GOVERNMENT OF THE COOK ISLANDS
INFRASTRUCTURE COOK ISLAND

VARIATION REPORT
ENVIRONMENT IMPACT ASSESSMENT

PROJECT: Manihiki Airport Runway Improvement

DATE: 28/05/2024

REVISION: 2

Prepared by: Planning, Projects & Pa Enua Division

Infrastructure Cook Islands

Revision History

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Document Acceptance

Action	Name	Signed	Date
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Approved for Issue	Elizabeth Wright – Koteka, Secretary, ICI		10/6/24

1.0 Table of Contents

2.0 Executive Summary

Project Overview

The Manihiki Airport Improvement Project aims to reconstruct and surface the existing coral runway at Manihiki Airport on Manihiki Island. This Environmental Impact Assessment (EIA) Addendum Report updates the initial EIA Report submitted to the National Environment Services and the Manihiki Island Government in 2022, prepared by AECOM New Zealand Ltd. The Manihiki Airport Improvement Project focuses on reconstructing and surfacing the existing coral runway at Manihiki Airport. This Environmental Impact Assessment (EIA) Addendum Report updates the initial 2022 EIA Report prepared by AECOM New Zealand Ltd.

Updated Plans and Information

The EIA Addendum Report includes several key updates:

- **Tukao Harbour Enabling Works**: Enhancements to Tukao Harbour to facilitate the mobilization of construction materials and machinery. Six landing concepts are proposed, including various reef platform and causeway configurations.
- **Medevac Emergency Flight**: A temporary runway (1.2km by 30m) will be formed within 24 hours during airport closures for medical evacuations.
- **Vegetation Clearing**: Removal of trees and shrubs encroaching into Obstacle Limitation Surfaces (OLS) for compliance with Civil Aviation requirements.
- **Project Laydown Site**: Establishment of the main site compound at the Manihiki Airport Terminal, including project offices and storage areas.
- **Desalination Plant**: Installation of units at the airport jetty to provide potable water for the construction project and personnel from the lagoon.

Tentative Schedule (2024-2025)

The project is planned as follows:

- **September 2024**: Commencement of enabling works
- **November/December 2024**: Mobilization of equipment and materials to Manihiki
- **January 2025**: Start of runway preparation
- **January to February 2025**: Vegetation clearing for OLS compliance
- **May/June 2025**: Runway sealing

The entire project is expected to be completed within 10 months, from September 2024 to June 2025.

Conclusion

The Manihiki Airport Improvement Project aims to enhance the operational capacity and safety of Manihiki Airport. The updates in this EIA Addendum Report ensure a comprehensive approach to project implementation, meeting environmental and regulatory standards.

3.0 Glossary of Terms

Terms, abbreviations and acronyms	Meaning
AECOM	AECOM New Zealand Limited
AACI	Airport Authority Cook Islands
CIIC	Cook Islands Investment Corporation
CIG	Cook Islands Government
CIPA	Cook Islands Ports Authority
CEMP	Construction Environment Management Plan
EIA	Environment Impact Assessment
EMP	Environment Management Plan
ESCP	Erosion and Sediment Control Plan
HSP	Health and Safety Plan
MMR	Ministry of Marine Resources
MFEM	Ministry of Finance & Economic Management
MSL	Mean Sea Level
MIG	Manihiki Island Government
MoT	Ministry of Transport
NES	National Environment Services
TAU MOH	Te Marae Ora – Ministry of Health
NGO	Non-Government Organisations
TOR	Terms of Reference

4.0 Introduction

4.1 Project Proponent

The Ministry of Infrastructure Cook Islands (ICI) is the lead agency for the implementation of the Manihiki Airport Improvement Project.

4.2 Project Description

The Manihiki Airport Improvement Project aims to reconstruct and surface the existing coral runway at Manihiki Airport, located in Tukao Village on Manihiki Island. This Environmental Impact Assessment (EIA) Addendum Report provides updated plans and additional information not included in the 2022 AECOM EIA report.

Infrastructure Cook Islands (ICI) is the lead agency for this project, employing a 'Public Works Model' to manage, facilitate, and resource all aspects using ICI personnel, operators, engineers, heavy plant machinery, and equipment.

Updated Plans and Key Components

The updated plans include several significant improvements and additions:

- **Tukao Harbour Landing Enabling Works**: Enhancements to Tukao Harbour aim to facilitate the safe and efficient mobilization of construction machinery, equipment, and materials from the shipping barge to Manihiki Island. Six landing concepts have been proposed, including utilizing the existing harbor and channel, deepening and widening the channel and landing platform, direct reef landing, and various sheet piled reef platforms with coral aggregate or composite mat causeways. These options provide flexibility in addressing logistical challenges and ensuring smooth project execution.

- **Medevac Emergency Flight**: During the runway preparation and mining phase, the airport will be closed for domestic air travel. However, in the event of a medical evacuation (Medevac), a temporary runway (1.2 km long by 30 m wide) will be formed within 24 hours, using leveled, graded, and compacted coral gravel, to facilitate emergency flights from Manihiki to Rarotonga.

- **Obstacle Limitation Surfaces (OLS) Clearance Area**: To comply with Civil Aviation requirements and obtain runway certification, tall trees and shrubs encroaching into the OLS clearance area will be felled, stockpiled, and repurposed for community use, such as compost.

- **Project Laydown Site**: The main site compound, including project offices, storage areas, stockpile sites, and associated facilities, will be located at the Manihiki Airport Terminal and surrounding grounds.

- **Desalination Plant**: To ensure a consistent and reliable supply of potable water, a desalination plant will be installed. This plant will provide water for construction activities like runway compaction, dust suppression, and equipment cleaning, as well as for drinking and sanitation needs of the workforce.

These improvements are designed to ensure the safe, efficient, and environmentally responsible execution of the Manihiki Airport Improvement Project

Figure 1: Map location of the Tukao Harbour, site for *enabling* works

4.3 Project Objectives and Scope

To support the Manihiki Airport Improvement project, the additional scope of works comprise:

- The Tukao Harbour Enabling works, the construction of a safe and efficient landing methodology; either construction of a temporary causeway or improving the existing Tukao Harbour channel.
- Develop and implement a standard-operation-procedure to support emergency medical evacuation (medevac) flights, where ICI operators are able to form a temporary runway, with a minimum length of 1.2km at 30m wide, within 24 hours.
- Compliance to the Civil Aviation requirements, with regards to the vegetation clearance of all tall trees within the 'Obstacle Limitation Surfaces' (OLS) clearance, adjacent to the runway area.
- That all Project Laydown site, are located in a secure place, away from vulnerable areas, such as high seas and flooded areas. The laydown compound is to be appropriately cordoned off from the general public at all times.
- Installation of desalination unit is to meet the project's water requirements while minimizing environmental impact. To mitigate environmental issues, the plant will be situated away from high seas or flood-prone areas. The units earmarked for the project will only return 50% discharge. Additionally, regular monitoring of desalination brine will ensure its safe discharge into the lagoon, minimizing harm to marine ecosystems.

5.0 Project Need and Standards

5.1 Project Justification

To support the Manihiki Airport Improvement project.

Tukao Harbour Enabling Works

The outcome of recent visits to Manihiki, in addition to discussion ICI held with local shipping representatives, including the Ministry of Transport, has identified that the existing Tukao Harbour is the preferred landing site for the mobilization of heavy plant machinery, equipment, materials and fuel, from the shipping barge to the island.

The Tukao Harbour is more sheltered, and away from the typical windy 'windward' northern side. Access roads are in close proximity.

The only local barge shipping company has indicated that the existing Tukao Channel is unsafe for their barge and poses a safety risk to the vessel, via manoeuvring through a narrow and shallow channel space. The barge shipping company has requested that a landing platform be provided just outside the reef. This will then require a temporary causeway to provide a suitable platform for the movement of machinery along the Tukao lagoon and reef flat area.

Emergency Medical Evacuation Flight

Te Marae Ora (Ministry of Health) has requested that medical evacuation (medevac) flights are available throughout the course of the runway physical works, to cater for the elderly, vulnerable groups and pregnant mothers, when medevac flights are urgently required.

ICI on site Project manager, will ensure that appropriate contingency plans are in place to cater for medevac flight(s). A 'Medevac Runway' Standard Operations Procedure will be developed and implemented, the ICI team will ensure that an appropriate temporary runway is constructed within 24 hours.

