



**GOVERNMENT OF THE COOK ISLANDS
INFRASTRUCTURE COOK ISLAND**



**ENVIRONMENT IMPACT ASSESSMENT
EMPIRE BRIDGE REPLACEMENT**

**PROJECT: Bridges and Structures Asset Management & Improvement
Program
Project No. 10047**



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Infrastructure Cook Islands

REVISION HISTORY

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Document Acceptance

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Appendices

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- Appendix B – Final Project Design/Drawings
- Appendix C – Study Team & Contacts
- Appendix D – Beca Bridge Evaluation Report
- Appendix E – Geotechnical Report

DEFINITIONS AND LIST OF ABBREVIATIONS

Terms, abbreviations and acronyms	Meaning
CIG	Cook Islands Government
CIIC	Cook Islands Investment Cooperation
CIPS	Cook Island Police Services
EIA	Environment Impact Assessment
IC	Infrastructure Committee
ICI	Infrastructure Cook Islands
IUCG	Infrastructure & Utilities Coordination Group
MFEM	Ministry of Finance and Economic Management
NES	National Environment Services
TTV	To Tatou Vai (Water Supply Utility)
TAU	Te Aponga Uira (Power Supply Utility)
NSDP	National Sustainable Development Plan
NIIP	National Infrastructure Investment Plan
OPM	Office of the Prime Minister
PCC	Project Coordinating Committee
PM	Project Manager
RSC	Road Safety Committee
TC	Tender Committee
TOR	Terms of Reference
VCI	Vodafone Cook Islands (Communication Utility)

EXECUTIVE SUMMARY

Infrastructure Cook Islands is the agency responsible for the implementation of the 'Bridges and Structures Asset Management and Improvement Program', the Empire Bridge Replacement Project is a component of this program.

The environment performance objective of the project:

- Minimise disturbance to the existing Takuvaine Stream, the majority of the construction works will be on the side embankments and above the stream.
- Maintain natural stream flows at all times.
- Remove all debris and sediment accumulations from within the stream following demolishing works.
- Implement appropriate Sediment & Erosion Control measures to minimise contaminants entering the waterways.
- A safe working environment for all Stakeholders; Contractors and the Community.

This EIA Report has been prepared to seek full approval from the NES in adherence to the Environment Act 2003, for the replacement of the existing weakened Empire Bridge to that of a stronger, durable, safer and climate resilient bridge structure. The project will also include improving the Takuvaine Stream capacity with appropriate retaining walls to address ongoing erosion and slope instability issues along the stream embankment.

The Empire Bridge Replacement project is will be implemented in five stages.

- Stage 1 – Temporary Support to Existing Bridge Structure
- Stage 2 – Build Temporary Bridge Bypass, and transfer traffic onto temporary bridge
- Stage 3 – Demolish & Remove old bridge, Build New Bridge
- Stage 4 – Reinstate Traffic on New Bridge, Remove Temporary Bridge
- Stage 5 – Takuvaine Stream Works

A Technical Report for Stage 1 and Stage 2 was submitted to the National Environment Services (NES), which outlined that environment impacts are minor, as the bulk of the works will be carried out above and away from the Takuvaine Stream. Stages 1 & 2 has undergone a special REA sitting and gained Rarotonga Environment Authority Consent approval, on 24th August 2021.

This EIA Report has been prepared to address Stage 3, Stage 4 and Stage 5. Terms of Reference (TOR) for the EIA Report was received on 9th September 2021.

Practical Completion of The Empire Bridge Improvement is 8 months total.

- Stage 1 & 2: Build new temporary by-pass bridge, duration 2 months;
- Stage 3, 4 & 5: Demolish old bridge, build new bridge and stream works, 6 months

Landholdings Ltd is the main contractor to the project

1. INTRODUCTION

This EIA Report has been prepared to seek full approval from the NES in adherence to the Environment Act 2003, for the replacement of the existing weakened Empire Bridge to that of a stronger, durable, safer and climate resilient bridge structure.

1.1. Proposal Proponent

Infrastructure Cook Islands (ICI) is the overall project proponent. ICI is the executing agency for the implementation of the 'Bridges and Structures Asset Management and Improvement Program', in which 'The Empire Bridge Replacement project is a component of that program.

Landholdings Ltd has been awarded the construction of the Empire Bridge Replacement project. The management of the project will be the responsibility of ICI.

1.2. Proposal Description

The proposal is to replace the existing deteriorated Empire Bridge, with a safer, durable and climate resilient bridge structure. The project will also include improving the Takuvaine Stream capacity with appropriate retaining walls to address ongoing erosion and slope instability issues along the stream embankment.

The Empire Bridge Replacement project is will be implemented in five stages.

- Stage 1 – Temporary Support to Existing Bridge Structure
- Stage 2 – Build Temporary Bridge Bypass
- Stage 3 – Demolish & Remove old bridge, Build New Bridge
- Stage 4 – Reinstate Traffic on New Bridge, Remove Temporary Bridge
- Stage 5 – Takuvaine Stream Works

A Technical Report for Stage 1 and Stage 2 was submitted to the National Environment Services (NES), which outlined that environment impacts are minor, as the bulk of the works will be carried out above and away from the Takuvaine Stream. Stages 1 & 2 has undergone a special REA sitting and gained Rarotonga Environment Authority Consent approval, on 24th August 2021.

This EIA Report has been prepared to address Stage 3, Stage 4 and Stage 5. Terms of Reference (TOR) for the EIA Report was received on 9th September 2021.

In 2019, ICI engaged Beca Ltd to undertake a Geotechnical Investigation at three existing Rarotonga *Ara-Tapu* (main road) bridge sites, namely; 1) Avatiu Punanganui Bridge, 2) Empire Bridge and 3) Sheraton Bridge. Beca Ltd was also engaged to provide the design for the new bridge and undertake structural bridge assessments on Rarotonga.

1.3. Proposal Objective and Scope

The overall objective of the Empire Bridge Replacement Project is to provide for a safer, durable, climate resilient bridge and road infrastructure. This will contribute to continued economic growth and improved well-being of the population.

In 2013, Government made a commitment to rectify issues and allocate funding to address bridges and drainage improvement on Rarotonga, the 'Bridges and Structures Asset Management & Improvement Program' is an outcome of this obligation.

The Empire Bridge Replacement project is captured in the 2015 to 2020 Cook Islands National Infrastructure Investment Plan (NIIP), this project aligns to the NIIP projected for construction implementation period of 2021 to 2023.

The Empire Bridge Replacement project is further captured in the new updated 2021 Cook Islands NIIP.

The specific objectives of the proposed project include:

- Provide for a temporary supplementary access road and bridge, to maintain dual traffic flow at the Empire Bridge location during bridge construction.
- Isolate the existing Empire Bridge away from general traffic and pedestrians, to facilitate; safe, secure, uninterrupted and well-managed construction site.
- Redesign and removal of the old bridge stream-center support column, replace with a 13m wide bridge span deck, to increase flow capacity and reduce potential flow blockages.
- The specified design life for the bridge is 100 years. All replaceable elements (service supports, barriers, etc.) have a minimum serviceable life of 25+ years prior to first major maintenance or replacement.
- Cater for the increase in traffic usage volume and increased traffic loadings (more heavy trucks and 40ft containers using the road)
- Stabilizing a combine total of 250m length of stream embankment, using Rock-Gabion walls and Steel Sheet Pile walls at vulnerable places along the Takuvaine Stream.

Project Schedule

Practical Completion of The Empire Bridge Improvement is **8 months total**.

- Stage 1 & 2: Build new temporary by-pass bridge, duration 2 months;
- Stage 3, 4 & 5: Demolish old bridge, build new bridge and stream works, duration of 6 months.

Empire Bridge Structural Assessment

Beca Ltd recently undertook assessment of bridges and drainage structures in Rarotonga, as part of ICI 'Bridges and Drains Asset Management Forwards-Work Program'.

The Empire Bridge was assessed on 13th August 2021, the outcome of the assessment confirmed that condition of the bridge structure is 'critical' and that urgent strengthening and/or replacement of arches and damaged deck extension beams is recommended. The Beca Bridge Special Inspection Report is appended to this EIA report.



Figure 1 Extensive spalling of concrete arches including concrete cover (August 2021 Inspection)

Emergency Traffic Management Plan

ICI implemented an Emergency Traffic Management Plan on 13th August 2021, in response to the Bridge Inspection Report, traffic movement across the bridge was reduced to a one-way single traffic alternating lane, in order to reduce and divert loading away from the bridge critical area.

Bridge Structure Bracing

The works approved under Stage 1, Landholdings Ltd completed installation of steel supporting bracing under the Empire Bridge, and the traffic was return to a two-way lane on 27th August 2021.



