Initial Environmental Examination

Project Number 48484-004
August 2018

TUV: Outer Island Maritime Infrastructure Project (Additional Financing)

Initial Environmental Examination

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ABBREVIATIONS

ADB	Asian Development Bank
CCP	communication and consultation plan (for the project)
CSC	construction supervision consultant (supporting the PMU)
DOE	Department of Environment
EHSG	Environment, Health and Safety Guidelines (of the World Bank Group)
EHSO	Environment, health and safety officer (of the contractor)
EIA	environmental impact assessment
EMP	environmental management plan
ES	Environmental specialist (of the CSC)
GFP	Grievance focal point
GPS	global positioning system
GRM	grievance redress mechanism
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HSP	health and safety plan (of the contractor)
IEE	initial environmental examination
IUCN	International Union for Conservation of Nature
MCT	Ministry of Communications and Transport
NEMS	National Environmental Management Strategy
OHS	occupational health and safety
PAM	Project Administration Manual
PEAR	preliminary environmental assessment report (under Tuvalu country system)
PMU	Project Management Unit
PPE	personal protective equipment
SPREP	Secretariat of the Pacific Regional Environmental Program
SPS	Safeguard Policy Statement 2009 (of ADB)
STI	sexually transmitted infection
TKIII	Te Kakeega III National Strategy for Sustainable Development 2016 to 2020
TFD	Tuvalu Fisheries Department

CURRENCY EQUIVALENTS

Tuvalu uses the Australian dollar (AU$) - as at April 2018

AU$1.00	=	US$1.30
US$1.00	=	AU$0.76

EXECUTIVE SUMMARY

1. **The project**. The Outer Island Maritime Infrastructure Project – Additional Financing (the project) will continue the efforts of the Government of Tuvalu (the government) with support from Asian Development Bank (ADB) to rehabilitate and improve maritime infrastructure on outers islands. The Outer Islands Maritime Infrastructure Project[1] is improving infrastructure on Nukulaelae, Nanumaga and Niutao which was damaged by Tropical Cyclone Pam in March 2015. The government has requested ADB to provide additional financing for: (i) cost overruns resulting from contract variations and foreign exchange fluctuations; and (ii) provision of passenger facilities at Nukulaelae and construction of a small boat harbor at Niutao.

2. The original project is financing (i) a small boat harbour construction in Nukulaelae and rehabilitating boat ramps in Nanumaga and Niutao, (ii) institutional strengthening for government's asset management focusing on the sustainability of project deliveries, and (iii) the preparation of transport master planning. The ongoing project is being successfully implemented with all contracts awarded for the works, the project support and master planning, and project management staff have been awarded.

3. There are no docking facilities on Niutao for either of the three government-owned ships or the small workboats used to transfer people and cargo from the ship to the shore. Passenger transfers between vessels are often dangerous while movement of cargo is very labour intensive and carried in manageable pieces though the water to the shore. The small workboat harbour will involve the dredging of a new channel and turning bay for the workboats. The construction of breakwaters involve using precast concrete elements, with wharf and jetty raised on piles to reduce the impact on coastal processes within the reef environment. There will be ancillary buildings for cargo near the jetty to assist in the safe movement of passengers and cargo from the land to the ship. The project also includes six navigational aids.

4. **Institutional responsibilities**. The Ministry of Communications and Transport (MCT) is the executing agency for this project. The Director of Marine and Port Service was appointed as Project Director. A project management unit (PMU) has been established under the ongoing project and will deliver the new project. The PMU reports to the MTC. The PMU will be supported by a construction supervision consultant (CSC) which will include an environmental specialist (ES). Prior to recruitment of the CSC, an individual environmental specialist will be recruited to undertake tasks associated with updating the initial environmental examination (IEE) and environmental management plan (EMP) and inputs to the tender documentation and bid evaluation. Terms of reference have been prepared for the environmental specialists (for the individual and the ES included in the CSC) and are included in the project administration manual. The submission, review and acceptance of construction EMP (CEMP) is a condition of no objection to commencement of physical works and this is included in the grant agreement.

5. **Screening and categorization.** The project has been classified as Category B for environment following the ADB's Safeguard Policy Statement 2009 (SPS). A category B project requires an environmental assessment commensurate with its level of impact, and this IEE including an EMP has been prepared.

[1] ADB. 2016. *Tuvalu Outer Island Maritime Infrastructure Project* approved by the Board on 16 November 2016 for three grants in the total amount of $11.8 million.

6. **Anticipated impacts.** There is no critical habitat on this island directly affected by the project. The main potential negative environmental impacts relate to the construction phase and the dredging and excavation of 8,295m^3 of reef material for the new channel through the reef platform required for the small workboats and the subsequent disposal of the spoil on to the land. The spoil will be disposed of such that it does not result in damage to the reef environment, the remaining natural vegetation on land at the disposal sites, subsurface water resources and any areas of agriculture or cultural significance. The protection of the foreshore and vegetation against further deterioration, already damaged by recent cyclonic activity including Cyclone Pam in 2015, will be a priority during the construction phase.

7. Overall, few of the impacts are irreversible. Potential impacts can be managed and reduced to acceptable levels through the implementation of the measures identified in the EMP which will be developed into a detailed construction EMP (CEMP) by the civil works contractor, and effective monitoring of the same by the construction supervision consultant (CSC), who will support the PMU and acts for and on behalf of MCT.

8. The IEE will be re-formatted as required to comply with the Tuvalu country system and an application for clearance will be made under the Environment Protection (Environment Impact Assessment) Regulation 2012. The EMP requirements and provisions for environmental protection and management will be incorporated into the bid documents for the civil works and construction contract. Given the sensitivity of the marine environment, the contractor will be required to recruit an experienced marine environmental specialist to develop the CEMP and help the contractor implement the CEMP, including the site-specific plans and construction methodologies (working platforms, dredging methods, and spoil disposal locations and methods) most suited to the environmental conditions at each island. The CSC will also include an environmental specialist to work with the supervision engineer to review and approve the CEMP and to monitor the contractor's implementation of the approved CEMP.

9. **Consultation, participation and disclosure**. The project is a continuation of support to the maritime sector which commenced in 2015. Consultations and meetings were conducted in 2016 including a three-day workshop was conducted in Funafuti from 15 – 18 April 2016 with representatives from island groups in attendance. The purpose of the workshop was to outline the approved project brief and associated constraints and provide the preliminary design details for a phased approach to a small workboat harbour concept based on the ADB project budget. It also provided the opportunity for the community representatives to express their concerns and provide some feedback in relation to the project design.

10. For the current project, several key stakeholders in Funafuti and outer islands were consulted by the study team. These included the island councils (Kaupule), landowners, fisherfolk, women (including a separate focus group of pregnant women), youth groups, elderly men and a man living with disabilities. Three government departments were consulted from 5-7 March 2018.

11. **Grievance redress mechanism**. A grievance redress mechanism (GRM) has been established for the project, based on acceptable methods of conflict resolution in Tuvalu and the GRM that is currently being implemented for the ongoing project. The GRM will be implemented through all stages of the project including design, construction and operation. The community will be informed of the GRM, which has been developed in conjunction with the PMU, through a public awareness campaign and discussion with the Kaupule. The process of lodging a concern or complaint and contact details of the contractor and CSC will be posted on a public notice board. There will be full and free access to the site-based CSC.

12. The community is encouraged to voice any concerns or complaints, and during construction these are to be duly investigated and reported through to the contractor who will maintain a complaints/incident register.

13. **Inspections, monitoring and reporting**. During the pre-construction, monitoring will ensure that (i) bidding documents contain environmental requirements and any design measures specified for sensitive areas, and (ii) criteria for the selection of qualified contractors are clearly defined and followed. When construction commences, inspections and audits will be undertaken to ensure mitigation measures are protecting environmental conditions as anticipated (based on benchmarked conditions recorded prior to works commencing for parameters identified in the EMP) and overall contractor is working in compliance with the approved CEMP. Monitoring of environmental impacts will be carried out during the construction and post-construction period based on baseline environmental conditions recorded prior to commencement of any works. Monitoring will provide information to determine whether critical factors are within acceptable levels or being exceeded. It also helps to determine whether mitigation measures are effective or should be altered or improved to address the observed and measured change in impacts.

14. Reporting will include contractor's monthly reports to the PMU, quarterly progress reports (including summary of contractor's reports and safeguards matters) prepared by the PMU and CSC for submission to the executing agency and ADB, and semi-annual safeguards monitoring reports prepared by the PMU and CSC and submitted to the executing agency and ADSB. ADB will disclose the monitoring reports.

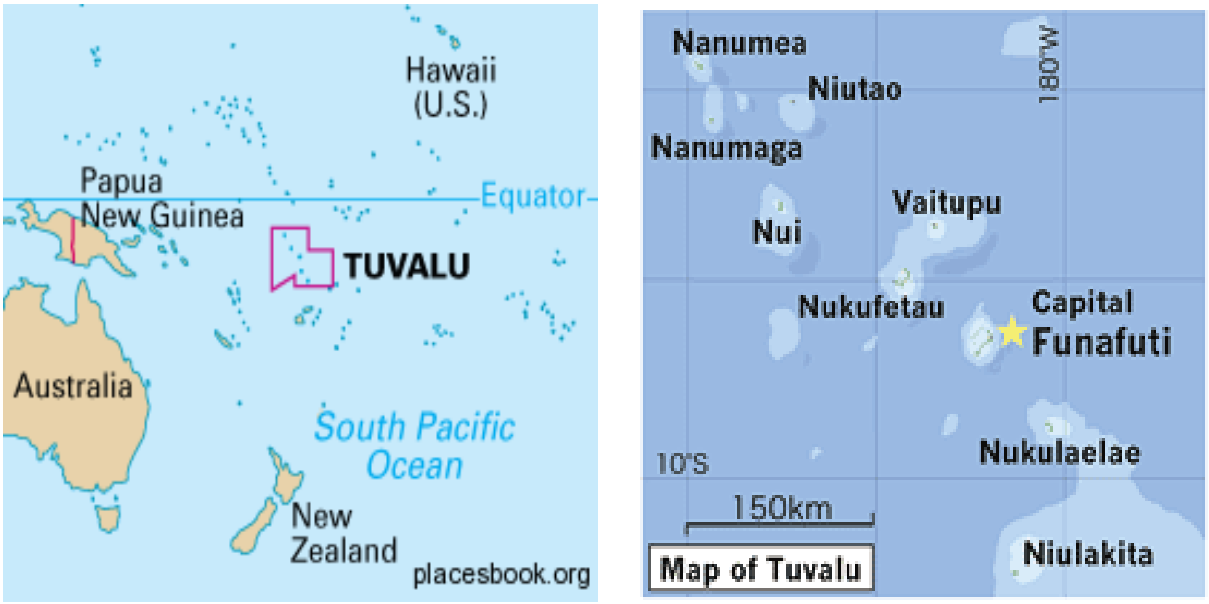
15. Conclusion. This IEE has identified as far as practicable the potential environmental impacts associated with the design, construction and operation of the small workboat harbor at Niutao and identifies the measures required to mitigate or minimize the impacts. The impacts and required measures to mitigate them are summarized in the EMP which will be updated based on detailed design following geotechnical investigations. Overall, impacts are site-specific and few, if any, of the impacts are irreversible. The potential impacts can be managed and reduced to acceptable levels provided the EMP is properly developed into a site-specific CEMP to be prepared and implemented by the contractor. The contractor's implementation of the CEMP will be monitored and reported.

I. INTRODUCTION

A. Project Background

1. **Location**. Tuvalu is a Polynesian country located in the west Pacific, situated 4,000 kilometers (km) northeast of Australia, south of Hawaii and east of Papua New Guinea, as shown in Figure 1.1. Tuvalu is one of the smallest and most remote member countries of ADB; it has a total land area of 26 square kilometers (km^2) and an oceanic area of 900,000 km^2. Its challenges in the transport sector and economic development come from its dispersed geography: (i) the country comprises nine atoll islands, stretching over 680 kilometers (km) in the southwest Pacific; (ii) it has a small and dispersed population of 10,640 (2012 census) with over half the population in Funafuti, the capital, and the rest spread in the outer islands; and (iii) the population of the outer islands is decreasing due to limited economic opportunities and people seeking better employment, social and health opportunities in Funafuti or abroad. These features pose challenges for the provision of cost effective and efficient transportation infrastructure and services in the outer islands.

Figure 1.1: Map showing location of Tuvalu and Tuvalu's Islands



2. A key constraint preventing the safe, efficient, and reliable transfer of passengers and freight from Funafuti to Tuvalu's remote outer islands is the lack of adequate domestic maritime infrastructure, including docking facilities that can accommodate the government ships. Passengers and cargo need to be transferred between the ship and the shore by small workboats, posing serious safety risks when they are overloaded and when the sea is rough. The workboats are required to pass through narrow channels where swells break, posing further safety risks. Only Vaitupu, Nanumea, and Nukufetau have docking facilities for the workboats, and the ongoing project is providing a small harbor for work boats on Nukulaelae.

3. Serious accidents have occurred during transferring, resulting in loss of economic value, injury and potentially life. All outer island people have safety concerns during transfer operations particularly for sick or vulnerable people including children, elderly, men and women and people with disabilities.

4. The Outer Islands Maritime Infrastructure Project[2] is improving infrastructure on Nukulaelae, Nanumaga and Niutao which was damaged by Tropical Cyclone Pam in March 2015. The ongoing project is financing (i) a small boat harbour construction in Nukulaelae and rehabilitating boat ramps in Nanumaga and Niutao, (ii) institutional strengthening for government's asset management focusing on the sustainability of project deliveries, and (iii) the preparation of transport master planning. The ongoing project is being successfully implemented with all contracts awarded for the works, the project support and master planning, and project management staff have been awarded.

5. The additional financing (the project) will continue the efforts of the Government of Tuvalu (the government) with support from Asian Development Bank (ADB) to rehabilitate and improve maritime infrastructure on outers islands. The government has requested ADB to provide further finance to cover: (i) cost overruns resulting from contract variations and foreign exchange fluctuations; and (ii) provision of passenger facilities at Nukulaelae and construction of a small boat harbor at Niutao.

16. **Implementation arrangements**. The Ministry of Communications and Transport (MCT) is the executing agency for this project. The Director of Marine and Port Service was appointed as Project Director. A project management unit (PMU) has been established under the ongoing project and will deliver the new project. The PMU reports to the MTC. The PMU will be supported by a construction supervision consultant (CSC) which will include an environmental specialist (ES). Prior to recruitment of the CSC, an individual environmental specialist will be recruited to undertake tasks associated with updating the IEE and EMP and inputs to the tender documentation and bid evaluation. Terms of reference have been prepared for the environmental specialists (for the individual and the ES included in the CSC) and are included in the project administration manual (PAM).

B. Objectives and Scope of the IEE

6. This document provides an initial environmental examination (IEE) of the project. The IEE has been prepared with the MCT following the requirements of the Environmental Protection Act of Tuvalu and the Safeguard Policy Statement 2009 (SPS) of the ADB.

7. The overall objective of the assessment process is to identify impacts and measures to avoid, minimize/mitigate or compensate for them. The objectives of the IEE are to:

- Identify and describe the existing environmental conditions—physical, biological and socio-economic—in the subproject area including the identification of environmentally sensitive areas;
- Assess the proposed location, design, construction, and operation activities to identify and evaluate their potential impacts, and determine their significance;
- Consult with stakeholders on the potential impacts and understand the issues and concerns about the impacts and how they might be affected; and

[2] ADB. 2016. *Tuvalu Outer Island Maritime Infrastructure Project* approved by the Board on 16 November 2016 for three grants in the total amount of $11.8 million.

- Propose appropriate mitigation and monitoring measures that are incorporated into an environmental management plan (EMP) that will avoid or minimize adverse impacts so that residual impacts are reduced to acceptable levels.

8. The scope of the IEE includes the footprint of the project which is relatively small and the zone or area of influence of the project to ensure that secondary or indirect impacts can be identified and subsequently managed.

9. The IEE is based on primary sources of information derived through field studies (including marine ecological baseline surveys) and consultations during site visits and secondary sources of information available in relevant reports.

II. LEGAL AND POLICY FRAMEWORK

A. Legal and Policy Framework of Tuvalu

10. **Institutional arrangements for environmental protection**. The Department of Environment (DOE), which is based in Funafuti, is overseen by the Director. It has a staff of four, including an EIA specialist, two environmental officers, and a librarian. It does not have offices or personnel in the outer islands. There will be limited capacity to provide environmental compliance monitoring of the projects on the outer islands during the construction phase. Coordination with South Pacific Regional Environmental Program (SPREP), which currently has existing capacity building capabilities in PEAR and EIA, will be canvassed to provide relevant training of the staff within DOE.

11. **Policy framework.** Government policy on environmental protection is expressed in the National Environmental Management Strategy (NEMS)[3] which presents a long-term approach to dealing with environmental management issues to assist in efforts to achieve sustainable development. The key objectives of NEMS are to ensure sustainability of development by i) integrating environmental considerations into economic development, ii) improving environmental awareness and education, iii) balanced development and planned urbanization, iv) improving waste management and pollution control, v) protecting natural resources and vi) environmental monitoring. This sets the framework for the requirement of projects to undergo an environmental assessment process prior to approval and to commencement of any development.

12. **Legal framework.** The principal law governing the protection and management of the environment is the Environmental Protection Act 2008, and specifically, Part V – Environmental Impact Assessment, outlines the requirements and provisions for an Environmental Impact Assessment and monitoring of environmental impacts. This legislation was further strengthened with the Environment Protection (Environment Impact Assessment) Regulation 2012 made under Section 39 of the Environment Protection Act 2008, which sets out the process for undertaking environmental impact assessments.

13. The DOE is responsible for the administration and enforcement of the Environmental Protection Act 2008 and the Environment Protection (Environment Impact Assessment) Regulation 2012.

14. The DOE is a department under the Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour. Prior to 2011, it was part of the Ministry of Natural Resources. The

[3] SPREP. 1997. Tuvalu: National Environmental Management Strategy (Apia, Samoa)

DOE has the responsibility under the legislation for reviewing, assessing and monitoring of projects.

15. The procedures for undertaking environment impact assessment under the Environment Protection (Environment Impact Assessment) Regulation 2012 include a preliminary environmental assessment report (PEAR) be prepared for all development projects in accordance with Regulation 8, and a full environment impact assessment (EIA) be prepared for activities with significant impacts as identified in the PEAR.

16. The PEAR will include inter alia an assessment of all reasonably foreseeable adverse and positive impacts, including long-term and short-term, primary and secondary consequences and an indication of measures that the proponent intends to take to mitigate or avoid identified adverse impacts. DOE will review the PEAR and prepare a report for the Minister. The Minister will consider the preliminary report and the recommendations provided by the Director of DOE.

17. If DOE confirms that a project will not cause any significant adverse impact to the environment and has complied with the requirements of Regulation 8, the Minister may give written approval to the project based on the preliminary report. The DOE and a proponent can also agree that an EIA is required for a major project at any time prior to or during the preparation of a preliminary report. If, after a review of the preliminary report, DOE confirms the project will cause significant adverse impacts to the environment, then the Minister may give notice in writing to the proponent that an EIA is required.

18. All EIA reports are submitted to the Director of DOE who arranges for a review of the report to be undertaken by DOE, or by an external review in accordance with Regulation 15 if DOE does not have the necessary specialist skills to appropriately review a full EIA or any specific parts of a EIA. All EIA together with the report of the review by the DOE and a report of public consultations (if any) shall be referred to the Environmental Assessment Task Force for consideration.

19. The Minister may give written approval to any project based upon a full EIA which has complied with the requirements of Part IV, and which the Task Force has reviewed in accordance with Part V. The Task Force may also recommend to the Minister that a proposed major project be refused permission to commence or continue due to the unacceptable environmental impacts of the potential or existing project.

20. **Other relevant legislation**. Under the Foreshore and Land Reclamation Act the State owns the foreshore and seabed. This is subject to public rights of navigation, fishing and passing over the foreshore, as well as any private rights which may exist. Section 3 (2) of the Act also gives authority to the Kaupule (council of elders) on each island specifically for licensing people who wish to remove anything from the foreshore. No person shall remove from the foreshore of any part of Tuvalu any sand, gravel, reef mud, coral or other like substances without having first obtained from the Kaupule in whose area of authority such foreshore lies, a license for that purpose.

21. The Conservation Areas Act 2008 makes provision for the declaration and management of conservation areas. The Minister may declare any part of the territory of Tuvalu as a conservation area upon the request of a Kaupule and after due consultation with the Kaupule recommending the establishment of a conservation area. The objective of the conservation area is to protect the coastal, marine and terrestrial environment and preserve the biodiversity.

22. The Marine Resources Act 2006 is the main law dealing with fisheries in Tuvalu and makes provisions for the promotion and regulation to ensure the long-term conservation and sustainable use of the living marine resources for the benefit of the people of Tuvalu. The Marine Resources Amendment Act 2012 implements changes to the principal act which are intended to ensure that Tuvalu's international, regional and national rights and responsibilities in relation to fisheries conservation, management and development are accommodated. The Amendment significantly increased the level of penalties for various types of offence under the Act.

23. Each inhabited island has a council of elders, or falekaupule, who are responsible for running the affairs of the island. The falekaupule cooperates with the national government on matters relating to the island and on matters of custom. The Falekaupule Act 1997 (revised 2000) empowers Kaupule to provide for the improvement and control of fishing and related industries in accordance with the Fisheries Act and to prohibit, restrict or regulate the hunting, capture, killing or sale of animals, reptiles, birds or fish in accordance with the Wildlife Conservation Act.

24. **International agreements and conventions**. Tuvalu has ratified numerous environment-related international and regional commitments, and remains in general compliance with the spirit of such commitments (Table 2.1).

Table 2.1: International Conventions and Treaties

Year	Convention or Treaty
1972	Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)
1973	All IMO conventions and protocols relating to the prevention of pollution from ships
1982	United Nations Convention on the Law of the Sea (UNCLOS)
1982	Cooperation in the Management of Fisheries of Common Interest (Nauru Agreement)
1985	South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty)
1985	Vienna Convention for the Protection of the Ozone Layer
1986	Protection of Natural Resources and Environment of the South Pacific Region and Related Protocols
1987	United States Multilateral Fisheries Treaty (as amended)
1987	Montreal Protocol for the Vienna Convention
1989	Basel Convention - Control of Transboundary Movements of Hazardous Wastes and Their Disposal
1989	Convention on the Prohibition of Fishing with Long Drift Nets in the South Pacific
1990	London Amendment to the Vienna Convention
1992	Rio Declaration on Environment and Development
1992	United Nations Framework Convention on Climate Change (UNFCCC)
1992	United Nations Convention on Biological Diversity (CBD)
1992	Copenhagen Amendment to the Vienna Convention
1993	Niue Treaty in Fisheries Surveillance and Law Enforcement

Year	Convention or Treaty
1993	United Nations Chemical Weapons Convention
1994	United Nations Convention to Combat Desertification
1995	Waigani Convention – banning importation, controlling and managing hazardous and radioactive waste within the South Pacific Region
1995	Amendment to the Basel Convention
1997	Kyoto Protocol to the UNFCCC
1999	Basel Protocol on Liability and Compensation for Damage to the Basel Convention
2000	Cartagena Protocol on Biosafety to the CBD
2001	Stockholm Convention on Persistent Organic Pollutants (POPs)
2004	Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (Tuna Convention)
2016	Paris Agreement to the UNFCCC

B. ADB Safeguard Policy Statement

25. The goal of the ADB's SPS[4] is to promote the sustainability of project outcomes by protecting the environment and people from any potential adverse impacts of the project.

26. The objectives of the SPS are to: (i) avoid adverse impacts of projects on the environment and affected people, where possible; (ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

27. The SPS contains three safeguard requirements; SR1: environment, SR2: involuntary resettlement, and, SR3: indigenous peoples. Each of the safeguard requirements comprises an objective, scope and triggers, and a set of policy principles that must be met. Each of the safeguard requirements follows a due diligence process of screening, categorization, scoping, consultation, impact assessment, management, and monitoring and reporting. Documentation of the due diligence is subject to disclosure as per the requirements of the Public Communications Policy 2011.

28. ADB will not finance projects that do not comply with the SPS and the host country's social and environmental laws and regulations, including those laws implementing host country obligations under international law. The SPS also contains a prohibited activities list identifying specific activities that ADB will not finance.

29. As per SR1, the project has been screened as category B i.e. its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. This IEE identifies as far as practicable the various components of the project and assesses the potential adverse environmental impacts and identifies the measures required to mitigate or minimize them and includes these in the EMP.

[4] ADB. 2009, Safeguard Policy Statement (Manila, Philippines)

III. PROJECT DESCRIPTION

A. Rationale

30. Tuvalu has inadequate transportation infrastructure and services. There are three Government owned ships that provide a service every two to three weeks from Funafuti. There are no docking facilities for these ships and passengers and cargo are transferred by small workboats to and from the ship floating off-shore. Niutao has no docking facilities even for the workboats, and passengers must transfer to and from the workboats directly from the beach.

31. Cargo is manually carried to and from the workboats and often while walking in the water. The workboats also need to navigate through the surf and into narrow channels to reach the shore. This is potentially dangerous depending on the sea conditions, and serious accidents do occur, resulting in loss of life and economic values. Transfer operations are not possible when the sea is rough or after dark, further reducing the efficiency of ship operations.

32. The effectiveness and efficiency of domestic maritime transport is essential for the economic development of Tuvalu. The only means of inter-island travel is through voyages by government owned ships. The government fleet currently includes three passenger/cargo ships operated by the MCT, a research boat under the Fishery Department, and a patrol boat. The passenger/cargo ships travel from Funafuti to the groups of outer islands and to Fiji, and therefore each island only has access to these ships once every 2–3 weeks as part of a four-day circuit.

33. Investment in the domestic maritime sector is articulated through the government's Te Kakeega III Strategic Priority (TKIII). TKIII's 9.7 Maritime Service states that: "The outer islands need boat harbors and related facilities. The islands most in need are: Niutao, Nanumaga, Nui and Nukulaelae. Boat harbors and facilities are needed to improve travel safety, faster and safer cargo handling (offloading and loading), handling a greater range of cargo, handling larger cargo loads, and improving shipping services overall." In October 2017, the Cabinet endorsed the prioritization of maritime infrastructure investment in the outer islands, with facilities at Nanumaga and Niutao to be constructed next.

