REPORT

Owen Roberts Runway Extension draft Terms of Reference

Client:	Cayman Island Government
Reference:	PC6310-RHD-XX-XX-RP-EV-0002
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Enhancing Society Together

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Executive Summary

The Cayman Islands Aviation Authority (CIAA) is proposing an extension of the runway at Owen Roberts International Airport (ORIA) of approximately 640 m (2,100 ft) eastward into the North Sound.

These improvements are required so that the runway can accommodate the increased landing distances required by wide-body aircraft flying new long-haul routes. The extension includes a 340 m (1,115 ft) extension to the runway and a 60 m (197 ft) long runway strip. Based on the forecast set out in the Airports Master Plan, it was also determined that full-length 240 m (787ft) RESAs beyond the runway strip end are recommended for Runway 08-26. Therefore, the Runway 08 RESA will be extended eastwards from 90 m (295 ft) to 240 m (787 ft) long; likewise, the Runway 26 RESA shall be extended westwards from 203 m (666 ft) to 240 m long (787 ft) (a total extension for RESA purposes of 187m (614 ft).

The Environmental Impact Assessment (EIA) process, voluntarily initiated by the CIAA in 2023, is underway to identify, assess and address the potential environmental impacts associated with the Project. In May 2023, the CIAA submitted a request for an EIA scoping opinion to the National Conservation Council (NCC). The NCC confirmed that the Project falls within Schedule 1 of the National Conservation Act, and therefore an EIA was required. On the 23rd August 2023, the NCC appointed the Environmental Advisory Board (EAB) to provide advice throughout the EIA process. The EAB comprises the Civil Aviation Authority (CAA), Cayman Islands Fire Service, Coast Guard, Hazard Management Cayman Islands, National Road Authority, Department of Planning, Water Authority-Cayman and the Department of Environment. In 2024, the CIAA acquired the services of Royal HaskoningDHV to author a Terms of Reference (ToR) (this document) to define the assessments required to inform the EIA for the Project. The EIA will address the potential environmental impacts associated with the Project and respond to public consultation feedback.

This ToR identifies the scope of work required to inform the EIA, including the detail required for the construction activities and operational parameters for the Project, the surveys required to inform the environmental baseline and the EIA methodology to be used to assess the potential effects on the natural and human environment. The EIA will address the following topics:

- Water environment
- Marine ecology
- Terrestrial ecology
- Air quality
- Noise and vibration
- Visual and landscape effects
- Public amenity
- Climate change and hazard vulnerability.

The EIA will assess the potential impacts arising from the construction and operational activities for the Project. Should significant effects on environmental resources and existing communities be identified the EIA will propose measures to avoid or minimise those effects so those effects are no longer significant in EIA terms. The EAB, in accordance with Section 3(13) of the National Conservation Act of 2013, will oversee the preparation and implementation of the EIA.

Acronyms

Acronym	Acronym description
ADCPs	Acoustic Doppler Current Profilers
AQG	Quality Guideline Levels
AQS	Air Quality Standards
ARN	Affected Road Network
AZE	Alliance For Zero Extinction
BAP	Biodiversity Action Plan
BEIS	Business, Energy And Industrial Strategy
BS	British Standard
BTO	British Trust For Ornithology
CAA	Civil Aviation Authority
CAL	Cayman Airways Limited
CCRA	Climate Change Risk Assessment
CEA	Cumulative Effects Assessment
CGI	Computer Generated Imagery
CH4	Methane
CIAA	Cayman Islands Airports Authority
CIEEM	Chartered Institute Of Ecology And Environmental Management
CINWS	Cayman Islands National Weather Service
CISC	Cayman Islands Sailing Club
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO2eq	Carbon Dioxide Equivalent
CPA	Central Planning Authority
CRTN	Calculation Of Road Traffic Noise
CUC	Caribbean Utilities Company
Defra	UK Department For Environment Food And Rural Affairs
DEH	Department Of Environmental Health
DMRB	Design Manual For Roads And Bridges

DoE	Department Of Environment
DPSC	Department Of Public Safety Communications
EAB	Environmental Advisory Board
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPUK	Environmental Protection UK
ES	Environmental Statement
ESF	World Bank Environmental And Social Framework
ESO	The Economics And Statistics Office
GHG	Greenhouse Gas
GIS	Geographic Information System
GWP	Global Warming Potential
HSA	Cayman Islands Health Services Authority
IAIA	International Association For Impact Assessment
IAQM	Institute Of Air Quality Management
IBA	Important Bird And Biodiversity Area
ICAO	International Civil Aviation Organization
IEMA	The Institute Of Environmental Management And Assessment
IFC	International Finance Corporation
IPCC	Intergovernmental Panel On Climate Change
IUCN	International Union For Conservation Of Nature
JNCC	Joint Nature Conservation Committee
KBA	Key Biodiversity Area
LAQM	Local Air Quality Management
LDA	Landing Distance Available
LULUCF	Land Use, Land Use Change And Forestry
N2O	Nitrous Oxide
NBAP	National Biodiversity Action Plan
NCA	National Conservation Authority

NCC	National Conservation Council
NEP	National Energy Policy
NH3	Ammonia
NO2	Nitrogen Dioxide
NOAA	National Oceanic And Atmospheric Administration
NOx	Nitrogen Oxides
NRA	National Roads Authority
NRMM	Non-Road Mobile Machinery
NTCI	National Trust For The Cayman Islands
NTP	National Tourism Plan
NVSR	Noise And Vibration Sensitive Receptors
NWP	Numerical Weather Prediction
ORIA	Owen Roberts International Airport
PC	Process Contribution
PEC	Predicted Environmental Concentration
PFC	Perfluorinated Chemicals
PM	Particulate Matter
POP	Persistent Organic Pollutants
RCIPS	Royal Cayman Islands Police Service
RCP	Representative Concentration Pathways
RESA	Runway End Safety Area
SLR	Sea Level Rise
SMP	Stakeholder Management Plan
SO2	Sulphur Dioxide
SOx	Sulphur Oxides
SPS	Strategic Policy Statement
SSP	Shared Socioeconomic Pathways
TG	Technical Guidance
ToR	Terms Of Reference
TORA	Take-Off Run Available

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention On Climate Change
USEPA	United States Environmental Protection Agency
VFR	Visual Flight Rules
VOC	Volatile Organic Compounds
VOR/DME	VHF Omnidirectional Range / Distance Measuring Equipment
WAC	Water Authority-Cayman
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organisation
WRI	World Resources Institute

1 INTRODUCTION

1.1 Project background

The Owen Roberts International Airport (ORIA) is the largest of the three aerodromes in the Cayman Islands, located on the west side of Grand Cayman, in George Town district. ORIA is owned by the Cayman Islands Airports Authority (CIAA) and is the primary international gateway to the Cayman Islands, processing over 25,000 aircraft movements and over 1 million passenger movements annually and is a vital hub for the islands' tourism and financial sectors. The Cayman Islands rely on imported goods and ORIA handles around 1.5 million pounds of cargo and nearly 300,000 pounds of mail annually (CIAA, 2024). However, this should be considered in combination with the cargo imported via cargo vessels into the port in George Town which imports at least 95% of all imports to the Cayman Islands. Situated approximately 1.6km (1 mile) southeast of George Town, the capital, ORIA is conveniently close to the downtown area, the banking and financial district, and the cruise ship terminal. The airport is also near Seven Mile Beach, a major hub for tourism. This strategic location makes ORIA a vital point of entry and exit for both tourists and residents.

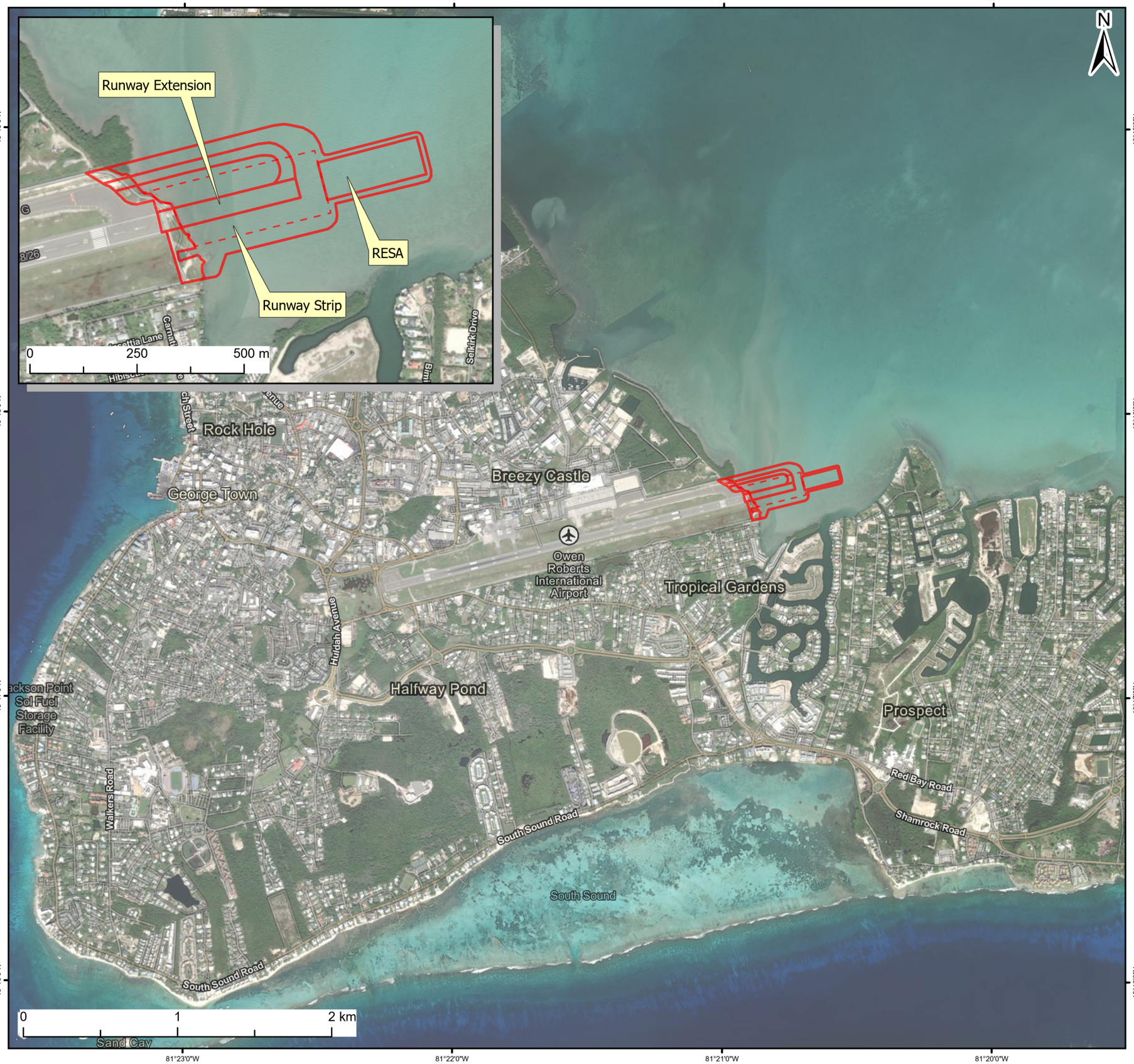
ORIA is currently served by a single runway (Runway 08-26) 2,010 m (6,596 ft) in length. The CIAA is proposing an extension of the runway at ORIA of approximately 640 m (2,100 ft) eastward into the North Sound. This includes a 340 m (1,115 ft) extension to the runway, a 60 m (197 ft) long runway strip and a 240 m (787 ft) long runway end safety area (RESA) (hereafter referred to as 'the Project'). These improvements are required so that the runway can accommodate the increased landing distances required by wide-body aircraft flying new long-haul routes (**Figure 1.1**).

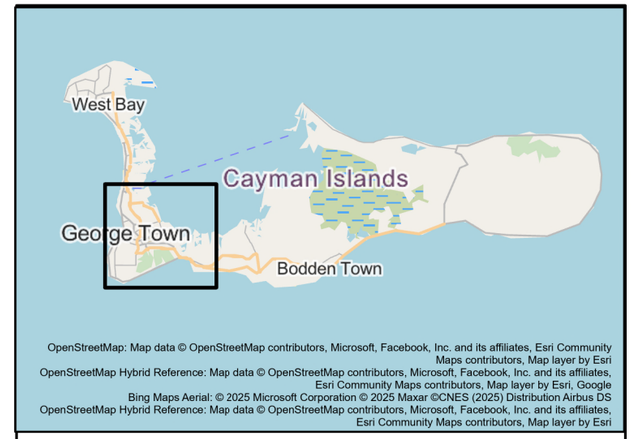
The Project is currently in the early stages of design and once the design is finalised and the Environmental Impact Assessment (EIA) process completed, assuming that the project is approved, it is anticipated the Project would be operational by 2030.

In May 2023, the CIAA voluntarily decided to carry out an EIA for the Project and submitted a request for an EIA scoping opinion to the National Conservation Council (NCC). The NCC confirmed that the Project falls within Schedule 1 of the National Conservation Act, and therefore an EIA is required. On the 23rd August 2023, the NCC appointed the Environmental Advisory Board (EAB) to provide advice throughout the EIA process. The EAB comprises the Civil Aviation Authority (CAA), Cayman Islands Fire Service, Coast Guard, Hazard Management Cayman Islands, National Road Authority, Department of Planning, Water Authority-Cayman and the Department of Environment.

Following the requirements of the EIA Directive a subsequent meeting was held on 27 September 2023, where the EAB met for an initial discussion regarding the EIA scoping and produced a scoping report. The EAB's Scoping Opinion was published on the 15 December 2023 (**Appendix A**).

The purpose of this report is to provide the Terms of Reference (ToR) for the EIA.





Legend:

Project Footprint

Client:	Project:
Cayman Island Government	Grand Cayman ORIA extension

Title: Map of the Proposed Extension

Figure: 1.1 | Drawing No: PC6310-RHD-GC-ZZ-DR-Z-0001

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	02/04/2025	GC	LR	A3	1:25,000

Co-ordinate system: Name: NAD 1927 UTM Zone 17N

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1.2 The Project location

Grand Cayman is a major global financial hub, contributing significantly to the island's Gross Domestic Product through banking, hedge fund formation, investment, and insurance sectors. In addition to this, the tourism sector accounts for a substantial portion of revenue, which is driven by the island's diving locations. Furthermore, the real estate market is robust, driven by local demand and international investors. The main attractions on the island include Seven Mile Beach, Stingray City, Queen Elizabeth II Botanic Park, Cayman Turtle Centre, Pedro St. James Castle, and Mastic Trail.

The North Sound of Grand Cayman (into which the runway extension would protrude) is home to several important protected areas that play a crucial role in the island's ecosystem. This includes the largest contiguous mangrove wetland in the Caribbean, covering approximately 8,655 acres which borders the majority of the eastern coast of North Sound. It acts as a vital nursery for marine life, supports bird populations, and helps in water filtration and storm protection. Part of the Central Mangrove Wetland is designated as an Environmental Zone under the Marine Parks Regulations, providing additional protection to this important habitat. The North Sound also includes several marine park zones established to protect coral reefs, seagrass beds, and marine life. The reserves are discussed in greater detail in **Section 4.2.1 and 4.3.1.1**.

ORIA is easily accessible via Dorcy Drive and Owen Roberts Drive, from Crewe Road, a main thoroughfare connecting the airport to George Town. The surrounding area is predominantly man-modified and urban, interspersed with small, isolated pockets of vegetation and a patch of tidally flooded mangrove and woodland forest to the northeast of the Project. The proposed works for the Project will extend into marine habitat dominated by seagrass and hard-bottom substrate.

1.3 Need and alternatives for the Project

1.3.1 Need for the Project

This ToR specifically addresses the proposed runway extension at ORIA. The need for the proposed runway extension is discussed in detail in the Cayman Airports Master Plan (Stantec, 2023) and key points are summarised here.

1.3.1.1 Existing runway capacity

The current dimensions of Runway 08-26 at ORIA (2,010 m (6,594 ft) in length and 150 m (492 ft) wide) meet the minimum requirements for length and width for a non-instrument runway. The largest aircraft the runway can accommodate, with payload limitations, is Code E aircraft i.e. a Boeing 777-200. The most common aircraft today is the Code C narrowbody aircraft Boeing 737 MAX 8 operated by various North American commercial airlines, including Cayman Airways.

The runway at ORIA is non-instrument, using VFR (Visual Flight Rules). The current estimated runway capacity at peak times is on average approximately 18 to 20 movements (a take-off or landing) per hour. The most common aircraft during the peak hours is the Code C Boeing 737-MAX 8. The critical aircraft, in terms of runway and taxiway facilities planning, is the Code E Boeing 787 and Airbus 350. Currently the runway length is too short to accommodate widebody aircraft at 85% payloads and an extension is required. Additionally, fully compliant runway end safety areas (RESAs) are required at each end of the runway to serve the growing aircraft mix of Code C narrowbody and Code E, widebody aircraft at ORIA. A runway extension would necessitate the development of RESAs that meet the requirements as indicated in the latest version of ICAO Annex 14 (**Table 1.1**).

1.3.1.2 Future runway capacity needs

The forecasting exercise undertaken for the Airports Master Plan (Section 6 of that document) identified requirements for future potential direct long haul, wide body aircraft services bringing passengers directly from the Europe, South America or other destinations. The Ministry of Tourism and Ports indicated that the potential to attract additional long-haul passenger air services has been limited by the current runway length. Both British Airways and Virgin Atlantic have indicated the need for a longer runway to support non-stop long-haul flights.

1.3.1.3 Runway end safety areas

The existing RESAs for Runway 08-26 meet minimum standards (90m (295ft)) for the runway length (2,010 m (6,595 ft)) (**Table 1.1**).

Table 1.1 ICAO Runway Standards

ICAO Annex 14 Standards and Recommended Practices (SARPs) for runways aim to enhance safety by providing adequate buffer zones at the ends of runways. They are categorised based on runway length into four codes:

Runway	Length	RESA length (beyond the runway strip)
Code 1	< 800 meters	Recommended 120 meters
Code 2	800-1199 meters	
Code 3	1200-1799 meters	Minimum 90 meters Recommended 240 meters
Code 4	1800 + meters	

Based on the forecast set out in the Airports Master Plan, assuming new long-haul air services by widebody aircraft, requiring a potential extension to Runway 08-26, it was also determined that full-length 240 m (787 ft) RESAs beyond the runway strip end are recommended for Runway 08-26. Therefore, the Runway 08 RESA will be extended eastwards from 90 m (295 ft) to 240 m (787 ft) long; likewise, the Runway 26 RESA shall be extended westwards from 203 m (666 ft) to 240 m long (787 ft) (a total extension for RESA purposes of 187 m / 614 ft).

1.3.2 Options considered

1.3.2.1 Options for the runway extension to the east

Two options for the runway extension were proposed:

Option A – An extension in the landing distance available (LDA) to accommodate the proposed direct long-haul service provided by British Airways using a widebody Boeing 787 to and from London Heathrow; and
Option B – An extension in the LDA that would also accommodate a broader widebody aircraft fleet mix (including the Boeing 787 and Airbus 350).

Under **Option A** the Masterplan identifies that a 200 m (656 ft) runway extension (with 90 m (295 ft) RESA) would accommodate the landing and take-off of a Boeing 787 with an 85% payload.

Option B identified that a 340 m (1,115 ft) runway extension would accommodate the landing and take-off of the Boeing 787 as well as an Airbus 350. A runway extension of 340 m would also facilitate a 240 m (787 ft) RESA (and 60 m (197 ft) runway strip) at the end of Runway 08 by shifting of the runway 37 m (121 ft) eastwards. Under Option B it is also proposed that a runway strip of 60 m (197 feet) and a 240 m (787 ft)

RESA should be constructed, thereby satisfying the RESA requirements for Runway 26. In total, this would necessitate an extension of 640 m (2,100 ft) and would bring the LDA to 2,438 m (8,000 ft).

Two sub-options were also proposed for **Option B**:

- **Option B1**: Runway extension (to 2,438 m (8,000 ft) LDA) with starter extension to increase take-off run available (TORA) from Runway 26.
- **Option B2**: Runway extension (to 2,438 m (8,000 ft) LDA) with no starter extension.

A starter extension (Option B1) would include the extension of the taxiway alongside the RESA as well as the runway and would therefore necessitate a wider construction into North Sound. Option B2 would limit the length of the taxiway to the length of the runway itself, therefore limiting the width of the construction required along the length of the RESA.

1.3.2.2 Alternatives for the runway extension to the west

Due to the environmental sensitivity of construction into North Sound, a westward runway extension was considered, however was discounted due to the following reasons:

A. Requirement for the relocation of Crewe Road and the Oval Cricket Ground
B. Requirement for the removal of obstacles (building tops, antennae, etc.) in George Town

Following a traffic study in June 2016 undertaken by the National Roads Authority (NRA) to consider the implications of extending the runway westward, followed by a modelling exercise in 2019, a runway extension to the west was dismissed by the NRA as they were opposed to the required traffic realignments and the building height-restrictions were seen as unworkable. The primary reason that the NRA is unwilling to close/relocate Crewe Road is due to the volume of traffic it accommodates, and the cost and challenge involved in creating new/expanded road intersections west of the existing Crewe Road (i.e., North South Road / Bobby Thompson Way, and Smith Road on the south side of ORIA) without negatively impacting already constrained adjacent road systems.

During the process to develop the 2041 Airports Master plan the CIAA met with the NRA again and discussed the issue of extending the runway to the west and the NRA were emphatic that the eastern road (Crewe Road), which handles over 24,000 movements daily (2021), could not be eliminated due to vehicular capacity constraints and had to remain. The NRA provided this statement regarding the closure/relocation of Crewe Road to enable a runway extension to the west:

> *"With the anticipated development and traffic growth within the next 3 to 18 years, Crewe Road between Smith Road and Dorcy Drive will continue to be a vital connection during both the AM and PM peaks. Traffic operations are expected to significantly deteriorate if this road is to be closed not only at the intersection level but also at a segment level and from a system-wide perspective. The minimum roadway infrastructure needs require up to a ten-lane cross-section on Huldah Avenue between Elgin Avenue and Smith Road in 2036 to mitigate the impacts from the closure; intersections include multiple turn lanes or by-pass lanes to accommodate the volume demand."*

The NRA also made the suggestion during the interview that potentially a road underpass could be constructed underneath the runway extension which may solve the issue. However, this was considered to be very costly and impractical.

The obstacle environment to the west of the runway is also key a negative factor in the western extension options above. The Object Limitation Surface (OLS), which is the imaginary surfaces in the airspace around

airports that define limits for the height and placement of obstacles that will ensure the safety and efficiency of aircraft operations, could be impacted by existing buildings in the west. It is important to note that the OLS is a regulatory part of the airport's safeguarding strategy. If the runway is extended to the west this imaginary non-penetrable surface will also move west and will affect building heights, cell phone towers, antennas, future development in the west, etc. A runway extension to the west may also have the potential to affect the cricket field as the aircraft would be much lower on approach to the runway over the field.

It is for these reasons that any option to extend the runway to the west was discounted early in the optioneering process and the government approved Master Plan reflects the preferred option to extend to the east. As such this is not an option that will be considered in the EIA.

1.3.3 Preferred option

To meet the requirements that enable Runway 08-26 to support wide-body aircraft flying new, non-stop long-haul destinations, (such as LHR – GCM), the Option B2 extension of the LDA to a minimum of 2,439 m (8,000 ft) for each Runway 08 and 26 is preferred. The extension supports the demand serviced by future widebody aircraft such as the Boeing 787, Boeing 777 and Airbus 350 aircraft operating non-stop long-haul flights and is considered to have a smaller environmental footprint.

The development of a full-length, 240 m (787 ft) RESA at each runway end supports the CIAAs objective to comply with ICAO, OTARs and CAACI standards to provide a higher level of safety for both narrowbody and widebody aircraft operators at ORIA. The development of the runway extension demands compliance with the latest standards for the runway based on feedback from the CAACI. The runway extension project would provide, in part, an additional section of a future full-length parallel taxiway to at both ends of Runway 08-26.

1.4 Outline Project description

The option being taken forward for consideration in this ToR is therefore the Option B2 extension eastwards into North Sound, including:

- A runway extension of 340 m (1,115 feet);
- A 60 m (197 ft) runway strip; and
- A 240 m (787 ft) RESA on both runways 08 and 26.

The construction will also include buffer areas around the runway extension resulting in a maximum length of 640 m (2,100 ft) and width of 280 m (920 ft) for the extension into North Sound. The area of the construction will be up to 0.09km^2 (22.4 acres).

At this early stage in the process, outline or detailed design of the potential extension into North Sound is not yet known. At a worst case the construction will require the reclamation of 0.09km^2 (22.4 acres) of North Sound. However alternative designs of the extension and methods of construction will be included or proposed within the EIA to reduce the footprint of the scheme and mitigate/prevent the loss of habitat.

During operation the runway extension will allow ORIA to receive the larger widebody Boeing 787 and Airbus 350 aircraft and is not projected to impact the peak hour traffic movements. It is considered that flights from Europe and South America would fall outside of the peak hour window. The larger aircraft will, however, facilitate increased numbers of visitors to the Cayman Islands and the potential socioeconomic effects of this should be assessed within the ES.

1.5 Scope of works for EIA project introductory sections

The EIA will include a full description of the Project including figures showing the red line boundary, with all facilities shown and all associated works and infrastructure. How the plans fit with existing and proposed planning requirements will be discussed. The EIA consultant will collaborate with the design consultants to finalise the project description and confirm the impacts to be assessed within the EIA with the EAB prior to the commencement of the process.

The justification for the Project shall be discussed in detail with particular emphasis on the predicted numbers of passengers and the basis for the predictions together with the specific need for the direct long-haul flights. This section shall take account of the responses to public consultation as summarised in **Section 3.2.2**..

The alternatives considered will be fully discussed together with the process followed for justification of the preferred option. The results of any public consultation, either directly for the Airport Master Plan, the Draft Planning Statement for the islands and the results of the public consultation for this ToR shall be incorporated into the EIA.

The study area for each parameter will be determined by the findings of the baseline characteristics and the potential for effect that could arise from the construction and operation of the Project, once the design and construction activities are established. The study area for each topic will be confirmed with the EAB prior to any surveys or modelling being undertaken.

The construction methodology shall be detailed together with a proposed time plan for any works showing any seasonal restrictions that are identified during the assessment process. If there is uncertainty over any methodologies, the precautionary principle will apply, the assumptions shall be detailed, and worst-case scenarios used for the assessment process.

The requirement for construction materials will need to be assessed. Any sources of material that are taken from outside of the red line boundary, for example fill material, if needed, shall be identified in terms of volumes required and sources and the transportation routes identified and assessed. A previous study of the supply of quarry fill in Grand Cayman was estimated to be sufficient for a further eight years if utilised fully (JacobsGIBB, 2004). , however this is largely outdated now and requires updated figures which shall be sourced through the EIA. The Central Planning Authority (CPA) has also noted that the policy on aggregate reserves may be outdated and needs revisiting (Cayman News Service, 2023). If material is to be taken from or deposited in sites that are not currently licensed or if aggregates are imported, then the potential effects shall be included in the EIA.

Any changes to the operation of the airport as a result of the runway extension shall be detailed and assessed including the numbers of flights, type of aircraft, materials to be stored and used for any operational activities (for example, the relocated fire and rescue facility), air quality information, management of drainage water from runway (and associated pollutants) alongside general drainage design to avoid storm water runoff onto neighbouring parcels, any wastes that could be produced during construction and operation and the methods for their use or disposal and any risks that are identified from the operations. Maintenance requirements and activities at the Project site shall be provided to inform the assessments in the EIA.

2 LEGISLATION AND PLANNING REQUIREMENTS

This section outlines the legislative and policy framework that is relevant to the EIA procedure. The requirements of the legislation shall be applied to the relevant sections of the EIA to ensure full compliance.

2.1 Legislative framework

2.1.1 National Conservation Act (2013)

The requirement for an Environmental Impact Assessment (EIA) in the Cayman Islands is determined by the National Conservation Act (2013). Specifically, Section 43 of this law outlines the legal framework for EIAs. The process is further detailed in the National Conservation Council's Directive for Environmental Impact Assessments, which was gazetted on 29 June 2016.

The National Conservation Act of 2013 is aimed at protecting and conserving the natural environment. The Act is designed to protect and conserve endangered, threatened, and endemic plants and wildlife, as well as their habitats. It provides a legal framework for the conservation of biodiversity in the Cayman Islands. The Act established the National Conservation Council (NCC). Section 6(1)(a) of the NCA places responsibility for the administration and enforcement of the law with the DoE. This includes overseeing the EIA process for projects that may impact the environment. Other aspects of the Act which may be relevant to the EIA process include:

- Legal Framework: The Act provides the legal basis for conducting EIAs in the Cayman Islands. Section 43 of the Act outlines the requirements and procedures for EIAs.
- The EIA Directive: The NCC issued a directive for conducting EIAs under the NCA legal framework, ensuring that all potential environmental impacts are thoroughly assessed and mitigated.
- Stakeholder Involvement: The Act mandates the involvement of various stakeholders, including government agencies, environmental organizations, and the public, in the EIA process. This ensures a comprehensive and transparent assessment.
- Sustainable Development: The law promotes sustainable development by ensuring that all government entities are required to consult with the NCC on the likely effects of their projects, plans and actions before taking any decisions or giving any undertakings.

As per section 43 (2), an EIA shall:

(a) assess the proposed action having regard to its direct, indirect and cumulative impact and the need to
(i) protect and improve public health and social and living conditions;
(ii) preserve natural resources, ecological functions and biological diversity;
(iii) protect and conserve protected areas and conservation areas;
(iv) protect and conserve protected, endemic and migratory species and their habitats; and
(v) avoid any adverse effects of climate change on the quality of the environment; be carried out by a person approved by the Council; and
(b) comply with any directives of the Council and regulations made under the Law.

