AECOM

# Appendix D

## Water Quality Effects Assessment

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## Runway End Safety Area, Billy Bishop Toronto City Airport

PortsToronto

60733457

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*AECOM: 2024-12-21*

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### Revision History

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| 0 | November 2024 | AECOM | Draft Water Quality Effects Assessment. |
| 1 | May 2025 | AECOM | Draft Water Quality Effects Assessment. |
| 2 | October 2025 | AECOM | Final Water Quality Effects Assessment. |

### Distribution List

| # Hard Copies | PDF Required | Association / Company Name |
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| | ✓ | PortsToronto |
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# Land Acknowledgement

We acknowledge that Billy Bishop Toronto City Airport is located on the traditional territory of many nations including the Mississaugas of the Credit, the Anishinaabe, the Chippewa, the Haudenosaunee, and the Wendat peoples, and is now home to many diverse First Nations, Inuit, and Métis peoples. PortsToronto also recognizes that Toronto is covered by Treaty 13 signed with the Mississaugas of the Credit, and the Williams Treaties signed with multiple Mississaugas and Chippewa bands.

# Table of Contents



## Figures



## Tables

# 1. Introduction

AECOM Canada ULC herein after referred to as “AECOM”, has been retained by Avia NG to complete an Environmental Assessment for the implementation of Runway End Safety Area (RESA) for Runway 08/26 at Billy Bishop Toronto City Airport (the Project). The Billy Bishop Toronto City Airport is owned and operated by PortsToronto (the Project proponent) and is located in the City of Toronto on the Toronto Islands.

The purpose of the Project is to comply with the Canadian Aviation Regulations Part III, Subpart 2, Division VI – Runway End Safety Area (RESA), published in January 2022, which mandate RESAs for airports serving over 325,000 commercial passengers annually. RESAs are designated open spaces at both ends of runways, designed to minimize damage if an aircraft overruns or undershoots the runway. At Billy Bishop Toronto City Airport, the RESA requirements apply only to the primary runway, Runway 08/26, which enables commercial aircraft use.

Although there are no regulatory requirements under the federal or the provincial acts that mandate the Environmental Assessment process for the Project, a Section 82 evaluation under the Impact Assessment Act is required for all Project components that fall on Transport Canada-owned land. A Section 82 evaluation is a requirement under the Impact Assessment Act for projects located on federal lands or being carried out by federal authorities. In the City of Toronto’s Official Plan (2024), policies exist that require projects where lakefilling in Lake Ontario is proposed to undertake an Environmental Assessment. As such, PortsToronto has undertaken a non-statutory Environmental Assessment process for the RESA project at Billy Bishop Toronto City Airport.

As part of the Environmental Assessment, PortsToronto has identified and evaluated various alternatives for implementing a RESA at Billy Bishop Toronto City Airport. The Environmental Assessment also considers the opportunities to enhance airport operational safety. This includes minimizing regular non-airport and airport vehicular crossings on Runway 08/26, currently necessary for both airport operations and Toronto Islands access requiring co-ordination with the airport traffic control tower. This effort supports Transportation Safety Board of Canada’s objective to reduce the risk of runway incursions at airports. Additionally, the Environmental Assessment examined measures to reduce emissions and ground-based noise levels along the lakefront.

The purpose of this Water Quality Effects Assessment Report is to review factors affecting water quality in Toronto Harbour and identify any potential impact to water quality in the harbour associated with the proposed RESA alternatives.

## 1.1 Study Area

The Project Study Area encompasses all Billy Bishop Toronto City Airport lands involved in the RESA implementation, including the Marine Exclusion Zone. The Marine Exclusion Zone is a buoy-marked area of the lake where vessel entry is prohibited without PortsToronto' s authorization. The Project Study Area is illustrated in **Figure 1-1**. The study area for water quality extended to the complete Inner Harbour (**Figure 1-2**).

## 1.2 Background

An overview of the previous studies on water quality in Toronto Harbour was conducted. From this review, a substantial amount of useful information was gathered. One piece of data discovered was a current and comprehensive bathymetric data set of the Inner Harbour that the Canadian Hydrographic Services had obtained in 2015. These data set served as the base of subsequent modelling of water circulation in the Harbour. The most current and relevant water circulation modelling was performed by AECOM in 2018, which explicitly reviewed potential changes in water circulation caused by various Billy Bishop Toronto City Airport's runway encroachments in the harbour under review at that time.