Figure 2 Temporary steel bracing under the Empire Bridge (August 2021)

Alternative

The Empire Bridge is an important transport access road link in the Avarua Township, which is able to facilitate for all vehicles and pedestrians across the Takuvaine Stream. The Takuvaine Ara Metua (Back Road) bridge has limitations in terms of safe turning radius for large vehicles, especially trucks and buses. The connecting road through the Takamoā grounds is reserved for Takamoā CICC activities, it is not suited for general traffic due to the close proximity of monuments and buildings to the road. The Takamoā Road is alternatively used for emergency purposes.

‘Do-nothing’ is not a considered option, the recent structural assessment highlights its current critical condition and that the bridge is vulnerable to collapse, if strengthening works and/or bridge replacement is not undertaken. *Do-nothing* increases the safety risk to all road users and adjacent properties.

A collapse bridge would also increase flood and erosion damage in the area.

1.4. Environmental Impact Assessment Process

1.4.1. Methodology of the EIA

The Cook Islands Environment Act 2003 states – “No person shall undertake any activity which causes or is likely to cause significant environmental impacts except in accordance with a project permit issued under Section 36 of the Environment Act 2003”. A person who proposes to undertake an activity of the kind referred to above shall apply to the permitting authority, in this case, the Rarotonga Environmental Authority, for a permit in respect of the activity and in accordance with a Terms of Reference (TOR) prepared by the National Environment Service (‘NES’). Every application for a project permit shall be submitted to the NES and shall include an environmental impact assessment report meeting the requirements set out in the TOR.

The EIA process, which is outlined in the Environment Act 2003, involves three stages. These are described below.

1) Application Stage

The Application Stage has two parts. The first part is the preparation of the TOR and the second part is the acceptance of the permit application (in the form of an EIA report) by the NES.

The preparation of the TOR involves an initial presentation of the proposal by the applicant to the NES. The applicant outlines the need for the project, a preliminary discussion of the impacts of the project on the environment, proposed actions to mitigate potential adverse environmental effects and possible alternatives to the proposed activity. The NES determines whether or not the proposal will cause or is likely to cause significant environmental impact. If a permit is required TOR are prepared and provided to the applicant for the preparation of a permit application under Section 36 of the Environment Act 2003.

For the Empire Bridge Replacement Project this determination was made in early August 2021 after the Proponent for the project met with the NES. In consultation with the Environment Service Office at Aitutaki, the NES Compliance Division, the Senior Environment Officer, prepared and issued a TOR to the Proponent on the 9th September 2021 (Appendix A).

The EIA report has been prepared with on-going dialogue between Infrastructure Cook Islands (ICI) and the National Environment Service (NES), especially the NES Compliance Division, including face to face meetings on several occasions in August and September 2021.

2) Consultation Stage

In preparing the EIA report, the Infrastructure Cook Islands (ICI) consulted with key stakeholders and any other person who may have an interest in or be affected by the proposal. This included; aronga mana of the respected area, religious organisation, government agencies, commercial business in the area, neighbouring residents, community groups and the general public.

The purpose for this consultation was to inform stakeholders about the proposal, identify any particular uses or values of the project area that need to be considered in determining potential impacts and to gain valuable local knowledge to inform the environmental impact assessment.

The early consultation took place in November 2020, separately with each important stakeholders groups. Further consultation in December 2020, this was focused on identifying potential property areas that could provide assistance to the project and aid with the proposed project construction methodology.

The *first* Public Consultation took place on **16 March 2021** at the Sinai Hall, Avarua. ICI, Planning & Projects Division, assigned Project Manager presented:

- The project background and status of the Empire Bridge.
- Scope of works; concept design, tentative schedule and construction methodology.

- Impacts on surrounding areas; buildings, properties, traffic management plans, pedestrians, stream and lagoon/basin outlet.
- Outcomes of previous stakeholder consultations.

At the end of the presentation, ample time was given for question and answer session. The concerns raised were more directed towards the impacts on the surrounding areas, such as; properties, access to properties and traffic movement during the construction period.

The ICI presentation team highlighted that the project is currently in the tender process, once the construction contract is awarded to the successful contractor, a follow up Public Consultation will take place, where the engaged contractor will present their respective scope of works, schedule and methodology.

The *second* Public Consultation took place on **10th August 2021**, following the award of the construction contract to Landholdings Ltd. ICI Project Manager along with a representative from Landholdings Ltd presented an update on the project, which is relative to the five key stages above. Tentative project completion is 8 months total, starting in mid-August 2021. It was made clear at the meeting that once the project commences, Landholdings Ltd will have full authorisation of the construction area. To address potential traffic delays, Landholdings Ltd confirmed that full-time traffic controllers will be active on-site to implement the Traffic Management Plans (TMP) for both day operations and night operations.

One-page summary updates were made available to all present at the meeting.

Point of Contacts: Kiri Ataera is the Project Manager and point of contact for the project.

The Environment Act 2003, specifically Section 36 (5) requires the EIA Report be made available for public comment in the form of written submissions. The public submission period lasts 30 days from the date NES accepts and advertises the submitted EIA report.

At the conclusion of the 30 day consultation period, NES will give the applicant all written submissions received relevant to the proposed work, which are to be addressed and, as necessary, incorporated into the final EIA report to be submitted and considered by the Rarotonga Environment Authority (REA).

3) Approval Stage

Once the issues raised during the 30 day consultation period are incorporated into the EIA report (forming the Final Report) the EIA report is submitted to the Rarotonga Environment Authority (REA). NES will provide the Final EIA report to the REA Secretariat for consideration at their next meeting. This process has two possible outcomes:

1. The application is approved and the NES informs the applicant by letter and outlines the conditions of the approval; or,

2. If there are any issues that are not satisfactorily addressed, the EIA Report is referred back to the applicant to review and address any aspects that may have been insufficiently covered. The applicant can then re-submit the application to the REA for further consideration.

In the event of public feedback, applications can be declined or deferred until the issues raised have been properly addressed by the applicant.

1.4.2. Objective of the EIA

The objectives of this EIA are to:

- Ensure that possible adverse environmental, social and economic impacts are identified and mitigation measures determined and,
- Inform the public about the proposal.

1.4.3. Submissions

Refer to section 1.4.1.

1.5. Public Consultation Process

Refer to Section 1.4.1.

1.5.1. Relevant Legislation and Policy Requirement

A number of policies and legislature are relevant to this proposal, and these are discussed below.

Legislation

There are Acts and regulations, of relevance to the Empire Bridge Replacement Project.

In order of date enacted these include:

- Labour Ordinances 1964
- Transport Act 1966
- Immigrations Act 1971/72
- The Building Controls and Standards Act 1991
- Prevention of Marine Pollutions Act 1998
- Environment Act 2003
- Transport Amendment Act 2007
- Ministry of Health Act 2013
- Infrastructure Act 2019

The Environment Act 2003 (the 'Act') is the principal Act under which this EIA report is prepared. The process for the application of this Act is described in Section 1.4.1. The Act is also fundamental to the planning process and standards described below.

The Building Controls and Standards Act 1991, requires that prior to the construction of every building structure, a building permit must be obtained from the Building Controller appointed under this Act. In the case of the rebuilding the *removed* Canoe Shed, the applicant must satisfy the requirements of the Cook Islands Building Code 2019. The Cook Islands Building Code does not cover; bridges, large culverts and drainage structures.

Under the Prevention of Marine Pollutions Act 1998 it is an offence to discharge any oil or pollutant into the Cook Islands waters. In the case of this project, discharge whether accidental or not as a result of damage to the machinery used along and within the Takuvaine Stream is an offence under Section 3 of this Act. It is therefore very important that every precaution is taken to ensure all machinery used for the construction works are well maintained and that operators are properly trained and experienced to operate them.

The Infrastructure Act 2019, under Part three 'Infrastructure other than roads', the Infrastructure Managers, in this case, Infrastructure Cook Islands, is responsible for the maintenance of infrastructures that includes; repairing, replacing or upgrading infrastructure.

Transport Act 1966, Transport Amendment Act 2007, and Section 33(3) of the Ministry of Health Act 2013 ("the Acts") places the responsibility on the Ministry of Police, Ministry of Infrastructure, Ministry of Justice and the Ministry of Health to ensure the safety of all road users and to minimise the impact of road crashes or incidents.

Other legislation with which compliance may be required includes the Immigration Act 1971/72, for the importation of foreign workers with specialized skills for the works. Under the same requirement, any applicant who will bring in foreign workers to work on a project will be required to comply with the Labour Ordinances 1964. A Ministry of Internal Affairs contractual agreement between the employer and employee will need to be agreed.

Government Policies

The Government Policies that are directly relevant to this Report are the Cook Island Climate Change Policy and the Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation 2011-2015 (JNAP). Both policy documents are linked to the Cook Islands National Sustainable Development Plan. These policies are administered by the Office of the Prime Minister. Central to all three policies are the requirement that the Infrastructure Cook Islands consult with people on the issues that may directly affect them, and that any mitigating measures proposed, in order to climate proof the Project, must take every precautionary measure possible to prepare those that may be affected.

