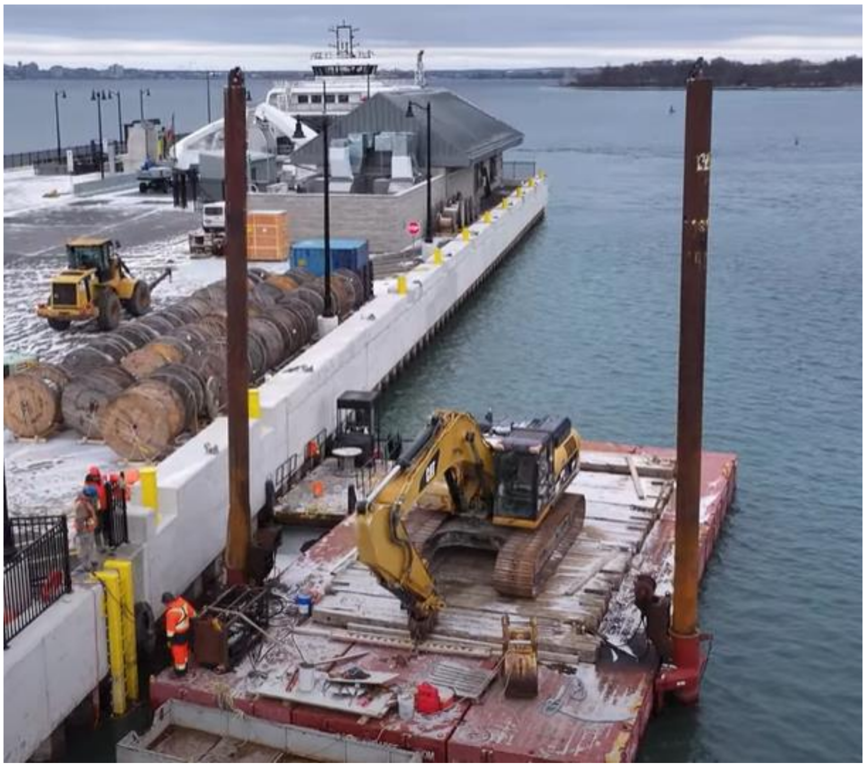

Figure 15: Typical Vertical Retaining Wall (Sheet pile) - Wolfe Island Ferry Terminal, Marysville

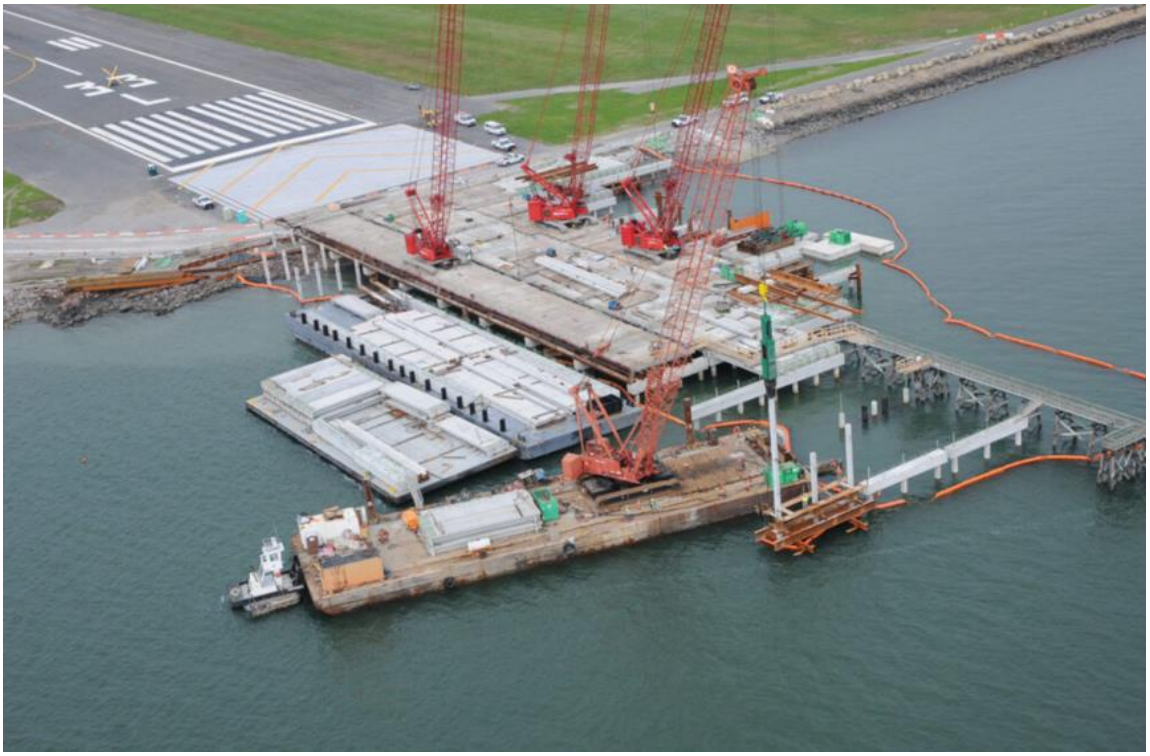

Figure 16: Typical Deck on Piers – Boston Logan International Airport Threshold 33L RESA[13]

3.9 DECK ON PIERS ALTERNATIVE FOR RESA EXPANSION

One of the options considered to support the RESA requirements was a deck on piers. A deck on piers is a structure constructed on piles socketed into bedrock with a steel/concrete substructure supporting a concrete deck. This option was considered to minimize the in-water footprint of the landmass expansion into the lake. This type of construction has been used at other airports including recent RESA projects at the Boston Logan International Airport as shown in ***Figure 16.*** In this case, the overall structure length and width was minimized using EMAS.

This type of structure must be designed to withstand the wave forces and dynamic and static ice loads. Some ice forces can be overcome by providing an ice repression system, but this comes with increased operating costs. This type of pier on deck installation would be exposed to high wave energy on the west side of the runway during storm events. Furthermore, waves will overtop the structure and flood the deck on a regular basis as shown graphically in ***Figure 17.*** RESA design standards do not permit a rise in elevation from the threshold restricting the profile to 0% off the threshold or to a maximum downward slope of 5%. As such, the deck as shown in ***Figure 17*** cannot be raised to mitigate wave overtopping conditions.

Furthermore, it is anticipated that construction costs will be significantly more than the landmass/ breakwater structure option due to the nature of the work. A deck on piers presents construction issues due to the equipment needed to install the piles. The work would be constructed using marine based equipment (cranes on barges). Drilling and grouting equipment would be employed to socket the piles into bedrock. Weather conditions would need to be considered when installing the substructure and deck.

Furthermore, this type of work cannot be mobilized and demobilized on a nightly basis and would require extended closures of the only commercial passenger serving runway at the airport. In the case of the Boston

[13] https://gtrinc.net/single-project/massport-logan-runway-33l-pile-design/

Logan International Airport RESA project as shown in Figure 16, the airport is served be multiple runways which were used during periods of extended runway closures to facility the construction off the threshold of 33L. A similar deck on pier is proposed at Boston for their Runway 27 RESA project which is currently undergoing environmental studies and is programmed for construction in 2026/2027. The budget for this project is the order of C$145-150 million for one runway end using an EMAS RESA on a deck on pier. This project also involves scheduled runway closures to facilitate the construction activities.

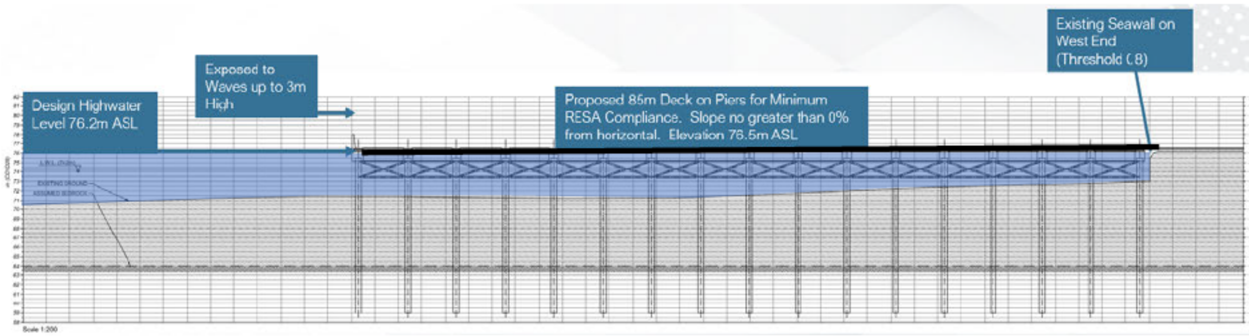

Figure 17: Typical Deck on Piers – Conceptual Design off West End (Lake Ontario)

Finally, these structures require detailed routine inspections over their lifetime. The substructure and piles will need to be inspected with divers working under the deck. Maintenance or repairs may be more expensive if the components are underwater.

Based on the above, the deck on pier option was not considered a practical solution as part of the review of alternatives.

3.10 AIRPORT SAFETY SETBACKS AND WAVE AND ICE ALONG SEAWALLS

Standard operating procedures implemented at the airport prevent routine access by airport maintenance and security personnel and equipment from working within 30m from unprotected seawalls. A review of historical highwater levels revealed that the lake levels breached the seawalls and propagated inland by up to an additional 5metres. The RESA alternative layouts and design concepts considered these site-specific safety provisions for a minimum 35m operational safety setback from existing seawalls.

Figure 18 shows the western seawall in winter conditions on a windy day. These are not unusual conditions and must be considered in the evaluation of the RESA alternatives. As noted earlier, during the winter, ice shelves will build up along the seawall. Wave action along with high winds will generate water spray, which will freeze and result in ice accretion on the seawalls and onto the safety areas off the runways. Historically, ice accretion forms to about 40-60m inwards from the western seawall and to a lesser extent on the eastern seawall where wave heights are mitigated through the protected inner harbour.

Ice accretion (freezing spray) is most pronounced when there is no ice in Lake Ontario, or only a small amount of ice, as this does not dampen any of the incoming wave energy. Waves combined with winds (especially southwest winds), cause spray over the end of the runway, which subsequently freezes. Freezing spray can build up to 150-300mm and cover some of the runway approach lights at times.[14] Airport maintenance staff are responsible to manage this ice within at least 60m off the thresholds to comply with the airport operating certificate. Any ice buildup beyond this is normally left in its natural icy state until it melts naturally in warmer temperatures.

[14] G. Comfort Ice Engineering ltd., "Ice Study". 2015

Ice encroachment on the west end of the runway (Lake Ontario side) was considered a significant design consideration along with the 30-35m airport operational safety setback from the unprotected seawalls.

Figure 18: Water Spray and Ice Buildup on Western Seawall (Threshold 08)

For the east end of the runway (Toronto Harbour side) ice pile-ups and encroachments were not considered a critical design consideration. The Toronto Harbour is a low-energy environment and relatively small (i.e., low impact from wind to move ice). The harbour tends to be fully ice-covered over the winter. This prevents individual ice floes from being moved and accelerated towards shore, which could cause pileups.[15]

3.11 Absorptive Sound Wall

A new sound wall is proposed for the east end of the airport to be considered ancillary to the RESA work off Threshold 26 and the potential Taxiway D relocation option considered under Alternative 6. This PortsToronto design initiative builds on the benefits derived from the existing sound wall installed at the western end which attenuates ground-based noise from aircraft taxiing along Taxiway A. ***Figure 19*** shows the existing western noise wall. The wall is about 6m in height and would need to installed clear of runway and taxiway airspace protection areas on the east end. The final limits and height of this wall would still be subject to more detailed preliminary and final design analysis and acoustic modelling. For this study, sufficient space and height protection was considered in the RESA Alternative 6 layout for this new sound wall.

[15] G. Comfort Ice Engineering ltd., "Ice Study". 2015

Figure 19: Existing Absorptive Sound Wall-West End of Airport

3.12 Preliminary Natural Heritage Assessment and Considerations

3.12.1 General

As part of preparing the RESA Alternatives Study, a preliminary natural heritage assessment was completed to provide initial insights and understanding of existing environmental conditions that would potentially influence the layouts and conceptual designs for the alternatives. It was understood that the project may be subject to further environmental impact assessment review as part of future preliminary and final design. Furthermore, the RESA study established guiding principles which emphasized minimizing environmental impacts and where possible, integration of features that will benefit the community through improved accessibility, reduction in ground-based aircraft noise, emissions, and improvements to the natural environment.

Previous studies and reports obtained through the airport's technical library in conjunction with the following resources informed this preliminary desktop natural heritage assessment:

- *Natural Heritage Information Centre (NHIC)*
    - *Three (3) 1 km x 1 km squares encompassing the study area: 17PJ2831, 17PJ3032, & 17PJ2932*
- *Ontario Breeding Bird Atlas (OBBA)*
- *Ontario Reptile and Amphibian Atlas (ORAA)*
- *Ontario Butterfly Atlas (OBA)*
- *Species at Risk (SAR) bat distribution range from IUCN Red List*
- *Species at Risk Ontario (SARO)*
- *iNaturalist – A citizen science database of wildlife observations*
- *Toronto and Region Conservation Authority (TRCA)*
- *Land Information Ontario (LIO)*
- *Fisheries and Oceans Canada (DFO)*
- *Fish ONLine (MNRF)*

- *Aerial photography*
- *Natural Heritage Existing Conditions Report for the Redevelopment of Ontario Place, Morrison Hershfield, 2022.*
- *Billy Bishop Toronto City Airport EA: Natural Environment Cumulative Net Effects Assessment (AECOM, 2015)*
- *Environmental Study Report (AECOM, 2017)*

3.12.2 DESIGNATED NATURAL AREAS

In general, most of the airport property is well maintained and does not include natural areas. However, a portion of the western shoreline has been retained in its natural state which is included in the property and is immediately adjacent to the proposed project area. The following designated natural areas are present within or adjacent to the airport grounds and are shown on **Figure 20** (where mappable data was available):

TRCA Regulated Areas – Lands adjacent to Lake Ontario, including all of the airport grounds are regulated by TRCA under Ontario Regulation 166/06: Toronto and Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. The entire study area is also included in the Toronto Waterfront Screening Area (lands located in the Central Toronto Waterfront area, which are exempt from regulatory approvals under the Conservation Authorities Act, as specified in TRCA policies).

Toronto Islands Candidate Life Sciences Area of Natural and Scientific Interest (ANSI) – The main body of this candidate ANSI is located south of the airport grounds. However, a portion of the area extends along the western shore into the airport grounds and in close proximity to the proposed project area. The Toronto Islands contain a high diversity of plant species and habitat types that are rare or uncommon in the area (AECOM, 2015).

Figure 20: Environmental Opportunities and Constraints near Billy Bishop Airport

Hanlan's Beach Environmentally Significant Area (ESA) – Hanlan's Beach includes the western shoreline from Gibraltar Point north to the airport runway. The area includes thicketed and open sand dunes as well as beach near the airport. It supports significant flora species and is a notable stopover area for migratory birds (North-South Environmental Inc. et. al, 2012).

Toronto Islands Coastal Wetlands Complex Provincially Significant Wetland (PSW) – This wetland complex includes 34 wetland units on the Toronto Islands and supports a variety of rare or uncommon vegetation communities, plants, and animals. This wetland is not located within the airport grounds but is immediately adjacent to the southwest (North South Environmental inc., 2006)

City of Toronto Natural Heritage System – The majority of the shoreline at the airport is included in Toronto's Natural Heritage System as shown on Map 9 of The City of Toronto's Official Plan.

3.12.3 VEGETATION AND VEGETATION COMMUNITIES

The airport primarily consists of well-maintained lawns, runways, taxiways, aprons and buildings. Areas of vegetation were noted by AECOM on the shoreline at the end of the runways but were too small to be considered vegetation communities from an Ecological Land Classification (ELC; AECOM, 2015) perspective.

The western shoreline, also known as Hanlan's Beach, is partially located within the airport property, immediately adjacent to the west runway, and is part of the Toronto Islands Life Science ANSI and Hanlan's Beach ESA. As indicated by AECOM (2015), this area is represented by two vegetation communities: Mineral Open Beach/Bar (BBO) and Little Bluestem – Switchgrass – Beachgrass open Dune (SDO1-1). SDO1-1 has a subnational conservation rank of S2 (Imperiled), meaning the community is rare in the province and at a high risk of extirpation if habitat is lost (NatureServe Explorer, 2023). Refer to ***Figure 21*** for the locations of vegetation communities.

Figure 21: Ecological land classification for Billy Bishop Airport and the surrounding area

3.12.4 WILDLIFE AND WILDLIFE HABITAT

Birds

The OBBA provided records for 124 bird species within two 10 km x 10 km squares encompassing the study area, including nine SAR. The NHIC reported eight SAR bird species within four 1 km x 1 km squares encompassing the study area. iNaturalist contained verified records for 100 bird species, including six SAR, reported by members of the public within approximately 2 km x 2 km area encompassing the study area.

Between fall 2014 and summer 2015, AECOM (AECOM, 2015) completed seasonal avian surveys to assess bird species presence within 500 m of the proposed runway extensions. These surveys included fall migration, overwintering, spring migration, breeding bird season, and summer Cormorant (Phalacrocoracidae) behaviour. AECOM (2015) recorded 38 species of birds across all surveys within, or in close proximity to, the airport grounds. The majority of bird species observed were waterfowl and shorebirds that were able to utilize the open water and shorelines. AECOM also noted, based on personal comments from the airport Wildlife Control Officer, that occasional congregations of waterfowl such as Canada Geese (*Branta canadensis*) and Mallards (*Anas platyrhynchos*) were present on airport lawns primarily after rain caused the formation of shallow pools. Aerial foragers were common over the grounds. Nests of migratory bird species were observed on the abandoned wooden terminal building on the southeast side of the airport.

Based on a review of background information including information provided by AECOM, bird habitat within the airport grounds is quite limited. Buildings on the property may provide nesting opportunities for some species of birds. There are few natural areas that provide suitable breeding habitat for birds. Vegetation around the shorelines and on Hanlan's Point Beach may provide limited nesting habitat based on habitat characteristics of birds recorded within the area. Open water around the airport provides waterfowl stopover and staging habitat (refer to Section 3.3.5).

Herpetofauna

The ORAA provided records for 30 species of herpetofauna (amphibians and reptiles) within two 10 km x 10 km squares encompassing the study area, including seven SAR. The NHIC reported three species of reptiles within the four 1 km x 1 km squares encompassing the study area. iNaturalist contained verified records (photos verified by community) for 6 herpetofauna species, including two SAR, reported by members of the public within approximately 2 km x 2 km area encompassing the study area.

AECOM noted that no herpetofauna species have been observed by Wildlife Control Officers at the airport, however, it is possible that due to their size, these species go undetected.

The Toronto Islands as a whole support good diversity of herpetofauna. However, habitat for these species is very limited within the airport grounds. Hanlan's Point Beach is likely the only location with potential to provide suitable habitat due to naturalized area and lack of maintenance.

Insects

The OBA provided records for 99 species of butterflies within two 10 km x 10 km squares encompassing the study area, including one SAR. The NHIC reported one species of insect, American Burying Beetle, within four 1 km x 1 km squares encompassing the study area; however, this species is extirpated and no longer present in Ontario. AECOM noted that no butterflies or other insect species have been documented within the airport grounds although these are not typically recorded by Wildlife Control Officers. Following review of information provided by AECOM, no significant species have been recorded on the property.

Mammals

Four SAR bat species are known to have ranges that extend into this region, including Little Brown Myotis (*Myotis lucifugus*), Eastern Small-footed Myotis (*Myotis leibii*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*). iNaturalist contained verified records for five mammal species reported by members of the public within approximately 2 km x 2 km area encompassing the study area. AECOM noted that a variety of mammal species have been observed within or in close proximity to the airport grounds including Coyote (*Canis latrans*), Raccoon (*Procyon lotor*), American Mink (*Neogale vison*), and other species more infrequently.

Mammals encountered within the airport grounds are likely incidental encounters as mammals tend to move larger distances than other wildlife. The airport grounds do not provide specialized habitat for most mammal species as the grounds are regularly maintained.

Significant Wildlife Habitat

Significant wildlife habitat (SWH) is an area that is "ecologically important in terms of features, functions, representation or amount, and contributes to the quality and diversity of an identifiable geographic area or natural heritage system" (MNRF, 2010). AECOM identified four SWH within or in close proximity to the airport grounds:

Waterfowl Stopover and Staging Area (Aquatic) – The open water of Toronto Harbour and Lake Ontario at the airport is confirmed SWH habitat. Waterfowl overwinter in large concentrations and in close proximity to the property.

Migratory Butterfly Stopover Area – Hanlan's Point Beach and the Toronto Islands provide migratory butterfly stopover habitat. Monarchs (*Danaus plexippus*), among other species, are known to use these sites during migration and roost in trees overnight along the lakeshore. With regards to Hanlan's Point Beach, it is expected that this habitat is present outside of airport grounds (south) as there are limited trees present within the airport grounds.

Rare Vegetation Community: Little Bluestem – Switchgrass - Beachgrass Open Dune (SDO1-1) – This community is considered rare within the province and has a subnational conservation rank of S2 (MNRF, 2000). This community is present along the north portion of Hanlan's Point Beach and contains several uncommon or rare species.

Habitat for Species of Conservation Concern – Species of conservation concern (SOCC) include species of special concern (under the Endangered Species Act (ESA), 2007) and provincially rare species (S1-S3). SOCC have been documented at Hanlan's Point Beach, and in open water areas. Therefore, these areas are considered SWH for SOCC.

3.12.5 AQUATIC HABITAT

Based on background data review, fish habitat within Lake Ontario at the location of the site is largely characterized by the effects of anthropogenic alteration. Existing habitat has been altered throughout the site over decades of changes to the areas surrounding the airport (e.g., Toronto Harbour and Ontario Place) as well as to the Toronto Islands themselves since the opening of the airport in 1939.

Despite the altered condition of the area, Lake Ontario at the Billy Bishop Toronto City Airport is classified as having a coldwater thermal regime and supports numerous resident and migratory fish species. According to background sources, LIO, NHIC and TRCA survey records, American Eel (*Anguilla rostrata*) are present within the area of interest for each of the eastern and western RESAs. American Eel are listed as threatened by COSEWIC and endangered provincially under the provincial Endangered Species Act. According to DFO, Shortnose Cisco (*Coregonus reighardi*) is also found within Lake Ontario. Shortnose Cisco is listed as endangered both federally and provincially, with the latest observation of the species identified in Lake Ontario occurring in 1964. A complete list of fish species that have been recorded within the study area through multiple background sources can be found in ***Table 3***.