Manihiki Airport Civil Aviation Certification

An important and vital component for the improved Manihiki Airport Runway project is the attainment of the Civil Aviation certification, which will require vegetation clearing of tall trees within the 'Obstacle Limitation Surfaces' (OLS) clearance area.

The Civil Aviation OLS clearance standard, associates with safety, OLS clearance reduces the risk of unfavourable cross-winds, which poses a significant safety issue for aircrafts, where a crosswind can cause the aircraft to drift laterally as it approaches the runway. If the crosswind landing is not executed safely, the aircraft may experience a *wing strike*, where the aircraft wing hits the runway.

The tall trees within the OLS clearance area, generally comprise of coconut trees, will be felled, stockpiled and repurpose to benefit the community, like compost for home gardens. It is recommended that dwarf coconut trees be the preferred replacement of coconut trees adjacent to the Manihiki Airport.

Safe and Secured Project Laydown Site(s)

Safe site working practices will be implemented for the full project duration, specifically the Tukao Harbour *enabling works* and the Manihiki Runway *physical works*.

The main laydown site compound is to be appropriately fenced (where required) with safety warning signs, to ensure the general public stays away from the laydown hazard area. All heavy plant machinery are to park within the laydown area, at the end of each day or working shift.

All refuelling, oil change and lubrication of heavy plant machinery are to be undertaken within the laydown area, away from the foreshore-receiving waters environment. All oils and fuels are to be stored and locked away within the laydown compound.

Desalination Unit

To ensure the safety of the local water supply, desalination units will be installed and operated with rigorous safety measures overseen by the project mechanic.

Thorough site assessments are conducted before installation to address potential hazards, and workers are equipped with appropriate personal protective equipment (PPE). Compliance with safety standards and regular maintenance routines uphold equipment integrity, while emergency response plans are in place to manage incidents effectively.

Continuous monitoring of environmental impacts from brine discharge ensures regulatory compliance and ecosystem preservation. These measures collectively prioritize worker safety and environmental protection in the installation and operation of desalination units.

5.2 Alternatives to the Project

No Action Alternatives

- Without implementing the Tukao Harbour Enabling works, the mobilization of heavy plant machinery, equipment, materials, and project facilities to Manihiki will be impossible.
- Lack of a medical evacuation strategy will hinder urgent medical assistance for individuals on Manihiki, potentially delaying critical treatment on Rarotonga.
- Failure to comply with Civil Aviation requirements regarding OLS clearance will heighten aircraft safety risks, impede certification, and restrict aircraft size and type for Manihiki.
- Absence of safe and secure project laydown sites increases public safety risks, particularly for children in the area. Refuelling and oil changes conducted outside designated areas pose environmental risks, including accidental oil spills impacting sensitive areas.
- Without the desalination plant, the project exacerbates strain on the local water supply, further depleting already limited reserves and jeopardizing community access to water. The brine discharge will be monitored and the plant routinely undergoing maintenance.

6.0 Description of the Project

6.1 Tukao Harbour Enabling Works

Figure 2: Location of Tukao Harbour (Google Maps)

Tukao Harbour is located at the northern motu (islet) of Manihiki, along the western side of the Tukao Village, some 1 km from the Airport Runway.

Tukao Harbour Landing Enabling Works, is the improvements to the Tukao Harbour, to facilitate the safe and efficient mobilization of construction machinery, equipment and materials, from the shipping barge to the island (Tukao Village), for the runway improvement work. At present six *landing* concepts have been identified:

1. Utilizing Tukao Harbor and channel
2. Deepening and widening the Tukao channel and landing platform
3. Direct reef landing
4. Sheet piled reef platform and coral aggregate fill causeway
5. Sheet piled reef platform and block/coral aggregate fill causeway

6. Sheet piled reef platform and composite mat causeway

Utilizing Existing Channel

In opting to utilize the existing Tukao channel for transporting project-related materials, several environmental factors come into play. Initially, this choice presents a notable advantage by facilitating a swifter commencement of the project while inherently reducing the need for extensive modifications or new construction that could disrupt the surrounding ecosystem. By leveraging the natural waterway, the project minimizes its environmental footprint, preserving the integrity of the coastal environment and minimizing disturbances to marine habitats.

However, the narrow and shallow characteristics of the Tukao channel present challenges that must be addressed. The restricted dimensions limit the size of vessels that can navigate the channel, potentially leading to increased costs and longer loading/unloading times associated with the use of smaller vessels. Moreover, the limited manoeuvrability within the channel could result in delays in transporting materials to the project site, impacting project timelines and potentially increasing operational costs. Concerns raised by local barge companies regarding the draft depth and width of the channel further underscore the feasibility challenges associated with this option, potentially necessitating reactive measures to address emerging issues and unforeseen delays.

Tukao Channel, widening, deepening and channel extension.

The proposal entails widening and dredging the Tukao Channel and constructing a landing platform for large vessels, aiming to enhance transportation efficiency and support economic growth. This initiative anticipates reducing logistical challenges and attracting more shipping traffic, potentially benefiting local businesses and communities. However, it comes with considerable construction and maintenance expenses and significant environmental consequences, such as habitat destruction and disturbance to marine life. Additionally, there are concerns about intensified coastal erosion and safety risks due to increased swells.

The Tukao Channel improvement, was captured in the EIA Variation Report, submitted to NES and Manihiki Island Government in 2022, titled ‘EIA Variation Report for Tukao Harbour Landing Upgrade, to support Manihiki Airport Improvement Project’ date 17 October 2022.

A copy of the EIA Variation Report is appended to this report.

Reef Landing

In this option, shipping vessels anchor directly on the reef without engineered supports for unloading machinery and equipment. However, several challenges accompany this approach. Maneuvering machinery through knee-deep water increases the risk of damage, while the remote location complicates equipment repairs, potentially leading to delays and increased costs. Moreover, anchoring on the reef poses ecological damage concerns, triggering regulatory and reputational issues. Unforeseen complications, such as adverse weather conditions, could disrupt the project timeline and escalate expenses. Additionally, the feasibility of this option is constrained by the necessity for low tides and calm weather conditions. Given these challenges, cost estimates remain uncertain, necessitating preparedness for reactive measures to address emerging issues and delays.

Temporary Steel Sheet-Pile & Concrete Block Causeway

Shipping vessels will anchor unassisted on the reef to unload machinery onto a sheet pile-constructed landing platform, with a concrete-block infilled causeway facilitating offloading, enhancing safety and efficiency while reducing long-distance water transport. Materials will be repurposed after completion. However, building the platform involves complex engineering in a challenging marine environment, increasing costs and timelines.

ICI has conducted a thorough analysis to assess the feasibility of six different causeway alignments, considering factors such as the layout of the coral reef flat, tidal patterns, wave behavior, and the depth of the reef at proposed locations. The selected alignments are strategically positioned within the Tukao Harbour area to optimize functionality and minimize environmental impact. These alignments, ranging from 180m to 290m in length, were to accommodate varying conditions and requirements.

In consultation with the local barge operator, discussions with the captain of the MV Taunganui barge emphasized the necessity of a minimum depth of 1.5m for the barge to dock effectively. The precise location of the causeway platform was determined based on drone survey imagery further confirmed with surveying works carried out in a recent scoping trip to Manihiki, providing insights into the depths of the coral reef flats along the alignments. The Temporary Causeway Design Drawings appended to this report serve as visual references for the proposed alignments, facilitating further evaluation and refinement of the project plans.

Six alignment concepts identified at several locations within the Tukao Harbour area.

I. Temporary Causeway Alignment 1; 220m long, southern-side of Tukao Harbour Quay.
II. Temporary Causeway Alignment 2; 190m long, southern-side of Tukao Harbour Quay.
III. Temporary Causeway Alignment 3; 180m long, southern-side of Tukao Harbour Quay.
IV. Temporary Causeway Alignment 4; 190m long, southern-side of Tukao Harbour Quay.
V. Temporary Causeway Alignment 5; 280m long, northern-side of Tukao Harbour Quay.
VI. Temporary Causeway Alignment 6; 290m long, northern-side of Tukao Harbour Quay.

