



# Initial Environmental Examination

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Project Number: 46453  
May 2016

Proposed Loan and Administration of Grant  
Cook Islands: Renewable Energy Sector Project

Prepared by the Ministry of Finance and Economic Management, Government of Cook Islands for the Asian Development Bank.

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## CURRENCY EQUIVALENTS

(as of 22 March 2016)

Currency Unit = New Zealand Dollar (NZ\$)

NZ\$1.00 = US\$ 0.67

US\$1.00 = NZ\$ 1.48

## ABBREVIATIONS

ADB	-	Asian Development Bank
AP	-	Affected Person
CEMP	-	Construction Environmental Management Plan
CIBD	-	Cook Islands Biodiversity Database
CIIC	-	Cook Islands Investment Corporation
CIREC	-	Cook Islands Renewable Energy Chart
CIRESP	-	Cook Islands Renewable Energy Sector Project
EA	-	Executing Agency
EARF	-	Environment Assessment and Review Framework
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EPA	-	Environmental Protection Authority
ESD	-	Environmental Significance Declaration
GDP	-	Gross Domestic Product
GEF	-	Global Environment Fund
GRM	-	Grievance Redress Mechanism
GWh	-	Gigawatt Hour
HV	-	High Voltage
IA	-	Implementing Agency
IEA	-	Island Environmental Authority
IEE	-	Initial Environmental Examination
IEE	-	International Environmental Expert
IUCN	-	International Union for Conservation of Nature
LV	-	Low Voltage
MFEM	-	Ministry of Finance and Economic Management
MW	-	Megawatt
NES	-	National Environmental Service
OPM	-	Office of the Prime Minister
POE	-	Project Owners Engineer
PPE	-	Personal Protective Equipment
PPTA	-	Project Preparatory Technical Assistance
PSG	-	Project Steering Group
PV	-	Photovoltaic
REDD	-	Renewable Energy Development Division (Office of the Prime Minister)
SPS	-	<i>ADB Safeguard Policy Statement 2009</i>
TAU	-	Te Aponga Uira

## NOTES

- (i) The fiscal year (FY) of the Government of Cook Islands ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2013 ends on 30 June 2013.

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## Executive summary

1. **Introduction:** The Cook Islands is heavily reliant on imported fossil fuels for electricity generation. The Government of the Cook Islands is implementing The Cook Islands Renewable Electricity Chart (CIREC) which aims to supply 100% of the Cook Islands electricity generation from renewable sources by 2020. The Asian Development Bank (ADB) is supporting the Government of the Cook Islands to implement the CIREC through the Cook Islands Renewable Energy Sector Project (CIRESPP) (the Project) which aims to provide a secure, sustainable, and environmentally sound source of electricity for private and commercial consumers.
2. The Project has two outputs; i) to construct solar photovoltaic (PV) power and/or energy storage systems on Mangaia, Mitiaro, Mauke and Atiu (Phase 1) and Rarotonga and Aitutaki (Phase 2) ii) to provide institutional strengthening to the Cook Islands Renewable Energy Development Division (REDD).
3. The Phase 1 subprojects will install a total of 1,246 kW of solar PV systems with battery storage. The systems at Mitiaro and Mauke will include new high speed diesel generators whilst the more modern existing diesel power stations on Mangaia and Atiu will be retained. The upgrade of the electricity distribution system is also included for all but the Atiu subproject.
4. The Phase 2 subprojects include the installation an additional 1,000 kW solar PV system of Aitutaki together with a new 300 kW high speed diesel and battery storage and the installation of a 1 MW, 4 MWh Battery Energy Storage System (BESS) on Rarotonga.
5. Table 1 (over page) provides a summary of the key features at each subproject site.
6. **Initial Environmental Examination:** The CIRESPP is classified as a Category B project. The ADB provided a project preparatory technical assistance (PPTA) which included the preparation of an Initial Environmental Examination (IEE) that included the Mangaia, Mitiaro and Mauke projects (initial Phase 1 projects). During project implementation it was decided to also include Atiu in Phase 1 and the IEE was updated. Development of the Phase 2 projects has commenced and this IEE presents updates to include the environmental impacts and risks associated with the Aitutaki and Rarotonga subprojects.
7. **Administrative, Policy and Legal Framework:** The subprojects will comply with the requirements of the Cook Islands *Environment Act 2003*. With the exception of Mangaia which is not subject to the *Environment Act 2003* the subprojects will require a permit authorised by the Island Environmental Authority but administered through the Cook Islands National Environment Service (NES). The NES advised that Mangaia would be subject to the same assessment process. The subprojects must also comply with the requirements of ADBs *Safeguard Policy Statement 2009* (SPS).
8. This IEE is intended to meet the requirements of a Category B project as described in the SPS. The NES have formally requested the preparation of an Environmental Impact Assessment (EIA) under the *Environment Act 2003* for each of the four subprojects. This IEE does not therefore seek to comply with the EIA requirements of the *Environment Act 2003*.

Table 1: Subproject Features

Feature	Atiu	Mitiaro	Mauke	Mangaia	Aitutaki	Rarotonga	Total
Geographical Location	116 nautical miles NE of Rarotonga	142 nautical miles NE of Rarotonga	150 nautical miles NE of Rarotonga	110 nautical miles ESE of Rarotonga	140 nautical miles N of Rarotonga	-	
Land Area (km <sup>2</sup> )	26.9	22.3	18.4	51.8	18.1	67.2	204.7
Island Population <sup>1</sup>	480	189	307	572	2038	13,095	16,681
Households <sup>2</sup>	161	76	106	195	-	-	-
Project Intervention	Installation of 399 kW solar power plant with gel-acid battery storage plus power station upgrade with advanced control system connected to distribution system (being upgraded under separate project).	Installation of 157 kW solar power plant with gel-acid battery storage plus new power station with new diesel generators and new control system plus upgrade of existing distribution system.	Installation of 228 kW solar power plant with gel-acid battery storage plus new power station with diesel generators and new control system plus upgrade of existing distribution system.	Installation of 462 kW solar power plant with gel-acid battery storage plus new control system for power station.	Installation of 1000 kW solar PV array, new 300kW high speed diesel generator in existing power house, containerised battery storage system plus upgrade of switchgear and control.	Installation of a 1MW, 4MWh Battery Energy Storage System (BESS) and connection to the Rarotonga Grid.	
Ownership of Land to Be Acquired	Privately owned native freehold land.	Privately owned native customary land.	Privately owned native freehold land.	Privately owned native customary land.	Privately owned native freehold land.	Government of the Cook Islands	
Location of Site for Solar Installation	Vaitamina 556, former agricultural land approximately 140 m south of existing power station in Teenui village.	Teramake Section 8 and Tueru Section 9, <i>makatea</i> 230 m inland from existing power station behind Mangarei village.	Tengaru 6B, agricultural land in Areora village adjacent to Public Works shed and Agriculture Research buildings.	Aratane Section 35 Puna Keia, agricultural land and <i>makatea</i> 150 m SSE of existing power plant on E side of Aremauku Road.	10 parcels of land located approximately 1.2 km east of the village of Arutanga at the site of the existing power station	The Tau owned airport solar PV array located at the Rarotonga Airport in Avarua District just to the SW of the terminal building.	
Area to Be Acquired for	15,000 est.	4,837	8,400	12,162	38,711	-	79,102

<sup>1</sup> 2011 Census.

<sup>2</sup> Active residential electricity accounts.

<b>Feature</b>	<b>Atiu</b>	<b>Mitiaro</b>	<b>Mauke</b>	<b>Mangaia</b>	<b>Aitutaki</b>	<b>Rarotonga</b>	<b>Total</b>
Solar Site m <sup>2</sup> (ha)	(1.5)	(0.48)	(0.84)	(1.21)	(3.87)		(7.91)
Land Use	Unused – previous agricultural use	Unused	Unused – previous agricultural use	Unused	Unused	Used to house TAU's airport solar PV array	
Vegetation	Vegetated with predominately introduced species	Vegetated with native and introduced species	Predominately cleared with sparse introduced species	Vegetated with native and introduced species	Vegetated almost entirely with introduced species	Cleared and sealed. No vegetation	
Threatened species significantly impacted <sup>3</sup>	None	None	None	None	None	None	
Terrain	Gently eastward sloping comprised of volcanic soils	Flat, makatea	Flat, volcanic soils	Flat, makatea	Flat, volcanic soils	Flat, existing hardstand	

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<sup>3</sup> Species listed on the International Union for Conservation of Nature Red List or Listed as Endangered on the Cook Islands Biodiversity Database.

9. **Environmental Impacts:** All the subproject sites are located in modified environments and, although the subprojects will result in the clearing of up to 52,000 (5.2 ha) of vegetation in total (not all land acquired will be cleared), their construction will not result in a significant long term adverse environmental impact.
10. Flora and fauna surveys were undertaken at all subproject sites (except Rarotonga where no vegetation clearing is required). The survey results demonstrate that clearing of the sites selected for the subprojects will not result in the significant loss of any native vegetation or have significant negative impacts on any species recorded as Endangered on the Cook Islands Biodiversity Database (CIBD) or listed on the International Union for the Conservation of Nature (IUCN) Red List. Consultation with the mayors of each Island Council found that no sites of cultural significance (marae) or historical significance are associated with the subproject sites.
11. Landowners and local communities were consulted during site selection. Landowners at the subproject sites agree, in principle, to transfer and use of the sites to the Government of the Cook Islands for the project purpose subject to agreement of a formal land use agreement. The site selected on Aitutaki is already leased by the Cook Islands Investment Corporation (CIIC) on behalf the Government of the Cook Islands and the site selected on Rarotonga is owned by the Government of the Cook Islands and already leased to Te Aponga Uira (TAU).
12. Potential construction environmental impacts, including dust and noise generation, waste management (including hazardous materials), erosion control, clearing, the introduction of invasive species and health and safety management, can be avoided or controlled to acceptable levels with the implementation of the mitigation measures described in the Environmental Management Plan (EMP).
13. There are few potential operational environmental impacts. Batteries, inverters and solar PV modules that require replacement during the operational life of the project and/or decommissioning will be transported to Rarotonga for recycling or disposal.
14. **Project Benefits:** The Project will provide a secure, sustainable and environmentally sound source of electricity to each of the Phase 1 subproject islands. It will provide approximately 30% renewable energy on Aitutaki and increase the limit of renewable generation on the Rarotonga grid from 4.2 MW to 6.2 MW. The Project will provide a significant contribution toward the Government of the Cook Islands meeting its goal of supplying 100% of the Cook Islands electricity generation from renewable sources by 2020.
15. The implementation of the subprojects will result in the displacement of approximately 4.05 GWh of diesel generated electricity per year which equates to a reduction in annual diesel usage of approximately 1.26 million litres. The displacement of 4.05 GWh of electricity avoids the emission of approximately 2,793 tons of Carbon Dioxide Equivalents per year.
16. **Implementation Arrangements:** The Ministry of Finance and Economic Management (MFEM) is the executing agency (EA) and Te Aponga Uira (TAU) and the Renewable Energy Development Division (REDD) is the implementation agency (IA). The IA will be supported by the Project Owners Engineer (POE) for the design, construction and commissioning of the subprojects.
17. **Consultations and Information Disclosure:** Local communities and community leaders from subproject islands were consulted during the PPTA and again during project inception and are aware of and fully support the proposed project. Information was provided to the local communities on the scale and scope of the Project, the expected impacts and the proposed mitigation measures. Recommendations and suggestions received during consultations were incorporated in the design of the project and in the project IEE and EMP.

18. **Grievance Redress Mechanism:** A Grievance Redress Mechanism (GRM) is proposed for the Project to receive, evaluate and facilitate the resolution of affected people's concerns, complaints and grievances about the environmental and social performance of the Project. The GRM contains methods to promptly address affected people's concerns and complaints, using an understandable, transparent and culturally appropriate process. The mechanism does not impede access to the Cook Islands' judicial or administrative remedies.
19. **Environmental Management Plan:** An EMP has been prepared for the subprojects and has been updated based on the design work undertaken during project implementation. The IAs (REDD) and POE will be responsible for implementing the EMP at all subproject sites. The EMP identifies potential preconstruction, construction, operation and decommissioning environmental and social impacts associated with the subprojects. The EMP will form part of the construction contract documents and the contractor will be required to prepare a site specific construction environmental management plan (CEMP) based on the approved IEE's EMP. The contractor will submit the CEMP to the POE for approval prior to commencement of works.

## 1. INTRODUCTION

### 1.1 Project Background and Rational

1. The Cook Islands is a Pacific island country divided into two island groups—Northern and Southern—with a total resident population of 14,947 people (2011 census). The Northern Group consists of six low-lying, sparsely populated, coral atolls while the Southern Group consists of nine high islands mainly of volcanic origin and several smaller atolls. Approximately 74% of the country's population lives on the largest island, Rarotonga.
2. The Cook Islands is heavily reliant on imported fossil fuels for electricity generation. In 2012 approximately 12.2 million litres of diesel was imported in to the Cook Islands of which approximately 7.2 million litres was used for electricity generation. The cost of imported fuels was \$58 million or approximately 28% of the Cook Islands gross domestic product (GDP) and electricity costs are currently amongst the highest in the Pacific. Like other Pacific island countries, the Cook Islands are highly vulnerable to fluctuating oil prices, affecting the affordability of food, goods, electricity, and transportation. Its dependency on imported fossil fuels consequently affects the economic growth of the country.
3. The total installed power generation capacity in the Cook Islands is 11.75 megawatt (MW) with a distribution network comprising 80 kilometres (km) of 11 kilovolt (kV) underground cables and 200 km of 0.415 kV low voltage distribution lines. The power system generated 33.8 gigawatt-hour (GWh) of electricity in 2012. On the major islands of Rarotonga and Aitutaki, nearly 99% of all households are grid connected, 8% had additional domestic solar photovoltaic (PV) systems, and 3% also used small diesel generators. In the outer islands, about 60% of households are grid connected, and 43% have solar PV systems.
4. The Government of the Cook Islands is implementing the Cook Islands Renewable Electricity Chart (CIREC) which aims to supply one hundred per cent of the Cook Islands electricity generation from renewable sources by 2020. The CIREC together with the CIREC Implementation Plan sets out the planned approach to replacing existing electricity generation with renewable sources on each island. Substantial progress towards meeting the plan has already been achieved, with six of the 12 inhabited islands (the Northern Group) having renewable electricity generation systems installed and operating in 2014/15.
5. The Asian Development Bank (ADB) is supporting the Government of the Cook Islands to implement the CIREC. The Cook Islands Renewable Energy Sector Project (CIRESPP) (ABD Project Number 46453-002) (the Project) aims to assist the Cook Islands Governments efforts to reduce the country's heavy reliance on imported fossil fuels for power generation by providing a secure, sustainable, and environmentally sound source of electricity for private and commercial consumers. The Project is funded by a loan from the Asian Development Bank (ADB) and grants from the European Union and Global Environment Fund (GEF) to be administered by ADB.
6. The project will be carried out in the islands of the Southern Group including Rarotonga, Aitutaki, Atiu, Mitiaro, Mauke, and Mangaia. Figure 1.1, below, presents a map showing the locations of the six islands included in the Project.



Figure 1.1: Project Location

7. The Project will have two outputs:

- (i) **Solar Photovoltaic Power System Development.** In Phase 1, the project will construct solar PV power systems with a total installed capacity of approximately 1.2 MW on Mangaia, Mitiaro, Mauke and Atiu. The project will also install advanced secondary battery storage and control systems (all islands), new diesel backup generators (Mauke and Mitiaro), and new power stations (Mauke and Mitiaro), and will rehabilitate the distribution networks on Mitiaro, Mauke, and Mangaia. In Phase 2, the project will install a solar PV power system, advanced secondary battery storage and control systems and a new diesel backup generator on Aitutaki, and a Battery Energy Storage System (BESS) on Rarotonga.
- (ii) **Institutional Strengthening and Project Management Support.** The project will provide institutional strengthening to the Renewable Energy Development Division (REDD) for (i) developing the energy efficiency policy implementation plan including an energy audit and monitoring scheme to enhance demand side energy efficiency management practices for targeted major electricity consumer groups; (ii) developing capacity for renewable energy technology assessment and appropriate off-take tariff setting for power purchase agreements for private sector funded projects, and (iii) updating the CIREC Implementation Plan through refining electricity load demand up to 2020, renewable technology choice, and least cost investment plan. The project will also provide project management support to the Implementing Agencies (IA) (see below) to help implement Phase 1 and Phase 2 subprojects.

## 1.2 Report Purpose and Scope

8. The ADB provided a project preparatory technical assistance (PPTA) to the Cook Islands Government to develop the CIRES. The PPTA included (i) solar resource assessment; (ii) screening and site selection for solar power plants; (iii) preparation of conceptual feasibility studies for three selected subprojects (Mangaia, Mitiaro and Mauke) including the preparation of an IEE.
9. During project implementation it was decided to include Atiu in Phase 1. In accordance with the Project's Environmental Assessment and Review Framework (EARF) the PPTA IEE was updated to include Atiu and design undertaken for Phase 1 subprojects during implementation.
10. In accordance with the EARF, due diligence for Phase 2 subprojects will be completed in parallel with the administration of Phase 1 subprojects. Due diligence has been completed for Aitutaki and Rarotonga and the purpose of this IEE is to present the environmental impacts and risk associated with the Phase 2 subprojects.
11. The objectives of the IEE are to:
  - (i) Establish the baseline environmental and social values associated with the subproject sites.
  - (ii) Identify the presence of Critical Habitat (as defined in ADB Safeguard Policy Statement 2009 (SPS)) potentially impacted by the subprojects.
  - (iii) Assess the potential environmental and social impacts (positive and negative) of the construction and operation of the subprojects.
  - (iv) Provide avoidance, mitigation and management measures for the identified impacts.
  - (v) Ensure that all statutory requirements for the project such as applicable legislation and regulations, permits required (if any) and policies have been considered.
  - (vi) Document stakeholder consultation undertaken for the Project.
12. The IEE adheres to the requirements of the ADB SPS.
13. The Cook Islands National Environmental Service (NES) have formally requested the preparation of an environmental impact assessment (EIA) under the Cook Islands *Environment Act 2003* for four of subprojects included in this IEE and is expected to do likewise for Aitutaki (refer below). Whilst it is recognised that much of the information is common, this IEE does not seek to meet the requirements of an EIA under the *Environment Act 2003*.

## 1.3 Methods

14. The IEE included:
  - (i) Literature and database review: a review of existing reports and information available on the subproject sites including documents prepared for as part of the PPTA, records of stakeholder consultation, the Cook Islands Biodiversity Database (CIBD) and the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (Version 2014.3).
  - (ii) Stakeholder consultation: stakeholder consultation was undertaken during the PPTA phase, continued for the IEE and is planned to continue for the duration of the project. Stakeholders consulted for the IEE included the Cook Islands NES, Cook Islands Natural Heritage Trust, Island Councils, Island Environmental Officers, Te Aponga Uira (TAU), staff of the existing power stations and landowners.

- (iii) Site visits: site visits were undertaken to all sub project sites during 2013 and again in May and June of 2015. The sites of the proposed solar PV arrays and power stations were inspected. Other project elements were also inspected including existing power stations, substations that will require minor upgrade, the wharf and access roads to the proposed sites and potential sites for sourcing construction materials.
  - (iv) Ecological assessment: flora and fauna surveys were completed at all sites in May 2015 (Phase 1) and February 2016 (Phase 2 - except on Rarotonga where no vegetation clearance is required). The surveys were undertaken to identify the presence of listed threatened flora species and potential habitat for threatened fauna species (CIBD or IUCN) and species considered to have medicinal or economic value.
  - (v) Prepare IEE: the updated IEE report describes the environmental and social risks identified through the literature review, stakeholder consultation and site visits and provides avoidance, mitigation and management measures for the subprojects in accordance with ADB SPS and Cook Islands statutory requirements. The IEE contains an environmental management plan (EMP) outlining mitigation and management measures and a monitoring plan to ensure critical environmental parameters are monitored during the implementation of the project.
15. The scope of the IEE is limited to the subproject sites (including solar PV array, solar powerhouse and/or new power station/BESS (if applicable) and associated infrastructure, such as substations, requiring upgrading.
  16. The IEE will be made publically available through the ADBs website and locally at the offices of REDD, TAU and the subproject Island Councils.