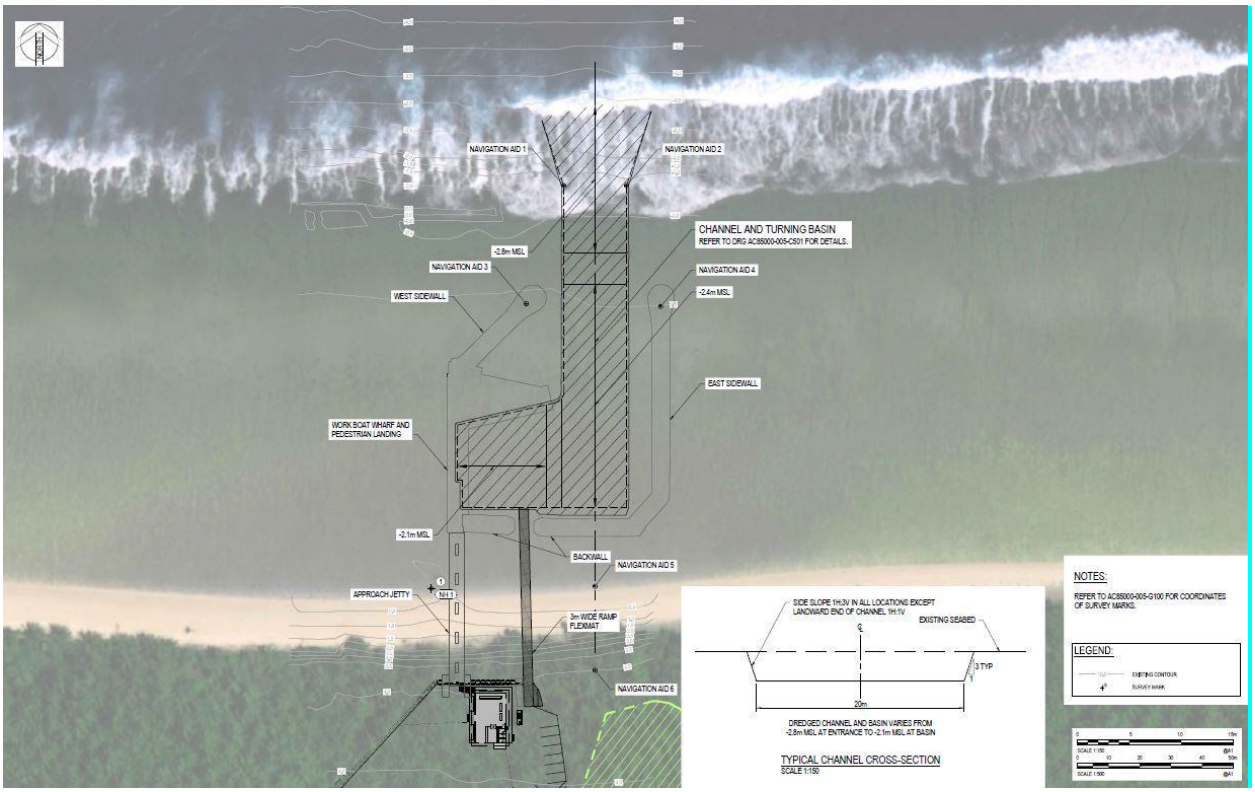
B. Proposed Works and Activities

34. The project's works consists of the dredging and reclamation, concrete construction of the wharf, the approach jetty, navigational aids, the boat ramp, a warehouse and passenger terminal building (Figure 3.1).

35. It is expected that construction works would take approximately two months, although this would be dependent on there being a sufficiently suitable weather window for the works to take place. The construction phase will consist of several elements, being the temporary working platform, breakwater, the dredging and excavation works, the wharf and the access jetty from the land to the wharf. The work on the reef platform may be done in separate stages or in tandem with the dredging and excavation. This will be largely determined by the contractor who will assess the practical aspects including machine utilization and efficiency, depending on the size and complexity of the planned works on the reef platform.

36. Existing access to the island of Niutao is by way of a dredged channel in the outer reef on the north- western side of the island. It is expected the contractor will initially use this existing channel for the first stage mobilization onto the island.

Figure 3.1: General Arrangement of Marine Infrastructure



Source: TA 8674-REG: Trade and Transport Facilitation in the Pacific – Feasibility Study (April 2018)

37. **Channel and basin dredging**. Dredging is defined as the removal of sand and rock material from the bottom of the channel and includes removal of the solid rock material from the side walls and existing turning basin within the reef platform. Dredging will, by preference, be restricted to tracked excavators using a hydraulically operated rock breaker attachment.

38. The width of the dredged channel has been set at 20m which should allow for the contractor's vessel to gain safe access to the wharf area to unload construction equipment for the works, while also be suitable for ongoing use by the workboats when the infrastructure is operational. The main channel is approximately 130 m long and dredged at its seaward end to a maximum depth of – 2.8 m below mean sea level (MSL). At the shoreline end the channel ends in a turning basin that is dredged to a depth of -2.1m MSL. There is an intermediate -2.4m MSL dredged depth for the channel along the central section of the channel. These depths have been determined based on the wave heights in the channel and ensuring acceptable under keel clearance for the workboats.

39. The channel and basin would be dredged using one of two preferred methods: (i) perched on top of a bund extending from the shoreline to the end of the channel; or, (ii) the basin and part of the channel (closer to the shore) would be built in the dry season with the use of pumps and edge bunds. Dredging will, by preference, be restricted to excavators using a hydraulically operated rock breaker attachment. The previous New Zealand financed Ship to Shore project successfully excavated (dredged) the narrower channels with 40 tonne excavators.

40. The dredging for the channel and the basin is most likely to be undertaken with a 40 or 50 tonne excavator after the top crust of coral flats has been ripped to loosen it. Alternatively, a cutter suction dredge could be used. The removal of broken reef rock material and debris from the channel will be carried out by a tracked excavator with a long-reach bucket attachment. The excavated material will be transported by truck from the work site to the spoil disposal site located on the land. The footprint of the channel and turning bay will be surveyed and marked prior to dredging. The coordinates will also be recorded by GPS to assist with any satellite based excavation or dredging methods. The use of a grinder/suction head may also be considered in the final method statement by the contractor as a complementary method for the removal of smaller material and sand once the larger material has been removed from the channel and turning basin. This will involve a grinder/suction device which will deliver sands and sediments to the island by way of pipes to the spoil disposal site that has already been defined. These dredging machines are often equipped with GPS so that they can operate accurately within a clearly defined environment, particularly one that is affected by wave movement.

41. Dredging and placement of marine infrastructure would result in the loss of approximately 8,295m^3 of intertidal flat and subtidal reef habitat.

42. **Spoil site**. A large area (12,800m^2) on land has been identified for the contractor to use for stockpile of dredged material for short term use and for the longer-term storage of crushed coral. The contractor will need to design the layout and details of the reclamation to suit their construction approach, to ensure that there is minimal impact on the lands. It is expected that the coral spoils not used in the project works will be left in this area to provide a working stockpile for the Kaupule. This spoil site will be subject to further discussion and agreement with the community, through social due diligence to be completed prior to construction.

43. **Pre-cast concrete**. A precast blockwork approach was selected to assist with the rapid construction of the sidewalls and the wharf. The concrete blocks are expected to be precast out of the country and delivered by ship or barge to the site. Prior to the placement of the concrete blocks, the surface of the reef flats will be cut to form a shallow trench to provide a surface upon which to place the individual blocks. The extent of trenching will be limited to the width and length of the structures. The blocks should be placed into the prepared trench by crane. Works will be constrained by the tide and will require coordination with other associated construction activities. There are three different types of blocks used but all are hollow blocks. The approach also has precast concrete works. These are precast slab panels which are used temporarily as formwork to support the in-situ slab which is poured on top of it. The precast slabs will act compositely with the hardened in-situ concrete to structurally act as one slab element.

44. **In-situ concrete**. As noted above there is some in-situ concrete in the approach jetty slab and this needs to be made from high quality concrete and using imported aggregates. The second type of in-situ concrete is more a filler concrete and is used in the sidewalls and the wharf and has been specified as coral based concrete. The fine and the coarse aggregate will be made from crushed coral that has been dredged from the channel and the basin.

45. **Sidewalls**. Sidewalls along the side of the channel has been designed to reduce the operating wave and current climate in the channel to allow for improved boat navigation. These sidewalls act as breakwaters in terms of wave actions. The review undertaken included several seawall options and has recommended optimal lengths, widths and top surface levels of the sidewalls. There are two sidewalls beside the channel, a northern and a southern sidewall.

46. **Wharf and pedestrian loading area**. The main marine structure is the wharf and its adjoining pedestrian landing area. The quay-line for the loading dock section will include rubber fenders and mooring bollards. The main deck area has been designed to cater in its extents for the turning maneuver of the crane truck. A wave wall has been incorporated into the deck to allow the deck level to be lowered which reduces the amount of concrete needed and provides a more useable level for unloading and loading the boats.

47. **Approach jetty and abutment**. The approach jetty is the structure between the shore and the wharf. It will consist of a suspended concrete deck placed on steel hollow tube piles that are specified as driven into the reef platform. The approach jetty is an open structure allowing water flow through it, so it will have limited impact on the critical movement of sands along the beach as the jetty. The deck comprises precast and in-situ concrete slabs cast separately but acting together as a composite member once the in-situ concrete is cast. The deck does not have any wave wall protection and will be inundated by waves during a major cyclonic event. The concrete deck has grated openings in the deck to ensure that air entrapment is kept to a minimum.

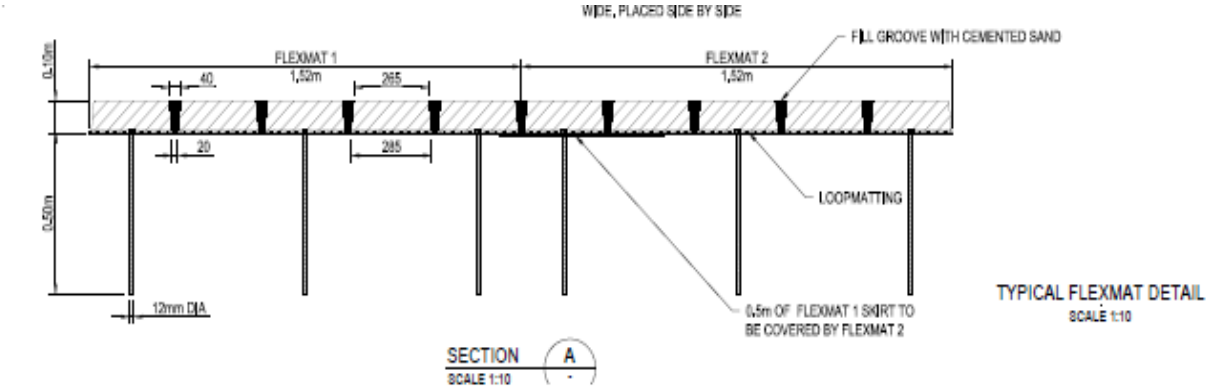
48. Further geotechnical investigation and assessment will be undertaken. A redesign maybe required for the pile foundations to best suit the conditions and the contractor equipment. Various options are considered suitable as alternatives and include:

- Steel H driven piles with a durable protection system, or
- Precast concrete columns grouted into pre-drilled holes as bored piles, or
- Removing piles as foundation altogether and instead directly supporting the concrete columns on mass concrete footings approximately 7m long, 2m wide and over 1m deep at every bent, or
- Adopting one of the above and incorporating into the deck another opening so that there are two grated openings positioned in between the column/pile centerlines.

49. **Boat ramp**. A proprietary type flexmat will be used to provide a boat access ramp from the dredged turning basin to the land. The flexmat consists of a 3m wide uniform rectangular pattern of square concrete blocks pre-cast onto a durable woven polypropylene fabric which is then laid by a mobile crane onto the prepared site and anchored to the reef platform using anchor pins to prevent creep or slippage caused by vehicle movement and wave dynamics. It is expected that the flexmat will be precast out of the country and delivered by ship or barge to the site. Minimal surface levelling of the reef platform and beach will be required to allow for the placement of the flexmats which can be undertaken by mobile cranes.

50. A flexmat system has been chosen for the ramp instead of a solid concrete slab and beam as they are lightweight, can be precast to minimize costs and have a flexibility that can follow the changing shape of the beach profile as it moves seasonally with the prevailing conditions. A cross section of the flexmat ramp is shown in Figure 3.2.

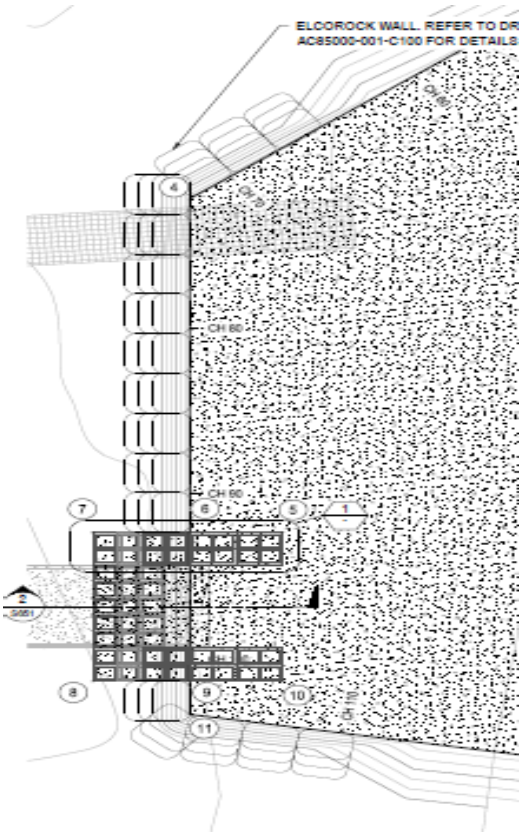
Figure 3.2: Cross-section of Flexmat Ramp



Source: TA 8674-REG: Trade and Transport Facilitation in the Pacific – Feasibility Study (April 2018)

51. **Seawall**. A seawall along the face of the seaward edge of earth-fill compacted platform has been adopted to ensure that erosion of the platform resulting from cyclonic wave effects is minimized. An Elcorock (sandbag) container solution has been adopted for the seawall. Figure 3.3 is a plan showing the extent of the Elcorock seawall.

Figure 3.3: Extent of Elcorock Seawall



Source: TA 8674-REG: Trade and Transport Facilitation in the Pacific – Feasibility Study (April 2018)

52. **Navigational aids**. The channel needs to be properly marked to ensure the safe passage of boats entering and departing from the harbor. There are six navigational lights (nav-aids) proposed; nav-aids 3-6 are standard type nav-aids and nav-aids 1-2 are important indicators of the start of the channel and are located in deeper water and subject to significant extreme wave forces during a cyclonic event. A tripod type structure is considered the most appropriate design for the nav-aids. The design of the tripod is specialized given that certain companies hold intellectual design rights on specific details. Consequently, a performance specification has been drafted for the nav-aids to allow for the most efficient solution to the adopted for the project.

53. **Road works and platform**. Approximately 6,000m^3 of the dredged material will be used and approximately 6,000 cum of it will be used as fill for the roadworks and for constructing earthen platforms. The fill material shall be deposited in layers of a thickness appropriate to the compaction method to be used. Each layer of sub-base shall be separately compacted to a density not less than 95% of maximum modified dry density. The roadworks and the platforms have been graded to ensure that there is no major ponding due to heavy rain events. Otherwise, drainage is achieved by sheet flow onto the surrounding un-cleared land without the need to construct any specific drainage infrastructure.

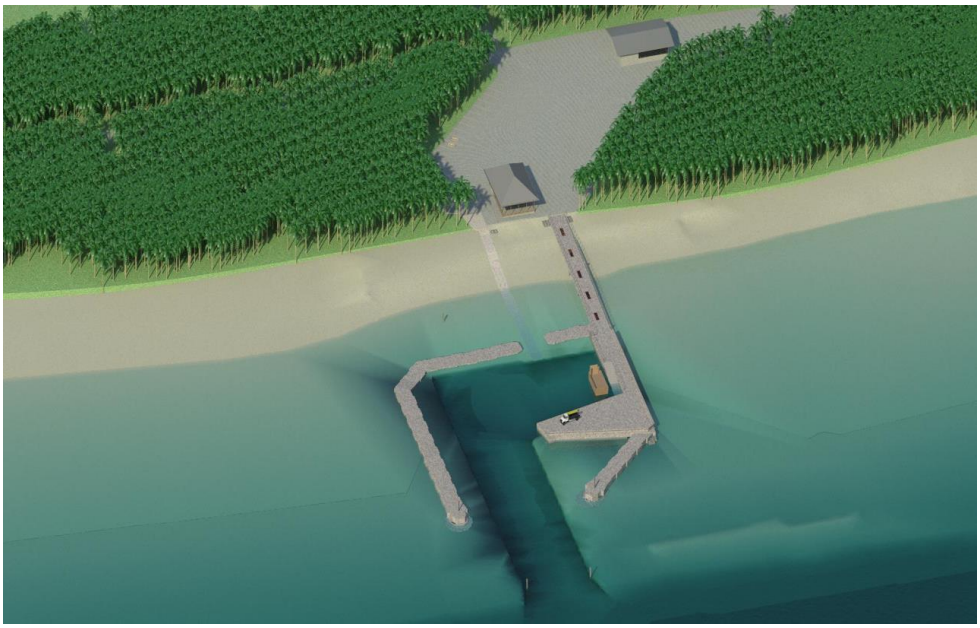
54. **Warehouse**. The proposed warehouse is a standard building shell that is best designed and built as a performance based specification combined with the concept building layout drawings to achieve the best possible outcome and price of the structure. The warehouse is a single-storey structure with one section partitioned off for food storage. The walls of the warehouse are partially exposed to allow good ventilation of the structure. The warehouse lighting is by solar powered LED lights. There is an outside electrical pit for future connection of mains power. A circular water tank is included for water supply of the warehouse and nearby areas and provision has been made for a future connection to the passenger terminal building.

55. **Passenger terminal**. The passenger terminal is a one-story building with no main walls. It has a roof of a form to mirror the traditional Tuvaluan main building style with an aluminium sheeting roof. The passenger terminal is a standard building shell that is best designed and built as a performance based specification combined with concept building layout drawings to achieve the best possible price of the structure.

56. The building layout includes one male, one female and one person with disability toilet in a corner of the building with its own walls. The septic tank is shown nearby and is based on a standard Tuvalu PWD type tank. A 5m by 4.5m kitchen is provided so that simple food and drinks can be catered for in the building. A 15,000 litre rain water tank is set-out close to the kitchen and the toilets. The sitting and table furniture in the building is minimalistic to allow for people to stand and also pass through the building.

57. Figure 3.4 is an impression of the proposed marine and land-side infrastructure.

Figure 3.4: Visual Montage of Infrastructure at Niutao



Source: TA 8674-REG: Trade and Transport Facilitation in the Pacific – Feasibility Study (April 2018)

58. **Implementation schedule**. The actual and proposed schedule for milestone events for the original project and the additional financing are shown in Table 3.1

Table 3.1: Project Milestone Events and Dates

Milestone	Original Project Date	Additional Financing Date
IEE/EMP prepared	Jul-16	May-18
Board approval	Nov-16	Sep-18
IEE/EMP updated	Mar-17	Q4 2018
Grant effectiveness	Aug-17	Oct-18
Civil works tender	Mar-17	Sep-18
CSC contract award	Sep-17	Oct-18
Civil works contract award	Aug-17	Dec-18
Sediment plume modelling and analysis	Q4 2018	Q4 2018
Construction program + CEMP submitted	Feb-18	Q1 2019
Construction commencement	Aug-18	Q2 2019

IV. BASELINE INFORMATION

A. Physical Resources

59. Tuvalu consists of six coralline atolls (Nanumea, Nui, Nukufetau, Funafuti, Nukulaelae, Vaitupu), and three table reef islands (Nanumaga, Niutao, Niulakita) with a total land mass of some 26 km^2 spread across an economic zone of 757,000 km^2.

60. **Topography and geology**. The islands of Tuvalu are very low-lying with an average height of 2m above sea level. Like other coral atolls and islands, the soil is derived from limestone which results from coral formation over thousands of years. Tuvalu is geologically very young, with most of its islands having poorly developed sandy or gravel coralline soils. Niutao, located some 348 km north-west of Funafuti, is surrounded by a fringing reef. It is a table reef comprising a single island of 2.53 km^2 being approximately 2.5 km long and 1.1 km wide with its long axis oriented east to west (Figure 4.1). There is a large inland lagoon east of Tavea village which is traversed by a causeway. There is also a small brackish-water lagoon in the central western half of the island that is connected to the sea by subterranean passages.

Figure 4.1: Satellite Image of Niutao

61. The island has two reef channels, one to the north of the village (the Muli Channel) and the other to the west of the village (the Kulia Channel). The Muli channel, approximately 75 m in length, is currently the favored approach with a better landing facility. The island is characterized by consistently rough seas, and access from ship to shore and for fishing boats is very challenging and risky even in calm conditions.

62. A concrete beach ramp was built landwards of the Muli Channel in 1994-95 and resulted in very severe erosion of the beaches of some 1.4 km of coast, affecting up to 20% of the island's foreshore around the north-eastern corner and western side of the island. Much of this sand has been permanently lost from the island ecosystem by being directed out through the Muli Channel, and it is unlikely that the island will recover the loss in human timeframes. Removal of this ramp was completed by the Kaupule in January 2006.[5]

63. The coastal areas of Niutao are characterized by white sandy beaches, reef flats, reef patches, lagoons, mangrove forests, extensive reef mud flats and sea grass beds. The island is vulnerable to coastal erosion due to human activity and the effects of tropical cyclones.

64. **Soils**. The calcareous soils found on all three island are shallow, coarse-textured and poorly developed overlying a limestone formation. Soils range from 250-1000mm in depth, generally low in fertility and have limited potential for agriculture production being typically deficient in most of the important nutrients needed for plant growth (eg. nitrogen, potassium and micronutrients such as iron, manganese, copper and zinc). The island landscape is inherently dynamic, with erosion and accretion of sands along the coastal margin being common features on all the islands, especially during tropical cyclones associated with high seas and storm surges.

65. **Seismicity**. Tuvalu is situated in a relatively quiet seismic area but is surrounded by the Pacific "ring of fire," which aligns with the boundaries of the tectonic plates. These tectonic plate boundaries are extremely active seismic zones capable of generating large earthquakes and, in some cases, major tsunamis that can travel great distances. No significant earthquakes have been observed in recent history. However, in 1899, a large earthquake off the eastern coast of New Ireland, Papua New Guinea generated a large tsunami that resulted in destructive waves at Nukufetau atoll and a significant historic seismic event was a magnitude 7.0 earthquake recorded in 1907.[6] The World Bank Country Risk Profile concludes that Tuvalu has a 40% chance in the next 50 years of experiencing, at least once, weak levels of ground shaking.[7]

66. **Coastal processes**. Hindcast modelled wave data offshore of Tuvalu (deep ocean waves) indicates that the offshore non-cyclonic wave climate is predominantly driven by the south-east trade winds and long period south-westerly swell waves from the Southern Ocean. The wave climate information shows that waves predominantly come from the east to the south-east (~25% occurrence) and can exceed 3 m significant wave height (Hs) at times. There is also a significant occurrence of long distance swells coming from the south-west which typically have higher periods.

67. **Tides**. Tidal variations in the area are generally small, with a mean spring tidal range (MLWS to MHWS) of 1.6 m. Due to the small tides, tidal currents are expected to be small. The governing currents on the reefs are expected to be driven by waves. The island has a fringing reef. The larger waves plunge on the edge of the reef due to the steep drop-off and abrupt change in depth at this location. The tidal range for Funafuti – Tuvalu is set out in Table 4.1; Niutao's tides are expected to be similar to Funafuti's tides.

[5] New Zealand Aid Programme and Beca. 2004. Tuvalu Ship to Shore Transport Project (Auckland, New Zealand)
[6] AIR Worldwide Corporation. 2008. Pacific Catastrophe Risk Financing Initiative, Country Risk Profile Tuvalu (Funafuti, Tuvalu)
[7] World Bank. 2011. Pacific Catastrophe Risk Assessment and Financing Initiative: Tuvalu Country Risk Profile (Washington D.C, US)

Table 4.1: Tidal Range for Tuvalu

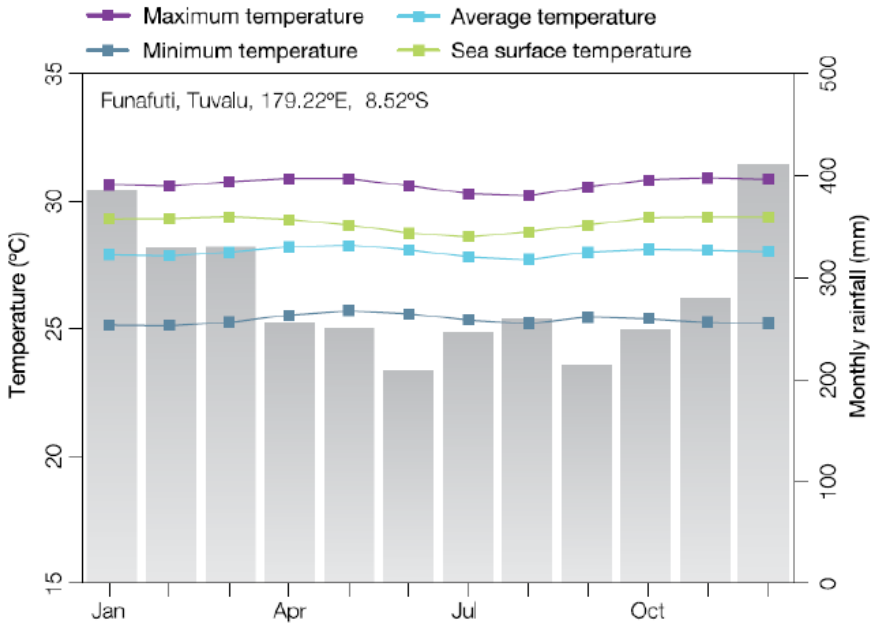
Tidal Plane	Water Level (m to LAT)	Water Level (m to MSL)
Highest Astronomical Tide (HAT)	2.422	1.263
Mean High Water Spring (MHWS)	1.980	0.821
Mean High Water Neap (MHWN)	1.492	0.333
Mean Sea Level (MSL)	1.159	0
Mean Low Water Neap (MLWN)	0.827	-0.332
Mean Low Water Spring (MLWS)	0.338	-0.821
Lowest Astronomical Tide	0.000	-1.159

Source: Pacific Catastrophe Risk Financing Initiative - Country Risk Profile Tuvalu (2008)

68. **Climate**. Tuvalu lies within the south-east Pacific trade wind belt just south of the dry belt of the equatorial oceanic climate zone.