The **Cook Islands Road Safety 2016-2020 (Strategy)** is a five-year plan which outlines the road safety priorities and key activities that the road safety community will undertake in order to establish safer road systems in the Cook Islands. The Strategy is aligned to the five pillars of the Global Plan for the Decade of Action for Road Safety 2011-2020, as well as the action priorities identified in The World Health

Organization Regional Action Plan for Violence and Injury Prevention in the Western Pacific (2016-2020).

The Cook Islands Road Safety Strategy is purposely time-limited and places emphasises on clarifying the legislative framework which underpins all road safety measures including the identification of the main regulatory agencies and their functions; as well as initiating safer road system improvements. With emphasis to incorporate planning for a longer term Cook Islands Road Safety strategy. The Strategy aims to set the Cook Islands on a path towards safer road systems, and a sustainable social, cultural and economic future.

1.5.2. Planning Process and Standards

Empire Bridge Replacement

The design of the replacement bridge has been based on the following standards and guidelines:

- Design that utilises structural components that were previously developed for the Avatiu Bridge design be adopted for consistency between the two bridges and other bridges to be replaced on Rarotonga.
- NZ Transport Agency – Bridge Manual 3rd Edition, Amendment 3 (NZTABM)
- AS/NZS¹ 1170:2002 Structural Design Actions
- NZS 3404 Steel Structures Standard
- NZS 3101 Concrete Structures Standard

2. PROPOSAL NEED AND ALTERNATIVE

2.1. Proposal Justification

The Empire Bridge is located within Avarua, the Central-Business-District (CBD) of Rarotonga, the Empire Bridge is one of several key infrastructures that provides a vital transport access route for the CBD.

Economy/Tourism

Nearly 70% of the Cook Islands GDP² comes from Tourism, the Avarua CBD is the primary area for shopping, restaurants and cafes. The Empire Bridge provides vital access to these locations.

Cook Island Tourism promotes for a quality destination, poorly maintained infrastructure would affect tourism promotion to the Cook Islands.

The Empire Bridge Replacement Project will maintain tourism economic development in providing for an improved quality infrastructure.

Traffic Use

¹ Refers to Australia and New Zealand Standards

ICI Traffic Count Surveys undertaken in 2018 have indicated that on average less than 3,000 vehicles use the Ara-Tapu (Main Road) each day.

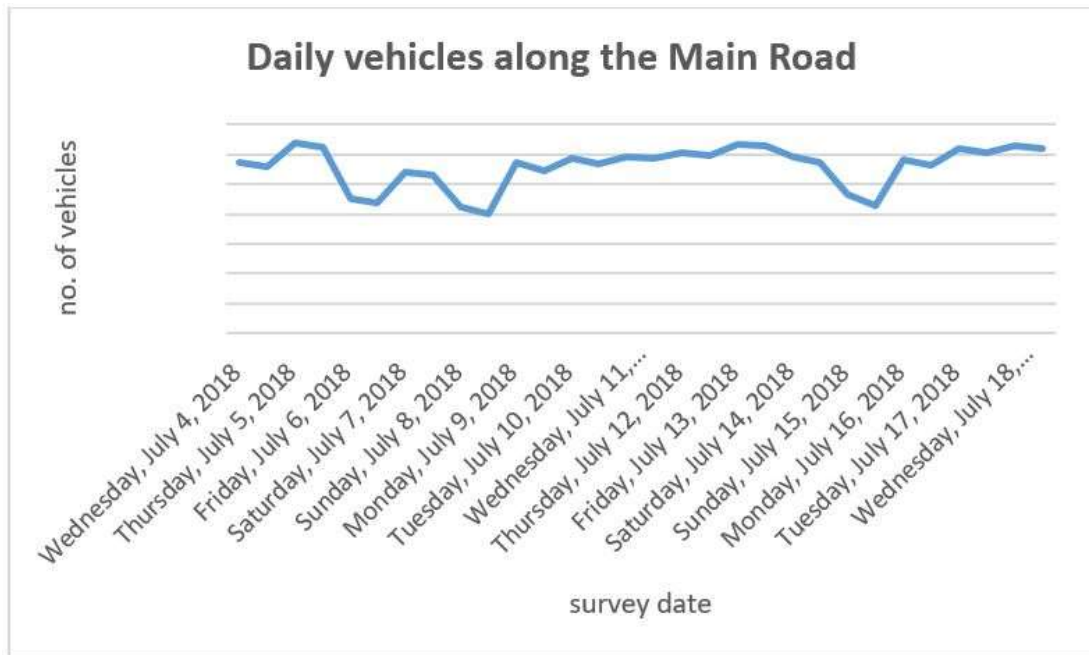


Figure 3 Graph showing the daily number of vehicles along the Main Road.

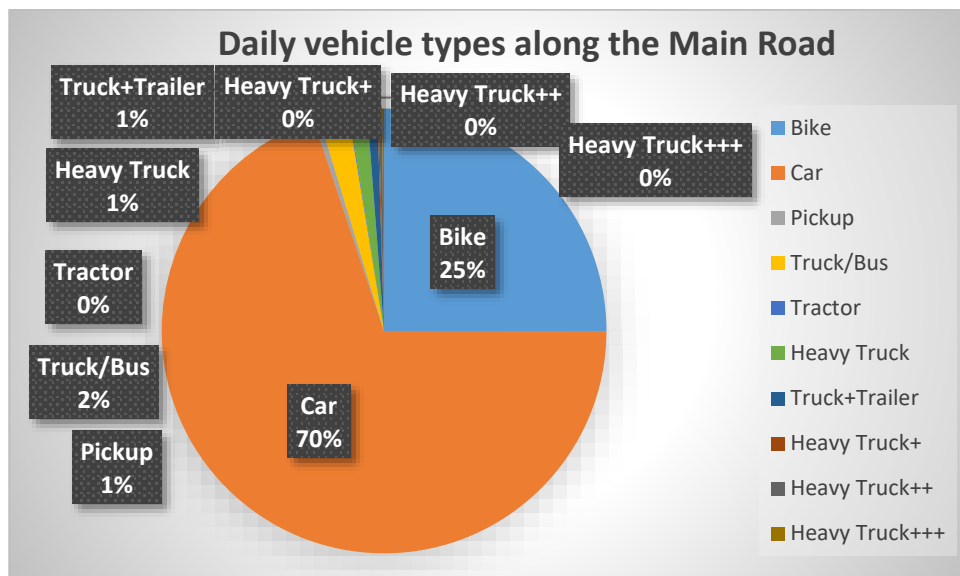


Figure 4 Graph showing the daily types of vehicles along the Main Road

The existing Empire Bridge has undergone ad hoc maintenance and repairs over the years, to cope with the increase in traffic vehicles. The ICI traffic count survey highlights that roads and bridges structures around Rarotonga will need to be able to cater for a minimum of 3,000 vehicles per day, and to facilitate for Heavy vehicles, such as truck and trailer that carries fully loaded 40-foot containers.

Bridge Structural Integrity

The ICI and Beca, Empire Bridge Special Inspection Report, has confirmed that the existing bridge structure is 'critical' and that urgent strengthening and/or replacement of archers and damaged deck extension beams is recommended.

At present the Empire Bridge is vulnerable to collapse if replacement work is not implemented. The collapse bridge will certainly impact economic and social values, such as; accident/loss of life, traffic detours/delays, and increased cost for emergency rebuild.

Road Safety Strategy

The Cook Islands Road Safety Strategy has two main goals:

1. Zero road incidents/crash related deaths;
2. A 50% reduction in the number of serious injuries by 2020;

The long term outcome is the 'Reduced social and economic burden of road incidents/crashes/crash-related injuries leading to premature deaths and disability'.

Of the five medium to short term outcomes, the Empire Bridge Replacement Project aligns to 'Safer Roads and Mobility'. Infrastructure Cook Islands is identified as one of the key agency responsible for delivering the strategy output 'Quality Road Designs'.

2.2. Alternatives to the Proposal

2.2.1. 'Do nothing' approach

Doing nothing is not considered appropriate. Without this project, the current deteriorated state of the bridge combined with the high traffic flow demand, influences the potential high probability risk of structural collapse, which would definitely affect economic, social and environmental values.

2.2.2. Alternative Location

The Empire Bridge is currently positioned along the legal *Ara-Tapu*, the Main Road land survey alignment. This *Main Road* area is highly developed, any propose bridge location along the Main Road would encroach into neighbouring occupied properties. The cost to place the bridge at a new location will significantly be higher compared to the bridge replacement proposal.

The existing Takuvaine *Ara Metua*, Back Road bridge, is an alternative to the Empire Bridge, however the current narrow road width and tight turning radius restricts large trucks and buses- using this transport route.