Field surveys were conducted by AECOM in 2015 within the study area which coincide with the Marine Exclusion Zone (MEZ), an area along each RESA which extends out into Lake Ontario. The field studies were conducted in order to determine the quality of fish habitat present. The following summarizes their findings.

- The substrate off the eastern runway was comprised of mainly sand, with some silty areas. Aquatic macrophytes such as Coontail (*Ceratophyllum demersum*), Canada Waterweed (*Elodea canadensis*), and invasive Eurasian Milfoil (*Myriophyllum spicatum*) were identified and were present in substantial numbers. AECOM concluded that fish habitat off the eastern runway was 'moderate' quality due to the amount of cover present. The substrate off the western runway was similar to that seen to the east; however, there was a substantial lack of aquatic macrophytes. The fish habitat quality off the western runway was determined to be 'low to moderate' due to this lack of cover. AECOM noted that lack of significant habitat features in and around the western MEZ made it more likely that fish would exclusively use this area as a migratory corridor.
- The eastern and western ends of the runway occupy two different characterizations of open water habitat, Marina Basin Habitat and Open Water Habitat, respectively. Marina Basin Habitat is habitat that is shallow (on average 6 m deep) with some wind and wave protection and typically a high level of boat traffic. Open Water Habitat is habitat that has no protection from wind and wave action. The wind and wave protection around the eastern MEZ helps to keep the water clear and relatively still, which allows aquatic vegetation to sustain yearly growth. Comparatively, the absence of any form of wave break in an open water habitat may result in higher turbidity levels as sediment may become displaced during periods of high winds and waves. This would account for the absence of vegetation exhibited by AECOM in 2015 within the western MEZ, as the constant agitation at such shallow depths would inhibit the establishment of most aquatic macrophytes.

Table 3: Fish Species Present within the Study Area

Fish Species	Scientific Names	TRCA Waterfront Electrofishing (2002-2018)	LIO (Lake Ontario)	Fish ON-Line
Alewife	*Alosa pseudoharengus*	X	X	
American Eel	*Anguilla rostrata*	X	X	
Atlantic Salmon	*Salmo salar*		X	
Black Crappie	*Pomoxis nigromaculatus*		X	X
Blacknose Dace	*Rhinichthys atratulus*	X	X	
Blacknose Shiner	*Notropis heterolepis*		X	
Bluegill	*Lepomis macrochirus*	X	X	X
Bluntnose Minnow	*Pimephales notatus*	X	X	
Bowfin	*Amia calva*	X	X	X
Brook Stickleback	*Culaea inconstans*	X	X	
Brook Trout	*Salvelinus fontinalis*		X	X
Brown Bullhead	*Ameiurus nebulosis*	X	X	X
Brown Trout	*Salmo trutta*	X	X	X

Fish Species	Scientific Names	TRCA Waterfront Electrofishing (2002-2018)	LIO (Lake Ontario)	Fish ON-Line
Central Mudminnow	*Umbra limi*		X	
Central Stoneroller	*Campostoma anomalum*		X	
Channel Catfish	*Ictalurus punctatus*		X	X
Chinook Salmon	*Oncorhynchus tshawytscha*		X	
Coho Salmon	*Oncorhynchus kisutch*		X	X
Common Carp	*Cyprinus carpio*	X	X	X
Creek Chub	*Semotilus atromaculatus*		X	
Common Shiner	*Luxilus cornutus*	X	X	
Emerald Shiner	*Notropis atherinoides*	X	X	
Fathead Minnow	*Pimephales promelas*		X	
Freshwater Drum	*Aplodinotus grunniens*	X	X	X
Gizzard Shad	*Dorosoma cepedianum*	X	X	
Golden Shiner	*Notemigonus crysoleucas*	X	X	
Goldfish	*Carassius auratus*	X	X	
Green Sunfish	*Lepomis cyanellus*	X		
Johnny Darter	*Etheostoma nigrum*		X	
Lake Chub	*Couesius plumbeus*		X	
Lake Trout	*Salvelinus namaycush*		X	X
Lake Whitefish	*Coregonus clupeaformis*		X	X
Largemouth Bass	*Micropterus salmoides*	X	X	X
Logperch	*Percina caprodes*		X	
Longnose Dace	*Rhinichthys cataractae*		X	
Longnose Gar	*Lepisosteus osseus*		X	
Longnose Sucker	*Catostomus catostomus*		X	
Mimic Shiner	*Notropis volucellus*		X	
Mottled Sculpin	*Cottus bairdii*		X	
Muskellunge	*Esox masquinongy*		X	X
Northern Pearl Dace	*Margariscus nachtriebi*		X	
Northern Pike	*Esox lucius*	X	X	X
Pumpkinseed	*Lepomis gibbosus*	X	X	X
Rainbow Smelt	*Osmerus mordax*		X	X
Rainbow Trout	*Oncorhynchus mykiss*	X	X	X
River Chub	*Nocomis micropogon*		X	
Rock Bass	*Ambloplites rupestris*	X	X	X

Fish Species	Scientific Names	TRCA Waterfront Electrofishing (2002-2018)	LIO (Lake Ontario)	Fish ON-Line
Round Goby	*Neogobius melanostomus*	X	X	
Round Whitefish	*Prosopium cylindraceum*		X	X
Sea Lamprey	*Petromyzon marinus*		X	
Shorthead Redhorse	*Moxostoma macrolepidotum*		X	
Slimy Sculpin	*Cottus cognatus*		X	
Smallmouth Bass	*Micropterus dolomieu*	X	X	X
Spotfin Shiner	*Cyprinella spiloptera*		X	
Spottail Shiner	*Notropis hudsonius*		X	
Tessellated Darter	*Etheostoma olmstedi*		X	
Threespine Stickleback	*Gasterosteus aculeatus*	X	X	
Trout-Perch	*Percopsis omiscomaycus*		X	
Walleye	*Sander vitreus*	X	X	X
White Bass	*Morone chrysops*		X	X
White Perch	*Morone americana*		X	X
White Sucker	*Catostomus commersonii*	X	X	X
Yellow Perch	*Perca flavescens*	X	X	X

3.12.6 Species at Risk

Ontario's Endangered Species Act, 2007, provides protection for species and their habitat listed as endangered or threatened on the Ontario Species at Risk List. The Ontario Species at Risk List also identifies species of special concern, defined as wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats. Species of special concern and their habitats are not protected under the ESA. Based on a review of background information, 29 SAR have been recorded in the vicinity of the airport (within 1 to 10 km). In consideration of the background information, known site conditions, and the known habitat preferences for these SAR, it was determined that preferred habitat is extremely limited on site, yet there is potential for nine SAR to occur within the Study Area. ***Table 4*** provides a list of SAR records within the Study Area.

Table 4: Summary of Species at Risk Records in the Study Area

Species Group	Common Name	Scientific Name	ESA 2007 Status	Source	Potential to Occur in Study Area
Birds	Bank Swallow	*Riparia riparia*	Threatened	OBBA, AECOM	Yes, Foraging
Birds	Barn Swallow	*Hirundo rustica*	Special Concern	OBBA, NHIC, iNaturalist, AECOM	Yes

Species Group	Common Name	Scientific Name	ESA 2007 Status	Source	Potential to Occur in Study Area
Birds	Bobolink	*Dolichonyx oryzivorus*	Threatened	OBBA, iNaturalist	No
Birds	Chimney Swift	*Chaetura pelagica*	Threatened	OBBA, AECOM	Yes, Foraging
Birds	Common Nighthawk	*Chordeiles minor*	Special Concern	OBBA, NHIC	No
Birds	Eastern Meadowlark	*Sturnella magna*	Threatened	OBBA, NHIC	No
Birds	Eastern Wood-pewee	*Contopus virens*	Special Concern	OBBA, iNaturalist	No
Birds	Least Bittern	*Ixobrychus exilis*	Threatened	NHIC	No
Birds	Peregrine Falcon	*Falco peregrinus*	Special Concern	iNaturalist	Yes, Hunting
Birds	Piping Plover	*Charadrius melodus*	Endangered	NHIC	Yes
Birds	Red-headed Woodpecker	*Melanerpes erythrocephalus*	Endangered	OBBA, NHIC	No
Birds	Wood Thrush	*Hylocichla mustelina*	Special Concern	OBBA, NHIC	No
Fish	American Eel	*Anguilla rostrata*	Endangered	NHIC, LIO, TRCA	Yes
Fish	Shortnose Cisco	*Coregonus reighardi*	Endangered	DFO	No
Herpetofauna	Blanding's Turtle	*Emydoidea blandingii*	Threatened	ORAA, iNaturalist	No
Herpetofauna	Eastern Hog-nosed Snake	*Heterodon platirhinos*	Threatened	ORAA	No
Herpetofauna	Eastern Musk Turtle	*Sternotherus odoratus*	Special Concern	ORAA	No
Herpetofauna	Eastern Ribbonsnake	*Thamnophis sauritus*	Special Concern	ORAA	No
Herpetofauna	Northern Map Turtle	*Graptemys geographica*	Special Concern	NHIC, iNaturalist	Yes
Herpetofauna	Queensnake	*Regina septemvittata*	Endangered	ORAA, NHIC	No
Herpetofauna	Snapping Turtle	*Chlydra serpentina*	Special Concern	ORAA, NHIC	No
Insects	American Burying Beetle	*Nicrophorus americanus*	Extirpated	NHIC	No

Species Group	Common Name	Scientific Name	ESA 2007 Status	Source	Potential to Occur in Study Area
Insects	Karner Blue	*Plebejus samuelis*	Extirpated	OBA	No
Insects	Monarch	*Danaus plexippus*	Special Concern	OBA	Yes
Insects	Mottled Duskywing	*Erynnis martialis*	Endangered	OBA	No
Mammals	Eastern Small-footed Myotis	*Myotis leibii*	Endangered	IUCN Red List	No
Mammals	Little Brown Myotis	*Myotis lucifugus*	Endangered	IUCN Red List	No
Mammals	Northern Myotis	*Myotis septentrionalis*	Endangered	IUCN Red List	No
Mammals	Tri-coloured Bat	*Perimyotis subflavus*	Endangered	IUCN Red List	No

Aquatic Species at Risk

American Eels are listed as threatened by COSEWIC, however not afforded protection by the Species at Risk Act (SARA) federally as it is not listed under Schedule 1. They are listed as endangered and afforded protection under the provincial Endangered Species Act. The species has also been recorded within the vicinity of the study area by TRCA waterfront sampling. American Eels are benthic but are known to prefer areas with abundant cover. Typically, they will inhabit areas with a combination of vegetation, rock piles and woody debris that can offer them cover during the day.

Shortnose Cisco is listed as endangered under SARA and the ESA and is afforded protection under each Act. While the Shortnose Cisco is historically present in Lake Ontario, they rely on deep water (22 to 92 m) to feed among all other life processes.

Birds

Bank Swallows are listed as threatened under the ESA 2007. "Bank Swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable. They breed in colonies ranging from several to a few thousand pairs" (MECP, 2023). Suitable foraging habitat is available throughout the study area. However, no suitable nesting areas such as exposed embankments are available. Bank Swallows were observed by AECOM in 2015 foraging over the airport grounds.

Barn Swallows are listed as special concern under the ESA 2007. "Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood since the mud does not adhere as well to smooth surfaces" (MECP, 2023). Suitable foraging habitat is available throughout the study area. Buildings within the study area may provide suitable surfaces for nest-building. In 2015, AECOM observed this species foraging over the airport grounds. AECOM also observed recently built nests on the abandoned wooden terminal building on the southeast end of the property.

Chimney Swifts are listed as threatened under the ESA 2007. “Chimney Swifts are commonly found in urban areas near buildings, and nest and roost in chimneys and other manmade structures. Before European settlement, Chimney Swifts primarily nested on cave walls and in hollow trees and tree cavities in old growth forests. They are highly gregarious and tend to feed over open water where insects congregate” (MECP, 2023). Suitable foraging habitat is available throughout the study area. However, no suitable nesting areas are expected within the airport grounds based on the habitat characteristics documented within AECOM’s 2015 report. Bank Swallows were observed by AECOM in 2015 foraging over the airport grounds.

Peregrine Falcons are listed as special concern under the ESA 2007. “Peregrine Falcons usually nest on tall, steep cliff ledges close to large bodies of water. Some of these birds have adapted well to city life. Urban Peregrines raise their young on ledges of tall buildings, even in busy downtown areas. Cities offer Peregrines a good year-round supply of pigeons and starlings to feed on” (MECP, 2023). Given the congregations of birds that are possible on site (aerial foragers) or in the water (waterfowl), there are opportunities for this species to hunt birds within the study area. Suitable nesting habitat, however, does not exist within the study area. In 2015, AECOM observed a Peregrine Falcon hunting within and nearby the airport grounds.

Piping Plovers are listed as endangered under the ESA 2007. “Piping Plovers nest exclusively on dry sandy or gravelly beaches just above the reach of high water and waves. When not migrating, this bird spends virtually all of its time between the water’s edge and the back of the beach. It pecks the sand and searches small pools of water for food - mostly insects and small crustaceans” (MECP, 2023). Hanlan's Point Beach provides suitable nesting and foraging habitat for this species. The north end of the beach extends into the airport grounds. Piping Plovers have previously nested on Hanlan’s Point Beach, part of which extends into the airport grounds. While nesting activities appear to have been somewhat infrequent at this location based on the available data, the species has recorded at the beach annually in recent years (eBird, 2023).

Herpetofauna

Northern Map Turtles are listed as special concern under the ESA 2007. “The Northern Map Turtle inhabits rivers and lakeshores where it basks on emergent rocks and fallen trees throughout the spring and summer. In winter, the turtles hibernate on the bottom of deep, slow-moving sections of river. They require high-quality water that supports the female’s mollusc prey. Their habitat must contain suitable basking sites, such as rocks and deadheads, with an unobstructed view from which a turtle can drop immediately into the water if startled” (MECP, 2023). Lake Ontario and Toronto Harbour provide potential habitat for Northern Map Turtles. This species may occur along shorelines while basking.

Insects

Monarchs are listed as special concern under the ESA 2007. “Monarchs use three different types of habitats throughout their life cycle. Monarch caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows. Adult butterflies can be found in more diverse habitats where they feed on the nectar from a variety of wildflowers. During late summer and fall, groups of Monarchs numbering in the thousands, can be seen along the north shores of Lake Ontario and Lake Erie migrating to central Mexico where they spend the winter months” (MECP, 2023). There is limited potential nectaring habitat for this species around the shoreline of the airport. Hanlan's Point Beach provides known stopover habitat for Monarch.

4. EVALUATION OF ALTERNATIVES

4.1 GUIDING PRINCIPLES

As part of developing and ultimately evaluating the various alternatives, the following guiding principles were established for this study:

- All alternatives must comply with Transport Canada TP312 design standards for new infrastructure including RESAs and taxiways and, applicable grandfathering provisions related to Runway 08/26.
- Regulation should not be prioritized over airfield utility and efficiency. To this end, the existing operating conditions of Runway 08/26 should be preserved, and no changes introduced related to:
  - *Declared runway distances.*
  - *Length of runway.*
  - *Level of service.*
  - *Instrument approaches.*
  - *Visual or navigational aids.*
- No runway closures to accommodate construction outside of the hours 11:00 pm- 6:45 am.
- Minimize impacts on marine navigation
  - *No changes to the Marine Exclusion Zone (MEZ)*
- Minimize impacts on marine environment
  - *Reduce amount of work in water i.e., landmass/breakwater*
- *Minimize impacts on the environment*
  - *The project will be subject to an environmental assessment (specifics to be determined)*
- NAV CANADA Facilities / Airspace Compatibility
  - *Mitigate Impacts and Land Use Approval / Coordination (ongoing)*
- Ancillary objectives to improve airport operational environment and community impacts
  - *Reduce need for Runway 08/26 vehicular runway crossings (safety) which supports the Transportation Safety Board of Canada (TSB) Watchlist priority to reduce the risk of runway incursions.*
  - *Reduce taxi times (environmental/community/operational efficiency)*
  - *Mitigate aircraft ground level noise (community)*
  - *Improve aircraft visual slope guidance for Runway 26 (safety)*
  - *Reduce the potential for significant change in airport maintenance or operational practices (minimize change management)*

Refer to ***Section 2.0*** for the detailed descriptions of all alternatives evaluated. The focus of the following sections was to provide a summary of key technical features of each of the RESA alternatives along with a summary of their significant attributes and constraints. ***Attributes*** were considered positive outcomes and features, whereas ***Constraints*** were considered negative outcomes or features, including aspects of the alternatives that are not sufficiently defined at this point that may cast some doubt on the feasibility or ability to meet the guiding principles.

Project cost projections shown for each alternative should be considered Class D for budgeting and planning purposes in accordance guidelines outlined by Public Services and Procurement Canada. Class D cost estimates are based upon a comprehensive statement of requirements, an outline of potential solutions and/or functional program and offer an indication of the final project cost that enables rankings to be made for all the options being considered. The cost projections include capital construction costs, design and environmental studies, project contingencies, allowances for environmental mitigation and are based on 2024 Canadian dollars. For this study, no allowances have been included for capitalized interest, financing, HST, cost sharing, inflation or other financial factors that may affect costs over time.

4.2 ALTERNATIVE 1: REDUCED DECLARED DISTANCES

Figure 22 highlights key features of Alternative 1 which explored options to use existing facilities without the need to construct new infrastructure. From ***Figure 22***, both ends of the runway require the sterilization of at least 35m for operational safety setbacks. On the west end, additional space was sterilized due to historical winter ice accretion propagation. Considering these minimum operational and environmental setbacks and the need to protect 150m for RESA, both ends of the runway must be shortened between 77 to 90 m (253 ft to 295 ft). *Shortening* in this case means that the official published declared runway takeoff and landing lengths must be reduced. Aircraft performance calculations can only use the published declared runway lengths regardless of the physical runway length. **Figure 23** shows these impacts on operations in both runway directions.

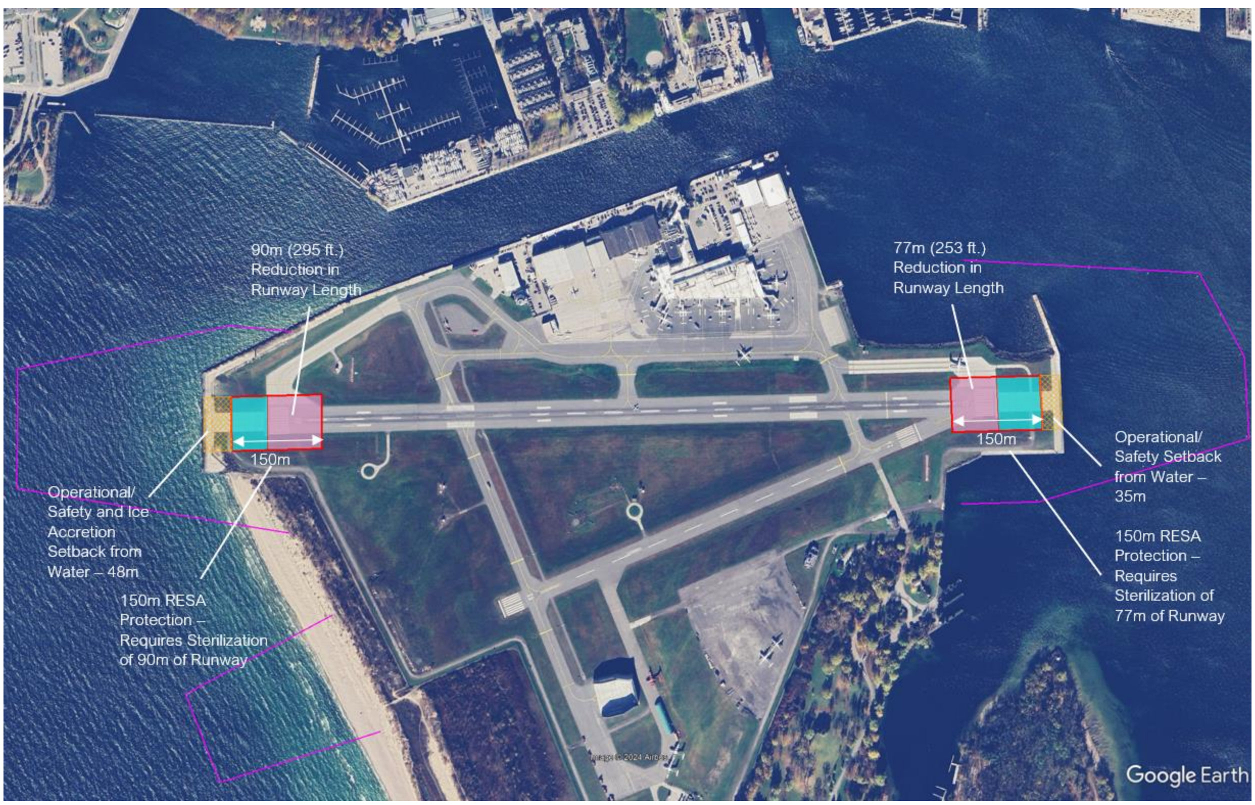

Figure 22: Alternative 1 Conceptual Site Plan

A reduction in takeoff length to this degree will negatively affect maximum allowable takeoff weights of the design aircraft i.e., Q400. The Q400 is already weight restricted on some of the longer routes flown from the airport under certain environmental conditions. This alternative will impose additional weight penalties which will reduce the utility of the runway for the air carriers.

Using aircraft performance charts specifically for the Q400, the impacts of these runway length reductions amount to an equivalency of about 10 or more passengers under summer conditions and wet runway conditions[16]. In the winter when runway conditions can become contaminated with patchy ice or snow, or on very hot and humid summer days, these penalties can increase. It should be noted that individual air carriers will have their own performance calculation procedures for their fleet. The calculations completed for study are intended to be indicative and demonstrate that there will be a negative impact due to reducing published declared runway lengths. Runway 08/26 is already at the minimum length required to support Q400 commercial air service.