69. The country has two distinct seasons – a wet season from November to April with winds from the west and northwest when strong winds and high rainfall can be expected, and a dry season from May to October (Figure 4.2) when light southeast trade winds predominate. The predominant wind direction ranges between east-northeast to east-southeast for all islands of Tuvalu.

Figure 4.2: Seasonal Rainfall and Temperature in Funafuti



Source: Pacific Climate Change Science Program – Current and Future Climate of Tuvalu (2011)

70. Tuvalu has a tropical marine climate with consistently uniform temperature ranging from 26°C – 32°C and high humidity. The average annual rainfall is 3000 mm but rainfall can exceed 4000 mm per annum at times, though Tuvalu often experiences droughts because of its location near the Pacific equatorial dry zone. The average rainfall for the period 1942–2005 is 2875 mm per annum. However, rainfall varies from 3500 mm/annum in the southern islands to 2700 mm/annum in the northern islands.

71. The cyclone season is from November to April with winds from the west to north-west when strong winds and high rainfall can be expected. An average of eight cyclones per decade developed within or crossed the Tuvalu exclusive economic zone between the 1969/70 to 2010/11 seasons. Tropical cyclones were most frequent in El Niño years (12 cyclones per decade) and least frequent in La Niña years (3 cyclones per decade). Only three of the 24 tropical cyclones (13%) between the 1981/82 and 2010/11 seasons were severe events (Category 3 or stronger). Available data are not suitable for assessing long-term trends.[8] Several severe tropical cyclones have caused devastating damage to Tuvalu in recent years. Notable cyclones include Cyclone Bebe in 1972, a Category 3 cyclone, which knocked down 90% of the houses on Funafuti and resulted in flooding due to seawater coming up through the coral to a depth of 1.5 m.

72. In 1990, Category 4 Cyclone Ofa affected Tuvalu and destroyed homes on Niutao, Nui and Nukulaelae. Cyclone Gavin was the first of three Category 3 tropical cyclones to affect Tuvalu during the 1996-97 cyclone season, with Cyclones Hina and Keli affecting the islands later in the season. In March 2015, Category 5 Cyclone Pam resulted in 3-5 m waves causing significant damage to agriculture and infrastructure on most of the islands in Tuvalu during including deposition of sand and rubble into the reef access channel of Niutao, cutting off access from the island to the open ocean. More recently, Category 4 tropical cyclone Ula affected Tuvalu in early 2016 with 3-4m waves affecting all the islands.

73. Storm surges associated with cyclonic disturbances combined with high tides can result in waves washing over low sections of the atolls. As well as disrupting road access, increasing soil salinity, contaminating groundwater, and enhancing coastal erosion processes, the resulting flooding causes agricultural losses, particularly of taro crops, and damage to buildings. These storm surges have implications for the design of the harbor and jetty facilities.

74. **Climate change**. Tuvalu is listed as one of several island groups most likely to disappear beneath the sea in the 21st century due to climate change effects. For the period to 2100, the Pacific Climate Change Science Program of Australia[9] projections and climate science findings indicate:

- Surface air temperatures and surface sea temperatures are projected to continually increase (very high confidence);
- Annual and seasonal mean rainfalls are projected to increase (high confidence);
- The intensity and frequency of extreme heat days are projected to increase (very high confidence);
- The intensity and frequency of extreme rainfall days are projected to increase (high confidence);

[8] Government of Australia and Pacific Climate Change Science Program. 2011. Current and Future Climate of Tuvalu (Canberra, Australia)

[9] Government of Australia and Pacific Climate Change Science Program. 2011. Climate Change in the Pacific - Volume 2: Country Reports, Chapter 15 Tuvalu (Canberra, Australia)

- The incidence of drought is projected to decrease (moderate confidence);
- Tropical cyclone numbers are projected to decline in the south-east Pacific Ocean basin (0–40ºS, 170ºE–130ºW) (moderate confidence);
- Ocean acidification is projected to continue (very high confidence);
- Mean sea-level rise is projected to continue (very high confidence); and
- The risk of coral bleaching will increase in the future (very high confidence).

75. **Water resources**. There are no fresh water rivers or streams on the island, however fresh water exists underground as water lenses floating on seawater. On Niutao there are three wells from which fresher water sits in a "lens" above the salt water that leeches in through the coral. These are derived from the infiltration of rainwater into the water table below the ground. These lenses exist along the length of the island and are deepest at the center and shallowest on the sides facing the ocean or lagoon. The lens is formed where the island is sufficiently wide to reduce the outward flow of the accumulated underground lens. These freshwater lenses are extremely vulnerable to occasional environmental influences.

76. Water quality measurements on the islands indicate that groundwater is heavily polluted with a high bacteria count. Due to the increase in the level of pollution and salinity of ground water sources and, all islands are now predominantly reliant on rain water collected from buildings and houses with iron roofs and stored in concrete tanks above and below ground or more recently in plastic tanks provided by European Union and Government of Australia financed projects.

77. **Coastal resources**. Tuvalu's shallow marine environments consist predominantly of fringing and patch reefs, with reef flats and intertidal rocky/sandy shores. There is no continental shelf seaward of any of the islands and the only substantial areas of shoal water are found within the internal lagoons. These atolls and low coral islands are generally subject to constant change through continuing growth of living corals, erosion and accretion of wave action. Water depths increase very rapidly from the coast to over 1000 m within a few kilometers from the shore or outer reefs (Sauni 1998). Nuitao is a single islet made up of sand and coral materials (McLean and Hosking 1991). The coral reef comprises the flat (Plates 4.1 and 4.2), crest and slope. The island is low-lying, with an average elevation of about 2 m above sea level.

Plate 4.1: Typical foreshore

Plate 4.2: Typical intertidal flat

78. The coastal areas of Niutao are characterized by white sandy beaches, reef flats, reef patches, lagoons, mangrove forests, extensive reef mud flats and sea grass beds. These areas contain a variety of habitats, numerous eco-systems and marine organisms. The islands are vulnerable to coastal erosion due to human activity and the effects of tropical cyclones.

79. The impact of mining of beach sand, gravel and other aggregates for construction purposes on the coastal processes has significantly affected coastal areas on all islands. Consequently, the removal of beach gravels and sands are now limited only for the construction of houses for personal use. Any project-scale removal of gravels and are sand are not permitted. Thus, infrastructure projects are now required to import suitable aggregate, mainly from Fiji, adding considerably to the costs of construction.

80. **Unexploded ordnance**. Tuvalu was used as an important staging base for US aerial attacks in the Battle of Tarawa in Kiribati during World War II. Bomber bases were established on Funafuti, Nanumea, and Nukufetau, being the only islands big enough to accommodate them, with the latter two being considerable closer to Tarawa. Funafuti, Nanumea and Nui were the only islands to be bombed during this operation. There are no recorded or expected unexploded ordnance (UXO) on Niutao.

B. Terrestrial Biological Resources

81. **Flora.** As the soils are generally of poor quality they can support only a limited variety of flora. Thaman et al notes that the total number of vascular plants reported present at some time in Tuvalu is about 356 species of which only 64 (18%) are possibly indigenous. The remaining 292 species (82% of flora) are exotic species that have been introduced.[10] Most of the exotic species are described are ornamental or food plants or weeds. The most common trees found on all islands are coconut (*Cocos nucifera*) stands which make up around 67% of the land cover area of the outer islands, casuarinas (*Casuarina equisetifolia*), breadfruit (*Artocarpus sp*), hibiscus (*Hibiscus sp*), papaya (*Carica papaya*) pandanus (*Pandanus tectorius*), flame tree (*Delonix regia*) salt bush (*Scaevola sericea*) and terminalia (*Terminalia sp*). These plants are widespread in the Pacific and tropical regions generally, though most are spread primarily by human cultivation. Papaya and flame tree originate from outside the Pacific region. Indigenous broad leaf species, including *Calophyllum inophyllum*, make up single trees or small stands around the coastal margin.

82. There are no endemic species that are unique to Tuvalu and almost all indigenous plants are widespread, easily dispersed pan-tropical, Indo-Pacific or pan-Pacific coastal species that can cope successfully in environments with loose shifting sands, soilless limestone and rock outcrops, high wave action, high salinity and sea spray, periodic flooding, strong sunlight, strong winds and drought – all of the them conditions common on the atolls and islands of Tuvalu. The low number of indigenous species is an indication of the lack of habitat diversity on atolls and low islands compared with larger high islands, the difficulty of cross-ocean dispersal of plants and the difficulty of long term survival in the harsh atoll and low island environment.

83. From the most “natural” to the most highly modified/disturbed vegetation, the main vegetation types found on the atolls and islands of Tuvalu include:

- Inland broadleaf forest and woodland – in Niutao this is represented by scattered remnant trees

[10] Thaman, R, Fihaki, E. and Fong T. 2012. Plants of Tuvalu. USP Press Suva.

- Coastal littoral forest and scrub
- Mangroves and wetlands
- Coconut woodland and agroforest
- Excavated taro gardens
- Village houseyard and urban gardens
- Intensive vegetable and fruit gardens.

84. Mangrove forests, comprising two recorded species *Lumnitzera littorea* and *Rhizophora stylosa* (Rhizophoridae), also exist on muddy shores and coastal beaches where water is calm and in areas that are protected from waves and strong currents. The mangroves of Tuvalu are listed as a threatened ecosystem.

85. **Fauna**. The fauna of Niutao is typical of the inhabited islands and atolls of Tuvalu.[11] The indigenous terrestrial vertebrate fauna of Tuvalu includes no indigenous land mammals, amphibians or freshwater fishes. There are some of terrestrial reptiles, all lizards, one of which is Tuvalu's only recorded endemic vertebrate, the Tuvalu forest gecko (*Lepidodactylus tepukapili)* which was found only on Tupuka Islet, Funafuti. Pigs, fowl, and dogs, all of which were imported in the 19th century, flourish on all the islands. There are also insects, land crabs and lizards, which are commonplace. The only indigenous mammal is the Polynesian rat which was most likely brought in with the first people.

86. **Avifauna.** A total of 41 species of birds have been identified in Tuvalu, of which 28 species are indigenous. There are three main families which include Sternidae, comprising eight species of terns and noddies; *Scolopacidae*, comprising six species of tattlers, godwits, curlews and stints; *Procellariidae*, comprising five species of shearwaters and petrels. These three families account for 46% of the total number of bid species recorded. Terns and noddies are resident birds and most of them are breeding in Tuvalu. Tattlers, godwits, curlews and stints are migratory birds. Shearwaters and petrels are visitors, quite uncommon and for which no breeding sites are known.[12] There are 22 known species of butterfly and moth.

C. Marine Biological Resources

87. **Overview.** Tuvalu's marine environment is the main local source of animal protein, products, such as shells, for handicraft production and revenue from licensing agreements with foreign fishing nations fishing within Tuvalu's EEZ.[13] Exploitation at the local level is mainly for subsistence use, although there has been limited local commercial fishing of finfish and shellfish for local sale and limited export on Funafuti.

88. The marine environment comprises of five main ecosystems or ecological zones; these include intertidal flats, subtidal lagoon areas, subtidal oceanside reefs and oceanic and open water, with mangroves included as both terrestrial and marine ecosystems. Within each of these zones are many combinations of habitat types, including algal flats, coral reefs, channels or reef passes, soft sandy and hard substrates or bottoms and seamounts, each with their own characteristic biological communities.

[11] Government of Tuvalu. 2016. Tuvalu National Biodiversity Strategy and Action Plan: Fifth National Report to the Convention on Biological Diversity (Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour)
[12] Job, S. 2009. Tuvalu Marine Life Project - Phase 1 Literature Review (Funafuti, Tuvalu)
[13] Government of Tuvalu. 2016. Op cit

89. All zones are important fisheries with the intertidal flats being among the most important, over exploited, and increasingly vulnerable traditional fisheries. Studies of Tuvalu's finfish resources, including sharks, rays and eels, suggest that the total number of inshore fish and offshore species could be 900 or more, about 500 of which are recognized by Tuvaluan names. The marine invertebrate fauna includes an incredible but threatened diversity of bivalve, gastropod and cephalopod molluscs, crustaceans, echinoderms, corals and other marine invertebrates. Almost of these species have been overfished or in declining numbers.

90. **Habitats and Biota** A review of existing information of key habitats and associated flora and a fauna indicated that Tuvalu's shallow marine environments, such as that found at the project sites, consist predominantly of fringing and patch reefs, with reef flats and intertidal rocky/sandy shores. Atolls and low coral islands such as Niutao, are generally subject to constant change through continuing growth of living corals, erosion and accretion of wave action. Importantly, Tuvalu contains many IUCN Red List threatened marine species, including many corals and mobile fauna (fish, turtles, sharks and marine mammals) that reside or forage in its nearshore environments.

91. **Marine ecological baseline survey methodology**. The marine ecological baseline study (October 2016) undertook surveying and sampling at 20 sites adjacent to the existing boat ramp, 40 sites around the vicinity of the proposed boat harbor location and three sampling points at reference locations to the north of the proposed boat harbor. Sampling was undertaken on snorkel from a small tender and from the shore on foot at low tide. A snorkel diver estimated the proportion of cover of coral, macro-algae, coral rock, coral rubble and soft sediment at predetermined sites within each location and within an approximate 50 m buffer of the proposed new boat harbor location. Where possible, sampling was also undertaken at reference sites to provide a broader assessment of conditions at each island and to provide a baseline for future monitoring if required. Each pre-determined sampling site was navigated to using a hand-held GPS. Photos and video of each site, including the types of coral, macro-algae and other biota (fish and mobile invertebrates), were taken for subsequent identification of taxa present. A towed underwater video camera with a live video feed was also deployed from the vessel to investigate habitats in deeper parts of the reef slope at the seaward margin of the project site and buffer.

92. Figure 4.2 shows the proposed harbor location divided into reef zones including the slope (farthest from shore), crest and flat (nearest to shore).

Figure 4.2: Reef Zones at Proposed Harbor Location

93. **Habitats and sessile assemblages**. As shown in Table 4.1, the proportion of live coral cover is greatest on the reef slope at each the three areas surveyed and greater at the proposed harbor location compared with the existing boat ramp. The reference survey stations (to the north of the proposed workboat harbor) recorded significantly greater proportion of live coral cover.

Table 4.1: Proportion of Habitat Cover Recorded at Survey Locations

Location	Reef Zone	Macro-algae (%)	Live coral (%)	Coral rock (%)	Other - coral rubble, soft sediment (%)
Proposed harbor	Flat (n = 15)	0.4	0.0	97.1	2.6
	Crest (n = 5)	2.8	11.4	85.8	0.0
	Slope (n = 7)	0.3	58.6	41.0	0.1
Existing boat ramp	Flat (n = 5)	14.0	0.2	83.8	2.0
	Crest (n = 4)	16.5	1.5	82.0	0.0
	Slope (n = 3)	0.0	3.0	96.3	0.7
Reference	Slope (n = 3)	0.0	61.7	38.3	0.0

Source: Cardno – Baseline Marine Ecological Investigation (2016)

94. At the proposed harbor location, a smaller proportion of coral cover was observed at the reef crest (11.4% ± 2.5) and none on the reef flat (Figure 4.3). The proportion of cover of live coral at the existing boat ramp at Niutao was very low, ranging between 3.0% ± 1.2 on the reef slope to 0.2% ± 0.2 on the reef flat, with most habitat consisting of coral rock covered with turfing and encrusting algae. A veneer of fine sediment was also observed on the coral bedrock at the existing boat ramp location. Families of corals recorded at Niutao included *Acroporidae*, *Pocilloporidae, Montiporidae* and *Poritidae* (see Plates 4.1 a and b). Several genera that were recorded for each of these families, however, genera of the family *Acroporidae* was the most abundant family, forming extensive pavements across the seafloor.

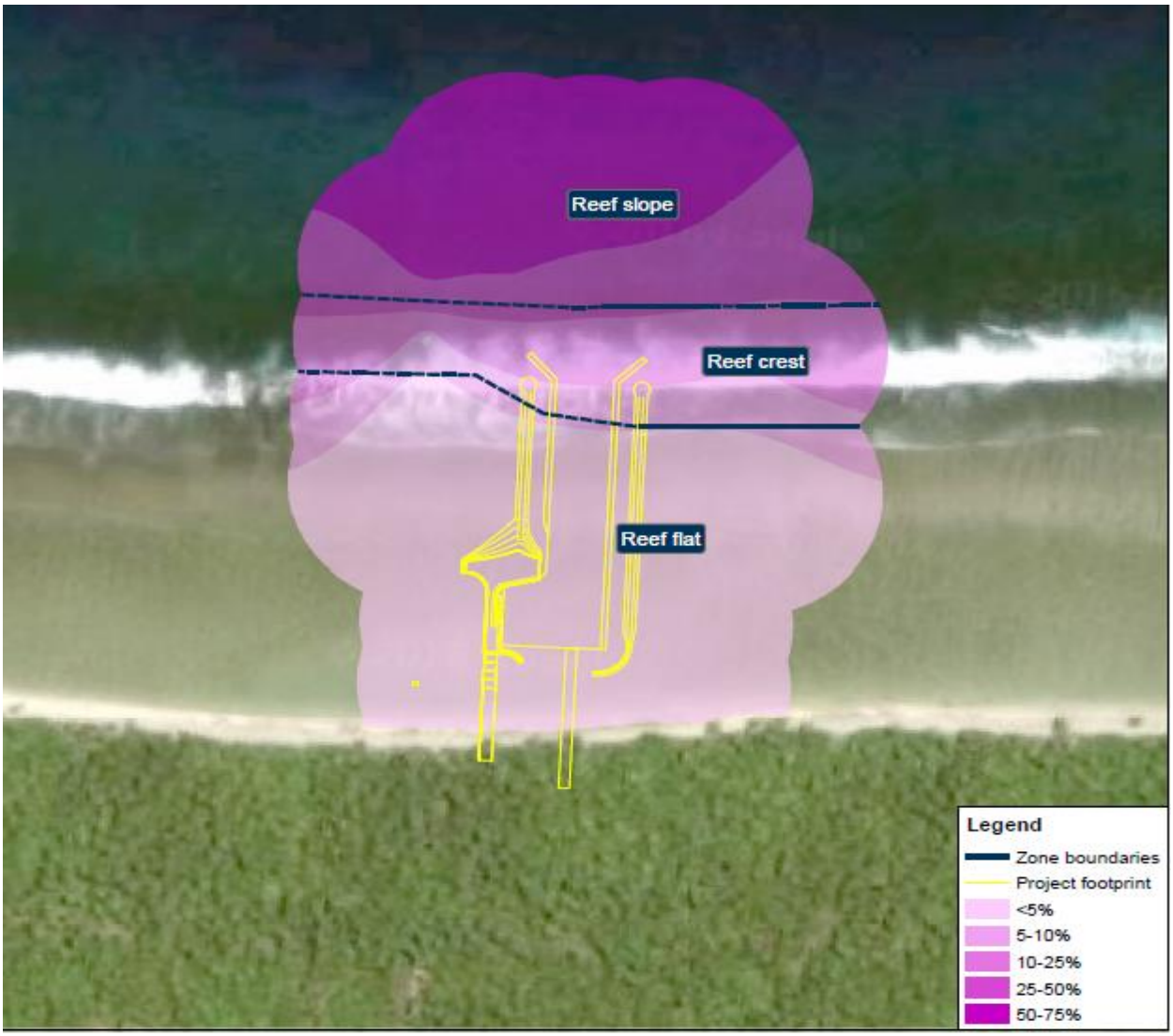
Plate 4.1a: Coral (*Pocilloporidae*) on reef slope

Plate 4.1b: Coral (*Montiporidae*) on reef slope

95. Plates 4.2 show the reef slope at proposed harbor location, Plate 4.2a includes school of convict surgeon fishes (*Acanthurus triostegus*) and blue-lined surgeonfish (*Acanthurus lineatus*).

Plates 4.2 a & b: Reef slope at proposed workboat harbor location

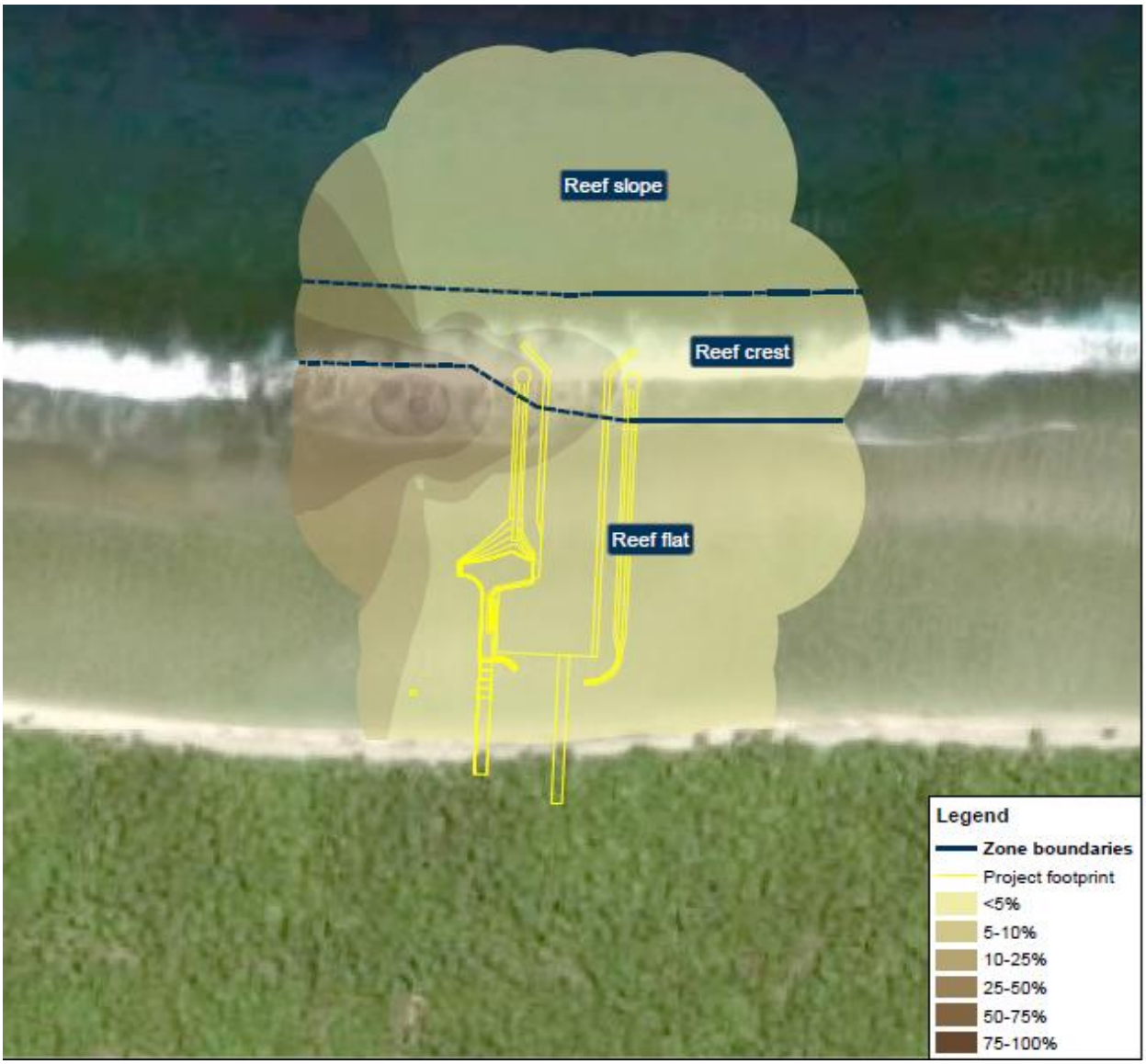
Figure 4.3: Proportion of Coral Cover



96. The proportion of macro-algae cover was greater at the existing boat ramp location than at the proposed harbor location and no macro-algae was recorded at the reference location. The mean percent cover at both these locations was, however, greatest within the reef crest zone and to a lesser extent, the reef flat, particularly at the existing boat ramp (Figure 4.4), *Caulerpa racemosa* and brown filamentous algae were the most common types of algae recorded on both the reef crest and flat.

97. The upper foreshore at the proposed harbor location consisted of bare rubble and loose boulders, with fine sand and no invertebrates or macro-algae was observed in this zone.

Figure 4.4: Proportion of Micro-algae Cover



98. **Fish assemblages and mobile macroinvertebrates**. A total of 37 species of fish from eight families were recorded during the surveys of Niutao across all locations surveyed. Families of fish represented by the most number of species included surgeon fishes (Acanthuridae), damselfishes (Pomacentridae), triggerfish (Balistidae) and wrasses (Labridae). The most commonly observed species at Niutao included the blue-lined surgeonfish (*Acanthurus lineatus*), surge damselfish (*Chrysiptera brownnriggii*), five stripe wrasse (*Thalassoma quinquevittatum*) and lemonpeel angelfish (*Centropyge flavissima*) (Annex 1). The holothuroid echinoderm (*Holothuria atra*) was present on the reef flat.

99. **Other marine fauna.** A total of 358 species of fish from 63 families were recorded on the islands of Niutao, Nui and Nanumea between January 1988 and August 1990 as part of an environmental impact study. The most diverse groups were from the families *Labridae* (wrasses), *Chaetodontidae* (butterfly fishes), *Serranidae* (groupers and rock cods) and *Pomacentridae* (damselfishes). Other speciose groups recorded in these surveys (and which are common to other Pacific islands) included *Acanthuridae* (surgeon fishes), *Balistidae* (trigger fishes), *Lutjanidae* (snappers) and *Scaridae* (parrot fishes). Several species of sharks and rays (elasmobranchs), including hammerhead, thresher and requiem (reef) sharks were also recorded among the many other families. Jones et al. (1991) considered that the actual number of species likely to occur in the islands of Tuvalu would likely be closer to that of the Marshall Islands (817 species).