2.2.3. Alternative Design

The current new Empire Bridge Replacement design went through a rigorous planning, investigation and design process, this comprised:

- Obtained and review topographic surveys of the Empire Bridge and surrounding area, to establish general requirements for the bridge (lane and footpath widths etc) to determine the general geometry of the structure.
- Geotechnical investigation to identify suitable foundation system for the bridge and retaining wall.
- Hydrological analysis, peak stream flows, flood levels at the bridge, and storm surge flows were all considered, to ensure the new bridge design is able to convey flood flows from the catchment towards the Avarua Harbour outlet.
- Design a robust structure that can cater for extreme events such as wave action and storm surges.
- Design a single-span deck bridge, to remove the old central support column wall and increase stream flow capacity beneath the bridge.
- Matching existing road level alignments on both sides of the bridge.
- Able to cater for existing and future utilities services through the bridge deck and across the bridge.

The new bridge design was consulted with all key stakeholders, and was presented at both Public Meetings. General feedback from the consultations was positive, with some queries for the new bridge to be lifted higher than proposed.

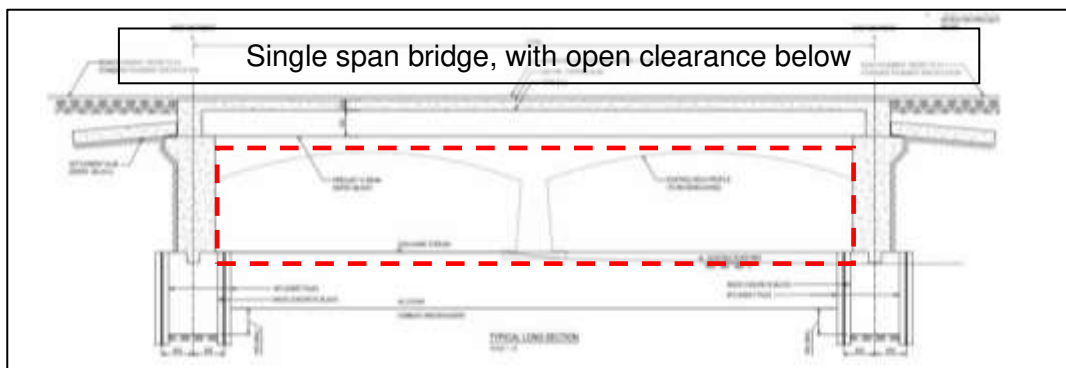


Figure 5: Removal of the central supporting column increase the clearance capacity by **32%**.

3. DESCRIPTION OF THE PROPOSAL/DEVELOPMENT

3.1. Location

The subject site 'Empire Bridge' is located along the main road, Ara Tapu. Adjacent to the Empire Cinema, Ministry of Justice, Rarotonga Canoe Association and Rehab/OTR Car Park.

The location of the Empire Bridge is legally described as **Public Road Gazette 1905 p238, Takuvaine Tapere, Avarua District.**

The Empire Bridge is some 100m away from the Avarua Harbour basin and lagoon. The bridge spans across the Takuvaine Stream which is one several major stream on Rarotonga with constant stream flows all year round.

The Global Positioning System (GPS) location for the Empire Bridge is:

- Latitude: -21.2065253931
- Longitude: -159.774542078

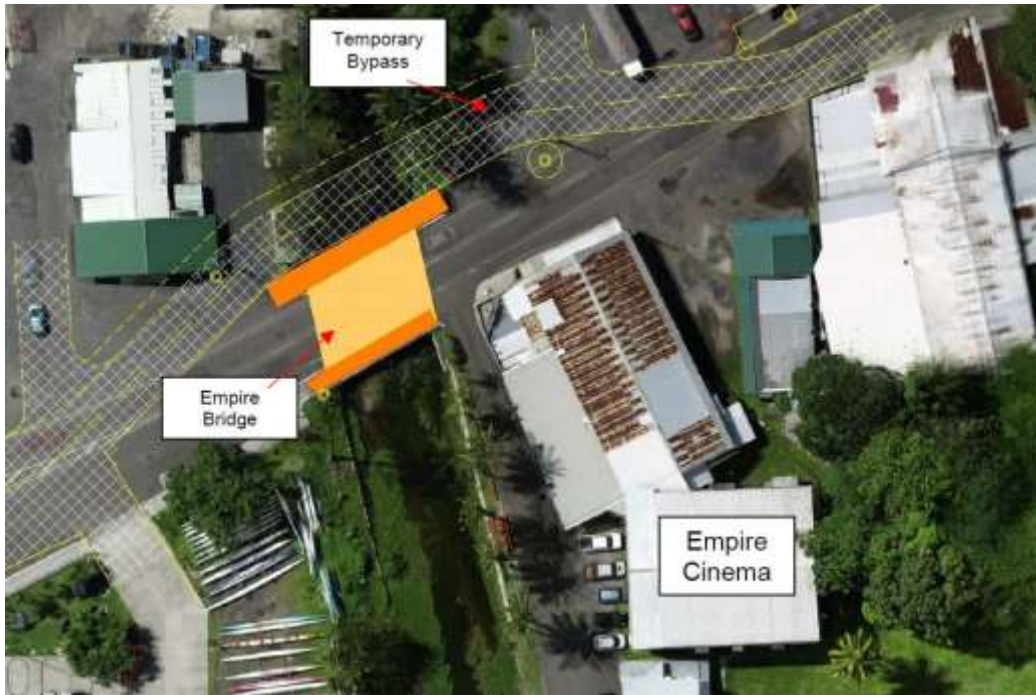


Figure 6: Location of Empire Bridge with the proposed development.

3.2. Staging

3.2.1 Stage 3 – Demolish & Remove old bridge, Build New Bridge

3.2.1a Traffic Management Plan. All traffic will be diverted from the existing main road to the temporary access road alignment and by-pass bridge. Concrete barrier fencing will occupy the majority of the road side barrier fencing.



Figure 7: Contractors Traffic Management Plan

3.2.2a Trader Jacks and Raro Chicken temporary access and parking will also be implemented.

3.2.3a The Contractor Laydown Area:

- Justice Laydown Area, this will be the main site for storage of plant machinery, equipment, and construction materials. In addition, the temporary storage of bridge demolished debris to allow drainage of saturated materials prior to cartage on the main road.
- Rehab/OTR Parking Laydown Area, this area will provide alternative space for contractor's storage of machinery, equipment and construction materials.

3.2.4a Traffic Management at Matina Travels, Rehab and Stationery Shop:

- TMP Day Access. The contractor will make available access for business vehicles entry and exit to the respective properties during the day.
- TMP Night Access. The contractor will ensure the construction site and laydown areas are secured, to limit public access to these areas there will be onsite security throughout the duration of the Contract.

3.2.5a Traffic Management at Empire Cinema and Pearl Shop:

- Pedestrian access will be made available to the property from the main road.
- Designated parking areas will be made available at locations where the contractor will not be utilizing.
- Assist to identify other available parking space nearby.

3.2.6a Structural Assessment of nearby properties and buildings prior to commencement of demolishing works.

3.2.7a Demolish existing Empire Bridge. A 38-tonne excavator with a mounted rock breaker will be used to undertake the demolishing work, stream flows will be maintained at all times, silt fences will be installed upstream and downstream of the works area. All debris will be collected from the stream and stockpiled

(dewatered if required) at the Justice laydown area. Waste and construction debris from existing bridge to be disposed to an off-site facility.

3.2.8a New replacement Empire Bridge construction.

- Bridge Abutments/Substructure. Sheet piles will be driven to form a coffer dam into the stream bed to a minimum founding depth of 6m. The stream materials within the sheet piled structure will be removed to a maximum depth of 5m allowing 1m embedment of the sheet piles into the stream. Mass Concrete will then be poured into the coffer dam.
- Bridge Abutments/Superstructure. Reinforcing will be tied into cages to form the bridge abutment above the stream level. Formwork will be placed around reinforcing cages and then concrete will be poured.
- Bridge Deck/Superstructure. Precast Concrete U-beams will be placed on the abutments tying the reinforcing from the Precast Concrete beams to the Abutment Superstructure. All utilities will be run through the Precast Concrete beams and boxed off. Concrete will be poured to form the Superstructure which will include the deck and kerb which doubles as footpaths.
- Road reinstatement. GAP 40 will be used to backfill the Superstructure and form the base course for the road. This will be cement stabilized as per the contract Specifications.
- Road Sealing. Asphalt concrete AC14 (Hotmix) has been specified as the pavement seal and will be installed as per the Contract Specifications and Standards.
- Road Marking will be completed once testing of the AC14 has been approved by the Engineer.

3.2.2 Stage 4 – Reinstate Traffic on New Bridge, Remove Temporary Bridge

3.2.2a Traffic Management Plan, divert and reinstate traffic onto the new replacement bridge.

3.2.2a Decommission and remove the temporary bypass bridge.

3.2.2a Rebuild and reinstate the Canoe Shed.