#### 1.4 Structure of the Assessment

17. In accordance with the SPS this IEE has the following contents:
  - *Executive Summary*: This section briefly describes the critical facts, significant findings, and recommended actions.
  - *Introduction*: Describes the overview of the project, environmental requirements, objectives and scope of the study, approach, and methodology.
  - *Administrative, Policy and Legal Framework*: Discusses the national and local legal and institutional framework within which the environmental assessment is carried out.
  - *Project Description*: Provides an overview of the proposed project, its objectives and major components including maps showing the project's location.
  - *Description of the Existing Environment*: Describes the relevant physical, biological, and socioeconomic conditions within the target islands and specific to the project sites.
  - *Anticipated Environmental Impacts and Mitigation Measures*: Provides an assessment of the associated environmental impacts and corresponding mitigation measures. The environmental impacts and mitigation measures including the environmental monitoring are summarized in the environmental management plan and environmental monitoring plan.
  - *Analysis of Alternatives*: Examines the alternatives to proposed project sites to ensure avoidance of significant adverse environmental impacts.
  - *Consultation and Information Disclosure*: Describes the process of engaging stakeholders and information disclosure. This section summarizes the comments and concerns of affected persons.

- *Grievance Redress Mechanism*: This section describes the grievance redress framework and setting out the timeframe and mechanisms for resolving potential complaints and/or issues from affected persons.
- *Environmental Management Plan*: Describes the set of mitigation and management measures to be taken for each identified environmental impact during project design, construction, and operation. This section also includes monitoring and reporting procedure as well as institutional implementation arrangements.
- *Conclusion and Recommendation*.

## 2. ADMINISTRATIVE, POLICY AND LEGAL FRAMEWORK

### 2.1 Administrative Framework

18. **Executing and implementing agencies**: The Ministry of Finance and Economic Management (MFEM) is the executing agency (EA) and will be responsible for the overall environmental management of the project including implementation of mitigation measures, environmental reporting and obtaining necessary approvals. MFEM will submit environmental reports to the ADB. TAU and the REDD are the project IAs. A Project Steering Group (PSG) has been established for the CIRESPP which is comprised of representatives of ADB, REDD, Office of Prime Minister (OPM), MFEM, TAU, The Cook Islands Investment Corporation (CIIC) and New Zealand High Commission. A Project Management Unit (PMU) has also been established.
19. **Environmental agencies**: The NES or Tu'anga Taporoporo is the principle national environmental agency in the Cook Islands. The role of NES is to protect the environment (including people, communities, land, water, and native species), promote sustainable development, and prevent and control pollution. The Advisory and Compliance Division of the NES is responsible for administering the *Environmental Act 2003* including receiving and assessing environmental impact assessments and issuing permits for development. The subproject Island Environmental Authority's (IEAs) are the determining authority's for permit applications on the subproject islands.
20. **Other agencies**: CIIC provides support to the IAs in project implementation and will be the owner of the assets generated by the project. Importantly for the project the CIIC will be responsible for acquiring land on the subproject sites in accordance with the *Cook Islands Act 1915*.
21. The Ministry of Transport – The Energy Division is responsible for administering the *Energy Regulations 2006* which govern the licensing, technical and safety requirements for power generation, distribution and consumer premise wiring. The project will result in changes to the generation and distribution (except Atiu) of electricity on the subproject islands and will require good coordination with the Energy Division.
22. The Ministry of Infrastructure and Planning is responsible for implementing the Cook Islands National Building Code. It also regulates construction of building and the issuance of building permits. The construction of the project will require consultation with this ministry.
23. **ADB**: As project financing agency ADB will be responsible for approval of project documents. In respect of safeguards, this includes approval of the IEE, and making sure that there are sufficient loan agreements and requirements in the Project Administration Manual covering updating of the IEE, integration of the EMP into bid and contract documents, monitoring undertaken and reported, and disclosure of environmental monitoring reports.

## 2.2 Legal and Policy Framework

24. The implementation of the Project will be governed by the environmental laws and regulations of the Cook Islands and the safeguard policies of the ADB.

### 2.2.1 Cook Islands' Environmental Laws and Regulations

25. **Environment Act 2003:** The *Environment Act 2003* was established to provide for the protection, conservation, and management of the environment in a sustainable manner. It provides for the establishment of both the NES and the IEAs and establishes their roles and functions. The Act does not apply on Mangaia, however, the NES have advised that the environmental assessment process as set out under the Act should still be followed.
26. Under the Part 5 of the Act *any activity which is likely to cause significant environmental impacts* shall require a permit issued by the permitting authority and that application for a permit *shall be submitted to the National Environment Service (NES) and include an environmental impact assessment*. Part 5 of the Act also outlines the information expected in the environmental impact assessment, public consultation and the process for the determining the permit application and the appeal of decisions.
27. **Environment (Atiu and Takutea) Regulations 2008:** The Regulations are made under Section 70 of the *Environment Act 2003* and provide for the establishment of specific regulations to manage and conserve the islands ecosystems. Relevant to the Project Part 2 of the Regulation provides for protection of Unga Kaveu, specific species of birds and native trees and shrubs, establishes protected areas and prescribes their management and prohibits removal or damage to artefacts and archaeological material. Part 3 provides for the establishment of Ra'ui over any land. Part 4 deals with environmental health including establishment of water reserves and control of construction within reserves and management of waste including hazardous waste.
28. **Environment (Mitiaro) Regulations 2008:** The Regulations are made under Section 70 of the *Environment Act 2003* and provide for the establishment of specific regulations to manage the environment on Mitiaro. Relevant to the Project Part 1 of the regulations provides for the prohibition of the import of animals, management of the importation of plants, protection of the Iniao tree, protection of specific species of birds, management of invasive species, establishment and management of protected areas and the prohibition of the removal or damage of artefacts or archaeological material. Part 2 provides for the establishment of Ra'ui over any land and Part 4 deals with environmental health including water supply, waste management and hazardous materials.

### 2.2.2 Environmental Assessment Process in Cook Islands

29. The environmental assessment process in the Cook Islands includes the following steps:
- (i) *Environmental Significance Declaration (ESD):* Any building or development that may have a significant effect on the environment or that is in a specific area of concern is required to submit an ESD to the NES. The ESD is assessed by the NES and Island Environmental Officer (IEO) to determine whether the project can be approved based on the ESD or will require an Engineering report and/or EIA. It is usual for the applicant to have a site meeting with the IEO to discuss the project.
  - (ii) *EIA Terms of Reference:* Where an EIA is required the NES will notify the applicant in writing and prepare Terms of Reference for the EIA that

outlines the information to be provided in the EIA and the key areas of concern.

- (iii) *Preparation of the EIA*: The applicant must engage a qualified environmental consultant (register maintained by the NES) to prepare the EIA.
  - (iv) *Public consultation*: The completed EIA is submitted to the NES who make the EIA publically available for a period of 30 days. Anyone may make a written submission for or against the EIA during the consultation period. All submissions are provided to the applicant who, if necessary, responds by amending the EIA.
  - (v) *NES assessment*: The NES assesses the amended EIA and public submissions and prepares a Memorandum or Information Paper that includes the NES recommendation as to whether the EIA should be approved.
  - (vi) *EIA approval*: The Memorandum or Information Paper is submitted to the IEA who determine whether the EIA is approved, deferred (the applicant must submit modifications) or refused.
30. Based on consultation with the NES the EA (via the IAs Project Owners Engineer) submitted ESDs for the four Phase 1 subprojects. The NES determined that each of the Phase 1 subprojects would require the preparation of a Technical Report (TR) and issued Terms of Reference for each of the subproject TR's.
31. TRs have been submitted to the NES for each of the Phase 1 subprojects and ESDs have been submitted for the Phase 2 subprojects. The Phase 2 subproject ESDs are included as Appendix 1.

### 2.2.3 Cook Islands Environmental and Energy Policy

32. **The National Sustainable Development Plan 2011 to 2015**: The National Sustainable Development Plan was developed as a pathway for sustainable development in the Cook Islands. The plan contains two priority areas of particular relevance to the project: Priority Area 3: Energy Security and Priority Area 6 Ecological Sustainability.
- Priority Area 3: Energy Security sets out the goal of *renewable energy for energy security to enhance our economic and social development and environmental integrity*. It outlines key objectives to establish secure and reliable energy services and to foster investment in renewable energy development.
  - Priority Area 6: Ecological Sustainability establishes a goal of a *Cook Islands where we sustain our ecosystems and use natural resources efficiently*. It documents key objectives and measures to achieve these objectives including improving the sustainable use of land and better protecting native ecosystems.
33. **Cook Islands Renewable Energy Chart (CIREC)**: The CIREC sets out the Government of the Cook Islands goal of transforming the energy sector from one based on imported fossil fuels to an independent, vibrant sector dominated by the efficient use of renewable energy. From an original baseline where all electricity was generated from fossil fuels (diesel), this chart sets a target of 100% of islands to be powered by renewable energy by 2020 (and 50% by 2015). The principles behind the chart are to; protect the environment by meeting climate change obligations and using environmentally friendly technologies, improve energy security by improving energy independence and reliability and increase economic growth by improving energy affordability and promoting a clean green image. The CIREC is backed by the CIREC Implementation Plan which sets out the means of achieving the CIREC goals. Substantial progress towards meeting the policy has been achieved already, with 6 of

12 inhabited islands (the Northern Group) having renewable electricity generation systems installed and operating in 2014/15. The next stage of implementation is planned for the Southern Group which is to be addressed through the Project.

34. Besides these laws and regulations, the Government of the Cook Islands is in the process of formulating the Environment (Permits & Consents) Regulation, which is yet to be approved by the Cabinet.

#### 2.2.4 ADB's Environmental Safeguard Requirements

35. This environmental assessment is carried out in compliance with safeguard requirement 1 of ADB's SPS so as to ensure that potential adverse environmental impacts are identified and avoided, and where impacts cannot be avoided, a suitable plan is prepared for them to be mitigated and managed.
36. The SPS has the objectives to (i) avoid adverse impacts of projects on the environment and affected people; (ii) where possible; minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks. To help achieve the desired outcomes, ADB adopts eleven policy principles for guiding the assessment of projects that trigger environmental risks and impacts.
37. ADB categorizes projects into categories A, B, C, and FI according to the significance of likely impacts. Project categorization is carried out using a rapid environmental assessment checklist. A rapid environmental assessment (REA) checklist was completed for the three subprojects considered as part of the PPTA and a separate REA has been prepared for Atiu. The Project was classified as a category B. Category B projects are judged to have some adverse impacts, but of lesser degree and/or significance than category A, the impacts are site-specific and can be managed or mitigated to satisfactory levels. Category B projects require an initial environmental examination (IEE), the assessment concludes whether or not there will likely be significant environmental impacts warranting an EIA. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. Accordingly, this assessment also constitutes an IEE and meets the requirements of the SPS.

### 3. DESCRIPTION OF THE PROJECT

#### 3.1 Project Location

38. The subprojects will be located in the Southern Group islands on Mangaia, Mitiaro, Mauke, Atiu, Aitutaki and Rarotonga (Figure 1.1). The location of the subproject sites on each island is shown in Figures 3.1 to 3.6 and a brief description provided below.
39. **Mangaia:** The proposed solar site is located on a property called Aratane on the eastern side of Aremauku Road in Oneroa village approximately 150 m SE of the existing power house. The area of land required for the subproject is 1.2162 Ha. The land is privately owned native customary land.
40. **Mauke:** The subproject site is located near the centre of the island in Areora village immediately NNE of the Public Works Machinery sheds. The area of land required for the subproject is 0.84 Ha. The land is privately owned native freehold land.
41. **Mitiaro:** The subproject site is located on the Mitiaro Community Access Road just inland from Mangarei village. The area of land required for the subproject is 0.4837 Ha. The land is privately owned native freehold land.
42. **Atiu:** The subproject site is located approximately 600 m west of the village of Teenui and the solar PV array site is approximately 140 m SSW of the existing power station.

The total area of land required for the subproject is 1.49 Ha. However, this excludes land for the solar power house which will be constructed on the same parcel as the existing power station. The land is privately owned native freehold land.

43. **Aitutaki:** The subproject site is located approximately 1.2 km east of the village of Arutanga at the site of the existing power station. The solar PV array will be located approximately 100 m east of the power station. The total area of land required for the subproject is approximately 3.87 ha (current site of the Aitutaki power station) however, the solar PV array will require only approximately 1.1 Ha. The land is privately owned native freehold land which the Government of the Cook Islands currently leases.
44. **Rarotonga:** The subproject site is located at the Rarotonga Airport in Avarua District adjacent to the existing solar array just to the south west of the terminal building. The existing airport solar PV array site is approximately 1.4 Ha however, the area required for the BESS is less than 0.02 Ha. The land is owned by the Government of the Cook Islands and is leased to TAU.

### 3.2 Project Scope

45. The subprojects will install solar PV systems on Mangaia, Mauke, Mitiaro, Aitu and Aitutaki (total solar PV capacity of 2,246 kW) and a BESS on Rarotonga. The proposed layout of each system is shown in Figures 3.1 to 3.5 and a brief description provided below:
46. **Mangaia:** Installation of a 462 kW solar PV array, new solar power house adjacent to the solar PV array containing control system and battery storage, low voltage (LV) underground cable connecting the solar powerhouse to the existing power station (existing diesel generators, switch gear and distribution grid connection to be used) and upgrade of distribution system.
47. **Mauke:** Installation of a 228 kW solar PV array, new power station adjacent to solar PV array containing new diesel generators, control system and battery storage, high voltage (HV) underground cable connecting the new power station with a distribution grid connection point adjacent to old power station and upgrade of distribution system.
48. **Mitiaro:** Installation of a 157 kW solar PV array, new power station adjacent to solar PV array containing new diesel generators, control system and battery storage, HV underground cable connecting the new power station with a distribution grid connection point adjacent to old power station and upgrade of distribution system.
49. **Atiu:** Installation of a 399 kW solar PV array, new solar power house adjacent to existing diesel power house containing control system and battery storage and LV underground cable connecting the new solar power house to the existing diesel power house (note the distribution system on Atiu is being upgraded under a separate project).
50. **Aitutaki:** Installation of a 1 MW (1000 kW) solar PV array, new 300 kW high speed diesel generator installed in a spare bay in the existing power station, and upgrades to the switchgear and control systems.
51. **Rarotonga:** Installation of a 1 MW and 4 MWh BESS co-located at the site of the Rarotonga Airport solar PV array and buried cable connection to existing solar PV array substation.





Figure 3.2: Mitiaro Project Location and Layout



Figure 3.3: Mauke Project Location and Layout



Figure 3.4: Atiu Project Location and Layout

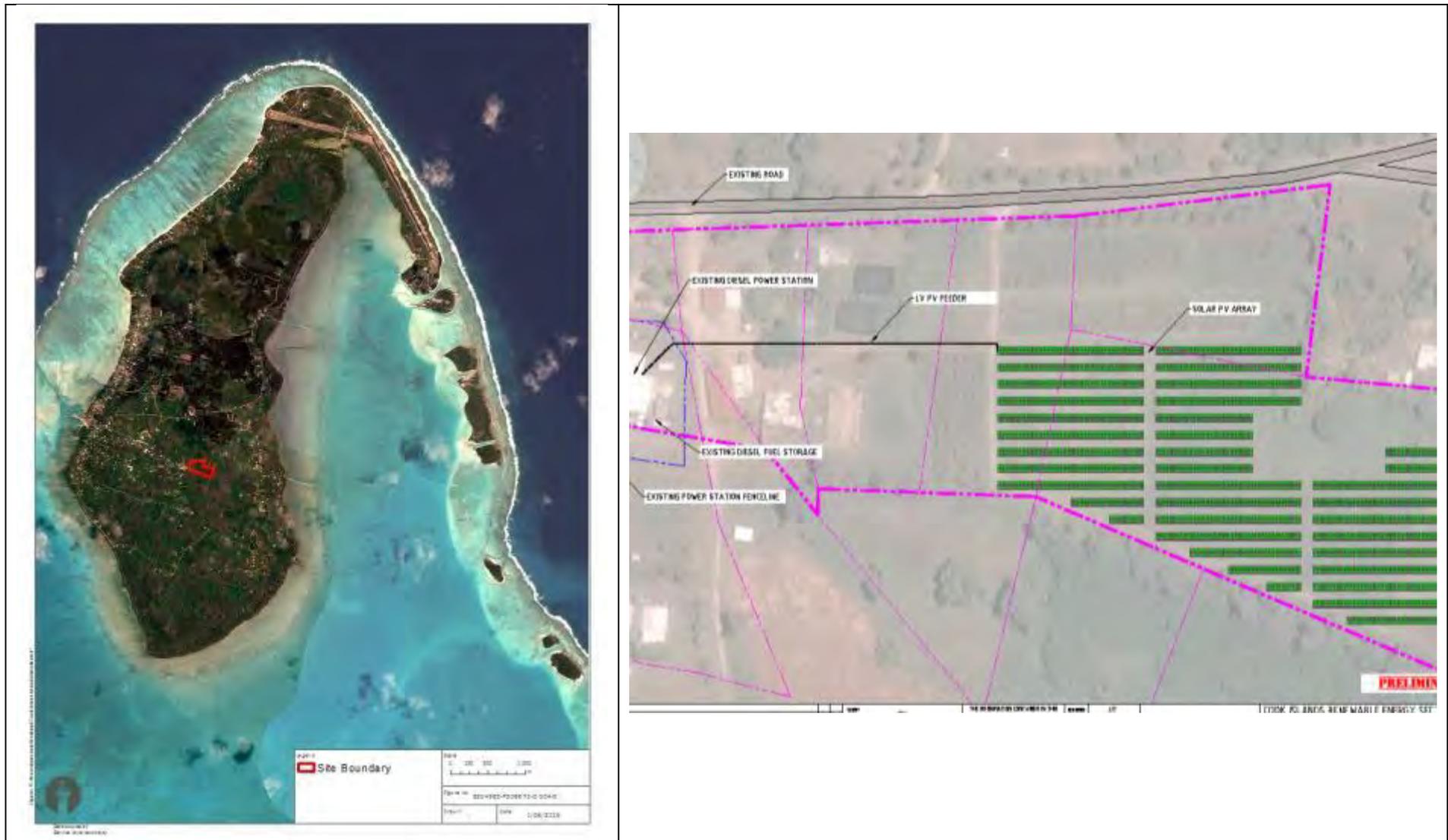


Figure 3.5: Aitutaki Project Location and Layout





52. A description of the key components of the solar diesel hybrid power systems (all subprojects except Rarotonga) is provided below:
- (i) *Solar PV modules:* Solar PV modules will be 250 Watt (W) 60-cell polycrystalline panels (or similar). They will be modern, high quality panels with a temperature / loss co-efficient suitable for the Cook Islands climate.
  - (ii) *Solar PV module mounting:* Solar PV modules will be installed on a pre-manufactured solar PV array mounting system constructed of stainless steel, anodised aluminium and galvanised steel mounted on either concrete blocks (pre-cast or cast on site) or piles.
  - (iii) *Solar PV Inverters:* Solar PV string will be installed within the solar PV array to convert direct current (DC) electricity produced by PV panels to alternating current (AC) for injection into the electrical grid.
  - (iv) *Cabling:* PV1-F Solar DC cabling either buried in HDuPVC conduit or attached to the rear of PV modules will be installed connecting the solar PV modules to solar PV inverters and inverters to the control system in the power station / solar power house.
  - (v) *Power station:* New power stations (Mauke and Mitiaro) and new solar power houses (Mangaia and Atiu) will be constructed of concrete block and will comply with the Cook Islands National Building Code and relevant Australian and New Zealand Standards.
  - (vi) *Diesel generators:* The new generators installed on Mauke and Mitiaro will be high speed diesel generators (nominally 2 x 88 kilovolt amps (kVA)) with control system, fuel tank and oil storage. The new diesel generator on Aitutaki will be nominally 300 kW with upgrades to the existing control system and fuel and oil storage (if required).
  - (vii) *Control system:* A control system will be installed in the power station / solar power house to manage the solar power system including regulating when electricity is injected into the grid from the solar PV panels, diesel generators and batteries and also control charging of batteries.
  - (viii) *Batteries and battery invertors:* high capacity batteries (likely to be valve regulated lead acid or lithium ion technology) will be installed in the power station / solar power house. Battery invertors will also be installed to convert AC to DC for charging batteries and DC back to AC for injection into the electrical grid.
  - (ix) *Associated infrastructure:* A perimeter security fence will be established around the solar PV array at all subproject sites.
  - (x) *Existing infrastructure:* Local infrastructure including roads, wharfs, and the pre-existing electricity distribution system will be used for the subprojects. The power station and existing diesel generators will also be retained on Atiu and Mangaia. Roads and wharfs were inspected during the site visits and found to be suitable for use during the construction of the subprojects.
53. A description of the key components of the BESS (Rarotonga subproject) is provided below:
- (i) *Batteries:* The BESS will be based on high capacity batteries (likely to be lithium ion or sodium sulphur technology).
  - (ii) *Power conversion:* A four quadrant power conversion system (inverter) will be used to convert electricity from AC to DC for charging batteries and DC back to AC for connection to the substation.