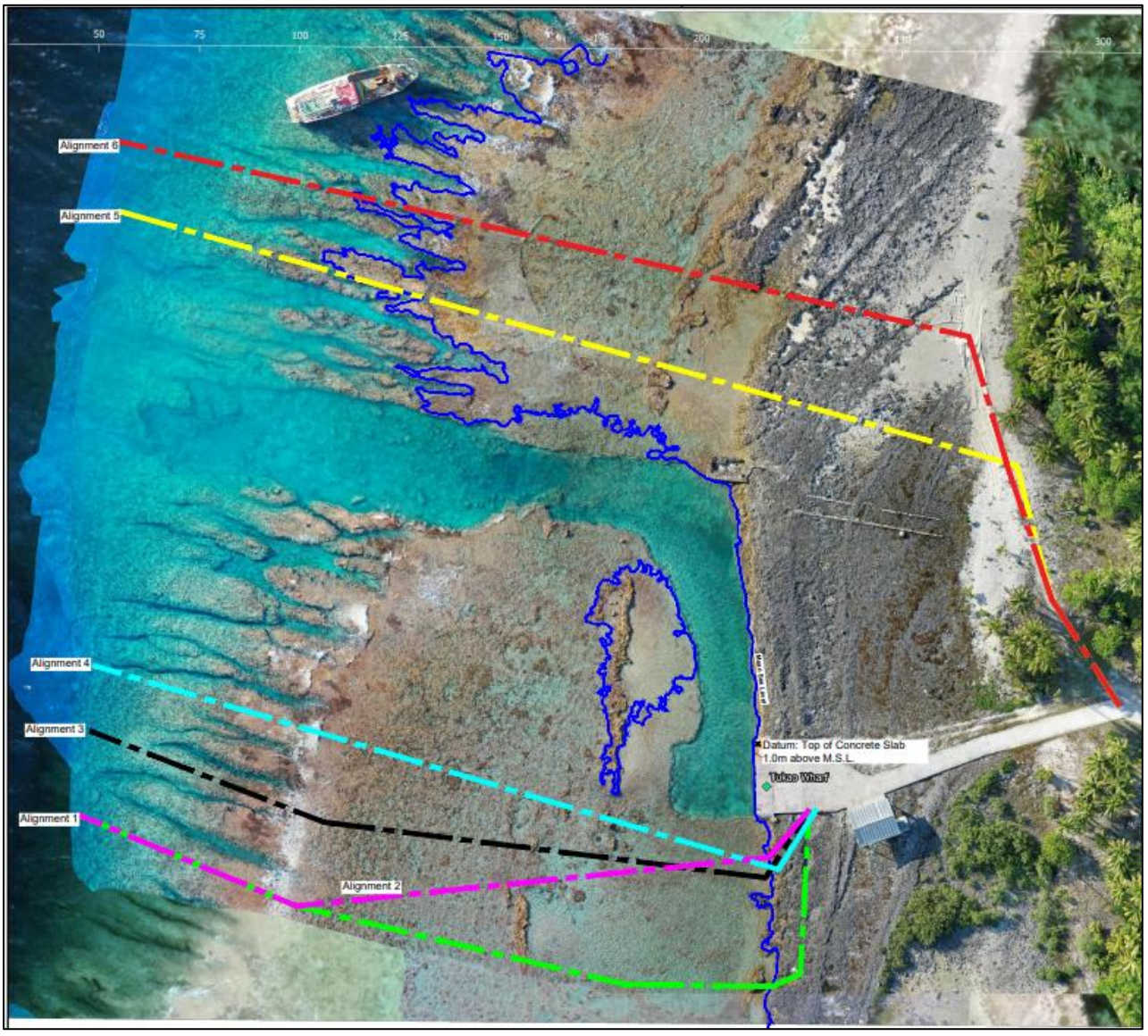

Figure 3: Causeway Alignment Options Tukao Harbor

Temporary Causeway Construction Methodology

The construction process for the temporary causeway begins with the establishment of the *barge landing platform*, marking the starting point for the causeway extension. Initially, platform perimeter sheet-piles are strategically driven into the natural reef makatea, ensuring a sturdy foundation for subsequent construction. The length of these piles is adjusted according to the slope of the reef, optimizing stability.

Once the sheet-piling is completed, bidim geofabrics are laid along the inner base, extending over the top of the platform sheet piles to enhance structural integrity. Granular coral cobble boulders and sand, devoid of any organic materials, are then carefully filled onto the platform, forming a solid base. This fill is levelled to 0.6m below the top edge of the sheet-pile, providing a uniform surface for the placement of concrete blocks.

Each concrete block is systematically positioned to minimize gaps, ensuring a secure and even structure.

Figure 4: Temporary Causeway Alignment Locations

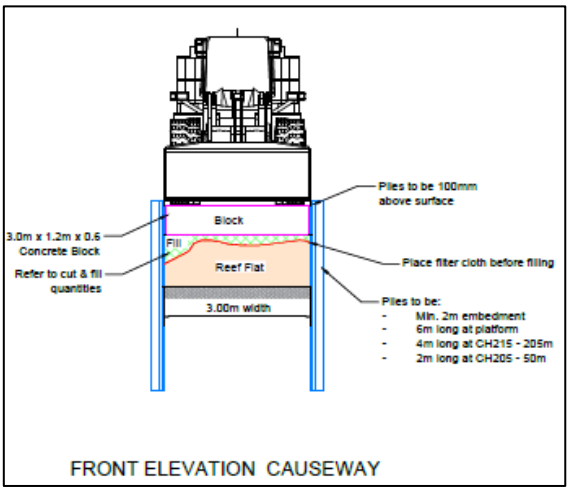

Figure 5: Temporary Causeway Design Details – Plan View

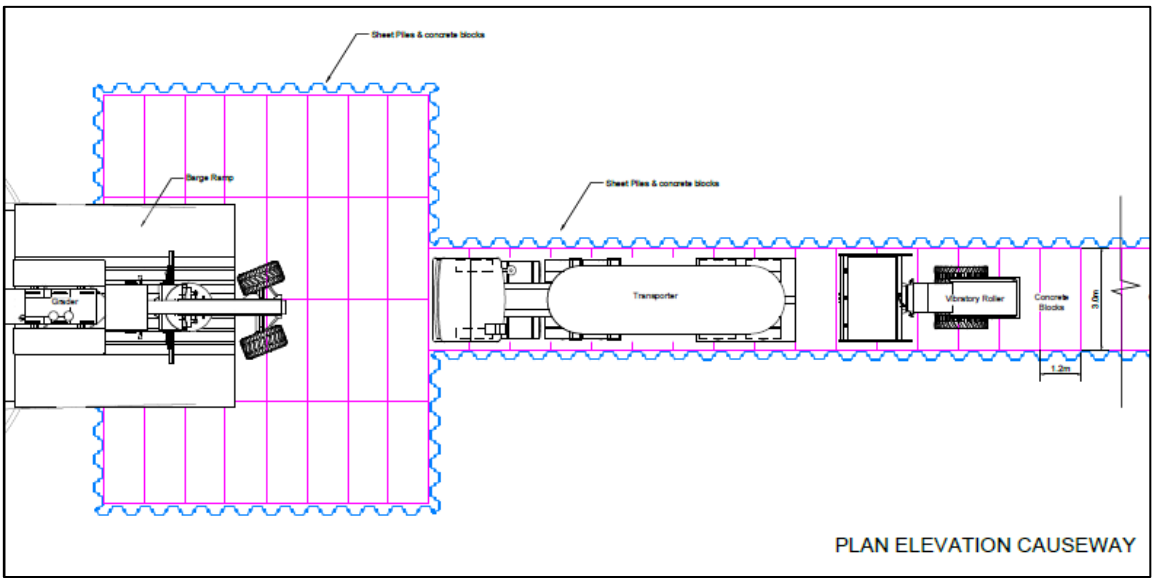

Figure 6: Temporary Causeway Design Details – Plan View

Continuing from the barge landing platform towards the beach, the causeway construction progresses with the driving of outside perimeter sheet-piles into the makatea reef flat, ensuring a minimum embedment of 1m for stability. Bidim geofabrics are again employed to reinforce the base and sides of each causeway section. Granular fill is then compacted and leveled to the specified height, facilitating the even placement of concrete blocks.

In areas where channel and lagoon circulation is necessary, 450mm culverts are installed perpendicular to the causeway base, positioned above the reef flat. A minimum 200mm granular fill overlay is applied between the culvert and the concrete block, ensuring structural integrity and functionality.

Encountering makatea outcrops along the causeway alignment requires careful removal and grading to appropriate levels, maintaining a gentle gradient from the barge platform to the existing Tukao Harbour concrete driveway.

Post-project measures include the dismantling of the causeway once the runway project is completed. This involves the removal of all concrete blocks and sheet piles, with any salvageable materials, including the 450mm culverts, preserved for potential future use. Any remaining granular fill is responsibly managed, with efforts made to stockpile it on the beach, minimizing environmental impact.