The following were the primary relevant studies that informed this water quality effects assessment:

**Reference 1:** "Appendix N – Hydrodynamic and Sediment Transport Modelling Memorandums", Don Mouth Naturalization and Port Lands Flood Protection Project, Baird, June 2010.

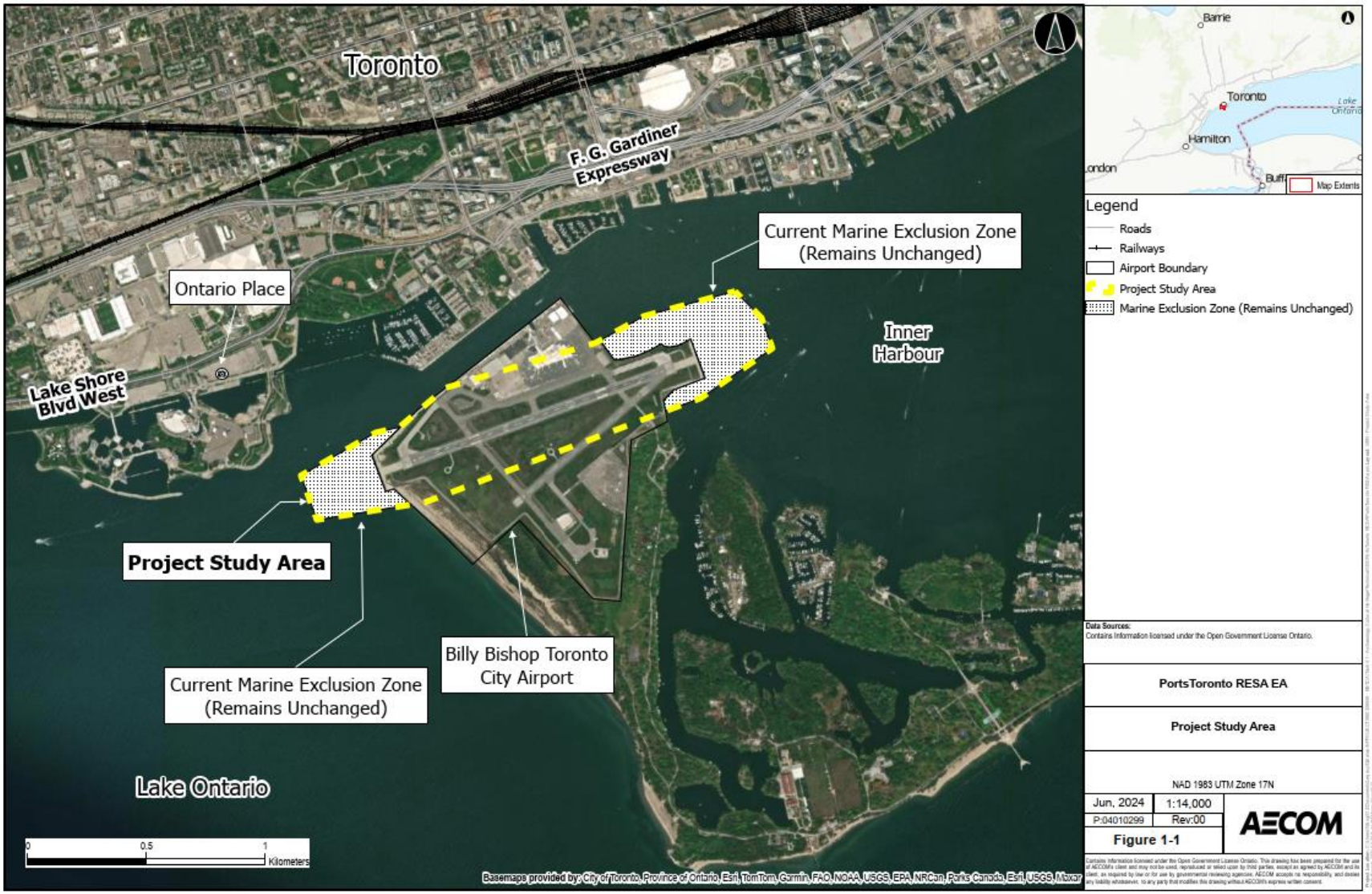
**Reference 2:** "Appendix 3.3 – Toronto Inner Harbour Water Quality Modelling Report", City of Toronto's Don River and Central Waterfront Project – Class Environmental Assessment Study Report, Modelling Surface Water Limited, April 2012.