Figure 23: Alternative 1 Runway 08 and 26 Operational Impacts

For more details related to this alternative refer ***Technical Exhibit 2*** in ***Appendix A***.

Based on the above, the key attributes and constraints of Alternative 1 are summarized below:

- *Project Capital Cost Projection: No Cost*
- *Attributes*
    - Compliant with Transport Canada TP312 5th Edition design standards for RESA
    - No capital costs (lowest cost).

[16] 1. Based ISA+20C Wet Runway Conditions

2. Q400 Average Performance (Not Carrier Specific SOPs)

3. Performance Calculations by Automated Systems in Aircraft Performance, Inc., 2023

    - Immediate implementation (publish reduced declared distances).
    - No physical works.
- *Constraints*
    - Utility and efficiency of airfield compromised (reduced runway length).
    - Air carriers will operate with weight and passenger restrictions.
    - The published declared runway length reductions may prevent operations of existing passenger carriers due to minimum runway restrictions contained in their Air Operator Certificates (AOC) or Standard Operating Procedures (SOPs).
    - No ancillary airport operational safety and efficiency improvements are enabled.
    - No added community benefits.

This alternative does not meet the key guiding principle to *preserve Runway 08/26 utility and efficiency* and as such this this alternative was not considered for further evaluation.

4.3 Alternative 2: Reconfigured Thresholds/Pre-threshold Area

Alternative 2 explored additional opportunities to utilize the 108m of pre-threshold areas of both ends of the runway to make up for the reduction in runway lengths calculated under Alternative 1. ***Figure 24*** shows the results of this analysis which only identified the potential to gain 13m (42 ft.) of additional takeoff length for Runway 26.

Although this 13m (42 ft.) of physical pavement and lighting modification could be made, the outcome remains like Alternative 1 whereby the design aircraft flown by the air carriers will operate under additional weight penalties due to takeoff runway distance reductions of 77m (253 ft).

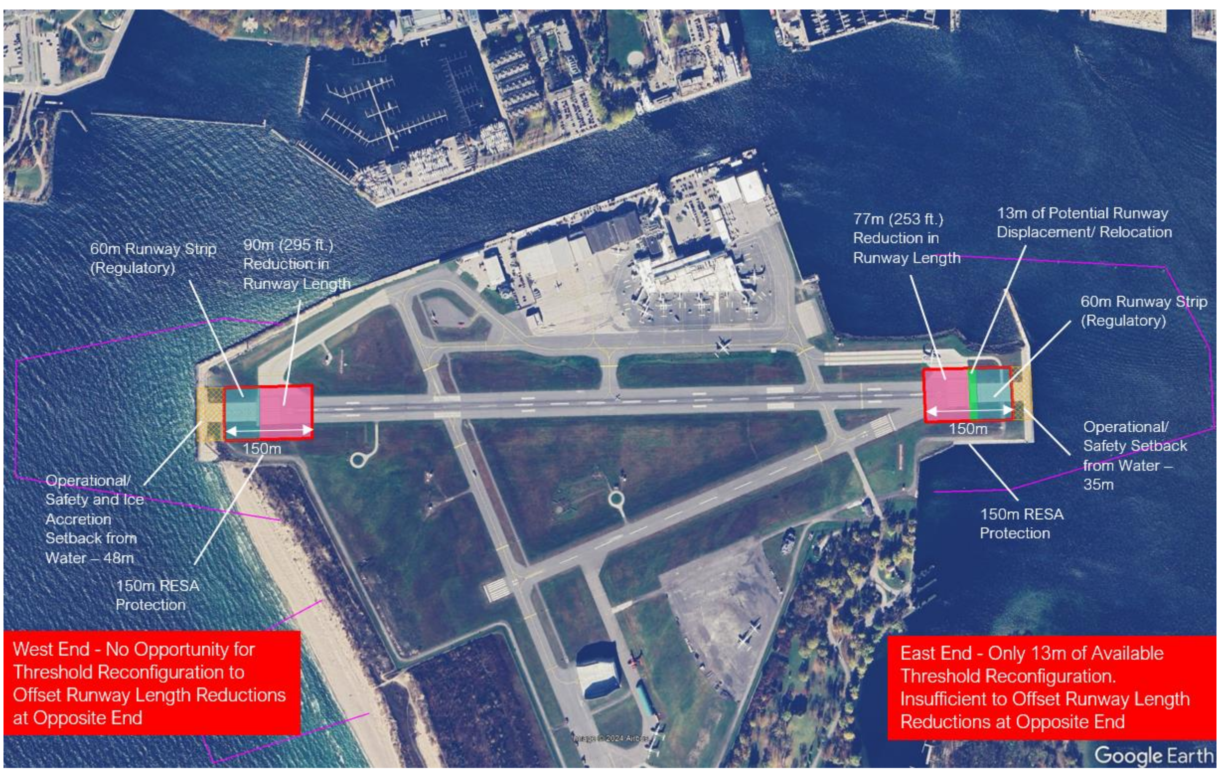

Figure 24: Alternative 2 Conceptual Site Plan

For more details related to this alternative refer to ***Technical Exhibit 3*** in ***Appendix A***.

Based on the above, the key attributes and constraints of Alternative 2 are summarized below:

- *Project Capital Cost Projection: No Cost*
- *Attributes*
    - Compliant with Transport Canada TP312 5th Edition design standards for RESA
    - No capital costs (lowest cost).
    - Immediate implementation (publish reduced declared distances).
- *Constraints*
    - Physical construction with no significant benefit in terms of gaining additional published declared takeoff and landing length.
    - Utility and efficiency of airfield compromised (reduced runway length).
    - Air carriers will operate with weight and passenger restrictions.
    - The published declared runway length reductions may prevent operations of existing passenger carriers due to minimum runway restrictions contained in their Air Operator Certificates (AOC) or Standard Operating Procedures (SOPs).
    - No ancillary airport operational safety and efficiency improvements are enabled.
    - No added community benefits.

This alternative does not meet the key guiding principle to *preserve Runway 08/26 utility and efficiency* and as such this this alternative was not considered for further evaluation.

4.4 ALTERNATIVE 3: ENGINEERED MATERIAL ARRESTING SYSTEM (EMAS)

Alternative 3 explores the use of EMAS given the limited space off the runway ends at the airport. EMAS is specifically designed to reduce the distance needed to arrest an aircraft that may overrun the runway ends. Only 108m is available off the runway ends at the airport, which falls short of the minimum 150m required to meet the RESA requirements. ***Figure 25*** presents a series of typical EMAS installation details including an example of how the material is "crushed" to absorb energy resulting from an aircraft excursion.

Figure 25: Runway Safe Inc. [17] EMAS Installation Examples

Runway Safe Inc., an FAA approved supplier and installer for EMAS solutions, was consulted and engaged to prepare preliminary performance calculation and design recommendations for this study. Runway Safe used their latest software and EMAS technology to model the site conditions for Billy Bishop Toronto City Airport. ***Figures 26 and 27*** present the results of this analysis which were used to prepare the conceptual RESA/EMAS layouts with a total length of 79.3m (260 ft) and total width of 67.1m (220 ft).

RUNWAY SAFE

CYTZ-Preliminary Performance & Pricing Estimate_v1.0_010424

Classification: Client Privilege

Preliminary Performance & Costing Estimates:

Airport:	Billy Bishop (Toronto City) Airport (CYTZ)
Runway:	**RW 8 & 26 Departure End**
Runway Dimensions:	3,988 ft long x 150 ft wide
Elevation:	253 ft above sea level
RSA slope(s):	8 & 26 dep end: Centerline Profile: RW 0.0% and RSA -0.0%

Aircraft Fleet Mix:

FAA Advisory Circular AC150-5220-22B Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns, paragraph 8.c (Preliminary Planning, Design) states:

In general, use the maximum take-off weight (MTOW) for the design aircraft. However, there may be instances where less than the MTOW will require a longer EMAS. All configurations should be considered in optimizing the EMAS design. To the extent practicable, however, the EMAS design should consider both the aircraft that imposes the greatest demand upon the EMAS and the range of aircraft expected to operate on the runway. In some instances, a composite design aircraft may be preferable to optimizing the EMAS for a single design aircraft.

Aircraft Model	MTOW [kg or lb]	MLW [kg or lb]	80% MLW [kg or lb]
Dash 8 - 400	63,000	61,750	49,400

Figure 26: Runway Safe Performance Calculation Assumptions

[17] Runway Safe Inc. (US Regional HQ Logan), 2239 High Hill Road, Logan Township, NJ 08085 USA

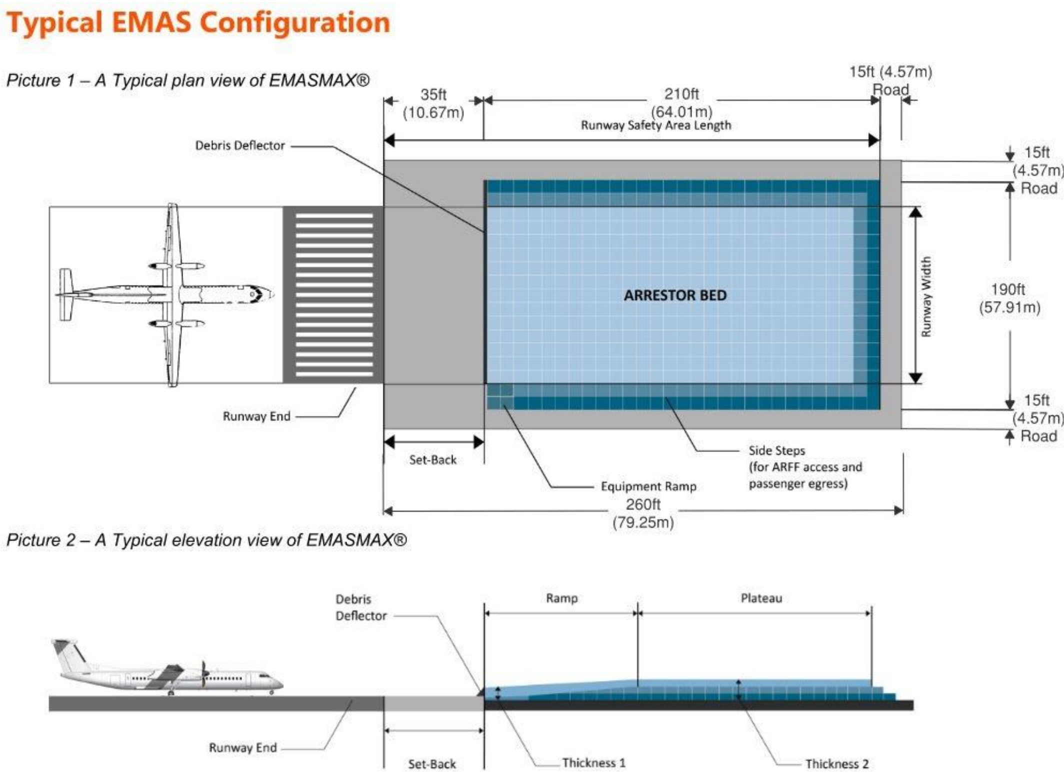

Figure 27: Runway Safe EMAS Layout Recommendations

Figures 28 and 29 present the proposed Alternative 3 layout concept. The EMAS material and associated perimeter emergency access roads can be accommodated within the existing 108m pre-threshold areas off both runway ends. However, on the west end, additional landmass is required in combination with a breakwater structure to control wave overtopping and water spray to reduce ice encroachment onto the EMAS. Ice buildup on the EMAS can compromise its performance and can reduce its operational life expectancy resulting in more frequent maintenance and replacement. The height of the breakwater in this case was set to comply with airspace protection requirements off the runway and to control water spray sufficiently to mitigate ice accretion onto the EMAS. No additional landmass or breakwater was proposed at the east end due to the low probability of significant wave action and limited to no ice encroachment risks due to the protected inner harbour.

Figure 28: Alternative 3 EMAS Conceptual Site Plan

Research and consultations with the supplier Runway Safe confirmed that EMAS is compatible with marine and cold climate environments similar those experienced at Billy Bishop Toronto City Airport. EMAS installations with similar winter environments can be found at airports like Boston Logan International, JFK, Minneapolis St. Paul, Rutland/Southern Vermont Regional and Kodiak, Alaska.

To accommodate winter conditions and routine maintenance of the surface of the EMAS, small/light snow clearing equipment, i.e., Bobcat/Kubota are required and would need to be purchased by the airport as part of this alternative and have been included in the cost projections. This will introduce some changes in the airport's winter operations plans and investments specific to EMAS.

It should be noted that EMAS is used extensively in the US and internationally, but there are no EMAS installation to date in Canada. This would be the first EMAS installation in Canada and requires a commitment from Transport Canada to demonstrate their acceptance of the FAA design and operating standards, including the provision in the FAA Advisory Circulars that does not require the closure of a runway should the EMAS be damaged from an aircraft excursion. FAA standards permit up to 45 days to repair and return to service any damaged EMAS and that the runway does not need to be closed. In these cases, the airport is responsible to issue a notice advising airport users of the reduced performance of the EMAS until the repair is completed. Given that Runway 08/26 is the only runway that supports scheduled air passenger airlines at the airport, the risk of a prolonged runway closure of any kind due to damaged EMAS is a major concern.

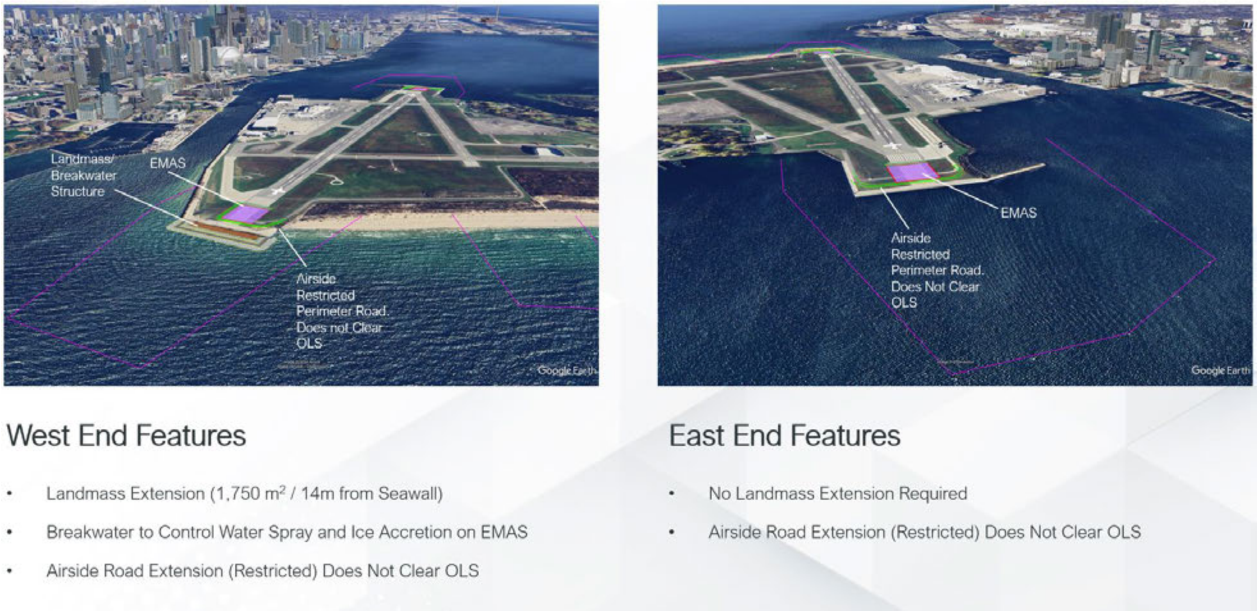

Figure 29: Alternative 3 EMAS Runway End Features

For more details related to this alternative refer ***Technical Exhibit 4*** in ***Appendix A***.

Based on the above, the key attributes and constraints of Alternative 3 are summarized below:

- *Project Capital Cost Projection: $39 million*
  - The net present value (NPV) for a 20-year life cycle cost analysis including capital and maintenance/replacement for the EMAS was project to be about $43-45 million. These cost estimates included an allowance of $500,000 for new EMAS maintenance equipment.
- Attributes
  - Compliant with TP312 5th Edition for 70 knots exit speed for EMAS alternative.
  - EMAS has proven performance in marine and cold climates.
  - Shortest schedule and lowest scheduling risk (meets RESA compliance timeline) and would meet RESA Implementation deadline (mid 2027).
  - No impact on airfield efficiency and MEZ.
  - Mitigates ice accretion impacts on the EMAS on the west end through landmass and breakwater structure.
  - Construction can be accommodated during nighttime closures 11 p.m. – 6:45 a.m.
  - Lowest implementation cost among the viable options.
- Constraints
  - Environmental permitting and environmental impact study schedule and approval risks due to in-water work on west end.
  - Marine environment impacts (west end landmass) still required to protect for ice accumulation on EMAS

- EMAS life expectancy of 20 years versus landmass options which are indefinite.
- Additional ongoing airport operational costs for EMAS inspections and routine maintenance. Special equipment and operational procedures required for snow and maintenance of EMAS.
- Procurement of EMAS limited to one international supplier from the US i.e. Runway Safe Inc. (cross-border maintenance support and only one EMAS manufacturer available).
- Would be the first EMAS installation in Canada and would require Transport Canada to acknowledge acceptance of FAA AC *150/5220-22 Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns* (e.g. 45 days return to service FAA requirement and no runway closure due to damaged EMAS). Transport Canada's Advisory Circular AC 300-007 defers to the United States FAA EMAS planning, design, installation and maintenance standards. While this offers clear direction at this time, it may introduce future unknown risks due to changes in standards by an agency outside Canada
- PortsToronto only has one runway servicing all scheduled air carriers. There are no options other than closing Runway 08/26 should any unusual operations or maintenance be required off either runway end related to the EMAS.
- No ancillary airport operational safety and efficiency improvements enabled. Insufficient new land mass and development areas to enhance airfield appearance and flow, such as improved taxiway-to-runway separation and visual approach guidance procedures, compared to other expansive development options
- No added community benefits.
- Absence of aesthetic considerations for landmass extension and landscaping.

4.5 Alternative 4: RESA Minimum Landmass

Figures 30 and 31 present the Alternative 4 layout concept. Alternative 4 explores the minimum landmass expansion required off both runway ends to accommodate the 150m RESA requirements under the new regulations.

On the west end (Lake Ontario), the breakwater structure would be raised to an elevation of 81m ASL (about 4.5m above Threshold 08) which will effectively control any wave overtopping and water spray. As noted in ***Section 3.6***, the final height and shape of the breakwater will be subject to further design inputs from NAV CANADA to ensure these is no impact on the electronic signals from the Glidepath 08 antenna. On the east end (Inner Harbour), the breakwater is only about 1-1.5 metre above the threshold elevation at about 77m ASL since there is no need to control any waves or water spray.

The proposed layout also allocates space for perimeter airfield roads around the ends of the RESA to allow for restricted access across the runway similar to existing conditions. While these roads allow for access across the runway ends, passage is restricted and controlled by the Control Tower to avoid conflicts with aircraft landing or taking off since insufficient airspace clearance is offered by this landmass configuration.

It is proposed that the RESA surfaces off both ends be comprised of a combination of turf and pavement. Paved pre-threshold areas would allow for efficient snow removal in the winter, a procedure that is already in place and working effectively. It is, however, recommended that any pre-threshold pavements be grooved similar to the existing runway to ensure a consistent braking coefficient should an aircraft exit the runway.