- (iii) *Control system:* A control system will be installed to manage the charge and discharge rates of the batteries, system parameters, monitoring, alarms, communications with other network systems and data logging.
- (iv) *Cabling and connection:* the BESS will be connected to the existing electricity grid either at the existing solar PV array substation or directly into the West Coast Feeder. Connection cabling will be buried to either of these connection points.
- (v) *Environmental controls:* Dependent on the technology selected environmental controls including fire protection and air-conditioning will be installed.
- (vi) *Housing:* The BESS will likely be housed in containerised modules (e.g. four forty foot shipping containers or similar) that contain all

### 3.3 Project Construction, Operation and Decommissioning

54. The following provides a general description of the proposed construction, operation and decommissioning of all subprojects.
55. **Construction:** Construction of the subprojects (excluding Rarotonga) will generally include:
- Upgrade of the existing tracks to provide access to the solar PV array sites (where required).
  - Clearing of existing vegetation and makatea (where required).
  - Spreading of fill material, compaction and levelling (note: the solar PV site on Atiu will not be levelled although some minor localized levelling may be required to ensure solar PV modules can be installed optimally).
  - Installation of site drainage, erosion and runoff controls.
  - Installation of security fencing.
  - Trenching and installation of underground cables and conduit.
  - Installation of solar PV mounting system.
  - Installation of solar PV panels on mounting system.
  - Construction of new power station / solar power house including excavation of footings, installation of earth grid, pouring of concrete slab and construction using concrete blocks and steel sheet roofing.
  - Installation of generators (Mitiaro, Mauke and Aitutaki), control system and batteries in power station / solar power house.
  - Landscaping of site. Landscaping will include planting low growing vegetation (e.g. grasses) beneath the solar PV modules to help stabilise the site and prevent erosion.
  - Commissioning (load testing) of all equipment.
56. Construction of the BESS on Rarotonga will include installation of the containerised BESS units (likely four 40ft ISO shipping containers), connection to the electricity grid and commissioning.
57. **Operation:** The Phase 1 subproject solar power systems are designed to deliver approximately 95% of electricity from the solar PV system. This is achieved using the solar PV modules to deliver electricity to the distribution grid and charge the batteries when the solar resource is adequate (e.g. sunny or light clouds) and batteries to deliver electricity when the solar resource is not (e.g. during the night or heavy clouds). When the solar system can't meet the load demand the diesel generators will be used to charge the batteries and deliver electricity directly to the distribution grid. The control

system will manage grid stability by controlling the source of electricity input into the grid as the output from the PV system fluctuates (e.g. a cloud passes over PV modules) and as the load changes. The control system also manages the charging of the battery storage. In the event of a system failure of the solar system, the existing diesel generators will be able to meet continuous load, and hence provide a level of redundancy. The systems will be able to be monitored remotely from Rarotonga but will also be monitored locally. During operation the solar power systems require minimal maintenance including cleaning PV modules and batteries and maintaining vegetation.

58. The Aitutaki subproject will supply solar PV generation capacity to meet approximately 30% of Aitutaki's annual electricity load. An upgraded control system will control grid stability by controlling the source of electricity into the grid as output from the PV system fluctuates and load changes. The new solar PV generation will be coupled with either a forecasting system or battery storage to manage output. The forecasting system will include a local met station, with a pyranometer (irradiance sensor), sky facing camera, data logger and software. The system should provide estimated irradiance at the array at each 30 second interval out to 15 minutes from the current time. This device will be connected by communications cabling to the master controller at the power station. The master controller will transfer the estimated irradiance into an estimated power output of the array, and then make a decision as to whether it is satisfactory to operate with the single small diesel generator, or whether a larger generator needs to be brought online.
59. The Rarotonga subproject will install a BESS into the Rarotonga grid enabling more renewable energy generation to be installed and better utilising it once installed. Installing renewable energy generation into the Rarotonga grid enables reduction in use of the diesel power station. However, when the difference between the load on the grid and the renewable energy being generated is less than the minimum loading requirement of the generators faults will occur that compromise system reliability. Studies have indicated that the limit of renewable energy generation in Rarotonga's grid is 3.3 MW. Currently, there is approximately 3.0 MW of installed renewable energy on Rarotonga's grid and, with current rates of installation, the 3.3 MW limit will be reached in the first half of 2016. TAU has set a limit of 4.2 MW (expected to be reached by mid 2017) and to reduce system faults will 'curtail' the output of the 1 MW airport solar PV array (owned by TAU) when required to satisfy the 3.3 MW limit. That is, in sunny conditions, where the power demand is low and solar PV output is high, they will provide a set-point to the Airport array to reduce its output (potentially down to zero). The BESS will store the otherwise curtailed output of the renewable generation (primarily solar PV generation) for reinjection into the grid when renewable energy generation is lower (e.g. overnight).
60. **Decommissioning:** The subprojects are expected to have a lifespan of approximately 25 years. It is likely that the system will be replaced with similar equipment and solar PV modules, batteries, inverters and other electronics and metal will be collected for recycling in the Cook Islands (where facilities exist) or in Australia and/or New Zealand.

### 3.4 Implementation Schedule

61. The Phase 1 subprojects will be implemented between June 2014 and December 2016. The tendering process will begin in October 2015 and expected to be completed in February 2016. Bid evaluation and contract will be awarded in March 2016. The detailed design and updating of safeguards documents shall take place before start of installation work. Installation work is expected to start in June 2016 and be completed by December 2016.
62. The Aitutaki subproject will be implemented between June 2014 and March 2017. Tendering will commence in June 2016 with construction work expected to commence in January 2017 and be completed by March 2017.

63. The Rarotonga subproject will be implemented between February 2016 and June 2017. Tendering will commence in June 2016 which construction work expected to be completed by June 2017.

### 3.5 Project Benefits and Justification

64. The Phase 1 subproject solar power systems will deliver approximately 95% renewable energy, using a solar PV based generation system with battery storage to manage overnight load. Battery storage and the control system will manage grid stability in light of rapid fluctuations in PV output. The unmet load will be managed through the use of existing diesel generators for backup. Further, in the event of a system failure of the solar system, the existing diesel generators will be able to meet continuous load, and hence provide a level of redundancy. A reliable, 24/7 power supply, which is less vulnerable to diesel supply volatility, is thus expected to be achieved.
65. The Aitutaki subproject will deliver approximately 30% renewable energy using a solar PV based generation system with either a forecasting system or battery storage. The unmet load will be managed through the use of existing diesel generators with the addition of the new diesel generator installed as part of the sub project.
66. The Rarotonga subproject will enable the installation of a greater quantity of renewable energy on to the Rarotonga grid without compromising system stability and reliability. In order to continue toward the Government of the Cook Islands 100% renewable electricity goal TAU are working on the following initiatives:
- increasing the limit of renewable generation of the grid from 3.3 MW to 4.2 MW (including curtailment of existing generation where the capability exists); and,
  - commissioning a detailed network study to determine the long term technical and commercial requirements for implementing storage and grid enabling technology which will ultimately lift the stability limit sufficiently to allow enough renewable generation to be installed to reach close to the 100% goal.

The subproject, in cooperation with TAU, will lift the limit of renewable energy generation from 4.2 MW to 6.2 MW, allowing more time to complete the detailed network study, while continuing installation of renewable generation, and maximising the output of generation (reducing curtailment) already installed or committed

67. The implementation of the subprojects will result in the displacement of approximately 4.05 GWh of diesel generated electricity per year which equates to a reduction in annual diesel usage of approximately 1.26 million litres. The displacement of 4.05 GWh of electricity avoids the emission of approximately 2,793 tons of Carbon Dioxide Equivalents per year<sup>4</sup>.
68. In addition, a key element of the Project will be capacity building including training of local power stations operators in the operation and maintenance of solar-diesel hybrid energy systems. The Project will also have a positive contribution by reducing emissions (including CO<sub>2</sub>) from running of existing diesel generators; a reduction in noise from diesel generator operation and a reduction in land and ground water contaminations caused by spill of oil from diesel generator sets. Overall, at a local level, the project will improve socio-economic conditions of the local communities and at a national level will help improve the national gross domestic product (GDP).

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<sup>4</sup> <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>

## 4. DESCRIPTION OF THE ENVIRONMENT (BASELINE)

### 4.1 Physical Environment

#### 4.1.1 Physiography

69. The Cook Islands is a Pacific island country comprising 15 islands scattered between Tonga to the west and New Zealand to the northeast. The islands are located between 8.0 and 23.0 south latitude and 156.0 and 167.0 west longitude and are geographically divided into two groups, commonly referred to as the Northern and Southern Group islands. The Northern Group consists of six low-lying, sparsely populated, coral atolls, while the Southern Group consists of nine raised atolls and volcanic islands.
70. The subproject islands are all volcanic islands that have central volcanic hills surrounded by makatea (coralline limestone). This structure has resulted from the subsidence of the volcanic hills followed by uplift forming the raised makatea. A brief description of each island is provided below.
71. **Mangaia:** Located about 177 km south of Rarotonga, Mangaia is the southernmost island of the Cook Islands. With an estimated land area of 51.8 km<sup>2</sup>, it is also the second largest island. It is the oldest island in the Pacific. Roughly circular in shape, it rises 4,750 m above the ocean floor. Mangaia consists of a low central plateau, which is separated from the completely encircling platform of makatea by a series of irregular swampy depressions. The subproject site on Mangaia is flat.
72. **Mauke:** Mauke is one of the smallest islands lying at the south-eastern corner of Cook Islands about 270 km northeast of Rarotonga. It is a raised atoll encircled by the characteristic fossilized cliffs of makatea. Mauke is virtually flat with its centre about 30 m above sea level. The island has a circumference of 18 km. The soil is fertile and supports agriculture. The total land area of Mauke is 18.4 km<sup>2</sup>. The subproject site is flat.
73. **Mitiaro:** Located at 230 km northeast of Rarotonga, Mitiaro stands in water 4,500 m deep, it is 6.4 km across at its widest point and has a total land area of 22.3 km<sup>2</sup>. The centre is almost flat, quite swampy and contains two freshwater lakes. It is surrounded by 6 to 9 m high belt of makatea. The subproject site on Mitiaro is flat.
74. **Atiu:** Atiu is located 214 km north east of Rarotonga and has an encircling ring of makatea around a raised volcanic interior. It has a total land area of 26.9 km<sup>2</sup>. The subproject site slopes gently away from the power plant toward the SSW. The terrain slopes steeply away from the solar site to the W and S, and slopes less steeply to the E.
75. **Aitutaki:** Aitutaki is located 255 km north of Rarotonga and has a land area of 18.05 km<sup>2</sup>. It is a raised volcanic island surrounded by a barrier reef and is the second most visited island in the Cook Islands. The subproject site is located in the interior of the island, well above sea level (the high point on Aitutaki is 123 m) and is flat.
76. **Rarotonga:** Rarotonga is the largest of the Cook Islands with a land area of 67.05 km<sup>2</sup>. It is a volcanic island and remnants of the original volcano can be seen in the steep interior landscape. The tallest peak, Te Manga, rises to 658 m above sea level. The subproject site is located on an existing hardstand.

#### 4.1.2 Climate

77. The climate of the Cook Islands is sub-tropical and tropical oceanic, moderated by trade winds. It has two distinct seasons. The average rainfall is between 2,000 and 3,000 mm per year. The mean annual temperature is 24°C with little seasonal variation. Temperatures range between 18°C and 28°C in the southern winter, which is May to

October, and between 21°C and 29°C in the summer, which spans from November to April. The wet season is normally January to early May.

78. Seasonal temperatures differ between the northern and southern Cook Islands. The Northern Cook Islands' position so close to the equator results in fairly constant temperatures throughout the year, while in the Southern Cook Islands, temperatures cool during the southern winter. Changes in temperatures are strongly tied to changes in the surrounding ocean temperature. The annual average temperature at Penrhyn in the Northern Group is 28°C and at Rarotonga in the Southern Group is 24.5°C.
79. Rainfall in the Cook Islands is strongly influenced by the South Pacific Convergence Zone. This band of heavy rainfall is caused by air rising over warm waters where winds converge, resulting in thunderstorm activity. It extends across the South Pacific Ocean from the Solomon Islands to east of the Cook Islands. It is centred close to or over the Southern Group from November to May. From November to March, the South Pacific Convergence Zone is wide and strong enough for the Northern Group to also receive significant rainfall. The driest months of the year in the Cook Islands are from June to October.
80. The Cook Islands' climate varies considerably from year to year due to the El Niño-Southern Oscillation. This is a natural climate pattern that occurs across the tropical Pacific Ocean and affects weather around the world. There are two extreme phases of the El Niño-Southern Oscillation: El Niño and La Niña. There is also a neutral phase. The El Niño-Southern Oscillation has opposite effects on the Northern and Southern Groups. In Rarotonga, in the south El Niño events tend to bring drier and cooler conditions than normal, while in the north, El Niño usually brings wetter conditions. Ocean temperatures are warmer in the north during an El Niño event and consequently air temperatures also warm.
81. Tropical cyclones affect the Cook Islands between November and April. In the 41-year period between 1969 and 2010, 47 tropical cyclones passed within 400 km of Rarotonga, an average of just over one cyclone per season. The number of cyclones varies widely from year to year, with none in some seasons but up to six in others. Over the period 1969 to 2010, cyclones occurred more frequently in El Niño years.

#### **4.1.3 Geology and Soils**

82. The islands of the Southern Group differ widely in form, structure and relief, such that it is difficult to construct a geological history that is consistent for the whole group. They include a high mountainous island, Rarotonga; four raised coral islands with volcanic cores, Mangaia, Mauke, Mitiaro and Atiu; one atoll, Manuae; one "near-atoll" with a volcanic core, Aitutaki; and a sand-cay on a coral foundation, Takutea. The geology of Southern Group is comprised of three soil forming deposits. These are the volcanic rocks, the raised coral limestone, and the swamp deposits. The volcanic rocks are mainly olivine basalts including tuffs, breccias, and dikes. The coral limestone forming the makatea comprises mainly calcite and aragonite but is magnesium enriched in some inland areas. The swamp deposits in the depression comprise fine textured basaltic alluvium derived from erosion of interior upland rocks.
83. The soils in the Southern Group generally consist of six types; Tamarua Clay Loam, Makatea Sand, Keia Clay Loam, Oneroa Clay Loam, Ivirua Clay Loam, and Tupapa Clay Loam (Grange and Fox, 1952).

#### **4.1.4 Water Resources**

84. The water resources of the islands consist of rainwater (collected from roofs and stored in tanks), groundwater (fresh and brackish), surface water lakes (brackish) and

swamps (fresh and brackish). Many of the community buildings have rainwater collection systems and there are also some at private houses.

## 4.2 Biological Environment

### 4.2.1 Ecology

85. The Cook Islands' flora and fauna is limited in diversity. The estimated plant and animal biodiversity is about 7,000 species, divided almost equally between marine and terrestrial species. There are few terrestrial endemic species.
86. The vegetation of subproject islands is sharply divided, dependent on substrate of either volcanic hills or makatea. The volcanic hills have been intensively cultivated and little native vegetation remains. The 'Au (*Hibiscus tiliaceus*) and Toa (*Casuarina equisetifolia*) are the only native tree species which remain common. On makatea the vegetation is less disturbed and becomes more diverse away from the coast. The makatea vegetation is similar across all islands and contains many native species. At the junction of the makatae and volcanic hill substrates wet, marshy areas often occur. These have been almost entirely used for wetland taro cultivation.
87. The fauna of the Cook Islands is generally common in the region and few species are considered threatened. There are eight species of range restricted birds of which two the Atiu swiftlet (*Aerodramus sawtelli*) and Mangaia kingfisher (*Todiramphus ruficollaris*) are endemic to those islands. Both these species are listed as Vulnerable on the IUCN Red List.
88. Flora and fauna assessments have been completed at all subproject sites (Appendix 2) except for Rarotonga which does not require any vegetation clearance. The assessments included review of existing databases (CIBD and IUCN Red List), consultation with stakeholders including Cook Islands National Heritage Trust, NES and IEOs and a field survey of the sites. The results of the assessments are summarized below.
89. **Mangaia:** The subproject site is covered by secondary forest that is comprised of canopy species including *Cocos nucifera*, *Syzygium cumini*, *Elaeocarpus tonganus*, *Hernandia moerenhoutiana*, *Aleurites moluccana*, *Adenantha pavonina* and *Falcataria moluccana* (Figure 4.1: *Syzygium cumini* (Java plum) dominated secondary forest at the Mangaia site
90. A secondary (lower) tree layer was present which was predominantly comprised of *Eugenia uniflora* and *Morinda citrifolia*. The ground layer is generally bare with few plant species present. Overall 36 flora species were recorded across the site during the field survey of which 16 were native and 20 were introduced. The native species are widespread throughout the Cook Islands and none are listed as Endangered on the Cook Islands Biodiversity Database (CIBD) or listed on the IUCN Red List. Nineteen of the flora species had medicinal uses and one had economic value (*Cocos nucifera* - coconut palm). Ninety coconut palms were counted in the survey area during the survey. Eight moderate to serious weed species were recorded, all from the road verge on the edge of the site including two creepers; the hard and soft shell passion fruits (*Passiflora edulis* and *Passiflora maliformis*) and two small trees, the menemene (*Eugenia uniflora*) and the guava (*Psidium guajava*). The Mangaia Kingfisher (*Todiramphus ruficollaris*) a native bird species endemic to Mangaia has been reported by locals as regularly being observed in the vicinity of the survey site, although it was not recorded during the survey. The Mangaia Kingfisher is listed as Vulnerable on the IUCN Red List. The survey site is likely to provide foraging habitat but is unlikely to provide breeding habitat for the Mangaia Kingfisher.



