Initial Environmental Examination

July 2016

Tuvalu: Outer Island Maritime Infrastructure Project

Prepared by the Ministry of Communication and Transport for the Asian Development Bank.

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	affected persons
DOE	–	Department of Environment
EA	–	executing agency
EIA	–	environmental impact assessment
EMP	–	environmental management plan
GPS	–	global positioning system
GRM	–	grievance redress mechanism
HIV/AIDS	–	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IA	–	implementing agency
IEE	–	initial environmental examination
IUCN	–	International Union for Conservation of Nature
MCT	–	Ministry of Communication and Transport
NEMS	–	National Environmental Strategy
PDA	–	project design advance
PEAR	–	preliminary environmental assessment report
PIU	–	project implementation unit
PMU	–	project management unit
PPTA	–	project preparatory technical assistance
PSC	–	project supervision consultant
SPREP	–	South Pacific Regional Environmental Program
SPS	–	Safeguard Policy Statement (ADB)

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EXECUTIVE SUMMARY

1. **The project**. The Tuvalu Outer Island Maritime Infrastructure Project (the project) will rehabilitate and improve maritime infrastructure on the island of Nukulaelae, Nanumaga and Niutao in Tuvalu which was damaged by Tropical Cyclone Pam in March 2015, and improve safety, efficiency and sustainability of maritime transportation between Funafuti, the capital.

2. The small workboat harbour project will involve the design and construction of a new channel and turning bay for the workboats located south of the current site which has proved to be an unsatisfactory approach for passengers and cargo. At present it passes through an existing channel through the outer reef and then uses a natural channel through the reef platform where the current is fast especially at low tide to the beach at the village. 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.

3. There are no docking facilities on Nukulaelae, Nanumaga or 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.

4. **Institutional responsibilities**. The Ministry of Communications and Transport (MCT) is the Executing Agency (EA) for this project. The Director of Marine and Port Service was appointed as Project Director. The Project Management Unit (PMU) reports to MCT.

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 initial environmental examination (IEE) has been prepared.

6. **Nukulaelae**. There is no critical habitat directly affected by this project. The turtle nesting beaches are located on sandy beaches on other islets within the lagoon away from the island where the village is situated. The Nukulaelae Conservation Area covers the eastern end of the lagoon where there are known turtle nesting areas. This is some 4 to 8 km from the proposed channel and wharf site.

7. The main potential negative environmental impacts relate to the construction phase and the dredging and excavation of a new channel through the reef platform at Nukulaelae 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.

8. **Nanumaga and Niutao**. There is no critical habitat directly affected by this project on these two islands. There is not anticipated to be any significant environmental impact associated with the preparation and installation of the flexmat ramp from the existing channel to the land at either site.

9. 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 project support and master planning consultant (PSMPC), who will support the PMU and acts for and on behalf of MCT.

10. Based on the surveys and detailed design to be undertaken during the project design advance (PDA) stage, the IEE (including the EMP) will be updated with additional information and existing information gaps will be filled at this time. The updated IEE will be 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 updated 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 PSMPC 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.

11. **Consultation, participation and disclosure**. A three day workshop was conducted in Funafuti from 15 – 18 April 2016 with representatives from all project island groups in attendance and included the ADB Project Officer and the Environmental Safeguards Officer. 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.

12. The community representatives from Nanumaga and Niutao, which included women and youth groups, did not express support for the project as proposed and there was general consensus that the small workboat harbour option would not fit their respective Island Development Plans or the aspirations of the community. The general consensus was that a big harbour concept capable of taking large boats such as the *Nivaga III* or the LCT barge, which would improve passenger safety and reduce cargo handling and damage, was the preferred option. As a consequence, a revised scope of works was drawn up which limited the works to the construction of a flexmat boat ramp at the existing channel location.

13. A workshop was held at Nukulaelae on 24-25 April 2016 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.

14. The community representatives, which included women and youth groups, expressed support for the project as proposed. While the women's group representative expressed their aspiration for a large boat harbour capable of taking large boats such as the *Nivaga III* or the LCT barge to improve passenger safety and reduce cargo handling and damage, there was general agreement that a smaller workboat harbour in a new location that can be expanded to a larger harbour at a future date would be acceptable as part of a phased approach to the improvement of ship to shore access.

15. **Grievance redress mechanism**. A grievance redress mechanism (GRM) has been established for the Project, based on acceptable methods of conflict resolution in Tuvalu. 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.

16. 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.

17. **Monitoring and reporting**. During the period of project design, monitoring will ensure 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. When construction commences, a key aspect of environmental monitoring is to ensure mitigations 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.

18. 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 EA and ADB, and semi-annual safeguards monitoring reports prepared by the PMU and CSC and submitted to the EA and ADSB. ADB will disclose the monitoring reports.

19. **Conclusion**. This IEE has identified as far as practicable the potential environmental impacts associated with the design, construction and operation of the small workboat harbour at one site and improvement of existing facilities at two other islands and identifies the measures required to mitigate or minimise the impacts. The impacts and required measures to mitigate them are summarised in the EMP which will be updated based on further information to be provided during the PDA. Overall, impacts are considered to be 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 and implemented by the contractor. The contractor's implementation of the CEMP will be monitored and reported.

1. INTRODUCTION

1. The Tuvalu Outer Island Maritime Infrastructure Project (the project) will rehabilitate and improve maritime infrastructure on the islands of Nukulaelae, Nanumaga and Niutao in Tuvalu, which were damaged by Tropical Cyclone Pam in March 2015, and improve safety, efficiency and sustainability of maritime transportation between Funafuti, the capital. The project will also help Tuvalu overcome connectivity problems that constrain its economic and social development.

2. The small workboat harbour proposed for Nukulaelae will involve the design and construction of a new channel and turning bay for the workboats located south of the current site, the construction of breakwaters involve the use of 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. Existing facilities at Nanumaga and Niutao will be improved. The project outcome will result in improved transfer operations of goods and passengers

3. The project will also provide technical and advisory support to increase the capacity of the Department of Marine and Port Services, part of the Ministry of Communication and Transport (MCT), to operate and maintain the rehabilitated facilities.

4. This document provides an initial environmental examination (IEE) of the components of the project at the three selected locations that have been subject to feasibility study during the Project Preparatory Technical Assistance (PPTA) for the project. The IEE has been prepared with the Ministry of Communications and Transport (MCT) following the requirements of the Environmental Protection Act of Tuvalu and Safeguard Policy Statement 2009 (SPS) of the Asian Development Bank (ADB). Based on the surveys and detailed design to be undertaken during the project design advance (PDA) stage, the IEE will be updated with additional information and existing information gaps will be filled at this time.

1.1 Objectives and Scope of the IEE

5. 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:

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

6. 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. The IEE is based on primary sources of information

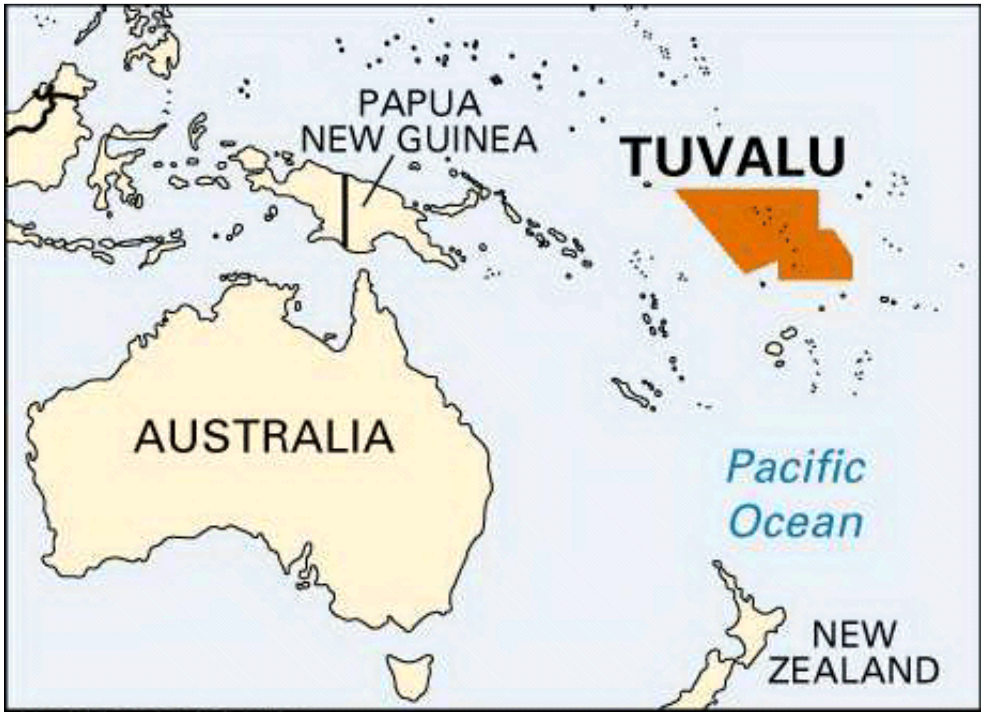
derived through field studies and consultations during site visits and secondary sources of information available in relevant reports.

2. DESCRIPTION OF THE PROJECT

2.1 Project Rationale

7. Tuvalu is a Polynesian country located in the west Pacific, situated 4,000 kilometres northeast of Australia and south of the Micronesian country of Kiribati, as shown in Figure 2.1. Tuvalu is a small country with a total land area of 26 square kilometres (km^2) comprising nine islands within an oceanic area of 900,000 km^2. It has a small and dispersed population of 10,640 (2012 Census). Funafuti, the national capital, has the largest population, with 5436 people. The population on Nukulaelae, Nanumaga and Niutao is very small with only 364, 551 and 694 people respectively. A key factor is the level of depopulation from the outer islands over the 10 year inter-census period as people seek 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 Nukulaelae and the other islands.

Figure 2.1: Map showing location of Tuvalu



8. 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. Nukulaelae, Nanumaga and Niutao have no docking facilities even for the workboats, and passengers have to transfer to and from the workboats directly from the beach.

9. 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.

2.2 The Proposed Project

10. The proposed project will rehabilitate and improve maritime infrastructure in Nukulaelae, Nanumaga and Niutao and improve safety, efficiency, and sustainability of maritime transportation between Funafuti (the capital) the island. The outputs will be (i) improved and rehabilitated maritime infrastructure in the outer islands, and (ii) improved capacity of the outer island communities and the Department of Marine and Port Services of the MCT to operate and maintain facilities.

11. The preparatory and feasibility stage of the project involves:

- Analysis of the current conditions in the transport sector to ensure complementarity and synergy of overall investments in Tuvalu.
- A feasibility study and basic design for proposed facilities of the project including least-cost analyses of alternative options for both the construction and post-construction phase and economic analysis to meet ADB requirements.
- Stakeholder consultation to build consensus amongst the government and relevant stakeholders, including ADB, on the proposed investment plan.
- Identification of project environmental and land acquisition impacts and due diligence to ensure the project complies with government and ADB safeguards requirements.
- An assessment of the capacity of the government to plan and manage project delivery and subsequent maintenance.
- Development of a project procurement strategy.

12. The IEE will be updated during the PDA when the geotechnical, topographical and hydro-geographic surveys and detailed design are being undertaken.

13. **Implementation arrangements**. The MCT is the executing agency for this project. The Director of Marine and Port Services was appointed as Project Director. The Project Management Unit (PMU) reports to MCT and is the implementing agency. The PMU will be supported by a project support and master planning consultant (PSMPC) which will include an environmental specialist to ensure that during implementation the project will comply with requisite environmental safeguards.

14. **Scope of the project**. The project scope includes:

(i) construction of a workboat harbour in Nukulaelae with new channel dredging (Figure 2.2);

(ii) construction of a transit shed, and a truck with crane (GEF financing) in Nukulaelae;

(iii) construction of boat ramps in Nanumaga and Niutao (Figures 2.3 and 2.4); and

(iv) master planning for the transport and fishery sectors including feasibility studies for relocating Nanumaga and Niutao harbour sites and other harbour development options.