Temporary Steel Sheet-Pile & Beach fill Causeway

The proposal to use locally sourced beach gravel for the temporary causeway offers sustainability benefits by reducing reliance on imported materials. However, it raises environmental concerns, particularly regarding habitat disturbance and potential lagoon sedimentation during and after sheet pile removal. Following the methodology of the Temporary Steel Sheet-Pile & Concrete Block Causeway, this proposal substitutes concrete blocks with beach gravel quarried from the island itself, aligning with sustainable practices and minimizing the need for external resources. The gravel is transported to the construction site and placed between sheet piles, compacted to meet design specifications, ensuring structural integrity.

While beach gravel use offers functional and environmental advantages, challenges and potential impacts arise, especially during sheet pile removal. These include habitat disturbance during quarrying, lagoon sedimentation as backfilled material settles, and coastal dynamics alteration. To address these, careful quarrying planning will prioritize ecologically sensitive areas, implementing measures to minimize habitat disruption. Sediment control methods like silt curtains and sedimentation basins will prevent excessive lagoon sedimentation during construction and sheet pile removal. Post-construction monitoring and maintenance programs will assess and mitigate environmental impacts over time.

Temporary Sheet pile & concrete block Causeway with DURA-MAT inter-connected Roadway.

A sheet-piled platform, linked to a 40-meter sheet-pile lined causeway, will be erected along the coral shelf's edge, following the outlined methodology above. This platform and causeway combination utilizes beach gravel and concrete blocks for infilling. Subsequently, the construction transitions into the remaining 120-meter stretch leading to shore, composed of composite mats. These mats are supported with sandbags to fill coral pools on the reef flat, ensuring the mats remain traversable even during low tide periods.

The composite mats are buoyant and are trafficable up to loads of 20Tn allowing land access during high tide. However, ICI prefers the offloading of plant and materials during low tide periods as the risk of damage to plant is greatly reduced. The option to offload plant and materials during high tide periods was required to ensure program milestones are met. Temporary DURA-MAT floating roadway will follow similar alignments as the Sheet-Pile & Concrete Block causeway. This innovative approach utilizes inter-connected HDPE modular floating mats, offering flexibility and resilience to changing tide conditions and ensuring seamless operations for plant and material offloading.

Figure 7: DURA-MATS used in USA around 2013 to access across tidal lakes.

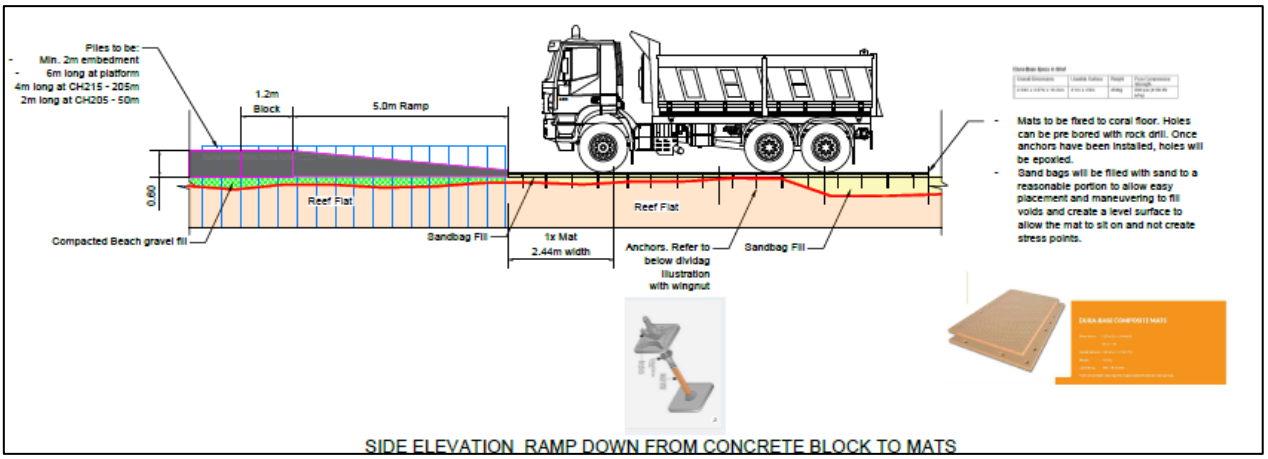

Figure 8: DURA-MATS, Sheet Piles & Concrete Block Causeway Design Details – Side Elevation

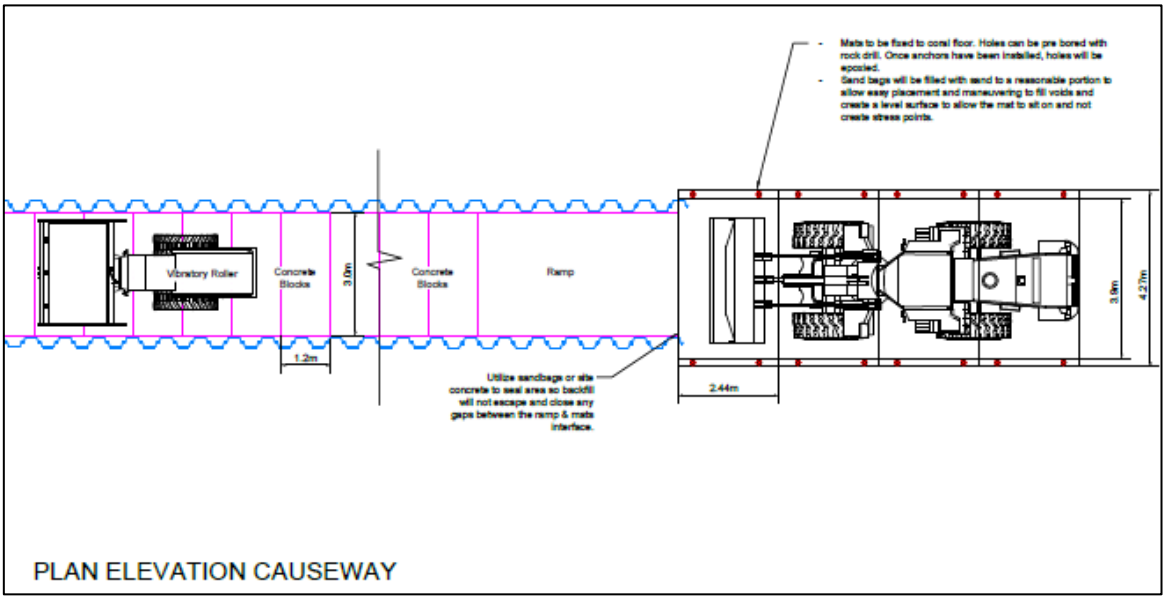

Figure 9: DURA-MATS, Sheet Piles & Concrete Block Hybrid Causeway Design Details – Plan View

The DURA-MATS are light weight, made specifically for vehicle access across swamp and water body areas, with durable strength, anti-skid and wide surface area, the DURA-MATS can cater for heavy plant machinery from *Class D* = 8 tonne capacity to *Class G* = 30 tonne capacity.

Anchor systems will be required to keep the mats submerged and locked in the same location, allowing the mats to rise and fall with the tides.

For detailed installation methodology of the pile causeway, please refer to the concepts outlined above.

The DURA-MATS can easily be dismantled and retracted, in a shorter time, compared to the above temporary causeway method. However, the mats will sink when heavy plant machinery are driven across, with inferred in excess of 10 tonne drives across the mats, sinking some 300mm to 500mm below the water level, but the heavy plant machinery will not sink any further. Refer to Figure 7, the crane wheels have sunk but the crane stays buoyant.

Beach Gravel Fill

During a recent trip to Manihiki for discussions with the Island Council regarding the proposed design updates detailed in this document, the Council identified a suitable site for quarrying the necessary beach gravel fill. Initially, ICI anticipated that finding suitable quarry sites would be a logistical challenge. However, through further consultation with the Council, a potential site in Tauhunu was proposed for inspection.

Figure 10: Proposed Quarry Site

ICI members conducted a preliminary inspection of the Tauhunu site, evaluating its size, available material, and location. They confirmed that the site could produce the required quantity of fill. The schematics below represent the proposed quarrying activities. Note that these are not based on surveyed data and are intended only to provide an understanding of the proposed works.