Figure 4.1: *Syzygium cumini* (Java plum) dominated secondary forest at the Mangaia site

91. **Mitiaro:** The subproject site is vegetated with flora species that are commonly found growing on makatea (Figure 4.2, Figure 4.3). The over story was dominated by the trees *Timonius polygamus*, *Guettarda speciosa*, *Pisonia grandis*, *Elaeocarpus tonganus*, *Myrsine cheesemanii* and *Pipturus argenteus*. There were also patches of the native small trees Pandani (*Pandanus tectorius* complex) and *Pouteria grayana* present across the site. Shade tolerant species grew below the canopy and in shady areas formed by makatea including several fern species and herbs (e.g. *Peperomia pallida* -Bold-Vein Peperomia). The field survey recorded 29 flora species of which 19 were native. Two species *Pouteria grayana* and *Pisonia grandis* are recorded as Locally Endangered on the CIBD, but neither are listed on the IUCN Red List. Both species are widespread on Mitiaro and the Locally Endangered listing applies to other islands. Nineteen of the species recorded have medicinal uses but none had economic value. Several invasive weed species were recorded in previously disturbed areas associated with the road and it is likely that they could spread into the project area when vegetation clearing and ground disturbance occurs. The Pacific Pigeon (*Ducula pacifica*) and Cook Islands Warbler (*Acrocephalus kerearako*) are both reported to use the site though neither were seen or heard during the survey. Both are listed as locally endangered on the CIBD but not listed on the IUCN Red List. Both bird species are widespread on Mitiaro and the Locally Endangered listing applies to other islands. The Chattering Kingfisher (*Todiramphus tuta*) is reported by locals to use the site but was not seen or heard during the survey. No habitat for fauna species listed as Endangered on the CIBD or listed under the IUCN Red List was recorded.



Figure 4.2: Sharp makatea (uplifted coral) terrain.



Figure 4.3: Pisonia (*Pisonia grandis*) (partly covered by *Cassytha filiformis*) and Guettarda (*Guettarda speciosa*).

92. **Mauke:** The subproject site is located on agricultural land that has been used by the National Ministry of Agriculture for agriculture research development purposes for the last 50 years (Figure 4.4). Agricultural plant species present include Macadamia trees (*Macadamia integrifolia*), Teak (*Tectona grandis*), Coconut palms Mango (*Mangifera indica*), Lime (*Citrus aurantifolia*), dry land taro (*Xanthosoma sgittifolium*), Kumara (*Ipomoea botatas*), Nono (*Morinda citrifolia*), Banana (*Musa ABB group*) and Pineapple (*Ananas cosmosus*) growing over introduced grasses. Only four species native to the Cook Islands were recorded at the site out of a total of thirty-one flora species. The four

native species are widespread throughout the Cook Islands and none are listed as Endangered on the Cook Islands Biodiversity Database or on the IUCN Red List. Eleven of the flora species recorded at the site also have medicinal uses. They are all designated as 'very common' on the CIBD and are widely distributed on Mauke. Two of the most common serious weed species were recorded at the site were Mimosa (*Mimosa pudica*) and the Sickle pod (*Senna obtusifolia*). Both species have the potential to be spread by the works associated with the subproject.



Figure 4.4: Grassed area with Macadamia trees (*Macadamia integrifolia*) in the foreground, Teak (*Tectona grandis*) on the far right and Coconut palms in the left corner

93. **Atiu:** The sub project site has been planted with two introduced tree species Caribbean Pine (*Pinus caribaea*) and Java Plum (*Syzygium cumini*), (Figure 4.5, Figure 4.6). These two species dominated the canopy layer and the fine needle leaves of the Caribbean pine forms a dense fine litter layer resulting in only a sparse cover of shade tolerant species. A total of 15 flora species were recorded across the site of which only four were native. No species recorded were listed as endangered on the CIBD or listed on the IUCN Red List. Five flora species have medicinal uses. Four species of flora on the project site were introduced for economic purposes and all four have become invasive species. Albizia (*Folcataria moluccana*) was introduced in the 1930s as a source of timber for making crates used to pack and export tomatoes and bananas. Caribbean pine, was introduced to protect the soil from erosion following the collapse of the pineapple industry in the 1980's. Acacia (*Acacia mangium*) on the other hand was introduced to Atiu as a source of fuel wood for the purpose of wood burning power generation in the mid-1980s. Java plum was introduced as a wind break plant to protect orange plantations. All four economic species are serious and invasive weed species. The Chattering Kingfisher (*Todiramphus tuta*) and Cook Islands Fruit Dove (*Ptilinopus rarotongensis*) are regularly reported by locals at the project site where they feed on the fruit of the Java plum during its fruiting season. Neither species was recorded during the survey. The Cook Islands Fruit Dove is listed as moderately endangered on the CIBD and vulnerable on the IUCN Red List.



Figure 4.5: Caribbean pine (*Pinus caribaea*) forest.



Figure 4.6: Java plum (*Syzygium cumini*) forest

94. **Aitutaki:** The subproject site is dominated by weed species and appears to be abandoned maniotia (*Manihot esculenta*) plantations (Figure Figure 4.7). Remnant Java plum (*Syzygium cumini*) trees border the western and southern boundaries of the site. Twenty one species were recorded of which only four were native. Two of the common weed species recorded on site para grass (*Brachiaria mutica*) and the Calopo (*Calopogonium mucunoides*) are highly invasive and will require control during the operation of the Project. Neither of the native species that were identified during the survey that are recorded as Endangered on the CIBD or listed on the IUCN Red List. Nine of the species recorded are medicinal species however, all are listed as very common on the CIBD and are widespread on Aitutaki. The Blue Lorikeet (*Vini peruviana*) is regularly reported by locals at the project site however, it was neither

seen nor heard during the survey. The Blue Lorikeet is listed as globally endangered (seriously) under the CIBD and vulnerable on the IUCN Red List.



Figure 4.7: Weed dominated subproject site

#### 4.2.2 Protected Areas

95. The Cook Islands' protected area network consists of one national park, one wildlife sanctuary, and six island specific conservation areas/reserves. The reserves in Cook Islands range from whole island reserves to specific locations on various islands.
96. *Suvarrow National Park*. Suvarrow Atoll was the first island to be formally established as a National Park in the Cook Islands in 1978 for the protection of the wildlife and the marine resources that it possesses. Suvarrow is an important sea-bird breeding site not only for the Cook Islands but also for the region and the world. Eleven species of seabirds breed are found on the island. It supports regionally significant colonies of Lesser Frigatebirds (9% of world population), Red-tailed tropicbirds (3% of world population), and the Cook Islands only large colony of Sooty Terns. The atoll also supports locally significant colonies of Red-footed Boobies, Great Frigate birds, Masked boobies and Brown Boobies. In addition, it is an important wintering site for Alaskan migrant, the vulnerable Bristle-thigh Curlew.
97. *Takutea Wildlife Sanctuary*. The Island of Takutea, a breeding ground for birds has been a Wildlife Sanctuary since 1903. The traditional leaders of Atiu who are the trustee of Takutea still manage the island as a conservation area for wildlife.
98. In addition to the two nationally protected areas, there are six island specific reserves, which are declared by island councils based on conservation significance. These are Rarotonga Island Reserves, Aitutaki Island Reserves, Pukapuka Island Reserves, Mitiaro Island Reserves, Rakahanga Island Reserves, and Manihaki Island Reserves.
99. The Government of the Cook Islands has declared the Cook Islands with its ocean exclusive economic zone of 2 million km<sup>2</sup> a whale sanctuary. The waters of the Cook Islands are now a safe haven for migrating humpback whales that consistently migrate through the Cook Islands every year from about August to October.

100. None of the subproject sites are located within or near to any of the conservation areas.

### 4.3 Socio-Economic Environment

#### 4.3.1 Demography

101. The population of the Cook Islands is approximately 17,794 people (Census 2011, as enumerated on 1 December 2011) consisting of 8,815 men and 8,979 women. The 2011 census reflects a decrease of 1,315 people compared to the 2006 Census (19,342). There has been a declining population trend since the early 70's, with the population declining quite dramatically, between 1971 and 1976, as a result of the opening of the Rarotonga International Airport in 1974, when many people took the opportunity to migrate to New Zealand.
102. The distribution of the total population varied considerably by region. About 74% (13,095) lived in Rarotonga, 20% (3,586) lived in the Southern Group islands, and 6% (1,113) in the Northern Group islands. The population density varied widely by island. While there were about 347 people per square kilometre in Pukapuka, in Mitiaro Island, there are only eight people per square kilometre. The population density of Rarotonga was 195 people per square kilometre. The average household size is four persons per household. Table 4.1 presents the demographic features of each subproject island.

Table 4.1: Subproject Demographic Features

Feature	Subproject Target Island						
	Cook Islands	Mangaia	Mauke	Mitiaro	Atiu	Aitutaki	Rarotonga
Area (km <sup>2</sup> )	236.7	51.8	18.4	22.3	26.9	18.1	67.2
Population	17,794	562	307	189	468	2038	13,095
Male	8,815	283	162	101	228	994	6,460
Female	8,979	279	145	88	240	1,044	6,635
Pop. density (person/km <sup>2</sup> )	75.18	11.04	16.68	8.48	17.39	112.59	194.86
Sex ratio	1.02	0.99	0.90	0.87	1.05	1.05	1.03
Number of Households <sup>5</sup>	-	195	106	76	161	-	-

103. Cook Island Maori made up the bulk of the resident population with 12,930 persons (84%), 1,045 persons (7%) were part Cook Island Maori, and 1,349 persons (9%) were of foreign descent. The largest single group of foreigners were New Zealand European (458 people) and Australian (311).
104. The Cook Islands Christian Church (CICC) continues to be the dominant religious denomination of the resident population; however, affiliation with this church has declined from 55% in 2001 to 53%. The next largest group is the Roman Catholic Church with 2,599 members (17%), followed by the Seventh Day Adventist Church (SDA) with 1,154 members (8%). All other religious denominations account for 6% of the resident population and people with no religion comprised of 4% of the resident population.

<sup>5</sup> Active residential electricity accounts (not available for Aitutaki and Rarotonga).

### 4.3.2 Economy and Infrastructure

105. Tourism is vital to the Cook Islands economy and is estimated to account for around 60% of GDP, with tourist arrivals ranging from 100,000-120,000 each year. The Cook Island's economic prospects are largely reliant on its capacity to grow and continually improve its tourism product. Tourism is currently is focused on Rarotonga and Aitutaki.
106. Subproject islands such as Atiu and Mauke also have smaller tourist operations. Other economic activities on the subproject islands include agriculture (taro, pineapples, noni), and fisheries which play a role in supplying local markets within the Cook Islands.
107. On all the Phase 1 subproject islands government employment is by far the main source of cash income together with fishing, agriculture, pension, and private sector (small retail shops and tourism-related activities). On the smaller subproject islands many households also have significant subsistence income. Private enterprise is the largest source of employment on Aitutaki and Rarotonga however, both also have high levels (approximately 40%) of government employment.
108. Almost all households are connected to the grid (Phase 2 subprojects) / mini grid (Phase 1 subprojects) for power. Account records show average residential monthly power bills from NZD 67 (Atiu and Mitiaro), NZD 70 (Mangaia), and NZD 83 (Mauke). No account records were available for Aitutaki and Rarotonga. Electricity in the outer islands is heavily subsidized by the government.
109. The per capita Gross Domestic Product (GDP) of Cook Islands at current price is NZD 17,799 (Cook Islands Statistics Office, 2011/2012). GDP per capita is high compared to other economies in the region.
110. Subproject economic and labour data are presented in Table 4.2.

Table 4.2: Subproject Economic Activities

Feature	Subproject Island						
	Cook Islands	Mangaia	Mauke	Mitiaro	Atiu	Aitutaki	Rarotonga
Average annual Household income (NZ\$)	15,028	8,070	8,070	8,070	8,070	8,070	17,695
Employed population	6,938	132	102	63	130	654	5,411
Economically active pop.	7,554	179	122	74	148	771	5,774

### 4.3.3 Land Use

111. Land use on each of the subproject islands is summarised below.
112. **Mangaia:** The subproject site is currently unused. There are approximately 90 coconut trees on the site that have economic value which will be cleared as part of the subproject.
113. **Mitiaro:** The subproject site is currently unused and has no residential or other structures and no other economic assets.
114. **Mauke:** The Government of the Cook Islands has used the site for many years as an agriculture research and extension station. The site is now abandoned by Government and has no residential or other buildings and no structures other than a pig fence in the

NW portion of the site. The fence protects the crops of one landowner from foraging pigs and encloses a small piggery belonging to one landowner.

115. **Atiu:** With the exception of the existing Atiu Power Station the subproject site is currently unused and has no residential or other buildings and no other economic assets. It has not been used productively since the site was intensively farmed for pineapples more than 30 years ago. The government subsequently planted Caribbean Pine on the site to help control erosion. Those introduced trees are now mature, but they have no economic value on Atiu. A rugby field is located to the north east of the site.
116. **Aitutaki:** There is a Government agricultural research station and the existing Aitutaki power station located on the subproject site. The area of land intended for the solar PV array is currently unused. . There are no private non-land assets on the site.
117. **Rarotonga:** The subproject site contains the airport solar PV array owned and operated by TAU. The subproject site is surrounded by the Rarotonga Airport.

#### 4.3.4 Land Ownership

118. All land required for the subprojects is privately owned native freehold or customary land. Land ownership details for each subproject are described below.
119. **Mangaia:** All land on Mangaia is classed as privately owned native customary land and is not subject to the Land Court but rather to local custom. The landowners and their *ariki* (high chief), *kavana* (senior chiefs), and *rangatira* (sub-chiefs) all agree, in principle, to transfer use of the subproject site to the government for the project purpose subject to agreement of a formal land use agreement.
120. **Mitiaro:** The subproject site straddles two different properties—Teramake Section 8 and Tueru Section 9—that are owned by two different family groups. The two sets of landowners agree, in principle, to transfer use of the site to the government for the project purpose subject to agreement of a formal land use agreement.
121. **Mauke:** the subproject site falls within Tengarū 6B which has been investigated by the Land Court, and the many individual owners are thus known and registered (subject to updating any succession orders). The landowners agree, in principle, to transfer use of the site to the government for the project purpose subject to agreement of a formal land use agreement.
122. **Atiu:** The subproject site is part of a large section known as Vaitamina 556. Vaitamina 556 has been investigated by the Land Court, and the many individual owners are thus known and registered (subject to updating any succession orders). The landowners agree, in principle, to transfer use of the site to the government for the project purpose subject to agreement of a formal land use agreement.
123. **Aitutaki:** The subproject site consists of 10 parcels of private freehold land. Each of the 10 parcels is secured by the CIIC under a long-term lease on behalf of the Government of the Cook Islands.
124. **Rarotonga:** The subproject site is owned by the Government of the Cook Islands and is managed by the Airport Authority. TAU has leased the subproject site from the Airport Authority. However, as both the Airport Authority and TAU are administered and managed by CIIC all parties to the leases are bodies of the national government.

#### 4.3.5 Cultural and Heritage

125. With the exception of Rarotonga, the Mayors of each of the subproject islands were consulted to determine whether any sites of cultural significance (*marea*) or historical significance existed on the project sites. The subproject on Rarotonga is previously disturbed and there is no potential to disturb sites of cultural or heritage significance.

Letters were received from each subproject island confirming that there are no marea or historical sites associated with the project sites. The letters have been included as Appendix 3.

## 5. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### 5.1 Impacts and Mitigation Measures Included in Design and/or Pre-construction

#### 5.1.1 Physical Environment

126. **Climate Change Adaptation:** A climate risk profile for Cook Islands indicates that the main impacts of climate change are expected to be high sea levels, extreme winds, and extreme high air and water temperatures. Best estimates of long-term, systematic changes in the average climate for Cook Islands indicate that sea level is likely to have increased by 4 to 15 cm and the frequency of severe short sea level rise resulting from storm surge (2.2 m above mean sea level) will increase from a one in 580-year event to a one in 5-year event by 2050.
127. With the exception of Rarotonga all subprojects are located away from the coast and are not expected to be impacted by sea level rise. Although Rarotonga is located relatively close to the coast it is not located in a mapped coastal hazard zone. All components procured for the subprojects will be suitable for tropical marine and coastal environments, preferably be preassembled and will be as resistant to corrosion as practicable (e.g. stainless or galvanized steel mounting systems). Components will meet international standards (e.g. *IEC 61730 Photovoltaic (PV) module safety qualification*). The subprojects have been designed to withstand extreme winds (e.g. cyclones) and temperatures.
128. **Noise and air emissions:** The installation of new diesel power stations on Mauke and Mitiaro has the potential to increase noise levels at surrounding residences and release polluting exhaust emissions. The closest occupied residence at Mauke is approximately 70 m from the power station and the closest occupied residence at Mitiaro is approximately 180 m from the power station. Noise modelling has been undertaken for the proposed Mauke and Mitiaro power stations<sup>6</sup>. Using measured standard noise emissions from a generator typical of one which may be used on site (Cummins high speed 60 kW) it was found that the noise level at the closest occupied residence on Mauke was naturally attenuated to 40 dBA whilst the noise level at the nearest residence at Mitiaro was attenuated to 30 dBA (Figure 5.1 and Figure 5.2).

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<sup>6</sup> ISO 9613-2: First edition, 1996-12-15: Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation

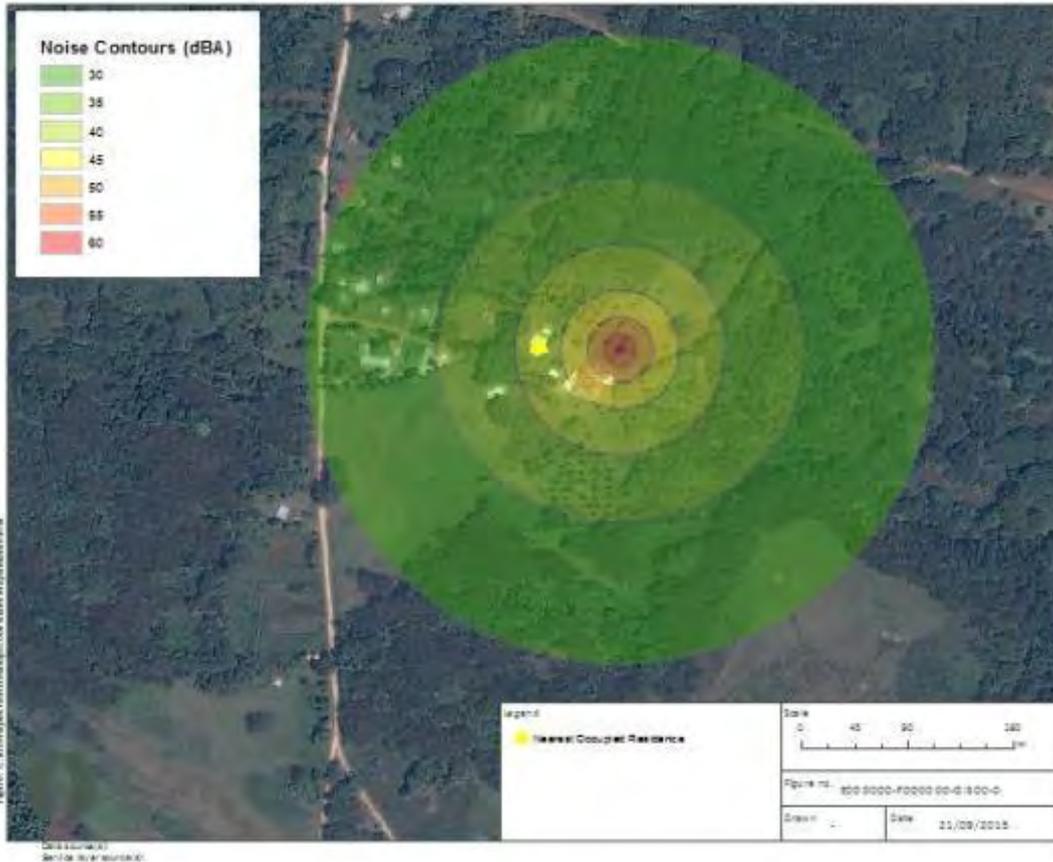


Figure 5.1: Modelled sound contours Mauke

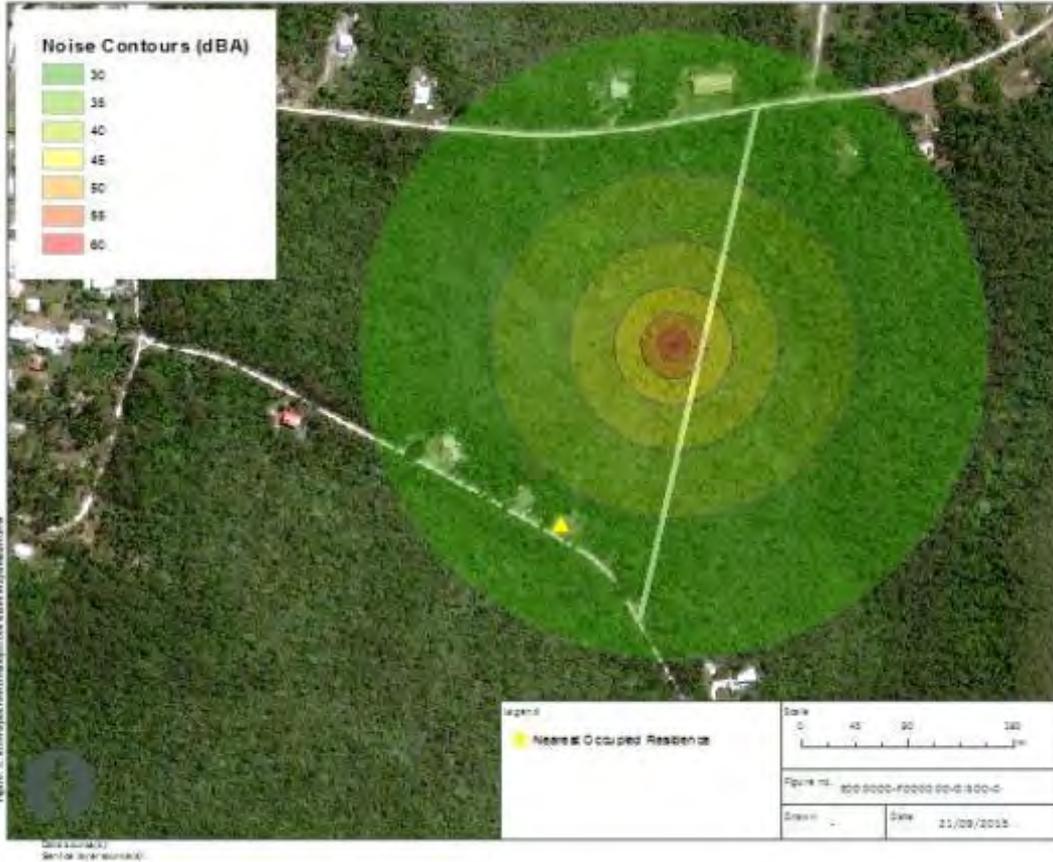


Figure 5.2: Modelled sound contours Mitiaro

129. IFC EHS Guidelines<sup>7</sup> stipulate that residential noise levels should not exceed 55 dBA during the day (07:00 to 22:00) and 45 dBA during the night (22:00-07:00). The modelled noise levels at both Mauke and Mitiaro fall within these levels. The modelled levels are conservative and do not take into consideration attenuation provided by the concrete block power station building or vegetation between the power station and the residence. The measured noise levels would be expected to be significantly lower. Further, the generators will only run infrequently (<5% of the time). However, given the proximity of residences to the power station additional noise mitigation measures will be considered in the detailed design of the power station (e.g. installation of bay doors instead of roller doors to help attenuate noise), the procurement of diesel generators and the operation of the power station (e.g. program battery charging to only occur during the day). Noise modelling will be rerun using the selected generator to ensure modelled noise levels comply with IFC guidelines at nearby residences.
130. The diesel generators will comply with relevant American Environmental Protection Authority (EPA) emission standards.
131. The subprojects on Rarotonga, Atiu and Mangaia do not include the installation of new diesel generators or any other sources of significant noise or air emissions. The subproject on Aitutaki includes the installation of a new diesel generator within the existing power station and is not expected to significantly increase noise emissions when the generators are in use. The implementation of these subprojects will reduce the use of the existing diesel generators thereby reducing noise and air emissions.

### 5.1.2 Biological Environment

132. Clearing for the subprojects will result in the direct loss of up to 5.2 Ha (52,000 m<sup>2</sup>) of vegetation (it is not expected that all of the project site at Atiu or Aitutaki will be cleared). There is no requirement for the temporary clearing of vegetation for access or for material or equipment storage. Flora and fauna surveys were undertaken at all subproject sites. The results of the surveys demonstrate that clearing of the sites selected for the subprojects will not result in the substantial loss of any native vegetation or have significant negative impacts on any species recorded as Endangered on the CIBD or listed on the IUCN Red List.
133. All the sites are part of larger contiguous areas of similar vegetation type and the clearing will not result in the fragmentation of habitat. The subproject sites are currently all easily accessible and their development will not result in increased access to previously remote areas that can result in an increase in vegetation clearance.
134. A description of the potential impacts and mitigation measures specific to each subproject is provided below.
135. **Mangaia:** Clearing for the sub project will result in the loss of native species however, all affected species are widespread on Mangaia and the clearing will not result in a significant adverse impact. No significant flora species are present on the site. The subproject site is likely to be used by the Mangaia Kingfisher. However, it does not provide breeding habitat for the species which breeds inland in dense Barringtonia forest. Although the subproject will result in the loss of a small area of potential habitat (1.22 Ha) it is unlikely to have a negative impact on the Mangaia Kingfisher as this habitat type is widespread on Mangaia. It is likely that the Mangaia Kingfisher will continue to use the project site as it moves between the surrounding habitats. Glare from the solar panels are unlikely to have any impact on the kingfisher. Several serious weed species were recorded and care will be required to prevent their spread on the

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<sup>7</sup> <http://www.ifc.org/wps/wcm/connect/06e3b50048865838b4c6f66a6515bb18/1-7%2BNoise.pdf?MOD=AJPERES>

site and into the surrounding environment. There are economic trees present on the site and the owners will be compensated as outlined in the Resettlement Plan.

136. **Mitiaro:** The subproject site is largely undisturbed due to its inaccessibility. Clearing will result in the loss of native species. However, the native species at the site are all widespread on Mitiaro and the small area to be cleared for the subproject (0.48 Ha) does not represent a significant adverse impact. Two flora species present on the site and two bird species reported to use the site are listed as Locally Endangered on the CIBD. However, all are widespread on Mitiaro and the Locally Endangered listing applies to other islands. Several serious weed species were recorded and care will be required to prevent their spread on the site and into the surrounding environment.
137. **Mauke:** The subproject site has historically been used for agricultural purposes and few native species are present. There is no fauna habitat for any significant species. No species were recorded that are listed as threatened on the CIBD or listed on the IUCN Red List. Several serious weed species were recorded and care will be required to prevent their spread on the site and into the surrounding environment. There are economic trees present on the site and the owners will be compensated as outlined in the Resettlement Plan.
138. **Atiu:** The site is dominated by introduced species (Caribbean Pine and Java Plum) that are widespread on Atiu. Clearing for the sub project will not result in a significant impact to native species nor will it adversely impact any significant flora species. The Caribbean Pine performs the role of a soil stabiliser at the site and prevents erosion. The civil works design will include appropriate drainage structures that adequately control surface water flow and prevent erosion of surrounding land. The loss of a small area (1.5 Ha) of potential habitat containing the Java plum and Polynesian Elaeocarpus is unlikely to have a negative impact on the Cook Islands Fruit Dove and other bird species that feed on the fruit of these species as both species are widespread on Atiu. It is likely that the Cook Islands Fruit Dove will continue to use the project site as it moves between surrounding habitats, Glare from the solar panels are unlikely to have any impact on the fruit dove.
139. **Aitutaki:** The subproject site is in poor condition with only two native species being recorded. No species were recorded that are listed as threatened on the CIBD or listed on the IUCN Red List. Several serious weed species were recorded and care will be required to prevent their spread on the site and into the surrounding environment. Although the Blue Lorikeet is regularly reported by locals the subproject site contains only marginal habitat for the species which is usually found in open forest, cultivated trees, plantations and gardens where it feeds on fruit, nectar and soft flowers. Clearing of a small area (1.1 Ha) of poor quality habitat is unlikely to have a negative impact on the Blue Lorikeet.
140. All sites are readily accessible via existing roads and tracks and will not require the clearing of additional vegetation.

### 5.1.3 Social Environment

141. **Site Selection:** The construction of the solar power/ energy storage systems on all subproject islands requires the use of relatively large areas of land. It is critical that the project site selected is acceptable to land owners and the wider island community. The subproject sites were selected based on consultation with stakeholders and landowners and taking into consideration technical and environmental considerations. There are no marae or historical values associated with any of the sites. The sites are all located such that the solar PV arrays will not be visually obtrusive to nearby residents.
142. Land for all sites is either owned by the Government of the Cook Islands or privately owned native freehold or customary land. The availability of all sites has been agreed

in principle with landowners and the Island Council's. Affected people will be compensated as per the entitlement proposed in the project Resettlement Plan. Since the proposed sites are free from any agricultural/commercial activities, the livelihoods of affected people will not be impacted. In addition there will be no relocation of people as proposed sites are free from buildings/structures.

143. The design of the subprojects has minimized visual impacts to local residents by:

- specifying that cables connecting the solar PV array to the power house will be buried; and,
- the power house (and other above ground infrastructure other than the PV panels) will be neutral coloured to reduce visual impact.

## 5.2 Impacts and Mitigation Measures Due to Construction Activities

### 5.2.1 Physical Environment

144. **Air Quality and Dust:** The construction of the subprojects has the potential to generate excessive dust through construction activities such as earth moving, by the movement of vehicles and machinery and by exposed soil on the cleared sites or in soil stockpiles. Implementation of good practice construction measures will reduce the impacts to air quality.

145. Mitigation measures include:

- Vehicles carrying soil, sand, crushed aggregate or other fine materials to or from the project site will be covered.
- The project site, material stockpiles and access roads, including those from the wharf, and material stockpile areas, will be wetted or stabilised if dust is generated.
- Earth moving equipment will be cleaned prior to leaving site to prevent the tracking of soil on nearby roads.

146. **Waste Management:** Management of waste during construction of the subprojects is important to prevent pollution of surrounding water and land. Waste management during all phases of the subprojects will seek to reduce, reuse and recycle waste as far as possible and dispose of waste in an appropriate way. There are expected to be few hazardous wastes generated during construction however, with the exception of Rarotonga, there are no facilities to process any hazardous wastes on any of the subproject islands and no hazardous wastes will be disposed of on any of the subproject islands other than Rarotonga.

147. Mitigation measures include:

- Vegetation cleared from the subproject sites will be disposed of in consultation with the POE and IEO (e.g. chipped and made available to local residents as mulch). A significant amount of vegetation will be required to be disposed of on Atiu and options are being investigated to determine an environmentally appropriate solution.
- The construction contractor will consult with the POE and IEO to identify opportunities to avoid and reduce the generation of waste and to recycle or re-use waste generated.
- Construction wastes that cannot be re-used or recycled on the subproject island will be transported off site for reuse, recycling or disposal.
- If excess spoil is generated during site preparation it will be stored at an existing stockpile site for re-use.
- With the exception of Rarotonga, hazardous waste (if generated) will be transported off the subproject island. All hazardous waste will be disposed of in accordance with manufactures requirements at a facility approved by the NES.

- Bins for recycling and general rubbish will be provided at the project site and materials laydown area for the disposal of construction wastes.
148. **Noise and Vibration:** The construction of the subprojects will generate noise through the operation of machinery on the site and movement of vehicle and machinery transporting equipment and materials to site. Construction noise impacts will be sporadic and are expected to be minor. Implementation of good practice construction measures will reduce noise impacts.
149. Mitigation measures will include:
- Wherever possible working hours will be between 8am and 5pm Monday to Friday. Where safety or technical reasons require work to be completed outside of these hours, noise levels will be kept to a minimum and the Island Council together with nearby residents will be informed.
  - Noise generating activities e.g. site clearance will be carried out in the least sensitive time periods to be determined in consultation with the Island Council.
  - Equipment and plant will be maintained in good order. Noise reduction components (e.g. mufflers) will be inspected prior to the commencement of works to ensure they are fully functional. Noise emissions from construction equipment will not exceed 75 dBA.
150. **Water Resources and Quality:** The construction of the subprojects has the potential to interfere with local water resources (ground or surface water) through inappropriate abstraction for construction, alteration of surface water flow across the site leading to sedimentation of adjacent environments (refer Erosion Control below) and pollution of water resources through accidental spillage of hazardous materials (refer Hazardous Materials below)
151. Mitigation measures will include:
- Where feasible construction techniques will be specified that minimise the need to alter the topography (e.g. piling) and hence surface water drainage on the site.
  - Water required for construction (e.g. concrete mixing) will be sourced with the agreement of the Island Council, IEO and POE.
152. **Hazards materials:** Hazardous materials will be required for the construction of the subproject. Hazardous materials (e.g. fuels and oils) will be appropriately managed during construction to prevent pollution of surrounding land and water.
153. Mitigation measures will include:
- Contractor(s) will prepare a hazardous materials management plan that shall, at a minimum, include:
    - The type and quantity of hazardous materials the will be present on site.
    - Safety Data Sheets for all hazardous materials.
    - A spill response plan including training for staff in the use of spill kits.
    - Details of planned transport, storage and disposal of hazardous materials (including compliance with commitments contained within this IEE).
  - The transport of hazardous materials will be done by an appropriately experienced and equipped contractor.
  - Hazardous materials will be stored in appropriate containers that are in good condition with adequate labelling.
  - Hazardous materials (including fuel and oils) storage will be appropriately banded.

- Spill kits and containment devices appropriate for the type and volume of hazardous materials on site will be located at the storage area(s), on the site and on vehicles carrying hazardous materials.
  - Hazardous materials will not be disposed of on the subproject island but will be transported offsite and disposed of at a facility approved by the NES.
154. **Erosion Control:** Erosion has the potential to occur when the sites have been cleared of vegetation but have not yet been stabilized or from stockpiles of materials. In particular, Atiu is susceptible to erosion due to its soil type and sloping topography. Erosion can lead to instability of the project site and surrounds causing damage to vegetation and sedimentation of surrounding streams and lakes.
155. Mitigation measures will include:
- All land disturbances will be confined to the minimum practicable working area to ensure that the minimum land area is exposed to erosion for the shortest possible time.
  - Existing drainage lines will be protected and diversion of drainage lines avoided.
  - Surface water will be diverted around the construction footprint using structures such as catch drains, silt fences or bunds. Surface water will not be diverted across erosion prone slopes.
  - Erosion control works and measures will be installed to control surface water runoff and prevent the export of sediments from the site by ensuring;
    - discharge of storm water is to stable preferably vegetated land
    - erosion control measures closely follow land contours to reduce runoff velocity from exposed soils.
  - Sediment traps (e.g. silt fences) will be constructed across all drainage lines and erosion controls from site that are likely to receive runoff from exposed or disturbed soils. Sediment basis will be installed where required.
  - The site will be covered with geotextile fabric immediately after clearing to prevent the loss of top soil (Atiu and if deemed necessary by the POE and Island Environmental Officer for remaining subprojects).
  - A shade tolerant low groundcover (e.g. grass) will be established across the site as soon as practicable after site clearance. The species of groundcover used will be selected in consultation with the IEO and will not shade the PV modules.
  - Sediment and erosion control measures will be monitored regularly to ensure their continued correct functioning.
  - Cable trenches will remain open for the shortest duration possible to reduce erosion and where possible will not be open during periods of heavy rain.
  - Spoil from excavated trenches will be stored on the uphill side of the trench such that any sediment from the spoil is deposited in the trench.

## 5.2.2 Biological Environment

156. **Ecological:** As outlined above the clearance of the sites will not result in the significant loss of any native vegetation or the loss or any species recorded as Endangered on the CIBD or listed on the IUCN Red List. Neither will the clearing of vegetation result in the loss or fragmentation of any significant fauna habitat. The loss of vegetation from the site has the potential to impact the surrounding environment through unauthorised clearing outside the site boundary, clearing additional areas (e.g. to store materials) or by causing damage to surrounding vegetation through erosion or the introduction of invasive species.

157. Mitigation measures will include:

- To ensure vegetation clearing is restricted to within the site boundary and is the minimum practically required a representative of the POE and the IEO will be on site during clearing.
- On Atiu, trees on steeply sloping land within the project site boundary (close to the north west boundary) will not be removed.
- Cleared vegetation will be removed and will not be stockpiled on site or pushed into existing vegetation adjacent to the site.
- Machinery storage and materials lay down areas will be established in previously disturbed areas to avoid increasing the footprint of the project site.
- As far as is practicable existing stockpiles of fill material will be used. If new fill material is required it will be sourced from locations approved by the IEO that do not result in the disturbance of native vegetation.
- Immediately following clearing the site will be planted with low growing grass species to help stabilise the site and minimise the spread of weeds (there is a risk of weeds spreading into newly cleared sites at all subproject locations).
- Bermuda grass (*Cynodon dactylon*) exists on Mauke and Mitiaro and the subproject sites shall be mowed after clearing to encourage this species to establish.
- Weed hygiene measures (e.g. cleaning machinery before it enters the site) will be implemented to prevent introduction or spread of invasive species.

### 5.2.3 Social Environment

158. **Social:** Social impacts during construction of the project may include increased work opportunities for local contractors, increase in traffic, including heavy haulage at wharfs and on roads and health and safety risks to contractors, power station operators and the general public. The subprojects are likely to require foreign contractors and technical specialists for the duration of construction (six to eight weeks) which can lead to conflict between foreign workers and local communities.

159. Mitigation measures will include:

- A list of relevant local contractors available on each subproject island will be provided in tender documentation to facilitate the engagement of local industry by the selected construction contractor.
- Opportunities will be made available by the contractor for local contractors and businesses to be engaged during construction and commissioning of the power station.
- With the exception of Rarotonga, the subproject Island Council, visitors centre, landowners, local residents and stakeholders will be kept informed of the project via monthly meetings during construction including details of:
  - the progress of the works and expected completion date
  - scheduled delivery of materials and equipment
  - any disruptions to the use of the wharf or site access roads
  - upcoming works that are likely to be noisy.
- As far as is practicable works will be timed to avoid disruption to local events.
- Fencing shall be installed on all areas of excavation greater than 1m deep whether temporary or permanent.

- The contractor(s) will be required to develop an occupational health and safety plan prior to the commencement of any works on site.
  - Workers shall be provided (before they start work) with appropriate personnel protective equipment (PPE).
  - Adequate sanitation and potable water will be supplied by the contractor.
  - A Grievance Redress Mechanism (GRM) (refer Section 8) will be established prior to the commencement of construction works.
160. **Cultural and Heritage Resources:** No marae or historical sites or artefacts are known to be associated with any of the subproject sites. Nonetheless, in the unlikely event of an artefact being uncovered during construction work will cease immediately and the Island Council and POE notified. Work will not recommence until authorised by the POE.

### 5.3 Impacts and Mitigation Measures from Operation

161. The operation of the solar power systems will have minimal environmental impacts at the subproject sites and in surrounding areas.

#### 5.3.1 Physical Environment

162. **Waste and Hazardous Materials:** the operation of the subprojects will generate waste, including hazardous waste (e.g. inverters and batteries will require replacement after approximately 10 years), which must be appropriately managed to prevent contamination of surrounding land and water.
163. Mitigation measures will include:
- Inverters and batteries that have been replaced during the operating lifetime of the power station will be removed, transported and disposed of by an appropriately experienced and equipped contractor.
  - Where possible batteries and inverters will be recycled. If recycling is not possible they will be disposal will be at a facility approved by the NES.
  - Waste oil and other hydrocarbons from generators will be stored in a bunded hydrocarbon storage area.
  - No hazardous waste (e.g. used oils, batteries or inverters) will be disposed of on the subproject Island (except Rarotonga). Waste will be sent for disposal at regular intervals and not allowed to accumulate at the power station.
  - Washing of solar PV panels would only be undertaken on an 'as needs' basis to minimise the generation of waste water. Disposal of waste water will be agreed with the Island Environmental Officer.
  - All infrastructure containing hazardous materials (e.g. batteries, transformers, generators) will be inspected regularly to ensure it is functioning correctly and no hazardous materials are being discharged.
  - Screening vegetation will be established between the PV array and the road to minimise dust from the road settling on the panels.
164. **Water resources:** Water will be required for washing solar PV modules during operation of the subproject. A source of water will be agreed with the Island Council and IEO.
165. **Erosion Control:** If localised erosion is detected during operation of the subproject effective mitigation measures such as application of mulch, covering with open weave

jute matting and reseedling with ground cover, protection with geotextile fabric or localised flow dispersal and diversion structures will be installed.