Figure 2.2: Proposed Workboat Harbour - Nukulaelae

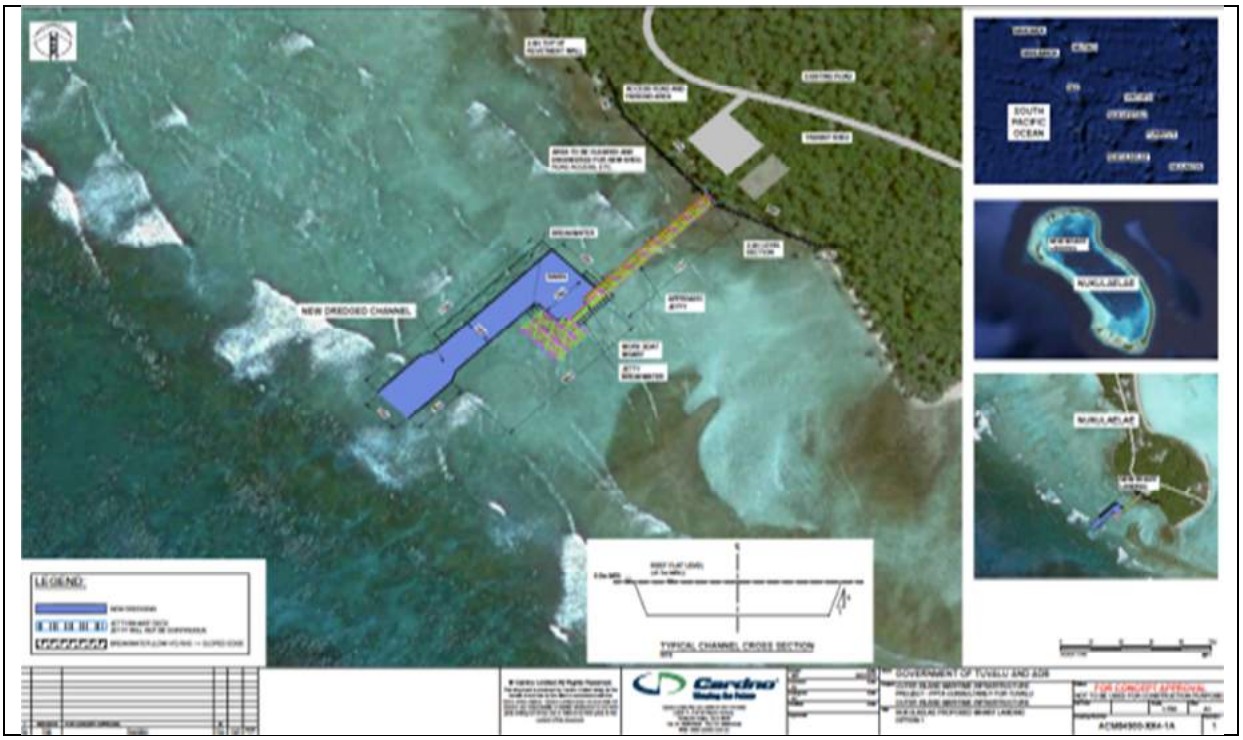


Figure 2.3: Boat Ramp - Nanumaga

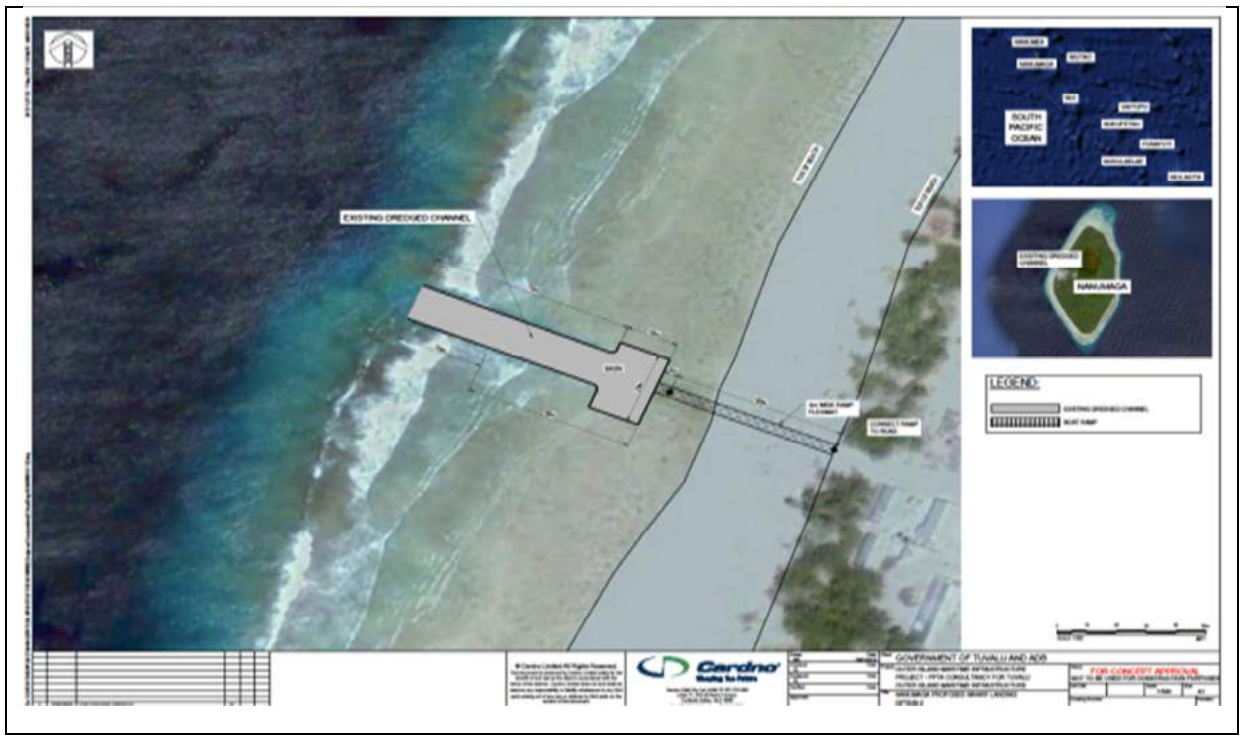


Figure 2.4: Boat Ramp – Niutao

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Legal and Policy Framework of Tuvalu

15. **Policy framework.** Government policy on environmental protection is expressed in the National Environmental Management Strategy (NEMS)[1] 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 urbanisation, 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.

16. **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.

17. The Department of Environment (DOE) is responsible for the administration and enforcement of the Environmental Protection Act 2008 and the Environment Protection (Environment Impact Assessment) Regulation 2012. The DOE sits within the Ministry of Foreign Affairs and Trade. Prior to 2011, it was part of the Ministry of Natural Resources. The DOE has the responsibility under the legislation for reviewing, assessing and monitoring of projects.

18. 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.

19. 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. If DOE has confirmed the project will not cause any significant adverse impact to the environment and it 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.

20. However, 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 where the PEAR indicates the project will result in the occurrence, or increase the chances of occurrence, of natural hazards such as soil erosion, flooding, tidal or sea wave inundation or result in, or increase pollution or have features, the

[1] SPREP. 1997. Tuvalu: National Environmental Management Strategy (Funafuti, Tuvalu)

environmental effects and potential impacts of which are uncertain and that warrant further investigation. In addition to the requirements stated in regulation 12.

21. The EIA shall be accompanied by a schedule outlining a programme of baseline and compliance monitoring, including frequency and method, which must be appropriate to the scale of the proposed activity.

22. 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.

23. 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.

24. The 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.

25. **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 the purpose of 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.

26. 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; to conserve the living and non-living natural resources of the island communities and to provide for their sustainable utilization by present and future generations; to preserve the biological diversity of the conservation area, especially those species which are endemic, threatened, or of special concern and the coastal and marine habitats upon which the survival of these species depend.

27. 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 a number of 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.

28. 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.

3.2 Environmental conventions, treaties and other instruments

29. Tuvalu has ratified numerous environment-related international and regional commitments, and remains in general compliance with the spirit of such commitments (Table 3.1).[2]

Table 3.1: 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
1993	United Nations Chemical Weapons Convention
1994	United Nations Convention to Combat Desertification
1995	Ban the Importation into Forum Island Countries of Hazardous and Radioactive Waste and to Control the Transboundary Movement and Management of Hazardous Waste within the South Pacific Region (Waigani Convention)
1995	Amendment to the Basel Convention
1997	Kyoto Protocol to the UNFCCC

[2] Government of Tuvalu. 2015. *Te Kakeega III*. National Strategy for Sustainable Development 2016 to 2020 (Funafuti, Tuvalu)

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), 2001.
2004	Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (the 'Tuna Convention')
2016	Paris Agreement to the UNFCCC

3.3 ADB Safeguard Policy Statement

30. The goal of the ADB Safeguard Policy Statement 2009 (SPS)[3] is to promote the sustainability of project outcomes by protecting the environment and people from any potential adverse impacts of the project.

31. 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.

32. 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 (PCP).

33. 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.

34. 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. In terms of level of environmental assessment, for category B projects, an IEE is required. This IEE identifies as far as practicable the various components of the project and makes an assessment of the potential adverse environmental impacts and identifies the measures required to mitigate or minimise them and summarises these in the environmental management plan (EMP).

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

4. BASELINE INFORMATION

4.1 Physical Environment

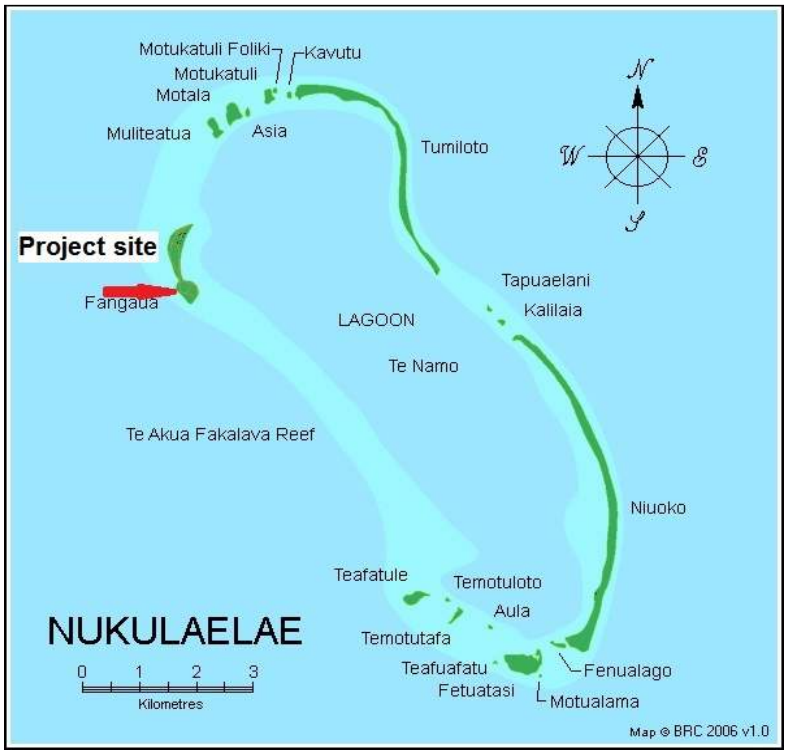
4.1.1 Site Description

35. **Nukulaelae** (means the 'land of sands') is a true coral atoll consisting of 20 islets located some 130 km to the south-east of Funafuti. The atoll, with a total land area of 185 ha, is characterised by a large central lagoon and fringing ponding lagoon that is some 10 km long by 4 km wide (Figure 4.1). The lagoon is completely surrounded by reef, without any passages to the sea. Although there are a number of natural shallow passages from the lagoon system to the ocean, the water level at low tide inside the lagoon is some 50cm higher than the surrounding ocean. Most islets are bordered with sandy beaches on the lagoon side.

36. There are two villages, Pepesela and Nukualofa. The main village of Pepesala is located on Fagaua on the eastern side of the atoll which is 1.5km long and between 50 – 200 m wide. There is an unpaved road leading from the village to the project site.

37. The Nukulaelae Conservation Area set up to protect marine species covers the eastern end of the lagoon and will not be affected by the project.

Figure 4.1: Map of Nukulaelae



38. **Nanumaga** is located 408 km northwest of Funafuti and 72 km south of Nanumea. It is a single island of 301 ha and is approximately 2.8 km long and 1.5 km wide surrounded by a fringing reef and with two small central brackish-water lagoons (Figure 4.2). The larger Vaiatoa Lagoon is located in the north of the island while the smaller Hapi Lagoon is in the south. A causeway constructed by the Council to the south of Vaiatoa Lagoon provides access to the eastern side of the island.

39. The population of the island lives in two villages, Tokelau and Tonga, on the west side of the island. There is an unpaved road around the island.

Figure 4.2: Map of Nanumaga

40. **Niutao**, surrounded by a fringing reef, lies east of Nanumea and Nanumaga and some 348 km north west of Funafuti. It is a table reef comprising a single island of 235 ha and approximately 2.5 km long and 1.1 km wide with its long axis oriented east to west. There is a large inland lagoon east of the village which is traversed by a causeway. There is a small brackish-water lagoon in the central western half of the island that is connected by subterranean passages to the sea.

41. The population of the island lives in two villages, Kulia and Teava, both on the western side of the island. There is an unpaved road around the island.

Figure 4.3: Map of Niutao

42. A more complete description of the islands, their respective ecosystems and other matters are described in the New Zealand Aid Programme funded Tuvalu Ship to Shore Transport Project.[4]

4.1.2 Topography, Geology and Soils

43. 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 has been formed as a result of coral formation over thousands of years. Tuvalu is geologically very young, with most of its islands having poorly developed sandy or gravel coralline soils.

44. These 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. 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.

45. While Tuvalu is relatively far from the boundaries of tectonic plates where large earthquakes occur, these active seismic zones are capable of generating large earthquakes and major tsunami which may affect Nukulaelae, Nanumaga and Niutao. The only significant historic seismic event was a magnitude 7.0 earthquake recorded in 1907[5].

4.1.3 Climate

46. Tuvalu has a tropical marine climate with consistently uniform temperature ranging from 26 – 32C and high humidity. The average rainfall in the period 1942–2005 is 2875 mm per annum. However, rainfall varies from 3500mm/annum in the southern islands to 2700mm/annum in the northern islands. Dry spells and droughts are relatively uncommon.

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[4] NZ Aid and Beca. 2007.Tuvalu Ship to Shore Transport Project, Annex J, Updated Pre-Design Environmental Working Paper (Auckland, New Zealand)

[5] AIR Worldwide Corporation. 2008. Pacific Catastrophe Risk Financing Initiative, Country Risk Profile Tuvalu (Funafuti, Tuvalu)

47. Tuvalu lies within the south-east Pacific trade wind belt just south of the dry belt of the equatorial oceanic climate zone. 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. From May to October, the south-east trade winds are generally light. The predominant wind direction ranges between ENE to ESE for all the islands of Tuvalu.

48. 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.[6]

49. A number of 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 as a result of sea water coming up through the coral to a depth of 1.5m.

50. 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.

51. 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. Nanumaga suffered damage to houses, crops and infrastructure as the result of storm surges and 60-100 houses were flooded and the health facility suffered damage.

52. More recently, Category 4 tropical cyclone Ula affected Tuvalu in early 2016 with 3-4m waves affecting all the islands.

53. 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 harbour and jetty facilities.

4.1.4 Issues of Climate Change

54. Tuvalu is listed as one of a number of island groups most likely to disappear beneath the sea in the 21st century as a result of global warming. For the period to 2100, the Pacific Climate Change Science Program of Australia[7] 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);

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

[7] 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 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);
- 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).