**Reference 3:** "Toronto Inner Harbour Water Quality Modelling Report" Environmental Assessment Study Report, MMM Group. Ray Dewey, April 2012.

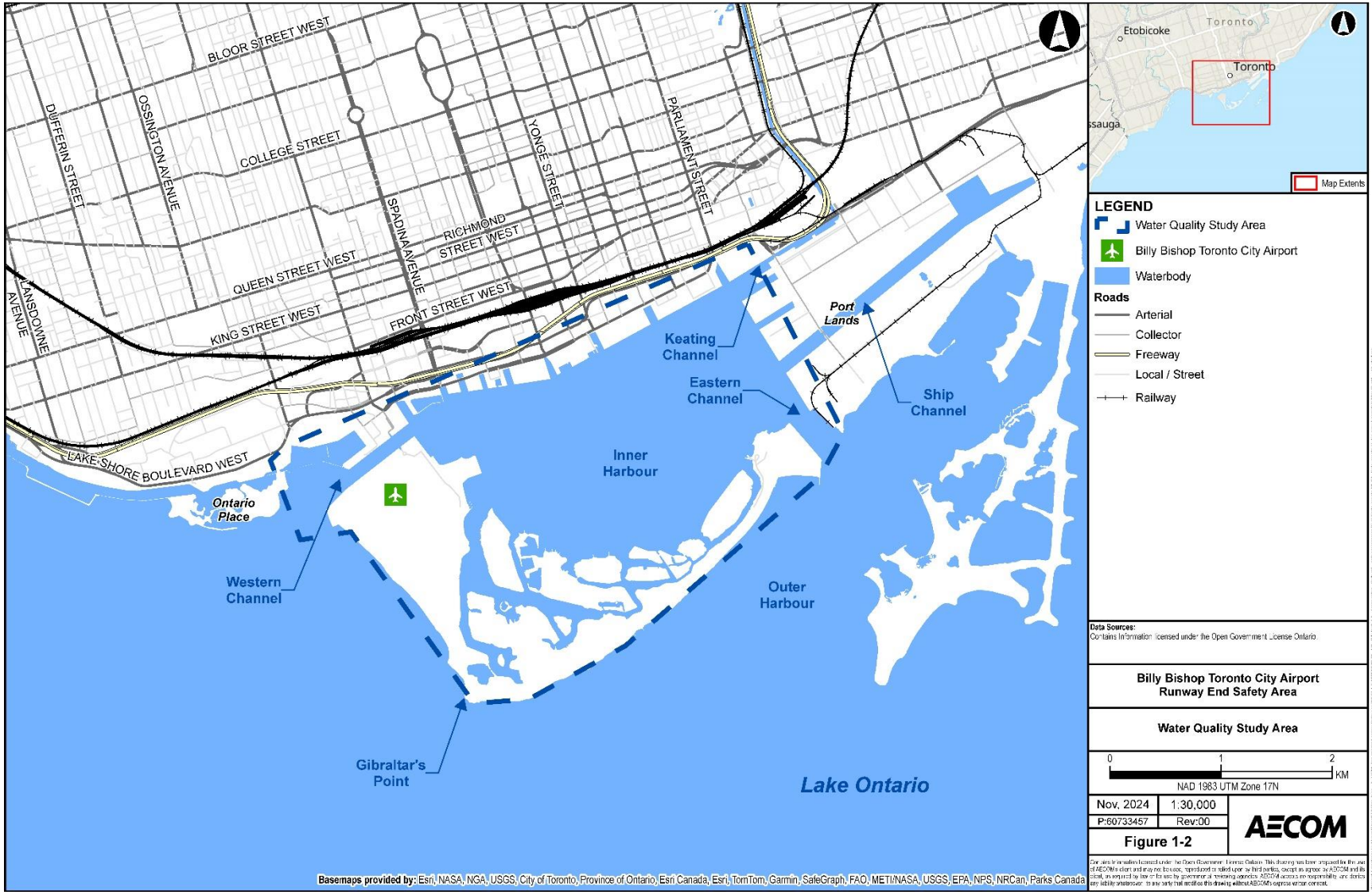
**Reference 4:** "Modelling to Assess Water Quality Impacts from Runway End Safety Area (RESA)", AECOM, April 2018.