100. There are 21 species of cetaceans recorded in the waters of Tuvalu, with 11 species of dolphin, one orca, three sperm whales, three beaked whales and three rorquals. Three species of marine turtles are recorded. These are the loggerhead sea turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricata*).

101. There are 411 species of macro-invertebrates of which the gastropods (molluscs and snails) are the most diversified group making up 62% of the species. There are 41 species of crabs, 24 species of shrimp and three species of lobsters which make up 17% of the macro-invertebrates. The holothuroid echinoderm (*Holothuria atra*) and gastropod whelks were abundant in the reef flat at all islands. Several starfish (families Echinasteridae and Oreasterisdae) were also observed on the reef crest and slope.

102. **Rare and endangered species**. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species records 3,248 species from 331 families and seven phyla listed as potentially occurring within the south-west Pacific marine region. This includes eight species that are critically endangered (facing an extremely high risk of extinction in the wild) including two sharks, one turtle, two sawfish, one stingray, one coral and one type of mangrove and 43 that are endangered (facing a very high risk of extinction in the wild) including sharks, rays, wrasses, sea snakes, sawfish and the green turtle (*Chelonia mydas*). Some 290 species are also listed as vulnerable and 234 as near threatened. These include several species of sharks and rays, sea snakes, whales, marine turtles (including hawksbill, leatherback and loggerhead) and corals from the families *Acroporidae, Agariciidae, Dendrophylliidae, Euphyllidae, Faviidae, Helioporidae, Milleporidae, Mussidae, Oculinidae, Pocilloporidae, Poritidae* and *Agariciidae.*

103. A review by Job (2009)[14] did include a comprehensive breakdown of listed species for Tuvalu. Results indicated that in 2009, there were 442 marine species listed, among which 83 species were considered as threatened (4 endangered species and 79 vulnerable species). Green turtles (*Chelonia mydas*) are the most common species seen in waters and found on beaches nesting. The leatherback (*Dermochelys coriacea*) and the hawksbill (*Eretmochelys imbricata*) species are mostly seen in waters and are caught by fishermen infrequently.

104. The current IUCN Red List database provides summary information regarding the number of threatened and protected species by country (Table 4.2). This indicates that for Tuvalu there are a total of 1023 animal species listed including those that are endangered, vulnerable and near threatened. A large proportion of those species are lower risk/least concern and/or are data deficient. Current species-specific information is not available by country on the IUCN website.

[14] Job, S. 2009. Op cit.

Table 4.2: Summary of Red List Categories for Tuvalu

Country	Tuvalu											
Category	EX	EW	**Subtotal**	CR	EN	VU	**Subtotal**	NT	LR/cd	DD	LC	**Total**
#Species	0	0	**0**	0	8	87	**95**	118	3	56	751	**1023**

IUCN Red List Categories: EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LR/cd – Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt - Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower Risk, least concern).

Source: IUCN Red List (2016)

105. There are no critically endangered species in Tuvalu. There are four endangered marine species; green turtle (*Chelonia mydas*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*) and the Maori wrasse (*Cheilinus undulates*). There are 87 species listed as vulnerable including 70 species of coral, clams (2 species), grouper (3 species), shark (3 species) and one sperm whale species. No birds or terrestrial species are considered endangered or critically endangered.

106. **Critical habitat**. The migratory green turtle (*Chelonia mydas*) is identified as endangered and lives in other atolls and islands in Tuvalu (within shallow bays and protected shores which include coral reefs and near-shore sea grass beds). A single marine turtle was observed during the snorkel survey of the reef slope sites at Nukulaelae (some 413 km south of Niutao). This was likely to have been a green turtle (*Chelonia mydas*) however, it was observed swimming quickly some 10 m away and the individual could not be verified at the time of survey. Niutao is a single island and there are no known turtle nesting areas. The project impact area does not include areas of critical habitat.

107. **Protected areas**. There are six protected marine areas in Tuvalu. Only one (the Funafuti Conservation Area) was established by formal legislation with the rest through local actions and established and managed through by the local government and the communities. Declared 'marine reserves' have been established on Nukulaelae, Vaitapu and Nui. These locally-managed marine areas were established to ensure sustainable harvests after recognition that many fish such as grouper, snapper, algal grazing fishes, squirrelfish, drummers and turban shells were becoming scarce.

108. Local conservation areas on the land which limit or influence land use options are determined by the Kaupule. These areas are generally not mapped.

109. As with all islands in Tuvalu, Niutao has some 75 km^2 of Locally Managed Marine Areas (LMMA) established and managed by the Kaupule. During community consultations in March 2018, the Niutao Kaupule noted that a marine conservation site called a muli has recently been approved on the opposite side of the island from the proposed harbour development. The muli is running as a trial since fish are decreasing in the area.

D. Socio-economic Resources

110. **Population**. The Tuvalu 2012 census[15] recorded a total population of 10,782 which included short term visitors, tourists, and temporary contract workers. However, since the previous census in 2002 the resident population of Tuvalu in 2012 had increased by 13.7% to 10,640 (Table 4.3). There is a general out-migration of people aged between 25-44 years from the outer islands--which have a median age of 23.3 years--with people seeking better employment, social and health opportunities in Funafuti or abroad. Niutao, with a population of nearly 700 people makes up 6.5% of the total population, has experienced a decrease in the resident population of 15.1% between 2002 and 2012. There are more women (52%) than men on Niutao which is opposite to the national trend where men account for 51% of the population. The average population density is 274 persons/km^2, however in reality, the density is greater as there are only two villages on the island; Kulia and Teava. Most of the Niutao population live in Kulia (approximately 430) and the remaining 264 people live in Teava village.

Table 4.3: Population of Tuvalu by Island

Island	Resident Population			% of total population	% population change 2002-2012
	Total	Male	Female		
Nanumea	612	322	290	5.8	-28.4
Nanumaga	551	297	254	5.2	-22.4
Niutao	694	340	354	6.5	-15.1
Nui	729	370	359	6.9	19.5
Vaitupu	1542	772	770	14.5	17.7
Nukufetau	666	328	338	6.3	-5.0
Funafuti	5436	2796	2640	51.1	37.0
Nukulaelae	364	174	190	3.4	-7.1
Nuilakita	46	25	21	0.4	22.2
Total	**10640**	**5424**	**5216**		**13.7**
% of total		**50.9**	**49.0**		

Source: Tuvalu National Population & Housing Census 2012 (Table 6)

111. The population of Tuvalu is very homogeneous, with 87% being of Tuvaluan descent and 12% being Tuvaluan/I-Kiribati or part Tuvaluan descent. Adult literacy rates are high, with 87% literate in English and 99.8% literate in Tuvaluan.

112. **Social infrastructure and services**. Pre-school education is not compulsory and caters mainly for children aged 3-5 yrs. The pre-schools are run by the Island Kaupule and subsidised by the government. The Uepele Primary School, which is similarly subsidised, is compulsory and free for all students attending class 1 (6 years) to class 8 (13 years). There is no secondary school on the island, requiring students to go Motufoua Secondary School on Vaitupu.

[15] Central Statistics Division - Government of Tuvalu. 2013. Tuvalu 2012: Population and Housing Census Volume 1 Analytical Report (Funafuti, Tuvalu)

113. There is a health center on the island staffed by up to two nurses but no doctors. All serious medical cases are referred to Princess Margaret Hospital on Funafuti and transferred by ship. Obesity and diabetes are the key health issues of the Niutao population and they typically travel to Funafati for treatment. Typically, women go to Funafati Hospital to have their first baby three months before delivery. For subsequent births women usually remain in Niutao. However, it is noted that many women want to travel to Funafuti for all births because they receive a government per diem (3 months) while awaiting delivery, regardless of whether they have family in Funafuti.

114. Other social infrastructure and facilities on the island include a maneapa (community hall), Tineifale church (of the Church of Tuvalu), a post office (see also Figure 4.5), and three wells. A gravel road rings the island to connect the graveyard, 800 m counter-clockwise from the village, and clockwise for 400 m to the hospital. The island also has a Telecom center, a bank, and retail shops.

115. **Local economy**. The UNDP human development indicators place Tuvalu as a middle-income country with a small and highly vulnerable economy, strongly linked to external economic influences (Tuvalu uses the Australian dollar as its currency). Government revenues are primarily derived from license fees from foreign tuna fishing vessels, the '.tv' internet domain, and income from the Tuvalu Trust Fund.[16] Direct foreign aid and project activities also constitute a major source of revenue.

116. **Livelihoods and income**. The main sources of cash income include salary (mainly from public service employ), remittances from family members working in Funafuti or overseas, rents and pensions (Table 4.4).

Table 4.4: Proportion of Households Receiving Cash Income by Source

Sources/types of cash income	% of households
Wages/salary	53.9
Remittances	43.4
Land leases/rents	41.0
Investments	24.3
Handicraft sales	26.4
Small business	15.8
Elderly Support Scheme payments	17.2
Fish sales	11.0

Source: Census 2012: Population and Housing Census Volume 1 (Table 31)

[16] The Tuvalu Trust Fund was established in 1987 by the United Kingdom, Australia, New Zealand. The Fund, an overseas-managed investment fund, has contributed roughly 11% of the annual government budget each year since 1990. The Fund had initial capital of about AU$27 million at independence and now totals about AU$120 million, with a capital value of about 2.5 times GDP, the Fund provides an important cushion for Tuvalu's volatile income sources from fishing and royalties from the sale of the '.tv" internet domain. The '.tv' domain name generates around $2.2 million each year from royalties, which is about ten per cent of the government's total revenue.

117. In the outer islands the average monthly income is in the order of AU$80; largest proportion (AU$30) of which is from agriculture, followed by livestock, fishing and handicrafts each which account for a similar proportion (AUD$15) and other smaller activities contribute about AU$5. By contrast, on Funafuti the average monthly subsistence income is about AU$190. There is an Elderly Support Scheme (ESS) whereby those aged 70 years and older are eligible to receive AU$50 per month if they meet the conditions required. This scheme was implemented in 2009 under the Department of Community Affairs.

118. Imported food stuffs, including frozen foods, are important sources of food for the local inhabitants and relies heavily on the Government shipping service (see below). There are frequent delays and some lines of food are in very short supply or run out until the next service arrives.

119. **Economic activities**. There are very few economic activities in the outer islands so people rely on subsistence activities. Livestock is one of the major subsistence activities in Tuvalu and is one of the main sources of meat, especially pigs and poultry. Reef and lagoon fishing including collection of shellfish is also an important subsistence activity. The Community Fisheries Centre (CFC) assists fishermen in the marketing of their fish within the community. Only registered fishers are permitted to fish and bring their catch to the CFC which sells it for them.

120. Agriculture opportunities are very limited due to poor soil fertility and are predominantly centered on the traditional taro-like root crop; pulaka, coconut, breadfruit, bananas, and pandanus all of which are important traditional food crops and are cultivated by most outer island households. Handicrafts such as brooms and mats, usually made by women, are another source of cash income.

121. **Employment and unemployment**. Around a quarter of the workforce is employed within the public sector, which includes the island Kaupule and about 15% of adult males work as seamen on foreign flagged merchant ships. The rate of unemployment on the outer islands ranges from 41% on Nuilakita to 59% on Vaitupu and 54% on Niutao (Table 4.5).

Table 4.5: Level of Unemployment

Island	No. of total unemployed			% of total population
	Total	Male	Female	
Nanumea	332	165	167	54.3
Nanumaga	279	140	139	50.6
Niutao	375	167	208	54.0
Nui	381	182	199	52.3
Vaitupu	912	418	494	59.1
Nukufetau	357	170	187	53.6
Funafuti	2114	1014	1100	38.9
Nukulaelae	197	96	101	54.1
Nuiliakita	19	12	7	41.3
Total	**4966**	**2364**	**2602**	**46.7**

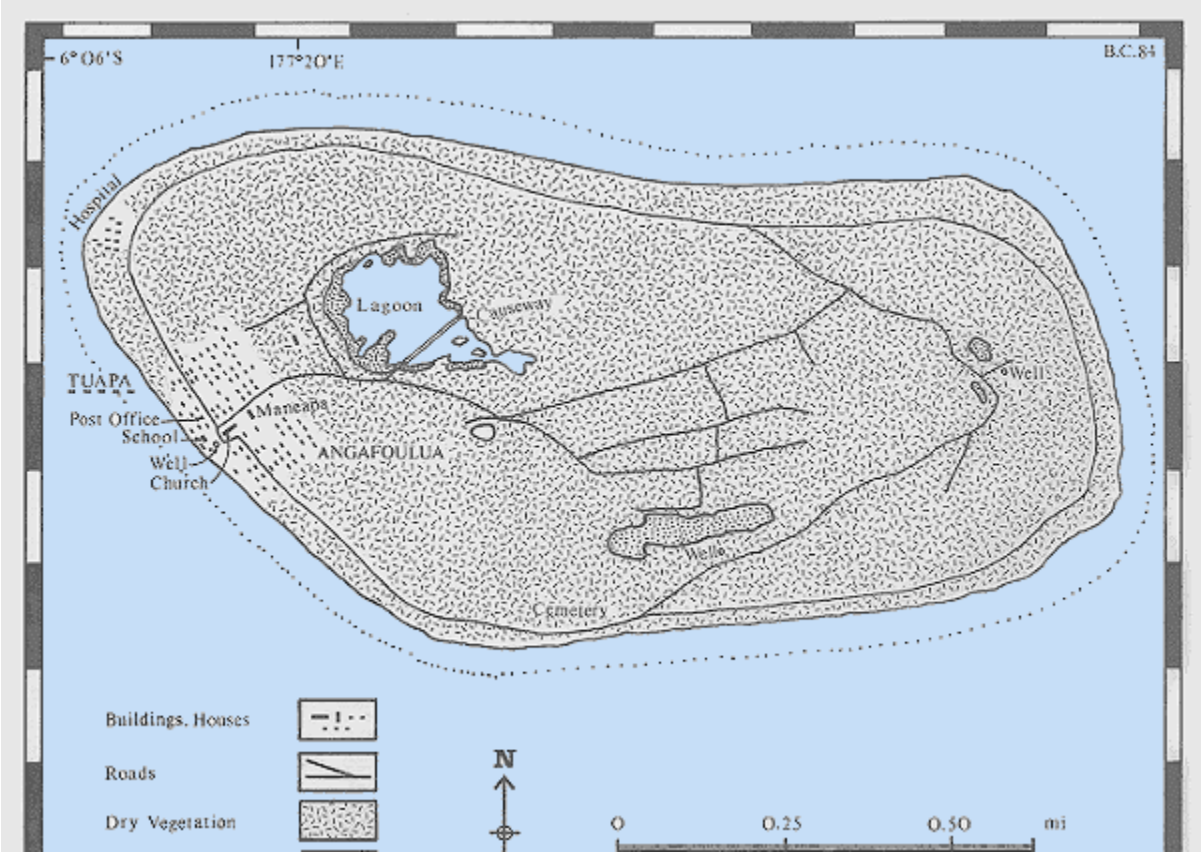
Source: Tuvalu National Population & Housing Census 2012 (Table 51)

122. From the 2012 Island Profile, only 98 people (23%) of the Niutao population over 15 years old were employed mainly through government work as nurses, teachers and Island Kaupule employees which together provided three quarters of the formal employment (77%). Some 335 people of working age were registered as unemployed; others worked as seafarers (10%). Self-employment is very low on the island with only four registered in the census as involved in self-employment through ownership of a bakery (1), canteen (two females and two males). Most of the unemployed are women although they are involved in subsistence activities such as feeding livestock, farming, fishing toddy cutting and handicraft making.

123. **Land tenure, ownership and use**. The land tenure system is largely based on extended family ownership. Around 95% of the land is held in customary tenure with only 5% government or privately owned or alienated and less than 0.1% is held in freehold title.

124. The island comprises two villages, Kulia and Teava (which used to constitute one village called Tuapa), both on the western side of the island. The area or district of the two villages is Angafoulua. As noted above, there is an unpaved road around the island (Figure 4.5).

Figure 4.5: General Land Use on Niutao



125. **Transport.** As with all the islands of Tuvalu, Niutao suffers from poor connectivity that constrains economic development. The challenge arises from Tuvalu's dispersed geography exacerbated by inadequate transport infrastructure and services such as:

- Two government-owned ships that travel from Funafuti to outer islands and Fiji every three weeks;
- No docking facility for the government ships, and passengers and cargo are transferred by small workboats from/to the ship floating off-shore;
- No docking facilities for the workboats makes passenger access on/off board difficult and sometimes unsafe due to weather or wave conditions. Cargo is manually carried to/from the workboats; and
- Workboats navigate channels to reach the shore, this can be dangerous depending on the sea conditions. Serious accidents can occur, resulting in loss of life and economic values. Transfer operations are not undertaken when the sea is rough or after dark, which reduces the efficiency of ship operations.

126. The island has a gravel road that rings the island and connects the existing boat landing facilities (which are in poor repair), with the main village and health facility. The total length of the road is about 1.2km. Local land transport is mainly by motorbike and bicycles with older people using a modified motorbike with sidecar.

127. **Energy.** Everyone on the island has electricity through connection to a mini-grid supplied by 80% solar power and 20% diesel generator. The diesel generator is used as a back-up supply when solar is low.

128. **Water supply and sanitation.** Rainwater is primarily used for human consumption, agriculture and domestic uses and supplemented by ground water during periods of drought.

129. Sanitation is provided through septic tanks by 90% of the population. When septic tanks are full, a hole is dug and septic waste is dumped into the hole. This practice is recognised by the community as a potential source pollution to the ground water system and an alternative long term solution to dealing with septic waste on the island is needed.

130. **Waste management.** Domestic solid waste is disposed of at a designated tip area on the island. At the dump site waste separation is practised with tins and plastics separated from dangerous items such as used batteries. The area is periodically managed by bulldozers and excavators when not working on construction projects. Burning of waste is prohibited on the island.

131. **Physical and cultural resources**. Niutao does not contain any known items of historical or archaeological significance. This was confirmed during the consultations.

132. During community consultations in March 2018, eight graves were identified at the proposed development site. It is a small area and the owner of the bones is happy to transfer to another site, but she is not the owner of the land. The design consultant also noted that it can move the site slightly if there is a problem.

133. When asked if there were any sacred sites on the island, one was identified by participants but it is not near the proposed development. It is called Toligna (the place of the ligna); this place is only known by a few senior people on the island and big decisions of the community are made there.

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Overview

134. The IEE provides an analysis of anticipated impacts associated with the construction of improved jetty/wharf and facilities at Niutao. Environmental safeguard measures have been incorporated in the project as follows:

a. Pre-construction phase--updating of detailed design, undertaking of further surveys as required and preparation of documentation required under the contract--prior to any construction works. During this period the EMP is updated based on the additional information available, designers incorporate environmental measures in the project design, the updated EMP is incorporated into technical specifications and bid documents, the contract is tendered, a contract is awarded and the contractor may mobilize but civil works (including any site clearance or preparation activities) are not permitted to start until the notice is issued. The contractor's environment, health and safety officer (EHSO), or specialist engaged to support the EHSO, will prepare the construction EMP (CEMP) during this period. The CEMP will be reviewed and cleared by the construction supervision consultant (CSC) and its environment specialist (ES) on behalf of the PMU;

b. Construction phase - the period from the time that the "notice to proceed" is issued to the contractor to when the "certificate of completion" is issued. The contractor will construct the project as per the design and technical specifications and implement the measures included in the approved CEMP. This process will be documented by the EHSO and monitored by the CSC and PMU; and

c. Operation and maintenance phase - the period starting when the "certificate of completion" has been issued by MCT until the end of the 20-year lifetime of the project. The MCT will be responsible for implementing the measures identified in the operation phase of the EMP to mitigate post-construction impacts.

135. To assess the anticipated environmental impacts of each phase of the project, it is necessary to understand the sequence and elements of the proposed work leading up to and during the construction and operation phases.

B. Design and Pre-construction Impacts

136. **Access to land and seabed**. The project will not require land acquisition or result in displacement. The project facilities will be located on government owned land or land (including seabed) leased from owners following standard agreements negotiated through the Kaupule. Compensation will be paid for any assets (fences etc) affected or requiring removal (trees and crops). A due diligence report (DDR) has been prepared. The DDR will be updated during the detailed design and third party verification will be completed at that time.

137. **Estimating sediment plume and impacts.** Given the highly sensitive marine environment and potential for dredging to affect coral beyond the area that will be removed/excavated through smothering from leakage of sediments, a sediment plume modeling and analysis will be undertaken to clearly identify the expanse of the plume and to determine the "spill budget" or volume of dredging per day that must be complied with to ensure the plume is reduced as much as possible.

138. The modelling will allow a dredging plan to be prepared which will provide additional information for the contractor. The modeling will be based on: (i) sediment characteristics (particularly how fine the materials is); (ii) current/tide information; (iii) assumption about equipment; and (iv) assumption about work plan. The information from the modeling and analysis will be included in the updated EMP and the bid and contract documents.

139. **Geotechnical investigations and detailed design**. Design was undertaken during the ongoing project, this has been reviewed and will be further updated, as required, to incorporate information from the geotechnical investigation (scheduled for third quarter 2018). The updated detailed design will consider (i) dredging methods, (ii) the pile length for the access jetty, and (iii) provide information on possible aggregate sources for concrete works. The updated designs will be reflected in an updating (as required) of the IEE and EMP, the bidding documents (through bill of quantities and employer's requirements) and the updated EMP.

140. The geotechnical survey will involve taking a core sample of the reef platform material by drilling a small 37 mm hole down to a depth of around 5 m using manually-operated motorized drilling equipment. These core samples will be made at around 25 m centers along the proposed location of the harbor or breakwater wall during low tide to determine the composition of the reef platform material and identify any weaknesses in the profile.

141. This is not a large-scale drilling operation and there will be little or no environmental impact. Each core sample will remove around 0.02 m^3 per drill hole. Based on the investigations undertaken at Nukulaelae, some 15 to 20 core samples may be taken around the project site.

142. **Updating of the EMP and bid documents.** Prior to recruitment of the CSC, an individual environmental specialist will be recruited to undertake tasks associated with updating the IEE and EMP and inputs to the tender documentation and bid evaluation. Terms of reference have been prepared for the environmental specialists (for the individual and the ES included in the CSC) and are included in the PAM.

143. The IEE and EMP will be updated following the update of the detailed designs based on geotechnical investigations, changes/modifications to structural designs and to include any additional information or requirements in respect of dredging, pile location and length and locally available construction materials.[17] The assessment will then be formatted as preliminary environmental assessment report (PEAR), checked for compliance with requirements of the Environment Protection Act 2008, and submitted for clearance to the DOE and issue of the development approval.

144. The updated IEE and EMP, along with any conditions of the development approval, will be incorporated into technical specifications and bid documents. Following contract award, the contractor, with support as required from the CSC, will prepare the CEMP responding to the EMP and providing the site-specific drawings, work method statements, sub-plans (as detailed in next sections), details and construction methodologies (including specifics around dredging method, impact mitigations and dredge spoil disposal).

145. **Adaptation for climate change**. The design and construction of the wharf and jetty facilities will take into consideration the impacts of future climate change parameters that have been projected for the region. Specifically, it will be important to factor in the projected rise in the mean sea level such that the relative heights of the structures above the current seal level must take this into account to ensure there is a strong element of climate resilience built into the design.

[17] Due to the limited sand, rock and other aggregates in the Tuvalu islands and atolls, it is most likely construction materials will be imported.

146. **Alien and invasive species introduction**. The mobilization of construction machinery/equipment and materials from the source country may result in the accidental introduction of soil-borne weeds, pests and pathogens becoming established on the island and reef environment. All construction machinery and equipment must be steam cleaned and all organic material must be removed in the source country prior to deployment with an appropriate approved phyto-sanitary certificate issued supported by any other documentation required under Tuvalu legislation.

C. Construction Impacts on Physical Resources

147. **Air quality**. There are no anticipated permanent impacts on air quality from the construction activities. Exhaust emissions and dust (see below) will be generated from construction machinery, pile drivers, vehicles and mobile generators. Mitigation measures will include:

- Use and operation of fully maintained vehicles and diesel equipment that have been certified as compliant with local air quality legislation prior to transhipment to project site; and
- Avoiding idling of vehicles when not in use and unnecessary operation of vehicles and equipment.

148. **Dust control**. As most of the associated works will be carried out in the reef environment during low tide, there will be minimal or no dust produced related to the shallow excavation of reef material and the placement of modular concrete breakwater or jetty structures. Dust may be generated by some land based activities including: (i) excavation and dumping of spoil and sand during construction of the seawall or jetty headwall and other facilities; (ii) movement of machinery on excavated areas; (iii) clean up and removal of storm debris for use as backfill behind the seawall, and (iv) activities including aggregate preparation and concrete-mixing.

149. Dust mitigation measures will include:

- Use of sprayers using seawater on bare sandy areas within the village and foreshore area;
- Limit or suspend excavation and other dust producing activities during periods of strong onshore winds when working adjacent to village buildings and houses; and
- Covering of stockpiled materials where feasible.

150. **Soil erosion and coastal protection works**. Potential environmental impacts associated with coastal protection works include: (i) the collapse of the exposed beach profile after excavation and prior to construction of the wall resulting; (ii) the loss and dispersion of excavated material placed in heaps on the beach environment; (iii) increased erosion of the foreshore from unexpected high tides; and (iv) release of hydrocarbons or other contaminants from earthmoving machinery during construction works.

151. Excavation work and other earthworks will be planned on the beach-land interface to connect the jetty facility with the island. The soils along this interface are nearly entirely loose undifferentiated sand deposits, coral fragments and storm debris and are highly erodible, even when they are not disturbed by excavation works. High tides and storm surges can result in rill and/or scour erosion around the adjoining buildings, headwalls, ramp or access track leading to the beach.

152. Surface water runoff from the adjoining land and road infrastructure also plays a critical role in the level of soil erosion at this sensitive transition site. There is evidence of incipient erosion at the workboat harbor and jetty site.

153. The current beach access is a short steep slope from the land that is gradually wearing back into the island. It has also been affected by Cyclone Pam. Runoff from the land following heavy rain is the main cause of the active rill and minor gully erosion starting from the top of the slope. Coupled with the movement of people and machinery, this will continue to degrade the approach area from the beach onto the land.