4.1.5 Water Resources

55. There are no fresh water rivers or streams on any of the islands, however fresh water exists underground as water lenses floating on seawater. These are derived from the infiltration of rainwater into the water table below the ground. These lenses exist along the length of the atoll or island and are thickest at the centre and thinnest on the sides facing the ocean or lagoon. The lens is formed where the island is sufficiently wide so as to reduce the outward flow of the accumulated underground lens. These freshwater lenses in low coral atoll and islands are extremely vulnerable to occasional environmental influences.

56. 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 Austrlia financed projects.

4.1.6 Unexploded Ordinance

57. Tuvalu was used as an important staging base for US aerial attacks in the Battle of Tarawa in Kiribati during WW2. 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.

58. There are no recorded unexploded ordnance (UXO) on Nukelaelae, Nanumaga or Niutao.

4.1.7 Items of Historical and Archaeological Significance

59. **Nukulaelae.** Tumiloto, on the north-east side of the atoll, is home to the Elekana Memorial, with a shrine commemorating the first arrival of Christianity to Tuvalu. It was introduced by a castaway from the Cook Islands named Elekana, in 1861. The memorial is located at the southern tip of the islet at a place called Olataga

60. There are ruins of an old village on Niuko, towards the southern end of the atoll. There is a large stone called Te Faleatua, where pre-Christianity religious rites were practised.

61. **Nanumaga.** There is an underwater cave off the northern shore of Nanumaga located more than 40 metres below sea level down the wall of a coral cliff. These are sometimes referred to as the Fire Caves of Nanumaga because of the blackened coral fragments on its floor which suggest the use of fire by ancient occupants.

62. **Niutao** does not contain any known items of historical or archaeological significance.

63. None of these items will be affected by the project.

4.2 Biological Environment

4.2.1 Flora

64. **Terrestrial Flora.** Of the total number of around 200 plant species recorded in Tuvalu, it is estimated around 50 species are considered indigenous.[8] Most of the exotic species are described are ornamental or food plants or weeds.

65. 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.

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

66. Indigenous broad leaf species, including *Calophyllum inophyllum*, make up single trees or small stands around the coastal margin. These trees are also useful for providing protection against erosion along the foreshore and assist in reducing the inland penetration of salt spray.

67. 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.

68. **Marine flora**. There are 59 species of marine algae recorded with the dominant ones being green (*Halimeda* species) and red algae making up 76% of the total number of species, followed by blue and brown algae which make up the balance.

69. There are 379 species of Cnidarians of which there are 366 species of hard coral. Seventy of the species are considered vulnerable (facing a high risk of extinction in the wild).

4.2.2 Fauna

70. **Terrestrial fauna**. 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.

71. **Avifauna.** A total of 41 species of birds have been identified in Tuvalu. There are three main families which include Sternidae, comprising eight species of terns and noddies; Scolopacidae, comprising six species of tatlers, 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. Tatlers, godwits, curlews and stints are migratory birds. Shearwaters and petrels are visitors, quite uncommon and for which no breeding sites are known[9].There are 22 known species of butterfly and moth.

72. **Marine fauna.** There are 532 species of fish of which wrasse, grouper, surgeonfish, snapper, butterfly fish, damselfish, parrotfish making up nearly half of the recorded species. There are 12 species of requiem (young are born fully developed) shark, two species of hammerhead and one of thresher shark.

73. 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.

74. 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*).

75. 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.

4.2.3 Rare and Endangered Species

76. Only four marine species found in the waters of Tuvalu and recorded on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species are considered endangered (facing a very high risk of extinction in the wild). These include the green turtle

[9] Job, S. 2009. Tuvalu Marine Life Project - Phase 1 Literature Review (Funafuti, Tuvalu)

(*Chelonia mydas*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*) and the Maori wrasse (*Cheilinus undulates*). Some 70 species of Cnideria, which include hard, soft and blue corals, are considered as 'vulnerable' (facing a high risk of extinction in the wild).

77. No birds or terrestrial species are considered endangered (facing a very high risk of extinction in the wild) or critically endangered (facing an extremely high risk of extinction in the wild.

4.2.4 Protected Areas and Critical Habitat

78. **Protected areas**. Local conservation areas on the land which limit or influence land use options are determined by the Kaupule. These areas are generally not mapped. There is a protected marine area on Nukulaelae.

79. 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. 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.

80. The Nukulaelae Conservation Area covers the eastern end of the lagoon; this is the opposite side of the island to the project site. Any project or activity that causes a disturbance to these highly sensitive areas will result in some environmental response, either immediately or over a longer period. The proposed project activities will not occur near any turtle nesting habitat. Given the small scale of dredging that is proposed in this project, it is not anticipated there will be any long term effect on the Nukulaelae Conservation Area.

81. **Critical habitat**. Nearly all atoll environments could be classified as critical habitat--particularly the sandy beaches, reefs and lagoons--given that the migratory green turtle (*Chelonia mydas*), identified as an endangered species (facing a very high risk of extinction in the wild), lives within shallow bays and protected shores which include coral reefs and near-shore sea grass beds. Turtle nesting areas are on sandy beaches and there are known nesting areas on the smaller islets of Nukulaelae beyond the project site. The Kaupule has passed a traditional rule that no one is allowed to harvest any nesting turtle on no-take zone beaches, nor take any egg from a nesting site. The no-take zone beaches are rotated throughout the year. People are also discouraged from harvesting juvenile turtles and mature turtles within the conservation area boundaries. The project sites are not areas of critical habitat.

4.2.5 Coastal Resources

82. The coastal areas of Nukulaelae, Nanumaga and 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 as a result of human activity and the effects of tropical cyclones. Coastal protection work is required at numerous sites on each island particularly after the impact of Tropical Cyclone Pam in March 2015 on the coast line.

83. 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. As a consequence, the removal of beach gravels and sands are now limited only for the construction of houses for personal use.

84. 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.

85. **Nukulaelae.** Access to the main island of Fangaua is by way of a dredged channel in the outer reef and then using the natural channels within the broad reef platform to the beach. This channel has had limited dredging in the past but it is still difficult to navigate during low tide when there is a fast current as a result of the 50 cm difference in elevation between the lagoon and the ocean.

86. **Nanumaga.** Due to the small size of the island there is little protection from swells that tend to wrap around the island. The westward flowing ocean currents create large-scale eddies that are shed off the northern and southern extremities of the island. These currents bring materials in the drift to shore at the centre of the island near the village. Access to the island is by a single reef channel approximately 90m long, the Nanumaga Channel, on its western side and adjacent to the village. An alternative site is sometimes used for access on the eastern side when conditions are too rough on the western side. The eastern site has had minimal blasting to remove some of the rocks at the seaward end of the reef platform, but a defined channel has not been constructed.

87. **Niutao.** 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 75m in length, is currently the favoured approach with a better landing facility. The island is characterised by consistently rough seas, and access from ship to shore and for fishing boats is very challenging and risky even in calm conditions.

88. 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.[10]

4.3 Socio-Economic Environment

4.3.1 Population

89. The Tuvalu 2012 census[11] showed a total population of 10,782 which included short term visitors, tourists, and temporary contract workers. However, the resident population of Tuvalu as at 2012 has increased by 13.7% to 10,640 since the previous census in 2002. 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.

90. The resident population on Nukulaelae, which makes up 3.42% of the total population, has decreased by 7.1% since the previous census. Similarly, in Nanumaga and Niutao, which make up around 5% each of the total population, there has been a decrease in the resident population of 22.4% and 15.1% respectively (refer to Table 4.1).

91. 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.

92. The Island Kaupule plays a crucial role in the education system, with an allocation for education in the budget every year, especially at the pre-school and primary level.

93. 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 Government. Primary school, which is similarly subsidised, is compulsory and free for all students attending class 1 (6yrs) to class 8 (13yrs). There are no secondary schools on these islands with both male and female

[10] New Zealand Aid Programme and Beca. 2004. Tuvalu Ship to Shore Transport Project (Auckland, New Zealand)

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

students going to Motufoua Secondary School on Vaitupu. There are health clinics on each island but no doctors. All serious medical cases are referred to Funafuti by ship.

94. The land tenure system is largely based on extended family ownership. Around 95% of the land is held in customary tenure with only 5% publicly owned. Less than 0.1% is held in freehold title.

Table 4.1: Population of Tuvalu

	Resident Population			% Total Population	% pop change 2002 -12
	Total	Male	Female		
Nanumea	612	322	290	5.75	-28.40
Nanumaga	551	297	254	5.18	-22.40
Nuitao	694	340	354	6.52	-15.10
Nui	729	370	359	6.85	19.50
Vaitupu	1542	772	770	14.49	17.70
Nukufetau	666	328	338	6.26	-5.00
Funafuti	5436	2796	2640	51.09	37.00
Nukulaelae	364	174	190	3.42	-7.10
Nuilakita	46	25	21	0.43	2220
TOTAL	**10640**	**5424**	**5216**		**13.7**
% of Total		**51%**	**49%**		

Source: Tuvalu National Population & Housing Census 2012, Table 6

4.3.2 Local Economy

95. According to UNDP human development indicators Tuvalu is 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 'dot TV' internet domain, and income from the Tuvalu Trust Fund. Direct foreign aid and project activities also constitute a major source of revenue.

96. There are very few economic activities in the outer islands so people rely on subsistence activities (Table 4.2). 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 a main subsistence activity. The Community Fisheries Centre (CFC) assists fishermen in the marketing of their fish within the community. Only registered fishermen are allowed to fish and bring their catch to the CFC who sells it for them.

97. Agriculture opportunities are very limited due to poor soil fertility and are predominantly centred on the traditional root crop, pulaka. Coconut, breadfruit, bananas, and pandanus along with pulaka are very important traditional food crops and are cultivated by the majority of outer island households. Handicrafts such as brooms and mats, usually made by women, are another source of cash income.

98. Around a quarter of the workforce is employed within the public sector, which includes the island Kaupule. Other sources of cash income include remittances, rents and pensions. Cash income is generally derived from paid employment, remittances from other family members working in Funafuti or overseas, land leases and self-employment or ad-hoc businesses.

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

Table 4.2: Proportion of households receiving types of income

Sources of Cash Income	%
Wages / Salary	53.9
Remittances	43.4
Lease of Land	41.0
Investment	24.3
Handicraft sales	26.4
Own business	15.8
Senior citizens pay	17.2
Fish sales	11.0

Source: Census 2012: Population and Housing Census Volume 1, Table 31

100. The rate of unemployment on the islands is around 54% (Table 4.3). There is an Elderly Support Scheme whereby only those aged 70 years and above are eligible to receive $50 per month if they meet the conditions required. This scheme was implemented in 2009 under the Department of Community Affairs.

Table 4.3: Level of Unemployment

	Unemployment			% Total Population
	Total	Male	Female	
Nanumea	332	165	167	54.25
Nanumaga	279	140	139	50.64
Nuitao	375	167	208	54.03
Nui	381	182	199	52.26
Vaitupu	912	418	494	59.14
Nukufetau	357	170	187	53.60
Funafuti	2,114	1,014	1,100	38.89
Nukulaelae	197	96	101	54.12
Nuilakita	19	12	7	41.30
TOTAL	**4,966**	**2,364**	**2,602**	**46.67**
		48%	**52%**	

Source: Tuvalu National Population & Housing Census 2012, Table 51

5. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

101. The IEE provides an analysis of anticipated impacts associated with the development and construction of improved jetties and facilities at each of the three islands. Environmental safeguard measures have been incorporated in the project as follows:

a. Design and pre-construction phase - the period of further surveys as required, detailed design, and period prior to any construction works. During this period the assessment and EMP are updated based on the additional information available, designers can incorporate environmental measures in the project design, the EMP is incorporated into technical specifications and bid documents, the contract is tendered, a contract is awarded and the contractor may mobilize to site but civil works are not permitted to start until the notice is issued. The contractor will prepare the construction EMP (CEMP) during this period;

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; 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.

102. In order 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.

5.1 Design and Pre-Construction Activities

103. The design and pre-construction phase will include a number of investigations and surveys to obtain technical information to go into the design. These will include the following.

104. **Topographic survey.** A survey of the land area around the existing landing facility will be made to determine relative elevations for the proposed jetty structure and also to assist with the development of the coastal protection works.

105. **Hydrographic survey.** A survey to map the sea bed in and around the channel and boat harbour to determine the volume of dredging and so that a wave analysis can be carried out. For each site, a plan with contour lines at least 20 centimetre interval, a longitudinal section, and cross sections with at least 20 meter interval will be prepared. This will also assess the profile of the floor of the channel to indicate where the reported high spots are located.

106. **Geotechnical survey**. This survey will involve taking a core sample of the reef platform material by drilling a small 37mm hole down to a depth of around 5m using manually-operated motorised drilling equipment.[12] These core samples will be made at around 25m centres along the proposed location of the harbour or breakwater wall during low tide to determine the composition of the reef platform material and identify any weaknesses in the profile. This is not a large scale drilling operation and there will be little or no environmental impact. Each core sample will remove around 0.02m^3 per drill hole. It is estimated that some 15 to 20 core samples will be taken at each project site.

[12] SMEC Australia. March 2011. Niue Port Study, report for Forum Fisheries Agency (Australia)

107. There will be an insignificant impact on any algal community and the amount of sediment produced will be negligible.

108. **Seismic probes**. These will be placed at low tide along the reef platform along the same line as the geotechnical survey. Sound waves are bounced off underground rock formations and the waves that reflect back to the surface are captured by recording sensors for later analysis. This data is used to correlate the information gained from the geotechnical survey. This will assist in determining whether piles for the structures are drilled into the reef platform or driven into the reef platform using a pile driver. It is assessed there will be little or no environmental impact from this seismic survey as this will be carried out at low tide on the exposed reef platform.