Part 3 addressed the conservation of land, and Section 7 described the designation process of protected areas. Similarly, Part 4 addressed the conservation of Wildlife, and Section 16 covers the listing procedures for protected species.

Section 11 (2), prohibits and regulates any activity that is likely, individually, or cumulatively, to harm or adversely affect a protected area or that is otherwise not compatible with the purposes for which a protected

area was established. To obtain an exemption to Section 11 (2), the proponent must submit an application to the Council to obtain a permit under Section 20 (2)(a). Section 11 (2)(d) prohibits or regulates the dumping of discharge of water or other substances.

2.1.2 Directive for Environmental Impact Assessments, 2016

The Directive for Environmental Impact Assessments (EIA), 2016, issued by the National Conservation Council of the Cayman Islands, provides a structured framework for conducting EIAs and establishes the EAB as a sub-committee of the NCC with responsibility for managing and coordinating EIA's. The directive is issued under Section 43 of the National Conservation Law ("the EIA Directive"), and in conjunction with Sections 3(12)(j) and 43(2)(c) of the National Conservation Act. The Directive outlines the procedures and requirements for EIAs (**Figure 2.1**).

2.1.3 National Trust Act, 2010

The purpose of the Trust is to preserve the historic, natural, and maritime heritage of the islands through the preservation of areas, sites, buildings, etc.; maintain conservation; and protect flora and fauna. Of relevance to this project are the environmental sites maintained by the Trust (of which there are 12 historic sites and seven nature reserves). The closest in proximity to the Project is the Central Mangrove Wetland Nature Reserve.

2.1.4 Cayman Islands Constitution Order, 2009

The Cayman Islands Constitution Order, 2009 establishes the constitutional framework for the Cayman Islands and replaced the previous constitution from 1972. Various aspects of the Constitution Order are relevant to the EIA process, for example:

- Environmental Protection Mandate: The Constitution mandates that the government must consider the need to foster and protect an environment that is not harmful to the health or well-being of present and future generations. This principle underpins the EIA process, ensuring that environmental sustainability is a core consideration in development projects.
- Legal Framework: The Constitution provides the legal foundation for the National Conservation Act (2013), which directly governs the EIA process. This ensures that EIAs are conducted within a robust legal framework that aligns with constitutional principles.
- Sustainable Development: The Constitution supports sustainable development by balancing economic growth with environmental protection. This balance is a key objective of the EIA process, ensuring that development projects do not compromise the environment or social well-being.

Schedule 2, Part I (18) states that:

(1) Government shall, in all its decisions, have due regard to the need to foster and protect an environment that is not harmful to the health or well-being of present and future generations, while promoting justifiable economic and social development.

(2) To this end government should adopt reasonable legislative and other measures to protect the heritage and wildlife and the land and sea biodiversity of the Cayman Islands that—

(a) limit pollution and ecological degradation;

(b) promote conservation and biodiversity; and

(c) secure ecologically sustainable development and use of natural resources.

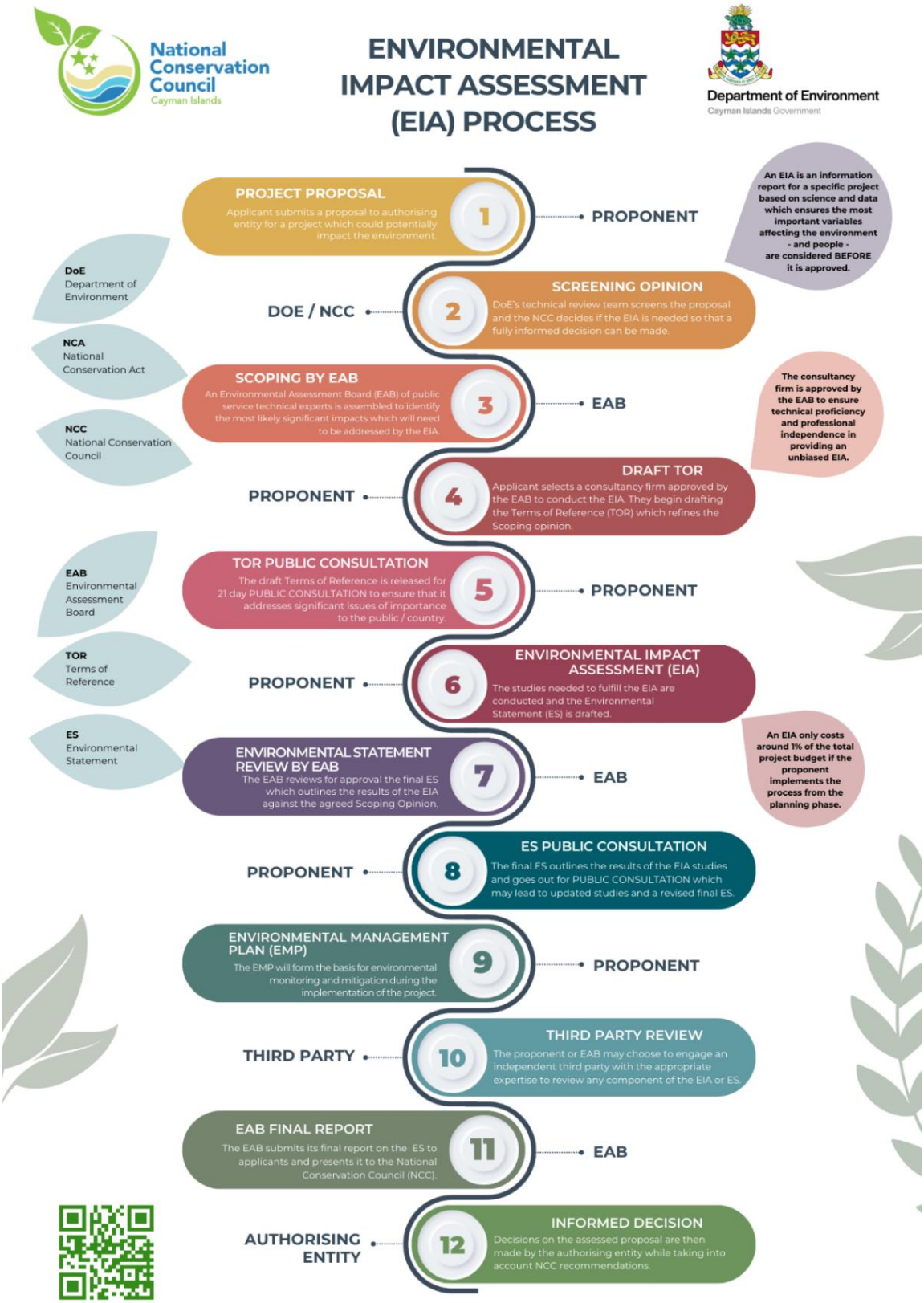


Figure 2.1 EIA Process as outlined in the EIA Directive.

2.1.5 Environment Charter, 2001

The Environment Charter, 2001 is an agreement between the Cayman Islands and the United Kingdom, aimed at promoting sustainable development and environmental protection. It outlines commitments by both the Cayman Islands and the UK to protect and conserve the environment. For the EIA process, it may provide:

- Framework for Action: It provides a framework for environmental management, including the development of policies and strategies to address environmental issues.
- Legal and Policy Foundation: The Charter serves as a foundational document that influences environmental legislation and policies in the Cayman Islands. It supports the implementation of the National Conservation Act (2013), which governs the EIA process.
- General EIA Guidance: The principles outlined in the Charter guide the EIA process, ensuring that environmental assessments are conducted to high standards. This includes thorough evaluation of potential impacts and the incorporation of sustainable practices.
- International Standards: By aligning with the Charter, the EIA process in the Cayman Islands adheres to international best practices and standards for environmental protection and sustainability.

2.1.6 Airports Authority Law, 2005 revision

The Airports Authority Law is relevant to the EIA process as it provides guidance on:

- Establishment of the Authority: The law establishes the CIAA, which is responsible for the management and operation of airports in the Cayman Islands.
- Environmental Compliance: The CIAA is mandated to ensure that airport operations comply with environmental standards and regulations. This is crucial during the EIA process, where potential environmental impacts of airport projects are assessed.
- Long-Range Planning: The law requires the CIAA to develop long-range plans for airport development, which includes considering environmental impacts and sustainability.
- Stakeholder Coordination: The CIAA coordinates with various stakeholders, including government agencies, environmental bodies, and the public, to ensure comprehensive environmental assessments.
- ICAO Standards: The law ensures that airport operations conform to the standards and recommended practices of the ICAO, which are integral to the EIA process.

Specifically, the Airports Authority Law states:

“ (3) In giving effect to subsections (1) and (2) the Authority shall – (b) in accordance with section 5(1)(g), take adequate measures for the protection and preservation of the environment, and to prevent or deal with noise, vibration, pollution or any other disturbance attributable to aircraft used for the purpose of civil aviation. ”

2.2 Planning framework

2.2.1 The Planning Statement, 1997

The 1997 Development Plan Statement for the Cayman Islands aims to maintain and enhance the quality of life by effectively directing development to safeguard the economic, cultural, social, and general welfare of the people; while also protecting the environment This document has specific guidelines for development in Grand Cayman.

Specifically, Appendix 3 provides provisions for an Environmental Impact Statement. It has relevance to the Terms of Reference and the EIA process by:

- Providing a guidance Framework for creating terms of reference; ensuring they align with the overarching goals of the plan.
- Ensuring a proposed development complies with the established guidelines and objectives.
- Encouraging public consultations and stakeholder involvement.

2.2.2 Development and Planning Act (2021) and the Development and Planning Regulations, 2024 revision

Section 25 (1) regulates the removal or destruction of trees (including individual trees, groups of trees, or woodlands), and includes conditions for replanting woodland habitat.

Further to the Act, which prohibits development within designated Mangrove Buffer zones, the Regulation considers impacts to the ecological function of mangrove habitat: which includes mangroves habitat that:

a) service as a nursery and natural habitat for marine life, birds, insects, reptiles and crustaceans;
b) filtration of overland run-off to the sea and ground water aquifer recharge;
c) export of organic particulate and soluble organic matter to coastal areas; and
d) coastal protection, and the protection of the Islands against storms and hurricanes.'

Specific requirements for development within or close to a Mangrove Buffer Zone are set out in Section 18 of the 2024 Regulations:

- Section 18(2) – development within a Mangrove Buffer Zone may be permitted, in exceptional circumstance, and 'only where equivalent storm protection is provided by some other means and it can be demonstrated to the Central Planning Authority (CPA) that the ecological role of the peripheral mangroves will not be substantially adversely affected by the proposed development'.
- Section 18 (4) – an application to the CPA is required to access through a Mangrove Buffer zone.
- Development shall adhere to a setback of a minimum fifteen feet from the inland boundary of a Mangrove Buffer zone, unless it is the opinion of the CPA, that it is not feasible to achieve this standard, in which case the minimum setback shall be at the discretion of the CPA.

2.2.3 Cayman Islands Development Plan Planning Statement (Draft)

The Draft Planning Statement is a high-level document that defines the various Zones, Overlays and Other Policy Considerations that will guide development in the Cayman Islands. The primary objective of the Plan is to maintain and enhance the economy, society and environment of the Cayman Islands. The Planning Statement is drafted to incorporate all three islands whilst factoring in flexibility, acknowledging that each island will have unique needs. The document outlines a strategic vision for land use and development, focusing on sustainable growth, efficient land use management, infrastructure improvements, community engagement, and environmental protection. It emphasises sustainable development, mixed-use development, infrastructure improvement, community engagement, and preserving natural habitats and biodiversity. Specifically, the draft document calls for the *"Support the long-range needs and alternatives for all types of airport facilities throughout the Cayman Islands*". It has relevance to the EIA as it:

- Provides detailed strategies and policies that address the objectives outlined in the ToR that shall be addressed as part of the EIA.
- Operationalises vision, translating broad goals into actionable policies.

- Ensures compliance with regulatory framework and standards.
- Facilitates monitoring and evaluation, establishing benchmarks for assessing progress and impact.

3 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

3.1 Overview

This ToR has been developed with reference to the Scoping Opinion prepared by the EAB and following guidance from the International Finance Corporation (IFC) of World Bank Group's Performance Standards on Environmental and Social Sustainability. These IFC standards play a significant role in shaping the Environmental Impact Assessment (EIA) process in many countries, including the Cayman Islands as they provide standards to follow on various subjects including:

- Risk management.
- Stakeholder engagement.
- Compliance and best practices and,
- Monitoring and reporting.

Although not a requirement, by incorporating these IFC standards into the EIA process, this project, and the Cayman Islands overall can achieve higher levels of transparency, accountability, and sustainability, aligning with global best practices.

3.2 Terms of Reference

In an EIA process, the first step is screening, to determine if a project needs an EIA based on its potential environmental impacts. This is followed by a scoping stage, which identifies the key issues to be addressed in the EIA through stakeholder consultation. Screening decides the necessity, and scoping defines the focus of the assessment. These stages have already been completed for the ORIA as it is a major development and so a full EIA is required under Schedule 1. The EAB have provided a scoping opinion that defines the potential impacts that require investigation during the EIA (**Appendix A**).

Through additional research and public engagement, the ToR refines the existing EIA's scope established in the Scoping Opinion. The EIA provides a systematic process for assessing the likelihood that a project may have a detrimental effect on the economy, society, and the environment. The ToR identifies the applicable environmental laws and regulations, establishes effective methods of evaluation, and directs the project to fulfil its ultimate needs efficiently and effectively.

The purpose of the ToR in the EIA Process is:

- **Defining Scope and Objectives:** ToR reports outline the scope and objectives of the EIA, specifying environmental aspects, methodologies, and key issues to be addressed.
- **Guided Assessment:** ToR provides a structured framework for conducting the EIA, detailing specific tasks and studies.
- **Stakeholder Engagement**: ToR reports include provisions for stakeholder engagement, ensuring the views and concerns of various stakeholders are considered.
- **Regulatory Compliance:** ToR ensures the EIA complies with environmental regulations and standards, aligning the assessment with legal requirements.
- **Quality Control:** ToR provides detailed guidelines and criteria for the EIA, maintaining the quality and consistency of the assessment.

- **Decision-Making:** ToR informs decision-making by providing a clear plan for the EIA, enabling informed decisions about the project.

This document forms the ToR for the Project and covers Steps 4 and 5 out of the 12 Step process as outlined in the EIA Directive[1] which are shown in **Figure 2.1**.

3.2.1 Requirements of the EIA

The EIA shall undertake the following tasks which will be presented in an Environmental Statement (ES):

- Describe the need for the project.
- Justify the selection of the preferred option for the project detailing the reasons why all alternatives were not selected.
- Compare the preferred option against the "Do Nothing" Option.
- Describe in detail the construction methodology including the sources and delivery of all material and the proposed duration for works with any seasonal restrictions on activities.
- Describe in detail the proposed operational activities for the project.
- Describe the proposed decommissioning for the existing airport.
- Discuss any potential future expansion plans for the airport.
- Undertake consultation with stakeholders (consultation is addressed in **Section 3.2.2 and 3.2.3** and will continue throughout the EIA phase).
- Identify the baseline conditions for each of the topics covered in **Section 4** including their sensitivity and vulnerability to the construction and operation of the proposed airport.
- Assess the potential impacts on the receptors.
- Determine the potential for mitigation of any significant effects.
- Assess the residual impacts on the receptors and determine next steps for any effects that are still significant (consider alternatives, importance and potential for offsets).
- Determine any monitoring requirements for each receptor where mitigation is required.
- Undertake a cumulative effects assessment.

Following completion of the ES, an Environmental Management Plan (EMP) shall be prepared outlining the requirements to be implemented during the construction phase and the roles and responsibilities of all those involved together with review and reporting requirements for the monitoring results. It is recommended that adaptive monitoring and management strategies are developed for any monitoring required.

Additional plans shall be produced at this stage that are needed to address specific activities, for example pollution contingency planning and waste management during both construction and operation.

3.2.2 Public consultation

Public consultation throughout the EIA process is essential given the nature and scale of Project. The potential impact on both the environmental features and the residents of Grand Cayman, could be considerable without mitigation. The National Conservation Act's EIA Directive mandates the public consultation requirements during the ToR and EIA process:

- During draft ToR development:
  - The draft ToR document (this report) will be available on the Department of Environment's (DoE) website for a period of 21 consecutive days.

[1] *https://conservation.ky/eia-process/*

- The availability of the ToR will be advertised at least twice in the local press within the 10-day period immediately preceding the start of the 21-day review period.
- As part of the public consultation process, a public meeting must be held to seek feedback on the draft ToR. Draft ToR will be presented / discussed at public meetings. The public meetings will provide an opportunity for stakeholders and community members to review and comment on the draft ToR, ensuring that their input is considered in the finalisation of the document.
- All comments and feedback received during the public consultation period will be reviewed. Relevant issues raised by the public will be integrated into the final ToR to ensure that the EIA addresses all key concerns. All comments will be anonymised, and responses will be appended to the ToR (see Appendix B).

- During ES development:
  - The draft ES document (once produced) will also be available on the DoE's website for 21 consecutive days.
  - Similar to the ToR, the publication of the ES will be advertised at least twice in the local press within the 10-day period prior to the commencement of the 21-day review period.
  - Draft ES results, along with a Non-Technical Summary report, will be presented at public meeting(s) to receive comments and feedback.
  - The public can submit comments directly to the EAB via the DoE, either by email, direct mail, or hand delivery to the DoE offices. These comments will be jointly assessed by the EIA consultants and the EAB, and relevant changes will be incorporated into the final documents. Responses to all comments received will be appended to the ES.

3.2.3 Stakeholder engagement

Stakeholder engagement will be an integral part of the EIA process, extending beyond public meetings and document publication. The stakeholder engagement will draw upon the consultation already undertaken as part of the public outreach for the planning stages, including that undertaken for the draft planning statement and the Airport Masterplan. The comments made during the public consultation for the CIAA's Master Plans for the Future Development of Cayman Islands Airports (Stantec, 2023) will be reviewed and the concerns raised will be incorporated into the EIA process.

A Stakeholder Management Plan (SMP) shall be developed as one of the first activities in the EIA process to outline the consultation stages to be followed and shall be a 'live document' which will record the outcomes at each stage. Any comments received throughout the EIA process shall be documented and responded to and included in the ES.

Various outreach and communication methods will be employed to continue the consultation, including stakeholder meetings, adverts in the Caymanian Times and Cayman Compass, press releases, radio, project newsletters, community outreach sessions, pull-up banners and regular CIAA website and social media updates. In addition to this, stakeholder organisations will be contacted directly to invite them to contribute to the EIA process in two consultation phases.

The first consultation phase, which will happen at an early stage in the EIA, will provide a forum for the discussion of the project and collate feedback from the stakeholders on specific topics/issues that will be covered in the ES. The second consultation phase will provide the opportunity for discussion of the draft report and advise attendees of the outcomes. In between these two stages there will be informal consultation with those stakeholders that either request further consultation at the initial stage, are identified for further consultation as they hold relevant information or have concerns over the project or those that are identified during the EIA process.

Stakeholders will be involved at critical decision-making stages, such as evaluating project alternatives, assessing impacts, developing mitigation strategies, and reviewing findings to determine the preferred solutions. This proactive engagement will ensure that the feedback and insights gathered from stakeholders are incorporated into the project planning and decision-making processes, thereby enhancing the project's overall effectiveness and community acceptance.

Stakeholders include representatives from:

- Local business owners.
- Local residents.
- EAB members.
- Appropriate government bodies.
- National Trust for the Cayman Islands (NTCI).
- Sustainable Cayman.
- CAL.
- Cayman Islands National Museum
- CIAA.

Due to the potentially controversial nature of this project, engaging both public and private stakeholders at an early stage is crucial. Throughout the EIA process it will be essential to thoroughly research and address environmental concerns and ensure all voices are heard. The stakeholder process will be flexible enough to incorporate new consultees as the project progresses as it is recognised that additional stakeholders are likely to be identified throughout the EIA.

3.2.4 Summary of consultation on this ToR

Following completion of a draft version of this ToR a public outreach event was held on Grand Cayman. The meeting was held at least seven days before the end of the public consultation review period A full record of [anonymised] consultation responses are provided in Appendix B. The below summarises the main discussion areas raised during the meeting and signposts where in this ToR the comments have been taken into account.

[To be completed following public outreach sessions for this ToR.]

3.2.5 Assessment methodology

It is proposed that the ES evaluates the potential direct and indirect effects of a project using the following methodology.

All receptors will exhibit a greater or lesser degree of sensitivity to the changes brought about by the proposed scheme and defining receptor ‘sensitivity’ as part of the definition of the baseline environment helps to ensure that the subsequent assessment is transparent and robust. The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected, and is defined by the following factors:

- Adaptability – the degree to which a receptor can avoid, adapt to or recover from an effect.
- Tolerance – the ability of a receptor to accommodate temporary or permanent change.
- Recoverability – the temporal scale over and extent to which a receptor will recover following an effect.

In order to define the sensitivity of a receptor, the guidelines presented in **Table 3.1** will be used to determine the level of effect that could occur on each receptor during the EIA process. Receptor specific definitions will be applied where appropriate.

Table 3.1 Generic guidelines used in the determination of receptor sensitivity and value

Sensitivity / value	Description
Very high	Receptor has very limited or no capacity to accommodate physical or chemical changes or influences. Receptor possesses fundamental characteristics which contribute significantly to the distinctiveness, rarity and character of the resource, is of very high importance and rarity that is international in scale (e.g. designated sites such as Ramsar Sites, World Heritage Sites, Important Bird and Biodiversity Area, Alliance for Zero Extinction Sites and Key Biodiversity Area) and has very limited potential for substitution / replacement.
High	Receptor has a limited capacity to accommodate physical or chemical changes or influences. Receptor possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the resource, is of high importance and rarity that is national in scale (e.g. designated sites such as Nationally Protected Areas, Marine Parks and Reserves, Biodiversity Action Plan (BAP) habitats and species, Heritage Coasts, Scheduled Monuments, (Major) Features listed on the National Heritage Register, National Trust Properties, etc.), and has limited potential for substitution / replacement.
Medium	Receptor has a limited capacity to accommodate physical or chemical changes or influences. Receptor possesses key characteristics which contribute to the distinctiveness and character of the resource, is of medium importance and rarity that is regional in scale (e.g. Regionally Important Geological Sites, (Minor) Features listed on the National Heritage Register), and has limited potential for substitution / replacement.
Low	Receptor has a low - moderate capacity to accommodate physical or chemical changes or influences. Receptor characteristics make a small contribution to local character or distinctiveness, and are of low importance and rarity, are not designated, and could be substituted / replaced.
Very low	Receptor is generally tolerant of and can accommodate physical or chemical changes or influences. Receptor characteristics do not make a significant contribution to local character or distinctiveness, and are of very low importance and rarity, are not designated, and are easily substituted / replaced.

It shall be noted that the sensitivity criterion is a composite one; combining value (a measure of the receptor's importance, rarity and worth) with tolerance to a change. In some instances, the inherent value of a receptor is recognised by means of designation (see below), and the 'value' element of the composite criterion recognises and gives weight in the assessment to that designation.

The magnitude of an effect is typically defined by four factors:

- Extent – the area over which an effect occurs.
- Duration – the time for which the effect occurs.
- Frequency – how often the effect occurs.
- Severity – the degree of change relative to existing environmental conditions.

To help define impact magnitude, the criteria presented in **Table 3.1** and **Table 3.2** are proposed to be adopted for the purposes of the EIA. While this table provides guidelines of a generic nature, more specific guidelines in relation to impact magnitude can be adopted for the topics assessed, where considered necessary.

Table 3.2 Generic guidelines used in the determination of magnitude of effect

Magnitude	Description
Very high	Adverse: Loss of resource and/or quality of the resource; severe damage to key characteristics, features or elements. Permanent / irreplaceable change, which is certain to occur. Beneficial: Large scale improvement of resource or attribute quality; extensive restoration or enhancement.

Magnitude	Description
High	Adverse: Loss of resource, but not affecting quality of the resource; partial loss of or damage to key characteristics, features or elements. Permanent / irreplaceable change, which is likely to occur. Beneficial: Improvement to, or addition of, key characteristics, features or elements of the resource; improvement of attribute quality.
Medium	Adverse: Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements; measurable change in attributes, quality or vulnerability. Long-term though reversible change, which is likely to occur. Beneficial: Minor improvement to, or addition of, one (maybe more) key characteristics, features or elements of the resource; minor improvement to attribute quality.
Low	Adverse: Very minor loss of, or alteration to, one (maybe more) key characteristics, features or elements; noticeable change in attributes, quality or vulnerability. Short- to medium-term though reversible change, which could possibly occur. Beneficial: Very minor improvement to, or addition of, one (maybe more) key characteristic, feature or element; very minor improvement to attribute quality.
Very low	Adverse: Temporary or intermittent very minor loss of, or alteration to, one (maybe more) characteristic, feature or element; possible change in attributes, quality or vulnerability. Short-term, intermittent and reversible change, which is unlikely to occur. Beneficial: Possible very minor improvement to, or addition of, one (maybe more) characteristic, feature or element; possible improvement to attribute quality.

The significance of an impact is determined by combining the predicted magnitude of the effect with the sensitivity of the receptor, as defined in **Table 3.3**. Impact assessments carry a degree of subjectivity, as they are based on expert judgement regarding the effect-receptor interaction that occurs and on available data. As such, each impact assessments shall be qualified appropriately, and all assumptions made shall be discussed in the relevant section.

Table 3.3 Impact assessment matrix

Receptor sensitivity (inclusive of value)	Magnitude of effect				
	Very high	High	Medium	Low	Very low
Very high	Major	Major	Moderate	Moderate	Minor
High	Major	Moderate	Moderate	Minor	Negligible
Medium	Moderate	Moderate	Minor	Minor	Negligible
Low	Minor	Minor	Minor	Negligible	Negligible
Very low	Minor	Negligible	Negligible	Negligible	Negligible

The probability of an effect occurring (i.e. an effect-receptor interaction) shall also be considered in the assessment process; capturing the probability that the effect will occur and also the probability that the receptor will be present. For example, the magnitude of the effect and the sensitivity of the receptor may have been established, and it may be highly probable that the effect will occur; however, the probability that the receptor will be present at the same time shall also be considered.

The level of confidence in the assessment of each receptor to each potential change will be detailed and shall be based on the level of confidence in the baseline situation and the ability to predict the change that could occur.

Significant impacts in EIA terms are taken to be those of moderate or major significance (as defined above); albeit that appropriate mitigation, where available, shall be sought for all impacts. Impacts will be assessed both prior to the application of mitigation and as a residual impact, assuming successful implementation of the mitigation. The mitigation hierarchy shall be followed for assigning measures to reduce or offset potential effects. The Institute of Environmental Management and Assessment (IEMA) provides detailed guidance on implementing the mitigation hierarchy. According to IEMA, the hierarchy involves the steps illustrated in **Figure 3.1.**

IEMA emphasises the importance of integrating these steps from the earliest stages of project planning and maintaining them throughout the project's lifecycle. Monitoring shall be recommended to ensure successful implementation of each mitigation measure.

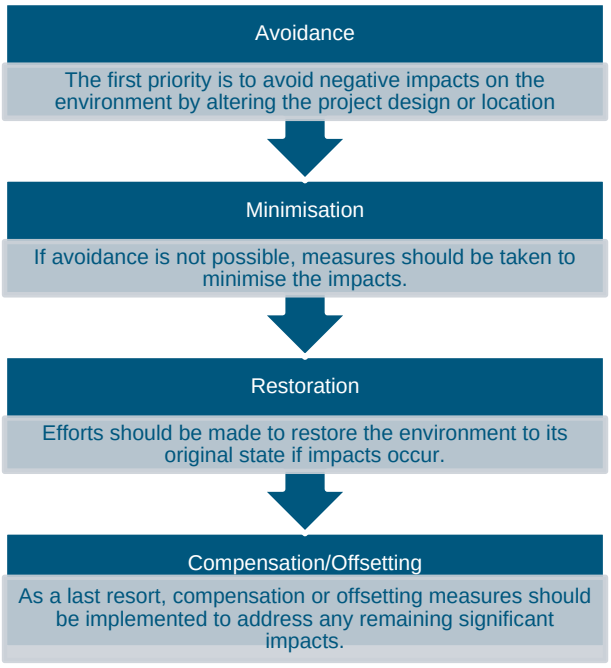
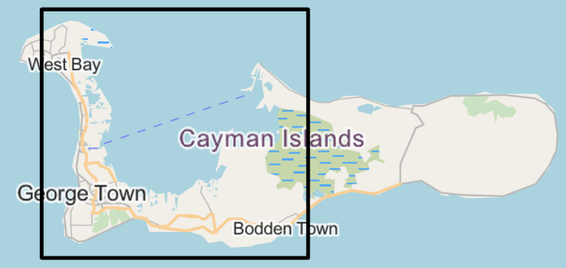


Figure 3.1 Mitigation hierarchy

Following the application of any required mitigation measures the magnitude of effect shall be reassessed and the residual significance of the effect determined using the matrix in **Table 3.3**.

3.2.6 EIA study area

An initial study area for the EIA is presented in **Figure 3.2**. The EIA shall refine this where needed and include details on the study area for each receptor and provide a justification for the assigned study area. The study area will differ for each receptor depending on the sensitivity of the receptor, its functional area (i.e. migratory pathways) and the vulnerability of the receptor associated with the potential changes that could occur due to the construction and/or operation of the proposed airport. The study area for each receptor will include the footprint of the project, surrounded by an area that takes account of the direct and indirect effects that could occur. A zone around the impact zones will be examined to determine whether the resources in the impact zones are unique or typical to the area. In addition to this, any areas linked to the site, for example, the seagrass and mangrove areas in the surrounding area, will also be included. Direct impacts will be evaluated on a quantitative basis were data permits and holistically to account for indirect impacts also. The study area for each receptor will be confirmed with the EAB before the commencement of surveys.