154. The existing boat ramp and landing site is away from the village and so does not get the same amount of daily traffic as sites on other islands where the village is right at the landing channel. Coconut trees and ground cover plants are evident but clearly unable to withstand the amount of traffic and the impact of tidal surges. The works at the new site should include coastal protection to arrest further erosion inland above the high tide mark due to the movement of traffic and cargo. This may include minor earthworks and drain lines to prevent surface water runoff from running down the beach access slope as well as the construction of soak pits to direct runoff safely away from the access.

155. General measures to minimize and mitigate soil erosion at the beach-island interface include:

- Careful planning of works such that only short sections of excavated trench for any seawall or jetty headwall structure are exposed at one time and which can be completed between periods of low tide, or if sufficiently above high tide mark, that can be completed before any advancing weather system approaches the island;
- All excavated material to be immediately removed to the designated spoil disposal area. No excavated material is to remain in stock piles on the beach or reef flat between tides;
- Minimize the period that excavated areas are left unprotected and open to tidal movement or storm effects;
- Ensuring that all equipment used below the highwater mark is in sound mechanical condition, and free of any leaks of any fluid;
- Minimize or reduce the clearing of any vegetation near the seawall or jetty headwall structure. Consultation with Kaupule undertaken in finalizing the locations and numbers of trees to be cleared;
- Construct sediment traps where suitable to divert overland runoff into a safe disposal area;
- Place concrete demolition waste from damaged buildings on the sea side of the bund to provide protection from tidal surges. This should not be placed along the beach margin such that it impedes long-shore movement of beach sands; and
- Incorporate bioengineering solutions where practicable (e.g. this could include, where practicable, planting ground cover species and local tree and shrub species in rows on the land side of the bund as part of the site remediation plan after completion of works to reduce exposure to wind).

156. **Water quality**. Dredging will cause the disturbance of unconsolidated sediments within the channel floor and turning bay in the harbor. This is expected to lead to short-term increase in concentrations of total suspended solids immediately around the active dredging site. Tidal flow will take this sediment plume out through the channel and into the sea. Use of explosives to blast the channel and turning bay is not allowed for in the current design due to the impact on the reef ecology (see Section V.D).[18]

157. Measures to minimize the environmental effects of sediment removal on water quality due to dredging activities include:

- The CSC will include a suitably qualified ES and the contractor will engage a suitably qualified EHSO. The contractor will engage an environmental specialist/marine ecologist to prepare a detailed method statement in the CEMP, to be approved by the CSC and its ES prior to the commencement of any works. The statement will identify the methodology and the rationale for any selected dredging system chosen and how the contractor intends to minimize the spread of suspended sediments. During works, the contractor's EHSO will need to have appropriate experience in marine ecosystems or have ready access (by phone) to a suitable expert for timely advice as required;
- Hydraulic excavators shall be in sound and well maintained condition and free of any leaks of any fluid. A pre-start inspection will be carried out on all machinery prior to the commencement of works at the start of each work period and records kept for monitoring purposes;
- All plant would be only operated by certificated and experienced operators;
- All excavation operations shall comply with relevant laws of the government of Tuvalu and international conventions to which it is a signatory;
- Excavation operations will be monitored visually by the EHSO. Photographs of plume movement will be taken along with details of sea conditions, wind speed and direction for each work period and phase of the tidal cycle. If the EHSO, on advice from a suitable expert, considers the plume density or extent to be at a level that could be having a detrimental effect on coral on the reef slope then the CSC will be consulted so that dredging is adapted to an agreed means for reducing the plume density or extent. This may, for example, involve reducing dredging intensity;
- Excavation operations during incoming tides or strong westerly winds (which occur intermittently, mainly between April and September) will only be permitted if it can be demonstrated that plume movement does not result in deposition of material on the reef platform; and
- A grinder/suction head should be used for the removal of smaller material and sand by way of pipes to the spoil disposal site that has already been defined. This would minimise the amount of finer sediments mobilised and potentially deposited on coral reef habitat.

[18] Kaly U.L & Jones G.P. 1990. Construction of Boat Channels by Blasting Coral Reefs: Immediate effects of Blasting and Broad-scale Survey of Channels on Three Islands in Tuvalu. Report No. 3. An Environmental Assessment of the Impact on Reef Channels in the South Pacific, report for New Zealand Ministry of External Relations and Trade (Wellington, New Zealand)

158. A comprehensive set of guidelines relating to reef channel excavation and construction has been developed. The guidelines prepared identify the major environmental impacts and mitigation measures associated with harbor projects on the outer islands.[19] These guidelines will be a key reference document to be used by the contractor in developing the CEMP.

159. **Waste and spoil management**. The management of construction waste from maritime projects can have a significant environmental impact on small remote island communities. There is generally very little ability to effectively manage solid waste as can be observed with the amount of solid waste generated by these small communities and the method of disposal. While waste pits are used, there are potential problems associated with leachate entering groundwater, which is already subject to degradation in water quality in all project sites.

160. The guiding principle to be adopted will be to remove all inorganic and solid waste generated from the construction of the facilities from the island environment. There may be some exceptions where surplus concrete used to anchor the concrete elements in the wharf and jetty structures or aggregate can be utilized for the construction of community facilities. This will be done in consultation with the Kaupule at the appropriate time.

161. A large land-side area (12,800 m^2) has been initially identified for contractor to use for stockpile of dredged material for short term use and for the longer-term storage of crushed coral. Finalization and approval of spoil site is to be undertaken following further Kaupule and community discussion. The contractor will undertake a risk assessment and propose management and mitigation measures in their waste and spoil management plan to be included in the CEMP. The CEMP will be reviewed and cleared prior to no objection being given for commencement of physical works.

162. The contractor will provide a detailed waste and spoil management plan as part of the CEMP. Waste management measures to mitigate the impact of solid waste and sewage at the project site include:

- Store and remove all waste hydrocarbons and filters in appropriate storage containers and remove from the island at the completion of works;
- Kaupule and community to agree spoil disposal area, following agreement the CSC will approve the location;
- Store and remove all inorganic solid waste include steel, formwork, fittings, pipes, hydraulic hoses, tires and any other spare parts used with construction equipment;
- Install on-site toilet facilities with an appropriate self-contained sewage tank; and
- Compost all green and organic wastes to assist soil improvement for communal food crops or use as pig food.

163. **Storage and handling of hydrocarbons**. Hydrocarbons (fuel, lubricants and marine paints and solvents) stored, dispensed and used during construction works by vehicles and plant and equipment pose a potential hazard to the marine environment, communities as well as the subsurface fresh water lens on the island if leakage or spillage occur. Large quantities of hydrocarbons will be required for each site for the duration of the project due to the logistics and the long supply line. Extreme care is required to ensure there are no accidental spills.

[19] Kaly U.L & Jones G.P. 1989. Construction of Boat Channels Across Coral Reefs: Results of Initial Survey of Reef Communities at Niutao (Tuvalu). Report No. 2. An Environmental Assessment of Impact of Reef Channels in the South Pacific, report for New Zealand Ministry of External Relations and Trade (Wellington, New Zealand)

164. All hydrocarbons will be stored either on the supply ship, barge or on a dedicated land based facility. The proposed storage shed has been selected in conjunction with the Kaupule to ensure it does not impact any houses or water supplies. Measures to minimize or prevent the environmental impacts of accidental spillage of hydrocarbons include:

- A spill response plan to be included in the CEMP;
- A comprehensive site induction prepared by the contractor, with input from the Kaupule, will be required for all personnel involved with the project, with specific attention made to the sensitive atoll and reef environment;
- All personnel involved in the handling of dangerous goods will be trained and inducted in the handling, emergency procedures and storage requirements for different types of substances;
- Where fuel is stored on land, it will be in dedicated areas in sealed tanks placed within a concrete bund that has 110% of the capacity of the drums or storage;
- Storage areas to be located at least 50 m away from the marine environment and should be fully secured and locked when not in use;
- Material safety data sheet is to be provided for all hazardous substances;
- Smaller volumes of hazardous substances should be contained within a metal storage locker within the storage shed;
- Due to the porosity of the soil, lined pits to separate oil and water will be required near any workshop or maintenance shed to prevent leaching of hydrocarbons into the water table;
- Vehicles and machinery will be refueled by authorized and trained personnel only in designated areas to reduce the likelihood of spillage in a sensitive environment;
- Drip trays will be used during refueling or servicing to prevent spillages onto the ground or the reef;
- Re-fueling is not permitted over water or in the reef environment. All refueling must take place on land in a designated area;
- Development of procedures for cleaning up and reporting of accidental spills;
- Spill-kits will be made available for land and sea-based fuel facilities;
- Collection, disposal and removal of all waste oil, filters off the island; and
- Limit the amount of any marine paint to be used on the jetty facility to no more than two liters at any one time contained within a larger volume drip tray to reduce the risk of any accidental spillage into the water.

165. **Construction demobilization and site rehabilitation**. When the construction activity has been completed, the construction camp, either based on land or on a barge, will be demobilized. To minimize any ongoing impacts from the establishment of laydown or construction camp areas, the contractor will provide a detailed management plan on how the site will be rehabilitated. This will include the removal of all construction material, used or unused, and may include re-vegetation activities.

D. Construction Impacts on Biological Resources

166. **Vegetation loss**. The removal of vegetation for the construction camp (if it is land based), laydown and transit shed area on the fragile soils can result in increased erosion and sedimentation, loss of the protective ground cover with the loss of habitat and shade.

167. Any construction works proposed at the transit shed site must protect the foreshore vegetation. Any building or shelter required at this site should not be located closer than 20m to the foreshore. Therefore, no vegetation should be removed from within this buffer zone to provide long term protection to the foreshore area. The width of clearance through this buffer zone for the movement of material and equipment should be no greater than 20m.

168. Similarly, there should be no clearance of any vegetation within 50m of the existing foreshore for any camp or laydown area. Formerly cleared land should be chosen as a preference and where suitable for the purpose.

169. The precise location and area to be cleared for the buildings has been confirmed by survey. Large single trees in the area designated for the buildings and parking site should be retained where practicable to provide shade and amenity value. However, these individual trees should not be retained where they are exposed to the influence of winds impacting on their stability, or the root plate is damaged during site preparation or they are affected by disease as they may result in damage to the buildings.

170. Measures to minimize any damage to critical shoreline or other vegetation will include:

- Clearly identify and mark on the trees and a site plan, with the assistance of the Kaupule, the exact location of any area to be cleared and what trees are to be retained prior to any cutting or removal. Ensure the site plan is provided to the contractor;
- Clearly identify alternate suitable beach access sites if the current one is not appropriate for the machinery. The alternate site will be preferably the one which causes the least damage to the shoreline;
- Minimize the clearance of vegetation within 20m of the shoreline;
- All contractor staff, especially machine operators, will be made aware of the location and what vegetation is permitted for removal by way of a comprehensive site visit which includes the Kaupule; and
- Retain mature trees for amenity value, shade and protection of the soil resource where practicable.

171. **General comment on dredging**. To minimize impacts on the marine environment, the channel and basin would be dredged using one of two preferred methods:

- The basin and part of the channel (closer to the shore) would be built in the dry season with the use of pumps and edge bunds; or
- An excavator would be perched on top of a bund extending from the shoreline to the end of the channel. This bund would be constructed of materials sufficient to provide a barrier to water circulation. For example, this may consist of a core of the dredged material wrapped in impermeable geotextile material and external armoring.

172. **Direct loss of habitat and sessile fauna**. This would occur within the footprint of the dredge channel, break wall and foreshore armouring/infrastructure. The direct loss of habitat from dredging and placement of the marine infrastructure would result in the irreversible loss of intertidal flat and subtidal reef habitat. At Niutao a total of approximately 8,295m^3 would be lost from within the proposed dredge footprint. Additional habitat would also be lost within the footprint of break wall. Foreshore habitat would also be modified with predominantly impermeable rock armoring. Some shading of habitat on the upper shore would also occur due to placement of jetties and pontoons. In general, cover of live coral at Niutao was greatest on the reef slope. Macro-algae occurred on the reef flat, crest and slope and was generally at its greatest cover on the reef crest.

173. The proposal indicates that at Niutao the channel or break wall would not extend beyond the reef crest. Most of the footprint will occur on reef flat, where there is no coral. Hence, very little live coral or coral habitat, and other biota associated with this habitat such as reef fishes and invertebrates, would be directly affected by the project. Given there would only be a small area of reef crest directly affected, the overall loss of coral from the project will be small. Given macro-algae grows on the reef flat, more macro-algae habitat would be directly affected by the project than coral habitat. However, the direct impacts to macro-algae assemblages would be inconsequential given reef flat is a very common habitat.

174. It is expected that corals, macro-algae as well as sponges, ascidians and a variety of other invertebrates would re-colonize and grow on the new artificial structure created by the harbor and walls of the dredged channel, given this has occurred at the existing dredge channels at Niutao. This 'new habitat' is likely to compensate for some of the coral habitat directly affected in the footprint of the new channels and break wall. In turn, the sessile benthic community on the new structure would provide shelter and food for a variety of fishes and other fauna.

175. Although there would be a small residual loss of coral habitat due to the project, there will be no net loss of biodiversity because the habitat to be removed at the new boat harbor location at Niutao is not unique. The proportion of live coral cover and species in the footprint and wider impact area also live in the reference locations where they occur in greater abundance and diversity. Although more families of coral were identified at the proposed boat ramp locations, this was likely a result of the greater sampling effort rather than a representation of greater biodiversity. Further, while only a small proportion of habitat on the island was surveyed, aerial imagery indicates that extensive similar reef habitat exists on all islands. It is therefore unlikely that there would be a net loss to biodiversity within the intertidal reef flat or subtidal coral habitat due to the project.

176. Despite no net loss in biodiversity, there would be a small net loss of reef area (and a small residual net loss of coral). While this impact is accepted as part of the project, the following should be undertaken to minimize further impacts:

- The dredging plan to be prepared based on the information from the sediment plume analysis will help reduce impacts on the coral beyond the dredge area by determining the rate at which the contractor can dredge materials to minimize sediment plume and impacts on coral. The CSC will ensure that the contractor complies with the requirements set out in the dredging plan and only excavates the volume per day stipulated in the plan;
- Other sediment control measures such as floating boom and silt curtain to be implemented by the contractor during the excavation and dredging works; and

- Any vessels and workboats associated with the construction works should not anchor over areas of coral reef habitat to prevent anchor dragging and damage. Designated anchoring zones outside of mapped coral habitat should be established and marked with buoys.

177. Post-construction monitoring will be undertaken to ensure that impacts to coral reef habitat has not occurred beyond the footprint of the proposed dredge channel and ancillary structures.

178. **Temporary impact on water quality**. Construction of dredge channels has potential to increase sediment mobilization and turbidity in the surrounding marine environment. Increased sediment suspension from dredge plumes may result in increased turbidity and reduced light available for photosynthesis of corals and macro-algae. Sediment deposition may also result in smothering of corals in the area adjacent to the dredging works.

179. Reduction in light available for photosynthesis and partial or complete burial can lead to decreases in growth rate or loss of coral cover, bleaching and higher prevalence of diseases. The extent of these impacts would depend on the type of dredge material and method used. Construction option 1 (para. 167) for example, would minimize the potential for sedimentation as the channel could be constructed in the dry and loose materials removed or used in construction of the break wall.

180. Similarly, land based construction works have potential to mobilize sediments. In the absence of proper sediment and erosion controls, heavy rainfall or wind may result in sediments being mobilized and transported into the ocean and lagoon.

181. Dredging also has potential to mobilize acid sulphate soils and/or other contaminants potentially present in the dredged materials, the extent of potential impacts and associated mitigation measures would be determined following results of geotechnical testing works. These impacts can largely be mitigated through:

- Geotechnical testing and standard erosion and sediment controls for land based construction to be implemented as part of the EMP;
- Should specific contaminants be detected management plans may be required;
- Controls to dredging would include silt curtains and bunding;
- Water quality monitoring of turbidity with triggers for adaptive and contingency dredge management procedures; and
- Best-practice vessel management and site management should be adopted to minimize the risk of contaminant spillage. Work vessels should provide sufficient spill response materials. All work vessels should be inspected to ensure fuels and equipment are appropriately stored and work surfaces kept clean of waste and litter.

182. **Increased disturbance to marine fauna from marine traffic**. Increased vessel traffic during construction has the potential to increase the risk of collision between vessels and marine fauna. Marine turtles and cetaceans (whales and dolphins) are particularly susceptible to harm from vessel strike. Disturbance from vessel noise and light also has potential to alter the behavior of sensitive species, however, this would be temporary, short-term and localized to within the construction area.

183. The key mitigation measure to minimize potential boat strike and noise related impacts would be to establish ‘go slow’ zones around the harbor construction sites.

184. The EMP also includes provisions to educate skippers of construction barges and work boats as to how best avoid boat strikes, what to do during vessel interactions with marine fauna and reporting of boat strikes or fauna interactions. Vessel masters should be competent in protected marine species interaction procedures. The contractor should ensure visual assessment is undertaken by trained Tuvalu Fisheries Department (TFD) officers prior to dredging activities, while dredging and while construction vessels are on route to/from Niutao.

185. **Impacts on marine fauna from construction noise**. Underwater noise generated from construction activities could deter fauna away from the vicinity of the construction site. Excavation works using the methods described are considered unlikely to generate noise of an intensity or duration that may result in physiological impacts on species, but would likely temporarily alter behavior i.e. animals would move away from the construction area. These impacts would also be intermittent and short term (approximately two months) and localized. However, management measures could be applied to further reduce underwater noise impacts to protected marine species.

186. The EMP should include procedures to limit physiological impact to marine megafauna due to sound and vibrations generated during dredging and construction activities. The construction Contractor should ensure that all equipment is maintained in good operating condition and has proper sound control systems in place. The contractor is to apply sound mitigation, where appropriate and practical. This should include:

- Ensuring that all equipment is maintained in good operating condition and has proper sound control systems in place;
- Application of sound minimisation tools, where appropriate and practical. This may include for example mufflers, propeller shrouds; and tuned propellers and drive shafts; and
- Sound-generating equipment should be switched off when not in use.

187. **Impacts on marine and terrestrial fauna from lighting**. Construction works using the methods described are considered unlikely to generate light of an intensity or duration that may result in physiological impacts on species, but could temporarily alter behavior. Any night construction activities would generate light which could deter or attract fauna away from the vicinity of the construction site.

188. These impacts would also be intermittent, short term (approximately two months) and localized. However, management measures could be applied to further reduce lighting impacts to protect marine and terrestrial species sensitive to it. Although it is understood that works would be done during daylight hours, any lighting used during the period of construction would need to be shielded and all effort should be made to minimize light emanating from the construction site.

189. **Ciguatera**. Ciguatera is a foodborne illness caused by eating certain reef fish whose flesh is contaminated with a toxin made by dinoflagellates such as *Gambierdiscus toxicus*. These dinoflagellates adhere to coral, algae and seaweed, where they are eaten by herbivorous fish which in turn are eaten by larger carnivorous fish. Exacerbation of the effects of Ciguatera outbreaks were linked to reef blasting in Niutao in 1989 (Tebano 1991). It is therefore possible that disturbance through dredging has potential to increase the risk of Ciguatera via the disturbance of these dinoflagellates, particularly in Niutao, where it is previously known to have been an issue.

190. Dredging and excavation both disturb the reef and can promote the growth of algae. The residual sediment on the reef surface encourages the growth of these algae.

191. It is recommended that although the risk of a Ciguatera outbreak is considered low, the following mitigation measures should be in place:

- It is recommended that a risk assessment be undertaken to determine whether there is a need to incorporate testing for harmful dinoflagellates in fish tissues into the EMP for implementation during the construction works. This should be carried out in consultation with TFD;
- Minimize the disturbance of the reef surface in any marine infrastructure project and remove any sediments from the reef surface to reduce the likelihood of an algal bloom occurring on the fresh reef material
- A register should be established to document any cases of Ciguatera brought to the attention of medical staff for a period six months before, during, or 6 months after construction;
- Any cases should be reported to the Project Manager and the TFD so that appropriate safeguards can be put in place. This could include (for example) a TFD notice to advise against consumption of herbivorous reef fish on the islet until further testing has occurred and/or sufficient time has passed post-construction and such fish are considered safe to eat; and
- Removing spoil from the excavated site to an approved location on the land to reduce the surface area of loose reef deposits on which the algae can colonise.

192. **Introduction of alien species or pests**. Vessels and movement of offshore equipment have potential to act as vectors for introduced species. Introduced species (such as the crown of thorns starfish (*Acanthaster plancii*)), have potential to be translocated into the project marine area via work boats through the release of ballast water (in the case of planktonic larvae or species) or via reproduction from individuals attached to the hull of a vessel.

193. Marine pests are a long-term, but reversible impact to which marine communities would have an existing level of exposure.

194. As there will not be sufficient suitable aggregate at the site, apart from the fact it is now not permitted to recover any sands or gravels from coral islands, it is proposed that all concrete elements of the harbor, breakwater and jetty facility will be pre-cast elsewhere in the region (likely in Fiji). These pre-cast concrete elements will be shipped by barge to the project site using one of the approved shipping services. Some aggregate may be trans-shipped to the project sites and used for the construction of lay-down pads, possible construction camp sites and other ancillary works associated with the project. There is a small chance that weed seeds may be present in this material and it will be important to ensure the likelihood of this is minimized with attention by the supplier to hygiene requirements for imported material.

195. Mobilization of equipment and hygiene requirements will be a key consideration to ensure no alien weed species or other organic matter is inadvertently transported to the country. The following requirements would be in place:

- All machinery and equipment be steam cleaned to remove any soil or organic matter and a phytosanitary certificate issued by the authorities in the country of origin prior to shipment to the project site;
- Appropriate phytosanitary documentation must be issued for all imported aggregate shipments into Tuvalu to confirm they are clean of organic material and soil and pests;

- Standard practice procedures for ballast water management should be observed by vessel operators and individual vessels should be assessed to determine that the vessel presents a low risk of introducing marine pests to the area;
- Ballast waters must be discharged no closer than 5km from the shoreline with confirmation provided by the captain by way of log book details; and
- All materials and equipment to be imported for the project must be cleared, and the contractor must have obtained the appropriate license or certificate for imported material and/or equipment.

196. **Impacts to threatened and protected species and habitats**. There are over 3,000 species of threatened corals on the IUCN red list for the South West Pacific Marine Region, hence, there is potential for some corals in the project site to be on the IUCN Red List as some of the genera observed in the baseline ecological survey were for species on the list. Of all the species of fish identified, none are recorded as critically endangered, endangered or vulnerable.

197. Habitat within the footprint and broader impact area of the proposed new boat harbor would not be considered to provide habitat that is unique within the islands or which is critical to their survival. Furthermore, the foreshore areas surveyed at Niutao was not considered to contain sandy beach habitat suitable for turtle nesting. It is possible that these species if occurring within the construction area could be temporarily affected by disturbance from altered water quality, noise, light and the risk of boat strike. It is most likely however, that these species would be deterred by construction activity and would move away from the area.

198. Provided the mitigation measures outlined in the previous sections are incorporated into the EMP and appropriately implemented, these potential impacts are likely to be suitably managed. As a further precaution, it is advised that construction works take place outside of the time of known turtle nesting seasons/period.

E. Construction Impacts on Socio-economic Resources

199. **Noise and vibration**. Noise will be generated from construction machinery and particularly from the hydraulic rock breaking attachment proposed for the channel widening and preparation of reef surface for the concrete caissons for the breakwaters. Noise will also come from the pile driver in the preparation for the jetty facility at all project sites. Noise from construction machinery is generally between 80 ~ 110 dB. On-shore winds will carry noise to the village area and may become a nuisance.

200. Given these works will be carried out during periods of low tide, the noise levels are expected to be intermittent and of relatively short duration. Noise will be an issue during times of church services, important village ceremonies and close to sensitive receptors such as houses, schools and health clinics. Noise mitigation measures include:

- Use modern and well-maintained equipment;
- Operate pile drivers and hydraulic rock picks during daylight hours only and between times morning and evening as agreed with the Kaupule;
- No noisy activities to be undertaken on Sundays or other days as nominated by the Kaupule; and
- Liaise with Kaupule to minimize disruption to church services, schools and health clinics and any other sensitive receivers.

201. **Site decommissioning and rehabilitation**. When the construction activity has been completed, each construction camp, either on based land or on a barge, will be demobilized. This will include any reasonable requests to use such areas for community purposes and will be done in conjunction with the Kaupule. All efforts will be made to engage local labor to undertake the decommissioning works, and where practicable, the use of women's or community groups.

202. **Use of water**. Potable and fresh water is a scarce commodity on any of the outer islands. Construction activities may impact on the supply of groundwater which is known to be increasing in salinity. There will be insufficient water within the villages to rely on any stored water for construction related activities. Any construction camp will need to be self-reliant on water from either rainfall collected in tanks or supplied from associated barges or supply ships.

203. Mitigation measures to ensure the project does not impact on the island water supply include: (i) the contractor to be self-sufficient in the supply and storage of all fresh and potable water to be used in the construction camp and for mixing of concrete; and (ii) use only seawater for dust suppression if/as required.

204. **Influx of labor - impacts of foreigners and non-local workers**. Construction activities will occur in a remote location and the consequences of the hazards and risks to construction workers and the community are high. Relatively minor injuries may result in life threatening consequences due to the difficulty in getting access to appropriate and timely medical treatment. It will be necessary to include a health and safety plan as part of the CEMP to be approved by the CSC prior to mobilization. This plan should also include details of the location and response times to emergency hospital services and an emergency medevac plan with lines of responsibility for action.

205. A construction project can have a social impact on a remote island community and there may be some community concerns in respect of the construction program. As a priority, a set of protocols (code of conduct) will be established and agreed upon with the Kaupule to determine the social and cultural parameters for working on the island. These protocols will form part of the contractual obligations of the civil works contractor. Measures to mitigate these concerns will be addressed in discussions with Kaupule and full public consultation prior to any mobilization to ensure all construction personnel are aware of locations and the importance of the sensitive areas both within the reef environment and on land and to avoid disturbing them.