5.2 Construction Activities

109. **Nukulaelae.** The construction phase will consist of a number of 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 utilisation and efficiency and may vary at each site, depending on the size and complexity of the planned works on the reef platform.

110. The concrete modules for the breakwater and wharf structures will be precast to the required specification out of the country and delivered by ship or barge to the site. Prior to the placement of the concrete modules, the surface of the reef platform will be shaped and scarified to provide a flat surface upon which to place the individual pieces. The extent of this work will be limited to the width and length of the structure.

111. The location of the wharf and breakwater structure will be surveyed and marked clearly prior to any works commencing to avoid excess shaping as well as reduce the time and costs associated with the work. The modules will be placed into the prepared site by crane. They will then be anchored onto the reef platform by drilling holes and then grouting the structure to the reef platform. Works will be constrained by the tide and will require coordination with other associated construction activities.

112. The access jetty is the structure from the land to the wharf. This will consist of a raised platform placed on piles that are either driven or drilled into the reef platform, based on the results of the geotechnical survey. There will be no impact from the structure on the critical movement of sands along the beach as the jetty will not impede any tidal flow. There will be a headwall structure constructed from the edge of the land out onto the reef platform to carry the jetty.

113. 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. 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 a predetermined disposal site or sites 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 global positioning system (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 barge mounted 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.

114. 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.

115. Construction of the transit shed and access link from the existing road to the jetty will require machine-assisted clearance of existing vegetation and trees in an area where the current land cover is vegetation.

116. Minor earthworks related to drainage for the parking area and construction of the building foundations will be required. Dependent upon the final survey and layout of the transit shed area, the removal of nearby existing graves may be required.

117. **All three project sites.** A flexmat will be used to provide a boat ramp from the turning bay to the shore, with associated drainage works on the foreshore. The flexmat consists of a 4m 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 of wave dynamics.

118. The flexmat will be precast to the required specification out of the country and delivered by ship or barge to the site. Prior to the placement of the flexmat, the surface of the reef platform and beach will be shaped to provide a flat surface upon which to place the sections of precast mat. The extent of this work will be limited to the width and length of the flexmat ramp.

119. The flexmat is a low-lying flat structure close to the original level of the existing reef platform and beach and is not anticipated to impede the movement of sand along the beach or influence tidal patterns or wave action. The installation will be carried out according to the specifications of the supplier.

120. **Method of assessment**. Potential impacts have been assessed by means of site visits, discussions with local authorities and beneficiaries, design engineers, marine biology specialists and the use of secondary sources of information. This section summarises the potential environmental impacts of the various activities and required mitigation measures which have been incorporated into the EMP.

121. The IEE will be updated during the PDA when additional information will be available. This may involve recommendation of certain types of equipment or construction methodologies to assist in reducing the environmental impacts.

5.3 Design and Pre-Construction Phase

5.3.1 Impacts on Physical Environment

122. 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. In particular, 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.

123. Dredging and excavation works will generate a significant volume of spoil. For every hectare of reef material excavated to the nominal depth of 4m, some 40,000m^3 of spoil will be generated. It will be critically important at the design phase to determine the estimated volume of spoil for disposal at each site and identify technically and environmentally suitable sites on

the island to dispose of the volume of spoil from the dredging and excavation activity. Site selection must be done in consultation with the Kaupule and based on site suitability criteria that meet the requirements of the national legislation. The project support and master planning consultant (PSMPC) will provide reasons why some options proposed by the Kaupule may not be considered in line with best environmental practices and considerations.

124. Storage or temporary stockpiling of dredged spoil will not be permitted within the reef area or tidal zone.

125. The design of the workboat harbour, breakwater and jetty facilities will have due regard to the sensitive reef environment to ensure coastal processes are not impacted.

126. To minimise damage to the reef shelf during low tide, the working area will be limited to ensure all machinery operate only within a defined corridor that will be marked prior to the commencement of any survey.

5.3.2 Impacts on Biological Environment

127. The mobilisation of construction machinery and equipment form 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.

128. The construction project will require the presence of a temporary workforce and appropriate accommodation and laydown facilities. It has yet to be confirmed whether the accommodation will be located on a suitable site on land, within available community housing or on a self-contained accommodation barge. 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.

129. The construction of a temporary camps will require a dedicated area of land for the duration of the project. This may involve removal of or damage to indigenous vegetation or shoreline vegetation to place prefabricated accommodation units and associated facilities brought to the island by barge to a suitable location.

130. It will be very important to minimise any earthworks or soil disturbance in order to reduce any impact on the fragile shallow soil resource and reduce the potential for erosion as a result of damage or removal of indigenous vegetation. Preference will be given to sites that have already been modified. Options will be provided in the tender document which may include having a self-contained barge to house the construction workers.

5.3.3 Impacts on Socio-Economic Environment

131. 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 provide a construction Health and Safety Plan to be approved by the supervision contractor prior to mobilisation. 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.

132. 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 first priority, a set of protocols 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.

133. Measures to mitigate these concerns will be addressed in discussions with Kaupule and full public consultation prior to any mobilisation 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.

134. Grave sites have been identified on Nukulaelae in the vicinity of the proposed transit shed and parking area and may require relocation depending upon the final survey. If it is determined that the relocation of the graves is necessary, then this will be carried out in consultation with and with the consent of the relevant landowner(s) and Kaupule. Any relocation of the graves will be carried out in accordance with the appropriate ceremonial protocols prior to the start of any construction work or land clearance activities.

135. 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.

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

137. 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 site-based CSC to raise any issues of environmental concern as a result of 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 in order to minimise any impacts that may affect project implementation. 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 8.

138. The presence of construction workers in small island communities can increase the risk of highly contagious and/or sexually transmitted diseases. In order to reduce the likelihood of the spread of highly contagious diseases and STI/HIV/AIDS to the island community, measures to mitigate this will include a requirement to have all expatriate workers screened for infectious and contagious diseases prior to mobilisation. An HIV/AIDS awareness campaign and screening tests for construction personnel prior to mobilisation will be planned and be an integral part of the tender document.

5.4 Construction Phase

5.4.1 Impacts on Physical Environment

139. **Dredging of reef materials**. Dredging will cause the disturbance of unconsolidated sediments within the channel floor and turning bay in the harbour. This is expected to lead to short-term increase in concentrations of total suspended solids immediately around the active dredging site. Tidal flow will takes this sediment plume out through the channel and into the sea.

Blasting of the channel and turning bay is not allowed for in the current design due to the impact on the reef ecology (see Section 5.4.2).[13]

140. At Nukulaelae, it is estimated that up to 10,000 m^3 will be dredged from the new reef channel and workboat harbour. An assessment will be made of the type of coral to be found in this location prior to confirmation of the exact channel location and extent of dredging required.

141. Measures to minimize the environmental effects of sediment removal on water quality and marine communities as a result of dredging activities include the following key points:

- The contractor will prepare a detailed method statement in the CEMP, to be approved by the CSC prior to the commencement of any works. The statement will identify the methodology and the rationale for any selected dredging system chosen and the means by which it will minimise the spread of suspended sediments.
- The dredging barge and its equipment, or hydraulic excavators, shall be in sound and well maintained condition and free of any leaks of any fluid at all times. 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.
- The barge shall be only operated by certificated and experienced operators.
- All dredging operations shall comply with relevant laws of the Government of Tuvalu and international conventions to which it is a signatory.
- Dredging operations shall be monitored visually, and photographs of plume movement taken, along with recording of sea conditions, wind speed and direction for each work period and phase of the tidal cycle.
- Dredging 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 extend to areas of intact coral or sea-grass formations or result in deposition of material on the reef platform.

142. A comprehensive set of guidelines relating to reef channel blasting and construction has been developed. The guidelines prepared identify the major environmental impacts and mitigation measures associated with harbour projects on the outer islands.[14] These guidelines will be a key reference document to be used by the contractor in developing the CEMP. An abridged copy of these guidelines is in Appendix A.

143. **Disposal of dredged reef material**. The dredging and excavation of reef material will generate considerable volumes of spoil that must be removed and disposed of in a manner that does not result in an environmental impact in another location. All spoil must be disposed of on predetermined and approved locations on land. This may involve many separate and discontinuous sites as well as areas for community purposes such as raising levels of school sports fields, roads or in-filling of communal land.

144. It is estimated that up to 10,000 m^3 of spoil disposal is required as a result of the dredging of the new reef channel and workboat harbour at Nukulaelae. The site for the spoil

[13] 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)

[14] 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)

disposal has yet to be confirmed but some material will be used to maintain the existing road infrastructure, used for the transit shed area and backfill behind a seawall near the jetty.

145. There are significant potential environmental impacts from spoil disposal in any marine areas including the reef platform, beaches, mudflats, or the lagoon where sediments will be subject to action by wind and waves and could spread over a wide area. The impacts of disposal in these locations can include scouring of the reef platform areas (which produce sand-forming organisms), smothering of corals and habitats and increasing the risk of ciguatera if certain algae that host them become well established. Temporary stockpiling of any dredged material or reef debris within the lagoon zone, the reef platform or in the tidal zone is not permitted.

146. Spoil disposal options can include the following:

- Create stockpiles of graded material of different sizes for future building and construction needs, such as rock, gravel and sand sized material for housing or other domestic uses.
- Road improvement and rehabilitation using smaller sized material to raise the road profile and improve resilience to climate change.
- Beach replenishment using similar sized sandy material along eroding sections of beach while maintaining the original beach profile.
- Level out the ground for school playgrounds or sports fields.
- Cover old rubbish areas or fill in small hollows in communal or private land.

147. The contractor will identify the sites, means and method of spoil disposal in the CEMP. As part of the CEMP the contractor will prepare and sign an agreement with the Kaupule that shows the spoil disposal strategy for each island (a copy will be forwarded to the CSC and PMU). Any variations to the method and location of disposal must be specifically approved by CSC prior to making any changes.

148. **Coastal protection works**. Any construction works along the foreshore environment requires a high level of planning and careful consideration of the type of facility to be constructed to ensure there is minimum impact to important coastal processes, particularly those involving sand movement that is typical on low lying atolls. The construction of any jetty and landing facility must include these processes into the design.

149. Coastal protection works have traditionally involved the construction of seawalls or similar energy dissipating structures. It typically involved excavation below the high water level with the placement of gabions, concrete walls or revetments using waste concrete recovered from storm damaged buildings proprietary concrete or geotextile products or sand-cement filled bags. However, in the case of atolls, which form as part of a dynamic and changing environment, these traditional approaches need to be revisited with serious consideration given to working with these natural processes rather than try to block these process with solid structures. This can only be achieved when there is a full understanding of these processes before any final design is selected for a harbour project.

150. 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. General measures to minimise and mitigate soil erosion at the beach-island interface are similar at each project site and include:

- The method statement as part of the CEMP will clearly identify the environmental risks and how the risk to the excavated area will be managed prior to the commencement of any works.
- 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 dry land and to a designated spoil disposal area. No excavated material is to remain in stock piles on the beach between tides.
- Minimise the period that excavated areas are left unprotected and open to tidal movement or storm effects.
- Ensuring that all equipment used below the high water mark is in sound mechanical condition, and free of any leaks of any fluid at all times.
- Minimise or reduce the clearing of any vegetation near the seawall or jetty headwall structure. Retain or provide a 20m buffer of foreshore vegetation within the vicinity of all structures.
- 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
- Incorporate bioengineering solutions where practicable. Plant 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 and as soon as practicable after completion of works to reduce exposure to wind.

152. **Erosion control**. 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. In particular, high tides and storm surges can result in rill and scour erosion around the adjoining buildings, headwalls, ramp or access track leading to the beach.

153. 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 each of the sites where small workboat harbour and jetty facilities are proposed.

154. It is recommended that a topographic survey of each foreshore site extending between 50-100m either side of the landing facility be carried out to assist in the design of any site specific drainage works and any other mitigation measures. Soil erosion mitigation measures are described more fully below.

155. **Nukulaelae**. The current boat ramp is inaccessible during periods of low tide due to the long approach path required from the sea through the reef. The foreshore along the village

frontage has been extensively damaged during Cyclone Pam. This has been repaired to a degree using locally produced concrete blocks placed along the shoreline.

156. As there is no reasonable access to the island at the existing location, a new location has been determined by the community for a small work boat harbour near the southern end of the island. This site is relatively undamaged by recent storm activity and is not connected to the ponding lagoon. There is a thin layer of soil developed over a deeper layer of cemented branch coral fragments that are reasonably resilient to normal tidal impacts. There is no significant coastal erosion at this proposed site due to the presence of this compacted layer of cemented coral fragments. Any construction works proposed at this site must limit the amount of excavation at the edge to reduce the likelihood or erosion of these fragile deposits.

157. A new access track from the existing beach perimeter road through coconut and other trees will be required to access the jetty facility. This will be through private land and a formal lease document and compensation will be required with the landowner. There are known burial sites located near this potential access track and these must be clearly identified with the landowner prior to any survey work required for construction.

158. **Nanumaga**. The access from the beach to the land has been cleared of debris from Cyclone Pam and it is suggested it is now at a lower level than prior to the cyclone. There is a long low gradient slope leading from the public open space behind the church (now unsuitable for use due to cyclone damage) and down to the beach. Based on GPS measurements taken on the site visit and satellite imagery of Nanumaga, an estimated 20 - 25m of sand has been lost from the village foreshore.

159. The road along the foreshore and behind the church has worn down through regular vehicle and motorbike use such that runoff from the large open area of around 0.5 ha of packed coral leads directly onto the ramp that provides access to the beach and landing area. There is active rill and minor gully erosion which is contributing sands and sediment onto the beach access above the high tide level. Site observations indicate a low point that can be used to construct a large soak pit containing large rocks covered and with geotextile cloth and fine sand into which surface water can be directed with some minor shaping and earthworks with suitable machinery. This will reduce the impact of sediment transport from land onto the new flexmat boat ramp.