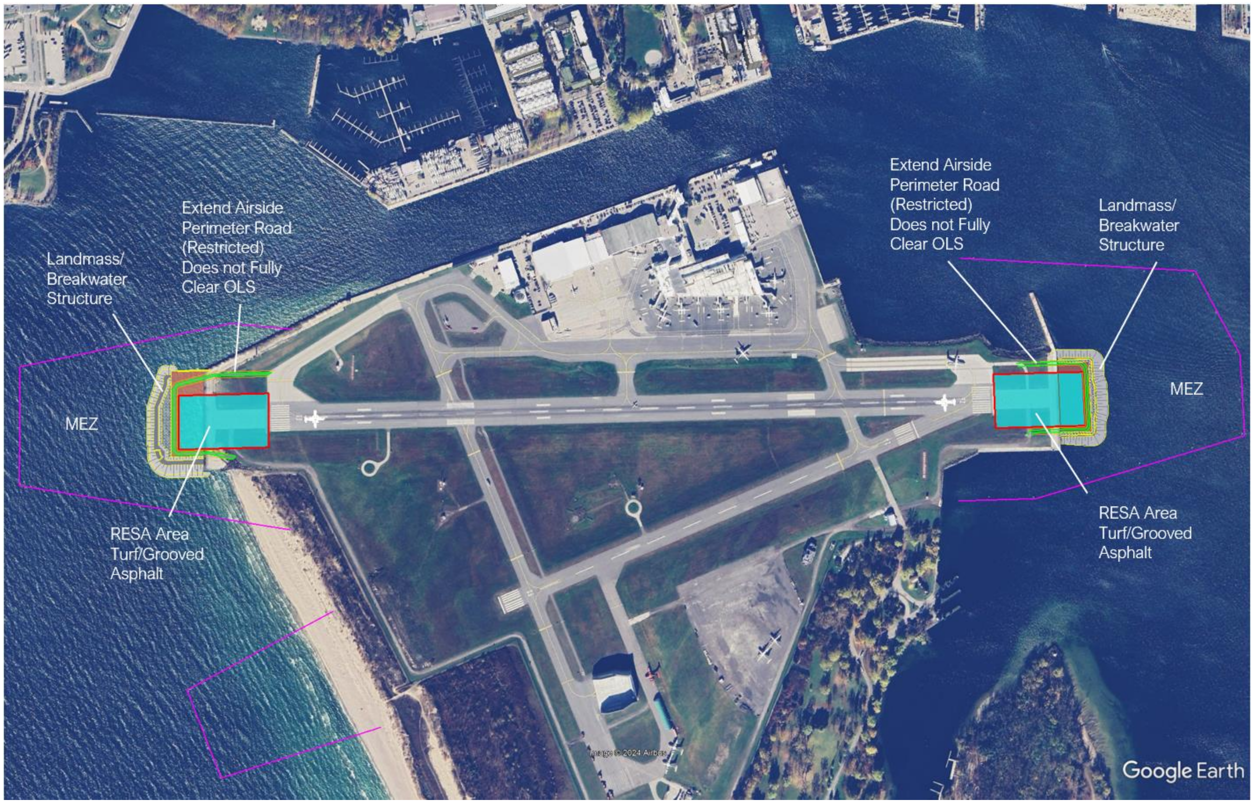

Figure 30: Alternative 4 RESA Minimum Landmass Conceptual Site Plan

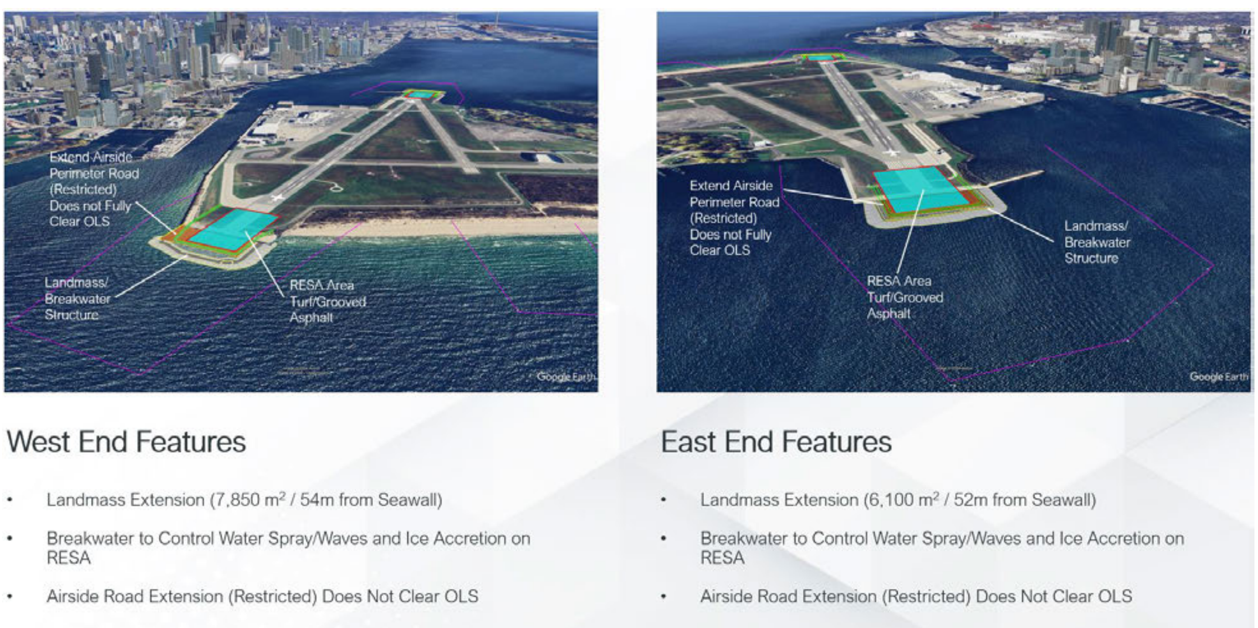

Figure 31: Alternative 4 RESA Minimum Landmass Runway End Features

For more details related to this alternative refer ***Technical Exhibit 5*** in ***Appendix A***.

Based on the above, the key attributes and constraints of Alternative 4 are summarized below:

- *Project Capital Cost Projection: $61 million*
- Attributes
    - Compliant with TP312 5th Edition.
    - No impact on airfield efficiency and MEZ.
    - Addresses wave water spray and ice accretion on west end.
    - Construction can be accommodated during nighttime closures 11 p.m. – 6:45 a.m.
    - Anticipated implementation schedule is longer than Alternative 3 but would meet the RESA implementation deadline (mid 2027).
    - No significant change in operations and maintenance at both ends. Similar level of maintenance to existing conditions off runway ends.
    - Least impact on marine environment (west and east ends) when compared to other expansive development options.
- Constraints
    - Environmental permitting and environmental impact study schedule and approval risks.
    - More significant marine environment impacts (west end and east end) when compared to Alternative 3.
    - Additional scheduling risk due to larger marine environment impacts, permitting, mitigation and construction scope.
    - More expensive than Alternative 3.
    - No ancillary airport operational safety and efficiency improvements enabled.
    - No community benefits.

4.6 Alternative 5: RESA Partial Safety & Environmental Benefits

Figures 32 and 33 presents the proposed Alternative 5 layout concept. Alternative 5 expands upon Alternative 4 by layering PortsToronto airfield efficiency, safety, and partial environmental/community improvement projects, including a new parallel Taxiway B segment, and the relocation of Taxiway D to bring its separation from the runway into compliance with design standards.

Taxiway B improvements are enabled by the relocation of the Localizer 26 antenna onto the new western RESA, which increases the landmass expansion to the west slightly. The new Taxiway D relocation requires additional landmass to the north but does not impact the landmass expansion off the runway end. As a result of the relocation of Taxiway D, the airport can now improve aviation safety by upgrading their visual approach guidance system for landing aircraft on Runway 26 from an “abbreviated”, two-light system to a higher precision four-light system. All the other features of this layout are retained from Alternative 4.

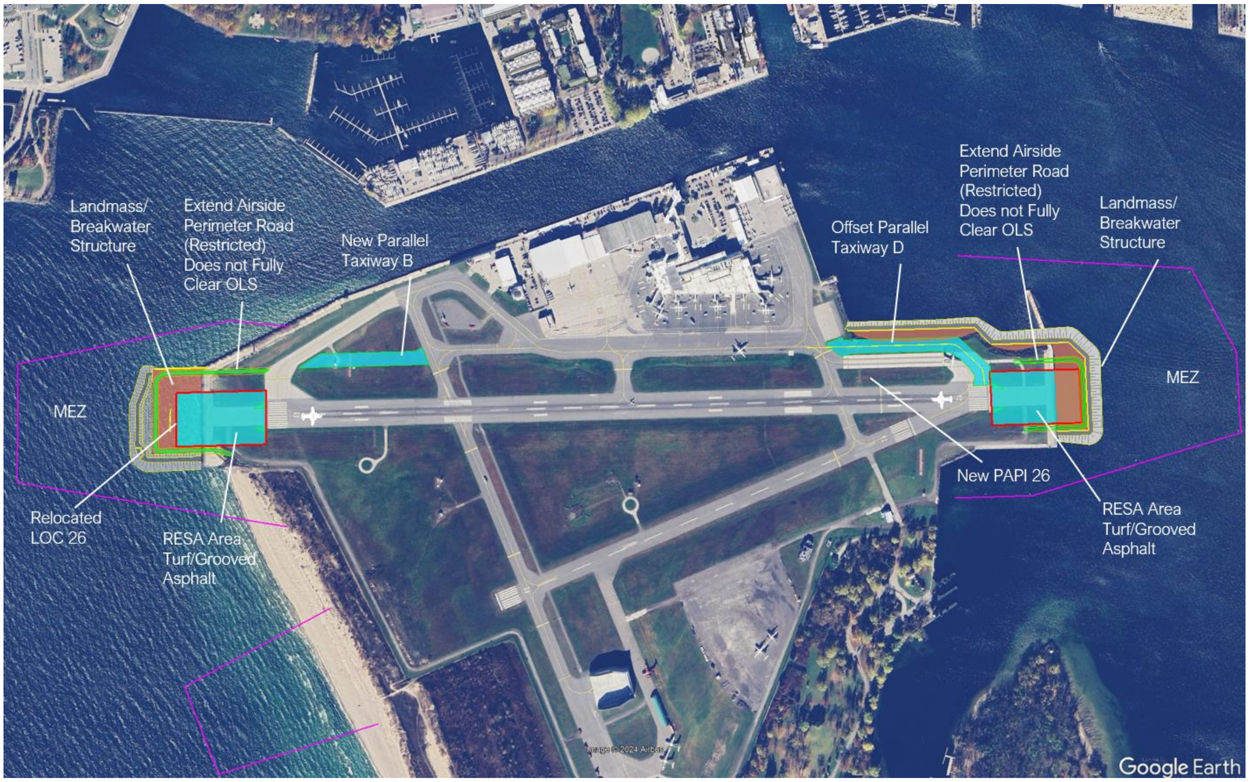

Figure 32: Alternative 5 Conceptual Site Plan

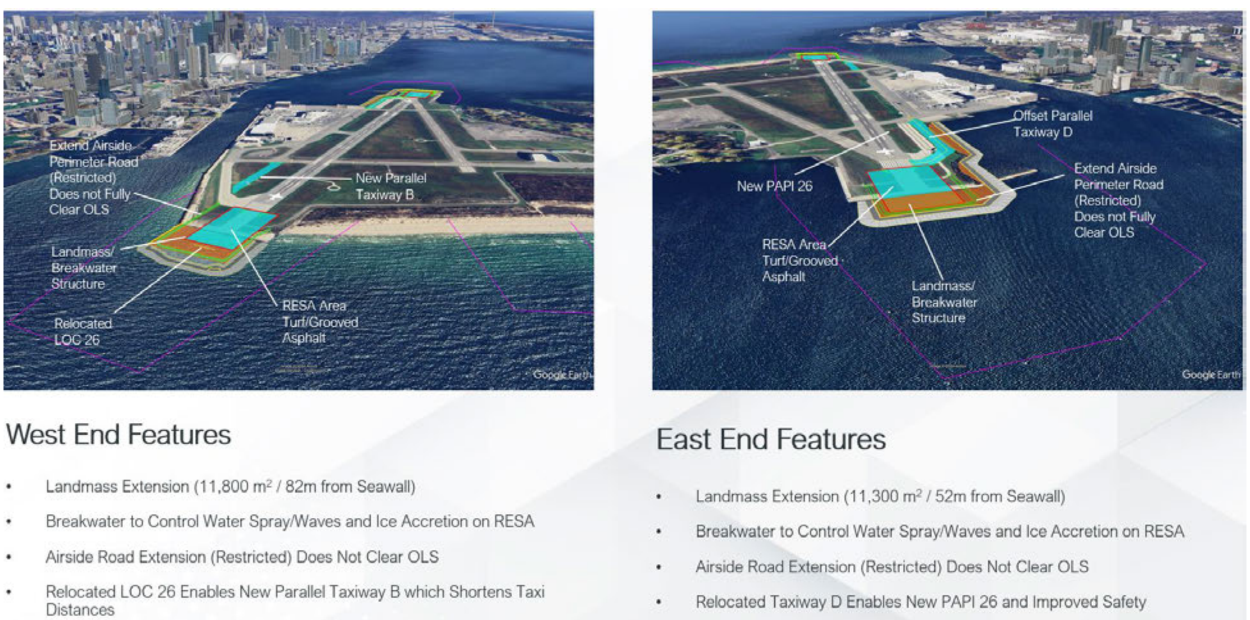

Figure 33: Alternative 5 RESA Landmass Runway End Features

For more details related to this alternative refer ***Technical Exhibit 6*** in ***Appendix A***.

Based on the above, the key attributes and constraints of Alternative 5 are summarized below:

- *Project Capital Cost Projection: $95 million*

- Attributes
  - Compliant with TP312 5th Edition.
  - No impact on airfield efficiency and MEZ.
  - Addresses wave water spray and ice accretion on west end.
  - Construction can be accommodated during nighttime closures 11 p.m. – 6:45 a.m.
  - Anticipated implementation schedule is longer than Alternative 4 but would meet the RESA implementation deadline (mid 2027).
  - No significant change in operations and maintenance at both ends. Similar level of maintenance to existing conditions off runway ends.
  - RESA compliance elements can be prioritized in the construction schedule compared to ancillary airfield improvements, which can be sequenced after priority RESA work is completed.
  - Improves airfield efficiency, safety and environmental protection: new Taxiway B alignment eliminates the need for Taxiway A (eliminate turns); Taxiway D relocated to proper separation from runway; both changes reduce taxi times and associated emissions.
  - Taxiway D flooding risks mitigated through design.
  - Enhances safety with changes to the airfield access road behind the runway ends, offering operational benefits despite runway crossings still being restricted by control tower approval.
  - Mitigates noise impacts to the community by relocating Taxiway B away from Lakeshore and orienting it to direct noise away from the shoreline built up area.
  - Improves Runway 26 approach safety with new Precision Approach Path Indicators (PAPI).
  - Lower impacts on marine environment (west and east ends) when compared to more expansive development options.
- Constraints
  - Environmental permitting and environmental impact study schedule and approval risks.
  - More significant marine environment impacts (west end and east end) when compared to Alternative 4.
  - Additional scheduling risk due to larger marine environment impacts, permitting, mitigation and construction scope.
  - NAV CANADA coordination related to marine radar modifications, relocation of Localizer 26 antenna and associated airspace/approach redesign. Scheduling critical path activities will be challenging.
  - Longer construction schedule than Alternatives 3 and 4, however still meets RESA compliance timeline.
  - More expensive than Alternatives 3 and 4.
  - Not all ancillary community and operational airport improvements enabled (e.g., noise wall and unrestricted airside roads access are not included in this alternative).

- Airfield access roads are restricted and require tower clearance, unlike Alternative 6 presented in the next section.

4.7 ALTERNATIVE 6: RESA + FULL SAFETY & ENVIRONMENTAL BENEFITS

Figures 34 and 35 presents the proposed Alternative 6 layout concept. Alternative 6 expands upon Alternative 5 by introducing the final three remaining PortsToronto airfield efficiency improvement and community benefit project elements including *1) unrestricted perimeter airfield roads, 2) noise mitigation at east end, and 3) landmass for future community access road/pedestrian sidewalk on east end*. These new elements result in an expansion of landmass primarily on the east end to accommodate these new features and to achieve aeronautical airspace clearances over the new roads, security fence and noise walls. All the other features of this layout are retained from Alternative 5.

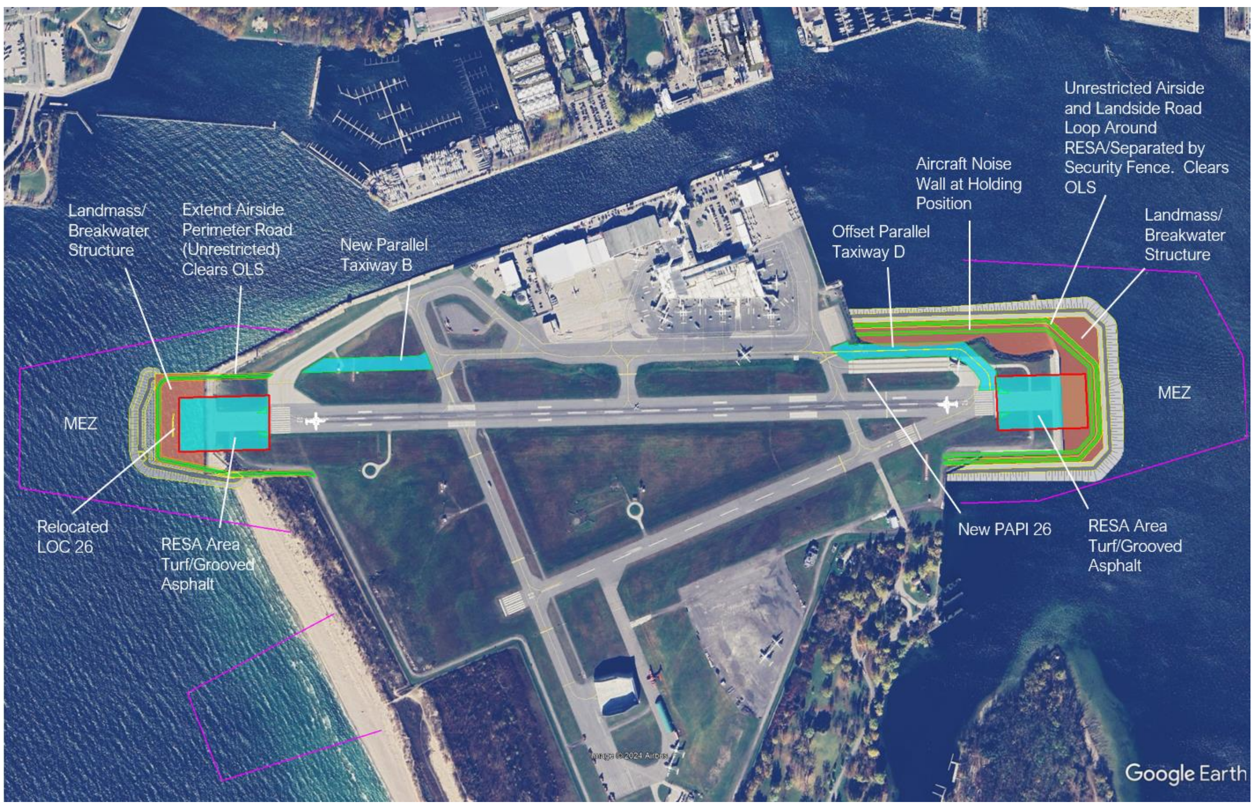

Figure 34: Alternative 6: Conceptual Site Plan

Figure 35: Alternative 6 RESA Landmass Runway End Features

For more details related to this alternative refer to ***Technical Exhibit 7 i***n ***Appendix A***.

Based on the above, the key attributes and constraints of Alternative 6 are summarized below:

- *Project Capital Cost Projection: $172 million*
- Attributes
  - Compliant with TP312 5th Edition.
  - No negative impact on airfield efficiency and MEZ.
  - Addresses wave water spray and ice accretion on west end.
  - Construction can be accommodated during nighttime closures 11 p.m. – 6:45 a.m.
  - Anticipated implementation schedule is longer than Alternative 5 but would meet the RESA implementation deadline (mid 2027).
  - No significant change in operations and maintenance at both ends. Similar level of maintenance to existing conditions off runway ends.
  - RESA compliance elements can be prioritized in construction schedule compared to ancillary airfield improvements which can be sequenced after priority RESA work is completed.
  - Improves airfield efficiency, safety and environmental protection: new Taxiway B alignment eliminates the need for Taxiway A (eliminate turns); Taxiway D relocated to proper separation from runway; both changes reduce taxi times and associated emissions.
  - Improves airfield efficiency, safety and environmental protection: new Taxiway B alignment eliminates the need for Taxiway A (eliminate turns); Taxiway D relocated to proper separation from runway; both changes reduce taxi times and associated emissions.
  - Taxiway D flooding risks mitigated through design.

  - Enhances safety with changes to the airfield access road behind the runway ends, offering operational benefits with no restrictions requiring control tower approval.
  - Mitigates noise impacts to the community by relocating Taxiway B away from Lakeshore and orienting it to direct noise away from the shoreline built up area.
  - Improves Runway 26 approach safety with new Precision Approach Path Indicators (PAPI).
  - Enhanced community benefits including the construction of a public right-of-way around the eastern end of the airport for future community access planning. Additionally, an improved noise reduction achieved by the relocation of Taxiway B away from Lakeshore and the installation of noise walls to reduce ground-based aircraft noise.
- Constraints
  - Environmental permitting and environmental impact study schedule and approval risks.
  - Greatest potential marine environment impacts (west end and east end) when compared to other alternatives.
  - Additional scheduling risk due to larger marine environment impacts, permitting, mitigation and construction scope.
  - NAV CANADA coordination related to marine radar modifications, relocation of Localizer 26 antenna and associated airspace/approach redesign. Scheduling critical path activities will be challenging.
  - Longest construction schedule than other alternatives, however, still meets RESA compliance timeline.
  - Most expensive alternative.

4.8 SUMMARY OF ALTERNATIVES

Table 5 summarizes key features of all viable alternatives.

Table 5: Summary of RESA Alternatives Subject to Evaluation

RESA Alternative Layout	Alternative No. and Description and Estimated Schedule	Supplemental Operational & Safety and ESG Enhancements	Landmass/ Breakwater Expansion (Approximate and for Comparison Purposes)	Capital Costs (2024 CDN$)
	Alternative 3: EMAS ***Meets Compliance Timeline (Mid 2027)*** – Critical Path Activities are Permitting 12-18 months and EMAS Procurement	• None	West End • 1,750 m^2 / 14m from Seawall • 70,000-75,000 tonnes East End • None	**$39M** **Note:** NPV for 20 Year Life Cycle Costs including Capital and Maintenance/Replacement for EMAS = **$45M (Still Lowest Cost Alternative)** Capital cost includes allowance of $500k for new EMAS maintenance equipment.
	Alternative 4: RESA Minimum Landmass ***Meets Compliance Timeline (Mid 2027)***– Critical Path Activities are Permitting 12-18 months	• None	West End • 7,850 m^2 / 54m from Seawall • 160,000-170,000 tonnes East End • 6,100 m^2 / 52m from Seawall • 157,0000-162,000 tonnes	**$61M** **Note:** Includes modifications to NAV CANADA Marine Radar System.
	Alternative 5: RESA Plus Partial Safety & Environmental Benefits ***Meets Compliance Timeline (Mid 2027)*** – Critical Path Activities are Permitting 12-18 months. Construction phased over 2 years.	• Operational: Localizer 26 Relocated • Operational and Safety: Taxiway B & D • Safety: PAPI 26 (Replace APAPI)	West End • 11,800 m^2 / 82m from Seawall • 250,000-255,000 tonnes East End • 11,300 m^2 / 52m from Seawall • 190,000-195,000 tonnes	**$95M** **Note:** Includes modifications to NAV CANADA Marine Radar System and Localizer 26 Relocation.
	Alternative 6: RESA Plus Full Safety, Community And Airfield Efficiency Benefits ***Meets Compliance Timeline (Mid 2027)*** – Critical Path Activities are Permitting 12-18 months. Construction phased over 2 years.	• Operational: Localizer 26 Relocated • Operational and Safety: Taxiway B & D • Safety: PAPI 26 (Replace APAPI) • Safety: Airside Roads Unrestricted • ESG: Landside Road (east end) unrestricted • ESG: Noise wall along Taxiway D	West End • 12,800 m^2 / 82m from Seawall • 250,000-255,000 tonnes East End • 32,700 m^2 / 66m from Seawall • 730,000-750,000 tonnes	**$172M** **Note:** Includes modifications to NAV CANADA Marine Radar System and Localizer 26 Relocation.