The site spans roughly 200 meters along the top of the shore banks, with an average width of 10 meters. The proposal is to quarry to a maximum depth of 1.0 meter to produce the required 200m³ of beach gravel. The gravel must consist of a mixture of rounded cobbles, avoiding jagged or fine materials. Not the entire site will be quarried; instead, selective extraction will be carried out in areas with suitable material until the required quota is met.

Figure 11: Extent of Quarry Works

Quarrying will take place along the top edge of the shoreline. ICI will ensure that the excavation does not leave any excessive holes. The depth of excavation will be managed to prevent any abrupt drop-offs at the excavated site. Any unusable fill material will be returned and the excavation area will be smoothed to ensure a seamless transition along the shoreline.

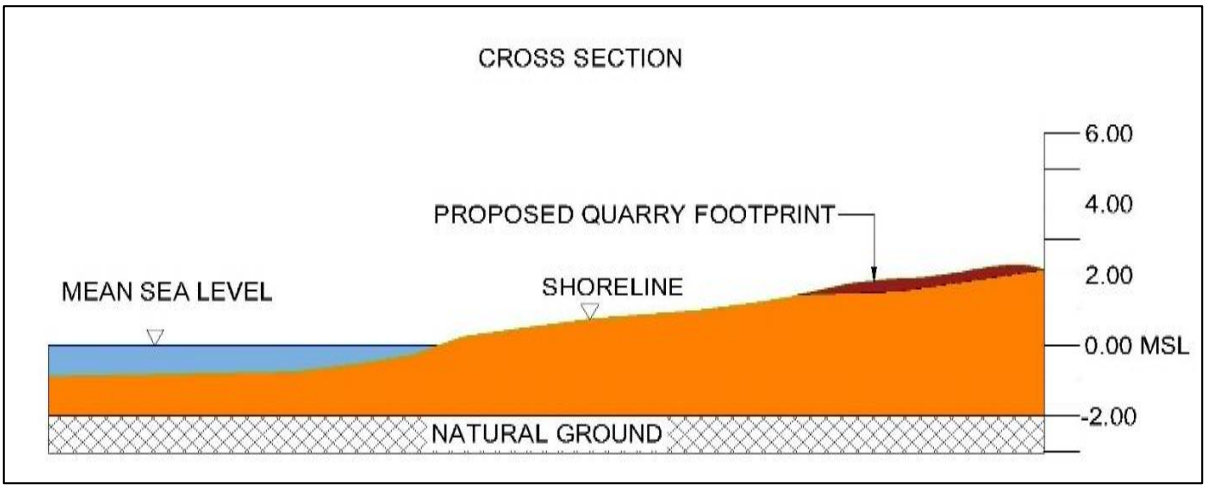

Figure 12: Typical Cross Section for Proposed Quarry

The Island Council has agreed to utilize this site for mining the proposed causeway fill, if needed, and for ICI to manage the logistics of quarrying and transporting the fill from the Tauhunu site to Tukao Harbor. ICI will continue with stakeholder engagement, environmental assessments, and adherence to best practices in construction and environmental management to effectively manage this process.

6.2 Emergency Medical Evacuation Flight

The runway physical works is scheduled to commence from January 2025 and completed by June 2025, the bulk of the physical works will involve the quarry of coral rock beneath and within the existing Airport boundary, which will be used to produce aggregates that will help form the runway pavement foundation layers.

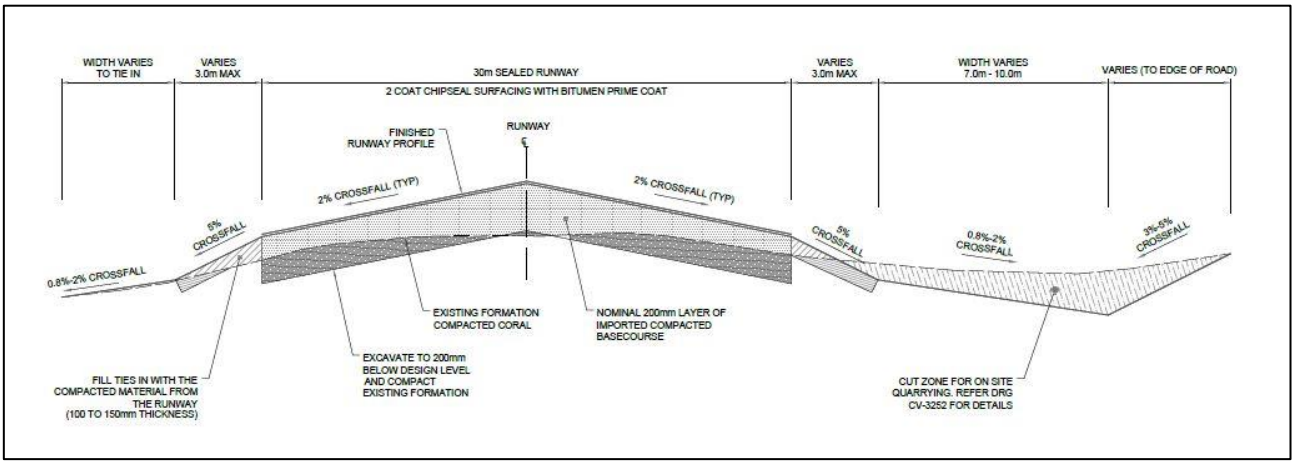

Figure 13: Typical Runway and Shape Correction Section

Figure 14: Quarry operations along the Aitutaki Runway 2004 (source AACI)

During the runway construction phase, regular domestic flights to Manihiki will be suspended, but planned charter flights for the project will occur before and after the runway closure. The runway will be closed for approximately two months for uninterrupted quarrying and preparation works.

In an emergency medical evacuation, all construction activities will halt immediately, and an emergency 1.2km by 30m wide runway will be prepared by compacting it to suitable standards and clearing all obstacles. This runway will be prepared along the proposed runway footprint. The ICI on-site Project Manager will oversee quarrying and runway preparation to ensure rapid establishment of an emergency runway, with daily monitoring to maintain readiness. Inspections and maintenance will ensure safety standards for charter flights. An immediate response protocol will halt construction upon emergency notification, with trained personnel and allocated resources ready for quick runway preparation.

Clear communication channels between Te Marae Ora (Ministry of Health), Air Rarotonga (Local Airline and the ICI on site Project Manager during emergencies will need be established. Construction will resume once Te Marae Ora confirms no further medevac is required.

Figure 15: Grading the Aitutaki Runway 2004 (Source AACI)

6.3 OLS Vegetation Clearing - Manihiki Airport Civil Aviation Certification

Obstacle Limitation Surfaces (OLS) define a series of surfaces around the runway that must be clear of obstacles to ensure the safe operation of aircraft. The primary OLS surfaces are the runway end approach and departure surfaces which are required to be clear down to a gradient of 2%.

The transitional surfaces along the sides of the runway rise at a gradient of 20.0% (1:5) starting from the edge of the 80-meter runway strip. These surfaces are relative to the runway centreline, providing approximately 2 meters of vertical clearance from the edge of the strip. Currently, a significant amount of mature tree growth penetrates the western side of the runway's transitional surfaces, covering an estimated 16 hectares. This will necessitate survey and groundtruthing to confirm the extent of clearance works.

The control of obstacles will be implemented in accordance with NZ CAA AC139-10 Control of Obstacles. All trees that currently infringe the approach and transitional surfaces shall be removed or topped as necessary to provide a clear obstacle surface.

ICI recent discussions with Ministry of Transport (MoT) propose to issue a *Notice to Airmen* (NOTAM) which defines the location and height of any infringement, in this case, Tukao housing/ residential buildings that exceed the OLS limitations, special beacons will be installed on the identified structures, the existing tall power poles will be removed and/or replaced with shorter poles, pending approval from MoT.