3.2.2a Relocate and return the Canoes from the ANZ park back to the Ministry of Justice yard.

3.2.2a Remove all barrier fencing and reinstate all parking and access paths.

3.2.3 Stage 5 – Takuvaine Stream Works

The Takuvaine Stream Capacity Works comprise of the construction of steel sheet piles with a concrete capping beam and gabion rock retaining wall along the vulnerable scoured embankments of the Takuvaine stream. A total of 250m will be retained at selected locations along the Takuvaine Stream. To be included also as part of the stream improvement works are, (i) rebuilding the collapse rock walls at the stream outflow and (lii) Re-grading the stream bed to remove the sediments and hence increase the stream capacity.

3.3. Emergency Management

Fuel and other hazardous materials that will be used during construction will be properly stored. All hazardous materials, including fuel, required during construction will be kept in the designated laydown area away from the Takuvaine Stream, reducing the risk of spillage. Refuelling and machinery maintenance will be undertaken at the laydown area or return to the contractor's yard.

Accidents and emergencies will be managed through the development and implementation of a Contractors Environment Management Plan with the necessary equipment and personnel training provided.

3.4. Infrastructure Requirements

The **Infrastructure and Utilities Coordination Group (IUCG)** comprising of representatives from Infrastructure Cook Islands (ICI), Te Aponga Uira (TAU), To Tatou Vai (TTV) and Vodafone Cook Islands (VCI) meet on a monthly basis to share and discuss each agency plan with regards to current and proposed work along the road corridor.

The Empire Bridge Replacement Project was presented at the IUCG meeting in October 2020. Each utility provided their respective asset information to assist with the bridge design and construction methodology planning.

Following the NES approval for Stage 1 and Stage 2, all utility services (TTV, TAU & VCI) temporarily divert their respective cables and pipeline away from the main construction area.

The Traffic Management Plan is currently in operation and is facilitated by the Contractor to ensure traffic flows are maintained and controlled along the construction area.

3.4.1. Transport

At present, approval has been given for Stage 1 and Stage 2, which is the construction of the temporary by-pass bridge and road alignment formation. Current reduced speeds across the Empire Bridge is required due to its present deteriorated state.

Stage 3 will allow traffic to use the new by-pass bridge and the Empire Bridge area will be sealed off from the general public.

The contractor will provide for 24hr traffic controllers to assist with transport movement along the neighbouring commercial properties and to facilitate emergency access for ambulance, firefighting trucks and police emergency.

The new by-pass bridge has a design capacity of 50 tonne loading, however precautions will be implemented with regards to heavy loaded trucks to reduce speed when crossing the by-pass bridge.

The Contractor will provide ample pedestrian access for business operating in the area, and will inform when certain places will be temporary closed off; for heavy plant movement, utility diversions, demolishing works and construction material movement.

3.4.2. Energy

Stage 2 - Te Aponga Uira have temporary divert all power cables away from the construction area, and will maintain power supply to the respective properties in the area.

No extra sub-station required.

The Contractor will provide their own power supply using generators, with supplementary supply from the TAU power grid.

3.4.3. Water Supply and Storage

Stage 2 - The To Tatou Vai (TTV) have temporarily diverted all water supply pipe network away from the construction area, the TTV will maintain adequate water supply to all properties in the area.

Water supply for the Empire Bridge Replacement Project is considered minimal, as the bulk of the construction work will involve transported specified standard strength ready-mix concrete from off-site concrete suppliers.

The Contractor will utilise existing water outlet taps from the neighbouring properties. No new water connecting into the existing water supply network is required.

The Contractor has standby water tanks, in the bulk water supply is required.

3.4.4. Stormwater Drainage

Existing stormwater infrastructure will continue to be used. The Empire Bridge is located towards the outlet end of the Takuvaine Stream and therefore captures the bulk of stream flows and surface water flows. The bridge is short in length, so no specific drainage is required. Water falls on the carriageway and the footpath surfaces will run along the kerb and channel system that ties into the existing stormwater network off the bridge.

Stage 3 - Old Bridge Demolishing

The Takuvaine Stream is vulnerable to blockages during the demolishing works, whereby fallen debris on the stream bed will impact the natural flow paths.

The Contractor methodology is for the use of a 38 tonne hydraulic excavator fitted with a rock breaker to undertake the demolishing work. The 38 tonne digger mounted

rock breaker will be positioned on the top of the stream embankment, and demolishing work will commence on side of the bridge at a time.

At the end of each demolishing work day, a second digger with a wide bucket will remove all the fallen debris along the stream bed.

The contractor will ensure that natural stream flows are maintained at all times.

Stage 3 – Build New Bridge

Following the completion of the demolishing works, the new bridge abutment foundations will be constructed. Deep steel sheet piles will be driven along both embankment streambed levels. The driven sheet piles will form a closed coffer dam, this will minimise surface water flows into the foundation area. Soils and sediments within the enclosed sheet pile wall will be excavated out, the excavated material will be temporary stored along the top of the stream embankment.

At all times, the contractor will ensure that natural flows are maintained and away from the construction area.

Emergency Work

In the event the weather forecast is for prolonged heavy rainfall, the contractor will remove all machinery, equipment and construction material from within the Takuvaine Stream, including stabilizing exposed areas, to minimise potential flooding and scouring impacts to the project area and surrounding properties.

3.5. Waste Management

3.5.1. Character and Quantities of Waste Materials

Construction demolition works of the old bridge and excavations for foundations associated with new bridge will be the main contributor of rubble and earth waste materials. The volumes will be relatively small, these will be temporary stored at the designated laydown areas to allow for water to drain away, before cartage to the Contractors yard.

3.5.2. Solid Waste Disposal

Concrete rubble, and reinforcing steel resulting from demolishing work

All of the material removed (road pavement, concrete, steel, rocks, soil etc) during demolishing works, can either be directly carted away, or temporary stored, once dried will be carted away to the Contractor's yard.

Excavated foundation soils

All soils, rocks, debris excavated out from the foundation area will be temporary stored, dried, and then carted away to the Contractor's yard.

Excavated sediments

All excavated sediments from the stream improvement works will be temporary stored, allowed to dry and then carted to an approved storage site for reuse as earthworks fill materials.

4. ENVIRONMENTAL VALUES AND MANAGEMENT OF IMPACTS

4.1. Land

4.1.1. Description of Environmental Values

The location of the Empire Bridge has for over 100 years served the purpose of providing a bridge access across the Takuvaine Stream.

The Empire Bridge is currently positioned within the legally described 'Public Road'. The proposed replacement bridge will occupy the same position and foundation footprint, less the central pier.

The close proximity of the bridge to the coastal waters, has meant that there is a considerable amount of freshwater and seawater mixing in this area. The projects strives to ensure that ecology of the area is not impacted by the project.

The proposed stream works will include the stabilisation of stream embankments at critical areas. This will include but not limited to the following;

- Replacing existing embankment stabilisation structures that have failed
- Construction of new embankment stabilisation structures
- Removal of sediments from the stream

4.1.2. Soils

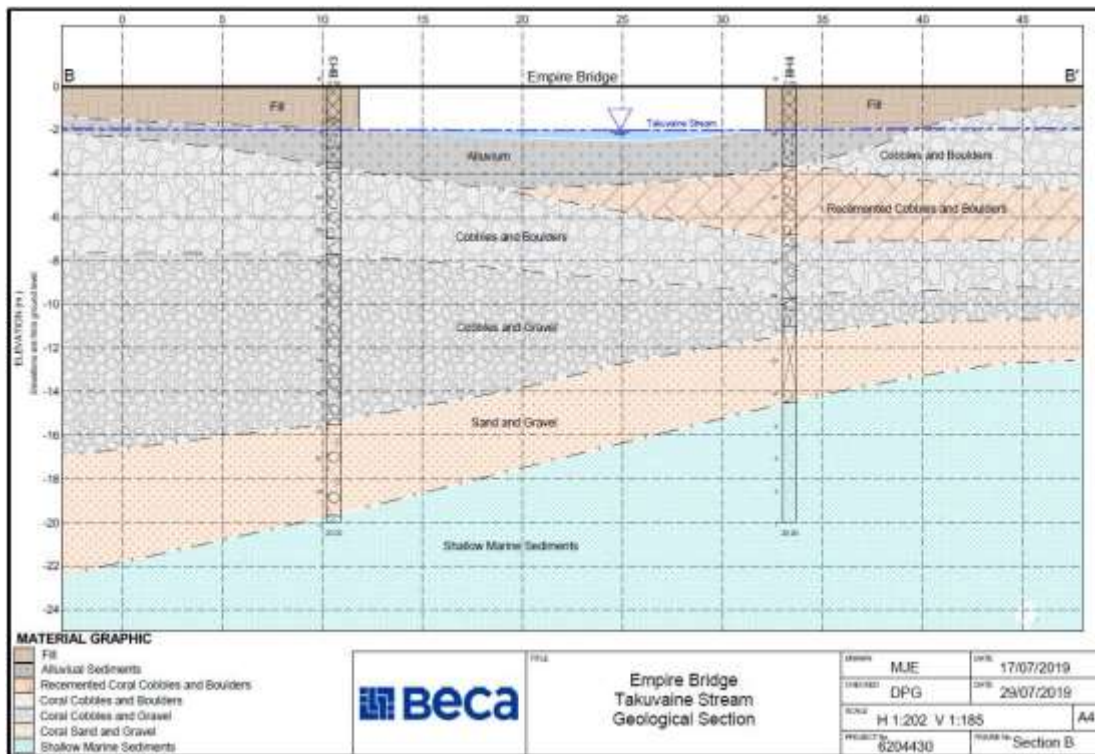


Figure 8: Soil strata profile from the Geotechnical Investigation work.