The first referenced study focused on the Don River. While the modelling extent only included a small portion of the Inner Harbour, the study provided Don River inputs to the model (i.e., flow) and also helped define the planned future conditions that will be part of the Don Mouth Naturalization and Port Lands Flood Projection Project.

## Figure 1-1: Study Area



## Figure 1-2: Water Quality Study Area



The second referenced study included the whole Inner Harbour and focused on water quality from a beach closure perspective (i.e., how many Blue Flag days occurred). While the model of the Inner Harbour was coarse (90 m grid), it was very useful in establishing the predominant current pattern in the Inner Harbour.

The third referenced study identified and assessed wider influences of water quality in the Inner Harbour in the current and longer trend, and considered such things as changes to water quality loadings, and current Combined Sewer Overflows and future Combined Sewer Overflows mitigation planned by the City. It is our understanding that the City of Toronto currently has a comprehensive water quality model of the harbour that is an update of these works.

The fourth referenced study was an update study to the City of Toronto's 2012 Study (Reference 2), performing 3-dimensional modelling of currents and circulation patterns in the harbour under existing conditions and under a RESA landmass expansion (60 m west, 75 m east) The model used a finer grid (10 m) extending for the entire harbour and incorporating all relevant harbour flow elements (Western Channel and Don River inflow, Eastern Channel outflow) using the Flow3D software. The study is the most comprehensive to date that looks at water circulation patterns in the harbour, and draws relevant conclusions regarding the potential changes in these patterns following the above noted RESA works and the corresponding potential changes in water quality.

# 2. Existing Conditions

## 2.1 Review of Current Sources of Pollutants in the Inner Harbour

The primary sources of pollutants in the harbour are from (a) Combined Sewer Overflows along the Toronto waterfront that occur during large rainfall events; and (b) sediment and pollutants in City storm sewer discharges, either directly to the lake or, more significant in terms of volume and overall impact, in Don River discharges to the harbour.

The harbour has typically been negatively affected by contaminated waters from the combined loadings of the Don River and the numerous storm and combined sewer outfalls, as well as point sources of contamination such as the shipping channel at the Toronto Port Lands. The Toronto and Region Remedial Action Plan and Aquatic Habitat Toronto are addressing water quality in the Toronto waterfront areas.

There have been frequency concentrations of nutrients and fecal coliform bacteria along the entire Toronto Waterfront that area above the Provincial Water Quality Objectives.

The City of Toronto is actively addressing water quality in the harbour through a number of ongoing initiatives. The Don River and Central Waterfront and Connected Projects program will greatly improve water quality in the harbour by capturing, storing, and treat existing Combined Sewer Overflows to the harbour. The City Wet Weather Flow Master Plan (implemented in 2003) is also reducing the impacts of stormwater runoff to the harbour.

It is expected that Combined Sewer Overflows and pollutant sources from the Don River will be significantly decreased and the overall water quality of the Inner Harbour enhanced for future conditions, as a result of these ongoing measures. The future naturalization of the Don Mouth as part of the Don Mouth Naturalization and Port Lands Flood Project will include a new Don River valley system located approximately halfway between the Ship Channel and Keating Channel. Improved water quality from the Don River is expected within proposed lake-connected wetlands.

# 3. Water Quality Assessment

## 3.1 Methodology

The methodology for assessing potential RESA impacts on water quality in Toronto Harbour consists of (1) a review of the processes that affect water quality in the harbour, and (2) a review of how the RESA may affect these processes.

These were addressed in the following steps, discussed in the following section:

- A review of existing processes that regulate or control these levels of pollution.
- An assessment of whether the RESA works would have a significant impact on either of these things.