Legend:

- Project Footprint
- 1km Study Area Buffer for Air Quality and Noise & Vibration Only
- 2km Study Area Buffer for all Parameters, Excluding Air Quality and Noise & Vibration
- Baseline Study Area

Client:	Project:
Cayman Island Government	Grand Cayman ORIA extension

Title: Map of Initial Study Areas

Figure:	Drawing No:
3.2	PC6310-RHD-GC-ZZ-DR-Z-0007

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/04/2025	GC	LR	A3	1:60,000

Co-ordinate system: Name: NAD 1927 UTM Zone 17N

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3.3 Cumulative Effects Assessment

A Cumulative Effects Assessment (CEA) will be undertaken to ensure that any impacts are considered cumulatively with others that are predicted for the same project but also for other projects or plans that could interact both temporally and spatially. At an early stage in the EIA process, a list of other projects shall be derived through investigation of planning proposals and discussion with the relevant government bodies.

The ORIA is undergoing an extension due to capacity constraints, facility upgrades, maintenance needs, safety and efficiency improvements, emergency services expansion, and runway and aprons improvements. A full description of existing infrastructure and operations, some of which has already been implemented, can be found in the CIAA Master Plan (2023). The elements of this work that are completed and operational when the ES is being developed shall be considered part of the baseline environment. Those elements that are yet to be completed or operational when the ES is being developed shall be described and the potential cumulative effects assessed in the Cumulative Effects Assessment.

4 CONSIDERATION OF POTENTIAL EFFECTS

4.1 Water Environment

4.1.1 Baseline Conditions

A review of published and publicly available information has been used to develop the existing baseline conditions for the Project site's water environment receptors: hydrology, surface drainage, water quality, geology and hydrogeology.

4.1.1.1 Physical and sedimentary processes

The North Sound is an 85km^2 (21,000 acres) semi-enclosed shallow lagoon. It is bordered to the east by the Central Mangrove Wetland and by a hook-shaped peninsula to the west and south (upon which the airport sits) fringed by mangroves. The northern opening to the lagoon is bordered by a narrow fringing reef, which extends along the entire northern coast of the island. The reef provides protection to the lagoon from waves. The tides at Grand Cayman are mixed, primarily semi-diurnal. The average tidal range is 0.26 m (0.9 ft) (Bush, 2007). This very small tidal range induces insignificant tidal flow speed. The bathymetry of the shore zone into which the runway extension would be constructed is shallow (average depth 1-2.5 m (3.3-8 ft) extending 1-2km (0.6-1.2 miles) into the sound). Here, the sediment cover is thin. Overall, the physical and sedimentary environments in North Sound and along its west and south coast are characteristic of a sheltered lagoon.

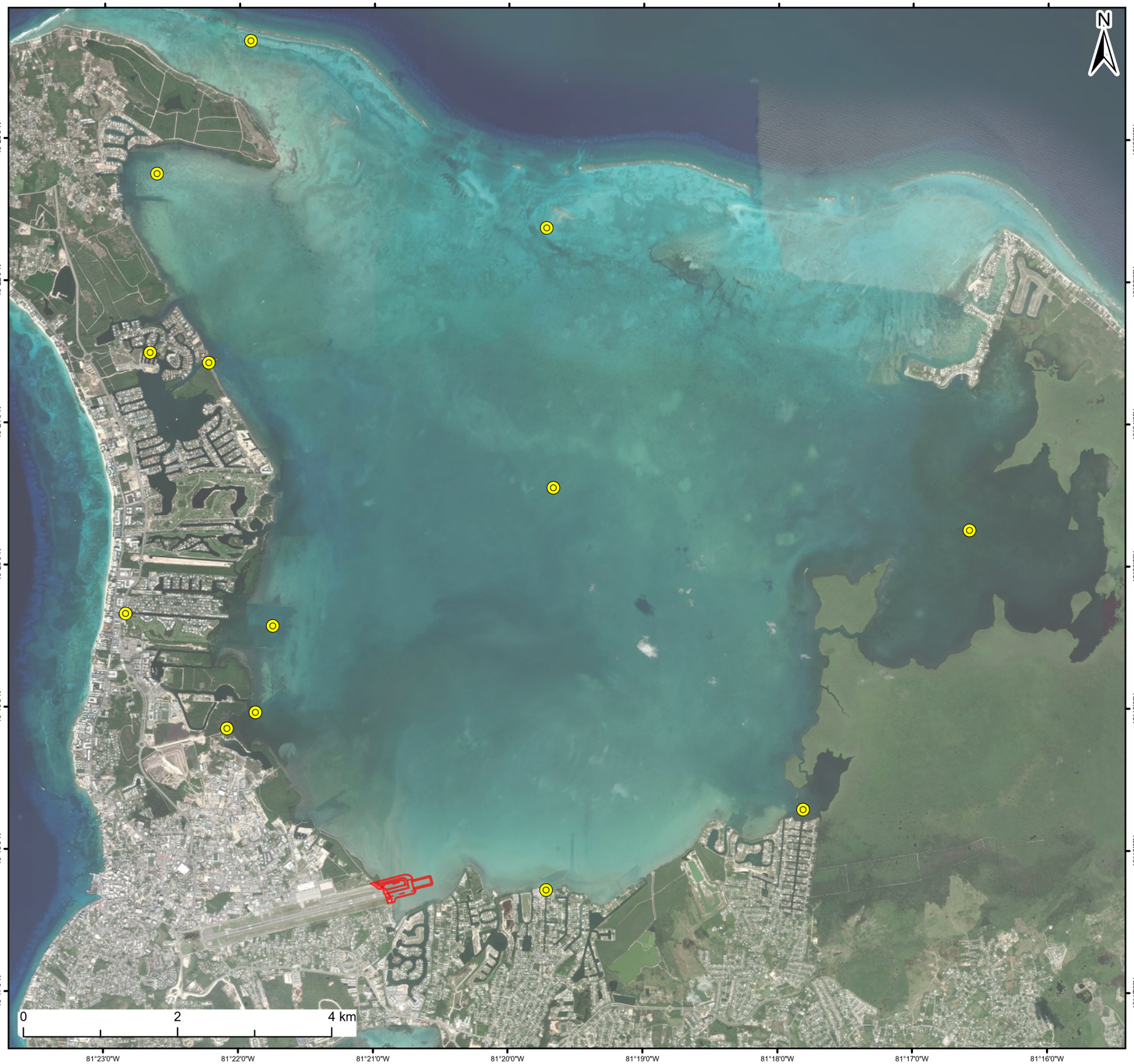
4.1.1.2 Water quality

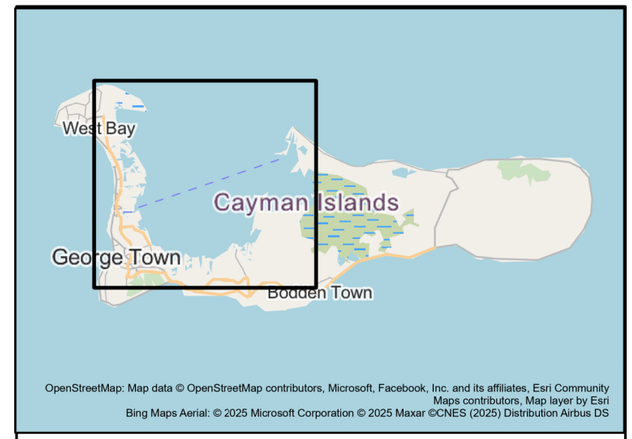
A joint comprehensive water quality monitoring programme was initiated in 2003 by the Water Authority-Cayman and the DoE and involved sampling at 16 locations in the North Sound to establish long-term data to track trends and indicators of pollution. The last sampling event was undertaken in 2015. The sites monitored are shown in **Figure 4.1**.

Overall, the (results (Water Authority-Cayman, 2003 – 2015, multiple data reports) indicate that water quality in areas closer to land, especially in the western part of the Sound, show elevated levels of bacteria, nutrients (phosphates and nitrates) and chlorophyll-a. Areas where canals drain into the Sound are considered to be the most affected. However, in a study conducted by Water Authority-Cayman, reported on the Cayman News Service (2010). Levels of bacteria, which are indicative of wastewater pollution, "rarely exceed the international standards for bathing water" such as those published by the World Health Organisation (WHO, 2021). Reasons given for poor water include leachate from the unlined George Town landfill, on-site wastewater treatment and disposal, poorly planned canal developments, fertiliser-enriched run-off from golf courses and other landscaping, and inputs from recreational use of the marine environment (Cayman News Service, 2010). In addition, the large-scale removal of mangrove wetlands and seagrass systems on the western side of North Sound to accommodate development has reduced the natural capacity of the local environment to mitigate the effects of nutrient and pollutant inputs. It is also recognised that there are already issues with fine sediments in suspension, particularly during and following storms, generated through previous dredging works (Bush, 2006).

4.1.1.3 Topography, hydrology and surface drainage

The land to the north and south-east of the existing runway is recorded as supporting perennial wetlands. The airport's topography is low lying, and historically, parts of the airport flooded frequently. Flood incidents are likely to reflect a combination of high rainfall and a high-water table (as shown by the wetland habitats).





Legend:

- Project Footprint
- Water Quality Monitoring Locations

Client:	Project:
Cayman Island Government	Grand Cayman ORIA extension

Title: Water Quality Monitoring Locations in North Sound

Figure:	Drawing No:
4.1	PC6310-RHD-GC-ZZ-DR-Z-0004

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/04/2025	GC	LR	A3	1:50,000

Co-ordinate system: Name: NAD 1927 UTM Zone 17N

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As a consequence of the flooding, drainage systems serving the existing runway and associated buildings were upgraded in 2020 to include ancillary drainage structures; slot drains, drainage swales with catch basins, retention system and underground concrete encased drainage pipes. Deep Drainage Wells were also installed to allow ponded water to percolate down to the water table in areas where the grade is too flat to provide drainage swales with some gradient. The wells are used in conjunction to the retention ponds and swales that capture surface water. As part of the works, existing ponds in the airfield were also filled with imported granite rock to support the previous extension.

4.1.1.4 Geology and hydrogeology

The geology of Grand Cayman is largely composed of two sedimentary rock types; the Ironshore Formation, which consists of limestones from the Pleistocene epoch, and the Bluff Formation, which consists of dolostone (dolomitic limestones) from the Miocene and Oligocene epochs (Jones, 1994). The Ironshore Formation is the dominant rock type, with the Bluff Formation outcropping on areas of higher ground. The airport itself is underlain by rocks from the Bluff Formation, with the Ironshore Formation outcropping to the west of the western end of the current runway.

A hydrogeological survey undertaken on behalf of the Water Authority – Cayman (reported in Jones, B., et al, 2001) demonstrates that the Ironshore Formation supports limited or no fresh groundwater resources. However, parts of the Bluff Formation are recorded as supporting moderately productive freshwater aquifers, with the most significant freshwater lens located on the southern, northeastern and eastern sides of the island. Although the airport site is underlain by unproductive rock units (i.e., strata with limited or no fresh groundwater sources), there is also an outcrop of productive strata on the south-western corner of the island, to the west of the current runway. Groundwater flows away from this outcrop, towards the sea.

4.1.1.5 Rainfall

The Cayman Islands National Weather Service (CINWS) provides rainfall statistics for ORIA on Grand Cayman and shows an annual average rainfall of approximately 1400 mm over the last 30 years (CINWS, 2024). Records show strong seasonality, with a drier period between December and April and a wetter season from May to November (CINWS, 2024). Peak rainfall is recorded in September and October.

4.1.2 Potential effects

4.1.2.1 Matters scoped in

The potential significant impacts to be scoped into the Water Environment assessment are displayed in **Table 4.1** Many of these potential impacts could cause changes to hydromorphology, water quality and drainage. Where these changes could affect sensitive receptors, they are discussed in the relevant section.

Construction

Potential impacts of the runway extension on the physical and sedimentary processes during construction relate to any dredging that may be required and the necessary reclamation, and the potential increase in the volume of surface runoff from reclaimed land. These impacts comprise:

- Disturbance of sediment during dredging and reclamation, if required, resulting in increases in suspended sediment concentrations.
- Deposition of sediment that is entrained within the plume will have the potential to affect the seabed within North Sound.
- The potential for release of contaminants through dredging (if required) and run-off during construction, either from dewatering of any materials used for reclamation or run off from the works.
- Use of construction equipment associated with land reclamation could lead to accidental release of contaminants (including fuel and lubricants from construction plant) into the water environment

Although, these impacts would be short-term and temporary, lasting for the duration of any construction activities only, their magnitude could be high.

The dredging and reclamation activities, if required, could affect the water environment in a number of ways. Any dredging that is required, together with the reclamation activity, would release sediment into the water column and potentially any contaminants in the sediment. Given that the area is close to an existing airport, a shooting range and to areas previously used for firefighting practice, there may be some potentially contaminating chemicals within the sediments that could be released. Once the construction activities are confirmed and the area and volume of sediment to be disturbed has been estimated, assessment of the potential for effects shall involve survey work to analyse sediments prior to any dredging activities. There may also be a requirement for the use or disposal of the dredged sediment which shall be assessed. Assuming that the dredged material is considered to be appropriate for placement (following the sediment sampling outlined below), then beneficial uses for the sediment will be sought as a priority. Failing this, a suitable area for disposal would need to be assessed as part of the EIA.

The process of reclamation/infilling, if required, could potentially require a discharge of any de-watering effluent to sea. If not appropriately managed this could result in possible adverse effects on water quality in North Sound. Monitoring and management of any run-off would need to be detailed in the EMP developed for the construction phase and the operation phase.

Onshore activities associated with the land reclamation could potentially require ground disturbance and excavation, the stockpiling of reclaimed materials during dewatering, and the use of construction equipment in areas with a high water table. This could potentially result in the accidental release of sediment and contaminants (including fuel and lubricants from construction plant) into the water environment. It will therefore be important to ensure that construction-stage drainage is managed carefully to minimise the potential for adverse impacts; this could require the implementation of a temporary construction-stage drainage system or modifications to the existing permanent site drainage system. The need for such a system would need to be assessed during the EIA phase with details provided for any management to minimise potential effects to an acceptable level.

At this stage, the requirement for fill material is not known. However, if material will be required from sources other than licensed quarries and aggregate sources, then the removal of the material will need to be assessed. Transportation and placement methods will also need to be established and assessed with the experience of an appropriate contractor. The EIA shall quantify the volume of fill material required, compare this against the Cayman Island's reserves and assess the impacts along the transportation route. Should a new site be needed for aggregate extraction then all impacts will need to be assessed as part of the EIA.

Operation

Potential impacts to physical and sedimentary processes during operation relate to the presence of the runway extension within North Sound. The change in geometry could result in changes to tidal currents, which could potentially affect the sediment transport mechanisms and/or North Sound morphology. However, given the protected nature of the North Sound and the benign nature of the driving physical processes, the impacts on sediments and bed morphology are expected to be minimal. The operation could also potentially reduce flushing in areas local to the newly reclaimed area including the creek with residential areas, and the inlet fronting Ocean Crest, directly to the south of the proposed runway extension.

The airport is already operational in the vicinity, therefore, although many of the operational impacts may be exaggerated, they will not be novel to the surrounding area. Nonetheless, with the runway extending further into the lagoon, the area of impermeable surface cover would be increased thus increasing the

volume of surface runoff from the airport. Any increases in run-off (including stormwater runoff) will be considered in the EIA, particularly given the proximity of the reclamation to the lagoon, and whether the existing drainage would have the capacity to deal with the additional requirements.

With an increase in run-off there also is the potential for increased mobilisation of pollutants, namely persistent organic pollutants (POPs) such as aviation fuel and perfluorinated chemicals (PFCs), grease, oils, and heavy metals. Appropriate design and inbuilt control measures such as the installation of interceptors and natural solutions such as swales to accommodate this increase in runoff will be important to ensure these effects are reduced as far as possible.

Table 4.1 Potential water environment impacts

Activity	Impact	Receptor
Construction		
Dredging	Dredging resulting in increase in suspended sediment concentrations and subsequent deposition on the bed of North Sound	Potential for changes to hydromorphology and water quality to affect ecology and human usage of the area
Dredging	Dredging potentially releasing contaminants	Potential for changes to water quality to affect ecology and human usage of the area
Reclamation	Placement of fill material resulting in increase in suspended sediment concentrations and subsequent deposition on the bed of North Sound	Potential for changes to hydromorphology and water quality to affect ecology and human usage of the area
Reclamation	Discharge of pollutants from construction equipment associated with land reclamation.	Potential for changes to water quality to affect ecology and human usage of the area
Uncontrolled surface water run off	Potential for increased runoff (including discharges from dewatering of reclaimed materials) to overwhelm existing drainage system, increase turbidity and release contaminants	Potential for changes to water quality to affect ecology and human usage of the area
Operation		
Presence of newly reclaimed area	Alteration of tidal currents	Hydromorphology
Presence of newly reclaimed area	Alteration of natural sediment transport	Hydromorphology and water quality
Presence of newly reclaimed area	Alteration of flushing	Hydromorphology and water quality
Surface water drainage (to include management of storm water flows)	Potential for increased flows and pollutants to discharge into water courses (predominantly North Sound)	Potential for changes to water quality to affect ecology and human usage of the area
Surface water drainage (to include management of storm water flows)	Potential for increased flows to discharge into existing drainage systems, and potentially overwhelm the systems. This could result in increases to flood risk.	Existing drainage system

4.1.2.2 Matters scoped out

Assessment of waves is scoped out. This is because the lagoon is fully protected from waves by a fringing reef at its opening and assuming that the edge of the runway extension is constructed of sloping edges such that it would not generate reflected waves to affect the neighbouring coastline. This will need to be designed

into the scheme. Should this not be the case then there would be a need for wave modelling to ensure that the extension did not have a significant effect on the neighbouring coastline. The runway extension will be designed to take account of risks relating to climate change, including sea level rise and increased risk of hurricanes as discussed further in **Section 4.9.**

4.1.3 Assessment methodology

4.1.3.1 Site specific survey

Baseline measurements are required to inform the hydrodynamic, sediment dispersion and flushing modelling. The required input data would include:

- Bathymetry (a survey is likely to be required, and satellite-derived bathymetry can be an option);
- Measured tidal level and current data (a survey is likely to be required including deployment of one tidal level gauge and three Acoustic Doppler Current Profilers (ADCPs), **Figure 4.2**);
- Sediment data (particle size distribution); and
- Wind data (free hindcast wind data can be used; wind data is required to define worst case wind condition for flushing modelling and wave condition for sediment dispersion modelling).

Figure 4.2 Proposed locations of ADCP deployments to measure currents

Baseline measurements of water quality are required, to include turbidity, dissolved oxygen, temperature, pH, salinity and nutrients. The objective of the sampling would be to provide a baseline against which to assess the potential for change during the works and potentially for monitoring. A sampling plan will be developed that will provide good coverage of the area that could be affected, which will be established through the modelling, which in turn, is determined by the need for dredging. At least two sampling locations will be the same as the locations used for the previous water quality sampling undertaken for the Water Authority-Cayman and the DoE. This will provide a comparison against the survey data collated. In particular, a review of the Water Authority-Cayman and DoE results will provide an indication of the seasonal variation in data and enable assessment of the potential for the survey results to fluctuate over the year. The most recent survey data should also be compared against the data collated as part of the Wickstead Report (1976) to gain a more robust understanding of baseline and trends over time. Once the survey data is collated this will form the baseline for assessment of potential effects.

If dredging is required, a sediment quality survey will be undertaken with the objective of understanding the potential for re-using the sediment and/or release of contaminants. The number of samples will be dependent on the volume of dredging required but shall give good coverage of the area to be dredged including to the maximum depth of dredging. Sampling will be undertaken to determine the chemical characteristics of the sediment to be dredged, including the particle size, inorganic pollutants, heavy metals and synthetic organic pollutants. Specific testing for potential contaminants will include the those that may be present due to the activities in the area, including hydrocarbons, chemicals present in fire-fighting foam (including per-and polyfluoroalkyl substances (which are persistent chemicals so could remain in the area indefinitely) and lead (from lead shot used for shooting)). The results of the sampling will be compared against relevant public and environmental health standards to determine the potential for re-use, disposal or the treatment of the dredged sediment.

The results of the sampling shall be compared against the baseline data already collated for water quality for the Water Authority-Cayman and DoE sampling and against global standards including those derived by the United States Environmental Protection Agency (USEPA), Environment Canada and NOAA.

4.1.3.2 Modelling studies

Hydrodynamic model

A 2D hydrodynamic model would be set up covering Grand Cayman focusing on the hydrodynamics within the lagoon. MIKE21-HD software developed by DHI is recommended. The software provides the facility of a flexible mesh which can be used to fit a complicated coast accurately whilst maintaining computational efficiency. The model would be driven by a tidal level boundary condition outside Grand Cayman. The model would be calibrated by measured tidal level and current data collected within the lagoon (see site specific survey work above). Up-to-date bathymetry covering the lagoon is essential for model accuracy.

The calibrated hydrodynamic model would be run for both spring and neap tides with and without the proposed runway extension. Potential changes to the tidal current speeds and bed shear stress at peak ebb and flood tides would be produced for assessing the potential impact on hydrodynamics. The calibrated hydrodynamic model would be used to drive the sediment dispersion and flushing models described below.

Sediment dispersion modelling

As requested in the Scoping Opinion, sediment plume modelling will be undertaken. The modelling will confirm the extent (km^2), distance from protected areas and sensitive features (km) and duration (number of days) of any resultant changes in suspended sediment or sediment deposition that could require mitigation. Suspended sediment dispersion modelling would involve the use of a 3D model considering the vertical concentration change in suspended sediment concentrations. The entire dredging period will be simulated which includes the effects of neap and spring tides. Maximum suspended sediment concentration and deposition contour plots at the surface, middle and near bed layers would be produced for the EIA.

The calibrated hydrodynamic model would be coupled with a sediment dispersion model and run for the entire dredging period. Depending on the vertical sediment release position, the calibrated hydrodynamic model would be run either in 2D or 3D. The sediment would be represented in the model by five fractions (i.e. clay/silt, very fine sand, fine sand, medium sand and coarse sand). Contours of modelled maximum suspended sediment concentrations and total sediment deposition depth would be produced for assessing potential impacts. Time series of suspended sediment concentration at selected locations would also be presented.

Flushing modelling

The changes that the runway extension could cause on water quality as a result of the potential for reduced flushing will be modelled to determine any significant changes to flushing rates. The calibrated

hydrodynamic model would be coupled with a water flushing model and run for 30 days for the proposed runway extension for the worst wind condition. Sensitivity tests would be carried out to identify the worst wind condition for water flushing. In the flushing model, a conservative tracer will be used for quantifying retention time expressed in T90 and T37 (T90 and T37 means the time for tracer concentration to reduce from 100% to 10% and 63%, respectively). Contours of modelled retention time would be produced for the impact assessment.

Site drainage assessment
With respect to site drainage and hydrology, an initial detailed review of published and publicly available information will be used to further develop the existing baseline conditions for the Project site's hydrology. This would need to consider:

- the current drainage system, including its design capacity and any pollution prevention and control measures.
- the extent to which the drainage system could change, including a consideration of additional runoff volumes from the expanded site and new runoff route.
- potential increase in flood risk (consideration of the capacity of the drainage system to accommodate increased runoff volumes).
- the requirement for further pollution prevention measures, especially if the drainage system shall be expanded.

This review shall include any information prepared to support the earlier airport upgrades that were implemented during 2020 and 2021. Monitoring and management measures for water quality and drainage shall be detailed in the EMP.

4.1.4 Mitigation measures

4.1.4.1 Construction

A construction environmental management plan (as part of the EMP) shall be drafted to ensure surface water drainage and any run-off from reclamation activities was managed during construction. This plan shall include measures to ensure accidental spills to the marine environment are avoided alongside measures to ensure sediment run-off is controlled.

If dredging is to be undertaken, a dredge management plan should be formulated to manage the potential effects from dredging and reclamation (and any placement or disposal of dredged material, if needed) as far as practicable to include considerations regarding implementation of management measures, including timing and tidal conditions to determine whether any opportunity exists to undertake dredging at specific times to protect sensitive receptors (see **Section 4.2**). As part of the development of the plan and as noted in the EIA Scoping Opinion - ORIA Runway Extension drone imagery revealed the widespread impact of dredging from other projects despite the installation of two layers of silt screens. Therefore, the effectiveness of measures such as these would be reviewed within the management plan to ensure appropriate measures are put forward to reduce the scale of effect as far as possible. The residual effect would then be determined as part of the EIA. The dredge management plan would include the monitoring required to show the effectiveness of the measures and the review process for checking and adapting any monitoring or management.

4.1.4.2 Operation

Appropriate drainage design and management will be determined during the EIA process, and detailed in the management plans, to ensure:

- That existing drainage systems are not overwhelmed by increased volume of surface runoff from the extended runway.
- Risks to water resources (e.g. pollution from aviation-specific chemicals) are managed during rainfall/storm events. To this end, there shall be measures in the drainage system design to collect and treat surface runoff before they are discharged into the sea.

4.2 Marine ecology

4.2.1 Baseline conditions

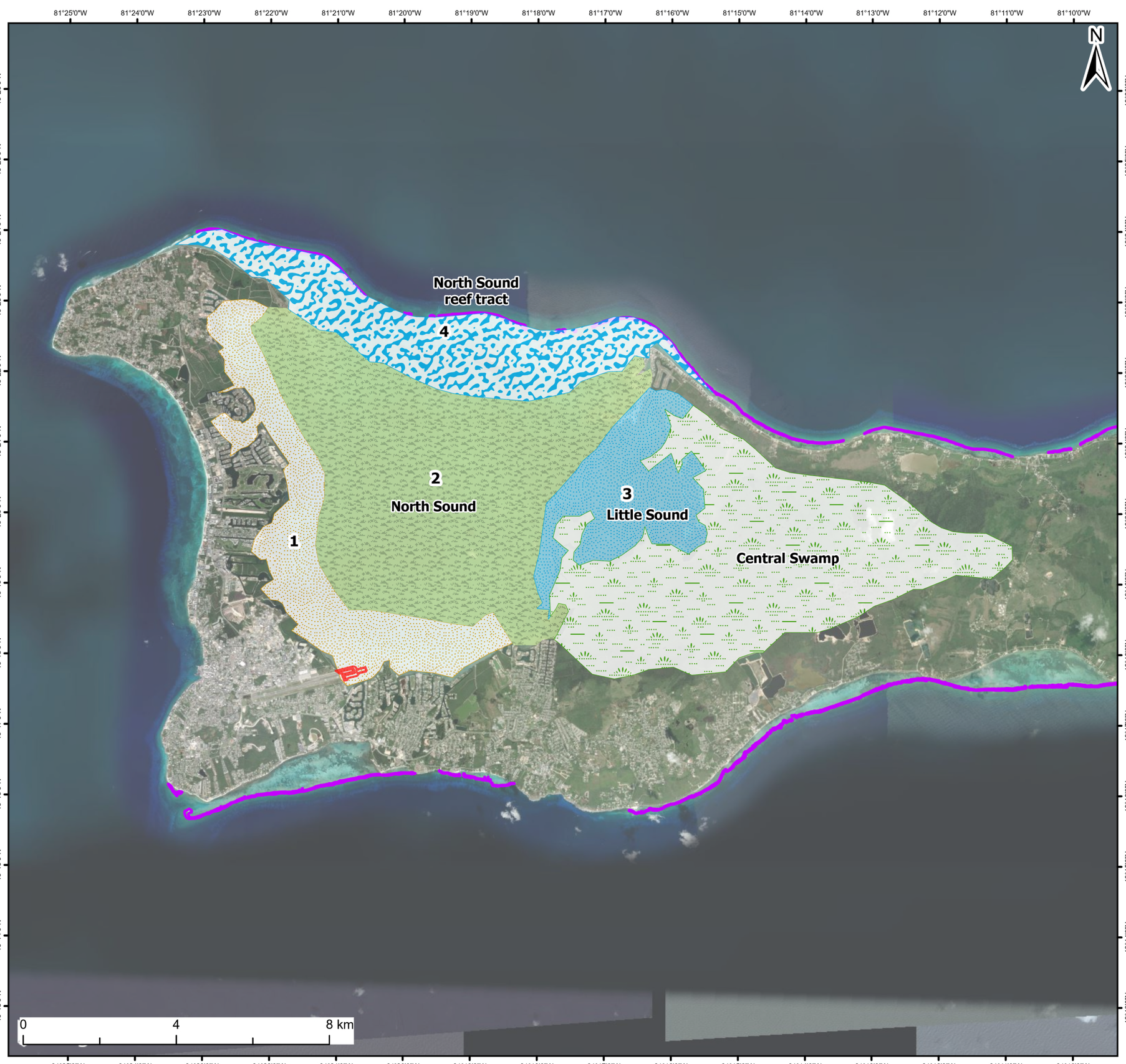
The runway extension would occur within the southwestern area of North Sound, which is a shallow, 85km^2 (21,000 acres) semi-enclosed lagoon protected by an outer fringing reef. The lagoon area is a soft sediment area supporting mangroves and seagrass beds together with sand and mudflats. The coastal habitats, in particular the mangrove and seagrass protect the coastline. A paper by Bush (2006) describes North Sound as having approximately 60% of the sound covered by well-developed beds of turtle grass (*Thallassia testudinum)*. This sea grass species provides many important functions including filtering water to improve water quality, providing habitat and a food source for many species and stabilising the seabed. It also provides an important function in carbon sequestration.