The geological structure of the island is of volcanic interior, and fringing reef. The lagoon, created between the volcanic body and the reef, is formed by marine organisms.

Soils of the coastal margin extend from the seaward boundary of the interior uplands to the lagoon beach and include the physiographic units, with associated soils; Estuarine margins (Koromiri soils), beach ridge (Muri soils), poorly drained depressions and flood plains (Vaikai soils), moderately well drained soils (Ngatangia soils), younger flood plains (Avana, Takuva and Rutaki soils), older flood plains (Matavera soils), terraces (Pouara and Nikao soils) and fans (Tikioki and Arorangi soils).

At the project construction site areas, it will be coral sandy beach at onshore end and weather boulder/gravel/sandy ground upstream.

The proposed design is to minimise the disturbances to the existing soil structure especially for the construction of the abutment foundations. The proposed methodology is:

- Bridge Abutments/Substructure. Sheet piles will be driven to form a coffer dam into the stream bed to a minimum founding depth of 6m. The stream materials within the sheet piled structure will be removed to a maximum depth of 5m allowing 1m embedment of the sheet piles into the stream. Mass Concrete will then be poured into the coffer dam.
- a) Stream embankment stabilisation:

- Removal of existing-failed structures
- Earthworks to allow for access to the work areas and preparation of the work area to enable construction of the proposed works.
- Where suitable, reuse excavated materials for fill materials or otherwise all surplus materials to be left to dry and then carted off site.
- Reinstate and cleanup work areas at completion of the works.

4.1.3. Landuse/Characteristics

The land use in Avarua is predominantly of commercial developments. The onshore end of the current Landuse characteristic from the Ara Metua has been extensively been for commercial use for many years by Trader Jack bar/restaurant, Chicken Fried eatery and two night clubs at the eastern end with several stores and shops.

The inland end of the site from the Ara Metua is the Empire Theatre – only a few metres from the bridge corner and several commercial buildings –offices, and a pharmacy store etc.

The surrounding landscape is fairly flat to gradual sloping ground towards inland.

The current commercial businesses will continue without any disruption by maintaining the flow of traffic during construction phase.



4.1.4. Landscape Character

The Empire Bridge is currently positioned within the legally described 'Public Road'. The proposed replacement bridge will occupy the same position and foundation footprint, without the central wall pier. The surrounding properties, businesses and Government agencies will not be impacted in terms of existing and long term landuse. Earthworks and land usage for access during construction will be affected at properties located where stream improvement works will be undertaken. The land will be reinstated at completion of the improvement works.

4.1.5. Potential Impacts and Mitigation Measures

Existing contours of the landscape are fairly level where the project can provide practical measures to alleviate potential impacts to the land.

Excavation exposed soils are to be stabilised with filter-cloth to prevent surface runoff. Sediment control measures are to be applied such as diverting clean surface water away from the construction site and the use of silt fences and sand bags.

4.1.6. Landuse Suitability

The project is a new bridge replacement one, introducing new design concepts to improving the service life of the structure to 100 years. The character of the landscape remains untouched apart from the demolition of the old bridge structure and reinstating it with a more durable structure.

4.1.7. Land Contamination

Land can also be contaminated through sub-standard wastewater treatment systems, careless disposal of solid waste (plastic, tin, glass), and mechanical defects in machinery (fuel and oil leaks).

Current legislation calls for wastewater disposal systems to be designed by a registered designer of wastewater treatment units specifically for use in the Cook Islands (regulated by the Public Health (Sewage and Wastewater Treatment and Disposal) Regulations 2014).

The Cook Islands have adopted the 4 R's of recycling waste: Reuse, Recycle, Refuse, Reduce. Section 3.5.2 provides a description for Solid Waste Disposal.

4.1.8. Soil Erosion (Refer to Erosion and Sediment Control Section)

Soil Erosion had taken place aeons before to create Rarotonga's coastal flood plain and only the residual clay pockets of soil remain in exposing the structural rock formation of the ridges and valley sides with mountain trees adapting to their changing environment.

The project will not take any unnecessary risks when working within the stream and in scoping for the best method to prevent too much soil erosion exposure and clogging the streams. We will be directed on what conditions the REA has set and ensure this carried out to ensure compliance. It will be the contractor's job to ensure neighbouring properties are not prone to soil intrusion by this project. Silt mats fencing may be constructed if need be in affected areas.

4.2. Climate

4.2.1 Overview

The climatic factors that affect the island are the cyclone season, (November-April), and the drought season (May-October).

Water supply is essential for the island and all development proposals are recommended to install water storage in every home.

Due to the use and size of the proposal, storage tanks are included into the development. The community supply is also tapped into to provide additional water for other purposes such as plant and machinery maintenance. A grounds person provides maintenance on all plants and appliances to include water supply system.

The World climate is under constant change, and is reported to have a significant effect on low lying coastal lands a result of Climate Change, increasing climate risks such as tropical cyclones with frequent strong storms and wind gusts, sea level rises and storm surges, temperature increases and prolonged droughts, increase rainfall/land based flooding.

Engineering judgment for planning, development and infrastructure items typically undertake a risk based approach, whereby thought is given to the level of risk through the likelihood, probability and consequence from extreme weather events due to Climate Change.

The Empire Bridge makes way for the Takuvaine Stream, which flows from Te Kou and out into the lagoon. The replacement of the Empire Bridge provides a good opportunity to understand and improve the conveyance water under the bridge and reduce any restriction by the bridge on the stream flow. A hydraulic assessment has been undertaken for the bridge to provide information on the expected flood levels following the construction of the new bridge.

4.2.2 Hydraulic Assessment.

a) Rainfall Data

Rainfall has been extracted from NIWA utilising the Te Kou rain gauge. The raw data has been processed and included in the hydraulic assessment.

b) Catchment Runoff

Takuvaine Stream drains a catchment of 451 ha above the Empire Bridge, with highest point of Te Kou at 588m above sea level. The catchment is largely forested and has a drainage length of 4.7km.

c) Tidal Effects

Given the locality of the bridge close to the lagoon, tidal effects have an influence on the water levels at the bridge, which will affect the ability of the bridge to convey flood flows from the upstream catchment.

d) Summary (*extract from the Beca Design Report*)

“The proposed minimum road level of the new bridge is 2.82m MSL (the same as the existing level). The results from the hydraulic assessment indicate that the proposed bridge has enough capacity to convey a 10-year flow without overtopping, with allowance for storm surge and sea level rise. In a 20-year storm

event (without climate change) it is expected that the water level at the bridge will be approximately at the road level.

The results show that the effect of climate change can be expected to increase water levels by 200mm – 400mm, but the bridge is able to convey the 10-year flow without overtopping.

For large storm events (20-year and greater) the tailwater level has no to minimum impact on the water level at the bridge.

Further, the analysis indicate the benefits of increasing the size of the flow area under the bridge. The flood levels at the bridge are decreased by 130mm and 150mm for the 5-year to 100-year flows with MHWS.

There are other external factors which could influence the capacity of the bridge not reflected in this assessment. Their effects are listed below;

- Blockage: There is a risk of trees and other obstructions washing down the stream, especially during cyclones, which could get stuck under the bridge or in the channel and reduce its capacity.
- Wave heights: The effects of waves hitting the reef can elevate water levels and waves in the lagoon during cyclones.
- Channel capacity: The capacity of the channel upstream and downstream of the bridge can have an influence on the water level at the bridge.

4.3. Water Resources

4.3.1. Description of Environmental Values

Surface waterways will be affected especially during the heavy rainfall periods; high sediment flow will need to be controlled using approved methods – erosion and sediment control procedures.

Ground water is located at depth and can be contaminated by nutrients from several sources, agriculture chemicals from inland plantations, animal wastes, and sub-standard wastewater treatment systems. All forms of nutrients travel through underground streams, to reach the lagoon, which will damage the lagoon environment.

The soil profile for the proposal are permeable weathered basalt boulder/gravel/sand and probably coral bedrocks, surface water flows to the lowest elevation, and is directed by drainage systems to the nearest water channel.