160. A low broad constructed (concrete) bund, which will also form part of the foreshore road along the top of the access to the beach, will prevent any surface water runoff from the large open area as well as reduce the impact of storm surges and high tides washing material up into the open area.

161. The existing sea wall will require rehabilitation and armouring with waste concrete material with protective planting of coconut and local tree and low growing shrub species suited to the site in order to mitigate soil erosion and stabilise the foreshore environment. There is very little foreshore vegetation remaining on the northern side of the harbour, leaving the coastal margin very exposed to more erosion. There is potential for increased erosion along either side of the proposed jetty facility as a result of tides and storms with the risk that project works may become exposed as a result of this erosion. Thus an integrated approach is required to combine the foreshore protection works with the construction works for flexmat ramp.

162. **Niutao**. The current beach access is a short steep slope from the land that is gradually wearing back into the island. It had 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.

163. The current harbour 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. Foreshore protection works will be a component of the installation of the flexmat ramp. The main focus will be 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.

164. **Air quality**. The predominant wind direction is from the north-east through to the south-east, but there is a regular onshore breeze or wind blowing on most days. There are no anticipated impacts on air quality from the physical works component. However, exhaust emissions will be generated from construction machinery, pile drivers, vehicles and mobile generators. Mitigation measures will include: i) the 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 each project site, ii) avoiding unnecessary operation of vehicles and equipment.

165. **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 and the process of anchoring these structures to the reef surface.

166. Potential sources of dust generation common to all land based activities on the project sites include i) activity associated with the construction of the seawall or jetty headwall and other facilities on the land during the excavation and dumping of spoil and sand, ii) the movement of machinery on the bare areas within and around village buildings and houses during clean up and removal of storm debris for use as backfill behind the seawall, and iii) dust from aggregate preparation and concrete-mixing. 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.

167. **Waste management**. The management of construction and domestic 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 into the groundwater, which is already subject to degradation in water quality in all project sites. On Nukulaelae, the disposal of solid waste is at the end of the island and exposed to storm surges which could lead to the waste material being removed from the disposal site and spread along the reef platform.

168. 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 utilised for the construction of community facilities. This will be done in consultation with the Kaupule at the appropriate time.

169. The contractor will provide a detailed waste 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.
- Store and remove all inorganic solid waste include steel, formwork, fittings, pipes, hydraulic hoses, tyres and any other spare parts used with construction equipment.
- Install on-site toilet facilities with an appropriate self-contained sewage tank.
- Compost all green and organic wastes to assist soil improvement for the production of communal food crops or use as pig food.

170. **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.

171. All hydrocarbons will be stored either on the supply ship, barge or on a dedicated land based facility. The latter will be selected in conjunction with the Kaupule to ensure it does not impact any houses or water supplies. Measures to minimise 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.
- 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 100m away from the marine environment.
- 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-fueling is not permitted over water or in the reef environment. All refuelling must take place on land.
- 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.
- 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.

172. **Site decommissioning and rehabilitation**. When the construction activity has been completed, each construction camp, either on based land or on a barge, will be demobilised. To minimise 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 any reasonable requests to use such areas for community purposes and will be done in conjunction with the Kaupule.

173. Site rehabilitation activities will include the removal of all construction material, used or unused, and may include re-vegetation activities. All efforts will be made to engage local labour to undertake the decommissioning works, and where practicable, the use of women's or community groups.

5.4.2 Impacts on Biological Environment

174. **Works on and adjacent to the reef.** Any suspension of materials may affect fish population and other marine life in and around the outlet of the channel. Blasting of a channel and turning bay is not anticipated in the current design proposal due to the impact on the reef ecology and fish population. Studies on the effects of channel blasting found it had the potential to kill fish due to ruptured swim bladders and body cavities.

175. The study also found that the numbers killed were small when compared with the numbers present and that, in general, the impact on numbers was not significant within two months of blasting.[15] In addition the study also found that the new habitats created may increase fish diversity and numbers of some species where the channel acts as a nursery site.

176. **Introduction of alien and invasive species.** As there will not be sufficient suitable aggregate at each 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 harbour, breakwater and jetty facility will be pre-cast in Fiji. These pre-cast concrete elements will be shipped by barge from Fiji to the project site using one of the approved shipping services.

177. Some aggregate will be transhipped 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 minimised with attention by the supplier to hygiene requirements for imported material. 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.

178. Mobilisation 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. It will be a requirement that 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.

179. The delivery by ship of the precast concrete elements from the country of origin used in the wharf and breakwaters may result in the introduction of foreign marine organisms or pollution of the near-shore marine environment. In order to reduce the likelihood of this occurring, the ballast waters must be discharged no closer than 5km from the shoreline with confirmation provided by the captain by way of log book details.

180. 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.

[15] Kaly U.L & Jones G.P. 1990. Ibid.

181. **Ciguatera**. Ciguatera outbreaks are reportedly related to damage to reefs caused by natural events such as cyclones or by human activity (shipwrecks, pollution etc), but there are many cases of ciguatera in areas where there has been no such damage. Disturbance to the reef environment promotes the growth of toxic algae which is eaten by small herbivorous fish and collects in the body tissue. These smaller fish are consumed by larger carnivorous fish and the toxin accumulates in the bodies of marine life further up the food chain to the extent that these toxins can become poisonous to humans if the larger fish are eaten. There have been periodic outbreaks of ciguatera in Tuvalu over recent years, with the incidence of poisoning becoming more common.

182. 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. It is therefore important to minimise 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.

183. Mitigation measures include 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. Reseeding new channel surfaces with coral can also help speed the period of restoration of coral communities in the channel.

184. Sound design and planning will provide a better mechanism to reducing a potential outbreak of ciguatera. The local community will be advised (through the Kaupule) that no fishing or harvesting of other marine resources should occur within 1km radius of the channels during dredging works and for at least four weeks after the works have been completed.

185. **Clearance of vegetation**. 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.

186. 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 not be in excess of 20m.

187. 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.

188. The precise location and area to be cleared for the transit shed has yet to be confirmed by survey and will be finalised in the detailed design stage. Any impacts from this clearance will be amended in the updated EMP.

189. Large single trees in the area designated for the transit shed 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.

190. Measures to minimise 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.
- Minimise 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.

5.4.3 Impacts on Socio-Economic Environment

191. There may be community concerns with the impact of additional construction personnel from outside of the island community on specific religious and cultural sensitivities. Measures to mitigate these concerns include a requirement for all construction personnel to have a full site induction on each island prior to the commencement of any works to raise awareness of any religious and cultural matters while working within the small isolated communities. This induction will be carried out with the assistance of Kaupule and other village representatives.

192. The contractor will agree with the Kaupule of each island a set of protocols that will govern the conduct of the contractor and work crew during the time they are working on the island. Any of the contractor's crew in contravention of the protocols will be sanctioned (through a fine, docking of salary, or termination of contract for serious offences).

193. **Use of water**. Potable and fresh water is a scarce commodity at all island project sites. 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.

194. 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, ii) use only seawater for dust suppression as required.

195. **Grave relocation**. There are known grave sites in the vicinity of the transit shed and parking area. Any vegetation clearance near these graves should only be carried out after consultation with the landowner and Kaupule and after the graves have been clearly identified and marked. The due diligence report: resettlement includes the process to be followed for relocating the graves.

196. **Risk of spread of communicable diseases**. The presence and management of sexually transmitted infections including HIV/AIDS in the community is well documented in Tuvalu. The introduction of disease into the island community from a short term construction project is a significant social concern and can be mitigated with appropriate awareness and training. There are qualified agencies that can provide HIV/AIDS 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.

197. **Health and safety**. Occupational health and safety (OHS) risks of construction works in a remote marine environment are high. 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 mobilisation with at least one member being

competent in advanced emergency first aid to deal with potential injuries and more serious accidents.

198. Risk can be limited by having a clear health and safety policy and an emergency response plan for all personnel. In order to minimise health and safety risks, the contractor will provide the CSC and PMU with a comprehensive OHS plan as part of the CEMP which will:

- Include the measures to demonstrate compliance with the World Bank Groups' Environmental Health and Safety Guidelines.
- Define responsibilities and authorities within the contractor's staff for adhering to 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.
- Set procedures for safe handling of toxic materials and other hazardous substances.

199. 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 form the OHS plan in the CEMP and will include: (i) introduction to OHS issues in construction sites; (ii) education on basic hygiene practices and procedures to minimise 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.

200. **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. 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 a particular issue during times of church services and other important village ceremonies and in the vicinity of 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.
- Liaise with Kaupule to minimise disruption to church services, schools and health clinics.

5.5 Operation and Maintenance Phase

5.5.1 Impacts on Physical Environment

201. Following construction of the workboat harbour, 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. As a result, major maintenance works may be required. 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.

5.5.2 Impacts on Biological Environment

202. 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.

203. 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 harbour and can result in damage to workboats and other vessels or injury to swimmers.

204. The movement of solid and liquid materials from the workboats to the wharf can result in spillage or loss into the harbour area causing pollution of the marine environment. Spillage of hydrocarbons into the water or onto the reef platform can result in damage to the aquatic biota.

205. 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, similar to 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.
- Regular community clean-up programs initiated by community leaders, youth and women's groups.

5.5.3 Impacts on Socio-Economic Environment

206. The improvements to the workboat harbour, 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.

207. 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.

6. ANALYSIS OF ALTERNATIVES

208. The western side of Nukulaelae to date has been the preferred option for the movement of cargo and passengers to the ship. This is mainly because the village is located on the western side of the island which is also on the western side of the atoll. The current location for the workboat access to shore is not considered efficient and has limitations at times of low tide.

209. As there is currently no boat access to the lagoon, the alternative of using the eastern side of the island for a harbour is not a practical, environmentally acceptable or economic option. This alternative would require considerably more excavation and dredging of the reef platform and lagoon environment with a number of known and unknown associated environmental risks. There would be a substantial volume of dredged material to place on the island which would require numerous sites for disposal on a small island. Construction costs would also be significantly higher.

210. A new channel and workboat harbour will be constructed at the southern end of the island. There are two options at the proposed site which have yet to be fully determined and the cost implications assessed. These involve having a longer channel dredged leading it to around 60m from the shore with a short jetty or a shorter channel requiring a longer jetty. The impacts of the increased length of the channel on the coastal processes at this location have also yet to be determined.

211. In both Nanumaga and Niutao, the flexmat boat ramps are to be constructed on the existing channel but an alternative channel location is promoted by the community. These new sites will require further studies to ensure their suitability in terms of the coastal processes.

212. The “no project” alternative would mean a continuation of the unsafe transfer of passengers and goods using the existing harbour facility and the loss and damage of goods due to the climatic and sea conditions. That there have been no major injuries or fatalities to date as a result of the delivery of passengers and goods from the ship to shore is a testament to the skill and ability of the crew of the ships. However, the risk of serious harm continues to remain very high.

7. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

7.1 Consultation and Participation

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

214. A three day workshop was conducted in Funafuti from 15 – 18 April 2016 with representatives from all project island groups in attendance and included the ADB Project Officer. Representatives from Nukulaelae were unable to attend due to logistics reasons related to the shipping service and a separate site visit was made to present the workshop. 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.

215. The 13 community representatives from Nanumaga and Niutao, which included women and youth groups, did not express support for the project as proposed and there was general consensus that the small workboat harbour option would not fit their respective Island Development Plans or the aspirations of the community.

216. The general consensus from the representatives was that a big harbour concept capable of taking large boats such as the Nivaga III or the LCT barge, which would improve passenger safety and reduce cargo handling and damage, was the preferred option. Any improvement to the existing facilities in the short term through a phased approach as proposed during the workshop was not an acceptable compromise. This was despite an explanation of the funding mechanism and limitations of available funds, the need to undertake more detailed environmental assessments to comply with Tuvalu legislation and ADB requirements and the economic justification for a significantly more costly project for small island communities with a population of fewer than 700.

217. Advice was also provided that these large harbours would not be in concert with the sensitive reef platform environment and would potentially have significant long term environmental risk including erosion of the foreshore and loss or severe damage to the lagoons. The community expressed that they were prepared to accept the environmental risks in order to have a facility that suited their long term aspirations. However, it was conveyed that such a change in project scope would increase impacts and cost, the increased significance of impact would mean the project re-categorization from Category B to Category A project which would require an EIA, requiring additional resources for the studies and report and additional time (120 days) for public review which could not be accommodated within the current processing schedule.

218. Aside from the substantial increase in cost and time to undertake the necessary studies for an EIA, the representatives accepted that this decision would mean that the project would not proceed and that funding for such a large investment would not be forthcoming from ADB. The community expressed a desire to seek alternative funding from other sources in order to have their preferred harbour option. Therefore the project as planned in the original scope of works will now not proceed on these islands. As a consequence, a revised scope of works was drawn up which limited the works to the construction of a flexmat boat ramp using the existing channel location on Nanumaga and Niutao only.

219. A workshop was conducted at Nukulaelae on 24-25 April 2016, which included the ADB Pacific Department's project officer and senior environment specialist, 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 financing envelope. It also provided the opportunity for the community representatives to express their concerns and provide some feedback in relation to the project design.

220. A total of 19 people, representing Kaupule, local residents and women's and youth groups, attended the workshop. While the women's group representative expressed their aspiration for a large boat harbour to transfer passengers more safely based on previous dangerous experiences, there was general agreement that a smaller workboat harbour that can be expanded to a larger harbour at a future date would be acceptable as part of a phased approach to the improvement of ship to shore access.

221. The workshop participants agreed on the following:

a. The project site to develop a workboat harbour to be at the south-west end of Nukulaelae's main island which would also improve access to the nearby Community Fishing Centre, was agreed upon at the workshop.

b. The project scope will include, subject to further investigation and fund availability:

- dredging of a new channel,
- constructing a workboat wharf, breakwaters, an access road, transit shed, an emergency shelter, a boat ramp, a mooring buoy, and other necessary facilities; and
- provision of a truck with crane.