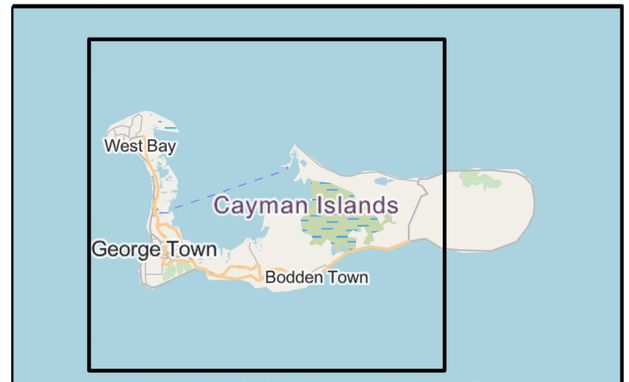
Mangroves occur around the fringes of North Sound, particularly along the eastern edge where the Central Mangrove Wetland area reaches the coastline. This area provides a vital resource for many species of coastal and terrestrial fauna and flora. Bush discusses the mangrove fringe and how it is not progressing and that there is evidence that the fringe is receding. Bush also describes the North Sound in terms of four zones: the shore zone; grass plain; restricted lagoon; and reef shoal (**Figure 4.3**: Source Bush (2006)). The shore zone, within which the runway would extend, is in the shallowest area out to about 1-2km (0.6-1.2 miles) from shore and comprises a thin layer of sediment with the benthos made up of stunted turtle grass, various species of alcyonarians and calcareous green algae, loggerhead sponges and small colonies of corals (*Porites* and *Siderastrea* species). The central part of the lagoon comprises high density beds of turtle grass, abundant green algae and sediment mounds of burrowing worms and crustaceans.

Part of North Sound is designated as a Marine Reserve as shown on **Figure 4.4**. The proposed airport extension does not fall within this zone.

Existing threats to North Sound include tourism and coastal development, with the destruction of approximately 62% of the mangrove within a half kilometre of the western periphery of the North Sound (Ebanks-Petrie, 1993, quoted in Bush, 2006). In addition, there are several areas of habitat that have been subject to dredging to extract marl for reclamation, particularly along the western edge of North Sound.

Water quality issues occur in the sound, particularly during dredging activities and during periods of high run off, where finer sediments are mobilised within the water column. Despite the drafting of a regulation in 1997 to prohibit commercial dredging in the North Sound, many projects have been permitted, with the damaging effects on the ecosystem still being visible with reduced biodiversity and increased suspended sediments.





Legend:

- Project Footprint
- Central Swamp

Benthic Zones

- 1 - Shore Zone
- 2 - Grass Plain
- 3 - Restricted Lagoon
- 4 - Reef Shoal

Client:	Project:
Cayman Island Government	Grand Cayman ORIA extension

Title:

Benthic Zones within North Sound (Source: Bush, 2006)

Figure:	Drawing No:
4.3	PC6310-RHD-GC-ZZ-DR-Z-0005

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/04/2025	GC	LR	A3	1:100,000

Co-ordinate system: Name: NAD 1927 UTM Zone 17N

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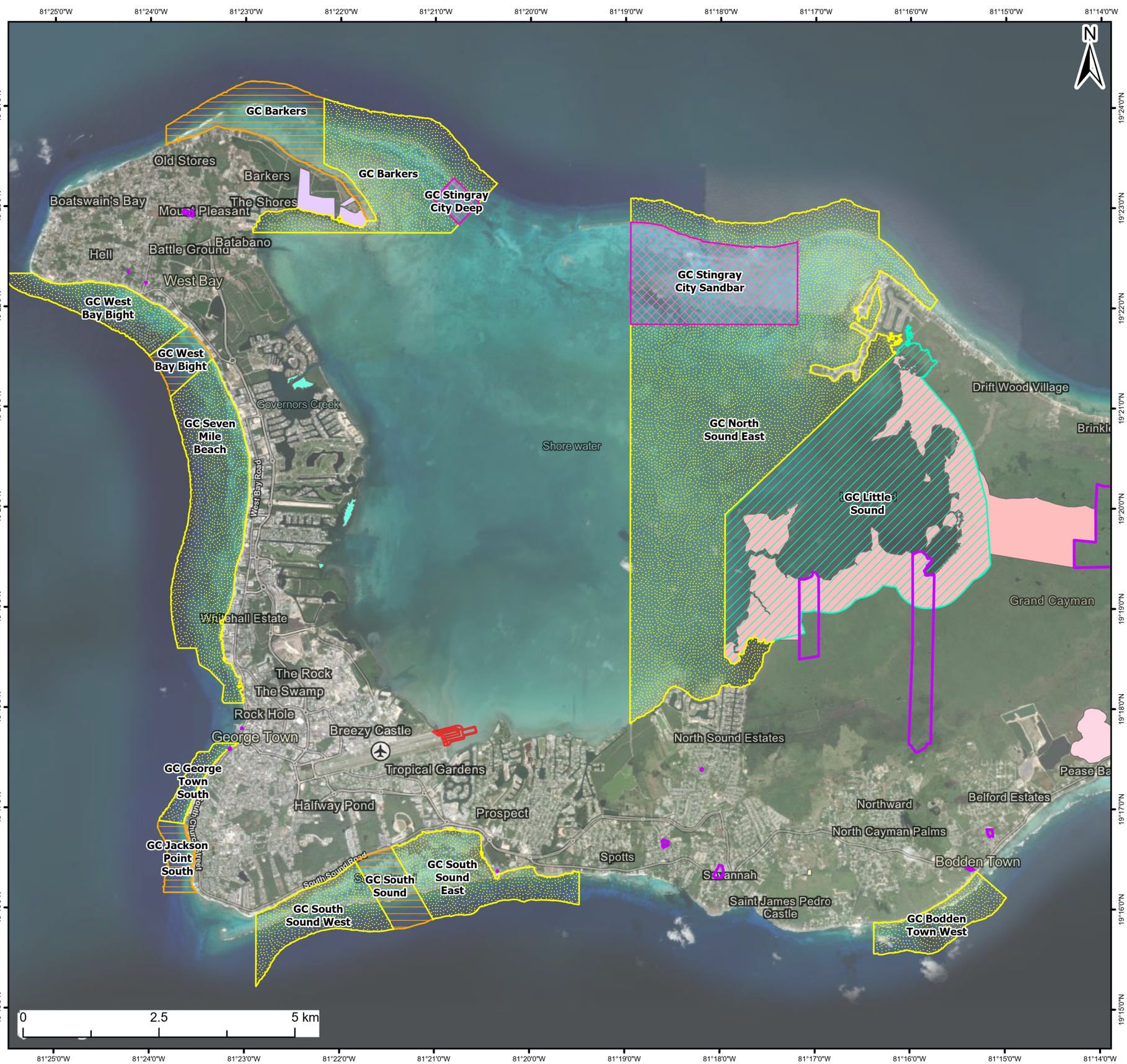

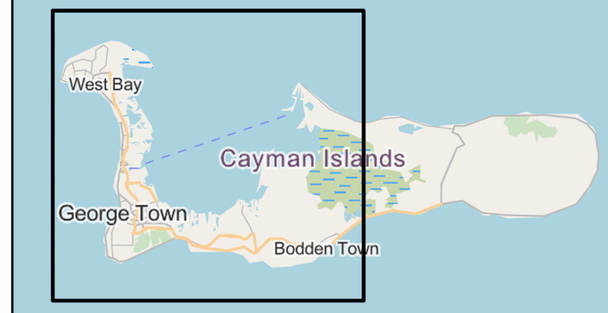

Legend:

- Project Footprint
- National Trust Act Protected Land

NCA Marine Protected Areas

- Environmental Zone
- Line Fishing Zone
- Marine Reserve
- Wildlife Interaction Zone

NCA Terrestrial Protected Areas

- Barkers
- Barkers (Vidal) Cay
- Central Mangrove Wetland
- Lower Valley Forest
- Meagre Bay Pond
- Western Mangrove Cays

Client:	Project:
Cayman Island Government	Grand Cayman ORIA extension

Title: Map of nationally protected and internationally recognised areas in proximity to ORIA (Source Department of Environment, 2022; KBA, 2024)

Figure: 4.4 | Drawing No: PC6310-RHD-GC-ZZ-DR-Z-0002

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/04/2025	GC	LR	A3	1:70,000

Co-ordinate system: Name: NAD 1927 UTM Zone 17N

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4.2.2 Potential effects

4.2.2.1 Matters scoped in

During construction

As discussed in the EAB Scoping Opinion (**Appendix A**), and outlined in **Section 1.4**, the proposed extension of the runway would directly affect an area of approximately 0.09km^2 (22.4 acres) of benthic habitat containing seagrass beds in addition to consolidated coarse sediments colonised with marine algae, seagrasses, sponges and coral colonies. There are also intertidal and coastal habitats that would be affected within the footprint and indirectly during construction. The habitats in this general area are already affected by threats from tourism, development and dredging. The airport extension would occur within an area of shallow water habitat.

The habitats that will be lost will be intertidal and coastal habitats together with the shallow subtidal areas that support seagrass beds and sedimentary habitat, both of which provide an important role in ecosystem health. The loss of such habitats, particularly in an area that has already been exploited through coastal development, dredging and tourism can have a significant effect. Seagrass habitats provide shelter and food for many species, bind the sediment and reduce wave action thereby providing some stability for the sediment and potential for coast protection and provide a carbon storage reservoir.

Options to reduce the scale of habitat loss will be investigated for the EIA, including the potential to extend the runway on an open structure that retains habitat underneath. It is recognised that the seagrasses may not flourish underneath the structure as the light levels would be reduced but the structure could provide a refuge for fish and a habitat for attachment of encrusting species.

During construction there would also be implications for water quality to affect the marine species in the area. **Section 4.1** discusses the work that will be undertaken to assess the changes in water quality and the results of this assessment will be used to assess the potential for effects on the benthic habitats and species and pelagic species that use the area, some of which may be seasonal. The effects could include the presence of a sediment plume affecting light availability and filter feeding organisms and smothering of benthic habitats and species.

The sourcing and delivery of materials shall also be assessed. This will include whether delivery by vessel will be feasible, given the shallow water in this area. The route for navigation and method of drop off will need to be assessed both in terms of the potential for physical impacts to the seabed during delivery but also to the route used and the potential for disturbance to ecological features and risk of pollution events occurring. Sources of material for the reclamation also need to be included in the assessment process, unless the source is an already licensed provider of aggregate. If there will be a need for dredging to provide a suitable base for placement of fill material, or to provide fill material from an extraction site, then a full assessment of the dredge location will be necessary, including seabed damage, disturbance to marine species and potential for pollution (air and water) during extraction, placement and transit. In addition, an assessment will be required of any changes to hydrodynamics and sediment dynamics resulting from the removal of the material.

The potential for noisy activities to affect marine species will be assessed during placement of materials and general construction noise. Should there be a need for piling then the study area shall be re-assessed following underwater noise modelling, and the potential for noise and vibration effects on marine species will be investigated and assessed. Any assessment would follow accepted guidance for quantifying the risks and determining the sensitivity of the species in the area. Guidance on assessing and managing effects of underwater sound is provided in PIANC Working Group Report 226 (2025). The assessment process will also follow the Joint Nature Conservation Committee protocol for minimising the risk of injury to marine

mammals from piling noise. Although this protocol has been developed for the United Kingdom, the principles are valid and it acknowledges that the measures included are also appropriate for turtles.

During operation

It is important to consider that although there will be environmental impacts from the construction phase, the airport is already operational in the vicinity. Therefore, although many of the operational impacts may be exaggerated, they will not be novel to the surrounding area. Nonetheless, with the runway extending further into the lagoon, there is an increased risk of run-off pollutants, namely persistent organic pollutants (POPs) such as aviation fuel and perfluorinated chemicals (PFCs) (see **Section 4.1**). Such chemicals can have an adverse effect on the aquatic species and habitats.

Additionally, as the proposed runway extension allows for more frequent visits, and larger planes, there may be an increase in the frequency or severity of noise pollution and vibration. The flight take-off route and the potential for larger planes to affect the water in the Sound and the species using the affected area shall be considered.

The presence of the reclamation within North Sound is likely to change the coastal processes in this area (as discussed in **Section 4.1**). This could have an ongoing effect on the coastal and benthic habitats in the localised area. Even small-scale effects can have an impact on ecosystem features and there is also the cumulative effects to consider of numerous smaller projects affecting the wider area. **Section 4.1** outlines the studies needed to assess any effect on habitats as a result of changes to hydrodynamics and sediment movement and the results of these studies will be used to determine and assess any long-term changes to habitat and species in the area.

The potential effects to be scoped into the marine ecology assessment are provided in **Table 4.2**.

Table 4.2. Potential marine ecology effects

Activity	Effect	Receptor
Construction		
Reclamation and any dredging needed	Direct loss of habitat	Coastal, subtidal and intertidal benthic habitat and species
Reclamation and any dredging needed	Dredging and deposition of fill material results in water quality changes via sediment plume and subsequent settlement of material.	Benthic and pelagic habitat and species
Piling	Noisy activities during construction, in particular relating to pile driving causing disturbance to species in the area	Mobile species such as fish, mammals and reptiles and invertebrates.
Delivery of materials	Disturbance to species in the transit area and the delivery zone, including noise generated during construction works.	Benthic and pelagic habitats and species
Source of fill material	Potential for direct and indirect impact at the extraction site if marine based sources are to be used	Benthic and pelagic habitats and species
Impact on protected area features	Indirect effects of construction activities on the Marine Reserve.	Benthic and pelagic habitats and species
Operation		
Changes to coastal processes	Changes to coastal and subtidal habitat and species composition.	Benthic and coastal habitats and species
Change to water quality	Potential for pollution events to increase given closer proximity to the coastal environment and potential for reduced flushing of water given the presence of the runway extension.	Benthic and coastal habitat and species
Disturbance to species	Potential for increased disturbance to benthic and pelagic species over and above existing levels of disturbance.	Benthic and coastal habitats and species

4.2.3 Assessment methodology

Throughout the EIA process, a comprehensive review of technical reports, publications, government documents, websites, and the GIS datasets provided by the DoE will be conducted to gain an in-depth understanding of the baseline existing conditions within, adjacent to, and in the vicinity of the proposed Project. This will include review of the following:

- Grand Cayman Landcover and Habitat (2018);
- Cayman Islands National Trust Sites (2022);
- Cayman Islands National Conservation Act (NCA) Sites (2022); and,
- International Bird and Biodiversity Areas (IBAs), Key Biodiversity Areas (KBAs) and Alliance for Zero Extinction (AZE) Database;
- Available data for species in the Sound from various users of the area, including consultation with tour operators;
- Previous information collated for projects within North Sound, including results from dredging campaigns, water quality monitoring undertaken for the Water Authority-Cayman and DoE and any EIAs that have an area of influence within North Sound;
- Baseline information collated as part of the Wickstead Report (1976) and subsequent relevant updates such as the DoE study to update the seagrass mapping and condition (Luke, 2002).and
- Results of the modelling and water and sediment quality assessments.

Surveys will be undertaken to ground-truth existing data and establish the sensitivity of habitats and species in the area to any of the proposed activities. The surveys shall follow the methodology outlined below but be agreed with DoE prior to the survey.

A study area for the surveys shall be determined based on the predictions of the area of influence from water quality and coastal processes changes together with any noise and vibration impacts that may occur. This can be estimated based on current flows in the area and the sediment type and following the results of the studies outlined in **Section 4.1** and any noise modelling (if required due to any particularly noisy activities such as piling) as outlined in **Section 4.5**. The study area shall cover the areas affected directly and indirectly together with an area outside of this to put the area into context.

A coastal walkover survey will be undertaken to incorporate habitat and species mapping along the coast and in adjacent areas to determine how typical, or unique the habitats and species are within the potentially affected area. Surveys shall be conducted in summer, and during a low spring tide, to ensure that all flora and fauna will be present and easily identified. Coastal habitats include mangrove areas and shall be co-ordinated with terrestrial surveys to ensure that there is crossover to cover transitional habitats. The surveys will also include any notes on condition of the habitats and species and any existing threats.

A subtidal benthic habitat survey will also be undertaken within the footprint of the Project and the surrounding area to establish the habitats and species that are present. It will be recognised that some species will only be present at certain times of year. The time when most species are likely to be present is the summer so surveys will be undertaken during this time. The surveys will include video recording of the benthic habitats along transects from the shoreline to at least 200m (656 ft) beyond the Project and further if the modelling prediction shows that a larger area may be affected. Along each transect, records will be made of where habitats change. At set intervals along each transect, photographs and quadrat surveys shall be undertaken to record percentage cover of habitats, observed species, any notes on potential for burrowing species and potential for seasonal use of the habitat.

Mapping of mobile species will be undertaken including rays, turtles and other species that use the Sound using information collated from existing data and consultation responses.

The sensitivity of each habitat and key species will be determined to enable an assessment of potential loss. This shall include its tolerance to an activity and its potential for recovery. Loss of the area of each habitat both in the localised area and compared with the overall habitat extent in North Sound and the area of habitat in Grand Cayman will be calculated.

The cumulative losses of habitat will be considered alongside the losses from this project. Any plans or proposed projects will be considered alongside this project to determine the overall losses and their significance within North Sound, particularly given the concerns raised for previous projects, as discussed above.

4.2.4 Mitigation measures

As noted in the Scoping Opinion - ORIA Runway Extension drone imagery revealed the widespread impact of dredging despite the installations of two layers of silt screens. Therefore, it is important to note that although mitigation measures can be put in place to reduce the damage of dredging, if required for construction works, as they have not been overly effective in the Cayman Islands. An adaptive management strategy would therefore be required to ensure the effective management of measures if the effects are considered to be significant.

Potential for reducing the habitat and species loss is key for mitigation and minimising disturbance during construction. This could include seasonal restrictions for particular activities and selecting appropriate methodologies to reduce potential impacts.

4.3 Terrestrial ecology

Although the findings in the EIA Scoping Opinion did not include any direct concerns arising from the proposed Project on terrestrial ecology, potential effects on ecological receptors during the construction and operation phases shall be investigated to provide a robust EIA process, due to the loss of the small area of terrestrial habitat and the proximity to areas that could support terrestrial species, such as mangroves.

4.3.1 Baseline conditions

Grand Cayman boasts a variety of unique habitats, each supporting diverse flora and fauna (Cayman Islands Department of Environment, 2024) including dry forests, mangrove forests, shrublands and herbaceous wetland.

4.3.1.1 Protected areas

There are no terrestrial protected areas within 1km (0.6 miles) of the Project (shown in **Figure 4.4)**.

4.3.1.2 Habitats

Terrestrial habitats present within the footprint of the Project and a 1km (0.6 mile) buffer zone are shown in **Figure 4.5**. Within the footprint of the Project, the habitats are predominantly urban and man-modified, including the infrastructure associated with the airport with a small patch of seasonally and tidally flooded mangrove forest.

4.3.1.3 Notable and protected species

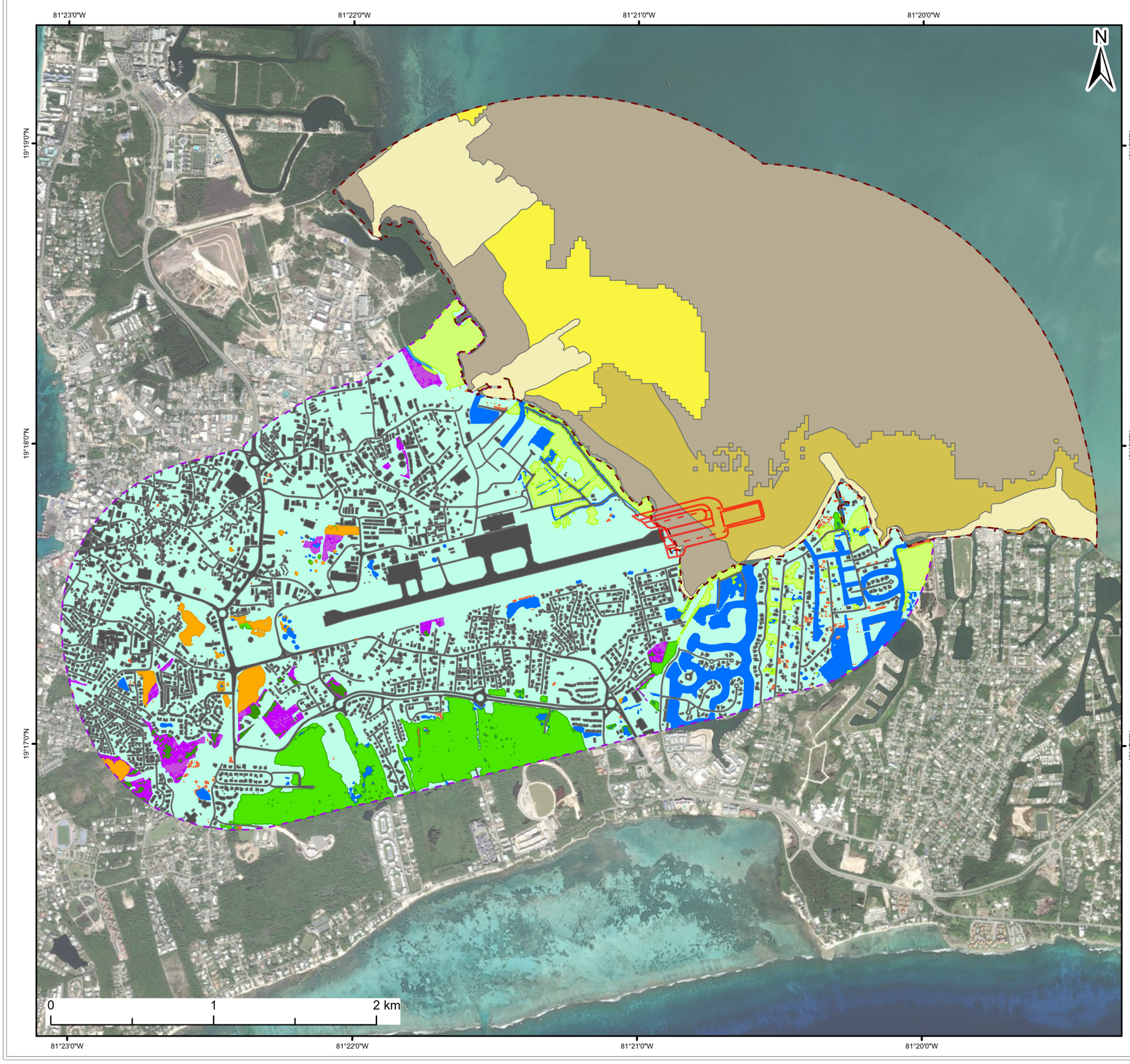
Grand Cayman is home to several protected species, each playing a crucial role in the island's biodiversity:

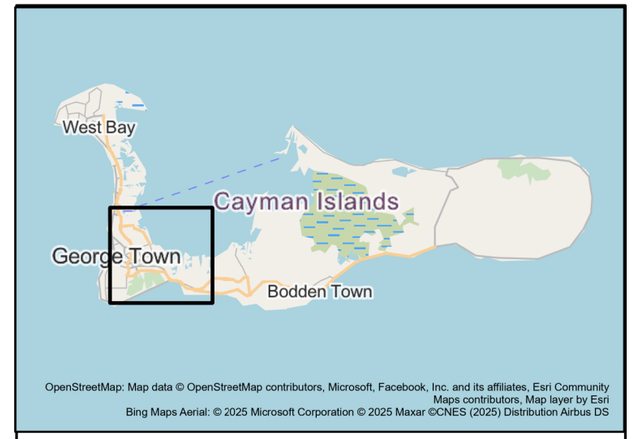
- **Blue Iguana** (*Cyclura lewisi*): This critically endangered species is endemic to Grand Cayman and was nearly extinct from the wild during the early 2000's mainly due to predation by domestic pets. This large, heavy bodied reptile are associated with habitats such as dry, rocky forests and coastal areas.
- **Grand Cayman Parrot** (*Amazona leucocephala caymanensis*): This parrot is native to Grand Cayman and is protected due to its declining population and habitat loss.
- **West Indian Whistling Duck** (*Dendrocygna arborea*): This duck is considered vulnerable and is protected to prevent further decline.
- **Other bird species**: The majority of bird species are legally protected. The Cayman Islands National Biodiversity Action Plan (NBAP) also identifies mangrove habitat as being of particular importance to bird species; in addition to the two species identified above, greater Antillean grackle (*Quiscalus niger caymanensis / bangsi*) and white-crowned pigeon (*Patagioenas leucocephala*) are associated with this habitat. It is also identified as being of importance to resident and migratory waders, including snowy egret (*Egretta thula*).
- **Bats**: Nine species of bats are native to the Cayman Islands, including the critically endangered Cayman Long-eared Bat (*Natalus primus*). These bats are vital for maintaining ecological balance and represent the only mammal species native to Grand Cayman.

4.3.2 Potential effects

Any potential effects from the construction and operation of the proposed Owen Roberts runway extension on terrestrial ecology will be determined during the EIA study using existing data, results from the walkover survey and consultation with relevant stakeholders, including the DoE and NTCI. Additionally, potential secondary impacts to surrounding ecological receptors, such as seasonally flooded mangroves, will be evaluated. These effects to ecological features from the proposed runway extension will include, but are not limited to:

- Loss of habitat and potential fragmentation within the footprint of the runway extension;
- Loss of species through direct impacts during site clearance and construction disturbance;
- Fugitive dust affecting habitats and associated species during construction;
- Construction and roadway runoff (sedimentation and/or contamination) affecting habitats and associated species;
- Disturbance to species from noise and visual impacts during construction and operational phases;
- Disturbance to species from additional light pollution into surrounding natural areas;





Legend:

- Project Footprint
- Project Footprint 2km Marine Buffer
- Project Footprint 1km Terrestrial Buffer

Terrestrial Habitat

- dry forest and woodland
- dry shrubland
- invasive species
- man-modified
- ponds, pools and mangrove lagoons
- seasonally flooded mangrove forest and woodland
- semi-permanently flooded grasslands V.A.1.N.h
- tidally flooded mangrove forest and woodland
- urban

Benthic Habitat

- Hardbottom
- Seagrass Beds
- Silt
- Vegetated Sand

Client:	Project:
Cayman Island Government	Grand Cayman ORIA extension

Title:

Map of habitats present on Grand Cayman within the Project Footprint and a 2 km buffer (2018)

Figure:	Drawing No:
4.6	PC6310-RHD-GC-ZZ-DR-Z-0003

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/04/2025	GC	LR	A3	1:23,000

Co-ordinate system: Name: NAD 1927 UTM Zone 17N

Royal HaskoningDHV
Enhancing Society Together

4.3.2.1 Matters scoped in

The potential significant impacts to be scoped into the terrestrial ecology assessment are displayed in **Table 4.3**.

Table 4.3. Potential impacts on terrestrial ecology and ornithology

Activity	Effect	Receptor
Construction		
Construction of the Project	Loss of habitat within the runway extension, and its associated effect on species using these areas.	Terrestrial habitats and species within the footprint of the Project.
	Loss of species through direct impacts during site clearance and construction disturbance.	All species within the footprint of the Project and surrounding area.
	Temporary disturbance to habitats and species including through the implementation of noise barriers.	Terrestrial habitats and species within the footprint of the Project and surrounding area.
	Fugitive dust affecting habitats and associated species.	Terrestrial habitats and species within the footprint of the Project and surrounding area.
	Construction and roadway runoff (sedimentation and/or contamination) affecting habitats and associated species.	Terrestrial habitats and species within the footprint of the Project and surrounding area.
	Disturbance to species from light pollution into surrounding natural areas.	Terrestrial and coastal habitats and species within the footprint of the Project and surrounding area.
Operation		
Presence of the Project	Disturbance to species from increased light pollution into surrounding natural areas.	Terrestrial and coastal habitats and species within the footprint of the Project and surrounding area.
	Potential for an increase in numbers of visitors to Grand Cayman resulting in increased disturbance to species and habitats.	Terrestrial habitats and species across Grand Cayman.

4.3.2.2 Matters scoped out

Based on the nature of the works and existing information on species, the following items have been scoped out but will be reconsidered if field surveys indicate a need:

- Direct impact on terrestrial animal species including bats, amphibians and reptiles including the blue iguana;
- Impact on terrestrial protected sites.

4.3.3 Assessment methodology

4.3.3.1 Baseline surveys

Existing data for habitats and species shall be reviewed to provide a detailed account of the baseline ecology of the coastal and terrestrial habitats around the Project location. In order to update and complement the existing baseline data, a preliminary ecological walkover survey to collect botanical information, map different habitat types and evaluate the suitability of the habitat to support notable or protected species is recommended.

It is important to bear in mind that some wildlife surveys may require licences or permits from the Cayman Islands Department of Environment. Prior to the surveys being confirmed, discussions with the Department of Environment and the NTCI shall be undertaken to ensure that all available data has been considered and

that the survey methodologies cover all species and habitats that could be of concern and require assessment as part of the EIA. The surveys will include but may not be limited to the following:

Preliminary ecological walkover survey methodology

- Habitat and Botanical surveys:
    - A desk study using existing datasets and latest satellite imagery will be carried out, in order to divide the survey area into homogeneous stands of vegetation/ land cover.
    - Habitat surveys will be undertaken to characterise broad habitat types within a minimum 50 metres of the Project footprint.
    - Surveys shall be undertaken between April and June when the majority of plants are in bloom to facilitate identification.
    - Methodology for vegetation surveys such as those provided for the National Vegetation Classification (Rodwell and JNCC, 2006) shall be followed. Representative sites within the area to be surveyed shall be selected and a suitable number of quadrats will be selected and all plant species within each quadrat recorded. A floristic table summarising the species frequency and abundance values characteristic of the vegetation will be produced.
    - Additional habitat features such as soil type, slope, aspect, and any signs of disturbance or management will be recorded.
    - The survey data will be presented as a comprehensive report, including maps, species lists, and descriptions of the vegetation communities listing details of endemic, notable and/ or protected species.
    - The potential of the habitats within the footprint of the Project to support protected and/ or notable species of animals such as roosting, nesting or resting sites will be recorded and further surveys recommended where appropriate.

Should the preliminary walkover survey find any habitats or species that could be affected by the construction and/ or operation of the runway extension, then they would be assessed using the Guidelines for Ecological Impact Assessment (EcIA) in the United Kingdom and Ireland (Chartered Institute of Ecology and Environmental Management (CIEEM), 2018). These guidelines aim to predict the residual impacts on important ecological features affected, either directly or indirectly by a development, once all the appropriate mitigation has been implemented.