### **5.3.2 Biological Environment**

166. No significant impacts to the biological environment are anticipated due to operation of solar power systems. Some subproject sites are located within habitat for bird species and it is possible that birds will avoid overflying the sites due to glare from the panels. The sites do not cause any habitat fragmentation, are relatively small and are not expected to significantly impact any species known to occur in the vicinity of the sites. Weed monitoring will be carried out at the subproject site regularly and ongoing weed control will take place to prevent the establishment and spread of invasive species.

### **5.3.3 Social Environment**

167. It is expected that existing employees will be retained to operate the new solar power systems. Training will be provided for power station employees in the operation and maintenance of the new solar power system.
168. The solar power station will be monitored remotely and any faults rectified by onsite maintenance staff reducing the risk of a health and safety incident (e.g. fire) occurring.
169. The POE will prepare an operational emergency response plan. The plan will be included in the training provided to employees and be implemented during the operation of the solar power system.

## **5.4 Impacts and Mitigation due to Decommissioning**

170. The subproject's solar PV modules are expected to have an economic life of 25 years. At this time it is expected that they will be replaced by modern solar PV modules. The removal of the solar PV modules will be contracted to a specialist supplier. The BESS installed on Rarotonga is expected to have an economic life of between 10 and 20 years dependent on the battery type selected. All equipment will be removed from the subproject sites (e.g. PV modules, batteries, invertors) and will be reused or recycled where possible. Equipment that cannot be reused or recycled will be disposed of at a facility approved by the NES.
171. The decommissioning contractor will be required to develop a hazardous materials management plan prior to the commencement of any works on site.
172. If the site is not reused it will be replanted with species appropriate to the future land use of the site.

## **5.5 Cumulative Impacts**

173. The installation of the solar power / energy storage systems will either incorporate the existing diesel power stations (Mangaia, Atiu, Aitutaki and Rarotonga) or replace the existing diesel power station (Mitiaro and Mauke). Presently, there is no future development or expansion plans of the existing diesel power plants. Therefore, there will be no cumulative environmental effects of constructing solar power systems of each of the subproject islands.
174. There are likely to be significant benefits in aligning the Phase 1 subproject design with each other and the Northern Group systems which have already been installed. Benefits include; common operating procedures allowing for easier training of staff and staff movement between stations, cost effective procurement of spare parts and redundancy of parts between stations in the event of emergencies.

## **6. ANALYSIS OF ALTERNATIVES**

175. An assessment of alternatives was completed with and without the proposed project. The results of the assessment found that the outer islands would continue to pay a high price for diesel imports for electricity generation which affects the economic development of the subproject islands and the Cook Islands as a whole. Further, reliance on diesel imports risks security of supply, and price spikes or transport delays can significantly affect the local economy. Implementation of the project will bring positive economic, social, and environmental benefits. Economic benefits will be from the reduction in import of diesel for power generation, and increased security of supply. Social benefits include a sustainable electricity supply to the consumers and environmental benefits will be from reduction in emissions and reduced transport and storage of hazardous fuels.
176. As part of capacity building local staff will be trained in the maintenance and operation of solar-diesel hybrid systems.
177. Alternative sites were considered however, the selected subproject sites were considered the most suitable sites because they met the following constraints:
- Technical: sites must be within close proximity to the existing power station, provide easy access to the existing distribution grid, receive sufficient solar radiation, reduce the need for extensive civil works and preferably be accessible by existing roads.
  - Environmental: construction on the sites must not result in a significant adverse impact of species listed as Endangered on the CIBD or listed on the IUCN Red List.
  - Social: sites must be acceptable to local community, landowners must be willing to enter into a land use agreements, not contain marae or historical values and preferably not negatively impact the livelihoods of affected people.

## **7. CONSULTATION AND INFORMATION DISCLOSURE**

### **7.1 Stakeholders and Community Consultations**

178. As part of the PPTA consultations were carried out during field visits in December 2013. Stakeholder consultations were carried out by holding meetings at offices of the respective agencies in Rarotonga, as well as at island council offices. Whereas personal discussion, focus group discussions and questionnaire surveys were used for community/public consultations.
179. In total eight stakeholder meetings involving 31 officials from various agencies, i.e., the REDD, TAU, NES, Island Environment Authorities, Statistics and Economics, Utilities from targeted islands, women groups, etc., were consulted during the fact-finding visits. The list of officials/stakeholders consulted and summary of the issues raised are presented in Appendix 4.
180. The consultations included both discussions with stakeholders and discussions with community/island level authorities including project affected people, landowners and women groups from the islands. Affected people and landowners (64 in total involving 26 women participants) and women groups (one group from each Island) were consulted during the field visits. Consultation will continue at next stages, i.e., after finalization of detailed design and before start of the civil works construction, as well as at implementation stage. The details of such consultation carried out during reconnaissance field visits are presented in Appendix 4.
181. Similar consultations were carried out by the POE in May and again in June of 2015 with similar results (Appendix 4). Information was provided on the scale and scope of the Project, the expected impacts and the proposed mitigation measures.

182. Local communities and community leaders from subproject islands are well aware of and strongly support the proposed project, as the installation of solar power plants will bring benefits to the islands in terms of improved and sustainable electricity supply, improve the overall economy situation by saving in cost of imported diesel and some employment opportunities.
183. Consultations have continued and will continue at the next stages--i.e., during the detailed design and before the start of civil works. IA with CIIC representative will continue consultations with leaders in the Island Councils, village leaders including traditional chiefs, affected landowners/APs, and other interested members of the community.
184. Recommendations and suggestions from stakeholders and the public were incorporated in the design of the project and in the project IEE and EMP.

## **7.2 Information Disclosure**

185. All environmental documents are subject to public disclosure, and therefore will be made available to the public. The IEE will be disclosed on ADB's website upon receipt as per ADB's Public Communications Policy (PCP) 2011.
186. The EMP includes a grievance redress mechanism (GRM) so that any concerns raised during construction or operation of the subprojects can be addressed.

## **8. GRIEVANCE REDRESS MECHANISM**

187. A Grievance Redress Mechanism (GRM) is proposed for the project to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental and social safeguards performance. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the construction and operation of the project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It addresses affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism does not impede access to the Cook Islands' judicial or administrative remedies. EA through IAs will appropriately inform the affected people about the mechanism before commencement of any works.

### **8.1 Proposed GRM Mechanism**

188. The key functions of the GRM are to: (i) record, categorize and prioritize the grievances; (ii) resolve the grievances in consultation with complainant(s) and other stakeholders; (iii) inform the aggrieved parties about the solutions; and (iv) forward unresolved cases to higher authorities for resolution.
189. The PMU, supported by PMU staff and consultants, will be the grievance focal point to receive, record, review, and address project related concerns in coordination with government authorities. Affected persons (APs) have been and will be made fully aware of their rights during consultations about land requirements. Since the PMU had not yet been set up at the time of consultations with APs and other stakeholders in May and June of 2015, stakeholders were advised to submit any concerns or complaints to the REDD office. APs and other stakeholders are all familiar with the REDD office, and the PMU will likely be located in the REDD office once established.
190. Any complaint will be recorded and investigated by the PMU working with relevant staff of the individual subproject. The PMU will inform or update the relevant IA immediately

of any complaints. A complaints register will be maintained that will record the date, details, and nature of each complaint, who makes the complaint, and the date and actions taken as a result of the resulting investigation. The register will also cross reference any non-compliance report and/or corrective action report or other relevant documentation.

191. When subproject implementation starts, a sign will be erected at all sites providing the public with updated project information and summarizing the grievance redress mechanism process including contact details of relevant persons at the PMU. All corrective actions and complaint responses carried out on site will be reported back to the PMU. The PMU will include the complaints register and corrective actions/responses in its progress reports to the ADB.
192. In the GRM process, relevant Cook Islands national agencies will always be available to review public complaints and advice on the PMU's performance for grievance redress.
193. Any APs, village chiefs, or elected officials can take a grievance to the PMU or to the site office. On receipt of a complaint in any form (in person, telephone, written), the PMU focal officer for the respective site or subproject will log the details in a complaints register. PMU will review and find a solution to the problem within two weeks in consultation with village or traditional chief and relevant local agencies. Then PMU will report back the outcome of the review to the village/traditional chief and affected persons within a week's time. If the complainant is dissatisfied with the outcome at the PMU level or has received no advice in the allotted time period, he or she can take the grievance through the Island Council to relevant national agencies (CICC, REDD, etc.). The relevant national agency then reviews and reports back to the Island Council/AP/village or traditional chief about the outcome. If unresolved, or at any time complainants is not satisfied, the complainant can take the matter to the appropriate court. Both successfully addressed complaints and non-responsive issues will be reported to the ADB by the PMU.
194. Table 8.1 presents the steps and corresponding time frame for proposed grievance redress mechanism.

Table 8.1: Grievance Redress Process

Stage	Process	Duration
1	Affected Person (AP), island elected or traditional chief, or other concerned party takes grievance to PMU.	Any time
2	PMU reviews and finds solution to the problem in consultation with island elected or traditional chief and relevant agencies.	2 weeks
3	PMU reports back an outcome to people who submitted the grievance.	1 week
<b>If unresolved or not satisfied with the outcome at PMU level</b>		
4	Concerned party takes grievance through Island Council to relevant national agency (CIIC, REED, etc.).	Within 2 weeks of receipt of decision in step 3
5	National agency reviews and finds a solution which may include recommendation of dispute resolution, including an appropriate body to oversee'.	4 weeks
6	National agency reports back to the people who made the complaint.	1 week
<b>If unresolved or at any stage if AP is not satisfied</b>		
Concerned party can take the matter to appropriate court.		As per judicial system

## 9. ENVIRONMENTAL MANAGEMENT PLAN

### 9.1 Introduction

195. This EMP is intended to cover all phases of the subproject implementation including design, construction, commissioning, operation and decommissioning. The EMP complies with ADBs SPS and includes the following information:

- Implementation arrangements including institutional roles and responsibilities for the EMP implementation throughout all phases of the project.
- Environmental management matrices including:
  - Potential environmental impacts at each stage of the project
  - Proposed mitigation measures to address each potential impact
  - Costs associated with implementation of the mitigation measure
  - Institutional responsibility for implementing proposed mitigation measures
  - Schedule of implementation of mitigation measures.
- Environmental monitoring plan including:
  - Aspects to be monitored to ensure mitigation measures have been implemented effectively
  - Schedule and frequency of monitoring
  - Costs associated with monitoring
  - Responsibility for implementing and supervising monitoring.

### 9.2 Mitigation Measures

196. Environmental mitigation measures have been designed to avoid potential impacts where possible and to mitigate impacts that cannot be avoided. Implementation of this EMP and mitigation measures will ensure compliance with obligations under the Cook Islands *Environment Act 2003* and ADB safeguard standards.

197. To ensure mitigation measures contained in the EMP are successfully implemented:

- The EMP will be included in tender documentation
- The contractor(s) shall prepare a construction EMP (CEMP) describing the subproject and site specific measures that will be implemented to comply with the EMP
- The contractor(s) will submit its CEMP to the POE and IA for approval prior to the commencement of construction.
- The POE will ensure there are sufficient resources to oversee the implementation of the EMP at all subproject sites
- The EMP and GRM will be disclosed to the public in accordance with the Section 7 of this EMP.

198. An environmental management plan describing the potential impacts and proposed mitigation measures and responsible agency has been prepared in a matrix form and presented in Table 9.1.

### 9.3 Implementation Arrangements and Responsibilities

199. **Implementation of the EMP:** MFEM as the EA has overall responsibility for all aspects of the project. TAU and REDD as the IAs will be responsible for the overall

implementation of the project. The PMU and PSC have been set up to support the implementation of the project. REDD will be responsible for ensuring the EMP is implemented for each of the four subprojects and at for stages of development. This includes ensuring compliance with all Government of the Cook Islands and ADB safeguard requirements. The NES and IEOs will also be involved in environmental management activities.

200. Whilst the ultimate responsibility for the subproject implementation resides with REDD, the PMU (with support from the POE) will be responsible for the day to day implementation of the EMP during the design, construction and commissioning phases of the subprojects.
201. **MFEM Environmental Responsibilities:** MFEM as the EA, with support from the POE International Environmental Expert (IEE), will be responsible for submitting environmental documentation to the NES as required under the *Environmental Act 2003* and ensuring that the environmental management and monitoring budgets are available and utilized as necessary for timely implementation of EMP.
202. **REDD and PMU (POE) Environmental Responsibilities:** The PMU, predominately via the POE IEE and National Environmental Expert (NEE), will support REDD in the following:
  - Preparation of tender documents including integration of the approved EMP and support REDD in tender evaluation with respect to contractors' environmental management capability and proposed CEMP provisions.
  - Prepare Environmental Significance Declarations (ESD) and Environmental Impact Assessments (EIAs) in accordance with the *Environment Act 2003* and the subproject specific terms for reference prepared by the NES to obtain project consent.
  - Ensure REDD and Contractors are aware of any consent conditions and the implications for the implementation of the subprojects.
  - Review and approve selected Contractor(s) subproject specific CEMP, Emergency Plan and Health and Safety Plan.
  - Ensure pre-construction environmental mitigation measures are incorporated into the project design.
  - Supervise the on ground implementation of the EMP at all subproject sites including monitoring of compliance with the approved CEMP.
  - Work with the project International Social Specialist to ensure the GRM is implemented.
  - Provide training to IA and contractor staff on managing the environmental issues associated with project.
  - Review of contractors monthly reports on safeguard application.
  - Include results of contractors monthly reporting and POE audits and checks in quarterly progress reports.
  - Prepare semi-annual safeguards monitoring reports to be submitted to EA, PSC, NES, and ADB. All safeguards monitoring reports will be disclosed as per ADB policies.
203. **Contractor Environmental Responsibilities:** The contractor will be required to have one staff with experience in environmental management. This staff will be responsible for preparing plans such as emergency preparedness plan; occupational health and safety plan, and energy day-to-day implementation of EMP. Contractors will report on construction progress on a monthly basis. The monthly reports will include a section on implementation of the EMP and other Health and Safety provisions as required.

#### 9.4 Monitoring and Reporting

204. **Monitoring:** Environmental monitoring will be carried out through all phases of the subproject development to ensure that the environmental mitigation measures are effective and that actual environmental impacts accord with predicted impacts and are in compliance with the Environment Act 2003 and ADB safeguard standards.
205. The POE will ensure appropriate monitoring is undertaken during construction in accordance with subproject progress.
206. Complaints received from the public will be monitored and resolved in accordance with Grievance Redress Mechanism. If required, additional monitoring inspections will be undertaken.
207. An environmental monitoring plan is presented in Table 9.2 and outlines the parameters, frequency and responsibility for monitoring.
208. **Reporting:** In consultation with EA and ADB, the IA will establish a system for preparing quarterly reports on safeguards performance monitoring, issues resolution, and corrective action plans. The quarterly report will include a summary of the contractor's monthly report and monitoring undertaken by the IA including the POE.
209. The EA will submit biannual environmental monitoring reports on EMP implementation for ADB's review.
210. Contractors will prepare monthly reports which will describe the implementation of the CEMP including any non-compliances and corrective actions. The report will be submitted to the IA and reviewed and approved by the POE.

Table 9.1: Environmental Management Plan

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
<b>Pre-construction</b>					
Statutory clearances/ permits	Obtain Environmental Permit and other statutory permits from the NES.	Undertake an environmental impact assessment, including preparation of an EIA report, in accordance with the <i>Environment Act 2003</i> . Ensure EIA is approved and Environmental Permit received prior to the commencement of onsite works.	Project Cost	EA, IAs through PMU	Prior to commencement of onsite work
Climate Change	Increased severe weather events and/or rise in sea level as a result of climate change.	Locate project sites inland and above predicted sea level rises. Ensure components procured are suitable for tropical marine and coastal environments and meet relevant international standards. Design subproject to withstand extreme weather events (e.g. cyclones).	Project Cost	EA, IAs through PMU	Detailed design
Site selection	Selected sites contain significant ecological values, will result in impacts to threatened species and/or are located in protected areas.	Flora and fauna surveys were undertaken at all subproject sites. The results of the surveys demonstrate that the sites selected for the subprojects will not result in the significant loss of any native vegetation or have any significant negative impacts on any species recorded as Endangered on the CIBD or listed on the IUCN Red List	Project Cost	EA, IAs through PMU	Detailed design
	Visual impacts	Careful selection of site away from inhabited areas.	Project Cost	EA, IAs through PMU	Detailed design
	Selected sites contain heritage values and/or are located in protected areas	The Island Councils from each subproject island were consulted and confirmed that there are no marae or historical significance associated with any of the subproject sites.	Project Cost	EA, IAs through PMU	Detailed design
	Selected sites are unacceptable to landowners or stakeholders.	Consultation has been undertaken with the local community. Landowners at all subproject sites agree, in principle, to transfer use of the site to the government for the project purpose subject to agreement of a formal land use agreement.	Project Cost	EA, IAs through PMU	Detailed design

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
Drainage and erosion	Development of the subprojects results in erosion at project sites.	The civil works design will include appropriate drainage structures that adequately control surface water flow and prevent erosion of surrounding land (particularly Atiu).	Project Cost	EA, IAs through PMU	Detailed design
Access	Impacts due to construction of new access roads and wharfs	Proposed sites are accessible by existing wharf and road network. Therefore there is no requirement to construct new access roads or wharfs.	Project Cost	EA, IAs through PMU	Detailed design
Project administration	Contractor unaware of environmental mitigation measures	Ensure that EMP is included in the bidding documents.	Project cost	EA, IAs through PMU	Tendering process
	Updating EMP	Mitigation measures defined in this EMP have been updated and incorporated into the detailed design to minimize adverse impacts.	Project cost	EA, IAs through PMU	Detailed design
	Updated EMP incorporated into bid and contract documents	Prepare environmental contract clauses for contractors, namely the special conditions (e.g. reference EMP and monitoring table).	Project cost	EA, IAs through PMU	Tendering process
Equipment design and selection	Release of toxic chemicals and gases in receptors (air, water, land)	PCBs should not be used in transformers and other project facilities or equipment.	Project Cost	EA, IAs through PMU	Tendering process
Equipment design and selection	Noise and air emissions	Undertake desktop noise modelling to ensure selected generators meet or exceed IFC EHS Guidelines – Noise. New diesel generators will comply with relevant American emission standards.	Project Cost	EA, IAs through PMU	Tendering Process
	Hazardous materials	PCBs will not be used in transformers and other project facilities or equipment.	Project Cost	EA, IAs through PMU	Tendering process
Resettlement (land acquisition)	Social inequities	Affected people will be compensated as per entitlement matrix proposed in the project Resettlement Plan	Project Cost	EA, IAs through PMU	Prior to start of onsite work
<b>Construction</b>					
Air quality and dust	Generation of excessive dust through project construction activities.	Vehicles carrying soil, sand, crushed aggregate or other fine materials to or from the project site will be covered The project site, material stockpiles and access roads, including those from the wharf and material stockpile areas,	To be included in Contractor cost.	Contractor (preparation and implementation)	During civil work and construction