## 3.2 Review of Existing Processes that Regulate Water Quality in the Harbour

The primary process that regulates water quality in Toronto Harbour is the 'flushing' of the harbour water with cleaner water in lake currents. Typically, pollutant loadings in the harbour rise after rainfall events, as pollutants wash off city surfaces or overflows of the combined sewer system occur. The pollutants enter the harbour and then are flushed out of the harbour over time with the prevailing currents from Lake Ontario. The lake water enters the harbour in the Western Channel and displaces the harbour water discharging in the Eastern Channel, as illustrated below.

This process is affected by circulation patterns of the flow entering the harbour, as well as the volume of circulated lake water vs the volume of water in the harbour. The hydraulic residence time of water in the harbour is an important indicator of water quality, with shorter hydraulic residence time meaning improvements to overall water quality in the harbour.

### 3.2.1 Summary of Findings from Technical Studies

The City's 2012 Study (Reference 2) found that the main direction of discharges from the Don River is for the Don River plume to discharge west toward the middle of the Inner Harbour, but for the plume to mix with the Inner Harbour water and to then be directed toward the Eastern Channel. Three-dimensional harbour current simulations performed by AECOM 2018 Study (Reference 4) found the Don River plume rapidly turned south upon entering the harbour, flowing south closely along the shoreline towards the Eastern Channel outlet from the harbour.

Baird and Associates (Consulting) 2010 Study (Reference 1) reviewed the planned improvements to the Don River mouth. It concluded that moving the Don River outlet would improve water quality.

Baird and Associates (Consulting) 2010 Study (Reference 2) identified the main currents in the Inner Harbour as entering the harbour through the Western Channel and out the Eastern Channel.

AECOM 2018 Study (Reference 4) performed 3-dimensional computational fluid dynamics evaluations using Flow3D to assess the likelihood of water quality impacts with a RESA landmass expansion (60 m west, 75 m east). A number of very important conclusions emerged from the analysis, as outlined below:

- There is no water quality impact from the Don River associated with the RESA landmass, with either the existing or future location of the Don River outlet. The Don River has weak momentum characteristics compared to the stronger current across the Inner Harbour from the Western to Eastern Channel. Currents from the Don River stay close to the eastern side of the harbour, flowing south out the Eastern Channel, and the flow paths are not impacted by the RESA landmass.
- There is minimal to no impact to flushing of the harbour or current patterns within the Harbour caused by the RESA landmass. The RESA landmass encroachment to the harbour is within an eddy zone where the flows entering the harbour through the Western Channel do not directly circulate. See Figure below from AECOM 2018 Study (Reference 4).
- Entrance velocities increased slightly in the Western Channel as a result of the RESA landmass expansion (60 m west, 75 m east), but this will have no water quality impacts in the harbour.

## Figure 3-1: Current Velocities in Toronto Harbour – Three-dimensional Model Results


Source: AECOM, 2018

# 4. Effects Assessment

## 4.1 Runway End Safety Area at Billy Bishop Toronto City Airport

The Project involves the implementation of Runway End Safety Areas (RESAs) at Billy Bishop Toronto City Airport, which requires expanding the landmass at both the east and west ends of Runway 08/26. To meet the requirements for RESA implementation, three alternatives were developed, each progressively building on the previous one with increased landmass expansion and additional features. The following outlines the three RESA alternatives.

### 4.1.1 RESA 1 – Minimum Landmass

RESA 1 proposes the minimum landmass expansion to meet RESA requirements, extending 54 m from the seawall on the west end (7,850 $m^2$), and 52 m on the east end (6,100 $m^2$). On the west end, the breakwater structure will be raised to 81 m above sea level, about 4.5 m above the threshold at Runway 08/26, to prevent wave overtopping and water spray. The breakwater at the east end (Inner Harbour) will be raised to 77 m above sea levels, about 1 to 1.5 m above the threshold, since there is no need to control any waves or water spray.

The proposed layout includes perimeter airfield roads around the RESA ends, providing restricted access across the runway, similar to current access conditions. The road will be managed by the control tower to avoid conflicts with aircraft landing or taking off, as this landmass configuration does not provide sufficient airspace clearance for unrestricted vehicle passage (does not meet Obstacle Limitation Surface requirements). An Obstacle Limitation Surface is an imaginary surface or series of surfaces that define the limits to which objects may project into airspace, to protect the airspace for the safe operation of aircraft during takeoff, landing and emergency operations.