7.2 Grievance Redress Mechanism

222. A grievance redress mechanism (GRM) will be established for the project. The GRM will cover social safeguards and has been developed based on traditional approaches to conflict and complaints resolution. The community will be informed of the GRM 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. 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.

223. 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 CSC to raise any issues of social concern as a result of 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 minimise any impacts that may affect project implementation.

224. The process (Table 7.1), developed in conjunction with the PMU, will be used to address the issues and concerns that an affected person (AP) may have. The process is relevant to all subproject sites. The key point of contact for the AP will be 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 according to the GRM.

Table 7.1: Procedures for Resolving Grievances

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

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

226. 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 AP 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. The timing and manner in which it will be resolved will be conveyed to the AP 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.

227. If the complaint is not resolved by the contractor or CSC to the satisfaction of the AP, then the Kaupule will forward the complaint directly to MCT, and with a copy to the Ministry of Home Affairs. 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 AP 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 AP is dismissed, the AP 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.

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

8. ENVIRONMENTAL MANAGEMENT PLAN

229. **General**. The EMP contains a number of 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; (iii) plan for mitigation of impacts (during pre-construction, construction and operation); and, (iv) monitoring. These are explained in detail in the sub-sections below.

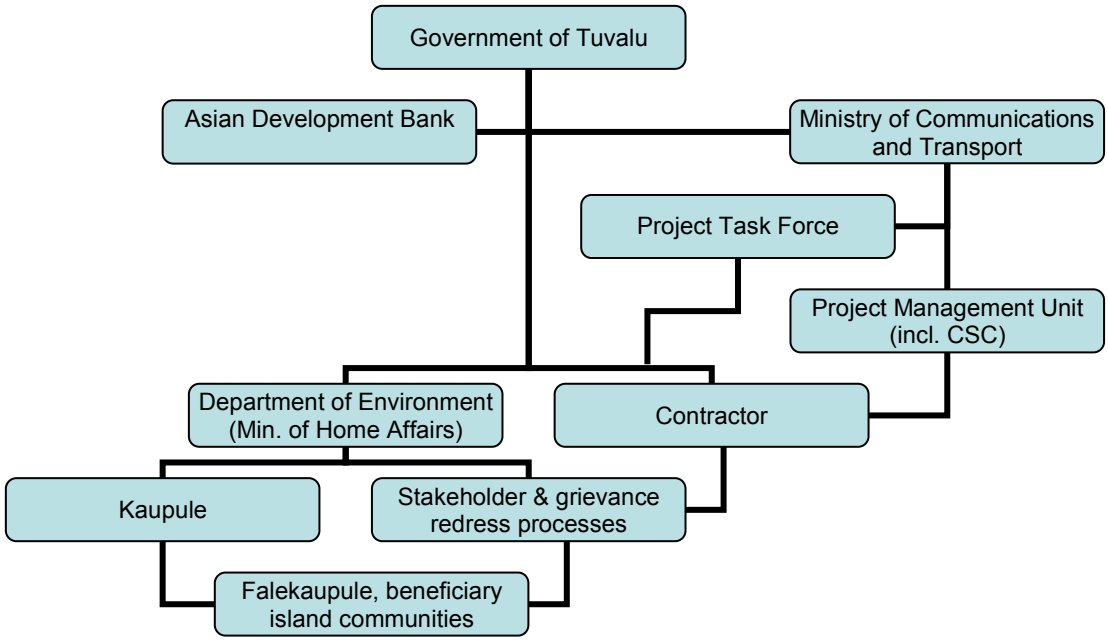
230. An EMP is developed to achieve the following objectives:

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

8.1 Institutional Arrangements for Environmental Management

231. Overall implementation of environmental safeguards including environmental management provisions and requirements is a joint responsibility between the MCT, PMU, CSC, and contractor. The CSC will support the PMU. The overall organizational structure for environmental management for the project is shown in Figure 8.1.

Figure 8.1:- Organizational Structure for Environmental Management



232. **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.

233. 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 CSC to develop and build institutional capacity to undertake the necessary monitoring activities within the project scope. In order to assist with building institutional capacity within the DOE, staff will be encouraged to assist the CSC to carry out specific site monitoring activities to ensure there is compliance with the national environmental legislation as well as specific project requirements.

234. **PDA consultant**. Based on the surveys and detailed design to be undertaken during the PDA stage, the EMP (as part of the IEE) will be updated with additional information and existing information gaps will be filled at this time (including elaborating the baseline). The updated IEE will be 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 updated EMP requirements and provisions for environmental protection and management will be incorporated into the bid documents for the civil works and construction contract. The PDA consultant will also be required to prepare the TOR for the environmental specialist required as part of the contractor's team.

235. **Construction supervision consultant**. 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. The CSC will include a suitably qualified environmental specialist (with appropriate experience in marine ecosystems) to ensure all project activities comply with the safeguard requirements of the country safeguards system and the SPS, this includes:

- prior to works commencing ensure the requirements under Environment Protection Act 2008 (including development application approval) are met;
- 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 environmental specialist 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 environmental specialist to identify appropriate construction methodologies and detailed site-specific mitigations;
- review and approve the contractor's CEMP including site-specific plans and construction methodologies;
- 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; and
- provide inputs on safeguards matters to quarterly progress reports, and prepare semi-annual safeguards monitoring reports and submit to ADB for disclosure.

236. The CSC will also include a site supervisor will be required at the island site 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 PIU and the CSC environmental engineer. The CSC's environmental specialist will work with the supervision

engineer to review and approve the CEMP and to monitor the contractor's implementation of the approved CEMP.

237. 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.

238. **The contractor**. Given the sensitivity of the marine environment, the contractor will be required to recruit an experienced marine environmental specialist 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.

239. The main responsibilities for environmental management at the different stages of the project are summarized in Table 8.1.

Table 8.1: Responsibilities for Environmental Management

Project Stage	Responsible Agency	Responsibilities
PPTA (incl. feasibility studies) and project approval	PPTA consultant	• Prepare IEE including overall EMP • Preliminary design
	ADB	• Review and approval of IEE • Review all feasibility study documentation • Prepare documents package for Board review (incl. requirements in PAM and covenants in grant agreement) • Board approval of project • Assist government to recruit CSC
PDA, surveys, detailed design and	PDA consultant, PMU	• Detailed design • Update IEE (including EMP) filling information gaps and elaborating baseline as required based on surveys and detailed design • Incorporation of IEE mitigation measures into bidding documents and technical specifications • Incl. in above TOR for environmental specialist as part of contractor's team • As required, assist government to recruit CSC
Pre-construction	Contractor	• Recruit suitably qualified environmental specialist • Prepare CEMP including the site-specific plans 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 by PMU) • Identify materials and equipment sources and arrange necessary permits and compliance certificates • Pre-mobilization provide induction on CEMP (incl. OHS) to employees
	PMU/CSC	• Prior to works commencing ensure the requirements under Environment Protection Act 2008 (including development application approval) are met; • 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 environmental specialist proposed as part of the contractor's team;

Project Stage	Responsible Agency	Responsibilities
		• 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 environmental specialist to identify appropriate construction methodologies and detailed site-specific mitigations; • Review and approve the contractor's CEMP
Construction	Contractor	• Implementation of CEMP • Implementation of GRM • Reporting of CEMP and GRM implementation in monthly reports • Implement corrective actions as required 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 data • Submission of quarterly progress reports and semi-annual monitoring reports • Work with contractor environmental specialist for provision of awareness/training to workers and technology transfer to contractor as required
	DOE	• Ensure compliance with government requirements • Review complicated issues arising from the project
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)
	PMU; ADB	• Review contractor's reports and monitoring reports

8.2 Mitigation Plan

240. 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.

241. The EMP matrix (Table 8.2) 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.

8.3 Monitoring and Reporting

242. During the period of project design, monitoring will ensure 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 will be further elaborated and

recorded/benchmarked (for required conditions and parameters as per the monitoring requirements in the EMP table) and will be updated during the PDA stage.

243. 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. Monitoring of environmental impacts is also carried out during the construction and post-construction period. This measures environmental impacts to ensure that critical factors are not exceeded.

244. 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.

245. 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/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.

246. The updated IEE and semi-annual safeguards monitoring reports will be subject to disclosure as per the PCP.

Table 8.2: Environmental Management Plan

ded in Contract (and specific means for mitigation to be identified and priced by Contractor where required)

	IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
CONSTRUCTION PHASE						
	• Ensure relocation as per family requirements and custom	• As set out in due diligence report: resettlement (DDR)	Family, Kaupule	Incl. in DDR	As per DDR	As per DDR
	• Non-invasive surveys that have no impact	• Nil required	Design Consultant/PMU	IIC	• Nil	• Nil
	• 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 refueling of drill 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	Design Consultant/PMU	IIC	• Sediment yield, timing of drilling, refuelling	• Daily during survey • Visual inspection
	• 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.	Design Consultant/PMU	IIC	• Clear demarcation of machine operating zone on reef platform and beach access	• Once • Details on plan
	• Increased size of channel width or harbour area will increase sediment yield during dredging, increase localised tidal currents and impact on longshore coastal processes and sand movement	• Utilise as much of the existing dredged channel and turning bays as possible to minimise the amount of extra dredging	Design Consultant/PMU	IIC	• Extent of existing channel and harbour used in design	• Once • Details on plan

IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
	• Loss of sediment from disposal site • Damage to areas used by community	• Calculate estimated volume to be dredged at each site to assist with the selection of the disposal sites. • Confirm with Kaupule and community the location of any suitable spoil disposal sites • Select sites where vegetation has been modified or are suitable for other community purposes eg playground, road upgrade or in-fill for community uses	Design Consultant/PMU	IIC	• Volume of spoil is calculated, disposal site confirmed	• Once • Details on plan
	• Risk of increased coastal erosion and change in longshore sand movement	• Ensure all measures incorporated in design are implemented	Design Consultant/PMU	IIC	• Review of plans and designs, works implemented	• Visual inspection
	• Potential risk from UXO during any channel dredging operations	• Confirm area is clear of UXO prior to any works commencing	CSC	IIC	• UXO	• Once • Historical records, reports
	• Soil-borne weeds, pests and pathogens become established on the island and reef environment	• Ensure all construction machinery and equipment is steam cleaned of all organic material in source country prior to deployment • Provide an approved phytosanitary certificate and any other documentation required under Tuvalu legislation	CSC	IIC	• Pathogen-free status of equipment and machinery	• Visual, once for each shipment • Phyto-sanitary certificate issued
	• Potential for disturbance within or near community facilities eg church, meeting places, from construction workers and workshop activities • Damage to existing vegetation from site clearance 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 eg graves. Relocate as required, with the appropriate ceremony according to local protocols • Use of existing village accommodation facilities	Contractor CSC	IIC	• 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	• Once • Area clearly marked on ground • Written agreement with Kaupule • CEMP - ongoing

IMPACT MITIGATION				IMPACT MONITORIN	
Environmental Impact	Mitigation Measures	Mitigation Responsibility	Mitigation Cost	Parameter to be monitored	Frequency and means of verification
	• Use separate self-contained accommodation barge • Select sites where vegetation has already been modified or cleared previously			works	
• Hazards and risks to construction workers	• Develop a Construction Health and Safety Plan as part of CEMP to be approved by the Supervision Consultant 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	Construction contractor	IIC	• Health and Safety Plan contains all relevant elements	• Once, Health and Safety Plan presented and approved
• Transmission of STD and HIV/AIDS between and within project sites by workers and villagers • Transmission of highly contagious diseases • Social disruption • Possibility of conflicts or antagonism between residents and Contractor • Children are exposed to sexual exploitation in camps or villages.	• Conduct an HIV/AIDS awareness campaign for affected communities and construction personnel **PRIOR** to mobilization of contractor using suitably qualified NGO or health specialist. • Ensure all construction personnel have medical clearance for any contagious/communicable diseases prior to mobilisation • Confirm Grievance Redress Mechanism and advise community of the process • MOU between villages and contractor with an agreed set of protocols for conduct on the island • Environmental, Health and Safety Officer recruited as part of project	Construction contractor NGO/ consultant	IIC	• Awareness program conducted • Medical clearance certificates • GRM process available for public inspection • MOU between village and contractor • EHS officer on site	• Once, program delivered • As required, all personnel with medical clearance confirmed • Once, GRM in place • Once, MOU signed • Once, EHS on site
• Effects on cultural values	• Identify all historical and cultural sites prior to construction • Advise community of the nature of the works in the vicinity of cultural sites • Ensure due care is taken in any construction activity adjacent to churches and other sites of cultural importance	CSC	PIU	• Any sites identified prior to works	• Once, in conjunction with Kaupule
• Sourcing of materials	• As part of CEMP prepare site-specific plan to address this element including: (i)	Contractor	BOQ - IIC	• Site-specific plan prepared	• Site specific

IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
	• Additional dredging depending on method proposed • Sedimentation (if causeway)	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. We should also require the contractor engage suitable experienced professional for assisting in preparing the CEMP given the sensitive marine environment	CSC		and approved • Approved method implemented	plan approved; • Weekly/monthly (as per plan) during construction
PHASE						
	• Increase in sediment content of tidal waters in channel and reef platform • Fish and marine life affected by increased suspended sediment levels • Potential source of pollution from dredging equipment or barge • Potential for an outbreak of ciguatera • Damage to reef platform from machinery	• Incorporate existing guidelines into contractor Method Statement (see Appendix A) • Limit dredging to areas where the channel floor has already been disturbed and where sediments are coarse and loose • Limit machinery to a 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 the reef platform between tides. • Remove material as it is excavated to reduce the growth of algae and the incidence of ciguatera. • Daily records to be kept of site conditions during each work period • Advise community against fishing or harvest of marine life within 1km of the channel and harbour area during dredging works and for at least 4 weeks after the works have been completed	Construction contractor	IIC	• Method Statement • 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 • Community advice on fishing near working area •	• Once, Method Statement contains existing guidelines • Daily, machinery is operating within defined area and during outgoing tides • Daily, visual inspection of machinery for leaks prior to going onto reef area • Daily, no stockpiles on reef platform, all material removed • Weekly, confirm daily record sheet for weather and sea conditions