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
		<p>will be wetted or stabilised if dust is generated.</p> <p>Earth moving equipment will be cleaned prior to leaving site to prevent the tracking of soil on nearby roads.</p>		PMU (approval)	
Waste management	Inappropriate storage and disposal of waste	<p>Waste management during the subprojects will seek to reduce, reuse and recycle waste as far as possible and dispose of waste in an appropriate way.</p> <p>No hazardous wastes will be disposed of on any of the subproject islands.</p> <p>Vegetation cleared from the site will be disposed of in consultation with the POE and Island Environmental Officer (e.g. chipped and made available to local residents as mulch). A significant amount of vegetation will be required to be disposed of on Atiu and options are being investigated to determine an environmentally appropriate solution.</p> <p>The construction contractor will consult with the POE and Island Environmental Officer to identify opportunities to avoid and reduce the generation of waste and to recycle or re-use waste generated.</p> <p>Construction wastes that cannot be re-used or recycled on the island will be transported off site for reuse, recycling or disposal.</p> <p>If excess spoil is generated during site preparation it will be stored at an established stockpile site (e.g. airport) for re-use.</p> <p>Hazardous waste (if generated) will be transported off the subproject island and disposed of in accordance with manufactures requirements at a facility approved by the NES.</p> <p>Concrete waste (including water) will be captured and taken off the subproject island for disposal.</p> <p>Bins for recycling and general rubbish will be provided at the project site and materials laydown area for the disposal of construction wastes.</p>	To be included in Contractor cost.	Contractor (preparation and implementation) PMU (approval)	During all onsite works

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation on schedule
Noise and vibration	Disturbance to local community and project staff through noise and vibration	<p>Wherever possible working hours will be between 8am and 5pm Monday to Friday. Where safety or technical reasons require work to be completed outside of these hours noise levels will be minimised as much as possible and the Island Council together with nearby residents will be informed. Work will not be undertaken on Sundays and holy days.</p> <p>Noisy activities e.g. site clearance will be carried out in the least sensitive time periods to be determined in consultation with the Island Council.</p> <p>Equipment and plant will be maintained in good order. Noise reduction components (e.g. mufflers) will be inspected prior to the commencement of works to ensure they are fully functional.</p> <p>Noise level not to exceed 85 dB(A) (over 8 hr period).</p>	To be included in Contractor cost.	EA, IAs through PMU	During civil work and construction
Water resources and quality	Depletion or contamination of local water resources	<p>Where feasible construction techniques will be specified (e.g. piling) that minimise the need to alter the topography (e.g. levelling) and hence surface water drainage on the site.</p> <p>Water required for construction (e.g. concrete mixing) will be sourced with the agreement of the Island Council, Island Environmental Officer and POE.</p>	To be included in Contractor cost.	Contractor PMU (approval)	During civil work and construction
Hazardous materials	Release of hazardous materials to the surrounding environment	<p>The Contractor(s) will prepare a hazardous materials management plan that shall at a minimum include:</p> <ul style="list-style-type: none"> <li>• The type and quantity of hazardous materials that will be present on site.</li> <li>• Safety Data Sheets for all hazardous materials.</li> <li>• A spill response plan including training for staff in the use of spill kits.</li> <li>• Details of planned transport, storage and disposal of hazardous materials (including compliance with commitments contained within this IEE).</li> </ul> <p>Transport of hazardous materials will be by an appropriately experienced and equipped contractor.</p>	To be included in Contractor cost.	Contractor (preparation and implementation) PMU (approval)	During all onsite works

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
		<p>Hazardous materials will be stored in appropriate containers that are in good condition with adequate labelling.</p> <p>Hazardous materials (including fuel and oils) storage will be appropriately bunded.</p> <p>Spill kits and containment devices appropriate for the type and volume of hazardous materials on site will be located at the storage area(s), on the site and on vehicles carrying hazardous materials.</p> <p>Hazardous materials will not be disposed of on the subproject island but will be transported offsite and disposed of at a facility approved by the NES.</p>			
Erosion control	Erosion of project site and surrounds.	<p>All land disturbances will be confined to the minimum practicable working area to ensure that the minimum land area is exposed to erosion for the shortest possible time.</p> <p>Existing drainage lines will be protected and diversion of drainage lines avoided.</p> <p>Surface water will be diverted around the construction footprint using structures such as catch drains, silt fences or bunds. Surface water will not be diverted across erosion prone slopes.</p> <p>Erosion control works and measures will be installed to control surface water runoff and prevent the export of sediments from the site by ensuring:</p> <ul style="list-style-type: none"> <li>• Discharge of storm water is to stable preferably vegetated land.</li> <li>• Erosion control measures closely follow land contours to reduce runoff velocity from exposed soils.</li> </ul> <p>Sediment traps (e.g. silt fences) will be constructed across all drainage lines and erosion controls from site that are likely to receive runoff from exposed or disturbed soils. Sediment basins will be installed where required.</p> <p>The site will be covered with geotextile fabric immediately</p>	To be included in Contractor cost.	Contractor (preparation and implementation) PMU (approval)	During all onsite works

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation on schedule
		<p>after clearing to prevent the loss of top soil (Aitiu and if deemed necessary by the POE and Island Environmental Officer for remaining subprojects).</p> <p>A shade tolerant groundcover will be established across the site as soon as practicable after site clearance. The species of groundcover used will be selected in consultation with the Island Environmental Officer.</p> <p>Sediment and erosion control measures will be monitored regularly to ensure their continued correct functioning.</p> <p>Cabling trenches will remain open for the shortest duration possible to reduce erosion and where possible will not be open during periods of heavy rain.</p> <p>Spoil from excavated trenches will be stored on the uphill side of the trench such that any sediment from the spoil is deposited in the trench.</p>			
Ecology/ site clearance	<p>Unauthorised clearing of vegetation</p> <p>Introduction of invasive species</p>	<p>To ensure vegetation clearing is restricted to within the site boundary and is the minimum practically required a representative of the POE and the Island Environmental Officer will be on site during clearing.</p> <p>On Aitiu trees on sloping land within the project site boundary (close to the north west boundary) will not be cleared.</p> <p>Cleared vegetation will be removed and will not be stockpiled on site or pushed into existing vegetation adjacent to the site.</p> <p>Machinery storage and materials lay down areas will be established in previously disturbed areas to avoid increasing the footprint of the project site.</p> <p>As far as is practicable existing stockpiles of fill material will be used. If new fill material is required it will be sourced from locations approved by the Island Environmental Officer and OEPMS that do not result in the disturbance of native vegetation.</p>	To be included in Contractor cost.	EA, IAs through PMU	During all onsite works

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
		<p>Immediately after clearing the site will be planted with low growing grass species to help stabilise the site and minimise the spread of weeds (there is a risk of weeds spreading into newly cleared sites at all subproject locations).</p> <p>Bermuda grass (<i>Cynodon dactylon</i>) exists on Mauke and Mitiaro and the site shall be mowed after clearing to encourage this species to establish.</p> <p>Biosecurity measures will be implemented to prevent introduction of invasive species cause damage to flora and fauna.</p>			
Social	Disturbance to local community Increased opportunity for local businesses and contractors	<p>A list of relevant local contractors available on Atiu will be provided in tender documentation to facilitate the engagement of local industry by the selected construction contractor.</p> <p>Opportunities will be made available by the contractor for local contractors and businesses to be engaged during construction and commissioning of the power station.</p> <p>The Atiu Island Council, Visitors Centre, landowners, local residents and stakeholders will be kept informed of the project via monthly meetings during construction including details of:</p> <ul style="list-style-type: none"> <li>• the progress of the works and expected completion date</li> <li>• scheduled delivery of materials and equipment</li> <li>• any disruptions to the use of the wharf or site access roads</li> <li>• upcoming works that are likely to be noisy.</li> </ul> <p>As far as is practicable works will be timed to avoid disruption to local events.</p> <p>Fencing shall be installed on all areas of excavation greater than 1m deep.</p> <p>The contractor(s) will be required to develop an occupational health and safety plan prior to the</p>	To be included in Contractor cost.	Contractor (preparation and implementation) PMU (approval)	During all onsite works

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation on schedule
		<p>commencement of any works on site.</p> <p>Workers shall be provided (before they start work) with appropriate personnel protective equipment (PPE).</p> <p>Adequate sanitation, potable water and first aid facilities will be supplied by the contractor.</p>			
Heritage	Unexpected discovery of an artefact	In the event of an artefact being uncovered during construction work will cease immediately and the Island Council and POE notified. Work will not recommence until authorised by the POE	To be included in Contractor cost.	EA, IAs through PMU	During civil work construction
Construction activities	Unexpected environmental impacts	If unexpected environmental impacts occur during construction phase, the POE will update the EMP, and the environmental protection measures will be designed to address the impacts.	Project cost	EA, PMU	During construction
<b>Operation and Maintenance</b>					
Waste and hazardous materials	Inappropriate disposal of waste	<p>Inverters and batteries that have been replaced during the operating lifetime of the power station will be removed, transported and disposed of by an appropriately experienced and equipped contractor.</p> <p>Where possible batteries and inverters will be recycled. If recycling is not possible they will be disposal will be at a facility approved by the NES.</p> <p>Waste oil and other hydrocarbons from the generator will be stored in a bunded hydrocarbon storage area.</p> <p>No hazardous waste (e.g. used oils, batteries or inverters) will be disposed of on the subproject Island. Waste will be sent for disposal at regular intervals and not allowed to accumulate at the power station.</p> <p>Washing of panels would only be undertaken on an “as needs” basis to minimise the generation of waste water. Disposal of waste water will be agreed with the Island Environmental Officer.</p> <p>All infrastructure containing hazardous materials (e.g. batteries, transformers, generators) will be inspected</p>	O&M cost.	IAs	During operation

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation on schedule
		regularly to ensure it is functioning correctly and no hazardous materials are being discharged. Screening vegetation will be established between the PV array and the road to minimise dust from the road settling on the panels.			
Water resources	Depletion of local water resources	A source of water for washing panels will be agreed with the Island Council and Island Environmental Officer.	O&M cost.	IAs	During operation
Erosion control	Erosion of project sites	If localised erosion is detected during operation of the subproject effective mitigation measures such as application of mulch, covering with open weave jute matting and reseeded with ground cover, protection with geotextile fabric or localised flow dispersal and diversion structures will be installed.	O&M cost.	IAs	During operation
Weeds	Spread of weeds and invasive species	Weed monitoring will be carried out at the subproject site regularly and on-going weed control will take place to prevent the establishment and spread of invasive species.	O&M cost.	IAs	During operation
Social	Solar power station operators	It is expected that existing employees will be retained to operate the new solar power systems. Training will be provided for power station employees in the operation and maintenance of the new solar power system.	O&M cost.	IAs	During operation
Emergency Plan	Emergency response	The solar power station will be monitored remotely and any faults rectified by onsite maintenance staff reducing the risk of a health and safety incident (e.g. fire) occurring. The POE will prepare an operational emergency response plan. The plan will be included in the training provided to employees and be implemented during the operation of the solar power system.	O&M cost.	IAs	During operation
Operation of project facilities	Unexpected environmental impacts	If unexpected environmental impacts occur during project operation phase, the IA will update the EMP, and the environmental protection measures will be designed and resources will be utilized to cope with these impacts.	O&M Cost	IAs	During operation

Project activity/ stage	Potential impact	Proposed mitigation measure	Mitigation Cost	Institutional responsibility	Implementation schedule
<b>Decommissioning</b>					
Decommissioning of solar PV array	Disposal of solar PV modules	<p>The removal of the solar PV modules will be contracted to a specialist supplier. All equipment will be removed from the project site (e.g. PV modules, batteries, invertors) will be reused or recycled where possible. Equipment that cannot be reused or recycled will be disposed of at a facility approved by the NES.</p> <p>The decommissioning contractor will be required to develop a hazardous materials management plan prior to the commencement of any works on site.</p>	Maintenance cost	EA	Post operation
	Rehabilitation of subproject site	If the site is not reused it will be replanted with species appropriate to the future land use of the site.	Maintenance cost	EA	Post operation

Table 9.2: Environmental Management Plan

Environmental Features	Aspect to be Monitored	Time and Frequency of Monitoring	Location	Monitoring Cost	Responsible party (Implementation/ Supervision)
<b>Construction stage</b>					
Dust and air quality	Dust emissions	POE - At least twice during civil works (visual check). Contractor – daily visual checks during civil works	Project site and access roads from wharf and laydown areas and stockpile sites	Project cost	Contractor / POE
Waste management	Waste collection, storage and disposal.	POE – once every two weeks. Contractor – daily visual checks of storage locations and records of all waste disposed (i.e. volume, location, contractor etc)	Project site, storage areas and disposal facility (if required)	Project cost	Contractor / POE
Noise	Noise levels in dB(A)	At least twice during construction period at times of predicted high noise (e.g. site clearance).	Project site boundary closest to nearest occupied residence	3000*2 =6000	Contractor / POE
Hazardous materials	Storage and disposal of hazards materials	POE – once every two weeks. Contractor – daily visual checks of storage locations and records of all waste disposed (i.e. volume, location, contractor etc)	Project site, storage areas and disposal facility (if required)	Project cost	Contractor / POE
Erosion control	Correct functioning of erosion control measures.	POE – once every two weeks. Contractor - daily visual checks of erosion control measures when rain has fallen in the previous 24hrs.	Project site	Project cost	Contractor / POE
Site clearance	Scope of clearing	POE representative to be present during site clearing	Project site	Project cost	POE
Stakeholder consultation	Records of consultation	POE – once every two weeks	Island Council	Project cost	POE
Occupational Health and Safety	As specified in project health and safety plan prepared by Contractor	Once every two weeks	Project Site	Project cost	Contractor & POE
<b>Operation Stage</b>					
Hazardous waste	Disposal of hazardous waste	Quarterly	Power station and hazardous materials	O&M cost	IAs

<b>Environmental Features</b>	<b>Aspect to be Monitored</b>	<b>Time and Frequency of Monitoring</b>	<b>Location</b>	<b>Monitoring Cost</b>	<b>Responsible party (Implementation/ Supervision)</b>
			storage areas		
Weed control	Control of weeds and invasive species	Quarterly	Project site	O&M cost	IAs
Occupational Health and Safety	As specified in project OHS plan prepared by Contractor	Weekly	Project Site	O&M cost	IAs

Note: This monitoring plan is prepared for one subproject site. The same plan will be implemented at all subproject sites.

## 10. Conclusion and Recommendation

211. All the subproject sites are located in modified environments and, although the subprojects include the clearing of up to 5.2 ha of vegetation, their construction will not result in a significant adverse environmental impact.
212. Flora and fauna surveys were undertaken at all subproject sites (with the exception of Rarotonga which does not require any vegetation clearing) the results of which demonstrate that clearing of the sites selected for the subprojects will not result in the significant loss of any native vegetation or have a significant negative impact on any species recorded as Endangered on the CIBD or listed on the IUCN Red List. Consultation with the Mayors of each subproject island has also shown that there are no sites of cultural significance (marae) or historical significance associated with the subproject sites.
213. Landowners at all subproject sites agree, in principle, to transfer use of the site to the Government of the Cook Islands for the project purpose subject to agreement of a formal land use agreement.
214. Potential construction, operation and decommissioning environmental impacts are not significant and can be avoided or controlled to acceptable levels with the correct implementation the mitigation measures contained in the EMP.
215. It is recommended that the project be considered environmentally feasible, and that this environmental assessment is adequate to justify the environmental feasibility of the project
216. The EMP identifies potential environmental impacts arising from the project along with a corresponding schedule of mitigation measures to ensure potential impacts are maintained at insignificant levels. It also includes the institutional arrangements for implementing the EMP to ensure its effectiveness.
217. This IEE, including the EMP is considered sufficient to meet ADB's environmental safeguard requirements. No further or additional impact assessment is considered necessary at this stage.

**Appendix 1: Aitutaki and Rarotonga Environmental Significance Declarations (ESDs)**



**NATIONAL ENVIRONMENT SERVICE**

TU'ANGA TAPOROPORO  
COOK ISLANDS



## **ENVIRONMENT SIGNIFICANCE DECLARATION AND PERMIT**

### **KIA ORANA**

Any person, group or organisation that intends to carry out any activity that may impact the environment must fill out this declaration.

The checklist is used to identify physical, biological, social and economic factors, which might be changed by the proposal. Normally a background study will show those factors or issues that the proposal will or will not impact. A "YES" answer indicates further consideration to obtaining more information may be necessary. A "NO" answer in the second column indicates that the activity has no or low impact to the environment.



*E Kura Mana to tatou Aorangi*

Under the Environment Act 2003 – Part 5, it is a requirement that all activities be assessed as to its potential impact upon the environment. Your cooperation in filling out this form will assist the National Environment Service in protecting our environment. Meitaki Maata.

### Section A: General Information

<b>A 1. Name of Applicant:</b>	Renewable Energy Development Division (Office of Prime Minister)			
<b>A 2. Is the application on behalf of a business or organisation? State here</b>				
Cook Islands Government				
<b>A 3. Name of the Project or Activity:</b>	Cook Islands Renewable Energy Project - Aitutaki			
<b>A 4. Project Address:</b>				
Vaka	TBC (refer attached figure)	Land Title	Aratea	
District	Teenui	Part Section	138, 139, 143 and 144	
Tapere	TBC	Lot	Parts of all the above.	
<b>A 5. Nature of ownership of land (tick appropriate box)</b>				
Occupation Right:	<input type="checkbox"/>	Lease:	<input checked="" type="checkbox"/>	
Vesting Order:	<input type="checkbox"/>	Other: Agreement		
<b>A 6. Contact Details:</b>				
Phone Number	Teariki Rongo	Mobile Number	75176	
Email Address	<a href="mailto:tiutematangi@yahoo.com">tiutematangi@yahoo.com</a>			
<b>A 7. Person or persons who have vested interests in this activity</b>				
Aitutaki Island Council, landowners, local contractors and appropriately qualified persons who may be part of this work.				
<b>A 8. Environment Significance Checklist (tick appropriate box)</b>				
Will this development -	Yes	No	Unsure	Comments
i. cause erosion on site and neighbouring properties due to rain, surface water, wind or wave action?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land is flat
ii. take place within 30 metres of the defined foreshore area?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Not applicable – land is inland
iii. take place between the defined foreshore and the reef	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Not applicable – land is inland
iv. take place within 5 metres of a bank of a stream, river or lake?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Not applicable – land is not near stream, river or lake.
v. take place on a site with a slope greater than 1:10 (slope of 15 degrees)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land is flat
vi. take place on or affect the top of a hill or mountain	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land is flat
vii. take place above or affect any water intakes /catchments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land is nowhere near any water source
viii. take place in or affect any wetlands areas e.g. taro swamps	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land is nowhere near any wetlands
ix. take place on or affect any motu or makatea areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land is on main island of Aitutaki
x. take place in or affect public and recreation areas or access to these areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land is used for agriculture purpose
xi. take place within or affect any reserve, parks or protected area	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Land was used for agriculture purpose
xii. impact on any species or species habitats	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimal. There are no significant environmental species or habitats on the site.
xiii. generate waste or pollution of any type	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimal. Inverters and batteries will require replacement during the life of the project.

## Section B: Proposal

### B 1. Describe your project or activity?

The construction of a solar photovoltaic power plant on Aitutaki and connection to existing electricity distribution network.

The project includes:

- clearing and levelling of approximately 1.1ha of land
- installation of solar panels with an installed capacity of 1.0 megawatt (MW)
- installation of a new 300kW high speed diesel generator in the spare bay in the existing power station
- upgrade of switchgear and control systems

A conceptual site plan is attached in Site Assessment Report.