5. SELECTION OF PREFERRED ALTERNATIVE

5.1 PORTSTORONTO STRATEGIC PLAN AND ESG PRIORITIES

The alternatives presented in Section 4 were presented to PortsToronto for consideration. The Board of Directors together with the PortsToronto RESA Technical Committee reviewed the alternatives and considered how implementation of the project would align with their latest Strategic Plan, ESG priorities and the work conducted during the 2018 Airport Master Plan, as added factors. From this, Alternatives 5 and 6 were chosen as the preferred alternatives based on the following rationale:

- Alternatives 5 and 6 address RESA compliance within the required regulatory implementation timeline of mid-2027.
- These alternatives complement PortsToronto's Strategic Planning and our Environmental Social and Governance (ESG) Priorities and Work Plan. Three of PortsToronto five strategic priorities and values from the 2024-2028 Strategic Plan are achieved with these alternatives including:
  - *Priority: Foster Greener, Quieter and Innovative Transportation*
    - Noise walls; reduced taxi times resulting in lower emissions and less noise.
  - *Priority: Accelerate Economic and Business Success*
    - Mitigate flood risks and associated costs; safer and more time-reliable access (avoiding runway crossings) would improve revenue generating opportunities for the south airfield; eliminating Taxiway A would improve revenue generating opportunities in the northwest corner of the airfield.
  - *Value: Safety and Security, Always*
    - Significantly reduce interaction between aircraft and vehicles by introducing service roads to eliminate runway crossings.
- These alternatives also align with earlier studies and pre-consultation with agencies, indigenous communities and the public during the 2018 Airport Master Plan. Although not yet mandated by regulation at that time, it was anticipated that Transport Canada would require the RESA to extend 150 metres beyond the end of the runway. The airport has been identified as one of the airports potentially subject to the installation of RESAs on those runways serving scheduled commercial passenger services. Transport Canada had, under NPA 2016-007, identified three options as to how the requirement for RESAs might be applied to airports. NPA 2016-007 had proposed possible compliance with RESA.

To this end, PortsToronto's Board of Directors approved proceeding with **Alternative 6** conditionally as follows:

  - Proceed with *preliminary design and impact assessment* based on **Alternative 6 considering Alternative 5 as a potential mitigation strategy for cost and impacts.**
  - Continue working on identifying funding opportunities and solutions through preliminary design stage.
  - Approach PortsToronto's Board of Directors for decision before proceeding to *final design* with more detailed construction cost estimates and funding opportunities / analysis (impact on AIF, borrow limits, etc.). At that stage, the scope of work could be reduced to Alternative

5 without significant design modifications, schedule impacts and without the need to expand additional time and effort on environmental impact assessment work.

- While Alternatives 3 and 4 will ensure compliance with RESA regulation, there are no added safety (e.g. runway crossings, PAPI 26, etc.), operational (e.g. Localizer 26, Taxiways B & D, etc.) and ESG (e.g. noise walls, etc.) benefits from this significant and complex project construction and investment – only regulatory compliance is achieved. The direction received by the Board of Directors was to ensure that this project takes the opportunity to address the additional safety / environmental / community benefits now, rather than in the future.

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6. Environmental Mitigation Measures and Permitting Recommendations

The following section provides preliminary recommendations for mitigating or avoiding impacts to natural areas. Mitigation measures in this section are based on current legislation, regulations, and species at risk requirements. All appropriate legislation and regulations should be reviewed during the design and implementation phases to ensure the mitigation measures used are appropriate and up to date.

Furthermore, jurisdictional matters should be reviewed and confirmed by PortsToronto/Billy Bishop Toronto City Airport as the airport authority. The project would fall under the authority of the Federal Aeronautics Act.

6.1 Designated Natural Areas

As the work areas for each alternative fall within areas regulated by TRCA and unless otherwise exempt due to governance under other applicable federal legislation, a permit may be required under Ontario Regulation 166/06: Toronto and Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

6.2 Vegetation and Vegetation Communities

Vegetation removal is expected to be quite minimal and limited to shoreline shrubs and herbaceous species. Given the anticipated scope of removals and lack of impact, it is not anticipated that specific mitigation measures will be required.

6.3 Wildlife and Wildlife Habitat

The Fish and Wildlife Conservation Act (FWCA) provides protection to several fur-bearing mammals, game animals, and specially protected animals listed under this act. To avoid adverse effects to wildlife that may be encountered within the work areas, the following mitigation measures are recommended:

- Harassment and/or harm to wildlife during construction is prohibited.
- A daily pre-construction search of the machinery and the work area shall be implemented by the contractor to identify the presence of wildlife, as animals may be found hiding or basking around equipment, rocks, debris piles etc.

- Wildlife observed within the work area shall be allowed to move out of the area on its own.

6.3.1 Migratory Birds

Environment and Climate Change Canada (ECCC) is responsible for the development and implementation of policies and regulations to ensure the protection of migratory birds, their eggs and their nests. Migratory bird species are protected under the Migratory Birds Convention Act (MBCA) and the associated Migratory Bird Regulations (MBR). Under the MBCA, which applies throughout Canada, no person shall harass, disturb, destroy, or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird, except under the authority of a permit.

The MBR provide protection to migratory bird nests when they are considered to have a higher conservation value for migratory birds. Typically, a higher conservation value refers to nests that contain eggs or young or are otherwise in use, such as during the nesting season.

Nesting habitat for migratory birds is limited to minimal shoreline vegetation. In order to avoid and/or mitigate impacts to breeding birds, it is recommended that the removal of vegetation is scheduled outside of the breeding bird season (April 1 to August 31). If the removal of vegetation during this period cannot be avoided, active nest searches may be conducted by a qualified biologist immediately prior to removal to reduce the risk that active nests of breeding birds are present. If any active nests are found within the work limits during construction, they must be protected during the nesting season with a species-appropriate buffer (determined by an avian specialist).

6.3.2 Significant Wildlife Habitat

As impacts to significant wildlife habitat are anticipated to be negligible, no mitigation measures are recommended at this time.

6.4 Aquatic Habitat

Since the preferred alternative is within 30 m of Lake Ontario and extends into the lake, there is the potential to impact fish or fish habitat. In order to avoid and/or minimize impacts to fish and fish habitat, it is recommended that the following mitigation measures be implemented:

In-water Work:

- Construction works to be carried out during approved periods only. It is anticipated the fish spawning restrictions will impact in-water work between **March 15 to July 15 (4 months)** of each construction season during which construction activities in the water will not be permitted.
- Only clean materials, free of fine particulate matter shall be placed below the high-water mark to mitigate change in sediment concentrations.
- If any dewatering is to occur, from within Lake Ontario, it shall occur within the in-water timing window, and fish shall be removed from the isolated work area by a qualified biologist.
- All hoses drawing water from Lake Ontario during temporary flow management and dewatering procedures shall be screened with fine mesh to prevent potential impingement or entrainment of fish according to interim code of practice: end-of-pipe fish protection screens for small water intakes in freshwater.

General Construction:

- All work shall be done in accordance with all applicable permit requirements; however certain activities may proceed as authorized by the regulatory agencies, if applicable.

- All materials and equipment used shall be operated and stored in such a manner that prevents any deleterious substance from entering the water.
- No sediment-laden water is discharged to Lake Ontario at any time.
- Minimize temporary work areas to the extent possible to limit environmental disturbance.
- Machinery should arrive on site in a clean condition and is to be checked and maintained free of fluid leaks.
- All equipment used for the purpose of carrying out the work will be operated in a way that prevents deleterious substances from entering Lake Ontario.
- All structural work (e.g., seawall repairs, breakwater construction) shall be isolated from the waterbody to avoid introduction or resuspension of fine sediments (e.g., silt or clay) to Lake Ontario.
- A Spills Action Plan (SAP) will be developed prior to commencement of construction and will include protocols to address emergency events such as the release of petroleum, oils and lubricants or other hazardous liquids and chemicals. All spills will be reported to the MECP Spills Action Response Centre immediately.

Erosion and Sediment Control (ESC):

- An ESC Plan shall be developed, implemented, monitored and maintained to isolate construction disturbances from the natural environment.
- ESC measures meeting or exceeding Ontario Provincial Standards and Specifications (OPSS) will be included in the ESC Plan and applied to avoid effects to surface waters.
- ESC measures shall remain in place until all work has been completed and all disturbed areas have been stabilized.

Restoration of Disturbed Areas:

- All disturbed areas are to be restored immediately following the completion of proposed works.

6.5 SPECIES AT RISK

6.5.1 SPECIES OF SPECIAL CONCERN

The following species of special concern have potential to be encountered within the work areas: Barn Swallow, Peregrine Falcon, Monarch and Northern Map Turtle. Species of special concern are not protected under the ESA.

6.5.2 ENDANGERED AND THREATENED SPECIES

Endangered and threatened species and their habitats are protected under the ESA. It is anticipated that there would be no impacts to endangered or threatened terrestrial Species at Risk.

For fish Species at Risk, American Eels are listed as endangered and afforded protection under the provincial Endangered Species Act. The species has also been recorded within the vicinity of the study area by TRCA waterfront sampling. Typically, American Eel will inhabit areas with a combination of vegetation, rock piles and woody debris that can offer them opportunities for foraging and cover during the day. For overwintering, American Eel typically require soft substrates where they burrow into the upper layers of sediment. Through background review, instances of sand substrates which may be suitable for overwintering American Eel are present along the eastern and western limits of the runway. In addition, aquatic vegetation was documented along the eastern runway limit. While these habitat features are not unique to the broader aquatic environment, or in apparent significant abundance, the habitat features are present in the immediate vicinity of the airport; however, no American Eels were observed by AECOM during 2015 field investigations.

Shortnose Cisco is listed as endangered under SARA and the ESA and is afforded protection under each act. While the Shortnose Cisco is historically present in Lake Ontario, they rely on deep water (22 m to 92 m) to feed among all other life processes. The airport's RESAs occur in water depths less than 12 m and therefore, no suitable foraging or rearing habitat is available in the project area. Therefore, they are not likely to be affected by proposed works around the airport RESAs which occur in water depths less than 12 m.

However, it is well known that American Eel, a provincially endangered fish species, utilize a broad range of habitats most commonly found in depths of 0 m to 10 m, or greater (American Eel Recovery Strategy, 2013) for each of their life cycles and as such could utilize the project area for foraging or refuge. There is less known about the habitat requirements for American Eel during their overwintering lifecycle, but habitat requirements do identify fine, unconsolidated substrates to be a critical component. Due to the presence of unconsolidated sand substrates within the aquatic boundaries of the proposed project areas along the eastern and western runway ends, it is recommended that consultation with the Ministry of the Environment, Conservation and Parks is carried out.

6.6 Recommended Next Steps and Potential Permitting

To further inform potential permitting requirements, early engagement and consultation with local authorities including TRCA to identify potential for updates to their open data portal, as well as an update to the existing conditions field investigations may be beneficial to capture any notable changes to the habitat or its usage that may have occurred on site over time. In addition, considerations of harbour capacity and bathymetry with respect to currents and sedimentation impacts may be studied as part of the preferred concept and preliminary design phase.

Updated assessments of SAR presence along with ELC is recommended to document the potential for SAR presence within the study area and would be beneficial to confirm the extent, or lack there-of, of the habitat utilisation of aquatic and terrestrial SAR present on site.

In advance of additional further design details, it is recommended, but not limited to, the following reviews be conducted as it relates to potential approvals, processes and permitting requirements and their associated recommended next steps be considered:

Impact Assessment Act

The Impact Assessment Agency of Canada is an agency of the Government of Canada responsible for federal environmental assessment process of major projects. It is a planning and decision-making tool used to assess:

- Positive and negative environmental, economic, health, and social effects of proposed projects; and
- Impacts to Indigenous groups and rights of Indigenous peoples.

The Impact Assessment Act outlines a process for assessing the impacts of major projects and projects carried out on federal lands or outside of Canada. The Impact Assessment Agency of Canada is responsible for conducting impact assessments under the Impact Assessment Act.

Projects that are subject to the Act or designated projects are described in the Physical Activities Regulations of the Impact Assessment Act. The Minister may designate any project not described in regulations, based on factors set in the legislation or non-designated projects on federal lands and outside Canada are assessed by federal authorities before decisions are made.

The project list under the Physical Activities Regulations focuses federal impact assessments on projects that have the most potential for adverse environmental effects in areas of federal jurisdiction.

City of Toronto Official Plan

The City of Toronto Official Plan designates the airport lands as Parks and Open Space Area, with the Central Waterfront Area Secondary Plan articulating the vision for development in the area including at Bathurst Quay. In Chapter 3 of the Official Plan, major facilities such as airports and sensitive land uses such as residences are to be appropriately designed, buffered and/or separated from each other to prevent adverse effects. This is also outlined in the Provincial Policy Statement which acknowledges the importance of airports and protecting them when making land use decisions.

The natural environment policies in Chapter 3 of the Official Plan specifically address lake filling projects in Lake Ontario (#17), indicating that such will only be supported only where:

- The land created will be used for natural habitat, public recreation or essential public works;
- The project has been the subject of an Environmental Assessment which ensures that water quality and quantity and terrestrial and aquatic habitat will be protected or enhanced; and,
- The project does not create new or aggravate existing natural hazards.

The Central Waterfront Secondary Plan (CWSP) identifies that lake filling will be considered only for stabilizing shorelines, improving open spaces, creating trail connections, preventing siltation and improving natural habitats and is subject to Provincial and Federal Environmental Assessment processes. Consideration will be given to the impact of such lake filling on recreational uses.

Department of Fisheries and Oceans Canada (DFO)

- Conduct detailed aquatic effects impact assessment using DFO's Pathways of Effects to characterize the potential for Harmful Alteration, Disruption or Destruction (HADD) of fish habitat or potential for death of fish during the detail design phase to characterize and quantify impacts to fish and fish habitat.
- The proposed impacts associated with the permanent destruction of about 45,500 m^2 of fish habitat are likely to result in the need for authorization under the federal Fisheries Act administered by DFO. Submission of a Request for Review to the Department of Fisheries and Oceans will assist with the identification and requirements of the project in relation to the Fisheries Act.
- The DFO approval process is anticipated to be in line with the "Aquatic Habitat Toronto streamlined process".

Ministry of the Environment, Conservation and Parks

- Consultation with Ministry of Environment Conservation and Parks (MECP) to address Species at Risk assessments.
- Specifically, due to the potential for presence of American Eel and the documented presence of unconsolidated sand substrates within the aquatic boundaries of the proposed project areas, it is recommended that consultation with the Ministry of the Environment, Conservation and Parks is conducted to confirm that no impacts to American Eel or its habitat is anticipated to occur and that no permitting under the Endangered Species Act would apply. This consultation is recommended to occur early on during the detail design phase in order to avoid potential for future schedule delays.

Toronto and Region Conservation Authority (TRCA)

- Due to the work proposed to occur within the TRCA Regulated Area, it is anticipated that permitting under O.Reg 166/06 will be required. It is recommended that the TRCA be consulted to confirm that a permit for the proposed development be required.

Ministry of Natural Resources and Forestry

- Should the construction require fish removal services to be completed from within an isolated area of Lake Ontario, a qualified biologist shall complete the relocation under the issuance of a License to Collect Fish for Scientific Purposes administered by MNRF under the Fish and Wildlife Conservation Act.

7. PRELIMINARY IMPLEMENTATION SCHEDULE

Figure 37 presents a preliminary implementation schedule for Alternative 6 to achieve RESA implementation by mid-2027. Although Alternative 6 serves as the basis for the following discussion, it's important to note that the timeframes for constructing each option depend on the resources committed to the project and that each alternative has a similar conceptual construction schedule profile with meeting the RESA regulatory compliance deadline of mid 2027. Alternative 4 would offer the least scheduling risks due to the much smaller in-water works scope. However, even Alternative 4 would likely only achieve completion in 2027 albeit in the later part of Q1 or early Q2.

Some of the critical path and scheduling challenges and assumptions are captured below. These are offered for initial planning purposes. A more detailed review is required and is recommended to form part of the preliminary and final design process and in parallel with the environmental impact assessment processs.

- To achieve the regulatory timeline set for completion of the RESAs at the airport, all contracts and subcontracts should contain a provision that time is of the essence.
- Preliminary design and associated impact assessment should begin as soon as possible.
- Environmental studies and associated permitting are considered critical path elements as they will control when construction activities can begin in the lake and the inner harbour. PortsToronto is a partner of Aquatic Habitat Toronto, which is jointly chaired by the Toronto and Region Conservation Authority and the Department of Fisheries and Oceans Canada. As an active member of that committee, PortsToronto will consult with the various agencies to ensure any approvals are in place before work begins. No construction can begin until in-water permits and approvals are in place.
- It is anticipated that fish spawning restrictions will impact the efficiency of in-water work between March 15 to July 15 (4 months) of each construction season.
- In water production will also be impacted by an estimated 1 to 2 months each construction season due to freeze-over of the lake and inner harbour and potential high-wind conditions.
- Efficiencies during construction will be reduced due to nighttime working hours and daytime restrictions.
- Landmass and breakwater structure work based on two crews working both the east and west sides concurrently. Fills and core materials will be placed using self-unloading vessels. A separate crew will be responsible for combi walls (sheet piles).

- It is recommended that as part of preliminary activities a constructability review be completed and local market conditions be evaluated, and the capacity of local construction firms be assessed to deliver this project within the required timelines.
- NAV CANADA coordination will require feasibility studies, procurement, airspace re-design, planning and construction coordination activities to be in place and finalized at least 12 to 18 months before construction begins. Initial discovery consultations have occurred and should continue on a regular basis.
- Work on the NAV CANADA Marine Surveillance Radar (MSR) modifications will need to be coordinated closely with the west landmass work to ensure no radar blind spots evolve as the breakwater structure is constructed.
- Taxiway B work cannot be initiated until the western landmass is complete and the NAV CANADA Localizer 26 antenna is relocated. The western landmass construction should be prioritized, and RESA compliance achieved as priority.
- Taxiway D work cannot be initiated until most of the north portion of the eastern landmass is complete and the work would need to be sequenced to ensure access to the existing Taxiway D is not restricted during daytime hours.
- The proposed schedule identifies ***RESA Phase 1*** as the highest priority for construction and commissioning. This Phase 1 is designed to prioritize RESA compliance by the regulatory timeline of mid-2027. Phase 2 represents the ancillary projects that can follow or be completed concurrently but are not mandatory for RESA compliance.
- Options that should be considered and incorporated into the design and construction sequencing planning to accelerate the in-water work include:
  - Install turbidity curtains and keep them in place so that the work can carry on during the no-in-water work window.
    - Implement on east / harbour side where it is less challenging.
    - Coordinate with TRCA to carry out electro fishing within the curtain to fish out the area.
  - Pre-order core stone and fill material.
  - Pre-order armour stone and rip rap.

  These options should be reviewed and studied further as part of completing preliminary design and the environmental impact assessment process.

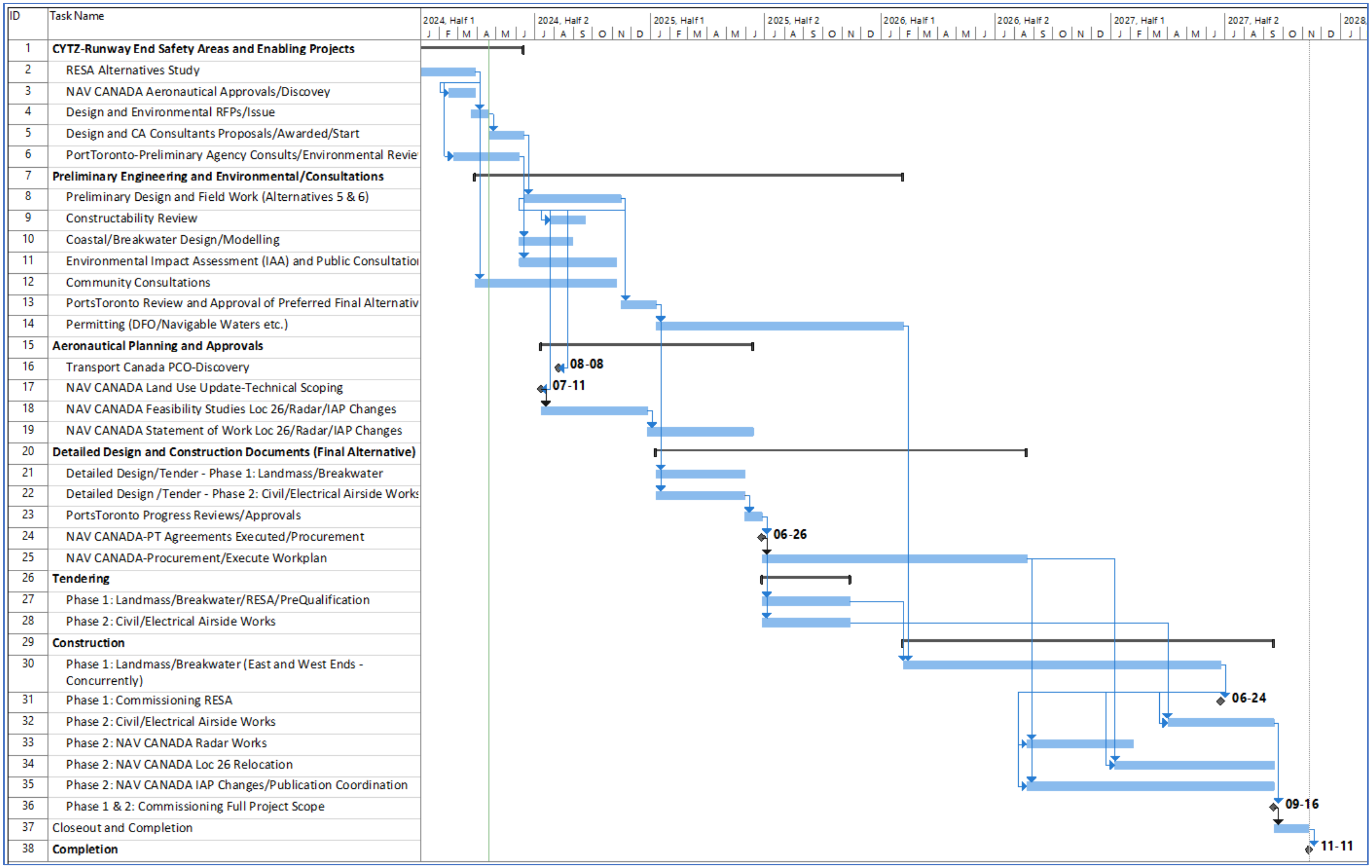

Figure 37: Preliminary Project Schedule for the Preferred Alternative

8. RECOMMENDED NEXT STEPS

Based on the foregoing, the following next steps are recommended:

- PortsToronto to endorse and issue this Runway 08/26 RESA Alternatives Study for review by the City of Toronto / Transport Canada.
- Prepare and issue a Request for Proposals to select a qualified consultant to proceed with the preliminary and final design and environmental impact assessments for Alternative 6.
- Select consulting team to undertake Preliminary and Final Design and Impact Assessment for Alternative 6 and commence the work.
- PortsToronto to continue to seek funding opportunities and prepare a financial plan for the project.