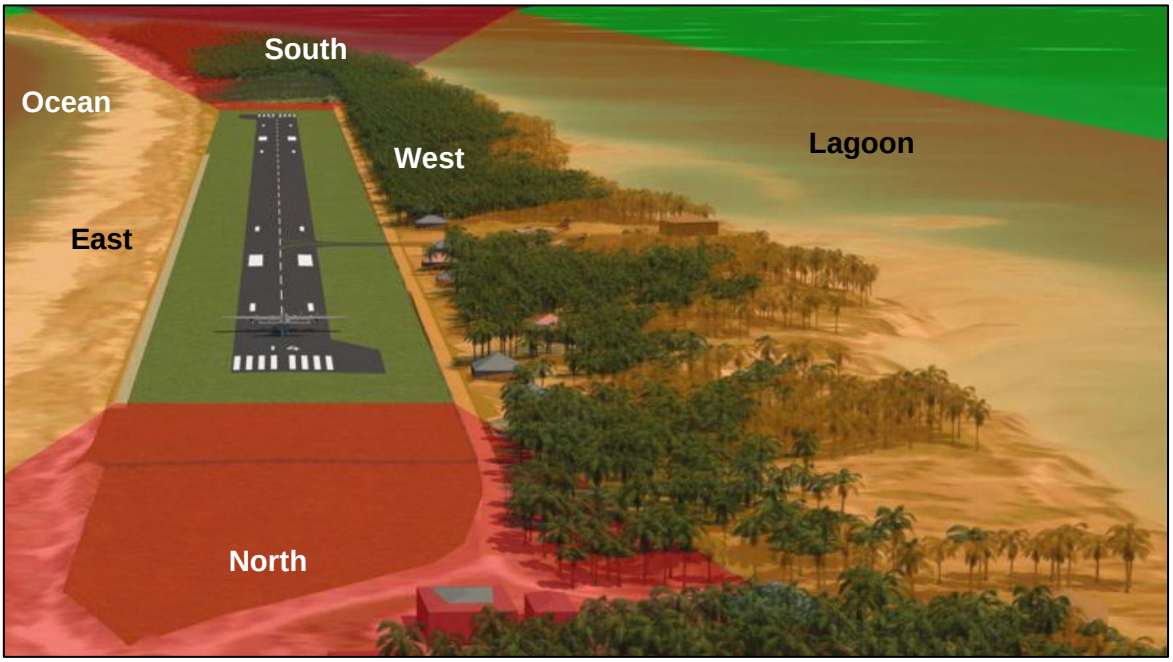

Figure 16: 3D render overview for scope of OLS clearance (Source AECOM 2022 Detailed Design)

Approach/Take-of slope at 1:50 (2%)

Transitional side slope at 1:5 (20%)

Reference to Figure 9; OLS intrusions are observed at the northern, southern and western ends of the airfield. Tall trees and buildings not shaded in red or orange are penetrating through the OLS surface.

All trees that exceed the OLS clearance area will be removed by ICI.

Figure 17: Aerial view of Manihiki Airport 2022 (source ICI PPP division)

Vegetation Clearing Methodology

ICI project team will visit Manihiki (end of May 2024) to conduct survey work in order to verify OLS clearance heights for both structures and vegetation, to ground-truth data from previous survey visits and firm up logistics with regards to the intended vegetation clearance program.

The outcome of the planned survey will identify tall trees and mark out the OLS clearance extent, where tall trees will need to be felled. All works will commenced from the airfield runway, clearing in gradual 30m wide sections parallel to the runway perimeter boundary.

Once trees are felled, the coconut fronds and trunks will be cut and stockpiled separately, away from the clearance work area. Where large exposed ground is observed following dense tree removal, the fronds can be used to temporary cover these areas to reduce sediment erosion especially during heavy rainfall events. Ideally *mulch* generated from the cleared trees is another useful alternative, to help promote grass growth. Low lying shrubs and short trees (beneath the OLS limit) will be retained.

The coconut trunks can be used for a variety of community projects and activities, such as:

- The tree trunks provide suitable edging for home garden, raised beds.
- Tree trunks can be used as fence poles; for livestock, such as pig pens, or keeping animals out of the home garden.
- Slide rails for mooring boats up along the beaches.

The coconuts from the felled trees, will also be stockpiled separately, these will be shared with the community. Where storage space is possible, ICI chartered returned shipping vessels can be filled to ship drinking coconuts back to Rarotonga and/or other islands, to help generate revenue for Manihiki.

Coconut fronds observed to be useful for weaving will also be stockpiled separately, and will accompany the drinking coconuts shipping to Rarotonga and/or other islands.

Where excess cleared vegetation have no further use, these will be stockpiled, dried and systematically burned, away from any residential or fire risks area. ICI project team is to monitor all stockpile fires with appropriate contingency plans.

6.4 Safe and Secured Project Laydown Site(s)

The Project Laydown Site(s), consists of the project offices, storage areas, stockpile site(s) and associated facilities. The location of the laydown site(s) comprise:

I. Manihiki Airport Terminal – Main Site Compound.
II. Tukao Airport Lagoon Jetty – Primary Desalination Site
III. Tukao Harbour – Enabling Works Construction Material Stockpile Site

Manihiki Airport Terminal – Main Site Compound

The existing Manihiki Airport Terminal and surrounding grounds, will be the main project site laydown compound. The cleared grounds offer ample space for movement and parking of heavy plant machinery.

General parking is designated adjacent to the Airport Terminal building. The existing terminal building will serve as a place for daily project briefings and general discussions. The terminal has toilet facilities and power supply.

Project site office and aggregate lab testing, will be mobilise to the site comprising of a 40ft shipping container. The container will be placed along the old building concrete slab.

The mechanic's workshop, comprising of two 20ft shipping containers, will be mobilised to the laydown compound, utilising an old concrete slab, the 20ft container will be spaced some 4m apart to facilitate a temporary shelter, for mechanical repairs and maintenance.

Several fuel containers will be transported to the laydown site, and placed at a designated cordoned off area. In addition, Bitumen drums and containers will also be transported to the laydown site, and placed

adjacent to the fuel containers. At a later stage, runway pavement sealing chips will be imported from Rarotonga, transported and temporary stockpiled at the laydown area, in preparation for the sealing work planned for April/May 2025.

A mobile water-supply desalination unit (20ft container size units) will be mobilised to the laydown site, and positioned on raised footings adjacent to the existing Tukao Airport lagoon jetty. The desalination unit will source seawater some 150m in the lagoon, and treat to appropriate potable water quality standards. The project will produce and store potable utilizing existing water tanks within the laydown area, namely the 60KL water tank at the old hanger and 10KL water tank at the former airport terminal building.