The approach to determining the significance of an effect will follow a systematic process for all impacts as discussed in **Section 3.2.5**. This involves identifying, qualifying and, where possible, quantifying the sensitivity, value and magnitude of all ecological receptors which have been scoped into the assessment. Using this information, a significance of each potential impact shall be determined.

The criteria for defining the sensitivity/value of a receptor will follow that set out in **Section 3.2.5** and may be refined for each receptor in the ES. This EIA Chapter shall use professional judgement to ensure the assessed significance level is appropriate for each individual receptor, taking account of local values for biodiversity, to avoid a subjective assessment wherever possible.

4.3.4 Mitigation measures

All significant effects shall be investigated in terms of the potential to mitigate the effect according to the mitigation hierarchy with a view to avoid impacts wherever possible, minimise those that cannot be avoided and restore any affected habitats to their original condition or better.

Specific mitigation measures would need to be tailored according to the potentially affected habitats or species and may include:

- Ecological supervision with interaction if needed;
- Controls on the timing, duration and location of works;
- Habitat and species translocation;
- Habitat creation, management and establishment;
- Protection and management of hydrological features;
- Wildlife tunnels and safe crossings;
- Wildlife fences; and
- Environmental awareness campaigns.

Depending on the significance of residual impacts there may be a need for offsetting if the project is deemed to be essential considering the significant effects remaining. The measures to be applied to reduce the significance of effects shall be detailed within the EMP for the project and within any feature, or activity, specific management plans required.

4.4 Air quality

This section considers the scope of potential air quality impacts at sensitive receptor locations during the construction and operational phases of the Project.

The air quality assessment will assess the impacts on human and ecological receptors. The results of these assessments will then feed into other disciplines as relevant, such as terrestrial ecology and socio-economics.

4.4.1 Baseline conditions

Air quality on Grand Cayman is generally good on account of being located in an oceanic setting and the presence of steady trade winds, which causes regular dispersion of air pollutants. The main sources of air pollutants on Grand Cayman are:

- The Caribbean Utilities Company (CUC) power station located approximately 1km (0.6 miles) northwest of ORIA. This power station uses a mixture of diesel engines and gas turbines.
- Spraying of chemical insecticides by the Mosquito Research and Control Unit.
- Road traffic emissions from vehicles using the road network.
- Localised emergency diesel generators and other emission generating systems.
- Emissions from ocean vessels using the port and anchoring offshore.
- Emissions from ORIA, including jet fuel emissions from aircraft and diesel emissions from ground vehicles.
- Odour and methane from the island landfill site.
- Emissions of Volatile Organic Compounds (VOCs) from petrol stations and fuel deliveries.

There are currently no baseline air quality data readily available for Grand Cayman. It is understood that the Cayman Islands Government Department of Environmental Health (DEH) has launched a new programme collecting baseline air quality data. Correspondence with DEH on 01/11/2024 has confirmed that the monitoring programme is still in the early stages and as such the full monitoring programme is not yet in place.

ORIA is located in a relatively built-up area. As such there are a number of sensitive receptors within 1km (0.6 miles) of the Project; these include residential dwellings, schools and medical centres. There are ecological receptors in the vicinity of the site, including sea grass beds which are sensitive to nutrient loading.

4.4.2 Potential effects

4.4.2.1 Matters scoped in

The potential effects to be scoped into the air quality assessment are displayed in **Table 4.4**.

Table 4.4. Potential air quality effects

Activity	Impact	Receptor
Construction		
Construction phase dust and particulate matter caused by activities associated with demolition, earthworks, construction and trackout[2]	• Dust deposition, resulting in the soiling of surfaces (resulting in potential amenity loss and annoyance) and leaves (resulting in restricted ability for plants to photosynthesise and, depending on chemical composition, damage to the leaves themselves); • Visible dust plumes indicating emissions of dust; and • Elevated PM_{10} and $PM_{2.5}$ concentrations which are detrimental to health.	• Human receptors sensitive to dust soiling and health effects related to particulate matter (e.g. residential dwellings, schools, hospitals, hotels, offices, car parks, museums) within 250 m of the boundary of the site; and/ or • Ecological receptors within 50 m of the boundary of the site.
Construction phase road traffic emissions	• Increased concentrations of NO_2, PM_{10} and $PM_{2.5}$ from vehicles associated with the construction phase using the public highway network.	• Human (e.g. residential dwellings, schools, hospitals) and ecological receptors within 200 m of the affected road network.
Odour from construction activities (e.g. excavation of historic landfill or contaminated land areas if present)	• Nuisance • Loss of amenity	• Sensitive human receptors in the general vicinity of the odour source. Distance will depend on odour concentration and prevailing meteorological conditions.
Operation		
Airport combustion emissions from aircraft, on-site ground vehicle movements and any stationary combustion plant (e.g. boilers, generators or combined heat and power (CHP))	• Increased pollutant concentrations from aircraft take-off, landing and taxiing, ground support vehicles and stationary combustion equipment used at the airport.	• Human (e.g. residential dwellings (such as those depicted in **Figure 4-7**), schools, hospitals) and ecological receptors in the vicinity of the airport.
Operational phase road traffic emissions	• Increased concentrations of NO_2, PM_{10} and $PM_{2.5}$ from vehicles associated with the operational phase using the public highway network.	• Human (e.g. residential dwellings, schools, hospitals) and ecological receptors within 200 m of the affected road network.
Odour from aviation fuel	• Nuisance • Loss of amenity	• Sensitive human receptors in the general vicinity of the odour source. Distance will depend on odour concentration and prevailing meteorological conditions.

[2] The transport of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction / demolition site with dusty materials, which may then spill onto the road, and/ or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

4.4.2.2 Matters scoped out

Construction phase Non-Road Mobile Machinery (NRMM) emissions can be scoped out provided that it can be demonstrated that suitable controls and site management are in place, such as through a Construction Environment Management Plan. These measures include:

- Ensuring all equipment is compliant with the appropriate NRMM standards;
- Ensuring further abatement plant is installed on NRMM equipment (e.g. diesel particulate filters) where practicable;
- Ensuring no idling takes place i.e. all vehicles switch off engines when stationary;
- Avoiding the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment wherever possible; and
- Impose and signpost a maximum speed limit of 15 mph on paved and 10 mph on unpaved haul roads and work areas.

The purpose of the Project is to provide compliant RESAs at both ends of Runway 08-26. It is not anticipated to significantly increase flight or passenger numbers. Therefore, operational effects on road traffic and subsequent air quality impacts upon sensitive receptors are not anticipated. As such, impacts in relation to operational traffic pollutant emissions are scoped out of the assessment.

4.4.3 Assessment methodology

The following standards will be reviewed during preparation of the EIA:

- Cayman Public Health Law, 2021 Revision.
- International Finance Corporation Guidance Note 3, 2012.
- Cayman Islands Climate Change Policy, 2024-2050.
- Development and Design (GG103), Revision 1, 2020.
- Cayman Islands National Energy Policy 2024-2045.

The Cayman Islands Climate Change Policy 2024-2050 identifies that:

> *"Opportunities must also be sought for the domestic aviation sector, and fishing and shipping interests to participate in climate action that reduces Cayman's GHG emissions in compliance with international regulations, while increasing cost-efficient operations. Options include the use of alternative marine fuel and sustainable aviation fuels, the latter estimated by the International Air Transport Association to contribute around 65% of the reduction in emissions needed by global aviation to reach net-zero in 2050."*

The following Strategic Actions, identified in the Policy, are of relevance to air quality on Grand Cayman:

- 5.1 Robust Economy
    - 5.1.13 Develop an aviation policy framework to reduce greenhouse gases in this sector and capitalise on global, regional and local carbon offsetting opportunities:
    - 5.1.13.1 Plan for the transition to sustainable aviation fuels use by Cayman Airways and other airlines refuelling in the Cayman Islands if deemed cost-efficient.
    - 5.1.13.2 Investigate whether Cayman Airways is eligible to participate in the International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation."

Whilst these positions are more related to reductions in greenhouse gas emissions, they indirectly relate to air pollutant emissions as well. Generally speaking, actions to reduce greenhouse gas emissions also reduce emissions of air pollutants.

The air quality assessment will be carried out in accordance with the principles contained within the following guidance documents:

- International Finance Corporation: General Environmental Health and Safety Guidelines Air Emissions and Ambient Air Quality, 2007.
- Department for Environment Food and Rural Affairs: Local Air Quality Management (LAQM) Technical Guidance 2022 (LAQM.TG(22)), 2022.
- Institute of Air Quality Management (IAQM): Guidance on the Assessment of Dust from Demolition and Construction, 2024.
- Environmental Protection UK (EPUK) and IAQM: Land-Use Planning and Development Control: Planning for Air Quality, 2017.
- IAQM: A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites, 2019.
- Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (NEA001), 2018.
- Highways England: Design Manual for Roads and Bridges (DMRB) LA105, 2019.

4.4.3.1 Baseline

In order to inform the EIA, it is proposed that a baseline nitrogen dioxide (NO_2), sulphur dioxide (SO_2), Carbon Monoxide (CO) and VOCs (specifically benzene, polycyclic aromatic hydrocarbons, and butadiene) monitoring survey is undertaken for a minimum period of 6 months, with an optimal period of 12 months, using a network of diffusion tubes supplemented by low-cost air quality sensors at key locations. Diffusion tubes require changeover on a monthly basis and the collected diffusion tubes are sent off for laboratory analysis. Locations shall include the closest sensitive human receptors in at least four (4) different compass directions from ORIA, upwind and downwind of the seasonal prevailing wind direction (northeast, southeast, southwest and northwest), background locations away from any nearby air pollutant sources, as well as appropriate locations along the main roads that will be used by construction and operational traffic, at a distance of between 1m (3.2 ft) and 5m (16.4 ft) from the road edge. Indicative locations for these receptors would be:

- Human receptors
    - Residential properties along North Sound Road
    - Residential properties along Sorrel Drive
    - Residential properties at Lyndhurst Avenue
    - Residential properties along Sound Way
- Background locations
    - Public parkland in George Town
    - Public parkland in West Bay
- Roadside locations (these shall be along the proposed routes of the construction and operational traffic)
    - Linford Pierson Highway
    - North Sound Road
    - Esterly Tibbetts Highway
    - East West Road

If practicable, a 12-month NO_2, nitrogen oxides (NOx) and ammonia (NH_3) diffusion tube monitoring survey shall also be undertaken at nearby ecological sites that are sensitive to nitrogen and/ or acid deposition. Indicative monitoring for particulate matter (PM_{10} and $PM_{2.5}$) using a fixed in-situ PM_{10} meter could also be undertaken in order to provide an indication of baseline conditions. A minimum of 6 months survey would be required to gain a robust baseline.

It is understood that the Cayman Islands has not adopted numerical standards for ambient air quality. Therefore, baseline monitoring data to be collected, will be compared against the UK (England) Air Quality Standards (AQS) and World Health Organisation (WHO) Air Quality Guidelines levels (AQG), presented in **Table 4.5**.

Table 4.5 Ambient air quality standards

Pollutant	Averaging Period	Concentration	
		UK (England) AQS	WHO AQG – presented as: Interim Target (IT)1/ IT2/ IT3/ IT4/ AQG Level where relevant
Particulates (PM_{10})	1 day	50 µg.m^{-3} (not to be exceeded more than 35 times a year)	150/ 100/ 75/ 50/ 45 µg.m^{-3} (not to be exceeded more than 3 times a year)
	1 year	40 µg.m^{-3}	70/ 50/ 30/ 20/ 15 µg.m^{-3}
Particulates ($PM_{2.5}$)	1 day	-	75/ 50/ 37.5/ 25/ 15 µg.m^{-3} (not to be exceeded more than 3 times a year)
	1 year	20 µg.m^{-3}	35/ 25/ 15/ 10/ 5 µg.m^{-3}
Nitrogen dioxide (NO_2)	1 hour	200 µg.m^{-3} (not to be exceeded more than 18 times a year)	200 µg.m^{-3}
	1 day	-	120/ 50/ -/ -/ 25 µg.m^{-3} (not to be exceeded more than 3 times a year)
	1 year	40 µg.m^{-3}	40/ 30/ 20/ -/ 10 µg.m^{-3}
Sulphur dioxide (SO_2)	10 minutes	-	500 µg.m^{-3}
	15 minutes	266 µg.m^{-3} (not to be exceeded more than 35 times a year)	-
	1 hour	350 µg.m^{-3} (not to be exceeded more than 24 times a year)	-
	1 day	125 µg.m^{-3} (not to be exceeded more than 3 times a year)	125/ 50/ -/ -/ 40 µg.m^{-3} (not to be exceeded more than 3 times a year)
Carbon Monoxide (CO)	15 minutes	-	100,000 µg.m^{-3}
	1 hour	-	35,000 µg.m^{-3}
	8 hours	10,000 µg.m^{-3}	10,000 µg.m^{-3}
	1 day	-	7,000/ -/ -/ -/ 4,000 µg.m^{-3} (not to be exceeded more than 3 times a year)
Benzene	1 year	5 µg.m^{-3}	No safe level, however the concentration of benzene for excess lifetime risk of 1/ 1,000,000 is 0.17 µg.m^{-3}.

Pollutant	Averaging Period	Concentration	
		UK (England) AQS	WHO AQG – presented as: Interim Target (IT)1/ IT2/ IT3/ IT4/ AQG Level where relevant
Polycyclic Aromatic Hydrocarbons (PAHs)	1 year	0.00025 µg.m^{-3} (Benzo(a)pyrene (B[a]P))	No threshold can be determined, however the concentration for lifetime exposure to B[a]P producing excess lifetime cancer risks of 1/ 1,000,000 is 0.000012 µg.m^{-3}.
1, 3 Butadiene	1 year	2.25 µg.m^{-3}	No definitive conclusion as to how to assign appropriate cancer risk in humans based on studies on animals, therefore no guideline value is recommended for butadiene.
Nitrogen oxides (NOx)*	1 day	75 µg.m^{-3}	75 µg.m^{-3}
	1 year	30 µg.m^{-3}	30 µg.m^{-3}
Ammonia (NH_3)*	1 day	-	270 µg.m^{-3}
	1 year	3 µg.m^{-3} (1 µg.m^{-3} if lichens or bryophytes are present)	8 µg.m^{-3}
*for effects on vegetation			

4.4.3.2 Construction phase

Construction phase dust emissions

An assessment of the potential level of risk associated with construction phase activities will be carried out in accordance with the method presented in the Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction. This will assess the potential level of risk of dust impacts caused by construction activities by taking into consideration the potential dust emission magnitude combined with the sensitivity of and distances to receptors in order to determine the level of risk. The guidance suggests appropriate mitigation measures according to the level of risk. When these measures are implemented correctly, it is concluded that any effects will be not significant.

There may be a requirement to extract quarry fill material from sites that are not currently licensed. Should this be required, then an assessment of the quarry site shall be undertaken in line with the method presented in the IAQM guidance on the assessment of mineral dust impacts for planning.

Construction phase road traffic emissions

Traffic data for the construction phase will be screened against DMRB LA105 criteria for roads within 200 m of ecological receptors, and against EPUK and IAQM land-use planning & development control: planning for air quality criteria for non-strategic roads. Where road links trigger the criteria, these will need to be modelled in the Air Dispersion Modelling System (ADMS)-Roads software. Appropriate receptor locations will be selected along the road links that trigger the criteria and all roads with traffic data within 200 m of the selected receptors will be identified, in order to identify the Affected Road Network (ARN).

Should dispersion modelling be required (based on review of traffic flows), the following scenarios will need to be considered:

- Baseline year (ideally 2023 or 2024);
- Future construction year without the Project under construction, but inclusive of all other committed plans and developments (do-minimum).
- Future construction year with the Project under construction and inclusive of all other committed plans and developments (do-something).

Appropriate emissions factors will be derived from the UK Department for Environment Food and Rural Affairs (Defra) emissions factors toolkit, in consultation with the Traffic Consultant on the project to ensure the fleet mix is appropriate. Meteorological data will either come from any long-term meteorological datasets that are of sufficient quality and data capture, or it will be procured from a Numerical Weather Prediction (NWP) model.

Pollutant concentrations will be predicted at locations equivalent to the locations used for pollutant monitoring. These predicted concentrations will then go through a process termed verification, as outlined in Defra Local Air Quality Management Guidance (LAQM.TG (22)). This process is used to derive an adjustment factor, which is equivalent to a calibration against real world monitoring results, in order to correct errors in the model.

Pollutant concentrations will be predicted at the selected human health receptor locations (once these are established based on traffic data screening). Modelled pollutant emissions from road sources will be added to the background pollutant concentrations. Background pollutant concentrations will come from the baseline pollutant monitoring survey and will therefore inherently include all existing sources relevant to that monitoring location, including emissions associated with aircraft. It is understood that the construction works will not impact upon flight schedules and as such flight schedules will not change. Therefore, emissions from aircraft will only need to be considered as part of the existing background and not explicitly assessed as part of the construction phase assessment. Predicted pollutant concentrations will be compared against the relevant AQS.

Ecological sites will be assessed in line with Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (NEA001). Appropriate emissions factors for NH_3 will be derived from the Calculator for Road Emissions of Ammonia (v1A), in combination with a review of traffic data related to the project. Pollutant concentrations of NOx and NH_3 will be predicted along receptor transects, perpendicular to the road out to a distance of 200 m from the road edge. The predicted pollutant concentrations will be compared with relevant Critical Levels and will be used to derive the level of nutrient nitrogen deposition and acid deposition. These deposition rates will be compared with an appropriate Critical Load, as specified by the Project Ecologist, for the ecological site.

Construction phase odour emissions

Odour emissions will be assessed using the qualitative risk-based assessment described in the IAQM guidance on the assessment of odour for planning. This method implements a source-pathway-receptor model to estimate the level of risk posed by an odour source on a receptor-by-receptor basis.

4.4.3.3 Operational phase

Operational phase airport and road traffic emissions

Road traffic

Scoped out as discussed in **Section 4.4.2.2**.

Aircraft

Operational phase aircraft emissions will be assessed using appropriate emissions data for aircraft using the runway, including aircraft types that use the existing runway (such as the Boeing 777 and Boeing 737 MAX 8) and the newly accommodated wide-body aircraft such as the Boeing 787 and Airbus 350. Emissions data will be confirmed with the operator and/ or manufacturer, and the ADMS-Airport model will be used to predict pollutant concentrations at relevant receptor locations.

Stationary combustion sources
Stationary combustion sources, if proposed, will be assessed using appropriate emissions data, to be confirmed with the operator, and the ADMS-6 model. Predicted concentrations for NOx/ NO_2, PM_{10}, $PM_{2.5}$, SO_2 and any other pollutants assessed (e.g. CO, benzene, 1, 3 butadiene or PAHs) assessed by each model will be combined in order to present the full impact of the operational phase on air quality.

Impacts
The assessment will consider future baseline emissions from these sources and future operational phase emissions from the completed runway extension. Predicted pollutant concentrations and changes relative to the future baseline will be compared against the relevant objectives, and the impact will be described in line with the approach outlined in **Section 4.4.3.4**.

Operational phase odour emissions
Odour emissions for the operational phase will be assessed using the method outlined in **Section 4.4.3.3**.

4.4.3.4 Significance criteria

Impacts on air quality will be assessed through identifying the:

- Sensitivity of receptors;
- Magnitude of changes; and
- Significance of impacts on local air quality.

Two sets of criteria will be used. These are dependent on baseline pollutant concentrations within the airshed. These criteria will be based upon an 'undegraded' airshed or a 'degraded' airshed. A 'degraded' airshed is an area of poor air quality where relevant AQS or WHO guideline levels are significantly exceeded. Receptor sensitivity and magnitude criteria differ depending on whether a project is located in a 'degraded' or an 'undegraded' airshed, where the former is more sensitive to any increases in pollutant concentrations.

Receptor sensitivity
Receptor sensitivity in an undegraded airshed is summarised in **Table 4.6**. Where baseline concentrations exceed relevant ambient AQS, the airshed receptor sensitivity is considered to be high.

Table 4.6 Receptor sensitivity

Sensitivity	Definition
High	Baseline pollutant concentrations are in exceedance of the relevant Ambient Air Quality Standards (AAQS).
Medium	Baseline pollutant concentrations are in exceedance of 50% of the relevant AAQS, but do not exceed the relevant AAQS.
Low	Baseline pollutant concentrations are below 50% of the relevant AAQS.

Magnitude criteria
The IFC General EHS Guidelines (2007) states that projects with significant sources of emissions to air and that have the potential for significant impacts on ambient air quality shall minimise or prevent impacts by ensuring that:

"*Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources;*" and

"*Emissions do not contribute a significant portion to the attainment of relevant ambient Air Quality Guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.*"

For projects next to ecologically sensitive areas or for projects located within degraded airsheds, the project shall ensure that "*any increase in pollution levels is as small as feasible, and amounts to a fraction of the applicable short-term and annual average Air Quality Guidelines or standards as established in the project-specific environmental assessment.*"

Therefore, impact magnitude can be determined as a combination of:

- Any increase in air pollutant concentrations due to the project (Process Contribution (PC)); and
- Total air pollutant concentrations i.e., baseline + PC (the Predicted Environmental Concentration (PEC)) or cumulative impacts at sensitive receptors.

Pollutant concentrations predicted by air dispersion modelling will be compared to the relevant AAQS or WHO guidelines for human health or ecology, as relevant.

Different standards will apply to each pollutant and the relevant averaging period. To determine impact magnitude, the contribution of emissions from the Project to ground level concentrations will be assessed alongside the combined total concentration (project contribution plus baseline, PEC) as a percentage of the AAQS, as presented in **Table 4.7**.

Table 4.7 Magnitude criteria

Magnitude	Definition	
	Undegraded airshed	Degraded airshed
Large	• PC is >25% of relevant AAQS; or • PEC exceeds relevant AAQS.	• PC is >10% of AAQS.
Moderate	• PC is 15-25% of relevant AAQS; and • PEC does not exceed relevant AAQS.	• PC is 5-10% of AAQS.
Small	• PC is 5-15% of AAQS; and • PEC does not exceed relevant AAQS.	• PC is 1-5% of AAQS.
Very small	• PC is <5% of AAQS; and • PEC does not exceed relevant AAQS.	• PC is <1% of AAQS.

Significance of effect

Receptor sensitivity and impact magnitude will be used to determine the significance of the effects using the significance matrix presented in **Table 4.8**. Effects may be classified as beneficial or adverse. For adverse effects, the significance is classified as **minor**, **moderate** or **major**. For beneficial effects, the significance is classified as positive but is not classified further than this.

Table 4.8 Significance of effect

Significance Matrix		Receptor Sensitivity		
		Low	Medium	High
Magnitude	Beneficial	Positive	Positive	Positive
	Very small	Negligible	Negligible	Minor
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

For the purposes of the assessment, impact significance descriptors will be assigned to each assessed receptor. The overall significance of effect of the project will be based on the magnitude, extent, duration and frequency of impacts. This will result in a binary judgement as to whether the effect of the Project is significant or not significant in relation to air quality.

4.4.4 Mitigation measures

Construction phase dust emissions mitigation measures

Mitigation in relation to construction dust risk will be determined in accordance with IAQM guidance. Measures are advised as highly recommended, desirable or not required dependent on the level of risk for each construction activity. Mitigation measures are provided for the following categories:

- Communications;
- Site management;
- Monitoring;
- Preparing and maintaining the site;
- Operating vehicle/ machinery and sustainable travel;
- Operations;
- Waste management;
- Demolition;
- Earthworks;
- Construction; and
- Trackout.

Construction phase traffic emissions mitigation measures

Construction phase traffic emissions mitigation measures could include the project specifying that road vehicles must be of a certain emission standard such that emissions from construction phase road traffic are reduced. Alternate routes could also be considered, along with timings of vehicle movements to avoid busier times of the day.

Construction phase odour emissions mitigation measures

Construction phase odour emissions mitigation measures could include containment at source or only undertaking works at specific times of day, when receptors are less likely to be present.

Operational phase airport and road traffic emissions

Aircraft emissions could be reduced through refinement of schedules such that less flights could be made but with a greater number of passengers per flight, therefore making each trip more economical. Stationary combustion sources shall be sited away from sensitive receptors and with exhaust stacks of the correct dimensions to ensure efficient dispersion of air pollutants.

Operational phase odour emissions
Operational phase odour emissions mitigation measures could include ensuring that aviation fuel is stored away from sensitive receptors and that appropriate management and containment measures are implemented to prevent fugitive release of aviation fuel odours.

4.5 Noise and vibration

This chapter considers the scope of potential noise and vibration impacts at noise and vibration sensitive receptors (NVSRs) during the proposed construction and operational phases of the Project, which includes a runway extension approximately 340m (1,115 ft) eastward and construction of a RESA.

This chapter only assesses impacts on human NVSRs, which includes structures, as discussed in **Section 4.5.2** of this chapter. The Project may result in noise and vibration effects at ecological and cultural heritage receptors, and these topics are considered in **Sections 4.2** and **4.3**.

Once the construction methods are known for the Project, at an early stage of the EIA, assessment of the potential for activities to generate disturbing levels of underwater noise, for example any compaction activities or underwater piling, shall be undertaken. T potential for effects on sensitive species and any recreational users due to underwater noise and vibration will need to be assessed and is discussed in the relevant section. This could involve modelling of the attenuation of any piling noise and vibration.

4.5.1 Baseline conditions

This section provides a summary of baseline conditions in respect of noise and vibration, based on a review of publicly available data for the area surrounding the site and extending to an initial study area of 1km (0.6 mile) from the Project. The study areas will be refined at the assessment stage as the design and consultation processes progress, and as related topic assessments are progressed. The review has identified:

- NVSRs - including residential and sensitive sites such as schools, parks and medical centre and places of worship.
- Potential sources of baseline noise levels at the identified NVSRs, such as the existing airport and roads.

ORIA lies within the George Town area of Grand Cayman, Cayman Islands. It is in an urban location, with a large residential area located approximately 120m (394 ft) south of the existing runway. Additional residential receptors are located 550 m (1,804 ft) south-west of the existing runway. The following non-residential human receptors that are potentially sensitive to noise and vibration have been identified within the initial study area (other receptors would be considered under separate topics, for example ecological receptors):

- Public Playground and Airport Park (Dorcy Drive, 50 m / 164 ft)
- The Oval Cricket Ground (230 m / 755 ft)
- Cayman Clinic (220 m / 722 ft)
- Island Montessori (School) (340 m / 1,115 ft)
- Pickleball Cayman (Smith Road, 340 m / 1,115 ft)
- Faith Tabernacle of Jesus Christ (Church) (650 m / 2,133 ft)
- Island Primary School (650 m / 2,133 ft)
- The Pines Retirement Home (900 m / 2,953 ft)
- Smith Road Medical Centre (730 m / 2,395 ft)

- Georgetown Church Of Christ (800 m / 2,625 ft)
- Cayman Prep Primary School (520 m / 1,706 ft)
- Sedano Medical Group (860 m / 2,822 ft)
- ENT in Cayman (875 m / 2,871 ft)
- Chemotherapy Unit Health Services Authority (HAS) (960 m / 3,150 ft)
- Cayman Learning Centre & School (910 m / 2,986 ft)
- Shining Stars Childhood Care & Education Centre (910 m / 2,986 ft)
- The Family Practice (Doctors) (960 m / 3,150 ft)
- Doctor Foley's Eye Clinic (790 m / 2,592 ft)
- Treasure Garden Preschool (720 m / 2,362 ft)
- Royal Pines (Linford Piersons Highway, 780 m / 2,559 ft)
- Cayman Blu Vacation Home (Edgewater Way, 940 m / 3,084 ft)
- Casa Bella Cayman (Candlenut Close, 820 m / 2,690 ft)
- Equestrian Center (Linford Piersons Highway, 570 m / 1,870 ft)

Aircraft activities at the airport are expected to be the dominant sound source in the baseline sound climate. There are numerous commercial activities north and east of the existing runaway and airport building, which may also contribute to the existing ambient noise at some identified NVSRs.

The only identified potential source of ground-borne vibration is the existing runway. The propagation over distance will attenuate emitted vibration such that it is not expected to be perceptible at the identified receptors; hence, baseline vibration levels are expected to be negligible.

In order to inform the EIA, it is proposed to undertake noise surveys to capture levels representative of the baseline noise climate at the identified receptors. Further details are described in the assessment methodology section.

4.5.2 Potential effects

4.5.2.1 Matters scoped in

The potential significant effects to be scoped into the noise and vibration assessment are displayed in **Table 4.9**.

Table 4.9. Potential noise and vibration effects

Activity	Impact	Receptor
Construction		
Earthworks and construction of runway extension and RESA	The proximity of sensitive receptors to the Project means that the generation of noise from on-site activities during the construction phase has the potential to cause disturbance, albeit temporary. This conclusion would be reinforced should any night-working be required.	NVSRs within 300 m of the proposed runaway extension and RESA[3], including: • Residential dwellings; • Community facilities, such as places of worship, medical centres, and schools; • Outdoor recreational facilities, such as The Oval Cricket Ground and Public Play areas; and • Commercial properties, such as hotels and offices.