>>> END OF REPORT

APPENDIX A:

Technical Report Figures 1 - 7

EXHIBIT INDEX

DWG No.	TITLE
EXHIBIT 1	RESA STUDY SITE PLAN
EXHIBIT 2	ALTERNATIVE 1 - REDUCED DECLARED DISTANCES (VIRTUAL RESA)
EXHIBIT 3	ALTERNATIVE 2 - RECONFIGURED THRESHOLDS / PRE-THRESHOLD AREA
EXHIBIT 4	ALTERNATIVE 3 - ENGINEERED MATERIAL ARRESTING SYSTEM (EMAS)
EXHIBIT 5	ALTERNATIVE 4 - RESA MINIMUM LAND MASS EXPANSION
EXHIBIT 6	ALTERNATIVE 5 - RESA PLUS PARTIAL SAFETY & ENVIRONMENTAL BENEFITS
EXHIBIT 7	ALTERNATIVE 6 - RESA PLUS FULL SAFETY, COMMUNITY, AND AIRFIELD EFFICIENCY BENEFITS

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April 18, 2024

Notes

1. THIS DRAWING TO BE USED FOR PLANNING PURPOSES ONLY.
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3. SOME ROUNDING MAY OCCUR ON CONVERSIONS BETWEEN METRIC AND IMPERIAL UNITS.

No.	DATE	DESCRIPTION	BY	APPD
1	APRIL, 2024	FINAL REPORT	EA	BGS
0	MARCH, 2024	ISSUED FOR DRAFT FINAL REPORT	EA	BGS

REVISION / ISSUE

PORTS TORONTO

AVIA · NG AIRPORT CONSULTANTS

SHOREPLAN

MORRISON HERSHFIELD

Project: BILLY BISHOP TORONTO CITY AIRPORT (CYTZ) RESA ALTERNATIVES STUDY

Scale 1:3000

Title: RESA STUDY SITE PLAN

Checked:	BGS	Avia NG Project No.	23-0153
Design:	EA	Contract No.	N/A
Drawn:	MG / EA	DRAWING No.	EXHIBIT 1

RUNWAY 08 OPERATIONS
- **TAKEOFF TO THE EAST**
- **LANDING FROM THE WEST**

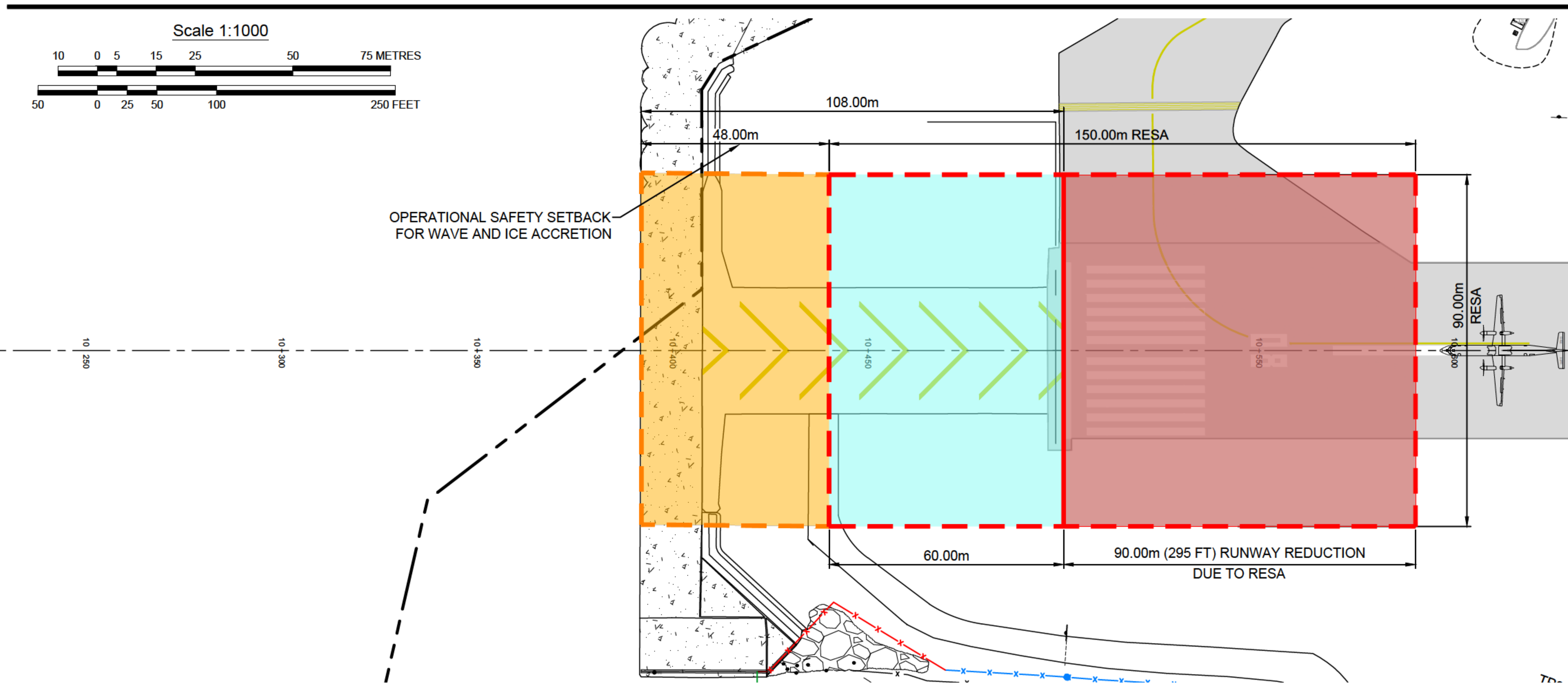
EXISTING DECLARED DISTANCES	
RUNWAY 08	
TORA	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)

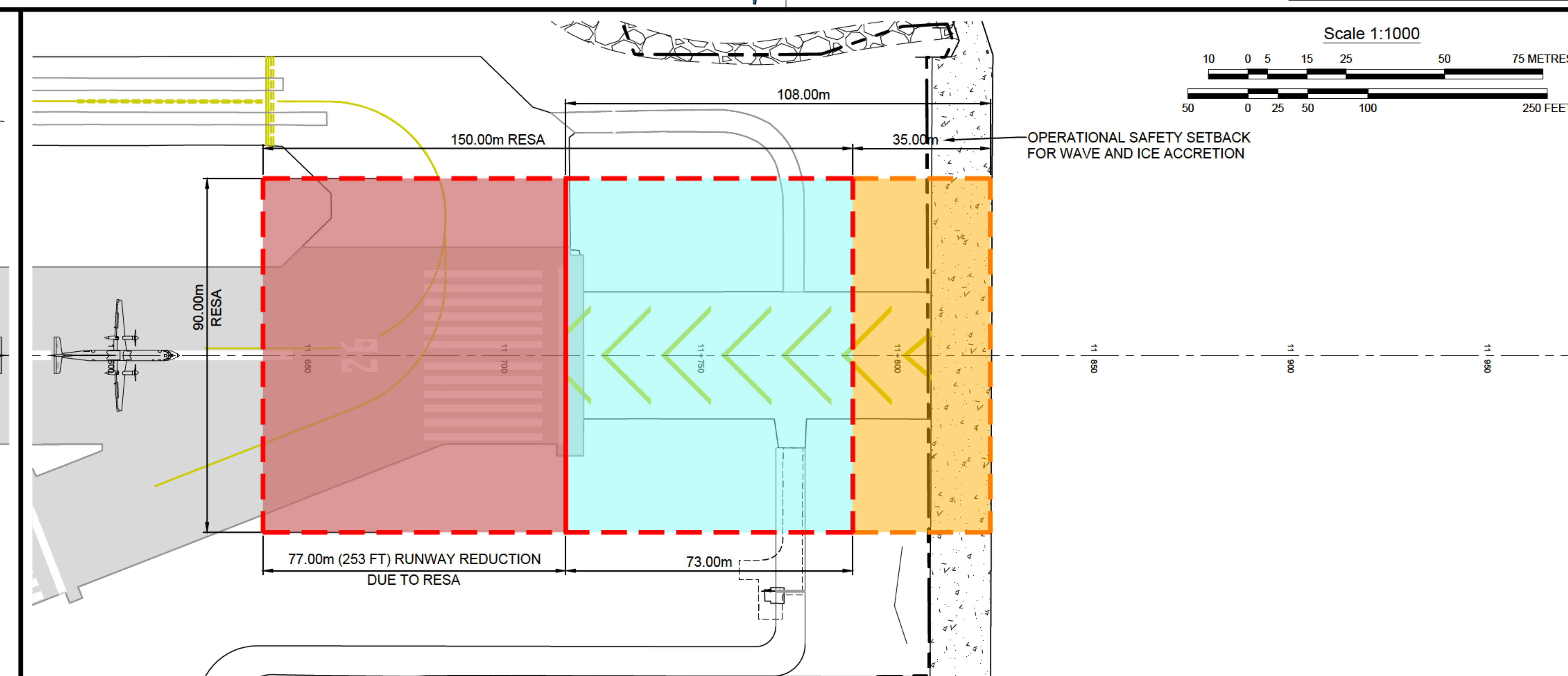
REVISED DECLARED DISTANCES	
RUNWAY 08	
TORA	3,735 ft (1,138.4 m)
TODA	4,338 ft (1,322.2 m)
ASDA	3,735 ft (1,138.4 m)
LDA	3,735 ft (1,138.4 m)

RUNWAY 26 OPERATIONS
- **TAKEOFF TO THE WEST**
- **LANDING FROM THE EAST**

EXISTING DECLARED DISTANCES	
RUNWAY 26	
TORA	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)

REVISED DECLARED DISTANCES	
RUNWAY 26	
TORA	3,693 ft (1,125.6 m)
TODA	4,338 ft (1,322.2 m)
ASDA	3,693 ft (1,125.6 m)
LDA	3,693 ft (1,125.6 m)





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3. SOME ROUNDING MAY OCCUR ON CONVERSIONS BETWEEN METRIC AND IMPERIAL UNITS.

No.	DATE	DESCRIPTION	BY	APPD
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0	MARCH, 2024	ISSUED FOR DRAFT FINAL REPORT	EA	BGS

REVISION / ISSUE

PORTS TORONTO

AVIA · NG AIRPORT CONSULTANTS

SHOREPLAN

MORRISON HERSHFIELD

Project: BILLY BISHOP TORONTO CITY AIRPORT (CYTZ) RESA ALTERNATIVES STUDY

Scale - AS NOTED

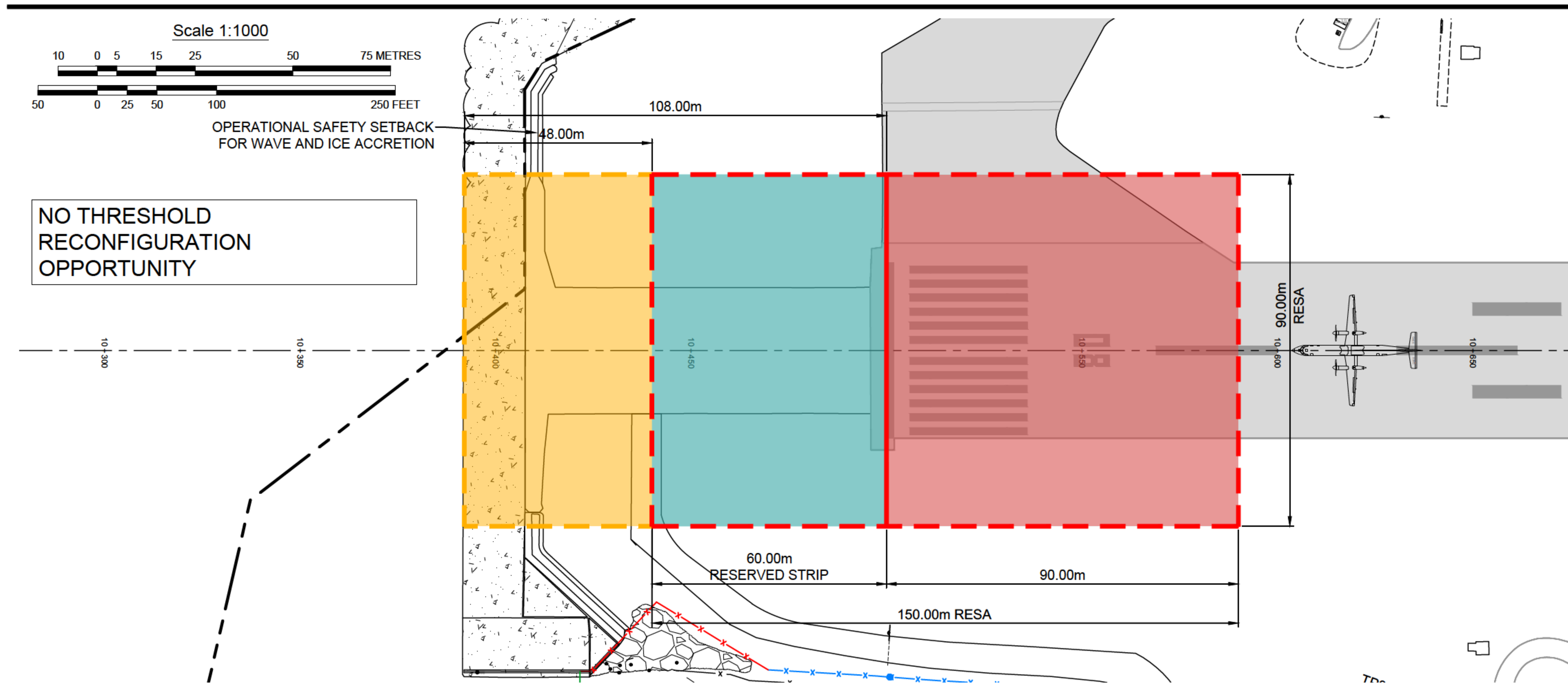
Title: ALTERNATIVE 1 - REDUCED DECLARED DISTANCES (VIRTUAL RESA)

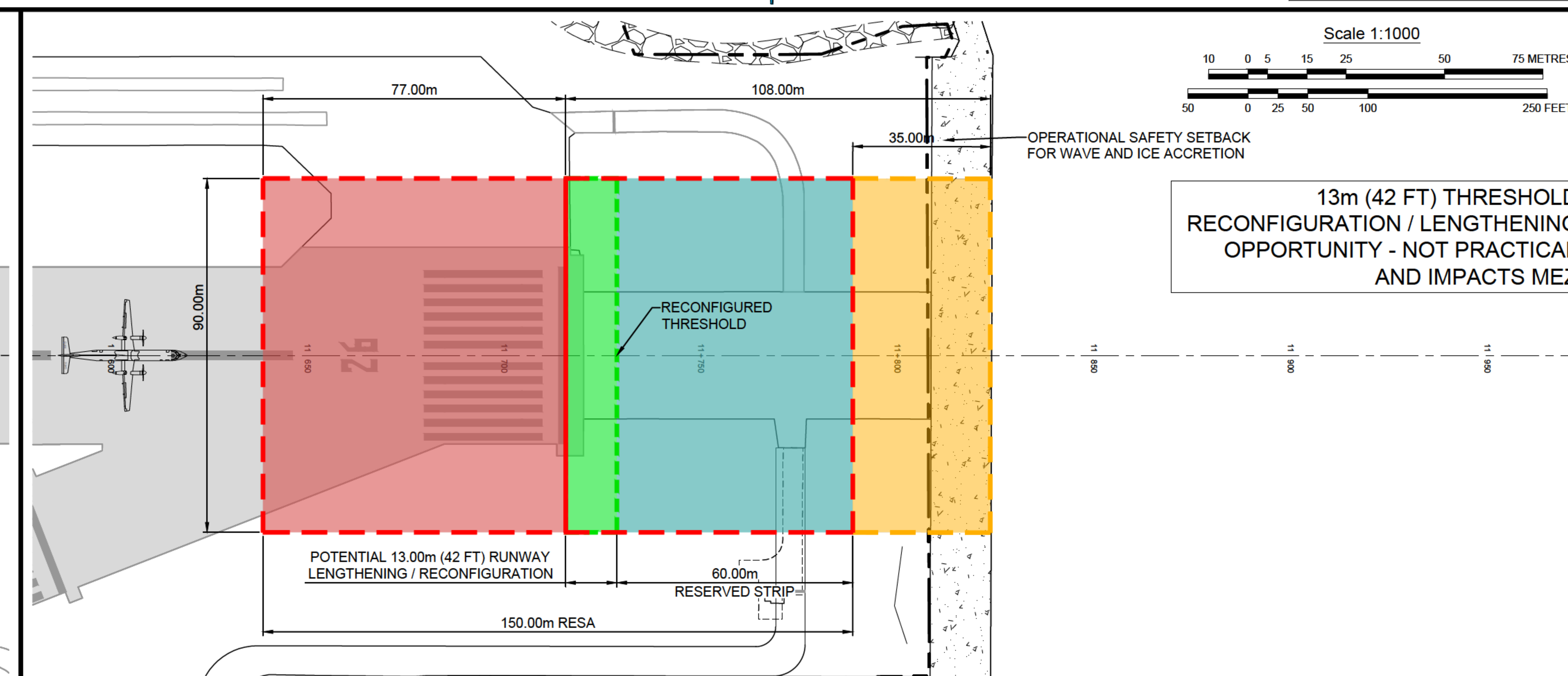
Checked:	BGS	Avia NG Project No.	23-0153
Design:	EA	Contract No.	N/A
Drawn:	MG / EA	DRAWING No.	EXHIBIT 2

ANSI FULL BLEED D (22.00 X 34.00 INCHES)
s:\cytz-billy bishop toronto city airport\CAD\23-0153 - resa study\23-0153 - Figure 2 - Alternative 1.dwg
April 18, 2024

EXISTING DECLARED DISTANCES	
RUNWAY 08	
TORA	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)
REVISED DECLARED DISTANCES	
RUNWAY 08	
TORA	3,735 ft (1,138.4 m)
TODA	4,338 ft (1,322.2 m)
ASDA	3,735 ft (1,138.4 m)
LDA	3,735 ft (1,138.4 m)

EXISTING DECLARED DISTANCES	
RUNWAY 26	
TORA	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)
REVISED DECLARED DISTANCES	
RUNWAY 26	
TORA	3,735 ft (1,138.4 m)
TODA	4,380 ft (1,335.2 m)
ASDA	3,735 ft (1,138.4 m)
LDA	3,735 ft (1,138.4 m)





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3. SOME ROUNDING MAY OCCUR ON CONVERSIONS BETWEEN METRIC AND IMPERIAL UNITS.