IMPACT MITIGATION				IMPACT MONITORIN	
Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
					• Once, notice in public view and Kaupule advised
• Loss of sediment from disposal site • Damage to surrounding land or pulaka pits for sediment loss. • Removal of vegetation required to establish a disposal site.	• Provide bunds around spoil disposal site to reduce sediment movement away from site • No sediment disposal site to be closer than 50m from any pulaka pits • Disposal of dredged material into the sea or lagoon is not permitted • Disposal of dredged material is not permitted along foreshore	Construction contractor	IIC	• Appropriate soil conservation measures implemented • Placement of spoil during dredging	• Daily, visual
• Loss and dispersion of excavated material from foreshore onto reef platform during high tides • Potential for pollution from construction machinery into foreshore environment	• Contractor Method Statement 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 between tides • Plant suitable ground cover vegetation and trees behind seawall • All machinery to be free from visible leaks of hydrocarbons, no refuelling on the foreshore.	Construction contractor	IIC	• Method Statement • Location of excavated material	• Once, Method Statement identifies mitigation measures • Daily, during construction
• Active rill and gully erosion from the land onto to the beach environment from movement of people and machinery resulting in weakening of the fragile land especially at the beach access • Damage to and loss of root mass of foreshore vegetation from human interaction and cyclone damage	<u>Nukulaelae</u> • Limit new area of clearing along foreshore to no more than 20m wide to reduce damage to protective vegetation Nanumaga • Build up the foreshore road embankment with extracted spoil to provide a low broad bund to reduce the flow of runoff from the large open area in the village onto the beach and reduce	Construction contractor	IIC	• Soil conservation measures implemented • Any removal of vegetation within design parameters	• As required during construction • Compliance with design parameters • Vegetation planted along foreshore

IMPACT MITIGATION				IMPACT MONITORIN	
Environmental Impact	Mitigation Measures	Mitigation Responsibility	Mitigation Cost	Parameter to be monitored	Frequency and means of verification
• Sediment laden runoff from large open areas in the village running down beach access track and eroding ramp and other solid structures	the impact of storm surges • Construct a large covered soak pit to divert runoff away from the beach access Niutao • Minor earthworks and drainage to prevent surface water running down slope onto the beach				
• Emission of exhaust from vehicles and machinery	• Maintain construction equipment • Any machinery generating visible smoke is not permitted for construction activities	Construction contractor	IIC	• Exhaust emissions from machinery	• As required, visual
• Increase in levels of dust in and around the construction area, and in villages, schools, health clinics • 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 on sandy areas for any dust suppression • Apply water to access road within 50m 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	Construction contractor	IIC	• Levels of dust during operations • Application of water on access roads during dry dusty weather • Spoil disposal sites compacted when required	• As required, visual
• Contamination of island or reef environment	• Remove all inorganic and solid waste from the island generated as a result of the 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 the production of communal food crops or use as pig food.	Construction contractor	IIC	• Separate solid waste area in use which can be removed on completion of works • Compost area for green and organic waste used or as requested by community	• Weekly, visual

IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
	• Contamination of groundwater • Incidence of water-borne diseases	• 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	Construction contractor	IIC	• Self contained latrines on site and used. • 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
	• Potential hazard to the marine environment • Pollution of groundwater • Safety risk to workers and community	• Hazardous chemicals and hydrocarbons will be stored in secure containers within a secondary containment bund that has 110% greater storage than the largest container, or be retained on the supply barge or ship • Construct lined pits to separate oil and water near workshops to prevent pollution of the shallow groundwater lens • Limit volumes of hydrocarbons to be stored on the island • Develop Hazardous Waste Management Plan to cover hazardous materials and oil storage and spills, including any storage on a supply barge or ship. • Chemicals and hydrocarbons will be stored separately and at least 100m away from the marine environment and any open surface water bodies or lagoons. • Storage of hydrocarbons to be at least 100m away from any buildings or community facility • All spills will be cleaned up immediately as part of emergency response plan • Spill clean-up materials are available at each storage site • All waste hydrocarbons to be removed from the island	Construction contractor	IIC	• Hazardous Waste Management Plan is in place • Storage facility complies with design requirements and monitored for spills and leaks • All hydrocarbon waste removed from island on completion	• Once, visual • Weekly, inspection records and spill register • Once, records and visual inspection

IMPACT MITIGATION				IMPACT MONITORIN	
Environmental Impact	Mitigation Measures	Mitigation Responsibility	Mitigation Cost	Parameter to be monitored	Frequency and means of verification
	• Maintain a register of all hydrocarbon spills				
• Potential pollution of reef environment and groundwater on island	• Use drip trays during refuelling or servicing • Refuelling of machinery is not permitted on the reef platform	Construction contractor	IIC	• Drip trays in use • Refuelling only on land	• Daily, visual
• 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	Construction contractor	IIC	• Construction material removed from site • Site rehabilitation and planting of site has been completed	• Once, visual
• 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	CSC/PIU	• Ballast water is discharged at least 5km from shoreline	• At each shipment, ship records
• Soil-borne weeds, pests and pathogens become established on the island and reef environment	• Locally-sourced supplies of aggregate for concrete are not permissible under the current legislation. • Provide an approved phytosanitary certificate and any other documentation required under Tuvalu legislation prior to dispatch from country of origin	CSC	IIC	• Pathogen-free status of aggregate	• Visual, once for each shipment • Phyto-sanitary certificate issued
• 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	Construction contractor	IIC	• Separate potable water tanks in place at camps	• Once, visual

IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
	• Damage to community property and utilities eg water pipes, rain tanks, power utilities • Damage to private property, rain tanks	• Immediately repair any damage caused to community or private facilities • Pay appropriate compensation to affected parties as determined by the approved Government compensation schedule. • Ongoing community consultation regarding traffic movements	Construction contractor	IIC	• Damage to property during construction • Compensation paid for damage	• As required, visual • Written records of any compensation paid
	• Damage or disturbance to the known graves sites near the site of the land based facilities • Increased soil erosion and sediment loss for the site • Loss of ground cover • Loss of large trees • Loss of habitat and shade	• Clearance work will be limited to clearly defined areas set out by Kaupule • Clearly identify any areas of cultural and spiritual significance prior to clearing work eg graves. Relocate as required, with the appropriate ceremony according to local custom • All contractor personnel to have site induction and be aware of the location and the limits of clearance before work commences on the site • Minimise removal of coconut or other large trees where practicable • No disposal of spoil, vegetation or organic matter into any water body or lagoon environment • No clearance of any vegetation within 50m of the existing foreshore for camp or laydown • No clearance of any vegetation within 20m of the existing foreshore for the transit shed • Minimise footprint of facilities to reduce the area cleared of vegetation • Use former cleared land as a preference and where suitable • Surface water controls where required	Construction contractor	IIC	• Clear identification of all graves sites in the vicinity of the works prior to start of works • Clearance of vegetation for camp and laydown is within design parameters and no closer than 50m from shoreline • Clearance of vegetation for the transit shed area is within design parameters and no closer than 20m from shoreline • Site induction completed	• As required when vegetation clearance is carried out. Measurement of distance from shoreline • Once, site induction records
	• Transmission of STD and HIV/AIDS between and within project sites by workers and villagers • Transmission of highly	• Site induction conducted for all construction personnel at start of construction with the input from Kaupule • Village protocols agreed; worker awareness as part of mobilization i.e. prohibition on	Construction contractor	IIC	• Site induction completed • Local employment	• Register of participants maintained • Register of locals

IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
	contagious diseases • Social disruption	unauthorised people entering camp • Workers to respect village and landowner boundaries, observe codes of conduct and avoid damage to properties and resources • Employ local persons where practicable • Maximise the use of goods and services from local communities, where practicable				employed
	• Impact of increased number of people on vegetation • Impact on soil and subsurface water supply • Pollution and generation of solid waste and sewage from increased number of people and associated	• The use wood as fuel is not permitted • No dumping of solid waste or spoil in or near water bodies • Movement of construction vehicles shall be restricted to the designated path to minimize damage to the reef platform, soil and vegetation.	Construction contractor	IIC	• Movement of construction machinery • Solid waste disposal	• Daily, visual • Solid waste disposal is not near water bodies • Path on reef platform is designated
	• Hazards and risk to construction workers • Accidents to workers and general public resulting from construction activities	• Provide fully stocked first aid stations at each construction site with workers trained in emergency First Aid • Provide appropriate Personal Protection Equipment (PPE) for all construction workers and ensure they are used	Construction contractor	IIC	• First Aid stations fully stocked • Use of PPE	• Weekly, First Aid station contents checked, records kept, items replaced • Daily, PPE is worn as appropriate
	• Health and safety risks to the community from the movement of heavy machinery within or near the village	• Provide driver safety awareness program for all drivers as well as community to reduce the likelihood of vehicle accidents or contact with people, structures, prevent spills of hazardous substances or construction material during transportation to and from the site. • General public is not permitted in high risk areas and where heavy machinery is in operation • Ensure reversing signals are installed on construction vehicles or provide flagmen as required to ensure safe operations	Construction contractor	IIC	• Driver safety awareness program conducted • General public not in active construction zone, barriers in place, hazardous areas marked	• Once, program delivered • Daily, visual during construction

	IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
		• Mark dangerous areas with reflective tape or other effective means to identify hazardous areas during the hours of darkness • Provide safe access around work sites to keep public away from harm. Use safety barriers and fences as required.				
	• Source of waste and general environmental pollution, dust, noise	• Locate all depots and storage yards as far as practicable from villages and community facilities. • Storage of hazardous and bituminous materials to be at least 100m from nearest watercourse and above flood level. • Provide a secure site with a suitably sized containment bund and roof over all hazardous materials and their waste products. • Minimise the need for hazardous material storage on all sites. • Store bulk quantities of fuels on board the supply ship	Construction contractor	IIC	• Location of depots • Hazardous material storage site, appropriate signage	• Once, site preparation • Weekly, records of site inspection
	• Noise in community • Impacts on construction workers	• Construction vehicle exhaust systems and noisy equipment will be maintained to minimise noise • Contractor will develop a work schedule of operations with kapule to identify hours and days of no work due to religious and cultural activities • Limit noisy construction activities to day time hours, i.e. construction activities prohibited between 6pm and 6am • Provide all workers with appropriate protection equipment (ear-muffs etc)	Construction contractor	IIC	• 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
SE						
	• Undercutting of the concrete structures, abutments and piles	• Initiate and implement a periodic maintenance schedule	MCT	MCT	• Periodic maintenance	• Maintenance schedule in

IMPACT MITIGATION				IMPACT MONITORIN	
	Environmental Impact	**Mitigation Measures**	**Mitigation Responsibility**	**Mitigation Cost**	**Parameter to be monitored**	**Frequency and means of verification**
	• Damage to railings, steps, lighting	• 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 of sand, if required			schedule • Repairs carried out in timely manner	place and operational • Once, Repairs completed • Once after each event, sand removed
	• 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	Kaupule / 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

9. CONCLUSION AND RECOMMENDATION

247. The IEE process has identified a range of potential impacts and determined suitable mitigation measures together with a monitoring program. The IEE has found that the wharf and jetty project on Nukulaelae will not cause significant negative environmental impacts on the island reef environment on the basis that the construction of the channel and workboat harbour is not excessive and within the parameters for a small boat harbour as designed. That is, there is minimal excavation and dredging required to accommodate the workboats, prefabricated concrete elements are used for the breakwater and harbour structures, the jetty is raised on pylons out to the wharf and that all dredged material is removed from the channel site for disposal onto land, with no temporary storage within the marine environment.

248. The existing channel on Nukulaelae has been in operation for many years with some improvement works carried out by the Ship to Shore Transport Project in recent years. There have not been any substantial or long-term detrimental environmental impacts that have arisen or become known to the DOE as a result of these channel works. These did not include dredging in the lagoon area in front of the village but was carried out on the outer edge of the reef.

249. The potential negative impacts from the design 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.

250. Potential negative impacts relate mainly to the construction phase and can be managed and brought to acceptable levels through the implementation and effective monitoring of the EMP. The installation of low-profile flexmats from the existing channel on Nanumaga and Niutao will not result in significant environmental impact and is not anticipated to affect coastal processes.

251. Based on the foregoing, the project as proposed for Nukulaelae, Nanumaga and Niutao is Category B according to the ADB's SPS. The project will create site-specific impacts, few of which are irreversible, and which can be readily mitigated through development and implementation of an appropriate EMP.

252. Based on the surveys and detailed design to be undertaken during the PDA stage, the IEE and EMP will be updated with additional information and existing information gaps will be filled at this time (including elaborating the baseline). The updated IEE will be 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.

ANNEX A GENERAL RECOMMENDATIONS FOR MINIMISING IMPACTS OF LAGOON DREDGING IN TUVALU[16]

The following recommendations are intended as a guide to assist the managers of any future dredging operations in lagoons in Tuvalu.

They are based on current understanding in reports and the published scientific literature of the processes causing impact on reef areas. As such, they may be subject to future alteration as scientific understanding progresses.

1. ***Do not dredge during the westerly season***

The prevailing winds during this part of the year would tend to push sediments towards the reef areas of the lagoon. Also, the waters near the reef edge tend to be naturally more turbid during the westerly season due to high winds moving over the lagoon - the addition of further suspended sediment loads during this time may exceed the sediment stress load of the corals, causing them to bleach and die.