[3] *300m study area for construction noise impacts taken from the Design Manual for Roads and Bridges, Sustainability & Environment Appraisal, LA 111 Noise and vibration Revision 2 (May 2020) (DMRB) (Highways England, 2020)*

Activity	Impact	Receptor
		If construction noise modelling indicates that the threshold for significant effects may be exceeded at receptors further than 300m from the scheme, the study area would need to be extended. This will be considered in the EIA and shall be confirmed with the EAB.
	Depending on the type of construction works required, ground-borne vibration can also be generated, with the potential to cause temporary disturbance and building damage.	NVSRs within 100 m of the proposed runaway extension and RESA [4].
Construction road traffic	The construction of the Project will introduce HGVs and other construction related vehicles onto local roads, which may increase road traffic noise emissions and cause a disturbance to sensitive receptors.	NVSRs within 50m of any affected route[5].
Operation		
Airborne aircraft takeoff and landing	The extension of the runaway is not expected to change the rate of aircraft movements at the airport; however, it may introduce new wide-body aircraft. Larger aircraft may increase airborne aircraft (from start-of-roll for take-off until end-of-roll at landing, and while in flight) noise levels at NVSRs; with the potential to cause disturbance.	NVSRs with the potential to experience adverse noise effects from changes in airborne aircraft noise level, which extends to the following predicted aircraft noise level contours: 51 dB $L_{Aeq,16h}$ (daytime) and 45 dB $L_{Aeq,8h}$ (night-time)[6].
	Low frequency noise from airborne aircraft also has the potential to cause perceptible vibration levels within dwellings, which is most obviously characterised by effects such as windows rattling.	NVSRs with the potential to experience adverse effects from changes in low-frequency noise, which is classed as a threshold of 97 dB L_{Cmax}[7].
Surface activities, including: • aircraft taxiing and manoeuvring on the runways and aprons, • aircraft auxiliary power units and ground running; and • ground support vehicles.	The operation of the Project may change noise emissions from surface activities (also referred to as ground noise) with the potential to disturb NVSRs in close proximity to ORIA, in particular those near to the proposed extension area.	NVSRs within 1km of the existing airport site.

4.5.2.2 Matters scoped out

Ground-borne vibration may be generated by on-site sources such as road and air traffic activity that are associated with the operation of the Project. These sources are not expected to generate very high levels of ground-borne vibration, and the propagation over distance will attenuate emitted vibration such that it is

[4] 100m study area for construction vibration taken from the DMRB (Highways England, 2020)
[5] 50m study area and definition of affected route taken from the DMRB (Highways England, 2020)
[6] 51 dB $L_{Aeq,16h}$ (daytime) and 45 dB $L_{Aeq,8h}$ (night-time) criteria taken from UK Civil Aviation Authority (CAA) guidance 'Environmental Assessment Requirements and Guidance for Airspace Change Proposals' (CAA, 2023)
[7] 97 dB L_{Cmax} threshold taken from Historic England guidance 'Aviation Noise Metric – Research on the Potential Noise Impacts on the Historic Environment by Proposals for Airport Expansion in England' (Fiumicelli, Fisk, Perry, & Sutton, 2014)

not expected to be perceptible at the receptors. Consequently, operational ground-borne vibration is scoped out of the assessment.

As the purpose of the Project is to provide compliant RESAs at both ends of Runway 08-26 and is not forecast to increase flight or passenger numbers, operational effects on road traffic and subsequent disturbance to NVSRs are not anticipated and this is therefore scoped out of the assessment.

4.5.3 Assessment methodology

This section sets out the guidance and standards that will be adopted for the assessment of noise and vibration. The assessment will consider the likely significant effects during construction and operation of the Project. It will be undertaken in line with the International Finance Corporation's (IFC) Performance Standard 3 (Resource Efficiency and Pollution Prevention) (IFC, 2012) and the General Environmental, Health, and Safety (EHS) Guidelines: Environmental - Noise Management (IFC, 2007), as appropriate.

4.5.3.1 Baseline

In order to determine the potential noise impacts of the Project, environmental sound level surveying will be undertaken in the vicinity of noise sensitive receptors in close proximity to the site, in particular the extension area, to establish baseline sound levels. Surveys would be undertaken with due regard to the guidance in BS 7445-1:2003 (British Standards Institution, 2003) and would typically consist of a 7-day measurement at each identified location. Meteorological data will be used to verify that conditions during the survey are in accordance with British Standard BS 7445-2:1991 'Description and Measurement of Environmental Noise' (British Standards Institution, 1991), which requires calm, dry conditions with wind speeds less than 5 m/s. Consultation will be undertaken with the relevant stakeholders, prior to undertaking the surveys, to confirm measurement locations and methodology.

4.5.3.2 Construction phase

Due to the proximity of sensitive receptors to the existing site and proposed extension, temporary significant effects may occur at sensitive receptors during the earthworks and construction programme. The assessment of noise and vibration considers the following:

- Construction noise emissions from on-site activities;
- Construction vibration emissions from on-site activities; and
- Changes in road traffic noise due to construction traffic on the local road network.

Construction noise

A construction noise assessment will be undertaken based on expected construction activity and plant use during representative periods of activity throughout the construction programme. Noise levels at receptors will be calculated using British Standard (BS) 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise data and procedures (British Standards Institution, 2014).

Construction phase noise impacts will be assessed in accordance with Annex E 'significance of noise effects' of BS 5228-1.

Construction vibration

The following standards and guidance will be used to predict and assess potential construction vibration impacts:

- BS 5228-2 Code of Practice for Noise and Vibration Control on Open Construction Sites – Part 2: Vibration (British Standards Institution, 2014);

- BS 6472-1 Guide to evaluation of human exposure to vibration in buildings: 1-Vibration sources other than blast-induced vibration (British Standards Institution, 2008); and
- BS 7385-2 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground-borne vibration (British Standards Institution, 1993).

Construction road traffic

The assessment of noise impacts from construction road traffic will depend on the availability of road traffic data. If sufficient data are available, the impacts of changes in road traffic noise due to construction traffic on the local road network will be determined with reference to the following standards and guidance:

- Calculation of Road Traffic Noise (CRTN) (Department of Transport Welsh Office, 1988);
- BS5228-1; and
- DMRB LA111 Noise and Vibration.

4.5.3.3 Operational Phase

Potential noise effects due to the operation of the Project may be experienced at sensitive receptors due to:

- Airborne aircraft – noise from aircraft during the landing and take-off cycle, including noise from start-of-roll for take-off until end-of-roll at landing, and while in flight; and
- Ground aircraft operations – noise from on-site ground activities such as aircraft on the ground prior to take-off and after landing i.e. taxiing, holding and aircraft activity at stand. Additionally, on-site road traffic and support vehicles.

Noise emissions from stationary sources (i.e. fixed plant) may also need to be considered; however, it is likely that aircraft ground noise will dominate on-site noise emissions and an assessment of these sources can potentially be scoped out. However, as there remains uncertainty over this aspect, the need for a fixed plant noise assessment will be kept under review.

Aircraft operations

The Project has the potential to increase aircraft sizes at the airport, which could increase noise levels at sensitive receptors. A worst-case assumption has been made that this change could cause a significant effect and therefore this impact is currently proposed to be scoped into the EIA. However, once sufficient information is available, noise emissions data for current and future (i.e. 'with Project') aircraft will be compared, to determine the potential change in aircraft noise levels at receptors, at which point, it may be possible to exclude aircraft noise from the EIA. If an assessment of operational aircraft noise is required, 3-d modelling will be undertaken to predict aircraft noise levels at the receptors near to the existing airport. Changes in noise levels will be predicted in terms of the daytime $L_{Aeq,16h}$, and, if the airport is used at night, the night-time $L_{Aeq,8h}$. The overall impact of changes in aircraft operational noise on the residents of Grand Cayman will be determined with reference to appropriate guidance, which includes the Institute of Environmental Management and Assessment (IEMA) 'Guidelines for Environmental Noise Impact Assessment' (IEMA, 2014).

4.5.4 Mitigation measures

The EIA will determine the requirement for the implementation of mitigation measures to reduce the significance of the impact to noise sensitive receptors. The section below outlines possible mitigation measures which may be implemented where necessary.

4.5.4.1 Construction

Mitigation measures will be employed to ensure that potential noise impacts at nearby sensitive receptors due to earthworks and construction activities are minimised. BS5228-1 provides recommendations for basic methods of noise control which will be implemented where feasible. The preferred approach for controlling construction noise is to reduce source levels where possible, but with due regard to practicality. The simplest and most effective method of reducing noise at nearby receptors is to ensure that noisy plant is located as far from receptors as practicable and screened using temporary barriers. Noise can also be reduced by limiting the daily time that noisy equipment is operated; however, it is acknowledged that sometimes a greater noise level may be acceptable if the duration of the construction activity, and therefore length of disruption, is reduced.

4.5.4.2 Operation

Aircraft noise

The ICAO Balanced Approach to aircraft noise management is the main overarching policy on aircraft noise, and it is included in Annex 16, Volume I to the ICAO Chicago Convention. Mitigation measures in line with the ICAO Balanced Approach to Aircraft Noise Management would be adopted to reduce predicted potentially significant adverse aircraft noise effects, where practicable. The four principles of the ICAO Balanced Approach are:

- Reduction of noise at source;
- Land-use planning and management;
- Noise abatement operational procedures; and
- As a last resort, operating restrictions.

Ground Noise

Use of barriers, bunding or landscaping will be applied where necessary and practicable to reduce ground noise emissions from the airport.

Road traffic

Where significant noise effects are predicted, mitigation measures will be considered to reduce road traffic noise effects. This may be achieved, where practicable, through:

- Environmental barriers – can be either earth bunding or noise fencing. The use of these is dependent on space available;
- Low noise road surfaces – reduces noise created by the interaction between tyre and road. Reductions in road traffic noise range from approximately 1 dB at mean speeds of 10km/h (6mph) to approximately 3 dB at mean speeds of 50km/h (31 mph); and/or
- Speed restrictions – above 40km/h (25 mph), noise levels increase with vehicle speed.

4.6 Visual and landscape effects

4.6.1 Baseline conditions

Grand Cayman, the largest of the Cayman Islands, is known for its stunning natural landscapes and vibrant marine environments. With an average elevation of 6ft above sea level, the island has a low visual profile due to its limited relief. The Project area is primarily commercial and institutional, with residential areas to the north and south of the central business district. The flat relief and lack of tall buildings within the immediate area of the Project currently provides good visibility of the coast to people along the Grand Harbour, Tropical Gardens and Selkirk Drive residential areas and the general coastline (**Figure 4.6**).

The natural environment of Grand Cayman includes extensive coral reef systems, seagrass beds, and mangrove forests, which play a significant role in maintaining water quality and providing habitats for wildlife. The island also hosts diverse terrestrial ecosystems, including dry forests and shrublands, which support various plant and animal species, some of which are endemic to the Cayman Islands.

The built environment of Grand Cayman includes residential communities and commercial establishments, particularly in George Town and along Seven Mile Beach. These developments range from low-rise buildings to high-rise hotels and resorts. Tourism is a major industry on the island, with numerous attractions such as Seven Mile Beach, and the Cayman Turtle Centre. Recreational activities are often marine-focused and include snorkelling, diving, and boating.

Infrastructure on the island includes roads, airports, marinas, and docks that support both residential and commercial areas. The cultural significance of Grand Cayman lies in its rich cultural heritage, with traditional activities such as fishing and boat building being integral to the local community. Historical sites, remnants of early settlements, and maritime artifacts are located nearby.

The North Sound area of Grand Cayman is a significant ecological and recreational zone, characterised by its unique coastal and marine environments. The North Sound is home to several residential communities and commercial establishments, typically low-rise and designed to blend with the natural landscape. Tourists can enjoy activities such as snorkelling, diving, and water sports, with key attractions like Stingray City and the Rum Point Club. The area's natural beauty, ecological significance, and cultural heritage must be carefully considered to ensure sustainable and visually harmonious development.

4.6.2 Potential effects

Given the Project's location is adjacent to residential and recreational areas it may have an adverse effect on views from these coastal properties and the natural setting of North Sound (**Figure 4-7**). As such, a visual and landscape effects assessment is required. This assessment is essential to identify potential visual changes and mitigate adverse effects, ensuring the preservation of the island's unique aesthetic, cultural heritage and ecological integrity for future generations.

81°21'0"W
81°20'0"W
19°18'0"N
19°17'0"N
N
Cayman Islands Sailing Club
Ocean Crest
Allure
Tropical Gardens
Selkirk Drive
Grand Harbour
0
0.5
1 km

Legend:

- Project Footprint
- Landscape and Visual Receptors

Client:	Project:
Cayman Island Government	Grand Cayman ORIA extension

Title: Landscape and Visual Effects Receptors

Figure:	Drawing No:
4.7	PC6310-RHD-GC-ZZ-DR-Z-0008

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/04/2025	GC	LR	A3	1:12,000

Co-ordinate system: Name: NAD 1927 UTM Zone 17N

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4.6.2.1 Matters scoped in

The potential effects to be scoped into the visual and landscape effects assessment are displayed in **Table 4.10**

Table 4.10 Potential visual and landscape effects

Activity	Impact	Receptor
Construction		
Construction of the Project	Visual impacts during the dredging of North Sound and construction of the runway extension	Visual character of North Sound
Operation		
Presence of the Project	Effect on views across North Sound from the presence of the runway extension	Visual character of North Sound
	The creation of physical and/or visual boundaries	
	Loss of natural habitat (mangroves)	
	Addition of infrastructure, runway lights and navigational aids as a result of the runway extension	

4.6.3 Assessment methodology

The visual effects assessment will first describe the current (baseline) visual environment of the Project and its surroundings, including:

- **Landscape Character:** detailed description of the existing landscape, including natural features (e.g., vegetation, topography) and man-made elements.
- **Visual Receptors:** identification of key viewpoints and sensitive receptors, such as residential areas, tourism hotspots, and ecological sites.
- **Photographic Survey:** a comprehensive set of photographs from various viewpoints to document the current visual conditions.
- **Existing Land Use:** overview of the current land use and any relevant planning designations.

The methods used to assess the potential visual effects shall include:

- **Viewpoint selection:** definition of criteria for selecting representative viewpoints for the assessment.
- **Accurate Visual Representations:** use of computer-generated imagery (CGI) to create precise and realistic visual simulations of the proposed development from key viewpoints.
- **Impact criteria:** definition of criteria for assessing the significance of visual impacts, considering factors such as magnitude of change and sensitivity of receptors.
- **Consultation:** engagement with stakeholders, including local communities and planning authorities, to gather input on visual concerns.

4.6.4 Mitigation measures

Specific mitigation measures for visual impacts will be confirmed after surveys are undertaken, however, they may include:

- **Design considerations:** incorporation of design elements to minimise visual intrusion, such as colour and materials, for example for the reclamation boundary.
- **Lighting:** design of lighting to reduce night-time visual impacts, including the use of downward-facing and low-intensity lighting.
- **Monitoring:** establishment of a monitoring program to ensure the effectiveness of mitigation measures and to address any unforeseen visual impacts.
- **Viewshed enhancements:** analysing and improving the visible areas from a specific point or set of points. Using Geographic Information System (GIS) tools, viewshed analysis determines which areas are visible from a particular location, helping to optimise scenic views and minimise visual obstructions.
- **Public engagement:** The temporary and unavoidable negative visual impacts of construction require ongoing communication and public involvement to increase understanding and reduce complaints.

4.7 Public amenity

This chapter outlines the public amenities in the vicinity of the Project, focusing on the potential effects and benefits to the community.

The assessment will define the nature and scale of potential effects on public resources, particularly in areas near sensitive receptors. An evaluation of the available public resources, such as parks, libraries, and community centres, will be undertaken to understand the current state of amenities and identify any knowledge gaps. Both the construction and operational phases of the Project will be assessed for their impacts on public amenities.

Consideration of potential effects on the local population are also be covered in the following sections:

- Water environment (**Section 4.1**)
- Air quality (**Section 4.4**)
- Noise and vibration (**Section 4.5**)
- Visual and landscape effects (**Section 4.6**) and **4.7**

This section of the ToR therefore focusses on the potential effects the Project may have on recreational activities and access.

4.7.1 Baseline conditions

Limited public amenities currently fall within the direct footprint of the Project, including kayakers, paddleboarders, fisherman and sailors, however, the construction and operation phase of the Project may indirectly impact sensitive receptors within the immediate vicinity. For example, the residential areas of Tropical Gardens, Grand Harbour and Selkirk Drive and recreational areas such as the Cayman Island Sailing Club (CISC) (**Figure 4.7**).

4.7.1.1 Existing public amenities

Grand Cayman has a significant seafaring culture, with residents and visitors frequently engaging in boating activities. The North Sound is a central hub for these activities.

The Barcadere Marina and George Town Yacht Club are located on North Sound adjacent to ORIA to the north. The Cayman Islands Sailing Club (CISC), established in 1965, is the national sailing authority and a not-for-profit organisation promoting sailing and is located in Red Bay, directly to the east of ORIA. CISC offers sailing lessons for all ages and abilities, with a fleet of boats available for hire. The club hosts regular

racing events and aims to develop national teams, promote sailing, enhance seamanship and safety, and offer training programs, especially for juniors and youth. The CISC currently sail where the runway extension is proposed, which could impact their activities.

Airport Park, near ORIA, is a recreational area for families and children, featuring playgrounds and offering views of planes taking off and landing. It serves as a spot for families waiting for flights or seeking nearby outdoor activities.

The impact of the Project on recreation and boating activities in the North Sound shall be assessed, particularly for marina users and residents who may be affected by safety area exclusions at the end of the extended runway. Activities such as water sports should be considered.

4.7.1.2 Public access and usage

In Grand Cayman, public access routes to amenities and recreational areas are well-established and maintained, particularly in the west. The extensive road network provides primary access across the island. Additionally, the Shoreline Access Map identifies over 250 public access points to the shoreline, facilitating access to beach and coastal areas for residents and visitors.

More specifically, potential effects on water access to the Grand Harbour area and CISC shall be investigated due to the encroaching footprint of the ORIA's runway extension and alterations to mast clearance thresholds. Furthermore, for security and safety reasons, exclusion zones that extend past the footprint of the Project may be implemented, which in turn may reduce or prevent access to residential and recreational areas surrounding the runway extension. It should be noted that this exclusion zone will be explicitly defined as part of the ES. Canal entrances are located less than 500 feet from the perimeter of the Project, and public access is likely to be affected as a result.

4.7.2 Potential effects

4.7.2.1 Matters scoped in

The potential effects to be scoped into the public amenity assessment are displayed in **Table** 4.11**.**

Table 4.11. Potential public amenity impacts

Activity	Impact	Receptor
Construction		
Increased traffic on local road network	Driver severance and delay.	Other vehicles using the local area roads.
	Pedestrian severance, intimidation and delay, accidents and safety.	Local road users, pedestrians and cyclist, adjacent land uses.
	Hazardous and dangerous loads.	Local road users, pedestrians and cyclist, adjacent land uses.
Construction of the Project	Potential prevention of marine access to Grand Harbour and CISC and interruption of access for other users of North Sound.	CISC members and Grand Harbour residents. Users of the North Sound lagoon, including consideration of divers.
	Increased utility demand.	Residents
	Loss of amenity space during the construction of the runway extension.	Availability and accessibility of the amenity space Other marine users.

Activity	Impact	Receptor
Operation		
Public access to North Sound, private moorings, marinas, boat and yacht clubs	Potential access restrictions due to implementation of safety zones around the runway extension (e.g. exclusion zones). User severance, delay and inaccessibility.	Availability and accessibility of the amenity space. Local residents. Other marine users.

4.7.3 Assessment methodology

The assessment will evaluate the current state and potential effects on public amenities, such as the parks, recreational facilities, public transport, utilities and other community services mentioned above.

The steps taken during this analysis are as follows:

- Define objectives and scope (i.e. the public amenities to be assessed and the geographical area and population affected)
- Stakeholder identification and engagement plan
- Data collection
    - Secondary Data: Collect existing data from government reports, planning documents, and other relevant sources.
    - Primary Data: Conduct surveys, interviews, and focus groups with stakeholders to gather firsthand information on the usage and condition of public amenities.
- Impact analysis
    - Usage Impact: assess how the project will affect the usage patterns of public amenities, including potential increases or decreases in demand.
    - Quality Impact: evaluate the potential changes in the quality and accessibility of public amenities.
    - Service Impact: Analyse the impact on the provision and maintenance of public services
- Infrastructure assessment
- Travel and accessibility impact (patterns, cost and accessibility)
- Recommendations, monitoring and evaluation
    - Develop indicators: create indicators to monitor the ongoing socio-economic impacts of the airport relocation.
    - Regular reviews: conduct regular reviews and updates to the assessment as new data becomes available and conditions change.
- Public consultation and feedback
- Mitigation measures

4.7.4 Mitigation measures

Possible mitigation measures, to reduce residual impacts to acceptable levels, may include the following:

- Ensure that alternative routes and access points are provided for public amenities affected by construction activities.
- Install noise barriers around land-based construction areas to minimise noise pollution affecting nearby public amenities. Limit construction activities to daytime hours to reduce noise disturbance to the public.
- Ongoing stakeholder engagement to ensure that users of the area are aware of all activities and when they will be carried out.

- Implement dust control measures such as water spraying and covering of materials to reduce air pollution. Use low-emission construction equipment to minimise air quality impacts.
- Establish clear safety zones around construction areas to protect the public. Provide clear signage to inform the public about construction activities and alternative routes.
- Implement measures to protect and conserve mangrove and seagrass areas affected by the runway extension. Plan for habitat restoration projects to compensate for any loss of natural areas.

The ORIA project is committed to enhancing public amenities while minimising negative impacts to local communities. Through careful planning and community involvement, the project aims to provide significant benefits to the residents and visitors of Grand Cayman.

4.8 Climate change and hazard vulnerability

The EIA will include a review of applicable standards and guidelines, alongside an assessment of baseline conditions relevant to the climate resilience and hazard vulnerability assessment. In particular, the following hazards shall be evaluated in the EIA:

- **Hurricanes and Tropical Storms:** Grand Cayman is located in a region prone to hurricanes and tropical storms, which can cause significant damage through high winds, heavy rainfall, and storm surges. The Project must be designed to withstand these extreme weather events to ensure operational continuity and safety.
- **Sea-Level Rise**: As a relatively low-lying island, Grand Cayman is vulnerable to sea-level rise, which can lead to coastal erosion, increased flooding, and loss of land. The airport's location and infrastructure must account for projected sea-level changes to mitigate these risks.
- **Flooding:** Heavy rainfall associated with tropical storms and hurricanes can lead to flooding events. Appropriate drainage systems and elevated structures are essential to prevent water accumulation and damage to the airport's facilities.
- **Heatwaves:** Increasing temperatures and heatwaves can affect both the structural integrity of the aerodrome and the health and safety of personnel and passengers. Measures to mitigate heat impacts, such as heat-resistant materials and adequate cooling systems, will be incorporated into the design of the airport runway extension works.
- **Seismic Activity:** Although less frequent, and not likely to be impacted by future climate change, the potential for seismic activity in the region will not be overlooked. The airport's design will include earthquake-resistant features to minimise damage and ensure safety during seismic events. Additionally, the airport shall be designed to safely accommodate the residents of Grand Cayman during crisis situations.

4.8.1 Baseline conditions

An initial review of published data and publicly available information will be used to further develop the existing baseline described below for the Climate Resilience and Hazard Vulnerability assessment. This shall include consideration of topography, climate, tropical storms and hurricanes, storm surge and flood risk, earthquakes and land use changes. This data will also be used to inform the water environment chapter (**Chapter 4.1**).

4.8.1.1 Topography

The Cayman Islands are part of the Cayman Ridge, an undersea mountain range stretching from Cuba to the Gulf of Honduras. They are separated from Jamaica by the Cayman Trench, the deepest part of the Caribbean (Cayman Islands Goverment, 2024). The island measures approximately 76 square miles and is low-lying; with the highest point about 60 feet above sea level.

4.8.1.2 Geology and seismic activity

Grand Cayman is largely comprised of two geologies, the Ironshore Formation and the Bluff Formation. ORIA is underlain by rocks from the Bluff Formation, with the Ironshore Formation outcropping to the west of the western end of the current runway (**Section 4.1.1.4**).

The islands are situated on the plate boundary between North American and Caribbean tectonic plates, which limit the size of earthquakes. Minor tremors are common and the majority of them are not commonly detected by residents. A 7.7 magnitude earthquake struck in January 2020 but caused limited damage.

4.8.1.3 Existing climate

The Cayman Islands have a tropical marine climate with two seasons: wet (May to October) and dry (November to April). The average temperature is 78 °F (25.5 °C) in winter and 86 °F (30 °C) in summer (Climate Studies Group Mona & The University of the West Indies, 2020); rarely falling below 70 °F or above 90 °F (**Table 4.12**). Rainfall varies seasonally (**Table 4.13**), with prevailing winds from east to south between May and October and northeast to northwest from December to April. The hurricane season is considered to be between the 1st June and the 1st December.

Table 4.12 30-year average monthly temperature data at Owen Roberts International Airport, Grand Cayman between 1991 to 2020. Source: (National Weather Service, 2024a)

Average Temperature												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(ºF)	78.8	79.2	80.0	81.9	83.3	84.8	85.5	85.7	85.0	83.4	81.7	80.0
(ºC)	26.0	26.3	26.7	27.7	28.5	29.3	29.7	29.8	29.4	28.5	27.6	26.7

Table 4.13 Average monthly rainfall data in the Cayman Islands between 19919 to 202020. Source: (National Weather Service, 2024b)

Average Precipitation (mm)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
54.05	30.66	29.76	33.71	149.51	161.02	134.92	146.95	211.96	243.80	156.98	65.18

As identified in the Cayman Islands Climate Change Risk Assessment (CCRA) (Cayman Islands Government, 2022), the four most severe risks to Grand Cayman as a result of climate change are considered to be:

1. Disruption of turtle distribution and population dynamics
2. Increased frequency and severity of coral bleaching and coral disease outbreaks
3. Decline of coral reef structure and integrity
4. Damage & inundation to the sewerage system and release of waste-water

The following risks were also identified. Those highlighted in bold are most relevant to the Project:

- **Damage to roads, airports and infrastructure**
- **Loss and damage to mangroves**
- **Loss and damage to seagrass beds or change in seagrass distribution**
- **Damage to coastal settlements and buildings**
- Disruption & damage to the tourism sector (and related infrastructure)
- Disruption to fossil fuel imports, power generation and distribution
- Impacts on communications infrastructure
- Disruption to ports and shipping traffic

- Loss of endemic species and sub-species as a result of habitat degradation (animals and plants)
- Freshwater lens contraction and salinisation of surface and groundwaters
- Impact on forest, woodland and shrubland communities

In addition to this, the Cayman Island Climate Change Policy 2024-2050 evaluated the greatest climate related risks in the Cayman Islands, highlighted in **Figure 4.7.**

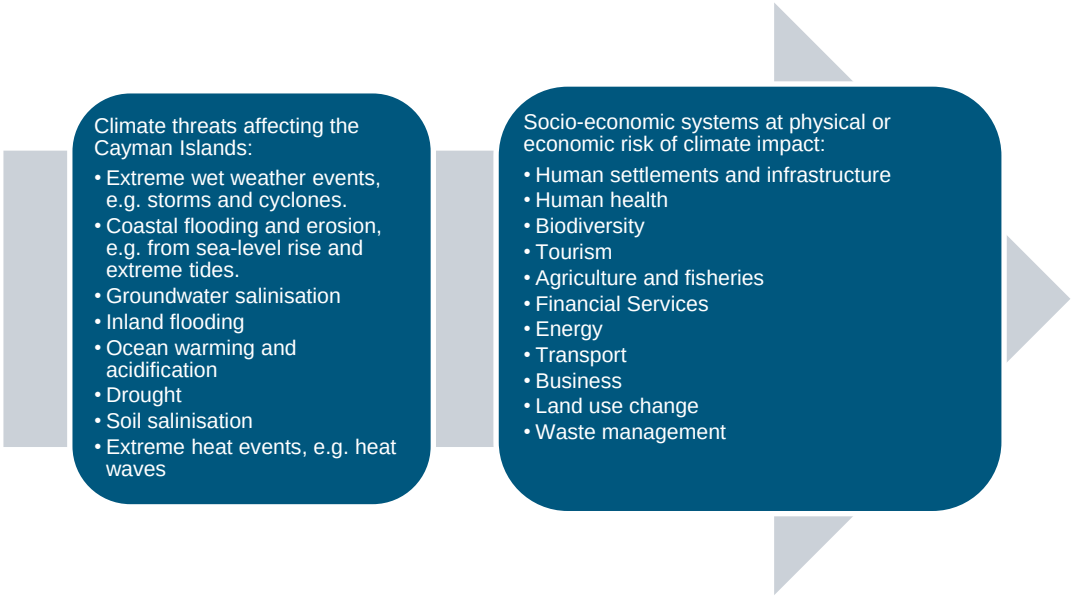

Figure 4.7 Identified climate threats affecting the Cayman Islands and the socio-economic systems at physical or economic risk of Climate impact. Source: (Cayman Island Government, 2024)

The CCRA for the Cayman Islands identified that over the past 40 years, air temperatures in the Cayman Islands have risen by approximately 2.2°C. Tropical cyclones have increased in frequency and intensity in the North Atlantic since the 1970s. Projections suggest that the frequency of hurricanes will not increase significantly in the Caribbean, however strong hurricanes are anticipated to become more common. Atmospheric carbon dioxide (CO_2) concentrations have increased by 42% since the industrial revolution, and declines in surface ocean pH are already detectable and accelerating, including in the Caribbean (Cayman Islands Government, 2022).

4.8.1.4 Tropical storms and hurricanes

Previous hurricanes in the Cayman Islands have flooded coastal mangroves, causing them to retreat or die-back in areas. Some of these have subsequently recovered, but recovery is often slow.

Between 1887 and 1987, the Atlantic Hurricane Season saw an average of one tropical cyclone passing within 100 miles of Grand Cayman every 2.7 years, 50 miles every 4.3 years, and a tropical storm directly over Grand Cayman every 12.5 years (Pinnegar, et al., 2022). A total of 77 storms, between Category 1 – 5 have been recorded within a 150 mile radius of Grand Cayman, between 1842 and 2023 (**Figure 4.8**) with 14 storms recorded between 2000 and 2023 (**Figure 4.9**).