No.	DATE	DESCRIPTION	BY	APP'D
1	APRIL, 2024	FINAL REPORT	EA	BGS
0	MARCH, 2024	ISSUED FOR DRAFT FINAL REPORT	EA	BGS

REVISION / ISSUE

PORTS TORONTO | AVIA NG AIRPORT CONSULTANTS | SHOREPLAN | MORRISON HERSHFIELD

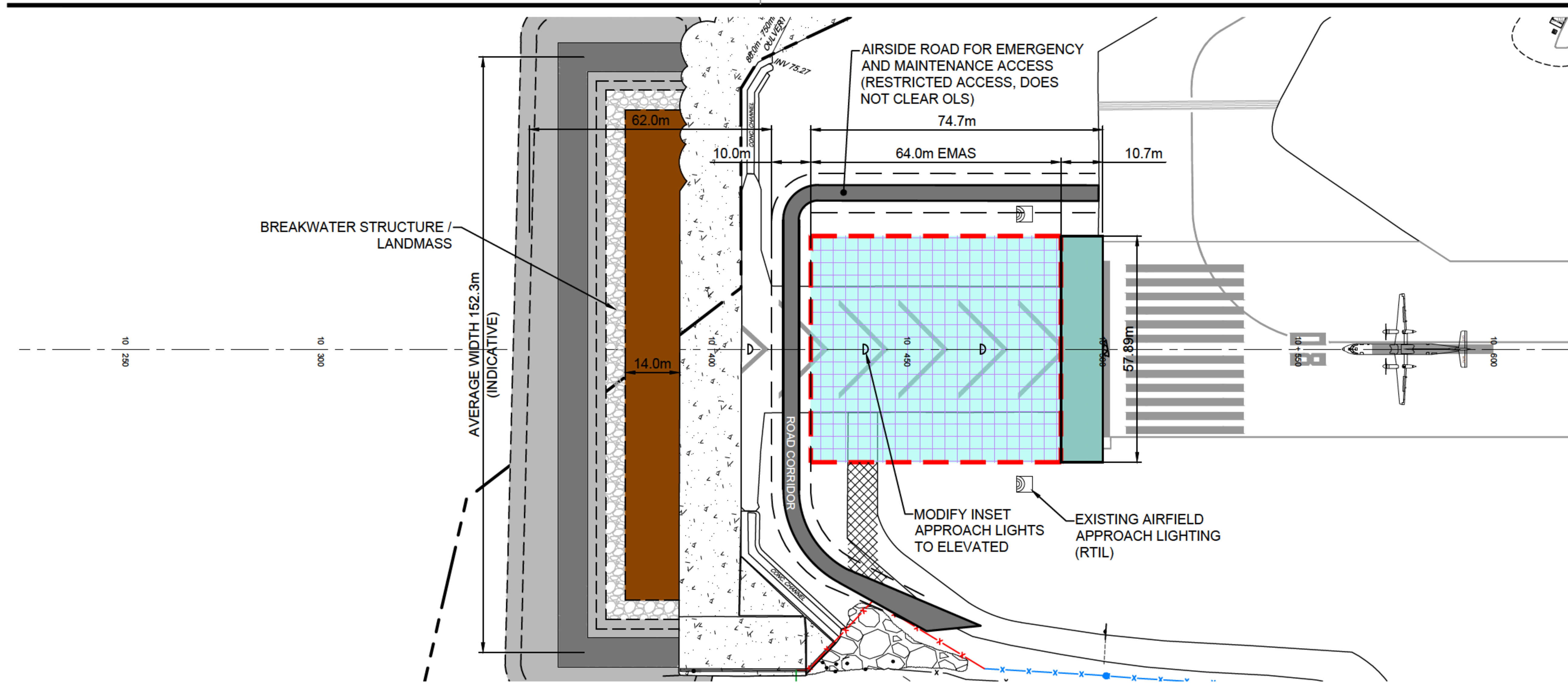
Project: BILLY BISHOP TORONTO CITY AIRPORT (CYTZ) RESA ALTERNATIVES STUDY

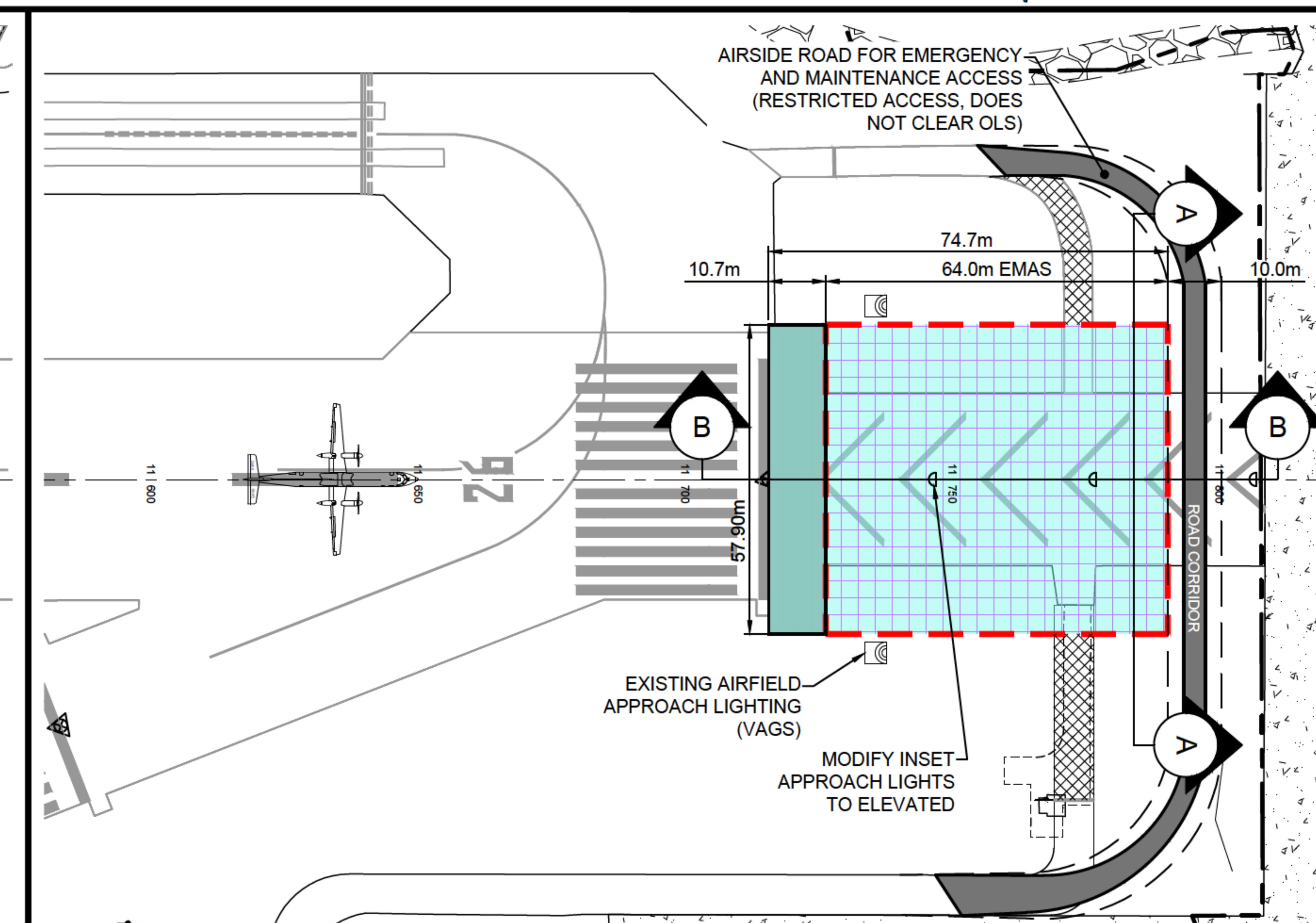
Scale - AS NOTED

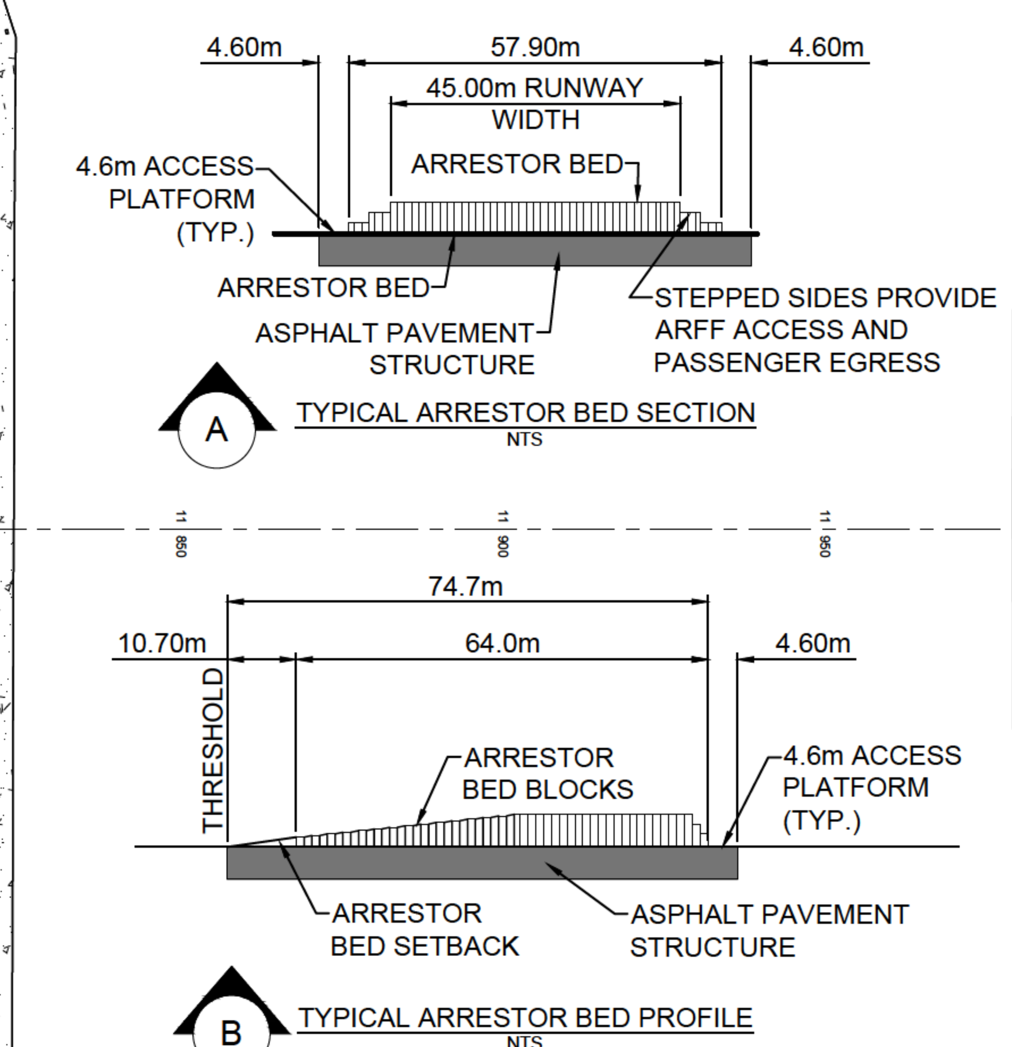
Title: ALTERNATIVE 2 - RECONFIGURED THRESHOLDS / PRE-THRESHOLD AREA

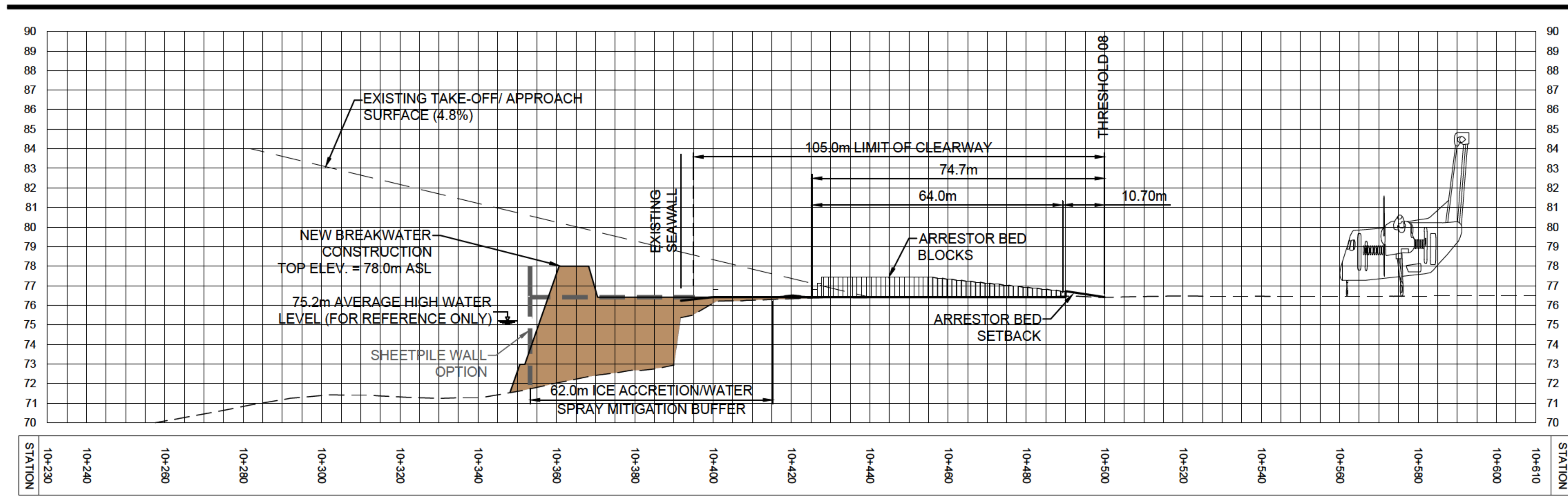
Checked:	BGS	Avia NG Project No.	23-0153
Design:	EA	Contract No.	N/A
Drawn:	MG / EA	DRAWING No.	EXHIBIT 3

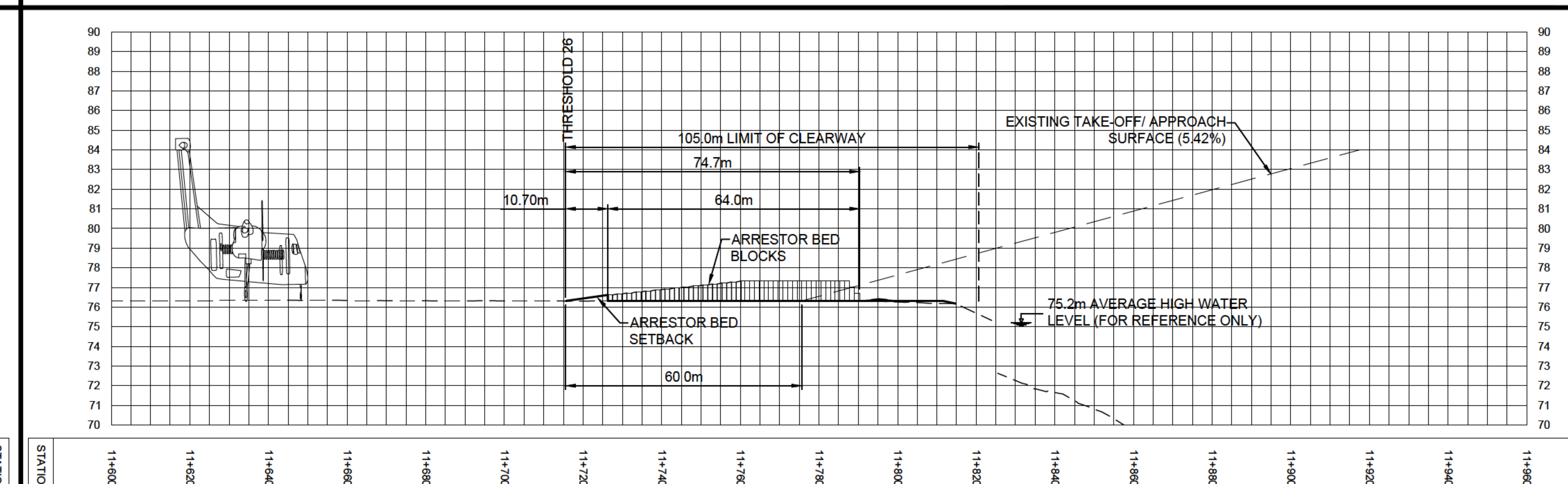
EXISTING DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
REVISED DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)











ANSI FULL BLEED D (22.00 X 34.00 INCHES)
s:\cytz-billy bishop toronto city airport\CAD\23-0153 - resa study\23-0153 - Figure 4 - Alternative 3 (EMAS).dwg
April 18, 2024

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REVISION / ISSUE

PORTS TORONTO

AVIA · NG AIRPORT CONSULTANTS

SHOREPLAN

MORRISON HERSHFIELD

Project:
BILLY BISHOP TORONTO CITY AIRPORT (CYTZ)
RESA ALTERNATIVES STUDY

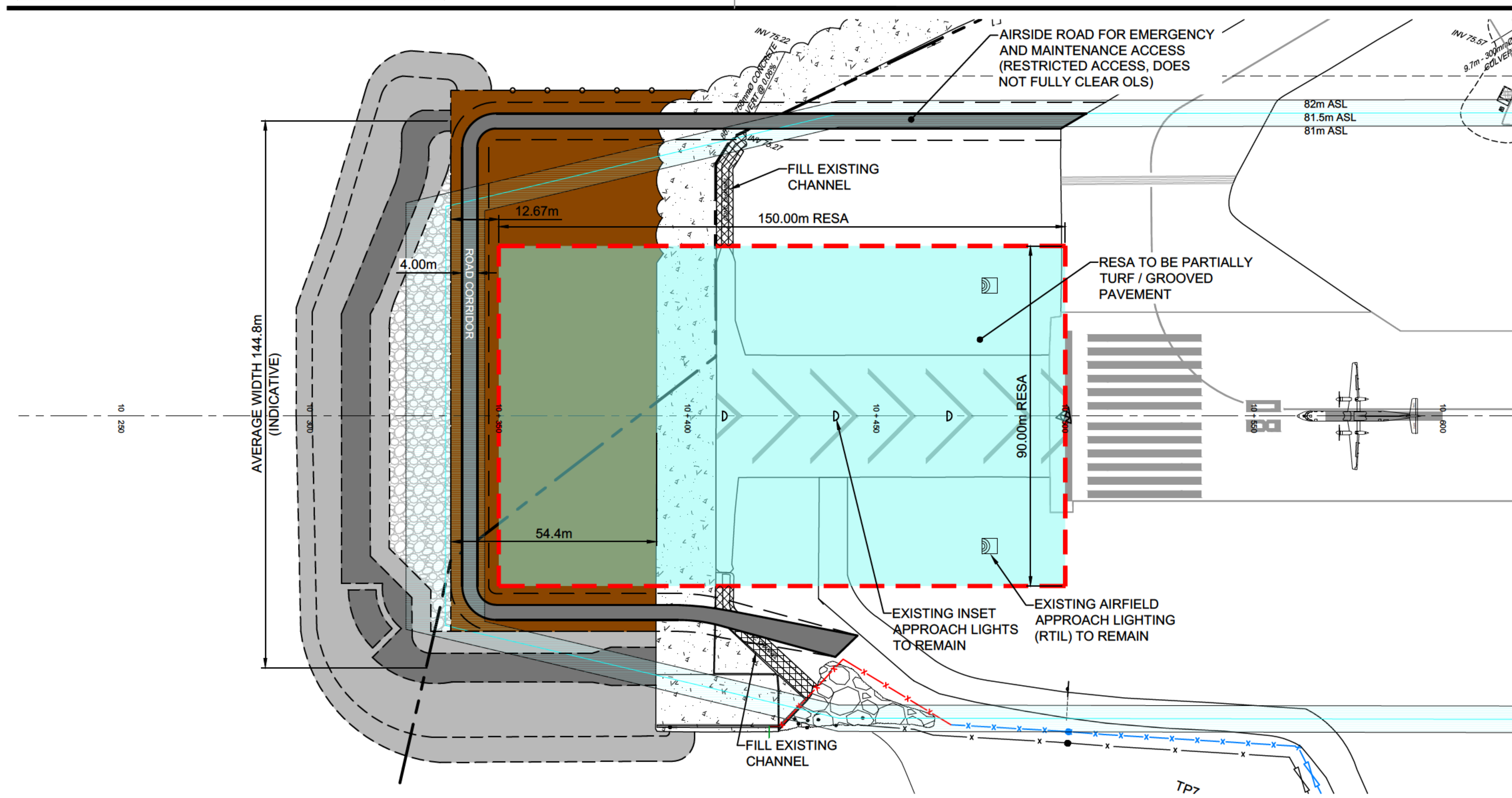
Scale 1:1000

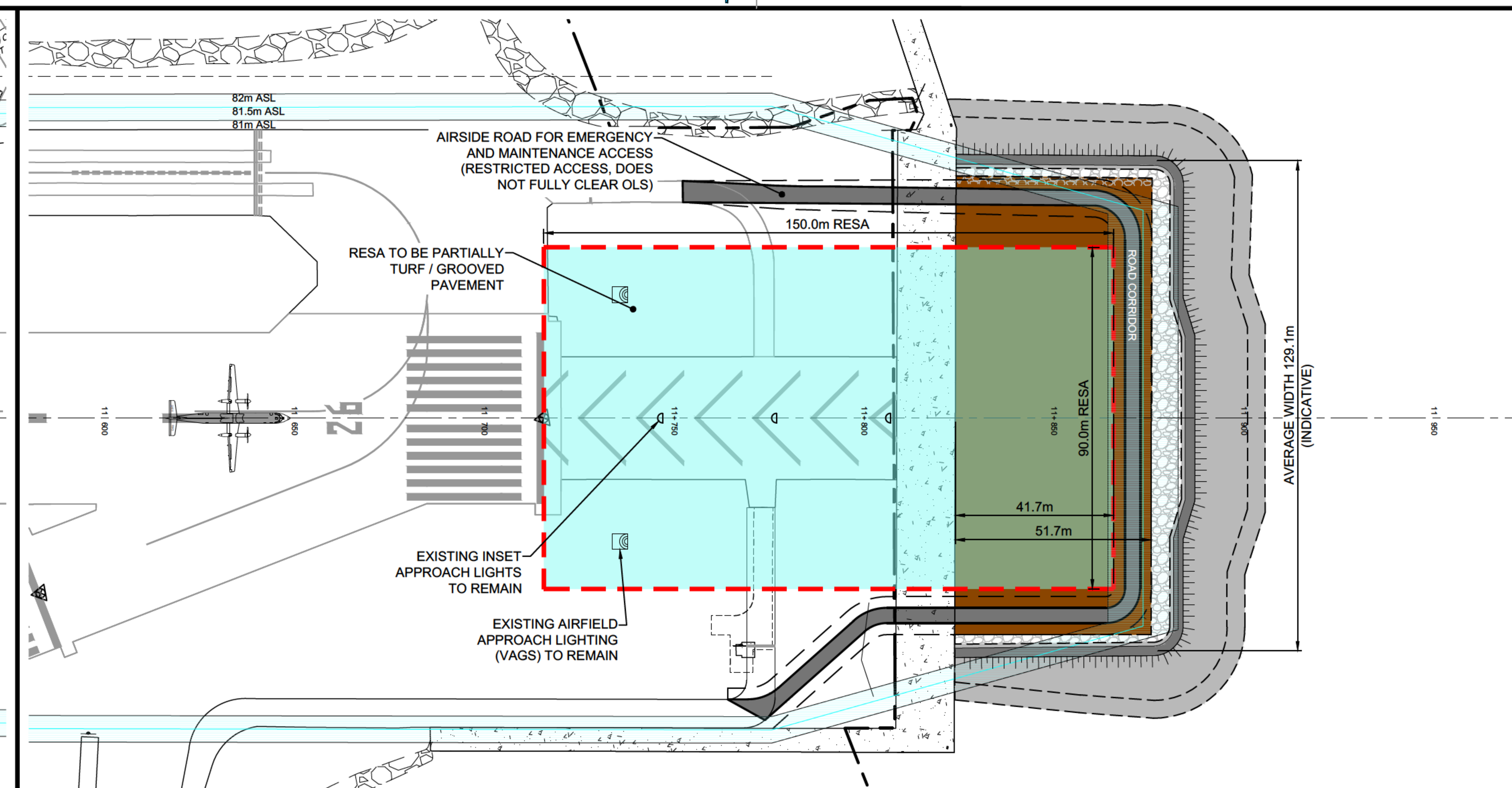
Title:
ALTERNATIVE 3 - ENGINEERED MATERIAL ARRESTING SYSTEM (EMAS)