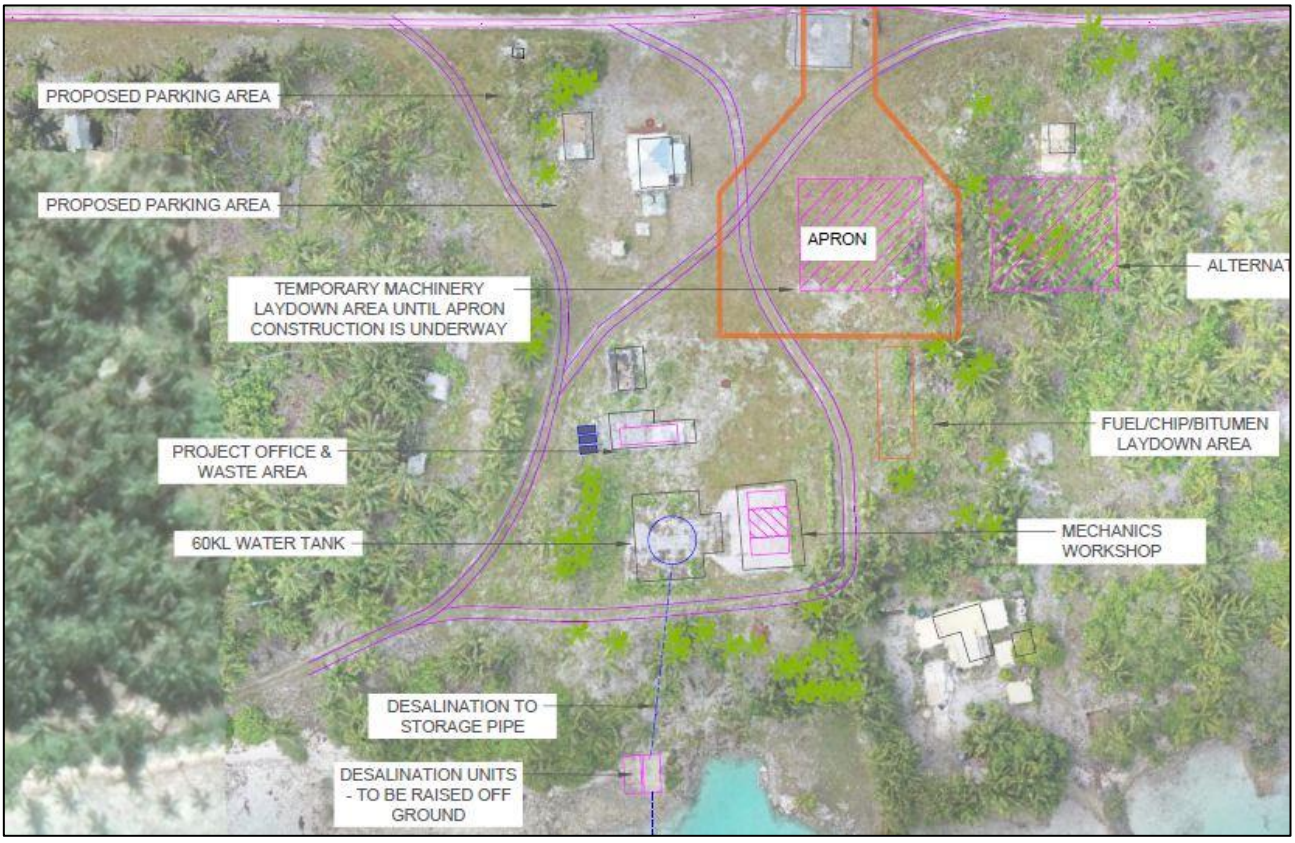

Figure 18: ICI Main Project Site Laydown Compound

The ICI project team, working closely with the Manihiki Island Government, will ensure 24hr security and monitoring for the laydown area, ensuring that there is someone designated to look after the main compound.

6.5 Desalination Unit

Desalination plant to be installed at proposed location. The Desalination plant was captured by Michiel Jonker, September 2022, Environment Impact Assessment Manihiki Airport Improvements, AECOM New Zealand Limited. Report will appended.

Location and Rationale

As illustrated in Figure 15, the desalination plant will be installed at the Airport Lagoon Jetty. This site was selected due to its proximity to the construction base and the calm waters in the lagoon, which provide a stable environment for the desalination unit. Initial proposals considered placing the desalination unit at the northeastern end of the runway, with inlet and outlet pipes extending into the ocean. However, this location posed risks due to intense wave action, which could cause significant damage to the unit and pipes. Therefore, the current site was chosen to balance operational efficiency and equipment safety.

Proposed System Specifications

ICI proposes installing an industrial reverse osmosis (RO) system equipped with pressure vessels, pumps, bearings, engines, motors, and a programmable logic controller (PLC). The system is designed for continuous operation, high-quality output, and minimal maintenance requirements. The RO system does not require acid regeneration, thereby saving recoil and cleaning water. It is designed to produce ultrapure water with a maximum yield of 30%, reducing brine concentration and minimizing environmental impact when discharged back into the water. The salinity of the potable water produced will be less than 300 mg/L, which is suitable for drinking.

Site Conditions

- **Salinity of seawater:** 30,000 – 50,000 ppm
- **Temperature of seawater:** 20 – 25°C (can be higher in shallow lagoon areas).
- **Unit to be located at area away from high tide mark**

Figure 19: Example of Containerised desalination unit at a higher ground level

RO Unit Specifications

- Produce 3.5m3 of potable water per hour.
- Water to be stored in storage tanks near the plant.
- Portable generators will accompany the RO unit due to the remoteness from mains power supply making it self-reliant.
- **Additional Installation Notes:**
    - The suction hose will be anchored to the coral to prevent interference or damage from passing boats.
    - The suction strainer will be mounted with floats, anchored, and placed approximately 1 meter above the lagoon base.
    - The site is currently used by boat travelers between Tauhunu and Tukao, particularly those traveling to and from the airport.

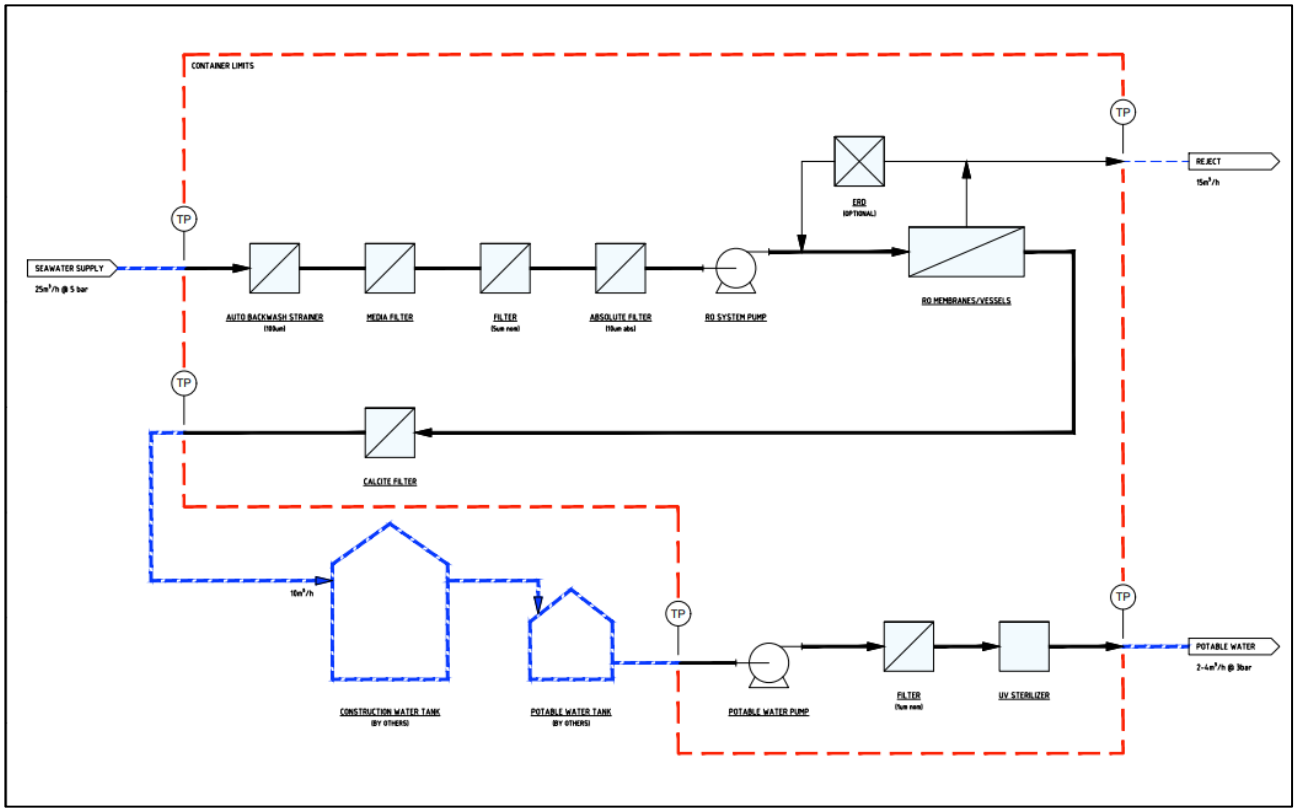

Figure 20: Example of Reverse Osmosis Process

Methodology for Installation

1. **Site Assessment and Preparation:** ICI will conduct a detailed site assessment to confirm the suitability of the location, ensuring accessibility to seawater sources and proximity to water usage points. Clearing any obstructions and preparing a stable foundation for the desalination units will be among the first tasks.
2. **Installation of Desalination Units:** ICI project team will begin by installing pre-treatment systems, such as intake structures, screens, and filtration units, to remove seawater impurities. The main desalination units will then be installed according to the engineered design, ensuring proper orientation and spacing with the assistance of our plant fabricator. The desalination plant technician and project mechanic will connect piping, valves, and electrical components to ensure operational integrity, followed by initial testing on each unit and subsystem to verify functionality and address any issues.
3. **Commissioning and Testing:** ICI and the unit technician will perform comprehensive testing to ensure the system meets performance and quality standards. This includes testing for water quality, flow rates, pressure levels, and energy consumption.
4. **Operation and Maintenance:** Regular monitoring and maintenance procedures will be established. Continuous monitoring of energy consumption and water quality will enable be carried out to identify and rectify any performance deviations promptly.
5. **Environmental and Regulatory Compliance:** Compliance with environmental regulations for seawater intake and brine discharge will be undertaken and monitored. Measures such as intake screens and brine dispersion systems will be implemented to minimize environmental impact. Additionally, ICI will maintain documentation and fulfill reporting requirements mandated by regulatory authorities to uphold environmental and regulatory standards

7.0 Environmental Management Plan (EMP)

Purpose of this Plan

The purpose of the EMP is to provide for the protection of the environment and the community during the proposed works and to minimize potential adverse environmental, social and economic effects that cannot be avoided. This EMP will be used by the ICI project team to prepare a detailed Construction EMP, which will be used throughout the proposed works.