206. There may be concerns associated with the location of any lay-down area or construction camp or the presence of a temporary work force on the island. The design team will undertake a careful assessment of potential locations for any construction camps and lay-down areas that may be necessary on the island. Suitable sites will be identified and approved first and foremost by the Kaupule to ensure these are not placed on or near any areas of cultural significance or require any removal of shoreline vegetation or result in any damage or removal of indigenous vegetation. Preference will be given to sites that have already been modified.

207. The breakwater and workboat harbor works on the reef and foreshore will not require displacement of people or the removal of community facilities.

208. A communication and consultation plan (CCP) will be prepared by the CSC and will be implemented for all phases of the project. A grievance redress mechanism (GRM) will be established to deal with any community or individual concerns related to the project. It will be expected that there will be full and free access to the CSC to raise any issues of environmental concern due to the construction works. All efforts will be made to address any community or individual concerns in a timely and transparent manner and without retribution to the affected person to minimize any impacts that may affect project implementation.

209. The community will be advised of the GRM through a public awareness campaign and by way of the Kaupule. The process of lodging a concern or complaint and contact details of the contractor and CSC will be identified on a public notice board. The GRM is described more fully in Section VII D.

210. The presence of construction workers in small island communities can increase the risk of communicable diseases included sexually transmitted infections (STI). Communicable diseases including STI are present in Tuvalu, with higher prevalence of Chlamydia, Syphilis and Hepatitis B in the most recently available studies. There have been 11 people diagnosed with HIV since 1995, a high rate for the low population.[20] Education and training in STI and HIV/AIDS awareness and prevention is an important health risk mitigation factor for the community members and projects workers, both expatriate and those from elsewhere in Tuvalu. There are qualified agencies in Funafuti and the Pacific that can provide HIV/AIDS and STI awareness and prevention training to both the construction workers as well as the general community. The requirement to fulfil this training will form part of the tender document.

211. The following measures will be included in the CEMP to manage or mitigate potential conflict or social impacts arising from influx of workers:

- Implementation of the project's CCP;
- Ensure that community and stakeholders are aware of the GRM and how to access the GRM;
- Appointing a grievance focal point (GFP) from the Kaupule;
- CSC and Kaupule to facilitate agreement of protocols--code of social conduct--between the contractor and community leaders. The protocols will govern workers' conduct while at work and in communities, behavior around women and children, restrictions on alcohol consumption, prohibitions (with sanctions for non-compliance) on workers hunting or fishing, implementation of awareness programs, implementation of the GRM and handling of complaints, hiring of local labor, and implementation of the HSP;
- The contractor will engage/recruit an approved service provider to deliver the HIV/AIDS/STI awareness and prevention program to workers and community;
- Workers' access to portable toilets and associated sanitation facilities will be provided at the site (either through agreement to use on-land toilets or sufficient ablution facilities on the barge).
- Following the CCP, the contractor will distribute information (through meetings or pamphlets) regarding the scope and schedule of construction, as well as certain construction activities causing disturbance or nuisance;
- For unskilled activities and labor, every effort to hire local people (including women) for these positions should be a priority;
- Child and/or trafficked labor will be strictly prohibited for any activities associated with the project;

[20] Ministry of Health. 2015. Global AIDS Progress Report. The first HIV case in Tuvalu was found in 1995. The cumulative number of HIV cases to 2015 is 11, two of whom have died. Of the nine people with HIV still alive, none are currently enrolled in anti-retroviral therapy.

- Accidental damage to utilities will be minimized by (i) obtaining plans from the public utilities identifying locations of pipelines, conduits and power cables and (ii) consultation with staff on the location of utilities prior to commencing excavation operations;
- Availability of screening for all workers on a voluntary and confidential basis;
- An HIV/AIDS and STI awareness and prevention campaign for all workers to be included in the bill of quantities of the contractor and delivered by a service provider approved by the government (Ministry of Health);
- Ongoing training and workshops presented to the community at regular intervals; and
- Availability of condoms, at no cost, to all on-site staff.

212. **Health and safety - workers**. Health and safety risks of construction works in a remote marine environment are high for both construction workers and the small island community. Medical assistance may be unavailable for extended periods particularly during bad weather. Therefore, all construction personnel must have a comprehensive first aid certificate prior to mobilization with at least one member being competent in advanced emergency first aid to deal with potential injuries and more serious accidents.

213. Risk can be limited by having a clear health and safety policy and an emergency response plan for all personnel and the adjacent community. To minimize health and safety risks, the contractor will provide the CSC and PMU with a comprehensive health and safety plan (HSP) as part of the CEMP which will:

- Prepare and implement the HSP which will include the measures to demonstrate compliance with the World Bank Group's Environmental Health and Safety Guidelines (EHSG);
- Define responsibilities and authorities within the contractor's staff for adhering to occupational health and safety (OHS) requirements;
- Provide personal protection equipment (PPE) for all full-time staff and part time workers;
- Define appropriate emergency and medical evacuation procedures;
- Undertake daily hazard identification checklists, risk assessments and toolbox sessions;
- Prepare appropriate work method statements for each construction activity and ensure all personnel understand the task before commencing work for the day;
- Clearly define procedures for handling construction materials, conducting tests, operating heavy equipment in a remote marine environment;
- Provide for installation of lights and cautionary signs in hazardous areas;
- Ensure operators of vehicles and equipment are properly licensed and trained;
- Provide information on emergency assistance procedures on community notice boards and location of first aid kits and other emergency equipment;

- Ensure safety and inspection procedures, setting schedules for regular checking; and
- Set procedures for safe handling of toxic materials and other hazardous substances.

214. There will also be a program to provide general health and safety awareness for construction workers prior to their arrival on site and at any time there are new employees. The program will provide the information from the HSP in the CEMP and will include: (i) introduction to OHS issues in construction sites; (ii) education on basic hygiene practices and procedures to minimize spread of tropical or contagious diseases; (iii) HIV/AIDS and STI awareness, including information on methods of transmission and protection measures; (iv) prohibition of drugs and alcohol on construction sites; and (v) availability of medical assistance for emergency or non-emergency situations.

215. **Health and safety - community**. The construction activities will create health and safety impacts on the adjacent community related to noise, dust and other risks and impacts such as communicable diseases associated with the influx of temporary construction labor. Mitigation measures include:

- The contractor's HSP will address community impacts and management measures in addition to worker health and safety. The HSP will be appropriate to the nature and scope of activities, meet the requirements of good engineering practice and national law and regulations and comply with the EHSG;
- The HSP will include agreement on consultation requirements, establishment and monitoring of acceptable practices to protect community safety, links to the complaints management system for duration of the works (in accordance with the GRM) and system for reporting of accidents and incidents. The PMU will ensure these actions are enforced;
- The contractor will coordinate directly with the GFP appointed from the Kaupule for the project;
- Before construction commences the contractor/s will conduct training for all workers on environmental safety, environmental hygiene including delivery of the HIV/AIDS/STIs awareness and prevention training and the code of conduct (see sub-section below);
- The contractor, following the requirements of the project's CCP, will inform the community of the works (likely impacts and control and mitigation measures), including the timeframe through information brochures and/or community meetings;
- Tuvalu minimum wage requirements to be observed, if local staff are required for the assessments. There should be proper enforcement of the labor laws at the work place;
- Child and/or trafficked labor will be strictly prohibited for any activities associated with the project;
- Children will be prohibited from entering the sites (including worker's accommodation, works area/construction zone) and prohibited from playing on any equipment or machinery;

- All advisory and warning signage will be clear, secured on fences, gates and signboards and be posted in Tuvaluan, the language of the main nationality of workers and repeated in English; and
- The contractor will clearly fence off and post warning signs at the site to prevent the public from entering during the construction period.

F. Operation Impacts

216. **Physical resources**. Following construction of the workboat harbor, wharf and jetty, there may be an increase in the rate of erosion due to the impact of the facility on the coastal processes. This erosion may be exacerbated by cyclonic storms and wave surges causing physical damage to the structures or undercutting of the concrete structures, abutments and piles. Major maintenance works may be required.

217. Periodic maintenance activities are typically scheduled over periods of several years and include minor repairs to rails, lights, signage, painting, jetty decking, bollards and landing platform. A regular inspection of the entire facility should be made as part of the maintenance schedule carried out by MCT and particularly after each significant storm event.

218. **Disturbance to marine fauna from increased vessel traffic**. Once constructed, long-term operation of the small work boat harbor at Niutao could increase the volume of vessel traffic in northern Tuvalu. In turn, this would exacerbate the risk of vessel strike on certain species as identified in the previous section. It would also increase disturbance from underwater noise. Given the relatively, small size and intermittent use of the new boat harbor, however, associated noise intensity would not be considered to increase significantly from that already experienced.

219. Improved infrastructure may also result in less engine noise as disembarkation/loading would be faster and less maneuvering would be required.

220. Appropriate vessel speeds and controls should be established for vessels operating within the boat harbor approach, channel and basin. This may include permanent signage and establishment of ongoing procedures and mechanisms for reporting of any vessel interactions.

221. **Changed coastal processes**. Any longer-term changes to hydrodynamic regime and wave refraction could potentially impact sensitive flora and fauna including corals. Water movement provides nutrients (food) and dissolved oxygen to aquatic vegetation and corals, removes wastes, and can reduce predation by herbivores and coralivores. The construction of the safe harbor structures including break wall is expected to alter local hydrodynamics and therefore has the potential to impact on the local marine ecosystem. Another consequence of constructing the small harbor breakwaters is that the structures would potentially reflect waves and thereby increase wave heights in the nearby areas of reef crest or slope inhabited by coral.

222. Results of the field investigations also showed that the mean percent cover of coral nearby the existing boat ramp location at Niutao was substantially lower than at the locations unaffected by habitat alteration. This suggest that creation of the artificial channel could have affected the coral assemblage beyond just the footprint of the dredged channel although no data about habitat ids available from before construction of the channel that could confirm this. The area of concern is the nearby reef slope where coral cover is generally highest. Hydrodynamic data was not available at the time this report was written but there would be some tidal flow at the project sites. It likely that flow around the reef crest close to the ends of the break wall would be altered to some extent but it is unlikely that the project would substantially affect flow on the reef slope.

223. Some wave reflection is likely to occur close to the ends of the break wall on the reef crest and the top of the reef slope but given the amplitude of reflected waves would reduce within short distances from the break wall and that corals in these areas are likely to be tolerant to wave action, they may not be adversely affected beyond a few meters from the ends of break wall. Notwithstanding this, care should be taken with respect to designs so that they are designed as practically as possible to mitigate the potential for the project to alter hydrodynamics and wave climate to local coral habitat.

224. In addition, because the effects of altered hydrodynamics and reflected waves are not clear, it is recommended that monitoring is done a year after construction to determine if any impacts had occurred, and if so to measure their extent, and whether offsetting may be required.

225. **Water quality effects**. Increased vessel movements during operation increases the risk of spills from hydrocarbon fuels, oils, greases and other contaminants associated with vessel operations could degrade water quality through spills of hydrocarbon and other contaminants, nutrient enrichment, littering and waste disposal. The increase in hard-stand areas associated with the new land-based infrastructure also has potential to influence sediment laden surface run-off and nutrients into the lagoon, potentially impacting on water quality in the long term. Corals could be directly impacted by changes in water quality. Changes to the hydrodynamic regime due to the new channel and breakwaters may also influence tidal flushing and water quality.

226. The new infrastructure will provide suitable facilities for the storage of fuels and wastes and be designed to ensure best practice in surface run-off and storm water management. It is possible that increased vessel use may result in minor spills, however, the improved facilities would also help minimize risks of spillage due to safer ship to shore transfers. The movement of liquid materials from the workboats to the wharf can result in spillage or loss into the harbor area causing pollution of the marine environment.

227. Spillage of hydrocarbons into the water or onto the reef platform can result in damage to the aquatic biota. Mitigation measures to reduce the impact of spillages and waste entering the marine environment would include:

- Bunding of all hazardous materials within the designated storage area and on vessels delivering the materials;
- Only personnel inducted and trained in appropriate handling and storage of bulk liquids to be permitted to undertake ship to shore transfers;
- Emergency response plan and procedures should be in place in case of an accidental spill;
- Spill kits should be available at the new boat harbour and on vessels transferring liquid cargo; and
- Education for boat drivers utilizing the facilities should be incorporated into the EMP to include best practice in spill management to minimize risks to the marine environment.

228. **Introduction of marine pests**. As discussed in Section D, vessels and movement of offshore equipment have potential to act as vectors for introduced species. Marine pests are a long-term, but reversible impact to which marine communities would have an existing level of exposure. Standard practice procedures for ballast water management should be observed by vessel operators throughout the operational life of the working harbors.

229. **Artificial lighting**. Artificial lighting has potential to disturb species such as marine turtles that are nesting or breeding. The specific project locations are not, however, known or suitable turtle nesting sites. Given the relatively small scale of the proposed boat harbor, the associated level of lighting would be minimal and the risk of disturbance to marine fauna considered minor. Impacts of lighting could be further minimized through suitable design and placement of lighting.

230. **Increased fishing pressure**. There is potential for increased fishing to occur due to more people potentially visiting the outer islands once new infrastructure is in place. This has potential to affect the abundance of some fish and crustacean species. It is, however, considered unlikely that the increase in fishing activity would be to a scale that would amount to any ecologically significant impact to local fish assemblages. Monitoring of fishing pressure should be managed through the EMP in consultation with the TFD.

231. **Impacts to threatened and protected species and habitats**. Long-term impacts to threatened and protected species as identified in Section D have potential to include disturbance from increased vessel traffic (e.g. vessel strike, vessel noise and light), changes to the hydrodynamic regime (particularly corals), degradation of water quality, introduction of marine pests and artificial lighting. Provided the mitigation measures outlined in the previous sections are incorporated into the EMP and appropriately implemented, these potential impacts are likely to be suitably managed.

232. **Cargo handling and passenger movements**. The improvements to the workboat harbor, wharf and jetty facilities will significantly improve cargo handling and the reduction in loss of value of spoiled or damaged goods from man-handling the cargo through the tide to the shore. There will also be improvements to the efficiency of operations with an increase in the rate of transfer from the workboat to the shore, allowing the boat to reduce the time required to idle unmoored in the sea nearby.

233. The project will also greatly improve safety to passengers, particularly the old and infirm, when embarking and disembarking from the workboats to the shore by way of a wharf and passenger access to the workboats without the need to wade through, at times, difficult tidal and sea conditions.

234. The use of a facility by the community will generate domestic waste material. Domestic waste and general litter includes non-biodegradable materials such as plastic and glass associated with food items and packaging discarded by people visiting the jetty. Over time the cumulative effects of waste has an impact on the surrounding area and can result in injury to people using the wharf.

235. Commercial waste includes materials associated with the transfer of cargo and other construction related material over the wharf or dumping of solid waste, tyres, motorbike parts, empty drums and concrete blocks into the harbor and can result in damage to workboats and other vessels or injury to swimmers.

236. Mitigation measures to reduce the impact of domestic and commercial waste include:

- Public awareness campaign conducted by the Kaupule and church leaders to keep the public facility in a clean and tidy condition, like the condition usually associated with other public facilities such as churches and hospitals;
- Provision of waste receptacles near the jetty and a program for the regular removal of the waste;

- Signs in a prominent position to ensure litter and waste is placed in the receptacles provided; and
- Regular community clean-up programs initiated by Kaupule, community leaders, youth and women's groups.

VI. CONSULTATION AND INFORMATION DISCLOSURE

A. Consultation

237. Following general good practice and as a requirement of the SPS and Public Communications Policy 2011, public consultations were undertaken during the development of the IEE to determine community attitudes to the project and elicit information germane to establishing baseline conditions and understanding potential environmental and social effects.

238. During preparation of the ongoing project, site visits and discussions at national and island level began in December 2015 through the site visit of the study team for the first phase. The team was accompanied by the Director of Ports, representing the implementing agency (MCT), and visited each of the eight outer islands of Tuvalu. A national workshop was held 15-16 and 18 April 2016 in Funafuti with representatives of five island communities and relevant government agencies. As part of the ongoing project, engagement activities occurred throughout 2016 to refine the project, inform communities, and collect information and feedback from community members. Initial meetings were held with Kaupule, landowners, women's and youth groups in Niutao in October 2016.

239. For the current project (and additional financing to cover cost over-runs for the ongoing project), several key stakeholders in Funafuti and outer islands were consulted. These included the island councils (Kaupule), landowners, fishers, women (including a separate focus group of pregnant women) youth groups, elderly men and a local man living with disabilities.[21]

240. Three government departments were consulted from 5-7 March 2018 including a meeting with Ms Lanuola Keleta - Acting Director Department of Gender Affairs and Ms Natalie Makhoul - GESI Advisor; Mr Faatasi Malaloga, Director of Department of Lands and Survey and Mr Tassi Pitoi - Director Marine and Ports Service. Non-government organizations—members of Tuvalu Association of NGOs (TANGO)—consulted included the Red Cross, Tuvalu Family Health Association and the National Council of Women.[22] Whilst aboard the Tala Moana, discussions were also held with the ship's Captain and a crew member.

241. Key stakeholders, particularly the Falekaupule, Kaupule, landowners, fisherfolk, the elderly, women (including pregnant women), people living with disabilities and youth representatives in Niutao were consulted on issues of social inclusion and community development. In addition, representatives of the Niutao Women's Council, the local Red Cross and the Women's Handicraft Centre were interviewed.

[21] As there was a concurrent workshop for people with disabilities on the island, these stakeholders were not able to attend. A separate key in depth interview was held with a man with disabilities, who uses the ship transfer, to gain specific issues of concern for people living with disabilities.

[22] Both members of TANGO were out of country during the mission and need to be further consulted in the next phase.

242. During implementation, MTC through PMU/CSC will ensure that meaningful public consultations, particularly with project affected persons', if any, continue to be undertaken. The process will follow the stakeholder consultation and participation plan prepared for the project. The EMP includes a grievance redress mechanism (GRM) so that any concerns raised during construction or operation can be addressed.

B. Information Disclosure

243. All safeguard documents are subject to public disclosure, and therefore will be made available to the public. Following clearance of the IEE by ADB and updating as PEAR, the document will be posted on government and ADB websites as per the Public Communications Policy. Provided it does not contain any commercially sensitive information, the approved CEMP will also be disclosed.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. General

244. The EMP contains the components crucial to effective environmental management within the project, these include: (i) organizational responsibilities (for various aspects of EMP implementation); (ii) consultation and information disclosure (explained in Section VI and reflected in the EMP table); (iii) grievance redress mechanism; (iv) plan for mitigation of impacts (during pre-construction, construction and operation); and, (v) monitoring and reporting. These are explained in detail in the sub-sections below.

245. An EMP is developed to achieve the following objectives:

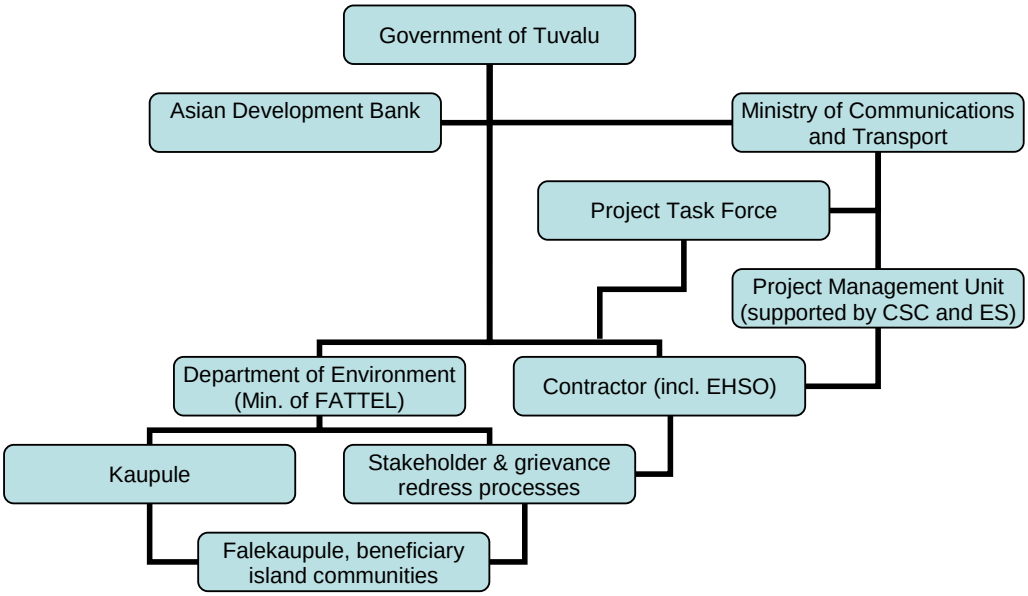
- To reflect the environmental and social issues and impacts identified during project preparation;
- To implement and monitor mitigation measures within the construction area; and
- To comply with the laws and regulations of the country and with international standards and best practice guidelines.

B. Institutional Arrangements for Environmental Management

246. Implementation of environmental safeguards including environmental management provisions and requirements is a joint responsibility between the MCT, project management unit (PMU)[23], CSC, and contractor. MCT, as the project executing agency, has overall responsibility for ensuring that the project activities comply with the project agreements and covenants. The PMU, on behalf of MCT and government, will implement the project, including managing consultants and the contractor, according to the requirements. An individual environmental specialist (prior to the CSC recruitment) and the CSC will support the PMU. The overall organizational structure for environmental management for the project is shown in Figure 7.1.

[23] The PMU has been established under the ongoing project.

Figure 7.1: Organizational Structure for Environmental Management



247. **Government agencies**. The MCT will ensure compliance with assurances contained in the project grant agreement, including environmental safeguards and updating and submitting the updates, and required environmental monitoring reports. The PMU, headed by a Project Director, implements the project and is responsible for overall planning, management, coordination, supervision, and progress monitoring of the subproject including updating the EMP with the assistance of the international and national environmental safeguards specialists.

248. Owing to the small size of the DOE, it has limited staff capacity to provide environmental compliance monitoring of the projects on the outer islands during the construction phase. However, a budget allocation needs to be made to assist the PSMPC to develop and build institutional capacity to undertake the necessary monitoring activities within the project scope. To assist with building institutional capacity within the DOE, staff will be encouraged to assist the PSMPC to carry out specific site monitoring activities to ensure there is compliance with the national environmental legislation as well as specific project requirements.

249. **Pre-CSC environmental safeguards**. The individual environmental specialist recruited to support the PMU prior to the recruitment of the CSC will deliver the following key tasks:

- Update the IEE including its EMP, as required, filling information gaps and elaborating baseline as required based on surveys, updated detailed design based on geotechnical investigations and any modifications to structural designs;
- Assist the PMU prepare and submit the development approval application including reformatting the updated IEE and EMP as a PEAR as per the requirements under Environment Protection Act 2008;
- Incorporation of updated IEE mitigation measures and EMP and any conditions on the development approval into bidding documents and technical specifications;

- Prepare, for inclusion in the bidding documents, the terms of reference (including requisite qualifications and experience) for the EHSO as part of contractor's team; and
- Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements including the suitability of the EHSO proposed as part of the contractor's team.

250. **Construction supervision consultant**. The CSC will include a suitably qualified ES to ensure all project activities comply with the safeguard requirements of the country safeguards system and the SPS. The ES will need to have appropriate experience in marine ecosystems or at least have ready access (by phone) to a suitable expert that can provide timely advice as required. The tasks include:

- Prior to works commencing ensure the baseline conditions are benchmarked and recorded as required by the EMP for subsequent monitoring;
- Provide induction training to the contractor prior to the preparation and submission of the contractor's CEMP and as required work with the contractor's EHSO to identify appropriate construction methodologies and detailed site-specific mitigations;
- Review and approve the contractor's CEMP including site-specific plans, construction methodologies; and work method statements;
- Review the monthly reports from the contractor and monitor and make site visits as required to report the compliance of the contractor with the approved CEMP and through the Engineer issue corrective action requests as required;
- Undertake inspections and monitoring of contractor compliance with the approved CEMP and effectiveness of the mitigations; and
- Provide inputs on safeguards matters to quarterly progress reports, and prepare semi-annual safeguards monitoring reports and submit to MCT and ADB for disclosure.

251. The CSC will also include a site supervisor at the island as well as where the prefabricated concrete elements are to be constructed to ensure quality control. Regular compliance monitoring, constrained by access and logistical reasons due to the very remote location and limited shipping service, will be carried out by the PMU and the CSC's ES. The ES will work with the supervision engineer to review and approve the CEMP and to monitor the contractor's implementation of the approved CEMP.

252. All contractor records will be subject to review. Due to logistical constraints in site access, time and distance, this matter will require greater analysis and a degree of pragmatism to achieve the required level of compliance monitoring for both ADB and Government of Tuvalu.

253. **The contractor**. Given the sensitivity of the marine environment, the contractor will be required to recruit an experienced environmental specialist (as the EHSO) to develop the CEMP and to help the contractor implement the CEMP, including the site-specific plans and construction methodologies (working platforms, dredging methods, and spoil disposal locations and methods) most suited to the environmental conditions at each island. The EHSO will need to have appropriate experience in marine ecosystems or at least have ready access (by phone) to a suitable expert that can provide timely advice as required.

254. The contractor will be supported by the CSC during the preparation of the CEMP which will be submitted to the CSC and PMU for approval prior to the commencement of works.

255. The main responsibilities for environmental management at the different stages of the project are summarized in Table 7.1.