Wastewater containment will employ the use of “Porta-loos” during the construction period. These are maintained by the service provider on a daily basis.

Plant and machinery fuel/oil are harmful and toxic substances. This will be stored in a secure location, safety procedures will be followed to ensure that these substances do not contaminate the stream waterways.

4.3.2. Potential Impacts and Mitigation Measures

Water resource is provided by the community supply, and is prone to shortage of supply during the dry months of the year (May-October). Storage tanks are included to store captured water from rooftops.

An inspection log will determine the progress or not, of faults to the water supply system.

During the construction phase, drainage systems are firstly established, to remove water off the site. Drains are directed to empty into the nearest drainage system.

Building materials waste is moved offsite on a daily basis, with the construction site cleared.

Exposed materials such as excavated soil are to be compacted before each working day to minimise sediment runoff from potential overnight rain.

4.4. Air

4.4.1. Description of Environmental Values

Air within the area is not known or reported to have been contaminated from harmful substances. Apart from machinery exhaust fumes; there is no direct effect on the atmosphere from the proposal.

4.4.2. Potential Impacts and Mitigation Measures

Potential air pollution is minimised through the expertise of professional contractors that have worked on similar projects, where contamination of the environment and air quality is highly considered essential to a safe working environment. Dust will be addressed in instances that neighbours are effected but we will work with them to ensure they notify us if the wind has carried dust to their location which can have an effect.

Exhaust from construction machinery and equipment may be minimising use within the agreed daily working hours

Spraying of the work site area with water would ensure air particles/light dust are not transported such great distance to neighbouring residential properties.

4.5. Waste

4.5.1. Description of Environmental Values

- Wastes generated from the project will mainly include;
- Structural debris from the bridge demolition works
- Construction debris during the duration bridge constructions works
- Excavated materials and rubbish from the stream improvement works
- Sediments and rubbish currently deposited in the stream

- Sediments and rubbish deposited during storm and flood events
- Oils and chemical liquids

4.5.2. Potential Impacts and Mitigation Measures

- a) Bridge demolition wastes:
 - Manageable items such as deck beams can be loaded directly onto transporters and carted and stored at the contractor's yard
 - Items that are allowed to fall into the stream will need to be uplifted and temporarily stored within the laydown areas to dry prior to being carted to the contractor's yard.
- b) Excavated sediments and materials:
 - These will be excavated and temporarily stored on site to dry prior to being carted to the contractor's storage site.
- c) Stream improvement works:
 - Excavated materials that are suitable for reuse as backfill can be temporarily stored at the construction area readily available for reuse.
 - The unsuitable materials will be left to dry and then carted to the contractor's storage.
- d) Chemical and liquid wastes:
 - Chemicals and liquid wastes (eg waste oils) are stored in containers and stored in shipping containers.

4.6. Noise and Vibration

4.6.1. Description of Environmental Values

Noise from construction machinery and equipment will generate noise. This is expected on any construction project and cannot be avoided, however it can be controlled.

Vibration will be generated by;

- Excavator mounted rock breaker during the demolition stages of the existing bridge
- Excavator mounted pile driving equipment when driving sheet piles

4.6.2. Potential Impacts and Mitigation Measures

- a) Noise:
 - Fit all construction machinery and equipment with noise reduction attachments
 - Limit use of construction machinery equipment within the agreed daily working hours
 - Provide advance notice to property owners regarding working hours and operation of construction machinery
- b) Vibration
 - Provide advance notice to property owners regarding working hours and operation construction machinery (rock breaker and pile driver)
 - Provide datums for monitoring impacts of vibration on adjacent buildings

4.7. Nature Conservation

4.7.1. Description of Environmental Values

Nature conservation is significant to the completed project, through maintaining existing trees and vegetation, and the introduction of the landscape plan.

Although some of the vegetation will be removed to accommodate the proposed development, the biological diversity of the terrestrial ecosystems is expected to live through this period of disturbance, and is enhanced through additional landscaping directly after completion of the construction process.

4.7.2. Terrestrial Flora & Fauna

Vegetation along the project boundaries is typical of existing species in the area. The existence of rare or threatened species was not located on the site. The plant community indicates some cultural significance of certain species; young coconut trees, these will be maintained and protected.

4.7.3. Aquatic Biology

The proposed project will be specifically confined within the section areas of the bridge and road. The stream flow will be diverted at the adjacent side of Stream. The aquatic fauna mainly comprise of eels and mosquito fish. No known rare or threatened aqua species were encountered during our site visits.

4.7.4. Potential Impacts and Mitigation Measures

At present this area does not provide a habitat for any vulnerable or endangered fauna, and it is likely that any water eels located in the stream will not be impacted during construction and landscaping works.

4.8. Cultural Heritage

4.8.1. Description of Environmental Values

Areas and places of cultural significance around the project site have been identified:

- Empire Cinema – historical building
- Takuvaine Stream

The works will be carried out at a distance from these sites. Project information will be shared with relevant property owners to inform them of the work to be undertaken and that there would be no direct impact to these sites except in the stream itself.

4.8.2. Potential Impacts and Mitigation Measures

There will be no significant impact on the cultural aspects of the project site.

4.9. Social

4.9.1. Description of Environmental Values

The island of Rarotonga is the main and most populated island, with a population of 13,007 (census 2016), out of the country's total population of 17,434. Rarotonga houses the centre of Government, Government Ministries and is the commercial hub of the nation. Entry and departure to the other islands is through Rarotonga via the international airport in Nikao and main sea port at Avatiu.

Tourism, offshore banking, marine resources and agriculture are the largest industries in the Cook Islands. Tourism in particular has experienced unprecedented growth over the last few years, with over 160,000 visitors per annum and continues to grow. However, the impact of the COVID-19 pandemic has dropped this number dramatically within a year.

The project work sites will have very little impact on the businesses in the Avarua CBD, surrounding businesses and recreational activities.

The Empire Bridge is an important road connection into and out of the Avarua CBD. The replacement of the bridge is to ensure for a safe and structurally sound bridge and road infrastructure. The following social impacts will be experienced throughout the duration of the project. These will include but not limited to the following:

- Reduced vehicular traffic speed through the construction zone into and out of the Avarua CBD
- Businesses: re-directed access to business, reduced parking spaces. Limited entry and exit points
- Recreation: use of vaka storage areas for contractor laydown areas.

4.9.2. Potential Impacts and Mitigation Measures

a) Travelling into and out of the Avarua CBD:

- The construction of the 2-way temporary bridge will ensure continuous traffic flow. However, the imposed 10km/h speed as part of the traffic management plan (TMP) will cause slow traffic movements especially during peak hours in the morning and afternoon. The community will be made aware of potential travel time delays via information signs and media.
- Businesses on the inland side of the Empire Cinema: Access and exits by vehicular traffic will be from the Ara Metua (back road) only.
- Opening an alternative route through the Takamoia grounds is not feasible.

b) Vehicle traffic flow and parking:

- The contractor is required to submit for approval by the Engineer a TMP. The Plan will ensure safe movement of traffic and people through the construction zone. It will also allow for delineated and designated parking areas around the bridge construction site.
 - For businesses on the inland side of the Empire Cinema, access route will be from the Ara Metua only.
- c) Recreation (Canoeing Association)
- Storage areas relocated to ANZ park, current site to be used as laydown areas for the contractor.
- d) Noise:
- Significant noise from plant and machinery may impact on nearby premises. Work will be carried out during the day to minimise noise impact, and will blend in with normal road traffic and aircraft movement noise.

4.10. Health and Safety

4.10.1. Description of Environmental Values

The contractor is required to submit a Health & Safety Plan for approval by the Engineer. The plan will highlight all the occupational health and safety aspects for;

- Construction personnel, machinery, equipment, materials
- QA personnel entering and exiting the construction site
- Community and people moving through the site
- Site security
- Emergency vehicles going through the construction zone

4.10.2. Potential Impacts and Mitigation Measures

- a) Occupational Health and Safety
- Health and Safety Plan
 - Traffic Management Plan
 - Media Releases
- b) Site Security
- Employment of security personnel to prevent unauthorized access onto the site after working hours
 - Installation of flood lights to improve visibility of the construction zone at night

4.11. Economy

4.11.1. Description of Environmental Values

The Project will benefit the whole community and private sector. As well as benefits to economic development, the project can provide specific contributions and respond to the growing needs of the labour market, potential pathways into the tourism and trades markets.

Private Sector benefits are the potential engagement of local construction contractors, sub-contractors, buildings, and transport suppliers.

4.11.2. Potential Impacts and Mitigation Measures

Although the project provides benefits such as economic development to the building industry and infrastructure, community and private sector, there are potential impacts with mitigation measures put in place to:

- Comply to local legal framework with regards to construction works;
- Acquire all appropriate construction permits;

4.12. Hazards and Risks

4.12.1. Description of Environmental Values

In construction activities, management skill and knowledge, professional tradesmen, play an essential part in keeping up-to-date with best industrial construction practices, general common sense, and the participation of all employees in maintaining control over construction activities.