### 4.1.2 RESA 2 – Taxiway Improvements

This alternative builds on RESA 1 – Minimum Landmass by incorporating additional airfield improvements in conjunction with the RESA work at both runway ends. Specifically, it proposes upgrades to Taxiway B at the west end and Taxiway D at the east end to enhance operational efficiency and safety at the airport.

For Taxiway B, the relocation of the Localizer 26 antenna to the new western RESA increases the landmass expansion to the west, reaching 82 $m^2$ from the seawall (11,800 $m^2$). The relocation of Taxiway D requires additional landmass to the northeast,

bringing the total landmass on the east end to 11,300 $m^2$. This relocation enables the airport to upgrade its visual approach guidance system for aircraft landing on Runway 26, which is intended to improve aviation safety with a more precise system. All other features from RESA 1- Minimum Landmass remain the same in this alternative.

### 4.1.3 RESA 3 – Noise Wall and East Utility Conduit

This alternative builds on RESA 2 – Taxiway Improvements by incorporating additional elements. The key new features of RESA 3 include: 1) unrestricted airfield perimeter roads connecting the north and south sides of the airport, 2) a noise wall at the east end along with an extension of the existing noise wall at the west end, and 3) a reserved utility conduit for future hydro, water, and telecommunication services to the Toronto Islands community.

To accommodate these new components and ensure aeronautical airspace clearances over the new roads, security fences, and noise walls, a landmass expansion is required; 73 m from the seawall (29,980 m²) on the east end and 82 m from the seawall (12,600 m²) on the west end. All other features from RESA 2 are included in this alternative.

## 4.2 Net Effects Analysis

The net effects analysis for the three RESA alternatives 1, 2, and 3 was completed based on the preliminary design of RESA alternatives 1, 2 and 3 available during the Environmental Assessment study, and identified key mitigation measures and effects management strategies to minimize or avoid potential impacts. The analysis summarizes the net effects remaining after the application of these measures.

### 4.2.1 Net Effects - Construction

**Table 4-1** outlines the potential effects, proposed mitigation measures, and net effects of RESA 1, RESA 2 and RESA 3 within the water quality study area, during construction.

### 4.2.2 Net Effects- Operation

**Table 4-2** outlines the potential effects, proposed mitigation measures, and net effects of RESA 1, RESA 2 and RESA 3 within the water quality study area, during operation.

## Table 4-1: Net Effects Analysis of RESA 1, RESA 2 and RESA 3 for Water Quality – Construction

| Factor | Criteria | Potential Effects | Mitigation Measures | Net Effects |
|---|---|---|---|---|
| ■ **Changes in water quality within the Inner Harbour.** | ■ Potential temporary impact associated with sedimentation and erosion during construction. | **RESA 1, RESA 2, RESA 3**<br>■ All in-water works present risk of sedimentation.<br>■ Results of 2024 borehole drilling indicate that off-shore sediments on the east end are contaminated. Although the need to dredging is unlikely, there is a potential for water turbidity during construction. | **RESA 1, RESA 2, RESA 3**<br>■ An Erosion and Sediment Control Plan for the work site should be developed and implemented prior to the start of construction and should be inspected and maintained during all phases of construction and especially following precipitation.<br>■ The Erosion and Sediment Control Plan should be tailored to meet construction requirements following identification of risks. Key objectives will include limiting soil disturbance, minimizing exposure, stabilizing surfaces, and controlling sediment displacement through adaptive measures to weather and site conditions. The Erosion and Sediment Control Plan should include the following primary components:<br>– Silt fences and straw wattles: Placed strategically along the perimeter of active construction zones, these barriers will intercept and filter overland flow, slowing water movement to encourage sediment settling.<br>– Sediment basins and traps: Sediment basins should be installed at low points and on existing catch basins to capture sediment-heavy runoff, allowing particles to settle before the water exits the construction area. These basins should be regularly inspected and maintained to ensure efficient operation throughout the Project.<br>– Runoff management and contaminant control: Overland flow, which may carry sediments and potential contaminants, should be managed within the Erosion and Sediment Control Plan by containing and treating runoff on-site. Techniques may include the use of containment berms and filter media around sensitive zones, especially near lake boundaries.<br>■ Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, or any suspended sediment has resettled to the bed of the waterbody and/or settling basin and runoff water is clear.<br>■ Activities near water should be planned to ensure that deleterious materials such as paint, primers, blasting abrasives, rust, solvents, degreasers, grout, or other chemicals do not enter the waterbody.<br>■ Refer to **Table 6-12** in the EA Study Report for additional mitigation measures on soil and sedimentation during construction. | **RESA 1, RESA 2, RESA 3**<br>■ No Net Effect.<br>■ Provided that proper erosion and sediment control measures will be in place during construction, no net effects are anticipated.<br>■ Provided that no dredging occurs in the eastern off-shore areas, contaminated sediment will not be mobilized, and no net effects are anticipated. |