Table 7.1: Responsibilities for Environmental Management

Project Stage	Responsible Agency	Responsibilities
Feasibility studies, detailed design review and project approval	FS & DD consultant	Review designs prepared as part of ongoing project and complete detailed design Prepare feasibility study including safeguards due diligence
	ADB	Review all feasibility study documentation (incl. IEE) Prepare documents package for Board review (incl. requirements and TOR in PAM and covenants in grant agreement) Board approval of project Assist government to recruit CSC
Pre-construction incl. detailed design update	FS & DD consultant	Update detailed design based on geotechnical investigations and any structural design modifications Prepare bid documents Assist PMU evaluate bids and prepare bid evaluation report
	Individual env. specialist	Update the IEE including its EMP, as required, filling information gaps and elaborating baseline as required based on surveys, updated detailed design based on geotechnical investigations and any modifications to structural designs; Assist the PMU prepare and submit the development approval application including reformatting the updated IEE and EMP as a PEAR as per the requirements under Environment Act; Incorporation of updated IEE mitigation measures and EMP and any conditions on the development approval into bidding documents and technical specifications; Prepare, for inclusion in the bidding documents, the terms of reference (including requisite qualifications and experience) for the EHSO as part of contractor's team; and Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements including the suitability of the EHSO proposed as part of the contractor's team.
	PMU, CSC	Include ES as part of CSC team Elaborate the stakeholder engagement strategy in PAM as the CCP Prior to works commencing ensure the baseline conditions are benchmarked and recorded as required by the EMP for subsequent monitoring Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements including the suitability of the EHSO proposed as part of the contractor's team Provide induction training to the contractor prior to the preparation and submission of the contractor's CEMP and as required work with the contractor's EHSO to identify appropriate construction methodologies and detailed site-specific mitigations

Project Stage	Responsible Agency	Responsibilities
		Review and approve the contractor's CEMP and advise Engineer of approval to trigger "no objection" to commencement of activities/works
	ADB	Review and clear updated safeguards documents Provide comments on the CEMP and proposed monitoring checklists
	Contractor	Recruit suitably qualified EHSO Prior to any works commencing, prepare CEMP including the site-specific plans, work method statements and construction methodologies (working platforms, dredging methods, and spoil disposal locations and methods) and GRM Submit CEMP to PMU and CSC for review and approval (revising as necessary if required) Identify materials and equipment sources and arrange necessary permits, consents and compliance certificates Provide pre-mobilization induction on CEMP (incl. OHS) to employees Recruit approved service provider to provide STI/HIV/AIDS awareness and prevention training for workers and community
Construction	Contractor	Inclusion of EHSO as part of core team Provide ongoing training, awareness and "tool box" sessions for workers Implementation of CEMP Implementation of CCP and GRM as pertains to construction Reporting of CEMP and GRM implementation in monthly reports Implementation of corrective actions as requested by Engineer
	PMU, CSC	Supervise, monitor and report on contractor's implementation of CEMP and all other contractual obligations Enforce contractual requirements Audit construction phase through environmental inspections and review monitoring reports and data Submission of quarterly progress reports and semi-annual monitoring reports Work with contractor EHSO for provision of awareness/training to workers and information transfer to contractor as required
	ADB	Undertake regular review missions Review monitoring reports Disclose project information as required
	DOE	Ensure compliance with government requirements Review complicated issues, if any, arising from the project Participate in monitoring
Operation	MCT	Provide budget to undertake maintenance activities and operation stage environmental monitoring as required by EMP
	Maintenance contractor	Undertake environmental monitoring and prepare bi-annual reports Prepare maintenance reports to adaptively manage environmental risks related to operations (per EMP)

C. Mitigation Plan

256. The EMP includes the description of the environmental impact of a range of project activities during the pre-construction and design phase and the construction phase, with mitigation measures and responsibility for undertaking these measures.

257. The EMP matrix (Table 7.2) provides an operational reference and a tool for environmental management during construction activities. It describes in general terms how the contractor will meet the specified contractual, regulatory and statutory requirements. The contractor will provide the detail in its response (the CEMP) which will set out method statements and site-specific plans as required.

D. Grievance Redress Mechanism

258. A grievance redress mechanism (GRM) will be established for the project. The GRM will cover all project matters, including environmental and social performance, and has been developed based on traditional approaches to conflict and complaints resolution. The community will be informed of the GRM following the methods and manner set out in the CCP and through discussion with the Kaupule which, if appropriate will appoint a GFP. The process of lodging a concern or complaint and contact details of the contractor and CSC will be posted on a public notice board. The community is encouraged to voice any concerns or complaints, and these are to be duly investigated and reported through to the contractor. All grievances, complaints or issues raised will be lodged in a register maintained at the contractor's site office. These are included in the monthly reports from the contractor to CSC and PMU and are subject to monitoring by the CSC and PMU.

259. Given the remote location, the small number of construction workers and the small size of the communities involved, it will be expected that there will be full and free access to the site-based members of the CSC team, including the Engineer, to raise any issues arising from the construction works. All efforts will be made to address any community or individual concerns in a timely and transparent manner and without retribution to the affected person/complainant to minimize any impacts that may affect project implementation.

260. The process (Table 7.3), developed in conjunction with the PMU, will be used to address the issues and concerns that a complainant may have. The process is relevant to all subproject sites. The key point of contact for the complainant will be a GFP appointed from the Kaupule, who will liaise directly with both the contractor and the CSC. The contractor will receive and document all matters and issues of social concern from the local community and forward copies of all grievances to the CSC and PMU. The contractor's CEMP will set out the process for resolving issues and complaints related to construction activities or behavior of workers as per the GRM.

261. For concerns such as damage to trees or food gardens i.e., taro plots without permission or compensation, the complainant will discuss this with the Kaupule, who will raise the matter immediately with both the contractor and the CSC. If the concern can be addressed without delay, and the outcome is satisfactory to the complainant, the matter is closed. The contractor will provide a corrective action report to the CSC as soon as the complaint has been resolved.

262. For more extensive complaints relating to damage to buildings or land issues such the encroachment onto land outside the designated work area by the project or the contractor, the complainant will make a formal written statement to be delivered to the Kaupule, who will forward this to the contractor. The contractor will document the complaint and forward a copy to the CSC and PMU. The complaint must be attended to within 24 hours of the complaint being lodged.

263. The timing and way it will be/has been resolved will be conveyed to the complainant by the Kaupule within 48 hours. The contractor will provide a corrective action report to the CSC as soon as the action has been taken.

264. If the complaint is not resolved by the contractor or CSC to the satisfaction of the complainant, then the Kaupule will forward the complaint directly to MCT, and with a copy to the Ministry of Home Affairs and Rural Development. The matter will be addressed with due consideration to the seriousness of the complaint and be carried out promptly. The MCT will attend to the complaint within 24 hours and advise the Kaupule how it will be addressed. MCT will make a decision within two weeks. The complainant may, if so desired, discuss the complaint directly with PMU or its representative at a mutually convenient time and location. If the complaint of the complainant is dismissed, the complainant will be informed of his/her rights in taking the complaint to the next step. However, every effort will be made to resolve the issue to the mutual satisfaction of both the parties.

265. Should this process not resolve the matter, then the complainant can take the grievance to the Tuvalu judicial system. The filing of the grievance will be at the complainant's cost, but if the court shows that PMU has been negligent in making their determination, the complainant may seek costs.

Table 7.3: Procedures for Resolving Grievances

Step	Process	Duration
1	Complainant lodges grievance with contractor and/or CSC or the GFP/Kaupule	Any time
2	GFP/Kaupule reviews the issue, and in consultation with the CSC and contractor (if appropriate), then records a solution to the problem.	24-48 hours
3	GFP/Kaupule reports back to complainant and gets clearance from the complainant.	48 hours
If unresolved		
4	Kaupule takes grievance to Director-MCT for resolution Director-MCT considers matter and responds	24 hours Decision within two weeks
5	Complainant refers matter to government ‘s legal office	2 weeks
6	Government legal office refers to an internal committee	4 weeks
7	National agency reports back through relevant government agency/complainant	2 weeks
If unresolved or if at any stage and complainant is not satisfied with progress		
complainant can take the matter to appropriate national court.		As per judicial system

E. Monitoring and Reporting

266. During the period of project design, monitoring has ensured that (i) design measures are specified for sensitive areas, (ii) bidding documents contain environmental requirements, and (iii) criteria for the selection of qualified contractors are clearly defined and followed. The baseline conditions established in this report have been further elaborated and recorded/benchmarked (for required conditions and parameters as per the monitoring requirements in the EMP Table 7.2).

267. When construction commences, a key aspect of environmental monitoring is to ensure overall contractor compliance with the EMP. It also serves to assess the effectiveness of environmental mitigation and management measures.

268. Monitoring of environmental impacts is also carried out during the construction and post-construction period (Table 7.2) including verification (one year after construction) of predictions of the scale and extent of impact to coral on reef slopes. This measures environmental impacts to ensure that critical factors are not exceeded.

269. It also helps to determine whether mitigation measures are effective or should be altered or improved to address the observed and measured change in impacts. This also assists in the evaluation of impacts as an input to decisions on future projects.

270. The reports to be prepared during the project include:

- Monthly reports prepared by the contractor (including implementation of CEMP and GRM issues);
- Quarterly progress reports prepared by the PMU and CSC which will include safeguards matters as relevant (summarizing above);
- Semi-annual safeguards monitoring reports summarizing above, reporting on corrective actions requested and actioned and training and capacity building activities.

271. The updated IEE, PEAR and semi-annual safeguards monitoring reports, along with other relevant project information, will be subject to disclosure as per the Public Communications Policy.

Table 7.2: Environmental Management and Monitoring Plan

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
DESIGN AND PRE-CONSTRUCTION PHASE						
Project access to land and seabed/reef	Obstructions during construction if access arrangements not properly negotiated and finalized	• Land ownership arrangements validated and leases/agreements made as set out in the DDR • DDR updated during detailed design and verified by third-party	PMU, Kaupule	As per DDR	As per DDR	As per DDR
Dredging and excavation activity creates sediment	Silt and sediment affects larger area of coral through smothering	• Sediment plume modelling and analysis undertaken • Dredging plan determining volume to be dredge per day and spill budget prepared • Dredging plan reflected in updated EMP and bid and contract documents • Contractor responds to dredging plan requirements in dredging work statement and site-specific plan included in CEMP	PMU, FS&DDC	Sediment and fines plume; Coral health	As per dredging plan	CSC
Geotechnical surveys to take core samples, seismic probes	Drilling into reef platform using manually-operated motorised drilling equipment to take core samples will not result in any significant long term impact. Potential for leakage of fuel, oil or hydraulic fluid onto reef from the equipment. Potential impact of seismic waves on marine life and fish	• Small size of the drill will not result in significant amounts of sediments from each site • Carry out drilling during outgoing tide to remove sediment from reef platform • Check manually-operated motorised drilling equipment for potential leaks from all hydraulic hoses and fuel lines • No refuelling to be done on the reef platform • Carry out any seismic survey at low tide only and when there is no water on the reef platform	FS&DDC, PMU	Sediment yield, timing of drilling, refuelling	Daily during survey Visual inspection	CSC / Contractor
Bid and contract documents (BCD) preparation, tendering and contractor award	Poor project environmental management if systems not established properly and from outset of project implementation	• PMU to be supported by individual env. specialist prior to recruitment of CSC • IEE updated based on updated detailed designs, reformatted as PEAR and submitted for development approval • Updated project EMP and conditions of development approval incl. in BCD; • BCD requires contractor to: (i) comply with laws and regulations; (ii) designate full-time EHSO; (iii) prepare and implement CEMP; (iv) provide induction and training for workers (and community) as specified); • CSC recruited and ES mobilized • Contractor to prepare site-specific CEMP; and • CEMP reviewed and cleared by ES prior to works commencing	PMU, CSC, Contractor	BDC (incl. TOR); Bill of quantities; CEMP approved prior to contractor commencing works	Once - env. specialist engaged; BCD includes updated EMP and safeguards provisions; Development approval; CSC recruited and incl. ES; CEMP prepared and cleared; no objection for works commencement; Notes of induction and training	EA, IA, PMU, DOE

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Climate change adaptation	Risk of increased coastal erosion and change in longshore sand movement	• Ensure all measures incorporated in design are implemented	FS&DDC PMU	Review of plans and designs	Visual inspection	PMU
Mobilisation of machinery and equipment from source country	Introduction of invasive/alien species (soil-borne weeds, pests, pathogens)	• Ensure all construction machinery and equipment is steam cleaned of all organic material in source country prior to deployment • Obtain approved phytosanitary certificate and any other documentation required under Tuvalu legislation	CSC	Pathogen-free status of equipment and machinery	Visual, once for each shipment Phyto-sanitary certificate issued	CSC, PMU
Supply of aggregate for construction purposes	Soil-borne weeds, pests and pathogens become established on the island and reef environment	• DOE consulted about using the dredged material as a source of supplies of aggregate for concrete. Some imported aggregate may also be used • Provide an approved phytosanitary certificate and any other documentation required under Tuvalu legislation prior to dispatch from country of origin	CSC	Pathogen-free status of aggregate	Visual, once for each shipment Phyto-sanitary certificate issued	CSC, PMU
Construction activities in remote locations	Hazards and risks to construction workers	• Health and Safety Plan (HSP) as part of CEMP to be approved by CSC prior to construction work starting • Confirm location of emergency hospital services and response times at each site • Provide an emergency medevac plan with lines of responsibility for action	CSC	HSP contains all relevant elements	Once, HSP presented and approved	CSC, PMU
	Hazards and risks to community: Transmission of communicable diseases incl. STI and HIV/AIDS Social disruption Possibility of conflicts or antagonism between residents and contractor Children potentially exposed to sexual exploitation.	• Conduct an HIV/AIDS awareness campaign for affected communities and workers PRIOR to mobilization of contractor • Ensure all workers have medical clearance for any contagious/communicable diseases prior to mobilisation • Confirm GRM, appoint GFP and advise community of the process • Code of conduct agreed between Kaupule and contractor (agreed set of protocols) • EHSO recruited by contractor	Contractor, Approved service provider, Kaupule	Awareness program conducted Medical clearance certificates GRM available for public inspection Agreed code of conduct EHSO recruited	Once, program delivered As required, all personnel with medical clearance confirmed Once, GRM in place Once, MOU signed Once, EHS on site	CSC, PMU
Delivery of pre-cast concrete elements from country of origin	Ballast water from ship may introduce foreign marine organisms or pollution of near shore environments	• Ballast water to be discharged no closer than 5km from the shoreline • Confirm with ship captain and review of log	CSC	Ballast water is discharged at least 5km from shoreline	At each shipment, ship records	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
CONSTRUCTION IMPACTS ON PHYSICAL ENVIRONMENT						
Operation of construction plant and vehicles generating emissions	Emission of exhaust from vehicles and machinery affects air quality	• Maintain construction equipment • Any machinery generating visible smoke is not permitted for construction activities	Contractor	Exhaust emissions from machinery	As required, visual	CSC, PMU
Construction activities during the dry season may cause dust nuisance	Air quality impacts (temporary and localized) Increase in levels of dust in and around the construction area Limited supplies of fresh water for dust suppression Dust from exposed spoil disposal sites	• Limit or suspend construction activity near villages during periods of strong winds • Limit truck movement through community areas during periods of high winds • Use sea water only for any dust suppression • Apply water to access road within 50 m of any occupied dwelling and through village during the dry season to reduce visible dust levels due to construction activities • Spoil disposal sites compacted to reduce exposure of loose debris from wind, if required	Contractor	Levels of dust during operations Application of water on access roads during dry dusty weather Spoil disposal sites compacted when required	As required, visual	CSC, PMU
Construction of temporary working platform	Sourcing of materials Additional dredging depending on method proposed Sedimentation (if causeway)	• Dredging plan from the sediment plume analysis to be reflected in contractor's work method statements • CEMP to include site-specific plan/work method statement to address this element including: (i) definition of boundaries; (ii) identification of environmental values of the site and surrounds; (iii) definition of construction activities; (iv) risk assessment; (v) identification of environmental management measures to address risks and impacts; (vi) site drawing/work plan; and (vii) baseline conditions and monitoring plan • Contractor to engage suitable experienced professional for assisting in preparing the CEMP given the sensitive marine environment	Contractor CSC	Site-specific plan prepared and approved Approved method implemented	Suitable EHSO (or other) prepares CEMP: Site specific plan approved; Daily/weekly during construction	CSC, PMU
Disposal area for material dredged from harbour and channel	Loss of sediment from disposal site Damage to surrounding land Removal of vegetation required to establish a disposal site	• Bunding the spoil area using local soil to reduce sediment movement away from site. • Sediment disposal to be > 50 m from pulaka (taro) pits • Disposal of dredged material into the sea or lagoon is not permitted • Disposal of dredged material not permitted on foreshore	Contractor	Appropriate soil conservation measures implemented; Placement of spoil during dredging; Effectiveness of bunds at spoil site	Stockpile area agreed with Kaupule; Daily, visual	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Construction of seawalls, headwalls and retaining structures	Loss and dispersion of excavated material from foreshore onto reef platform during high tides Potential for pollution from construction machinery into foreshore environment	• Contractor's method statement approved prior to the start of any excavation • Planning of works such that only short sections of coastal area are exposed at any one time • No excavation works immediately before any advancing bad weather system • All excavated material to be removed from foreshore environment • No excavated material to be stock-piled on the beach or reef flat. The only exception will the use of dredged material for construction of the temporary access bund for excavator access • Plant suitable ground cover vegetation and trees behind seawall • All machinery to be free from visible leaks of hydrocarbons, no refuelling on the foreshore	Contractor	Method statement approved; Location of excavated material; Coral on reef platform	Once, method statement identifies mitigation measures Daily, during construction	CSC, PMU
Coastal protection works, disposal of spoil from dredging	Collapse of beach profile after excavation (prior to construction of retaining wall) Foreshore erosion Loss and dispersion of excavated material and sediment from disposal site	• Dredging plan from the sediment plume analysis to be reflected in contractor's work method statements • Careful planning of works such that only short sections of excavated trench for any seawall or jetty headwall structure are exposed at one time and which can be completed between periods of low tide, or if sufficiently above high tide mark, that can be completed before any advancing weather system All excavated material to be immediately removed to the designated spoil disposal area. No excavated material is to remain in stock piles on the beach or reef flat between tides • Minimize the period that excavated areas are left unprotected and open to tidal movement or storm effects • Ensuring that all equipment used below the highwater mark is in sound mechanical condition, and free of any leaks of any fluid • Minimize or reduce the clearing of any vegetation near the seawall or jetty headwall structure. Consultation with Kaupule undertaken in finalizing the locations and numbers of trees to be cleared • Construct sediment traps where suitable to divert overland runoff into a safe disposal area	Contractor CSC	Volume of spoil is estimated to be 8,295m^3 of which 6,000m^3 used for road and platforms and 2,295m^3 would be disposed on land; Disposal site agreed with Kaupule; Sediment plumes; Coastal protection measures	Work method statements reflected in CEMP; Dredging plan requirments; Details on site specific plans and drawings; Sediment and erosion control measures implemented; Throughout construction activities	PMU, CSC

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• Place concrete demolition waste from damaged buildings on the sea side of the bund to provide protection from tidal surges. This should not be placed along the beach margin such that it impedes long-shore movement of beach sands • Incorporate bioengineering solutions where practicable (e.g. this could include, where practicable, planting ground cover species and local tree and shrub species in rows on the land side of the bund as part of the site remediation plan after completion of works to reduce exposure to wind) • Ensure the designated disposal site has capacity for the volume of spoil calculated • Ensure the designated disposal site is appropriately bunded • Consultation with Kaupule undertaken in finalising location of spoil disposal site				
Dredging	Disturbance of sediments and short-term increase in suspended solids and transfer of plume by tides affecting water quality	• The CSC will include suitably qualified ES and the contractor will engage a suitably qualified EHSO • EHSO prepare a detailed method statement in the CEMP. The statement will identify the methodology and rationale for any selected dredging system chosen and how the contractor intends to minimize the spread of suspended sediments • Dredging plan from the sediment plume analysis to be reflected in contractor's work method statements • During works, the contractor's EHSO will need to have appropriate experience in marine ecosystems or have ready access (by phone) to suitable expert for advice as required • Hydraulic excavators shall be in sound and well maintained condition and free of any leaks of any fluid. A pre-start inspection will be carried out on all machinery prior to the commencement of works at the start of each work period and records kept for monitoring purposes • All plant only operated by certificated and experienced operators	Contractor, CSC	Sediment plumes and localized water quality and coral health	ES and EHSO recruited and mobilized; CEMP with detailed work statements as required; Sediment control measures implemented (including silt curtains and sediment booms etc; Visual observation during works; Photos of plume movements; Logs and records of excavation works; Monitoring records and checklists	PMU, CSC

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• All excavation operations shall comply with relevant laws of Tuvalu and international conventions to which it is a signatory • Excavation operations will be monitored visually by the EHSO. Photographs of plume movement will be taken along with details of sea conditions, wind speed and direction for each work period and phase of the tidal cycle. If the EHSO, on advice from a suitable expert, considers the plume density or extent to be at a level that could be having a detrimental effect on coral on the reef slope then the CSC will be consulted so that dredging is adapted to an agreed means for reducing the plume density or extent. This may, for example, involve reducing dredging intensity • Excavation operations during incoming tides or strong westerly winds (which occur intermittently, mainly between April and September) will only be permitted if it can be demonstrated that plume movement does not result in deposition of material on the reef • A grinder/suction head should be used for the removal of smaller material and sand by way of pipes to the spoil disposal site that has already been defined. This would minimise the amount of finer sediments mobilised				
Movement of machinery (land to/from beach and foreshore)	Active rill and gully erosion from movement of machinery weakening fragile land Sediment laden runoff from landward-side eroding ramp and other solid structures	• Limit new area of clearing (i.e. locations and numbers of trees to be removed) along foreshore for pavement to what has been approved by Kaupule • Temporary retaining structures and sediment traps as require	Contractor	Soil conservation measures implemented; Any removal of vegetation within design parameters	As required during construction; Compliance with design parameters; Vegetation planted along foreshore	CSC, PMU
Solid waste generated at construction site(s) incl. laydown areas	Contamination of island or reef environment	• Remove all inorganic and solid waste from the island generated by project • Use waste concrete where appropriate for the construction of seawalls • No solid waste to be dumped in lagoons or water bodies • Burning of solid waste is not permitted • Compost all green and organic wastes to assist soil improvement for producing communal food crops or use as pig food	Contractor	Separate solid waste area in use which can be removed on completion of works; Compost area for green/organic waste	Weekly, visual	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Waste water and sewage	Contamination of groundwater	• All construction camps and temporary worker sites will have self-contained latrines • All grey water and septic tank material to be regularly pumped out from the septic tank and disposed of to an approved site or removed from island • Facility to be removed at the completion of the construction works unless required by the community and agreed with Kaupule	Contractor	Self-contained latrines on site or on barge; Disposal of grey water and septic tank material; Facility removed at completion of works	Once, visual As required, grey water and septic tank material disposed of safely Once, facility removed	CSC, PMU
Storage and handling of hydrocarbons; emergency or accidental spills of hydrocarbons	Potential hazard to the marine environment Pollution of groundwater	• Spill response plan to be included in the CEMP • A comprehensive site induction prepared by the contractor, with input from the Kaupule, will be required for all personnel involved with the project, with specific attention made to the sensitive atoll and reef environment • All personnel involved in the handling of dangerous goods should be trained and inducted in the handling, emergency procedures and storage requirements for different types of substances • Where fuel is stored on land, it will be in dedicated areas in sealed tanks placed within a concrete bund that has 110% of the capacity of the drums or storage • The storage area will be at least 50 m away from the marine environment and should be fully secured and locked when not in use • Smaller volumes of hazardous substances should be contained within a metal storage locker within the storage shed • Due to the porosity of the soil, lined pits to separate oil and water will be required near any workshop or maintenance shed to prevent leaching of hydrocarbons into the water table • Vehicles and machinery will be refuelled by authorized and trained personnel only in designated areas to reduce the likelihood of spillage in a sensitive environment • Drip trays will be used during refuelling or servicing to prevent spillages onto the ground or the reef • Re-fuelling is not permitted over water or in the reef environment. All refuelling must take place on land in a designated area	Contractor	Spill response plan is in place; Spill kit at works site with workers trained in its deployment; Storage facility complies with design requirements and monitored for spills and leaks; All hydrocarbon waste removed from island on completion; Refuelling practices	Once, visual Weekly, inspection records and spill register; Training records; Once, records and visual inspection	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• Development of procedures for cleaning up and reporting of accidental spills • Spill-kits will be made available for land and sea-based fuel facilities, workers trained in deployment of kits • Collection, disposal and removal of all waste oil, filters off the island • Limit the amount of any marine paint to be used on the jetty facility to no more than 2 litres at any one time contained within a larger volume drip tray to reduce the risk of any accidental spillage into the water				
CONSTRUCTION IMPACTS ON BIOLOGICAL ENVIRONMENT						
Site clearance for laydown area, transit shed and works area	Vegetation loss	• Clearly identify and mark on the trees and a site plan, with the assistance of the Kaupule, the exact location of any area to be cleared and what trees are to be retained prior to any cutting or removal. Ensure the site plan is provided to the contractor • Clearly identify alternate suitable beach access sites if the current one is not appropriate for the machinery. The alternate site will be preferably the one which causes the least damage to the shoreline • Minimize the clearance of vegetation within 20m of the shoreline • All contractor staff, especially machine operators, will be made aware of the location and what vegetation is permitted for removal by way of a comprehensive site visit which includes the Kaupule • Retain mature trees for amenity value, shade and protection of the soil resource where practicable.	Contractor CSC	Approved plan; Vegetation/trees cleared and retained	During site preparation and clearance activities	PMU, CSC
Dredging of reef material	Increase in sediment content of tidal waters in channel, reef platform and reef slope Fish and marine life affected by increased suspended	• Incorporate existing guidelines into contractor method statement	Contractor CSC	Water quality (sediment) and coral health; Method statement;	Once - method statement contains existing guidelines Daily - machinery is operating within	PMU, CSC

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
	sediment levels or sedimentation Potential source of pollution from dredging equipment or barge Potential for an outbreak of Ciguatera Damage to reef platform from machinery	• Dredging plan from the sediment plume analysis to be reflected in contractor's work method statements • Limit dredging to areas where the channel floor has already been disturbed and where sediments are coarse and loose • Limit machinery to defined narrow area on the reef platform • All machinery to be in sound condition and free from any leaks of lubricants and fuel • Carry out dredging on outgoing tides as far as practicable to reduce the development of a sediment plume in lagoon waters • Do not stockpile material on reef platform between tides • Remove material as it is excavated to reduce the growth of algae and incidence of Ciguatera • Daily records of site conditions kept during each work period including plume density and extent. If EHSO (in consultation with appropriate advisor with experience in dredge plume monitoring and impacts on marine ecosystems) considers plume density or extent to be at a level that could create detrimental effect on coral then the CSC will be consulted so that dredging is adapted to an agreed means for reducing the plume density or extent. • Advise community against fishing or harvest of marine life within 1 km of the channel and harbour area during dredging works and for at least 4 weeks after works have been completed • A register should be established to document any cases of Ciguatera brought to the attention of medical staff for a period six months before, during, or six months after construction • Any cases should be reported to the Project Manager and the TFD so that appropriate safeguards can be put in place. (e.g. fisheries notice to advise against consumption of herbivorous reef fish on the islet until further testing has occurred and/or sufficient time has passed post-construction, such that fish considered safe to eat)		Machinery operates in defined area; Machinery free from any leaks of oils, lubricants; Spoil removal from reef platform; Record sheets for daily conditions during construction; Plume density and extent; Community advice on fishing near working area; Ciguatera cases	defined area and during outgoing tides Visual inspection of machinery for leaks prior to going onto reef area Visual inspection of plume density and extent No stockpiles on reef platform, all material removed Weekly - confirm daily record sheet for weather and sea conditions Weekly for Ciguatera cases Once, notice in public view and Kaupule advised	