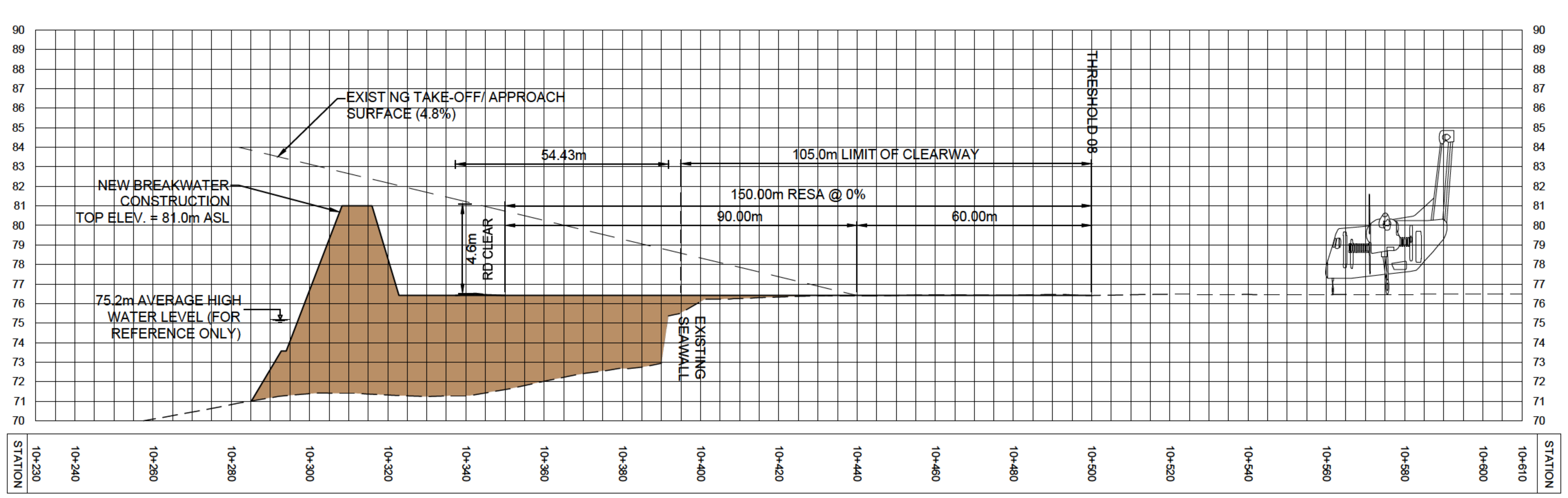
Checked:	BGS	Avia NG Project No.	23-0153
Design:	EA	Contract No.	N/A
Drawn:	MG / EA	DRAWING No.	EXHIBIT 4

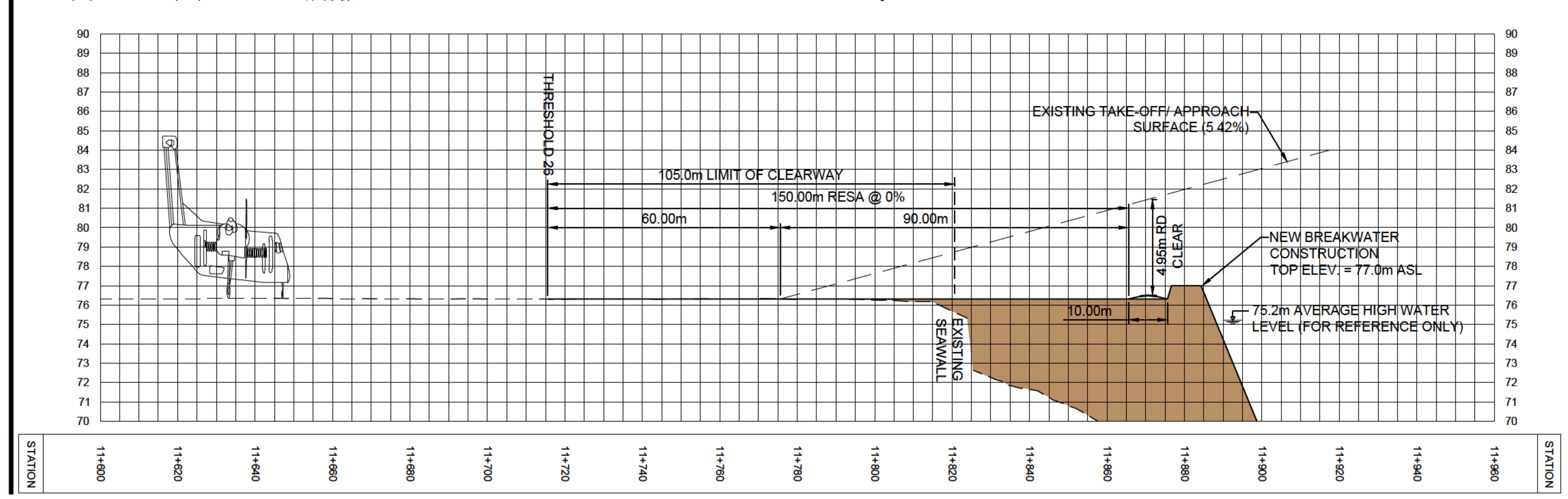
EXISITING DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)

REVISED DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)









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SHOREPLAN

MORRISON HERSHFIELD

Project:
BILLY BISHOP TORONTO CITY AIRPORT (CYTZ) RESA ALTERNATIVES STUDY

Scale 1:1000
10 0 5 15 25 50 75 METRES
50 0 25 50 100 250 FEET

Title:
ALTERNATIVE 4 - RESA MINIMUM LAND MASS EXPANSION

Checked:	BGS	Avia NG Project No.	23-0153
Design:	EA	Contract No.	N/A
Drawn:	MG / EA	DRAWING No.	EXHIBIT 5

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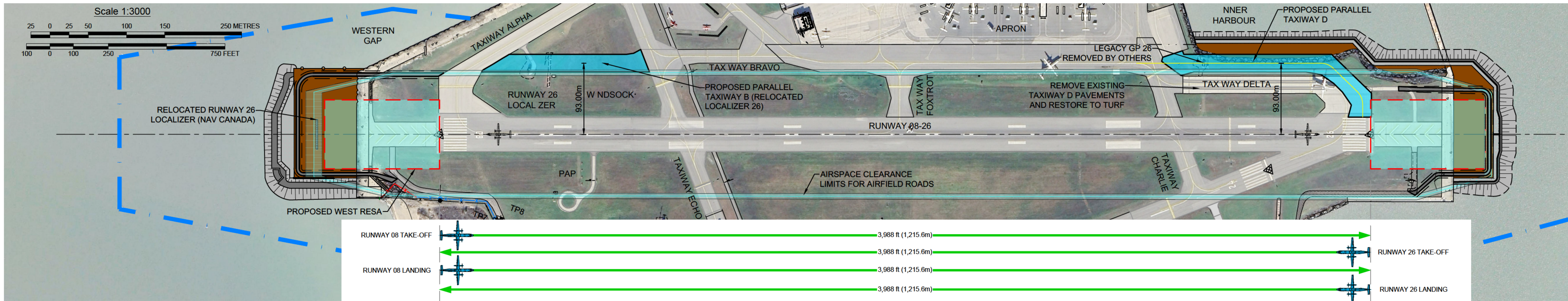
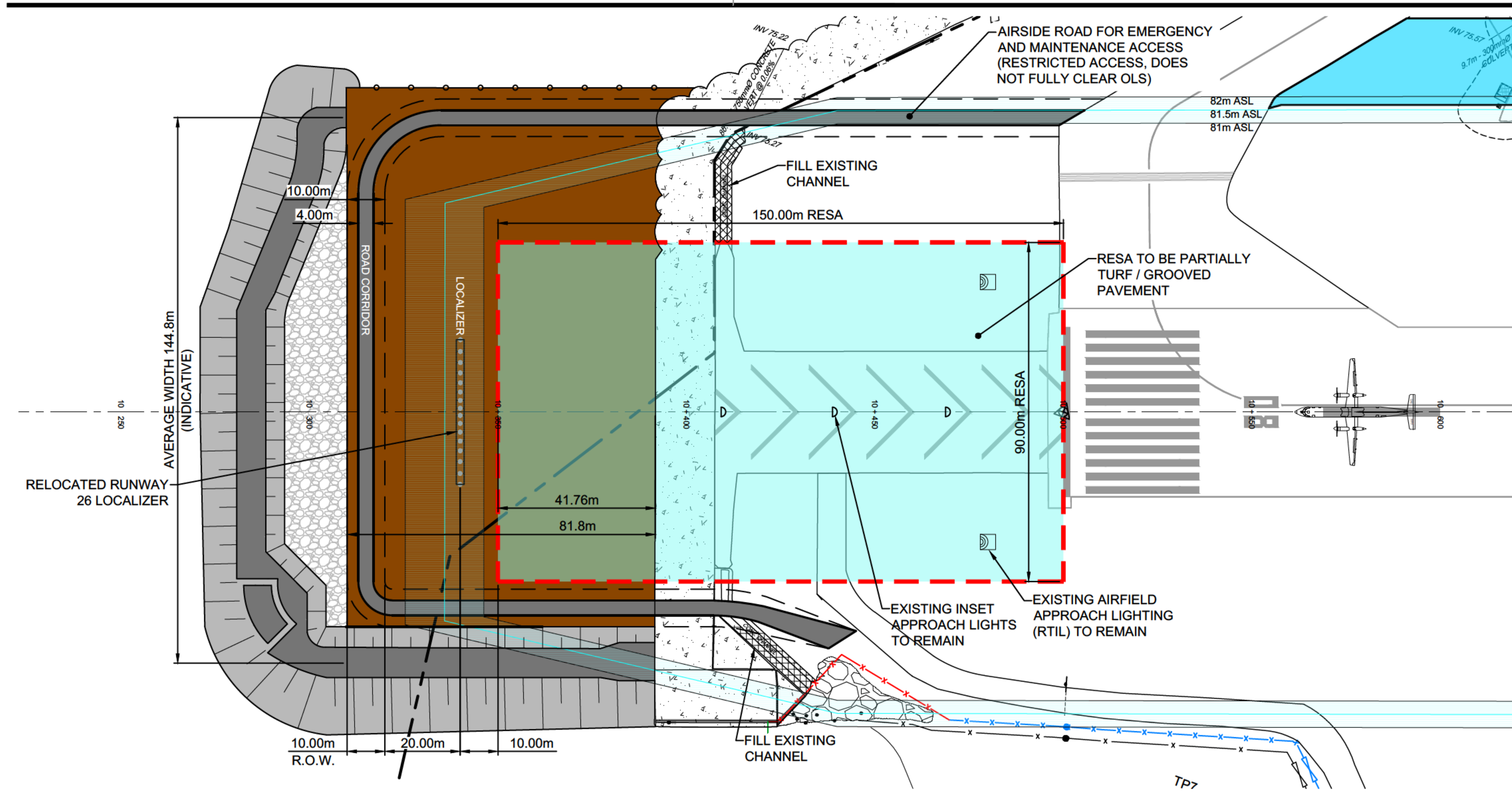
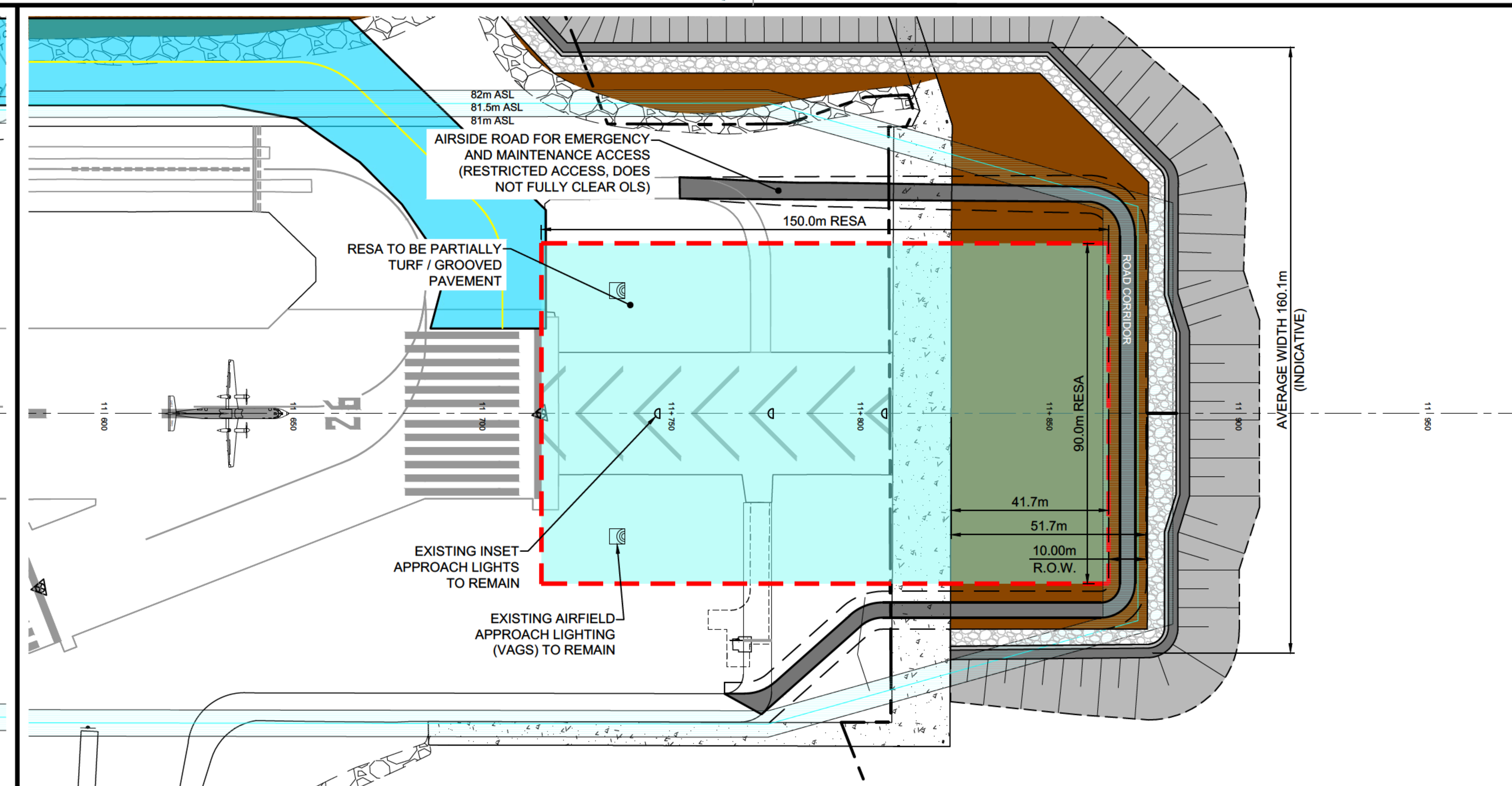
April 18, 2024

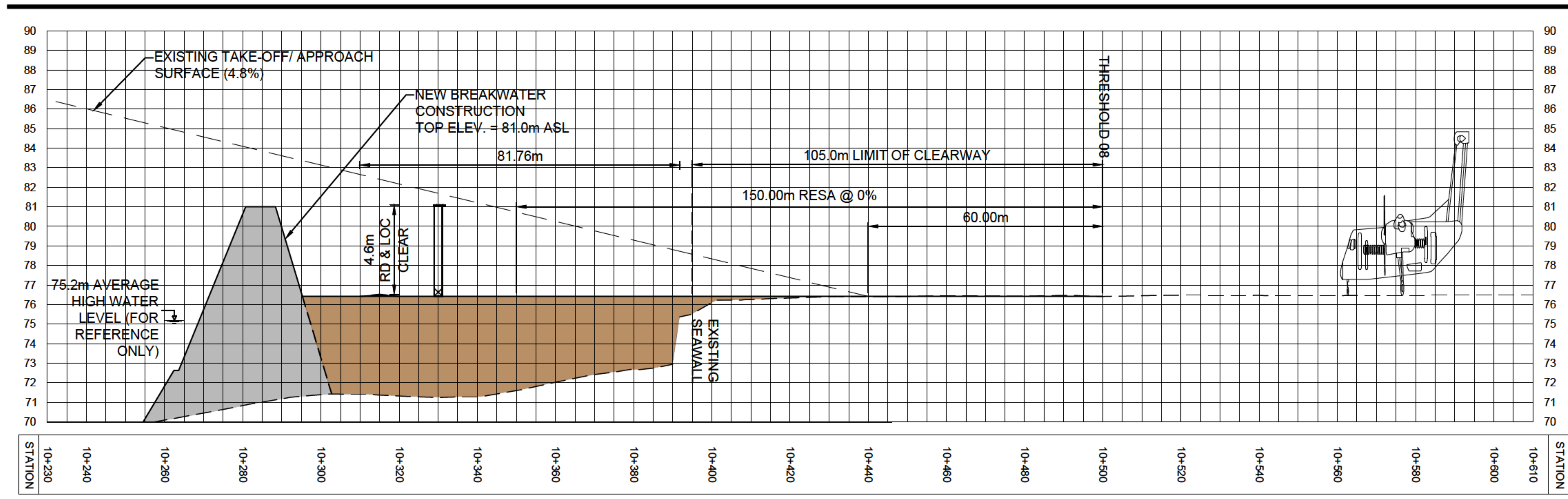


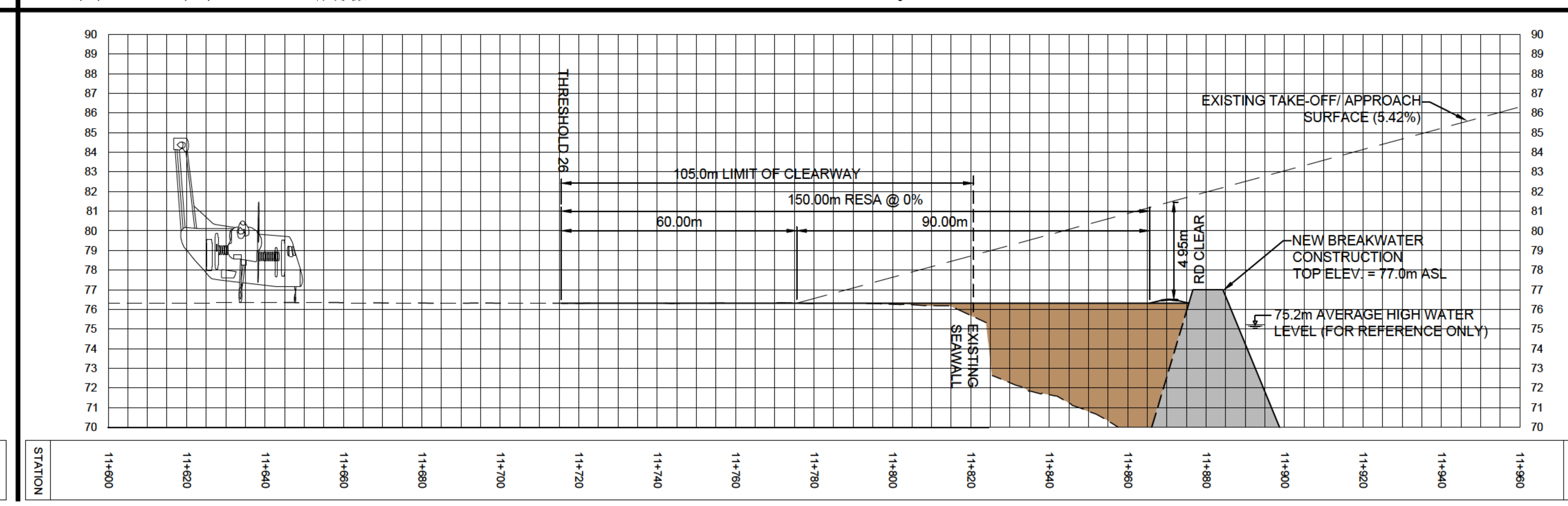
EXISITING DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)

REVISED DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)









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PORTS TORONTO

AVIA · NG AIRPORT CONSULTANTS

SHOREPLAN

MORRISON HERSHFIELD

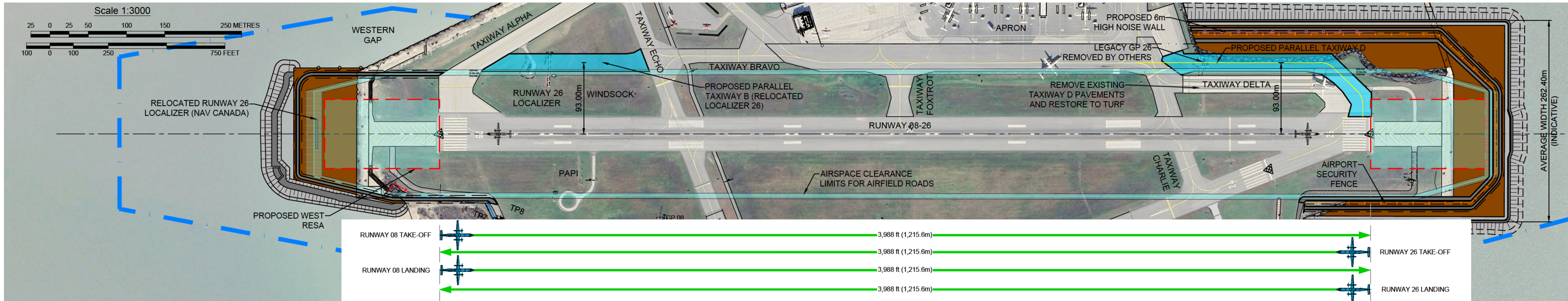
Project:
BILLY BISHOP TORONTO CITY AIRPORT (CYTZ) RESA ALTERNATIVES STUDY

Scale 1:1000

Title:
ALTERNATIVE 5 - RESA PLUS PARTIAL SAFETY & ENVIRONMENTAL BENEFITS

Checked:	BGS	Avia NG Project No.	23-0153
Design:	EA	Contract No.	N/A
Drawn:	MG / EA	DRAWING No.	EXHIBIT 6

ANSI FULL BLEED D (22.00 X 34.00 INCHES)
April 18, 2024



EXISITING DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)

REVISED DECLARED DISTANCES		
	RUNWAY 08	RUNWAY 26
TORA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
TODA	4,338 ft (1,322.2 m)	4,338 ft (1,322.2 m)
ASDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)
LDA	3,988 ft (1,215.5 m)	3,988 ft (1,215.5 m)

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PORTS TORONTO

AVIA · NG AIRPORT CONSULTANTS

SHOREPLAN

MORRISON HERSHFIELD

Project:
BILLY BISHOP TORONTO CITY AIRPORT (CYTZ) RESA ALTERNATIVES STUDY

Scale 1:1000
75 METRES
250 FEET

Title:
ALTERNATIVE 6 - RESA PLUS FULL SAFETY, COMMUNITY, AND AIRFIELD EFFICIENCY BENEFITS

Checked:	BGS	Avia NG Project No.	23-0153
Design:	EA	Contract No.	N/A
Drawn:	MG / EA	DRAWING No.	EXHIBIT 7

ANSI FULL BLEED (22.00 X 34.00 INCHES)
April 18, 2024