2. ***Avoid dredging during the first two months after the westerly season (March and April)***

This allows time for newly arrived juvenile corals and fishes to establish. Recruitment of corals and fishes appears to occur primarily during the latter part of the westerly season.

3. ***Favour dredging during outgoing tides***

Try to organise schedule so that the bulk of dredging occurs during outgoing tides. Dredging during incoming or slack tides tends to accumulate sediments on coral reef areas for longer periods and is likely to cause environmental stress. If dredging must occur during all stages of the tide, carry out dredging during in-coming and slack tides at locations at least 0.5km away from reef areas, moving closer to reefs only during the out-going tides.

4. ***Avoid dredging where winds can blow dredge materials towards reefs***

Patch reefs and reefs immediately adjacent to the dredge are particularly susceptible. If it is necessary that dredging continues at such places and during such times, do so only in small bursts (say, three days) and rest the corals for a week by dredging elsewhere before subjecting them to increased sediment loads again.

5. ***Larger dredging operations should use a dredging system which minimises the spread of suspended sediments***

Two methods can achieve this: (a) Collecting the waste waters and releasing them close to the bottom in pipes; or (b) surrounding the dredge with a "skirt" where some of the suspended sediments will settle. Bottom waters are less disturbed by winds - this combined with a shorter distance for sediments to settle may help to further minimise turbidity effects.

6. ***Dredge where sediments are coarse and loose, rather than where they are fine and cohesive***

Fine sediments harbour more organisms which are food to lagoon fish stocks. Dredging fine sediments can also result in greater water turbidity (cloudiness).

[16] Government of Tuvalu, 2000. Preliminary Environmental Assessment of 6 Development Projects On Vaitupu, Tuvalu. Technical papers (Environment) - #13 (*Abridged and edited)*

7. Dredging near reefs is alright as long as the sediment plume drifts away from the reef

Dredging near reefs will not harm them unless doing so also allows sediments to settle over the reef. If sediments are flushed away (by outgoing tides or favourable winds), dredging near reefs may actually improve the reef community by lowering the lagoon floor adjacent to the reef and reducing the turbidity by natural, wind and current driven re-suspension.

8. Informally monitor reefs most likely to be affected by dredging

If evidence of coral stress appears (e.g. excessive mucus-production, settlement of sediment on coral surfaces, bleaching of corals, or obvious large areas of die-off of parts of corals) stop the dredging for a few days until symptoms disappear. Many corals can repair themselves if the stress is short and allows for recovery time.

Excessive mucus can be recognised as a colourless to white film which covers a coral and may contain sediments. A coral, or part of a coral which is white in colour may be either bleached or recently dead, though note that dead corals become covered in small algae within a few days.

9. Focus dredging in one or a few areas to minimise the amount of reef area damaged

If dredging is spread to many sites around the lagoon, the potential for disruption of lagoon in fauna (the basis of some fish food webs) and damage to reef areas will be more widespread. By concentrating the damage, more areas of the lagoon will remain undisturbed and productive.

10. Focus dredging activities in areas already damaged by other forms of impact

This will help to keep all forms of damage to the reef within as small an area as possible, rather than allowing large areas of the lagoon to become stressed. Dredging in the presence of other stressors (such as pollution, overfishing etc) is likely to cause more damage to the area concerned. If, however, the area being dredged and polluted etc. is small, other areas of reef not subjected to either form of stress will continue to flourish and may supply offspring to damaged reef. We specifically recommend against dredging in areas of moderate to high coral cover.

11. Manage other developments and human activities occurring in the lagoon

Impacts of any one activity may produce little or no effect, but when many stresses are put on the lagoon environment over a large area, the combined effects can be very damaging.

12. Rehabilitate any reefs damaged by dredging operations

Areas of the reef in which corals have been killed may be repaired by attaching coral fragments to the rock. Fragments should be collected nearby by breaking them off a large coral colony. They should be transported in water and transplanted in a similar habitat to which they were found. The coral fragments should be at least 10cm long and be attached using an underwater epoxy cement, preferably into a hole in the rock.

Rehabilitation should not be regarded as a substitute for proper management which tries to avoid or minimise impacts, but as a fail-safe for accidental damage. No information is yet available on whether restored reefs are equivalent to natural ones.

13. Marine Reserves

A permanent marine reserve area could be created and maintained elsewhere to include those habitat types disturbed by the dredging. Such an area would partially compensate for the loss of reef area to dredging. No fishing, collecting or other human damage should be allowed in the reserve - its purpose would be to help ensure the continuation of healthy areas of reef and might help ensure the continuing supply of young reef organisms to all areas of the reef. A small reserve should be at least 1km^2 in size.

ANNEX B GEOTECHNICAL SURVEY

Niue Multibeam Bathymetric and Geotechnical Investigations for Alofi Wharf Development

OCEAN AND ISLANDS PROGRAMME

Sustainable development is an imperative for the Government of Niue. Consequently, the expansion of their harbour facilities is a key priority[1]. With the Ministry of Agriculture Forests and Fisheries, the Government of the Niue Island sought technical assistance from the SPC SOPAC Oceans and Islands programme to provide baseline data, make recommendations for port expansion opportunities through improved understanding of the physical conditions through numerical modelling on and in the vicinity of adjacent coral reef areas.

Plate 1 study site, Niue, Alofi fringing reef – drilling adjacent to Sir Roberts Wharf at low tide. Topographic survey 10th - 24th May 2013.

Multibeam Bathymetry

High-resolution swath mapping, using multibeam echo sounders maps a complete underwater landscape in a fraction of the time of a single-beam, with greater accuracy. Computer-processing of swath-mapping data produces data visualisations rendering complex three-dimensional concepts into simple, informative, colour diagrams for the lay observer.

Proposed new wharf location, Alofi, Niue. Image from Google Earth.

Swath mapping of the sea floor is carried out using sophisticated multibeam echo sounders fitted to a ship or towed at depth. A computer coordinates the large amounts of imaging information with the ship's position and attitude at very close time intervals. With further processing, an image is created that relays in fine detail the morphology of the sea floor and objects present.

Borehole Survey

A Shaw portable diamond drilling system was used with BQ size rod producing a 37 mm diameter rock core. The maximum depth for drilling was limited to the amount of drill pipe which was 5 m. Serious limitations on depth of penetration was due to formations of loose unconsolidated marine sands and coral detritus. The drill unit is shown below.

EQUIPMENT & METHODS

The system used is an R2Sonic multibeam system.

Plate 3: Drilling Borehole –NU 15 on the crest of the fringing reef Alofi.

Drill sites were only accessible at low tide. With each hole we selected hard or solid substrate in which to spud the borehole. In sand or loose unconsolidated or friable formations the drill pipe would tend to bind and the drill rig did not have sufficient torque to rotate the pipe.

Borehole samples were mostly solid core with limited sample collection from the drill washout circulation. Other physical attributes noted during the drilling phase included drilling speed, pressure, and drill rod behaviour. In broken ground of varying hardness the drill unit would bounce. In homogenous material of medium hardness such as coral the drill easy penetrated the material producing good core as shown for Plate 4.

[1] Reference report for this work is found in "Niue Port Study by SMEC Australia Pty Ltd March 2011 for FFA".

For more information contact the SPC/SOPAC Ocean and Islands Programme Robert Smith:roberts@spc.int, 3381377, *June 2013*

Niue Multibeam Bathymetric and Geotechnical Investigations for Alofi Wharf Development

OCEAN AND ISLANDS PROGRAMME

The topographic data collected consists of spot heights considered best to represent the topography of the fringing reef, collected with reference to MSL datum for Niue and based on the primary control at Tomb Point, requiring low tide and good weather. Diagram 1 is to be appended with the multibeam bathymetry in Diagram 2, providing base line data for building a numerical model. A "white zone" in Diagram 1 is an area difficult to obtain elevation points, representing the zone of wave break on the reef crest. Interpolation of slope gradient will be necessary to complete model in this area.

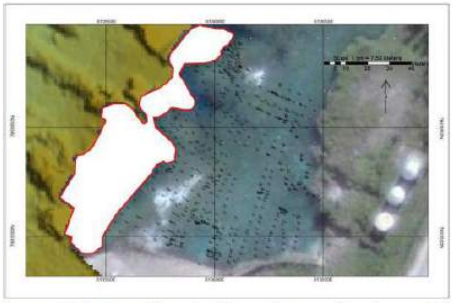


Diagram 1: Topographic elevation points on fringing reef flat adjacent to project site. Back drop from Google Earth imagery.

Multibeam Bathymetry

The final bathymetry is presented against a backdrop of Chart NZ845 and corrected to chart datum based on tide predicted tides. A large scale map is to be compiled using satellite imagery from Google Earth as a backdrop.

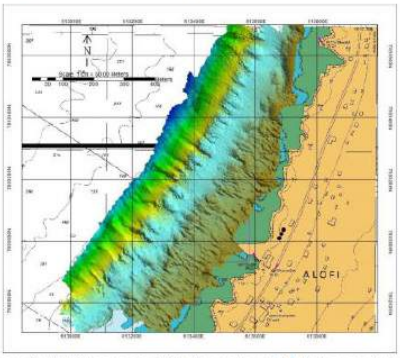
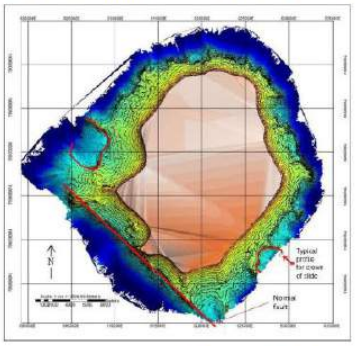


Diagram 2: Multibeam geotif bathymetry of Alofi fore reef slope.

Mapping this configuration was difficult with further complications of noise generated by fish and in the near shore with breaking waves on the fringing reef.

Geology and Coastal Geomorphology Alofi

Niue's bathymetry indicates the island to be a classic example of a carbonate platform that has as its foundation as a volcanic sea mountain. Through geologic time, tectonic forces and sea level changes have permitted reef formation and growth to form what is today an up lifted coral atoll.



Sketch map illustrating some of the morphological features revealed in the deep water multibeam bathymetry.

The present topography of Niue closely resembles a coral atoll that has, over time become emerged. As a consequence, the Niuean coastline is marked by sea cliffs with a narrow fringing reef. At Alofi, a paleo channel that once linked the now perched inner lagoon at about 42 m above MSL through a barrier reef can be traced to link up with a natural passage in the present day fringing reef that has now been artificially widened and maintained to allow vessel traffic to dock at Sir Roberts wharf at Alofi.

Borehole data

A Shaw portable diamond drilling system was used with BQ size rod producing a 37 mm diameter rock core. The maximum depth for drilling is currently limited to 5 m, based on the amount of drill pipe stock for the system. A limitation on depth of penetration was attributed to friable formations and/or loose unconsolidated marine sands and coral detritus. On average, the boreholes took 2 to 3 hours and had to be drilled between 2 and 3 hours either side of low tide. Carbonate rock descriptions are based tentatively on DunHam, 1960 classification for depositional texture. Core fit terminology relates to how sections of the core fit together once extruded from the core barrel. There are three basic terms, for core fitness; good fit, implying break surface mesh or fit together very neatly; poor fit surface, having some mating resemblance; and no fit, if the core is jammed in barrel and requires external force to remove it or the horizon is fractured or friable where the core breaks up as rubble.

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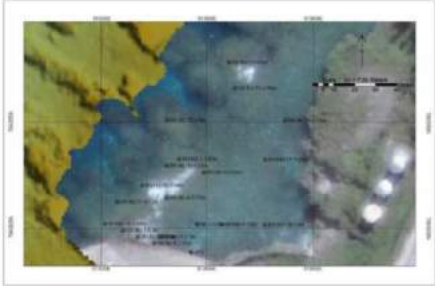
Niue Multibeam Bathymetric and Geotechnical Investigations for Alofi Wharf Development

OCEAN AND ISLANDS PROGRAMME



Borehole location map with Backdrop imagery from Google Earth.

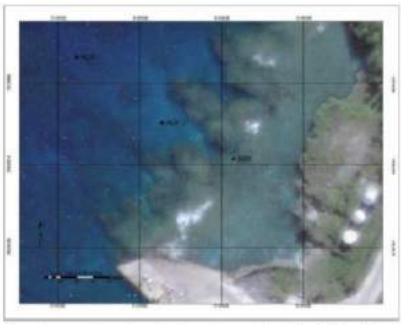
A total of 20 holes were drilled for a total core length of 62 m. Core recovery was excellent with near 100 % for all holes.

Tidal Corrections

Bathymetry data collected was reduced to sounding datum, using tidal data collected by remote water level recorder with vertical heights recorded, initially referenced to the HI-178 sounding datum calculated to be -0.305 below MSL.

Oceanographic and weather data

Apart from the water level wave gauge deployed on the reef, two Aquadop current and wave gauges were deployed on a transit line that was centred on the proposed boat channels in water depth of 6 and 14 m respectively.



Location of current and water level recorders Alofi Wharf.

These data sets are to be further processed and included in the modelling process. Sample data from the RBR water level recorder located within the fringing reef is shown in the below diagram. Complete data sets were also recovered from the offshore aquadop meters. A weather station located in the wharf area adjacent to the winch at Alofi wharf was successful with a full data set retrieved.

Water level and wave data as recorded on the fringing reef

Conclusion

The multibeam bathymetry revealed a complex offshore morphology and fore reef slope in the Alofi area. The detail in the bathymetry data set will contribute well to the modelling process. The topographic data collected for the fringing reef elevation at the project site complemented the offshore data. There was however, a no-data area "white zone", defined as the wave break area on the seaward edge of the fringing reef. Good weather conditions allowed mapping to reduce the overall width to an average width of 25 m. Nineteen boreholes were drilled, producing 62 m of quality rock core. Boreholes ranged from 1 and 5 m in depth, an average of 3m. Oceanographic and weather data from the instruments deployed were successfully retrieved.

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