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Location of access tracks from land onto reef platform	Damage to organisms on the reef platform due to the movement of heavy machinery Damage to ground cover vegetation along foreshore Damage to protective function of tree roots	• Define a clear working zone where machinery will be permitted to operate • Minimise the width of the access track • Define one access track for machinery from foreshore area, preferably where vegetation is already lost	Contractor, CSC	Clear demarcation of machine operating zone on reef platform and beach access	Once Details on plan	PMU, CSC
Dredging and excavation works	Direct loss of habitat and sessile fauna	• To minimize impacts on the marine environment, the channel and basin would be dredged using one of two preferred methods: • The basin and part of the channel (closer to the shore) would be built in the dry season with the use of pumps and edge bunds; or • An excavator would be perched on top of a bund extending from the shoreline to the end of the channel. This bund would be constructed of materials sufficient to provide a barrier to water circulation. For example, this may consist of a core of the dredged material wrapped in impermeable geotextile material and external armoring. • Any vessels and workboats associated with the construction works should not anchor over areas of coral reef habitat to prevent anchor dragging and damage. Designated anchoring zones outside of mapped coral habitat should be established and marked with buoys • Post-construction monitoring be undertaken to ensure that impacts to coral reef habitat has not occurred beyond the footprint of the proposed dredge channel and ancillary structures • A coral transplantation plan be considered to offset small residual direct impacts of the project. There is potential to offset the residual coral habitat lost by transplanting coral in the footprint of the proposed harbor to the inner walls of the proposed channel, or another recipient site if one can be found	Contractor CSC TFD	Dredging method; Post-construction monitoring of coral reef; Coral transplantation	Detailed plans and method statements; CEMP; Monitoring reports; Coral transplantation plan	PMU, CSC TFD

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Works in channels and harbour mobilizing sediment	Temporary effects on water quality	• Geotechnical testing and standard erosion and sediment controls for land based construction to be implemented as part of the EMP • Should specific contaminants be detected management plans may be required • Controls to dredging would include silt curtains and bunding • Water quality monitoring of turbidity with triggers for adaptive and contingency dredge management procedures • Best-practice vessel management and site management should be adopted to minimize the risk of contaminant spillage. Work vessels should provide sufficient spill response materials. All work vessels should be inspected to ensure fuels and equipment are appropriately stored and work surfaces kept clean of waste and litter	Contractor CSC	Dredging method; Sediment plumes;	Detailed plans and method statements; CEMP; Sediment/silt control measures implemented; Visual inspection of plume density and extent No stockpiles on reef platform, all material removed Weekly - confirm daily record sheet for weather and sea conditions	PMU, CSC
Vessel traffic	Potential for collision with or disturbance to marine fauna	• Minimize potential boat strike and noise related impacts by establishing 'go slow' zones around the harbor construction site • Educate skippers of construction barges and work boats as to how best avoid boat strikes, what to do during vessel interactions with marine fauna and reporting of boat strikes or fauna interactions • Vessel masters should be competent in protected marine species interaction procedures	Contractor TFD	Boat strikes; Training/ awareness delivered;	Prior to and during dredging activities; During vessel voyage to/from Niutao; Records and logs; Incident register	PMU, CSC, TFD
Dredging, excavation works and construction activities in marine environment	Underwater noise affecting marine fauna	• Ensuring that all equipment is maintained in good operating condition and has proper sound control systems in place • Application of sound minimization tools, where appropriate and practical. This may include for example mufflers, propeller shrouds; and tuned propellers and drive shafts • Sound-generating equipment should be switched off when not in use	Contractor	Condition of equipment and plant; Noise minimization	Prior to and during activities; During vessel voyage to/from Niutao; Records and logs;	PMU, CSC, TFD

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Works (incl. dredging) disturbing reef	Disturbances promote algae growth and potential Ciguatera outbreak	• It is recommended that a risk assessment be undertaken to determine whether there is a need to incorporate testing for harmful dinoflagellates in fish tissues as part of CEMP. This should be carried out in consultation with TFD • A register should be established to document any cases of Ciguatera brought to the attention of medical staff for a period six months before, during, or 6 months after construction • Any cases should be reported to the Project Manager and the TFD so that appropriate safeguards can be put in place. This could include (for example) a TFD notice to advise against consumption of herbivorous reef fish on the islet until further testing has occurred and/or sufficient time has passed post-construction and such fish are considered safe to eat • Removing spoil from the excavated site to an approved location on the land to reduce the surface area of loose reef deposits on which the algae can colonize.	CSC, Contractor, TFD	Algal blooms; Risk assessment completed	Register of outbreaks; TFD monitoring reports	CSC, PMU, TFD
Vessels and import of plant, equipment and materials	Introduction of invasive and/or alien species and pathogens	• All machinery and equipment be steam cleaned to remove any soil or organic matter and a phytosanitary certificate issued by the authorities in the country of origin prior to shipment to the project site • Appropriate phytosanitary documentation must be issued for all imported aggregate shipments into Tuvalu to confirm they are clean of organic material and soil and pests • Standard practice procedures for ballast water management should be observed by vessel operators and individual vessels should be assessed to determine that the vessel presents a low risk of introducing marine pests to the area • Ballast waters must be discharged no closer than 5km from the shoreline with confirmation provided by the captain by way of log book • All materials and equipment to be imported for the project must be cleared, and the contractor must have obtained the appropriate license or certificate for imported material and/or equipment.	Contractor	Pathogen-free status of equipment and machinery	Visual, once for each shipment Phyto-sanitary certificate issued	PMU, CSC

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
CONSTRUCTION IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT						
Operation of construction plant and equipment creating noise, vibrations and light	Noise in community Impacts on construction workers	• Construction vehicle exhaust systems and noisy equipment will be maintained to minimise noise • Application of sound minimization tools, where appropriate and practical • Sound generating of equipment should be switched off when not in use • Contractor will develop a work schedule of operations with Kaupule to identify hours and days of no work due to religious and cultural activities • Mostly limit construction activities to day time hours, i.e. construction activities will mostly occur between 6pm and 6am. Where construction is occasionally proposed at night, Contractor will develop a work schedule of operations with Kaupule. Where night constructions occurs, lighting should be kept to a minimum and directed inward to minimise impact on marine animals (e.g. turtles and birds) • Provide all workers with appropriate protection equipment (ear-muffs etc.)	Contractor	Vehicles have appropriate and functional exhaust systems Construction work carried out within specified times Workers using appropriate PPE during noisy operations	As required Daily, visual	CSC, PMU
Use of potable water	Lack of sufficient on-island supplies of potable water for construction camp and the number of workers	• Construction camp to provide sufficient quantities of potable water supply • Separate rain tanks required for camp • Manage water use during periods of dry weather • Do not use potable water for dust suppression	Contractor	Separate potable water tanks in place at camps	Once, visual	CSC, PMU
Construction camp, laydown area, workshop location and operation, land clearance for transit shed	Potential for disturbance within or near community facilities e.g church, meeting places, from construction workers and workshop activities Damage or disturbance to the known graves sites near the site of the land based facilities	• Confirm with Kaupule and community the location of any construction camp and workshop facilities • Addressed in CEMP prepared by contractor and cleared by supervision consultant • Ensure no potential environmental impacts as a result of location and operation of camp • Identify any areas of cultural and spiritual significance e.g. graves. Relocate as required, with the appropriate ceremony according to local protocols • Use of existing village accommodation facilities	Contractor CSC	CEMP; Confirmation of location of laydown and camp options, potential environmental impacts Clear identification of all graves sites in the vicinity of the works prior to start of works	Once Area clearly marked on ground Written agreement with Kaupule CEMP - ongoing	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• Use separate self-contained accommodation barge • Select sites where vegetation has already been modified or cleared previously				
Presence of construction workers in communities (influx of labor)	Transmission of highly contagious diseases incl. HIV; Social disruption and/or conflict	• Site induction conducted for all construction personnel at start of construction with the input from Kaupule including STD and HIV/AIDS awareness and prevention training • Implementation of the project's CCP • Ensure that community and stakeholders are aware of the GRM and how to access GRM; • Appointing a GFP from the Kaupule • CSC and Kaupule to facilitate agreement of protocols--code of social conduct-- between the contractor and community leaders. The protocols will govern workers' conduct while at work and in communities, behavior around women and children, restrictions on alcohol consumption, prohibitions (with sanctions for non-compliance) on workers hunting or fishing, implementation of awareness programs, implementation of the GRM and handling of complaints, hiring of local labor, and implementation of the HSP • The contractor will engage/recruit an approved service provider to deliver the HIV/AIDS/STI awareness and prevention program to workers and community • Workers' access to portable toilets and associated sanitation facilities will be provided at the site (through agreement to use on-land toilets or sufficient ablution facilities on barge) • Following the CCP, the contractor will distribute information (through meetings or pamphlets) regarding the scope and schedule of construction, as well as certain construction activities causing disturbance or nuisance • For unskilled activities and labor, every effort to hire local people (including women) for these positions should be a priority • Child and/or trafficked labor will be strictly prohibited for any activities associated with the project	Contractor, Approved service provider	Site induction completed; Local employment; Knowledge on STIs etc; Complaints and grievances; Public notices/ information	CCP implemented; Code of conduct agreed; Approved HSP; Approved service provider engaged and mobilized; GFP appointed; Items in bill of quantities; Register of training/ participants maintained; Register of locals employed; GRM; Monitoring checklists	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• Accidental damage to utilities will be minimized by (i) obtaining plans from the public utilities identifying locations of pipelines, conduits and power cables and (ii) consultation with staff on the location of utilities prior to commencing excavation operations • Availability of screening for all workers on a voluntary and confidential basis • An HIV/AIDS and STI awareness and prevention campaign included in bill of quantities and delivered by approved service provider • Ongoing training and workshops presented to the community at regular intervals • Availability of condoms, at no cost, to all on-site staff.				
Construction activities	Hazards and risk to construction workers from construction activities	• Prepare and implement the HSP which will include the measures to demonstrate compliance with the World Bank Group's EHSG • Define responsibilities and authorities within the contractor's staff for adhering to OHS requirements • Provide appropriate PPE for all workers • Define appropriate emergency and medical evacuation procedures • Undertake daily hazard identification checklists, risk assessments and toolbox sessions • Prepare appropriate work method statements for each construction activity and ensure all personnel understand the task before commencing work for the day • Clearly define procedures for handling construction materials, conducting tests, operating heavy equipment in a remote marine environment • Provide for installation of lights and cautionary signs in hazardous areas • Ensure operators of vehicles and equipment are properly licensed and trained • Provide information on emergency assistance procedures on community notice boards and location of first aid kits and other emergency equipment	Contractor	First aid stations fully stocked HSP and CEMP Use of PPE	Weekly, First Aid station contents checked, records kept, items replaced; Approved HSP; Daily, PPE is worn as appropriate; Accident/ incident register; Records of toolbox sessions etc	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• Ensure safety and inspection procedures, setting schedules for regular checking • Set procedures for safe handling of toxic materials and other hazardous substances				
Construction activities	Health and safety risks to the community from construction activities and movement of heavy machinery within or near the village	• The contractor's HSP will address community impacts and management measures in addition to worker health and safety • The HSP will include agreement on consultation requirements, establishment and monitoring of acceptable practices to protect community safety, links to the complaints management system for duration of the works (in accordance with the GRM) and system for reporting of accidents and incidents. The PMU will ensure these actions are enforced • The contractor will coordinate directly with the GFP appointed from the Kaupule for the project • Before construction commences the contractor/s will conduct training for all workers on environmental safety, environmental hygiene including delivery of the HIV/AIDS/STIs awareness and prevention training and the code of conduct • The contractor, following the requirements of the project's CCP, will inform the community of the works (likely impacts and control and mitigation measures), including the timeframe through information brochures and/or community meetings • Tuvalu minimum wage requirements to be observed, if local staff are required. Proper enforcement of the labor laws in the work place • Child and/or trafficked labor will be strictly prohibited for any activities associated with the project • Children will be prohibited from entering the sites (including worker's accommodation, works area/construction zone) and prohibited from playing on any equipment or machinery • All advisory and warning signage will be clear, secured on fences, gates and signboards and be posted in Tuvaluan, the language of the main nationality of workers and repeated in English	Contractor	Driver safety awareness program conducted Public not in active construction zone, barriers in place, hazardous areas marked; No children in work area or on equipment etc	Approved HSP; Once, program delivered Daily, visual during construction	CSC, PMU

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
		• The contractor will clearly fence off and post warning signs at the site to prevent the public from entering during the construction period.				
Encroachment into historical / cultural sites	Effects on cultural values	• Identify all historical and cultural sites prior to construction • Advise community of the nature of the works in vicinity of cultural sites • Ensure due care is taken in any construction activity adjacent to churches and other sites of cultural importance • Chance finds procedures included in CEMP	Contractor CSC	Any sites identified prior to works; Chance finds procedures in CEMP	Once, in conjunction with Kaupule; As required during activities	CSC, PMU
Demobilization	Residual construction material remaining on island; Camp and laydown footprint subject to erosion or degradation	• All residual material to be removed from island unless specifically requested by the Kaupule • Site rehabilitation works of camp and laydown to include scarifying soil and spreading vegetative material to assist with natural regeneration processes unless the area is required for community use • Replant coconut and other site-specific trees as required and as agreed with Kaupule and/or tree-owners	Contractor	Construction material removed from site; Site rehabilitation and planting of site has been completed	Once, visual	CSC, PMU
OPERATION PHASE						
Erosion due to coastal processes exacerbated by cyclonic storms	Undercutting of the concrete structures, abutments and piles Damage to railings, steps, lighting	• Initiate and implement a periodic maintenance schedule • Carry out facility inspections after each cyclonic storm event • Timely repairs to any erosion around wharf and jetty or damage to ancillary fixtures • Removal and disposal of built-up sand, if required	MCT	Periodic maintenance schedule Repairs carried out in timely manner	Maintenance schedule in place and operational Once, Repairs completed Once after each event, sand removed	MCT / Kaupule
Loading and unloading of cargo and passengers at the jetty facility	General and domestic waste deposited into reef environment Spillage of hydrocarbons from ruptured drums Damage to railings, steps, lighting during loading and unloading	• Provide signs and raise awareness of impacts of general waste on reef environment • Provision of rubbish bins on land side of jetty • Kaupule to arrange regular clean-up of general waste around jetty facility and from the water • Ensure proper handling procedures for drums of hydrocarbons from boat to shore are followed • Clean up and safe disposal of any spillage on land	MCT / community	Signs in place Jetty facility and harbour is clear or general and domestic waste Infrastructure is operational	Once, visual Monthly, site is clear of general waste, lights railings etc are functional and in good condition	Kaupule / community

Project activity	Potential impact	Management and Mitigation		Monitoring		
		Proposed measures	Institutional responsibility	Parameters	Frequency & verification	Institutional responsibility
Increased vessel traffic and use of facilities	Fish and marine life affected by increased noise and light Potential for vessel strike to marine mammals and turtles	• Appropriate vessel speeds and controls should be established for vessels operating within the boat harbour approach, channel and basin. This may include permanent signage and establishment of ongoing procedures and mechanisms for reporting of any vessel interactions • External lighting on the new infrastructure should be kept to a minimum and directed inward to minimise impact on marine animals (e.g. turtles and birds)	MCT	Compliance with vessel speed limits Incidences of vessel strike to marine mammals and turtles Light fittings are not in accordance with design specifications	Anecdotal reports of vessel strikes Once for verification that lighting meets design specifications	Kaupule / community (vessel strikes) MCT (lighting)
Presence of seawalls and new marine infrastructure	Potential to reflect waves and thereby increase wave heights in the nearby areas of living reef crest or slope	• Design of seawalls to minimise, as practically as possible, potential for reflected waves or reduced water movement to coral on reef slope	PMU	Coral on reef slope	Once for coral, one year after construction finishes	PMU

Key: BCD = bid and contract documentation; CEMP = construction environmental management plan; CSC = construction supervision consultant; DOE = Department of Environment; DDR – due diligence report; EHSG = Environmental, Health and Safety Guidelines; ES = environmental specialist; FS&DDC = feasibility study and detailed design consultant; HSP = health and safety plan; IEE = initial environmental examination; MCT = Ministry of Transport and Communications; OHS = occupational health and safety; PEAR = Preliminary Environmental Assessment report; PMU = project management unit; PPE =- personal protective equipment; TFD = Tuvalu Fisheries Department

VIII. CONCLUSIONS

272. Results of the marine ecology assessment indicate that in general, the reef flat, crest and slope habitats and foreshores within the project footprint of the small work boat harbor at Niutao are not unique to the island and that similar habitats (and associated biota) are well-represented, and extensive, elsewhere in Tuvalu. Species of coral listed as threatened on the IUCN red list do have potential to occur within a small part of the seaward parts of the proposed dredge footprint, and hence have potential to be removed due to the construction works but given these species would be likely to occur elsewhere on the island and very few individuals, if any, would be removed, the project would not result in a net reduction in biodiversity. In addition to the direct removal of some habitat (8,295m^3) there is potential for local changes to hydrodynamics and an increase in reflected waves at the reef crest and reef slope. This can be mitigated if the break wall is designed, as practically as possible, to minimize alterations to hydrodynamics and wave climate in nearby environments. Other threatened and protected species are likely to occasionally forage in or pass through the vicinity of the proposed harbor (turtles, sharks and rays), however, being highly mobile, these species would not be significantly affected by construction or operation of the harbor/jetty. Hence, the project would amount to only a temporary inconvenience to species. Habitats directly impacted by the construction of the proposed boat harbor are not considered to be critical to the lifecycle or survival of populations of any threatened species.

273. The potential negative impacts can be managed by carefully addressing the physical shape and layout of any permanent structures on the reef surface at the project site based on modelling of wave height and other parameters. The final design of these structures has yet to be confirmed at the time of the preparation of this IEE report and the EMP may need to be updated to reflect any change in the conceptual designs provided.

274. Provided the mitigation measures outlined in the EMP are incorporated into the bidding and contract documents and appropriately implemented, then the project would not be expected to have any widespread, irreversible or significant or long-term impacts on the marine environment. As such, it is considered that a category ‘B’ level of assessment as per the ADB’s SPS is appropriate to the scale and nature of the project. The IEE (including the EMP) will be updated as required and formatted as per Tuvalu legislation.

ANNEX 1: FISH SPECIES RECORDED DURING SURVEYS OF NIUTAO (OCTOBER 2016) VIZ FISH SPECIES KNOWN IN TUVALU WATERS

Family	Common Name	Scientific Name	Common Name	Niutao
Acanthuridae	Surgeonfish	*Ctenochatus striatus*	Lined bristletooth	X
Acanthuridae	Surgeonfish	*Acanthurus nigricans*	Velvet surgeonfish	X
Acanthuridae	Surgeonfish	*Acanthurus achilles*	Achilles surgeonfish	X
Acanthuridae	Surgeonfish	*Zebrasoma scopas*	Brown tang	
Acanthuridae	Surgeonfish	*Acanthurus guttatus*	Whitespotted surgeonfish	X
Acanthuridae	Surgeonfish	*Acanthurus bariene*	Bariene surgeonfish	
Acanthuridae	Surgeonfish	*Acanthurus pyroferus*	Mimic surgeonfish	
Acanthuridae	Surgeonfish	*Naso unicornis*	Bluespine unicornfish	
Acanthuridae	Surgeonfish	*Acanthurus olivaceus*	Orangeband surgeonfish	X
Acanthuridae	Surgeonfish	*Acanthurus nigrofuscus**	Brown surgeonfish*	
Acanthuridae	Surgeonfish	*Acanthurus lineatus*	Bluelined surgeonfish	X
Acanthuridae	Surgeonfish	*Naso lituratus*	Clown unicornfish	X
Acanthuridae	Surgeonfish	*Acanthurus triostegus*	Convict surgeonfish	X
Acanthuridae	Surgeonfish	*Ctenochaetus tominiensis**	Orangetip bristletooth*	
Balistide	Triggerfish	*Rhinecanthus rectangulus*	Wedgetailed triggerfish	X
Balistide	Triggerfish	*Melichthys vidua*	Pinktail triggerfish	X
Balistide	Triggerfish	*Pseudobalistes flavimarginatus*	Yellowmargin triggerfish	
Balistide	Triggerfish	*Melichthys niger*	Black triggerfish	X
Balistide	Triggerfish	*Sufflamen bursa*	Pallid triggerfish	X
Balistide	Triggerfish	*Odonus niger*	Redtooth triggerfish	X
Balistide	Triggerfish	*Sufflamen chrysopterum**	Eyestripe triggerfish*	
Carangidae	Trevallies	*Caranx melampygus*	Bluefin trevally	X
Carcharhinidae	Whalers	*Triaenodon obesus*	Whitetip reef shark	
Chaetodontidae	Butterflyfish	*Chaetodon auriga*	Threadfin butterflyfish	
Chaetodontidae	Butterflyfish	*Chaetodon vagabundus*	Vagabond butterflyfish	
Chaetodontidae	Butterflyfish	*Cheatodon ephippium*	Saddle butterflyfish	
Chaetodontidae	Butterflyfish	*Cheatodon quadrimaculatus*	Fourspot butterflyfish	X
Chaetodontidae	Butterflyfish	*Chaetodon lunula*	Racoon butterflyfish	X
Chaetodontidae	Butterflyfish	*Chaetodon falcula*	Blackwedged butterflyfish	
Chaetodontidae	Butterflyfish	*Chaetodon citrinellus*	Citron butterflyfish	
Chaetodontidae	Butterflyfish	*Heniochus chrysostomus*	Pennant bannerfish	
Chaetodontidae	Butterflyfish	*Chaetodon reticulatus*	Reticulated butterflyfish	X
Chaetodontidae	Butterflyfish	*Forcipiger* sp.		X
Cirrhitidae	Hawkfishes	*Paracirrhites hemistictus*	Ornate hawkfish	X
Cirrhitidae	Hawkfishes	*Paracirrhites arcatus*	Arceye hawkfish	X
Diodontidae	Porcupinefish	*Diodon hystrix*	Spotted porcupinefish	
Kyphosidae	Sea chubs	*Kyphosus cinerascens*	Blue sea chub	

Family	Common Name	Scientific Name	Common Name	Niutao
Labridae	Wrasse	*Gomphosus varius*	Birdnose wrasse (male)	
Labridae	Wrasse	*Gomphosus varius*	Birdnose wrasse (female)	
Labridae	Wrasse	*Halichoeres hortulanus*	Checkerboard wrasse	X
Labridae	Wrasse	*Thalassoma quinquevittatum*	Fivestripe wrasse	X
Labridae	Wrasse	*Thalassoma amblycephalum*	Bluehead wrasse (female)	X
Labridae	Wrasse	*Thalassoma amblycephalum*	Bluehead wrasse (male)	X
Labridae	Wrasse	*Labriodes dimidiatus*	Common cleanerfish	
Labridae	Wrasse	*Labroides bicolor*	Bicolor cleanerfish	
Labridae	Wrasse	*Diproctacanthus xanthurus**	Yellowtail wrasse*	X
Labridae	Wrasse	*Pseudocoris yamashiroi**	Japanese wrasse*	X
Lutjanidae	Snapper	*Lutjanus gibbus*	Humpback red snapper	
Lutjanidae	Snapper	*Lutjanus argentimaculatus**	Mangrove red snapper*	
Mullidae	Goatfish	*Parupeneus crassilabris*	Doublebar goatfish	
Muranidae	Moray Eel	*Gymnothorax pictus*	Peppered moray	
Pomacanthidae	Angelfish	*Centropyge flavissima*	Lemonpeel angelfish	X
Pomacanthidae	Angelfish	*Pygoplites diacanthus*	Regal anglefish	
Pomacanthidae	Angelfish	*Holacanthus tricolor*	Rock beauty (juvenile)	
Pomacenridae	Damselfish	*Chrysiptera brownnriggii*	Surge damselfish	X
Pomacenridae	Damselfish	*Chromis margaritifer*	Bicolor damselfish	X
Pomacentridae	Damselfish	*Neoglyphidodon melas*	Black damsel	X
Pomacentridae	Damselfish	*Plectroglyphidon dickii*	Dick's damsel	X
Pomacentridae	Damselfish	*Chromis analis*	Yellow puller	
Pomacentridae	Damselfish	*Plectroglyphidodon leucozonus*	White-band damsel	X
Pomacentridae	Damselfish	*Plectroglyphidodon lacrymatus*	Jewel damselfish	
Pomacentridae	Damselfish	*Chromis acares*	Midget chromis	X
Pomacentridae	Damselfish	*Abudefduf sordidus*	Blackspot sergent	X
Pomacentridae	Damselfish	*Chrysiptera biocellata**	Twinspot damsel*	X
Pomacentridae	Damselfish	*Plectroglyphidodon phoenixensis**	Phoenix damsel*	X
Pomecentridae	Damselfish	*Neopomacentrus violascens**	Violet damselfish*	
Scaridae	Parrotfish	*Chlorurus microrhinos*	Steephead parrotfish	
Scaridae	Parrotfish	*Scarus sordidus*	Bullethead parrotfish	
Scaridae	Parrotfish	*Scarus rubroviolaceus**	Blackvain parrotfish*	X
Serranidae	Rockcod	*Cephalopholis argus*	Peacock rockod	
Serranidae	Rockcod	*Cephalopholis urodeta*	Flagtail rockcod	
Serranidae	Rockcod	*Epinephelus hexagonatus*	Starspotted grouper	
Serranidae	Rockcod	*Cephalopholis cyanostigma*	Bluespotted rockcod	
Serranidae*	Rockcod*	*Epinephelus ergastularius**	Banded rockcod*	
Zanclidae	Zanclidae	*Zanclus cornutus*	Moorish idol	