A work site is a hazardous area, for contractors personnel only, hence the display of standardised information and warning signs around key points on the construction sites will be useful for construction personnel and authorised visitors onto the site..

Refuelling of machineries, plants and generators will be commonly adopted on site. The provision with respect to the packing, marking, handling, carriage, storage, and use of certain flammable, oxidising, and corrosive materials, and certain compressed, liquified, dissolved, and other gases. The Act (Cook Islands Dangerous Goods) requires promoting public safety in the storage and handling of dangerous goods and is referenced to AS 1940:2004 The Storage and Handling of Flammable and Combustible Liquids.

4.12.2. Potential Impacts and Mitigation Measures

As defined by Sub-Section 4.10 Health and Safety: The posting of signage warns onlookers and the general public of construction, with access limited to construction personnel only, and stakeholders. Access is monitored daily, and limited to one entry point and exit.

The Cook Islands Dangerous Goods Act requires promoting public safety in the storage and handling of dangerous goods and is referenced to AS 1940:2004 The Storage and Handling of Flammable and Combustible Liquids.

4.13. Erosion and Sediment Control

4.13.1. Description of Environmental Values

Erosion Control is the prevention of sediment loss from exposed soil surfaces. Disturbed soil surfaces face the risk of erosion through wind, and erosion by running water.

Where drainage channels are absent, adjacent properties become deposition areas for sediment. When erosion control measures and drainage systems are established, environmental values are protected from contamination of soil sediment and debris.

There is no foreseeable soil erosion generated from the bridge construction works.

It is anticipated that potential soil erosion during storm and flooding events will be encountered when the stream improvement works stage is implemented. The scope of the stream improvement works generally include

- Replacing existing embankment stabilisation structures
- Construction of new embankment stabilisation structures
- Removal of sediments from the stream

4.13.2. Potential Impacts and Mitigation Measures

Erosion control measures are available, from open drains on flat lands, to sediment barriers sloping ground. This project is developed in stages, therefore limiting the amount of disturbance and potential erosion of sediment and debris.

During the wet season, surface runoff is diverted to the nearest drainage system for disposal of storm water. To prevent sediment loss, construction of sediment barriers is set along disturbed soil platforms, prior to water entering the drainage system. Constant maintenance is required to keep sediment barriers from blockage.

Large boulders and silt fences will be positioned along the toe of the beach (down slope of the worksite) to serve as sediment retention bunds, filtering stormwater flow into the adjacent streams.

Vegetation clearing will be confined to areas directly within the extent of the new construction platform; vegetation outside these areas will be retained including trees to maintain soil stability.

4.14. Storage and Handling of Dangerous Substances

4.14.1. Description of Environmental Values

Refuelling of machineries plants and generators will be commonly adopted on site. The provision with respect to the packing, marking, handling, carriage, storage, and use of certain flammable, oxidizing, and corrosive materials, and certain compressed, liquefied, dissolved, and other gases. The Act (Cook Islands Dangerous Goods) requires promoting public safety in the storage and handling of dangerous goods and is referenced to AS 1940:2004 The Storage and Handling of Flammable and Combustible Liquids.

There will be no storage on site of dangerous substances (eg Class 1 Hazardous Substances).

Construction materials will be stored in shipping containers.

Fuel for machinery will not be stored on site.

4.14.2. Potential Impacts and Mitigation Measures

As defined by Sub-Section 4.10 Health and Safety: The posting of signage warns onlookers and the general public of construction, with access limited to construction workers only, and stakeholders. Access is monitored daily, and limited to one entry point and exit.

The Cook Islands Dangerous Goods Act requires promoting public safety in the storage and handling of dangerous goods and is referenced to AS 1940:2004 The Storage and Handling of Flammable and Combustible Liquids.

- a) Refueling of machinery and equipment:
 - Use mobile tankers and with the refueling carried out at a designated area within the laydown areas.
- b) Bulk construction materials:
 - Construction materials such as timber will be delivered and stored on site as required. The storage areas for these are at the contractor's yard.
 - Steels materials such as sheet piles and reinforcing steel will be stored on site.

Environmental Issue	Mitigation Measures	Locations	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Dust nuisance	Access road paths will be kept clean and free of sediments. Where excessive dust is experienced from the demolishing works, the old bridge surface will be moistened to minimise dust build up.	Access roads, old bridge	Throughout project	Contractors	Visual inspection Feedback / complaints received	Daily monitoring during site construction works	Contractors Site Foreman	Project Manager
Excessive noise during construction.	Ensure construction during daylight working hours 7.30am to 6.30pm Monday to Saturday. Maintain active communication with the local community, inform when to expect periods of loud noises. Provision of noise protection ear	General Empire Bridge construction site	Throughout project	Contractors	Construction noise levels Feedback / complaints received	Daily monitoring during site construction works	Contractors Site Foreman	Project Manager

Empire Bridge Replacement

	muffs to all construction workers. Maintenance of all plant and equipment in good working order.							
Removal of demolition and construction debris.	Remove all debris from the site, especially from within the stream.	Old bridge and Bridge bypass	During demolish of old bridge and removal of bypass bridge.	Contractors	Visual inspection Feedback / complaints received	Daily monitoring during site construction works	Contractors Site Foreman	Project Manager
Spills of fuels and other hazardous materials	All hazardous materials required during the construction works, will be kept away from the stream and within the laydown areas. No storage of fuel on site. Refuelling of machinery using mobile fuel tankers	General Empire Bridge construction site	Throughout project	Contractors	Leaks and spillages	Daily monitoring	Contractors Site Foreman	Project Manager

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<p>Health and Safety</p>	<p>Implementation of Health & Safety Plan. All construction workers are provided with adequate PPE and facilities. Implementation of Traffic Management Plans. Refer to Contractor Health & Safety Plan</p>	<p>General Empire Bridge construction site</p>	<p>Throughout project</p>	<p>Contractors</p>	<p>Local community feedback</p>	<p>Daily monitoring</p>	<p>Contractors Site Foreman</p>	<p>Project Manager</p>
<p>Site Security and Safety</p>	<p>Safety barrier fence to be constructed and installed around the perimeter of the construction site. Construction materials and construction equipment are safely stored away at the end of each working day. Installation of</p>	<p>General Empire Bridge construction site</p>	<p>Throughout project</p>	<p>Contractors</p>	<p>Site Inspection</p>	<p>Prior, during and following storm events</p>	<p>Contractors Site Foreman</p>	<p>Project Manager</p>

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	flood lights to illuminate bridge construction zone. Placement of night security personnel for security of site and also facilitate movement of emergency vehicles through construction zone.							
Erosion Control	Install, inspect, clean-out and maintain appropriate erosion control devices, eg silt fences.	General Empire Bridge construction site	Throughout project	Contractors	Site Inspection	Daily monitoring during site construction works	Contractors Site Foreman	Project Manager
Natural Hazards & Emergency	The site is prone to flooding and storm surge. Receipt confirmation of potential hazard, all works will	General Empire Bridge construction site	Throughout project	Contractors	Site Inspection	Daily monitoring of the weather (10 day forecast), Cook Island Met Office	Contractors Site Foreman	Project Manager

Empire Bridge Replacement

	cease, all plant and materials will be moved to the laydown area, site to be secured and made safe.					and EMCI broadcast.		
Traffic Management	A 24hour traffic controllers will be in place to ensure traffic flow through and from the Avarua CBD is maintained, especially during peak traffic flows, morning and afternoon.	All TMP areas	Throughout project	Contractors	Site Inspection	Daily monitoring	Contractors Site Foreman	Project Manager

5. ENVIRONMENT MANAGEMENT PLAN

The Environmental Management Plan (EMP) has been developed to address and manage potential impacts to the environment (biological, physical, social, cultural, and economic) that are considered significant or adverse. The EMP recommends the followings activities for implementation during the projects and following completion. Key activities are listed below.

6. CONCLUSION

The potential adverse effects of the project (Stages 3, 4 and 5) on the environment is considered not significant, provided that the recommendations and activities identified in this report along with the Environment Management Plan are implemented.

Active communication across all stakeholders; the community, the general public, commercial business, government agency and NGO groups are important to ensure that all are aware and updated with the project. Issues to be address on a timely basis.

7. APPLICABILITY

This EIA report has been prepared for submission to the National Environment Services, to support an ESD application. It is not to be relied upon or used out of context by any other person or organisation without approval from the Ministry of Infrastructure Cook Islands.

8. REFERENCES

9. APPENDICES

Appendix A – Final TOR for this EIA

Appendix B – Final Project Design/Drawings

Appendix C – Study Team, Contacts

Appendix D – Beca Bridge Evaluation Report

Appendix E – Beca Geotechnical Report