Environmental objective

To undertake the proposed works in compliance with the conditions of approval, in keeping with the principles of the Environment Act and avoiding wherever possible any significant negative environmental impacts, whether covered by plans and approvals, or not.

Environmental policies

General environmental principles shall be:

- Construction of a temporary or permanent barge landing structure at the Tukao Harbour; will not commence until the EIA and CEMP has been approved.
- Vegetation clearance along the northern, eastern and southern side of the airfield; will not commence until the EIA and CEMP has been approved.
- All works will be undertaken in compliance with all current legislation and any conditions imposed on the EIA Approval.
- All works will utilize the best practicable options to ensure adverse environmental effects are avoided, remedied or mitigated.
- Social disturbance as a result of the project will be minimized as far as practicable.
- Areas outside the bounds of the permanent works, which were developed or altered in any way, shall be reinstated to the condition as at the commencement of the project.

Environmental Issue	Mitigation Measures	Locations	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Turbidity from reef flat activities; pile driving, channel extension work	Good practice when working in coastal waters, is the provision for use of turbidity curtains	Tukao Harbour area	Enabling works, September to November 2024	ICI Project Team	Visual inspection of turbidity, sediment plumes in the harbour	Daily observations	ICI Project Supervisor	ICI Project Manager
Excessive noise during pile driving and channel extension work	All personal to wear appropriate PPE, including ear muffs. All works to be carried out from 8am to 4pm,	Tukao Harbour area	Enabling works, September to November 2024	ICI Project Team	Noise levels, complaints received	Daily observations	ICI Project Supervisor	ICI Project Manager
Spills of fuels and other hazardous materials	All hazardous materials required for plant machinery operations to be kept at the laydown area, away from the coastal environment. Spill kits to be available	Tukao Harbour area	Enabling works, September to November 2024	ICI Project Team	Leaks and spillage	Daily inspections	ICI Project Supervisor	ICI Project Manager
Disturbance to harbour users	Locational sequence of works Ongoing communications with wharf users, provide works schedule Implement onsite TMP	Tukao Harbour area	Enabling works, September to November 2024	ICI Project Team	Complaints received	Daily observations	ICI Project Supervisor	ICI Project Manager

Environmental Issue	Mitigation Measures	Locations	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Health and Safety concerns	Implementation of Health & Safety plans Work closely with MIG to raise awareness with the community Place caution signs at appropriate places	Tukao Harbour area	Enabling works, September to November 2024	ICI Project Team	Compliance with H&S Plan, accidents and incidences complaints	Ongoing throughout project	ICI Project Supervisor	ICI Project Manager
Storage of Hazardous materials; fuel and bitumen	All hazardous materials will be store at the Main Compound Laydown area	Manihiki Airport Terminal – Main Compound Site	Runway physical works, January to June 2025	ICI Project Team	Compliance with H&S Plan, accidents and incidences complaints	Ongoing throughout project	ICI Project Supervisor	ICI Project Manager
Medical Evacuation (medevac) emergency flights	ICI project team will develop and implement contingency plans, to ensure a temporary runway is completed within 24 hours	Manihiki Airport Runway (Airfield)	Runway physical works, January to June 2025	ICI Project Team	Upon request from Te Marae Ora (MOH)	Ongoing throughout project, when required	ICI Project Supervisor	ICI Project Manager
OLS Vegetation clearance (only tall trees)	Tall trees and potential trees observed to be encroaching into the OLS limits will be removed, low lying shrubs will be retained.	Properties adjacent to the Manihiki Airfield	Runway physical works, January to February 2025	ICI Project Team	Weekly briefing and progress reports	Daily observations	ICI Project Supervisor	ICI Project Manager

Environmental Issue	Mitigation Measures	Locations	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
OLS Vegetation clearance (open exposed ground areas)	Utilise felled coconut tree fronds or mulch to cover exposed areas, to minimise surface scouring via heavy rainfall	Properties adjacent to the Manihiki Airfield	Runway physical works, January to February 2025	ICI Project Team	Weekly briefing and progress reports	Daily observations	ICI Project Supervisor	ICI Project Manager
OLS Vegetation clearance (vulnerable high seas areas)	Maintain a minimum 10m wide vegetation buffer along the foreshore, encourage to plant suitable riparian vegetation, once established then the tall trees can be cut down, alternative hard measures	Properties adjacent to the Manihiki Airfield, and situated along the foreshore	Runway physical works, January to February 2025	ICI Project Team	Weekly briefing and progress reports	Daily observations	ICI Project Supervisor	ICI Project Manager
Coral Mining or Tukao Fill Shoreline Erosion	The depth of excavation will be closely monitored, ensuring it does not exceed a maximum depth of 1 meter. Any unspecified fill material will be replaced, and the shoreline will be re-formed to eliminate any cavities, ensuring a smooth and seamless shoreline transition	Tuahunu properties adjacent to the shore	Enabling works, September to November 2024	ICI Project Team	Weekly briefing and progress reports	Daily observations	ICI Project Supervisor	ICI Project Manager

8.0 Conclusion and Recommendation

8.1 Conclusion

This EIA Variation Report aims to provide addendum information to the existing report titled "Environmental Impact Assessment – Manihiki Airport Improvement Report" dated 21 September 2022, prepared by AECOM New Zealand Limited (AECOM).

The objective of this variation report is to provide support to the Manihiki Airport Improvement Project.

- Construction of a temporary or permanent barge landing structure at the Tukao Harbour; to support the mobilization of heavy plant machinery, equipment, project site office, fuel, bitumen, sealing chips and all other supporting materials, to support the project.
- Vegetation clearance along the northern, eastern and southern side of the airfield; to improve aircraft safety for the improved runway, and attain Civil Aviation certification.
- To facilitate for medical evacuation flights, throughout the runway physical works phase.
- To ensure a safe and efficient main project compound laydown site, away from natural hazards such as high seas, close proximity to the runway and cordoned off from the general public.
- The project will produce and used its own water supply via desalination, without impacting the community water reservoirs.

The ICI Project Team will provide a; Construction Environmental Management Plan, Traffic Management Plan and Health & Safety Management Plan. It is considered that with the implementation of these Plans, the potential adverse effects of the proposal on the environment, social values and the community, will not be significant.

Similar works have occurred at the site in the past, with the construction of the original channel in the 1980's, and the side channel, turning basin and wharf in 2000/2001

Consultations has been undertaken with key stakeholders; Manihiki Island Government, Ministry of Transport, Airport Authority Cook Islands, Air Raro, other government ministries and the Manihiki Community. Concerns and issues raised have been addressed in this Report, where relevant. These groups will continue to be kept informed throughout the construction duration.

8.2 Recommendations

The following recommendations are based on mitigation measures:

I. The overall construction works shall be monitored by ICI project team, comprising appropriately experienced and qualified Civil Engineer, Site Supervisors, Operators and Technicians.

II. Updated technical plans and drawings shall be provided to NES before construction commences.

III. On completion of the project, the Project Manager shall provide a statement or certificate of completion, in addition to the completion report. A copy of the statement or certificate shall be forward to NES within two months of construction completion.

IV. The adopted barge landing methodology, will aim to minimize damage to the surrounding Tukao foreshore and coastal marine area.

V. All machinery shall be operated in a manner that ensures spillage of fuel, oil and other contaminants are prevented. No refuelling or lubrication activities to take place in the marine environment, this all should be carried out at the main compound laydown area.

VI. Construction Environmental Management Plan shall include an Erosion and Sediment Control Plan. This plan shall be provided to NES for approval.

VII. The Project Manager and Site Supervisor will maintain on-going communications with the Manihiki Island Government, community leaders and other key stakeholders throughout the construction period.

9.0 References

Michiel Jonker, September 2022, Environment Impact Assessment Manihiki Airport Improvements, AECOM New Zealand Limited

ICI PPP Division, October 2022, EIA Variation Report for Tukao Harbour Landing Upgrade, to support Manihiki Airport Improvement Project, Infrastructure Cook Islands

10.0 Appendices

- Manihiki Airport Improvement Design – Contractor Laydown Area
- Manihiki Airport Improvement Design – Runway Physical Works
- Tukao Harbour Enabling Works – Temporary Barge Landing
- Manihiki Airport Improvement – OLS Clearance
- EIA Variation Report for Tukao Harbor Landing
- EIA Manihiki Airport Improvements