Note the Saffir-Simpson Hurricane Wind Scale consists of a five-point scale of hurricane intensity and starts at 74 mph. Below this, tropical cyclones with wind speeds up to 38 mph are classified as tropical depressions, and those with wind speeds from 39-73 mph are classified as tropical storms.

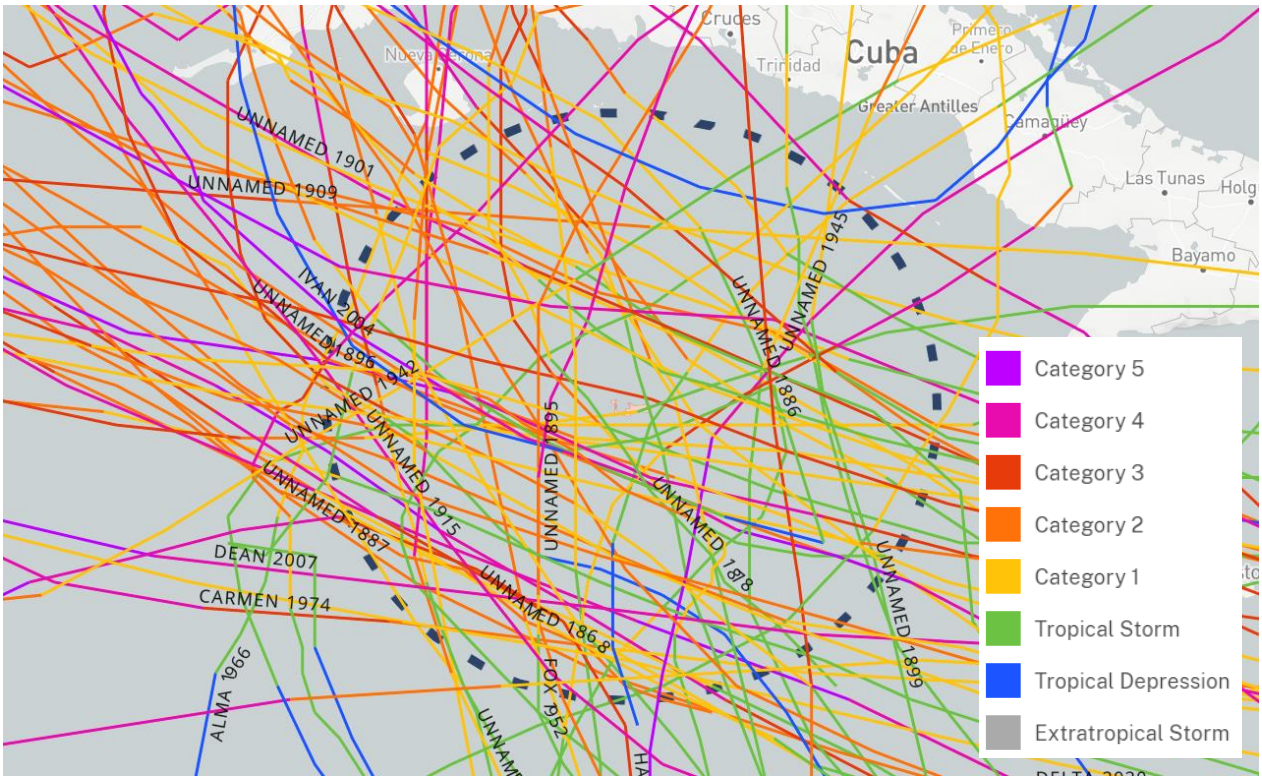

Figure 4.8 Storms tracks passing within 241km (150 miles) of Grand Cayman, between 1842 and 2023. Only Category 1 - 5 storms are shown. Source: NOAA Historic Hurricane Tracks portal.

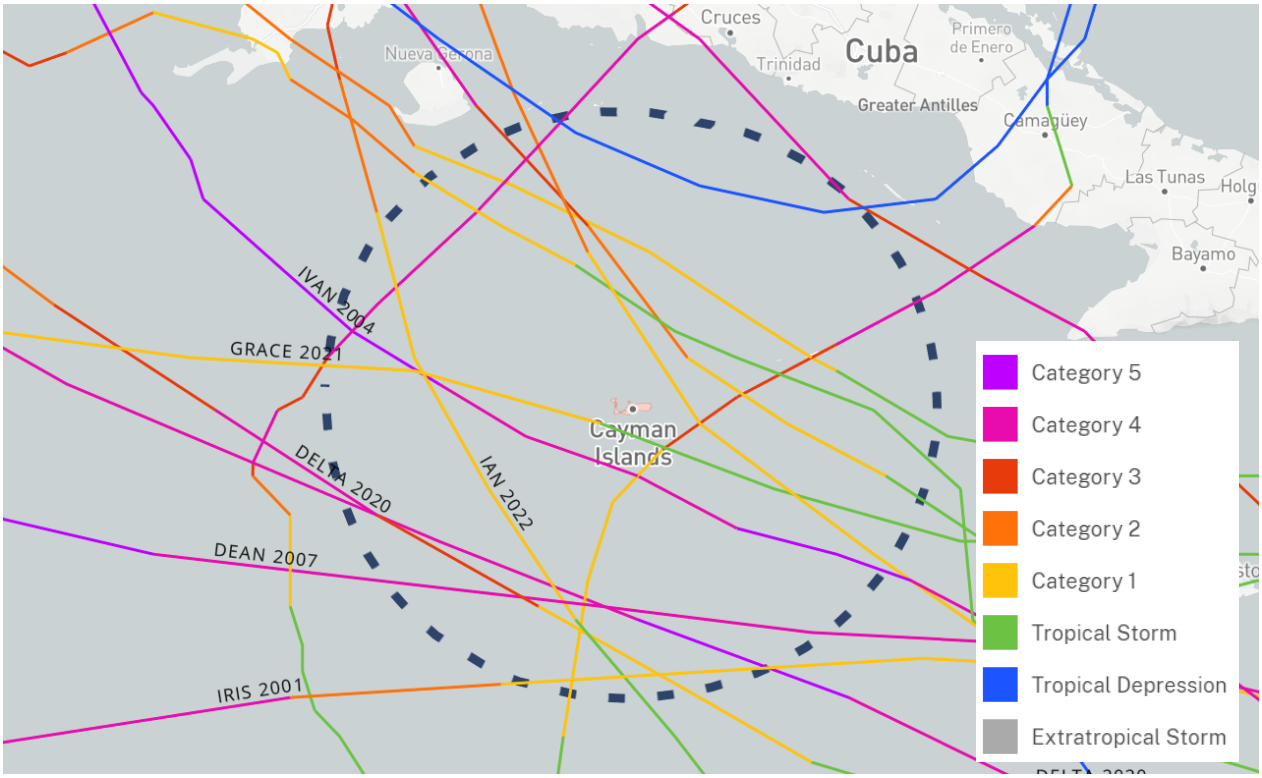

Figure 4.9 Storms tracks passing within 241km (150 miles) of Grand Cayman, between 2000 and 2023. Only Category 1 - 5 storms are shown. Source: NOAA Historic Hurricane Tracks portal.

4.8.1.5 Sea level rise

Historical records show significant variance in the rate of sea level rise across the Caribbean. Tide gauge data for South Sound (near George Town) show a rising trend of around 1.76 mm per year between 1972 and 1996, with future sea level rise (SLR) forecasts of 0.29 to 0.32 m by the 2050s compared to 1986–2005 (Cayman Islands Government, 2022). The North Sound dataset from 1976-2003 showed a rising trend of 2.76 ± 0.9 mm/year, closer to the Caribbean average of 2.5 ± 0.44 mm/year and the Caribbean-wide average of 2.5 ± 0.4 mm/year, with future SLR projections by 2050 also of 0.29 to 0.32 m (Pinnegar, et al., 2022).

This rise in sea level poses significant risks, including increased coastal flooding, erosion, and impacts on infrastructure and ecosystems. The data in **Table 4.14** below shows the anticipated loss of habitats associated with various SLR scenarios. Additionally, a 1 m sea level rise could significantly impact around 10% of Grand Cayman's roads, particularly those along the North Sound (Pinnegar, et al., 2022).

Table 4.14 Habitat extent on Grand Cayman in 2010, and percentage loss of habitat associated with various SLR scenarios. Source: (Pinnegar, et al., 2022).

Habitat type	2010 extent (acres)	% loss associated with sea level rise of *x* meters			
		0.25	0.5	0.75	1
Poole, ponds and mangrove lagoons	1,398	52.84	85.66	95.71	97.74
Salt tolerant succulents	33.6	5.89	28.4	67.02	90.23
Seasonally flooded semi-deciduous forest	164	0.06	1.29	8.02	29.3
Seasonally flooded grasslands	99.6	0.01	0.49	32.09	74.5
Semi-permanently flooded grasslands	122.7	3.44	10.88	26.52	56.67
Coastal shrubland	268	0.43	1.34	2.63	4.65
Dry forest and woodland	7,367	0.02	0.27	2.15	8.59
Dry shrubland	2,974	0.22	1.52	3.91	10.28

4.8.1.6 Future climate

The Intergovernmental Panel on Climate Change (IPCC) uses several climate scenarios to project future climate conditions based on different levels of greenhouse gas emissions. These scenarios are known as Representative Concentration Pathways (RCPs) and Shared Socioeconomic Pathways (SSPs):

1. RCP2.6: This is a low-emission scenario where significant mitigation efforts are made to limit global warming to below 2°C above pre-industrial levels. It assumes that greenhouse gas (GHG) emissions peak early and then decline significantly.
2. RCP4.5: This scenario represents a stabilisation pathway where emissions peak around 2040 and then decline. It assumes moderate mitigation efforts.
3. RCP6.0: This is a stabilisation scenario with emissions peaking around 2080 and then declining. It assumes less aggressive mitigation efforts compared to RCP4.5.
4. RCP8.5: This high-emission scenario assumes continued increases in GHG emissions throughout the 21st century, leading to significant global warming and severe climate impacts.

The newer SSPs combine these RCPs with different socio-economic pathways to provide a more comprehensive view of potential futures:

1 SSP1-1.9 and SSP1-2.6: These scenarios are optimistic, assuming sustainable development and significant mitigation efforts.
2 SSP2-4.5: This is a middle-of-the-road scenario with moderate mitigation and socio-economic trends.
3 SSP3-7.0: This scenario assumes high challenges to mitigation and adaptation, with fragmented and slow economic growth.
4 SSP5-8.5: This scenario represents a future with high fossil fuel use and rapid economic growth, leading to high emissions and severe climate impacts.

More specifically, the following climate projections (relative to 1986-2005) for the Cayman Islands are summarised in **Table 4.15** below.

Table 4.15 Climate change projections for the Cayman Islands. Source: (Cayman Island Government, 2024)

Air temperature	Rainfall	Storms and Hurricanes	Sea level rise
• 2050s: 1.57˚C - 2.4°C rise • 2080s: 2.53˚C - 3.72˚C rise • Increased 'hot days' and 'hot nights', approx. 30 in every month between July-October • 'Cool days' and 'cool nights' disappear by mid-century for the summer months and none between May-November	• Changes in rainfall patterns expected with generally heavier rainfall events • 2020s: drying trend established across Caribbean region • 2050s: region is 2% drier on average • 2100: region up to 17% drier • Slightly wetter conditions through to mid-century changing to drier conditions by the end of the century	• More 'major hurricanes' (category 4 and 5) expected • Substantially more rainfall and peak winds intensity	• 2020-2050: 11.4 to 12.6 inches • 2090s: 21.7 to 28.3 inches

4.8.2 Potential effects

4.8.2.1 Matters scoped in

An assessment of climate resilience and hazard vulnerability to ensure the long-term suitability and safety of the Project. This chapter in the ES will outline the critical environmental and climatic factors that will be considered, including the island's susceptibility to extreme weather events, sea-level rise, and other climate-related hazards.

At the time of writing, the Project is assumed to have an indefinite design life. The climate projection data in **Section 4.8.1.6** highlights that it is likely that climate conditions will change during the operational lifespan of the Project from current baseline levels. This could impact the operation and function of infrastructure and assets associated with the Project. Therefore, a Climate Change Resilience and Hazard Vulnerability Assessment will be undertaken for the operational phase of the Project. The EIA consultant shall derive a worst-case scenario based on available climate projections; including the impact of predicted SLR over the lifetime of the Project, or an appropriate length of time to be agreed with the EAB.

The receptors for Climate Change Resilience and Hazard Vulnerability Assessment include the infrastructure and assets associated with the Project. Potential effects are outlined in **Table 4.16**.

Table 4.16. Potential effects relating to climate change resilience and hazard vulnerability

Activity	Impact	Receptor
Operation		
Operation of the Project	Alterations to the natural water circulation and drainage patterns, disruption to groundwater recharge, and increased storm runoff volume of velocity;	Infrastructure and assets associated with the Project Marine and terrestrial habitats and species.
	Heat stress to key infrastructure and assets;	
	Damage to infrastructure and assets in storm events from high winds or surface water flooding;	
	Drought conditions leading to water stresses or affecting the functionality of infrastructure and assets; and	
	Sea level rise impact minimum elevation and the stormwater management plan.	

4.8.2.2 Matters scoped out

The construction phase of the Project is expected to take place within the next few years and so it is therefore not considered likely that there will be large changes to the climate parameters from present day conditions. With construction anticipated to be completed by 2030, changes in air temperature and rainfall are anticipated to be less than 1°C and 1% respectively compared to current averages. In addition, whilst there is the potential for non-climate hazards such as earthquakes to take place, responses to such events would be in accordance with established procedures.

Therefore, whilst hazardous climatic and weather events may occur, there is unlikely to be a significant change to climatic conditions which would significantly affect the resilience of the Project during construction. Therefore, it is proposed that a Climate Change Resilience assessment for the construction phase of the Project shall be scoped out of the assessment.

4.8.3 Assessment methodology

The following standards will be reviewed during preparation of the EIA:

- Stormwater Management Guidelines and Regulations (Cayman Islands Department of Planning and NRA, 2006).
- EIA Directive (2016) issued in accordance with the National Conservation Act (2013).
- International standards such as the UK's Environmental Quality Standards (2021).
- Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation, 2020.

4.8.3.1 Climate change resilience assessment

Methodology

The receptors for the Climate Change Resilience and Hazard Vulnerability Assessment include the infrastructure and assets associated with the Project. The assessment will provide a description of how the Project will be designed to be resilient to projected climate change in the Cayman Islands region.

The methodology for the Climate Change Resilience and Hazard Vulnerability Assessment will be based upon the principles in the IEMA Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (IEMA, 2020). A three-step methodology will be adopted for the Climate Change Resilience assessment and Hazard Vulnerability Assessment.

The first stage of the assessment aims to identify the climate variables, hazards and receptors associated with the Project which could be vulnerable to climate change and hazards during its lifetime. If deemed necessary, a more detailed climate vulnerability assessment is then undertaken following the identification of the influencing climate and hazard variables. This comprises an assessment of the level of risk associated with the hazards posed by the predicted changes in climate variables.

The approach carried out for each step of the Climate Change Resilience assessment is set out below.

Step 1: Identifying receptors and climate variables, hazards and receptors

The first step of the Climate Change Resilience and Hazard Vulnerability Assessment is to identify the climate variables and hazards within the study area, receptors associated with the Project and the likely effects of climate change.

The receptors for the assessment comprise of individual components associated with the Project, where section-specific climate and non-climate related hazards can be identified. The receptors identified shall include both known receptors (such as receptors reported/known to have already experienced a climate-related event (i.e. flooding)) and unknown receptors which are yet to be impacted according to available data and literature.

The climate variables that are likely to change as a result of climate change are identified from available climate projection data.

Step 2: Climate and hazard vulnerability assessment

Step 2 is undertaken where it is identified that receptors are considered to have the potential to be vulnerable to climate change or hazards, with consideration of primary mitigation incorporated as part of the design of the Project. The risks to the Project and its associated infrastructure are qualitatively identified through a hazard likelihood and consequence matrix. The descriptors of likelihood and consequence are provided in **Table 4.17** and **Table 4.18**. The matrix is provided in **Table 4.19**.

Table 4.17 Descriptors of likelihood for climate or identified hazards

Likelihood	Description
Almost certain (5)	The climate or identified hazard is likely to occur numerous times during the anticipated operational lifespan of the Project, e.g. approximately once per year
Likely (4)	The climate or identified hazard is likely to occur on several occasions during the anticipated operational lifespan of the Project e.g. approximately once every five years
Moderate (3)	The climate or identified hazard will occur on limited occasions during the anticipated operational lifespan of the Project e.g. approximately once every ten years
Unlikely (2)	The climate or identified hazard will occur infrequently during the anticipated operational lifespan of the Project e.g. approximately once every 15 years
Very unlikely (1)	The climate or identified hazard may occur once during the anticipated operational lifespan of the Project e.g. the event could occur once over the lifetime of the project.

Table 4.18 Descriptors of consequences as a result of climate or identified hazards

Consequence	Description
Catastrophic (5)	Permanent damage to infrastructure, resulting in a severe lasting effect to the Project to function. Very significant adverse effect to the surrounding environs requiring remediation and restoration
Major (4)	Extensive damage to infrastructure requiring major repairs and maintenance, resulting in a severe effect to the Project to function. Significant adverse effect to the surrounding environs
Moderate (3)	Limited damage to infrastructure requiring maintenance or minor repair, resulting in a potential effect to the Project to function. Adverse effect to the surrounding environs
Minor (2)	Small and localised damage to infrastructure and a minor effect to the Project to function. Potential for slight adverse effect to the surrounding environs
Insignificant (1)	No damage to infrastructure or the ability of the Project to function. No adverse effect to the surrounding environs

Table 4.19 Likelihood/consequence matrix for determining risk rating

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	Medium	High	Extreme
Moderate	Low	Low	Medium	High	Extreme
Unlikely	Low	Low	Medium	Medium	High

Where climate risks are identified as ‘low’, the resilience of the Project to projected effects of climate change or identified hazards is considered to be ‘high’, and effects are considered to be not significant.

Step 3: Mitigation and resilience rating

For climate risks identified to be ‘medium’ or ‘high’ in the likelihood/consequence matrix in Step 2 (see **Table 4.19**), secondary mitigation measures are identified. With the proposed mitigation measures taken into consideration, a residual risk rating is then assessed. For each hazard, a resilience rating is identified as one of the following:

- High – strong degree of climate resilience. Remedial action or adaptation may be required but is not a priority.
- Moderate – a moderate degree of climate resilience. Remedial action or adaptation is recommended.
- Low – a low level of climate resilience. Remedial action or adaptation is required as a priority.

Significance

The significance of the Climate Change Resilience and Hazard Vulnerability Assessment is determined through consideration of the climate risk (identified in Step 2) and resilience rating (identified in Step 3), applied to each climate hazard. **Table 4.20** presents the matrix used to identify the overall significance of the Climate Change Resilience assessment.

Table 4.20 Significance criteria

Risk rating	Resilience rating		
	High	Moderate	Low
Extreme	Significant	Significant	Significant
High	Not significant	Significant	Significant
Medium	Not significant	Not significant	Significant
Low	Not significant	Not significant	Not significant

Potential cumulative effects with respect to climate resilience may arise from other developments, which have the potential to exacerbate the vulnerability of the Project to the effects of climate change or identified hazards, for example other projects giving rise to increased flood risk. These cumulative effects will be considered in the relevant EIA topic (for example flood risk and hydrology) and summarised within the Climate Resilience and Hazard Vulnerability Chapter.

4.8.4 Mitigation measures

The Project will include resilience measures to address future climate change. This will take into account climate hazards such as flood risk, storms, SLR and high temperatures. These steps will be incorporated into the design, and any additional mitigation measures proposed after Stage 3 of the Climate Change Resilience Assessment will be given.

5 APPROACH TO EIA

5.1 Summary of approach to collation of baseline information required to inform the EIA

Table 5.1 summarises the baseline information required for the EIA of the Project so that the assessments can be carried out as described in **Section 3** and **Section 4**. A set out in **Section 1.5** the EIA consultant will collaborate with the design consultants to finalise the project description and confirm the impacts to be assessed (and therefore study area for each topic) within the EIA with the EAB prior to any surveys or modelling being undertaken.

Table 5.1 Summary of the approach to provide baseline information for the EIA

Topic	Approach
Water Environment	Bathymetry, tidal level and current, sediment and wind data will be collected as part of the establishment of baseline conditions. If dredging is required, a sediment quality survey will be undertaken to assess the potential for re-using the sediment and/or release of contaminants. In addition to this, the following modelling studies shall inform the impacts assessment: tidal currents and suspended sediment dispersion during construction, hydrodynamics for operational phase to look at sedimentation/erosion effects, and a site drainage assessment.
Marine ecology	Baseline surveys of marine habitats and species, as well as a coastal walkover, a subtidal benthic habitat survey and mapping of mobile species are required to inform the EIA. The cumulative losses of habitat will be considered alongside the losses from this project.
Terrestrial ecology	Baseline surveys of terrestrial habitats and species, breeding and non-breeding birds as well as vantage point surveys are required to inform the EIA. Habitat and species-specific surveys shall be conducted if they are found present during the initial walkover survey.
Air quality	Baseline NO_2, SO_2, CO and VOCs (specifically benzene, polycyclic aromatic hydrocarbons, butadiene, nitrogen oxides, and ammonia) monitoring survey is undertaken for a minimum period of 6 months; capturing data in both the wet and dry seasons is required to inform the EIA. Locations will include the closest sensitive human receptors, background locations away from any nearby air pollutant sources, as well as appropriate locations along the main roads.
Noise and vibration	A 7-day baseline sound level survey required in the vicinity of noise and vibration sensitive receptors near the Project boundary, particularly the extension area. Modelling of aircraft noise during operation required to predict aircraft noise levels at the receptors near to the existing airport.
Visual and landscape effects	A photographic survey will be undertaken to provide a comprehensive set of photographs from various viewpoints to document the current visual conditions. Viewpoints will be selected for the use of CGI to create visual simulations of the Project from key viewpoints which will form the basis of the EIA.
Public amenity	Baseline surveys of existing public amenities, as well as a stakeholder identification and engagement plan are required to inform the EIA. This will include an infrastructure and travel and accessibility impact assessment. Surveys shall reflect that significant seafaring culture of Grand Cayman.
Climate Change and Hazard Vulnerability	A desk-based assessment will be undertaken to identify the climate variables and hazards within the study area and the risks of those occurring and the receptors vulnerable to climate change or hazards and their resilience to each risk.

5.2 Outline EIA programme

An outline programme for the production of the EIA is provided in **Table 5.2** below, which provides a guide for effective forward planning.

Following the appointment of a suitably qualified EIA specialist consultancy, the detailed scope of the surveys required to inform the baseline of the EIA shall be developed and confirmed with the EAB. Consequently, a clear survey scope can be produced to commission specialist survey companies. Once commissioned, the surveys can commence. The timings provided in the programme are based on those recommended in each topic section in this ToR.

While the surveys are ongoing it is important that the design of the runway extension (the project description) is developed, and the construction methods and operational activities are developed so that the potential impacts on identified receptors can be accurately assessed.

At the same time, the initial sections of the EIA and all topic sections can be progressed, and the impact assessment sections commenced as far as possible while waiting for the survey data and/or modelling results to be finalised for those topics which require surveys to inform the baseline.

Sufficient time must be allowed for the provision of the survey reports and then for the EIA itself to be finalised. Following this a review of the draft report by the proponent shall be allowed for and updates to be made prior to submitting the final report to the EAB for review and consideration.

Table 5.2 Outline EIA programme

Task	Month																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Review, refine and agree survey scope with EAB																								
Commission and undertake surveys:																								
Water environment																								
Marine ecology																								
Terrestrial ecology																								
Air quality																								
Noise																								
Visual assessment																								
Public amenity																								
Finalisation of survey reporting																								
Development and provision of the ORIA project description, construction methodology and operational requirements																								
Production of EIA																								
Client review of EIA																								
Finalisation of EIA																								
Submission of EIA to Cayman authorities																								

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APPENDIX A – EAB SCOPING OPINION

Environmental Impact Assessment Scoping Opinion for the Proposed Extension of the Runway at Owen Roberts International Airport
Prepared by the Environmental Assessment Board Subcommittee of the National Conservation Council

15 December 2023

1. Introduction

At its meeting on 28 August 2023, the National Conservation Council (NCC) agreed to appoint an Environmental Assessment Board (EAB) comprising members of the Department of Environment (DoE), Planning Department, Civil Aviation Authority, Water Authority, Cayman Islands Fire Service, Coast Guard, Hazard Management Cayman Islands, and National Roads Authority. The EAB has been appointed to guide the Environmental Impact Assessment (EIA) for the eastward extension of the existing runway at Owen Roberts International Airport (ORIA) as proposed by Cayman Islands Airport Authority ('the proponent') as shown in Figures 1 & 2. Two separate EABs have been convened for EIAs for projects by the proponent on both Cayman Brac and Little Cayman. A summary of the appointments by the NCC for each EAB is provided below in Table 1:

Table 1. NCC appointments of Environmental Assessment Boards for each Environmental Impact Assessment for projects by the proponent.

Agency	Relevant EIA		
	Grand Cayman	Cayman Brac	Little Cayman
Civil Aviation Authority	Yes	Yes	Yes
Cayman Islands Fire Service	Yes	No	Yes
Coast Guard	Yes	No	No
Hazard Management Cayman Islands	Yes	No	No
National Roads Authority	Yes	No	No
Department of Planning	Yes	Yes	Yes
Water Authority	Yes	Yes	Yes
Department of Environment (Chair)	Yes	Yes	Yes

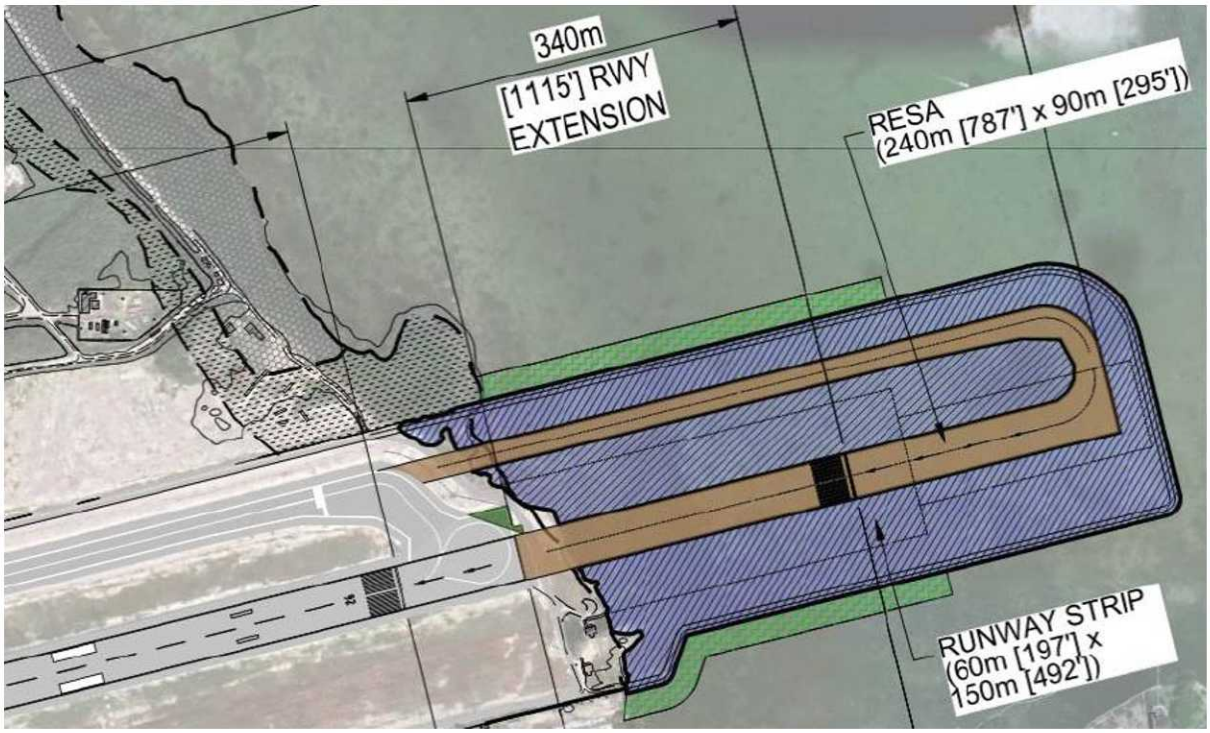

Figure 1. Proposed eastward extension of the existing runway at ORIA (CIAA, 2023)

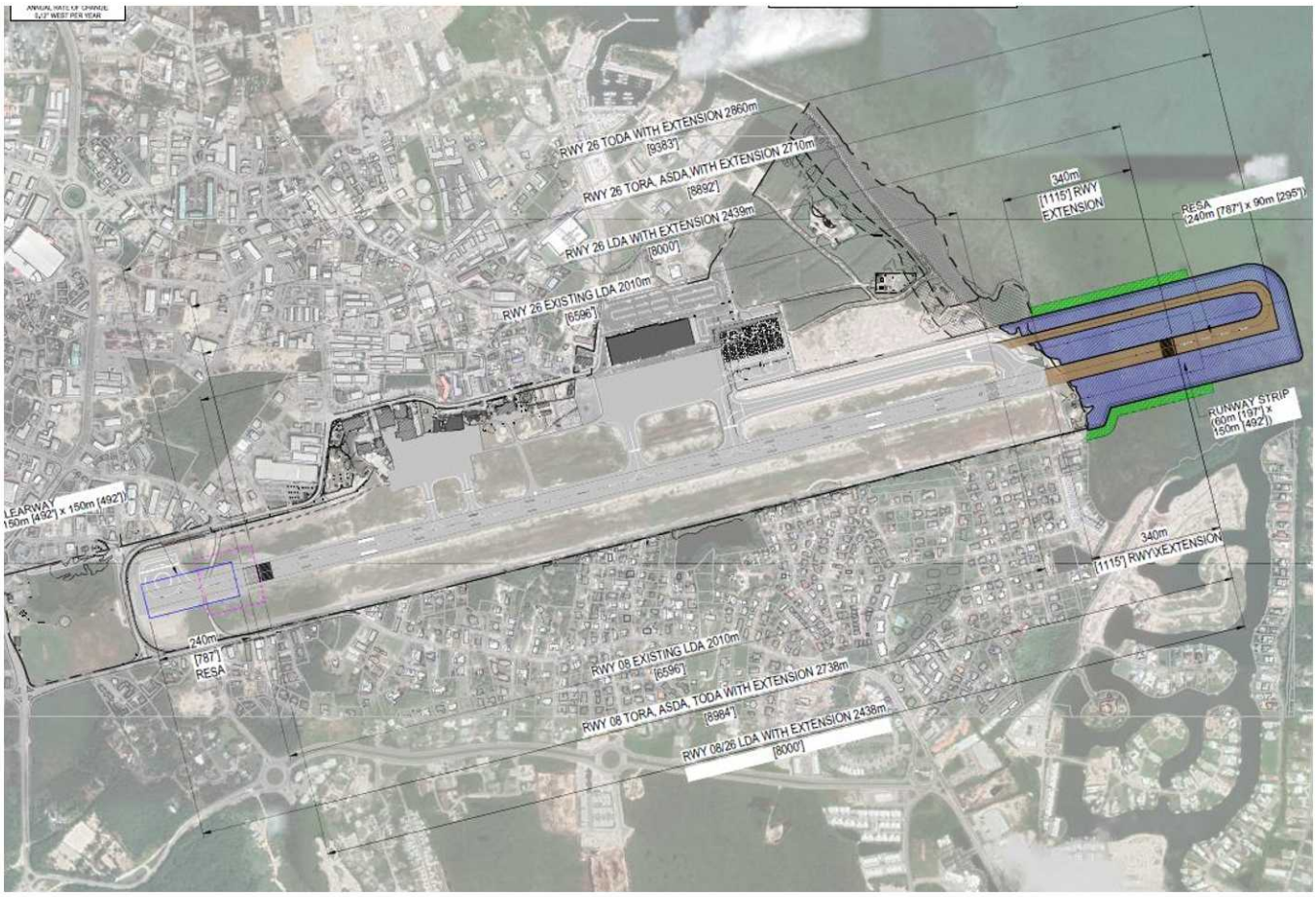

Figure 2. Overall site context for the proposed runway extension at ORIA (CIAA, 2023)

In accordance with the EIA Directive (2016), the following EIA Scoping Opinion outlines the likely significant effects of the project which will need to be assessed as part of the EIA process.