## Table 4-2: Net Effects Analysis of RESA 1, RESA 2 and RESA 3 for Water Quality - Operation

| Factor | Criteria | Potential Effects | Mitigation Measures | Net Effects |
|---|---|---|---|---|
| ■ **Hydraulic residence time of water in Toronto Harbour** | ■ Potential impact on water circulation within the Inner Harbour (longer residence times generally reflect poorer water quality). | **RESA 1, RESA 2, RESA 3**<br>■ 3D modelling showed negligible changes in overall harbour circulation patterns, or changes in velocities in the western (harbour inlet) and eastern (harbour outlet) channels. | **RESA 1, RESA 2, RESA 3**<br>■ No mitigation measure is required. | **RESA 1, RESA 2, RESA 3**<br>■ No Net Effect.<br>■ No change expected in Inner Harbour water quality as a result of proposed RESAs. |

Note: * It was assumed that the overall inner harbour water quality was the main design consideration, and variability of water quality within the harbour (e.g., near shore water quality, or isolated areas of poor flow circulation) were not critical design considerations. We also ignored the large long term water quality benefits in the harbour expected from current/planned City initiatives.

# 5. Conclusion and Recommendations

The water quality effects assessment concluded that each of the three RESA alternatives would have negligible impacts on water quality in the Inner Harbour. This conclusion is based on Three-dimensional modelling of Inner Harbour velocities and circulations performed by AECOM for previously considered runway extension alternatives, each of which is more of an encroachment into the harbour than the current proposed RESA alternatives.

The previous work identifying the factors affecting water quality in the harbour clearly indicated that the previously considered runway extension had negligible impact on water quality. It was also clear that any extremely small changes in water quality due to changes in circulation and hydraulic residence time in the harbour would be negligible in context of the large improvements in water quality expected as a result of future Combined Sewer Overflow storage and ongoing stormwater quality improvements as part of the Wet Weather Flow Master Plan. Given that the current proposed RESA expanded landmasses are smaller encroachments into the harbour than the previously considered runway extension, the potential impacts to water quality are expected to be even less than previously assessed, and are considered negligible. City of Toronto modelling of water quality in the harbour was not available at the time of the study; as a result, a comprehensive up-to-date review of water quality loadings to the harbour from all sources under existing and future conditions has not been acquired or reviewed. We recommend that the City of Toronto should be engaged to provide their current water quality modelling of the harbour and provide any concerns regarding the RESA in the context of long-term water quality in the Inner Harbour. Any concerns identified by the City should be addressed by reviewing the impact of stormwater discharges from the site in the context of the City’s overall water quality model, and reviewing current practices to control stormwater quality from the study area discharge to the Harbour.

# 6. References

AECOM, 2017:

Environmental Assessment of Proposed Runway Extension and Introduction of Jets at BBTCA Environmental Study Report. Appendix C-1 to C-11. September 2017.

AECOM, 2018:

Modelling to Assess Water Quality Impacts from Runway End Safety Area (RESA)

Baird, 2010:

Appendix N – Hydrodynamic and Sediment Transport Modelling Memorandums, Don Mouth Naturalization and Port Lands Flood Protection Project.

City of Toronto, 2012:

Appendix 3.3 – Toronto Inner Harbour Water Quality Modelling Report, City of Toronto's Don River and Central Waterfront Project – Class Environmental Assessment Study Report, Modelling Surface Water Limited

MMM Group, Ray Dewey, 2012:

Toronto Inner Harbour Water Quality Modelling Report. Environmental Assessment Study