2. Background

2.1 May 2023 – Request for EIA Scoping

The proponent voluntarily decided to carry out an EIA for the extension of the existing runway and submitted a request for EIA scoping. At their meeting on 28 August 2023, the NCC determined that the proposed runway extension falls within Schedule 1 of the National Conservation Act and agreed that an Environmental Impact Assessment was needed. At the same meeting, as outlined above, the NCC appointed the EAB to guide the EIA process.

2.2 September 2023 – EIA Scoping of Project Proposal

On 27 September 2023, the EAB met for an initial discussion on the scoping of the EIA. The result of this meeting is the EIA Scoping Report herein.

3. Proposed Project

The Cayman Islands Airports Authority (CIAA), as project proponent, is proposing an extension of the runway at Owen Roberts International Airport, approximately 340 m eastward into the North Sound. In addition to the extension of the runway, the proposed project also includes the construction of a 240 m x 90 m runway end safety area (RESA). According to the proponent, the proposed extension and RESA are required so that the runway can accommodate the increased landing distances required by wide-body aircraft flying new, long-haul routes.

Alternatives to the eastward runway extension have been considered, these include the following:

1. Extension westward towards Crewe Road. This solution was determined by the proponent to be not viable in the short term due to several constraints related to the road and the nearby obstacle environment (building tops, antennae).
2. Reducing the required extension into the North Sound by also extending the runway westward. This would require relocating Crewe Road and would need to be explored along with the National Roads Authority. This alternative was also determined to be non-viable in the short to medium term.

The runway extension will also require the relocation of the Marine Fire Service from the footprint of the runway.

4. Consultation

Prior to the EIA process, the CIAA conducted a number of public consultation sessions, which informed and guided the direction of the preferred project proposal.

Under the EIA process, no other government entities outside of the members of the EAB have been consulted on the project to date.

5. Scope of the EIA

5.1 General EIA Methodology

The EIA methodology shall follow the requirements of the NCA and the EIA Directive (2016). Particular reference should be made to Schedule 2 of the EIA Directive which contains the information for inclusion in Environmental Statements (ES). The methodology to be employed to assess the effects for each topic shall be agreed as part of the Terms of Reference.

Generally and briefly, the ES shall:

- Describe and state the need for the project,
- Consider alternatives and justify why it was decided to choose the proposed runway layout/design,
- Identify and assess the baseline conditions for each topic identified below,
- Identify the potential environmental receptors (especially sensitive receptors) which may be impacted by the proposed runway expansion and may need to be considered as part of the assessment,
- Identify mitigation measures for each topic identified below and identify any residual effects,
- Undertake a Demolition and Construction Impact Assessment including a prediction of impacts for each topic identified below,
- Undertake a Completed Development Impact Assessment, including a prediction of impacts for each topic identified below, and
- Undertake a Cumulative Effects Assessment.

As per the EIA Directive (in particular Schedule 3), each ES shall include an Environmental Management Plan which shall include the mitigation measures recommended and present procedures and reporting relationships. A Non-Technical Summary is also required as part of the EIA process. Further detail will be agreed as part of the Terms of Reference.

5.2 Topics with Significant Effects

There is the potential for likely significant effects, during both the construction works associated with the proposed runway expansion and once the expanded runway is complete and operational, for the below topic areas:

- Air Quality
- Noise and Vibration
- Public Amenity
- Visual Impact Assessment

- Hazard Vulnerability and Climate Change
- Marine Ecology
- Water Environment (including impacts from dredging) and Contamination

These topics shall be included as chapters within the ES.

5.3 Air Quality

Affected Resources

The proposed extension of the runway and enlarged RESA will allow larger planes to utilize the runway at ORIA. It is also possible that the runway extension will lead to an increased volume of flights in and out of ORIA. There are a number of residential and commercial developments in close proximity to the airport that could be affected by a reduction in air quality.

Potential Impacts

The utilization of larger planes and a potentially increased volume of flights comes with a risk of an impact to air quality, primarily due to the emissions produced by their engines. Major pollutants released by aircraft engines include nitrogen oxides (NOx), sulfur oxides (SOx), particulate matter, carbon monoxide, and volatile organic compounds (VOCs). Larger planes typically have more powerful engines, and require engines to operate at higher power levels during take-off and landing.

The ES shall identify how air quality in nearby residential areas is likely to be impacted by the proposed extension of the runway. At a minimum, the EIA shall include:

- A Baseline Air Quality Assessment measuring concentrations of key air pollutants, including nitrogen oxides, sulfur oxides, particulate matter, carbon monoxide, and VOCs;
- The baseline air quality assessment shall also consider seasonal variations and meteorological conditions;
- Air quality modelling to predict the dipersion of pollutants from the project sources; and
- An evaluation of the potential risks to human health associated with the anticipated exposure to air pollutants.

5.4 Noise and Vibration

Affected Resources

The area surrounding the proposed runway extension is largely residential in nature and there are a number of residential developments in close proximity that could be affected by noise and vibration both during construction, and during operation of the airport.

Potential Impacts

Construction of the the runway extension and RESA will involve a significant amount of dredging, filling, earthwork and grading; all dependant on heavy equipment. Heavy equipment often generates high noise levels, causing disturbances for nearby residents, tourists, and wildlife and potentially impacting quality of live. In addition to noise, vibration resulting from construction activities can impact nearby buildings and homes, potentially to the point of causing structural damage.

In addition to the impacts resulting from construction of the runway extension, the daily operation of the airport is also likely to result in noise and vibration impacts. A large amount of noise is generated by aircraft activities (take-offs, landings, general operation) and ground operations (aircraft maintenance, fueling, cargo handling). Aircraft take-offs and landings can also generate ground vibrations which may affect nearby structures and buildings in a similar manner to construction activities. The runway extension has the potential to move this aircraft activity closer to residential and commercial properties and therefore has the potential for adverse effects.

The combination of the above over time can lead to various health and environmental concerns, including annoyance, sleep disturbance and stress among residents living close to the aerodrome. It is also possible that the construction and day to day operation of the aerodrome will reduce property values and reduce the overall quality of life for the surrounding area.

Therefore, the EIA shall consider:

- Noise and Vibration Impacts on surrounding properties during construction; and
- Noise and Vibration Impacts on surrounding properties during operation of the proposed aerodrome

5.5 Public Amenity

Affected Resources

The proposed eastward extension of the runway is located in an area that is used recreationally by a number of groups, including nearby residents and members of the Cayman Islands Sailing Club (refer to Figure 3). Not only will this area now be occupied by the proposed runway extension, but security requirements (including possible exclusionary zones) may mean the public use of a larger area than that occupied by the runway is affected.

Exclusion zones may impact residents of nearby residential lots on the canals.

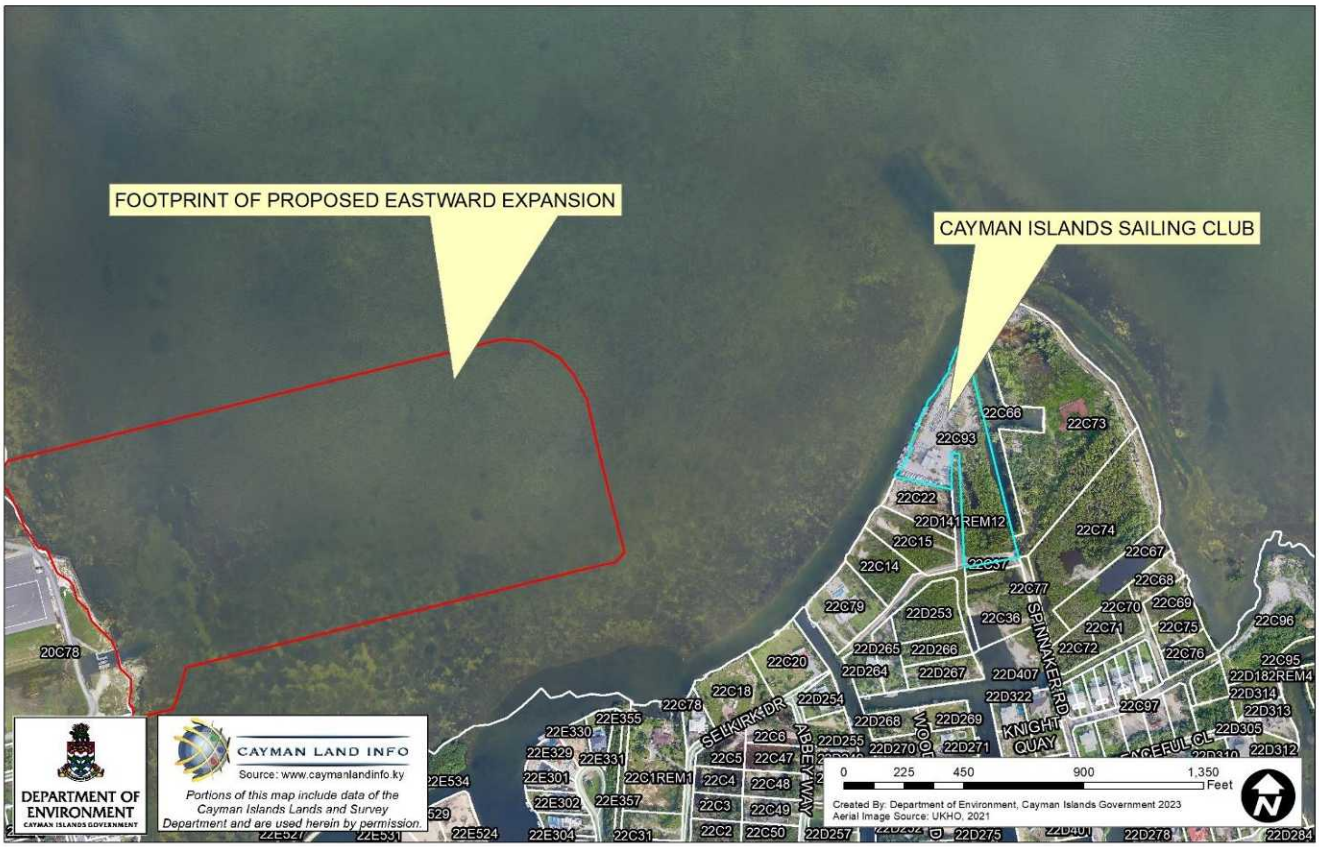

Figure 3. Proximity of the proposed eastward expansion to Cayman Islands Sailing Club (Aerial Image Source: UKHO, 2021)

Potential Impacts

Extending the runway eastward into an area currently used for public amenity has the potential for several impacts:

- Conversion of this area, which currently is freely accessible to the public and used by people on boats, kayaks, sail boats, paddleboards etc., to a airport runway will exclude them from the area directly and mean they directly lose this amenity space.
- Extending the runway will impact the enjoyment of the wider area and create an indirect loss of amenity space.
- Extension of the runway will alter the visual landscape of the area, requiring the clearing of mangroves. This will be assessed as discussed later as part of the Visual Impact Assessment however there is also a public amenity aspect.
- There will be severe loss of amenity during construction from the dredging, heavy equipment and construction of the runway.
- It is also possible that the extension of the runway and construction of the RESA may lead to access restrictions due to safety reasons for both the aerodrome and for users and residents of the area. These restrictions could be required both during construction and during daily

operation of the runway and has the potential to limit the accessibility and usability of the water for sailing enthusiasts and other leisure users and nearby residents, potentially reducing the overall amenity value of the area.

- The above changes have the potential to also affect the economic vitality of businesses that depend on the use of this area, either through sailing-related activities or other water based activities.

The ES shall identify how public amenity will be affected by the extension of the runway, both during construction and during day to day operation of the runway. At a minimum, the EIA shall include:

- A review of any access restrictions that may be required due to operational or security requirements during construction,
- A review of any access restrictions that may be required due to operational or security requirements during the daily operation of the airport,
- Impacts to residential receptors around Tropical Gardens, Grand Harbour and Selkirk Drive at a minimum,
- Impacts to the Cayman Islands Sailing Club, and
- Impacts to the public.

5.6 Visual Impact Assessment

Affected Resources

The extension of the runway into the North Sound will alter the coastal landscape and change views from the shoreline and surrounding areas. The area contains tidally flooded mangrove forest and designated mangrove buffers under the Development and Planning Regulations (2022) in which development of any kind is prohibited except in exceptional circumstances. Given the proximity of the runway extension to neighbouring residential and commercial properties, there may be considerable impacts to visual amenity.

Potential Impacts

The extension of the runway and construction of a RESA within the North Sound is likely to have a number of visual impacts. The natural aesthetics of the coastline are likely to be affected, especially in regard to existing ecosystems such as the mangroves in the nearby vicinity.

In addition to the runway itself, the extension is also likely to require additional infrastructure such as runway lights, navigation aids and other lighting systems along with additional man-made structures.

The runway extension will alter water views, and is likely to become a prominent feature in the local landscape.

The extension of the runway may also result in a reduction of property values due to changes in visual amenity of the area.

The ES shall include:

- A Visual Impact Assessment including verified views or Accurate Visual Representations, and
- A quantitative assessment of impacts to property values.

5.7 Hazard Vulnerability and Climate Change

Affected Resources

The proposed extension of the runway into the North Sound will result in the loss of a natural mangrove buffer, as well as the conversion of part of the North Sound into hard standing. This has the potential to increase the vulnerability of the large number of nearby residential properties to hazards related to climate change, flooding and storm surge.

Potential Impacts

The extension of the runway into the North Sound may alter wave patterns, and increase vulnerability of the surrounding area to erosion. Changes in the coastline can affect the natural buffering capacity of the shoreline against wave action. In addition to this, the extension of the runway into the North Sound also leaves the runway itself in a more vulnerable position, and susceptible to damage from extreme weather events such as hurricanes.

The ES shall identify how risks from major disasters and climate change will be mitigated and assess the potentially significant effects of the extension of the runway on the vulnerability of the surrounding area as well as the runway itself. At a minimum, the EIA shall include:

- A Hazard Vulnerability Assessment including hurricanes, storm surge, and earthquakes;
- A assessment of potential changes to wave patterns in the vicinity of the runway extension;
- A Flood Risk Assessment; and
- An assessment of the impacts caused by climate change.

5.8 Marine Ecology

Affected Resources

The extension of the runway eastward into the North Sound will affect an area of roughly 44 acres of benthic habitat containing seagrass beds, in addition to consolidated coarse sediments colonised with marine algae, sea grasses, sponges and coral colonies. This type of habitat, referred to as transitional habitat, has been greatly reduced and impacted by dredging activity along the western perimeter of the North Sound, making remaining habitats significantly more important.

Figure 4: Landcover map of the proposed runway extension site, mapped using 2013 aerial imagery (Source: DoE Landcover Mapping, 2013).

In this area, the seagrass beds complement the surrounding mangroves and help to provide a healthy ecosystem for marine life and aid in the protection and stabilization of the coastline. Seagrass and algal beds provide food and shelter for many marine species at different stages of their life cycles and thus function as nursery areas for commercially important fish species. The habitat function of seagrasses increases in value when they are connected to adjacent mangrove or coral reef ecosystems since seagrass beds act as transitional habitats and pathways for the juveniles of species that spend their adult phases in the adjacent ecosystems.

Seagrasses also provide many other ecosystem benefits and it is widely acknowledged to be one of the most valuable and vulnerable ecosystems. Given the climate change predictions for the region, which include rising temperatures, sea-level rise and increased intensity of storm events (including storm surge), another beneficial function of seagrass beds is that they provide flood reduction and reduce erosion from wave action aiding in shore protection, particularly along beaches and shallow areas. Although often overlooked in comparison to mangroves, seagrasses are also nutrient sinks, buffering or filtering nutrient and chemical inputs to the marine environment and aiding in water quality. The deposition and stabilisation of sediments provided by seagrasses assist other important adjacent marine ecosystems such as coral reefs.

Potential Impacts

The proposed extension of the runway, with the associated clearing and filling works required permanently alter important seagrass habitat. The loss of this habitat will result from the construction of the runway extension. There may also be indirect impacts on marine ecology depending on the source of the fill, required dredging around the runway extension.

Therefore, the EIA shall include an Ecological Impact Assessment which assesses:

- Direct impacts on marine ecology during construction and operation;
- Indirect impacts on marine ecology during construction and operation.

A detailed benthic study will be required as part of the assessment of the baseline conditions.

5.9 Water Environment and Contamination

Affected Resources

The proposed runway extension is likely to have a number of impacts related to local hydrology, drainage patterns and water flow. Run-off of pollutants associated with aviation are also likely to be a concern. There are also a number of residential and commercial properties in the immediate vicinity for which water quality is likely to be a concern.

The construction of the proposed runway is also likely to require at least some amount of dredging, whether for the removal of peat and other unsuitable substrates in the area where the runway is extended, or possibly from another location where aggregate is sourced for fill. The environmental consequences of dredging have long been documented and poor water quality arising from past dredging projects remains evident in the North Sound. Dredging of material is also likely to involve transport, dewatering, treatment, and/or disposal of sediment. All of the above activities are likely to impact water quality in the immediate vicinity of the runway extension.

Potential Impacts

During construction, there will be likely turbidity impacts and other impacts on the marine environment from dredging, site preparation and filling.

Dredging operations generate transient plumes of sediment as the material is being removed, regardless of the type of equipment used. The water column will be temporarily affected by turbidity during active dredging, reducing water quality in the short term, as well as the medium to long term. Dredging can lead to remaining silts and clays on the seabed to become re-suspended from natural perturbations or movement due to human activity. The resulting turbidity can impact fish and other marine species, as well as smother nearby seagrass beds and corals. These impacts can significantly alter the presence, distribution and abundance of species that currently colonise the area, performing vital ecological functions. The resulting impacts from dredging can also expand the impact of the project far beyond the

constructed footprint, as unmanaged sediment plumes are able to travel over a large distance (refer to Figure 5).

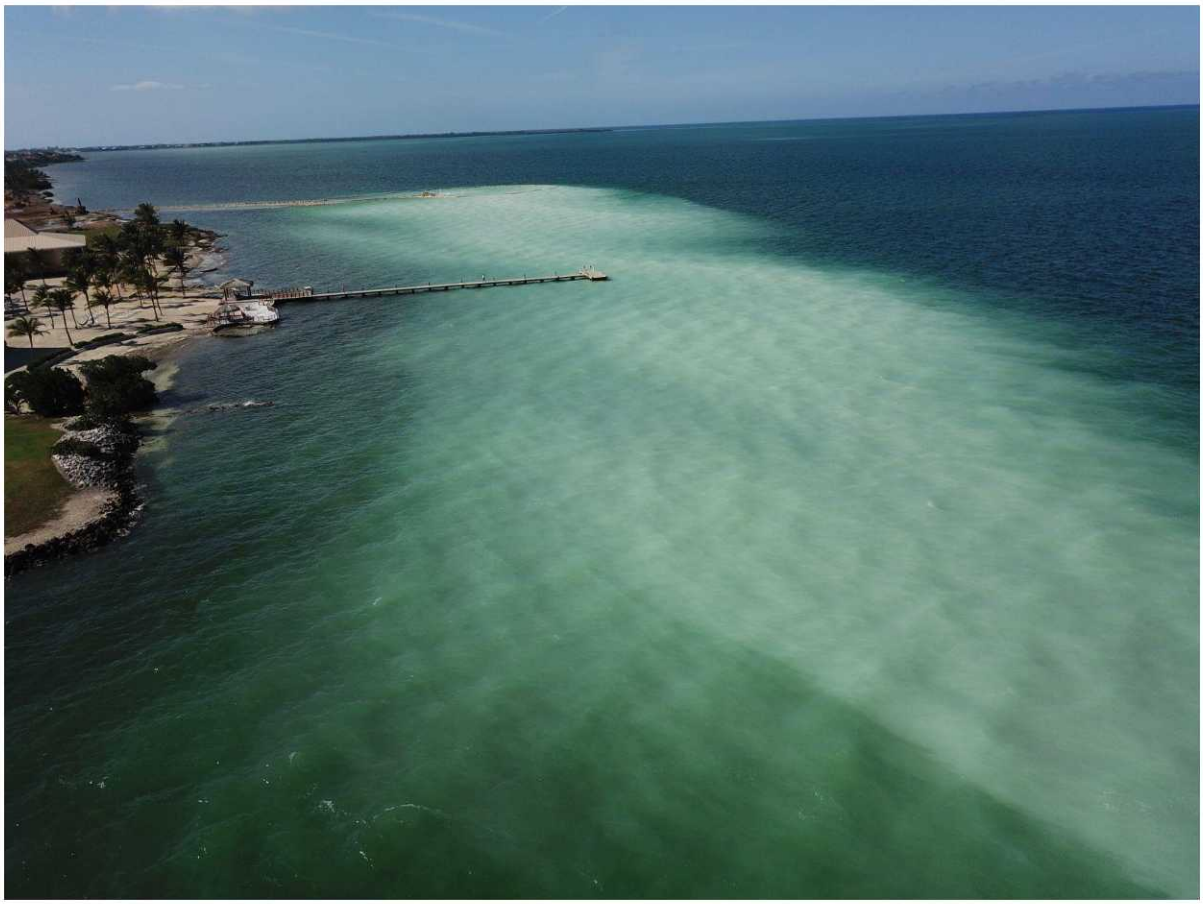

Figure 5: Drone imagery revealing the widespread impacts of dredging despite the installation of two layers of silt screens (Source: Submitted to DoE, 2018).

Management of sediment removed through dredging also requires consideration of the transportation, treatment, and final disposal or resuse of the dredged material in an approved location. Dewatering may be required to prepare dredged materials for reuse or disposal. Staging of the dewatering operation will likely require sufficient space to store the dredged sediment during the process. If the goal is to return the separated water back to the source water body, this is also likely to have effects on water quality in the short to medium term.

The extension of the runway into the North Sound will greatly increase the amount of impervious ground cover in the vicinity and increase the demand on drainage systems. These alterations can change the natural drainage patterns of the area. If not properly managed, these changes in drainage patterns have the potential to result in increased stormwater run-off, leading to erosion, flooding and sedimentation of nearby water bodies.

The increase in impervious site surfaces will lead to increased surface water run-off that will also need to be adequately managed. This increased run-off has the potential to affect water quality in the

immediate vicinity of the runway extension. Inadequate stormwater management can lead to pollutants, such as oil, grease, chemicals and heavy metals being washed into nearby water bodies and causing pollution which can effect nearby residential and commercial properties.

The project will require relocation of an area north-west of the existing runway that is used by the Fire Services for fire fighting practice and the area that is used for the shooting range. If this falls within the proposed development boundary, we recommend as a minimum a site assessment of existing conditions in both areas for the presence of pollutants. If pollutants are found to be present at levels exceeding public and environmental health standards, the development of these areas will have to address mitigation and remediation of soil and water impacted by pollutants. Chemicals of concern are:

- Use of firefighting foam may have impacted water and soil with PFAS (per-and polyfluoroalkyl substances);
- Presence of residual pollutants from fire fighting practice in water and soil (hydrocarbons, volatile and semivolatile organics and metals; and
- Use of lead shot may have impacted soil and water with lead at the shooting range.

Therefore, the EIA shall consider:

- Impacts from dredging, site preparation, filling and other construction activities on water quality and the marine environment, including:
    - Baseline measurements of turbidity, waves and currents,
    - Modelling of hydrodynamics and sediment plumes during construction,
    - A Dredge Management Plan and Water Quality Management Plan for during construction, and
    - Effects of the project on water quality including the potential for generating turbidity during construction.
- Impacts on stormwater water management during construction and operation, and
- An assessment of pollutants that may be present due to the previous use of the area for fire fighting training.

6. Next Steps

The next stage of the process is for the proponent to provide the EAB with details of up to three suitably qualified consultancy firms to carry out the EIA based upon the requirements outlined in the EIA Scoping Opinion. The Consultant's proposals shall provide details of the professional team composition, including Curricula Vitae for all team members who should have at least five years professional experience of similar projects. Consultants should:

(i) Include a qualified and experienced EIA Coordinator with experience of coordinating EIAs for similar aviation projects,

(ii) Include a qualified marine biologist with experience in tropical marine environments similar to the proposal site and capable of assessing the marine ecosystems in the area of the site and assessing the potential for mitigation measures to be carried out;

(iii) Include a qualified coastal engineer capable of assessing and modelling hydrodynamics and wave patterns;

(iv) Include a qualified water resources engineer or hydrologist/hydrogeologist capable of assessing (and modelling, as necessary) the stormwater drainage patterns and flows, flood risks, and risks to nearby water quality;

(v) Include a qualified specialist in contaminated land, with experience in assessing and remediating contaminated land, particularly with respect to pullutants commonly found in aviation environments;

(vi) Include an air quality specialist with experience in monitoring and predicting air quality, particularly with respect to pollutants commonly found in aviation environments;

(vii) Include a qualified marine operations / dredging specialist with experience in modelling the suspension and dispersion of sediments due to dredging activities, as well as the effects from dewatering operations.

(viii) Outline relevant experience in undertaking noise and vibration assessments; and

(ix) Outline relevant experience undertaking hazard vulnerability assessments including flood risk and climate change impact assessments.

The Consultant may propose suitable Sub-Consultants in specific areas of expertise as applicable. Credentials of such Sub-Consultants should be submitted as part of the Submission. The EAB will review the submissions from each consultancy team in order to confirm that the teams have the required experience and expertise to address the issues outlined in this EIA Scoping Opinion. Upon completion of the EAB's vetting process, the proponent is free to select consultant(s) from those which have been deemed competent by the EAB.

Upon appointment of the EIA consultants the EAB will make itself available to meet with the proponent and its EIA consultancy team to discuss the development of the draft Terms of Reference for the EIA, based on this EIA Scoping Opinion. Once agreed, the draft Terms of Reference will need to go out for public consultation (including discussion in at least one public meeting) for a period of 21 consecutive days and then finalised, taking into account the public's input all in accordance with the EIA Directive.

We trust that this information is of assistance. Please do not hesitate to get in touch should you have any questions.

Gina Ebanks-Petrie
Director, Department of Environment & EAB Chair

APPENDIX B – RECORD OF PUBLIC CONSULTATION

Royal HaskoningDHV is an independent consultancy which integrates 140 years of engineering expertise with digital technologies and software solutions. As consulting engineers, we care deeply about our people, our clients and society at large. Through our mission Enhancing Society Together, we take responsibility for having a positive impact on the world. We constantly challenge ourselves and others to develop sustainable solutions to local and global issues related to the built environment and the industry.

Change is happening. And it's happening fast – from climate and digital transformation to customer demands and hybrid working. The speed and extent of these changes create complex challenges which cannot be addressed in isolation. New perspectives are needed to accommodate the broader societal and technological picture and meet the needs of our ever-changing world.

Backed by the expertise of over 6,000 colleagues working from offices in more than 20 countries across the world, we are helping organisations to turn these challenges into opportunities and make the transition to smart and sustainable operations. We do this by seamlessly integrating engineering and design knowledge, consulting skills, software and technology to deliver more added value for our clients and their asset lifecycle.

We act with integrity and transparency, holding ourselves to the highest standards of environmental and social governance. We are diverse and inclusive. We will not compromise the safety or well-being of our team or communities – no matter the circumstances.

We actively collaborate with clients from public and private sectors, partners and stakeholders in projects and initiatives. Our actions, big and small, are driving the positive change the world needs, and are enhancing society now and for the future.

Our head office is in the Netherlands, and we have offices across Europe, Asia, Africa, Australia and the Americas.

EuroCompliance certification ISO37001

EuroCompliance certification ISO37301

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