### B 2. Does your project or activity take place on or relate to any of these areas of concern?

Foreshore and Cook Islands Waters	<input type="checkbox"/>	Inland Waters	<input type="checkbox"/>
Wetlands	<input type="checkbox"/>	Sloping Land	<input type="checkbox"/>
Low lying area or depression	<input type="checkbox"/>	Makatea	<input type="checkbox"/>
Disposal of Chemicals or Waste	x	Protection of Species	<input type="checkbox"/>
Protected Area e.g. ra'ui	<input type="checkbox"/>	None of the above	<input type="checkbox"/>

### B 3. Do any of these activity types fit the description of your proposal?

Tick all that apply

Foreshore Clearance	<input type="checkbox"/>	Foreshore Development	<input type="checkbox"/>	Foreshore Protection - Gabions	<input type="checkbox"/>
Foreshore Protection - Rock Revetments	<input type="checkbox"/>	Foreshore Protection - Groynes	<input type="checkbox"/>	Foreshore Protection - Coastal Protection Units (CPUs)	<input type="checkbox"/>
Development/clearance within the lagoon and Cook Islands Waters			<input type="checkbox"/>	Coastal Reclamation	<input type="checkbox"/>
Stream Clearance	<input type="checkbox"/>	Stream Development - Rock Revetments	<input type="checkbox"/>	Stream Development - Gabions	<input type="checkbox"/>
Stream Diversion	<input type="checkbox"/>	Stream dredging	<input type="checkbox"/>	Filling of wetlands	<input type="checkbox"/>
Vegetation clearance	x	Earthworks*	x	Excavation on sloping land	<input type="checkbox"/>
Mining of sand	<input type="checkbox"/>	Residential Development	<input type="checkbox"/>	Extension to residential development	<input type="checkbox"/>
Commercial Development	<input type="checkbox"/>	Commercial Extension /Reconstruction	<input type="checkbox"/>	Tourism Accommodation	<input type="checkbox"/>
Tourism Accommodation - Extension/Reconstruction	<input type="checkbox"/>	None of the above	<input type="checkbox"/>	Other _____	<input type="checkbox"/>

### B 4. Describe any features that are unique about your project or activity?

e.g. it is the only of it's kind

The construction of the proposed solar photovoltaic power plant will reduce Aitutaki's reliance on diesel fuel for electricity generation. This will result in a reduction in emissions of carbon dioxide and an increase in the security and sustainability of electricity supply on Aitutaki.

### B 5. Are there any significant features of the present ecosystem? Describe

e.g. site for the protection of endangered species from extinction, heritage site

No.

### B 6. Brief description of what the land is currently being used for:

The land is in fallow and was used for planting by the Government Ministry of Agriculture

### B 7. Which of these apply to the current use of the land?

	Yes	No	Unsure	Comments
Agriculture crops (commercial)	X	<input type="checkbox"/>	<input type="checkbox"/>	As in B6
Agriculture crops (subsistence)	X	<input type="checkbox"/>	<input type="checkbox"/>	
Live stock	<input type="checkbox"/>	X	<input type="checkbox"/>	
Residential	<input type="checkbox"/>	X	<input type="checkbox"/>	

Retail or Commercial Purposes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Tourism	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Industrial	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Native Forest	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Bush or scrubland	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Developed shoreline	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Wetlands	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Reclaimed land (coastal or wetlands)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Low lying or natural depression areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Aquaculture	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Recreational or public area	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Natural & cultural heritage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Section C: Environment Significance Details (Please tick appropriately)

This checklist is used to identify physical, biological, social and economic factors which might be changed by your proposed project or activity. Usually a background study will show those factors or areas that an activity will or will not impact. A "YES" answer indicates that further consideration is necessary. A "NO" answer indicates that the activity will not impact those areas or factors.

#### NON LIVING THINGS

Will your project or activity directly or indirectly:				
C 1. Earth	Yes	No	Unsure	Comments
i. Require the use of earth moving equipment that could change the shape and natural layout of the land or destabilize the area causing land slips?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The site will be cleared of vegetation (weeds and small trees) which will result in a minor change to the natural layout.
ii. Destroy, cover or change any landform or natural feature unique to the area?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iii. Will materials* for back filling be brought in from another site? - If yes, what type and from where?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iv. Will any materials* be removed from the site? - If yes, what types?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vegetation will be removed from site.
v. Involve the construction or erection of any wall or structure within the foreshore or Cook Islands waters?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
vi. Will a new road or access way be required?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Will use current access
C 2. Water	Yes	No	Unsure	Comments
i. Change the present water flow direction of a lagoon, stream, estuary or natural drainage causeway?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Will the project alter the existing surface water flows?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iii. Be located in an area where flooding occurs often because of a nearby stream; or the area is likely to be affected by flood waters or sea surge and tropical cyclones?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iv. Cause an increase or decrease in the amount and quality of water on the ground, underground or to the supply of drinking water?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	If required drainage control will be installed during construction and operation to control surface water flow.

\*Materials: Includes materials such as silt, sand, soil, cobble, gravel, boulder, hard rock, coral, trees, vegetation

Will your project or activity directly or indirectly:				
C 3. Pollution	Yes	No	Unsure	Comments
i. Would it produce poisonous gases that could result in the air becoming less clean and dangerous to people?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Would it cause the production of excessive	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cleared vegetation will need to be

waste?				removed from site and disposed of in a sustainable manner.
iii. Would it cause the discharge of any chemical or its waste?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Would it cause noticeable bad smell?	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Cause more noise than usual or make the ground to tremble disturbing neighbours?	<input type="checkbox"/>	x	<input type="checkbox"/>	

## LIVING THINGS

Will your project or activity directly or indirectly:				
C 4. Plants:	Yes	No	Unsure	Comments
i. Change the number of different plant species on the area?	x	<input type="checkbox"/>	<input type="checkbox"/>	The site will be cleared of all existing plant species.
ii. Cause the numbers of special plants, or plants already low in numbers to be further decreased; or disturb the places these plants live in. These special plants include those that are not found anywhere else, or that are in danger of dying out completely?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Bring a new kind of plant into the area? If the new plant does not exist in the area naturally, then it might compete with the present plants resulting in other plants dying out?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Reduce the amount of land that could be used for agriculture, business, or other uses that might be important to the community?	x	<input type="checkbox"/>	<input type="checkbox"/>	The Landowners have agreed for the land to be used for this activity thus relinquishing other uses that might be important.
C 5. Animals:	Yes	No	Unsure	Comments
i. Destroy or ruin the places that animals live in? (i.e. birds, land animals including reptiles, fish and shellfish, benthic organisms, insects or microfauna)?	x	<input type="checkbox"/>	<input type="checkbox"/>	Existing bird habitat will be removed however, the size of the area is too small for the impact to be significant.
ii. Change the population numbers of different kinds of animals?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Bring in a new kind of animal that does not already exist in the place, or that will cause other resident animals to move away from their usual living places?	<input type="checkbox"/>	x	<input type="checkbox"/>	

## 3. SOCIAL AND ECONOMIC FACTORS

Will your project or activity directly or indirectly:				
C 6. General:	Yes	No	Unsure	Comments
i. Cause you to break any law in the Cook Islands?	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Support any existing plans, policies or goals made by the village, communities or by Government?	x	<input type="checkbox"/>	<input type="checkbox"/>	The project will support the implementation of the Cook Islands Renewable Energy Chart Implementation Plan (CIRECIP) 2012-2020.
iii. Contradicts any existing plans, policies or goals made by the village, communities or by Government	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Alter or impact on any important scenic areas or natural land marks?	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Affect or destroy historical and significant sites such as marae, old buildings or artefacts?	<input type="checkbox"/>	x	<input type="checkbox"/>	Aitutaki Island Administration has confirmed this, see Attached copy of letter.
vi. Alter the aesthetics (natural and visual scenery) of the surrounding areas?	x	<input type="checkbox"/>	<input type="checkbox"/>	The solar power station will alter the aesthetics of the immediate area however, the site has been selected and the design will minimise the visual impact to residents and visitors.
C 7. Social:	Yes	No	Unsure	Comments
i. Disrupt households and existing businesses in	<input type="checkbox"/>	x	<input type="checkbox"/>	

the area?				
ii. Potentially disturb people's lifestyles or usual practices in the community or neighbourhood?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Involve the risk of an explosion or an accident happening thereby endangering people?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Create traffic detours, temporarily restrict access, etc?	x	<input type="checkbox"/>	<input type="checkbox"/>	There will be minor disruption to traffic during construction.
v. Use places commonly used by people such as parks, recreation areas, or wildlife sanctuaries or water flow areas which are protected for public purposes?	<input type="checkbox"/>	x	<input type="checkbox"/>	
vi. Produce more light, glare or shadows, e.g. glaring lights, overshadowing a planter's crop, etc?	<input type="checkbox"/>	x	<input type="checkbox"/>	
<b>C 8. Economic:</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Cause fewer jobs or fewer businesses?	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Cause other businesses or growers to move?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Cause the worth of the property to decrease?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Cause any changes to the inter-island movement of traffic either by air or sea?	<input type="checkbox"/>	x	<input type="checkbox"/>	

## Section D: Operational Activities

Following the completion of this project or activity there may be additional impacts that need to be considered.

### Will the ongoing operation of the proposed activity;

<b>D 1. Generate waste or pollution?</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Liquid waste (include the wash down of machinery, paint, oils, sewage)	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Solid waste	x	<input type="checkbox"/>	<input type="checkbox"/>	Inverters will be required to be replaced and removed off island after approximately 15 years.
iii. Hazardous waste	x	<input type="checkbox"/>	<input type="checkbox"/>	Batteries will need to be replaced and removed off island after approximately 10 years.
iv. Increase the level of noise	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Chemical pollutants	<input type="checkbox"/>	x	<input type="checkbox"/>	
vi. Gaseous wastes	<input type="checkbox"/>	x	<input type="checkbox"/>	
vii. Storm water runoff	<input type="checkbox"/>	x	<input type="checkbox"/>	
viii. <i>If YES {to the above} can the amount of waste be managed within the site or will it be removed</i>	Inverters and batteries will be contained and shipped to Rarotonga for disposal.			
<b>D 2. Biodiversity</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Impact on any bird, animal, plant or marine species or habitats?	<input type="checkbox"/>	X	<input type="checkbox"/>	
<b>D 3. Social</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Disrupt households and existing businesses in the area?	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Potentially disturb people's lifestyles or usual practices in the community or neighbourhood?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Involve the risk of an explosion or an accident happening thereby endangering people?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Create traffic detours, temporarily restrict access, etc?	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Use places commonly used by people such as parks, recreation areas, or wildlife sanctuaries or water flow areas which are protected for public purposes?	<input type="checkbox"/>	x	<input type="checkbox"/>	
vi. Produce more light, glare or shadows, e.g. glaring lights, overshadowing a planter's crop, etc.	<input type="checkbox"/>	x	<input type="checkbox"/>	

#### D 4. Could the activity create additional impacts to the country's:

	Yes	No	Unsure	Comments
i. Energy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The project will contribute toward increasing the amount of renewable energy in the Cook Islands
ii. Transport and Parking Space	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The project has the potential to indirectly lead to an increase in the price of fuel due to less fuel being required on the outer islands and consequent higher shipping costs.
iii. Water	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iv. Emergency services (fire, ambulance, cyclone shelters)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
v. Waste management facilities	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The project will generate additional hazardous waste (batteries, inverters) to dispose of but will also lead to less waste diesel disposal.
vi. Community Facilities	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

<b>Foreshore:</b>	Means all that area from the Mean High Water Mark (The line of mean high tide between the ordinary high-water spring and ordinary high-water neap tides. It is the average of all high tides), moving towards inland, to a distance of 30 metres or to where vegetation begins as well as those areas defined in the Environment Act 2003 (see last page)
<b>Cook Islands waters:</b>	Means the internal waters of the Cook Islands as defined by section 4 of the Territorial Sea and Exclusive Economic Zone Act 1977, the territorial sea, and the exclusive economic zone
<b>Inland waters:</b>	Means the waters, banks (5 metres landward from edge) and beds (whether dry or not) of any stream, river or lake.
<b>Wetlands:</b>	Means areas of marsh, swamp or water whether - natural or artificial; permanent seasonally flooded or temporary; with water that is static or flowing, or fresh, brackish or salty, and; includes water storage reservoirs, taro swamps and fish farms.
<b>Sloping Land:</b>	Means any area of land that has a slope greater than a gradient of 1:10 (slope of at least 15 degrees)
<b>Earthworks:</b>	e.g. levelling of land, backfilling, replacing sand with red soil materials etc

#### All applicants are required to provide the following information;

<b>Block Map</b>	This is available from the Survey Division, Ministry of Justice
<b>Site Map</b>	This is available from the Survey Division, Ministry of Justice
<b>Site Plan</b>	This must show; Where the proposed drainage systems will be The slope of the land and the surface water flows Land drainage patterns Access roads Water supply Driveway
If applicable to your activity – the site plan should also show;	Waste treatment system e.g. septic tank Buildings Rock revetments/groynes Excavated land Filled areas (e.g. wetlands)

Additional information may be required at a later stage.

**WARNING:**

Activities carried out without any authorization will result in a breach of the Environment Act 2003 and may be subject to fines and prosecution.

I .....**Teariki Rongo on behalf of REDD..** hereby declare that the above information is true and correct to the best of my knowledge and that anything stated may be held against me.



Signature of Applicant: ..... Date: ...**11/04/16**.....

**For office use only**

National Environment Service

Activity is	* Approved	[ ]	Stamp
	* Not Approved	[ ]	
	* Hold, amendments required	[ ]	

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Building Permit Number: \_\_\_\_\_ Consent Number: \_\_\_\_\_



**At the end of Section D, the National Environment Service, within reasonable time will advise you whether your activity causes or is likely to cause significant environment impacts and what further action will be required from you, if any.**

For any enquiries, contact us via:

Telephone: (682) 21256

Fax: (682) 22256

PO Box 371 Rarotonga,  
Cook Islands

Email: [resources@cookislands.gov.ck](mailto:resources@cookislands.gov.ck)

Web: [www.environment.org.ck](http://www.environment.org.ck)



**“Foreshore”** means:

- (a) in relation to Rarotonga –
  - (i) all that area between the mean high water mark and a line connecting those points landward and measured at right angles to a distance 30 metres from the mean high water mark or to the edge of the vegetation, whichever shall be the greater distance; and
  - (ii) every estuary, stream or river together with the bed of any stream or river and includes that area extending landward and measured at right angles from the mean high water mark in that estuary to a distance 5 metres landward from the edge of the vegetation; and
- (b) in relation to any Outer Island to which this Act applies–
  - (i) any area specified to be foreshore by the Island Environment Authority for the island concerned and approved for this purpose by the Queen’s Representative by Order in Executive Council; and
  - (ii) in the absence of any such order for an island, any area prescribed by regulations to be foreshore for the island, after consultation with the Island Environment Authority for the island concerned;



# Cook Islands Renewable Energy Sector Project Flora and Fauna Assessment - Aitutaki

05 February 2016

## 1. Introduction

The Office of the Prime Minister – Renewable Energy Development Division is currently implementing the Cook Islands Renewable Energy Sector Project (CIRESPP). The CIRESPP aims to install solar photovoltaic power stations on Rarotonga, Aitutaki, Atiu, Mitiaro, Mangaia and Mauke. Construction of the solar photovoltaic power station at Aitutaki will include the clearing and levelling of approximately 1.1 Ha of land for the installation of solar panels. Connection to the existing electricity distribution network will include the installation of a new high voltage cable connecting a new renewable power house to the existing power house (refer to Figure 1).

This assessment was undertaken to identify flora and fauna values present within the clearing footprint of the proposed project on Aitutaki. The following tasks were undertaken as part of the assessment:

- A review of terrestrial flora and fauna data held on the Cook Islands Biodiversity Database (CIBD) (accessed 5th February 2016) to identify the occurrence of native species and the potential occurrence of threatened flora and fauna species recorded as Endangered (Moderate and Serious).
- A review of the IUCN Red List of Threatened Species (Version 2014.3) to identify the potential occurrence of listed flora and fauna species.
- Consultation with Gerald McCormick (Director for the Cook Islands Natural Heritage Trust (CINHT)) to identify the potential occurrence of significant flora and fauna species (29 April 2015).
- A field survey was undertaken to investigate and verify the potential fauna and flora issues identified in the desktop review. The field survey included:
  - identification of vegetation communities present
  - a survey of terrestrial flowering annual and perennial plants
  - the identification and assessment of existing terrestrial flora and fauna values including for environmental, medicinal and economic use.
  - the identification and assessment of potential habitat for threatened terrestrial fauna species.

The results of the database review, consultation and field survey were used to identify any potential impacts from the proposed project which may require further assessment and/or mitigation strategies to avoid and minimise impacts.

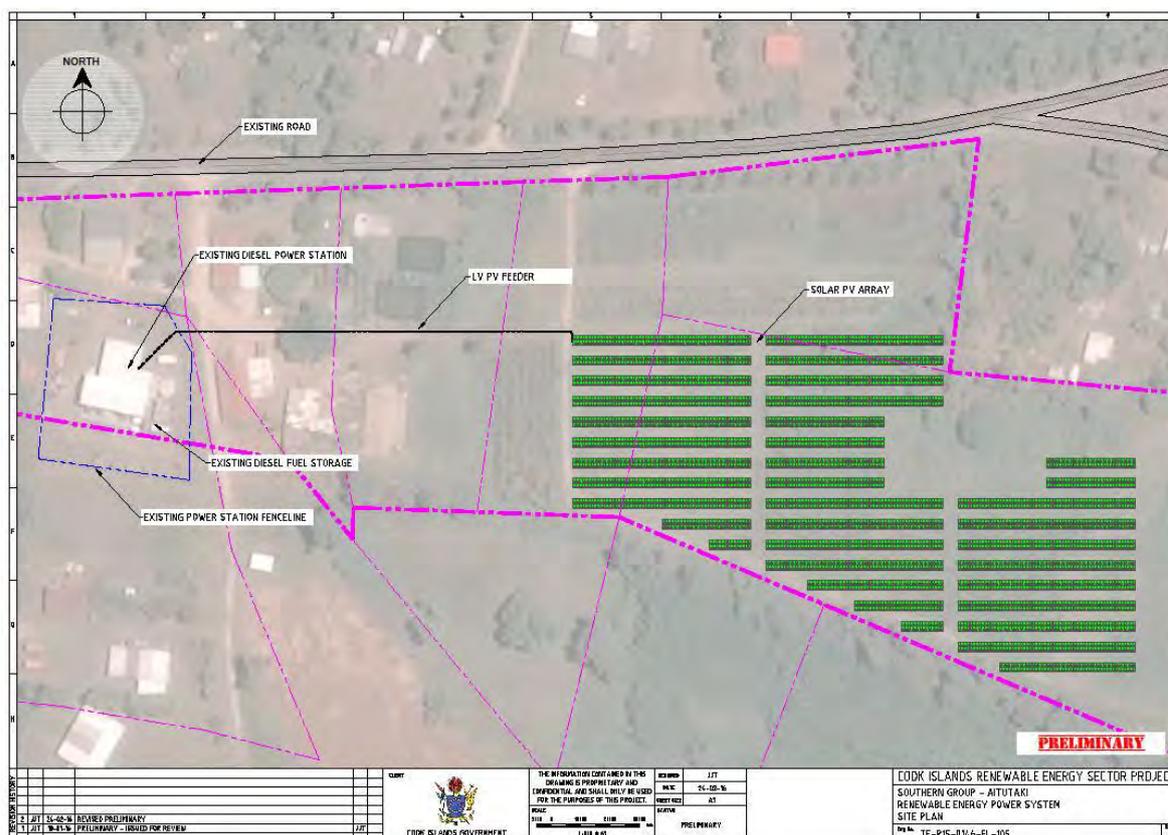


Figure .1: Proposed Aitutaki solar power station site layout

## 2. Methods

The vegetation and fauna habitat survey was completed on the 5<sup>th</sup> of February 2016 by Teariki Rongo with local informants with knowledge of local species. A meandering survey for flora was carried out within the works area. A timed meander search method involves walking over the survey area in a random manner and recording all flora species encountered. The search was stopped when no new flora species were identified following at least 20 minutes of searching since the previous species record. All species of flora encountered during the survey were recorded. Threatened species locations, if recorded, were mapped using a hand held GPS.

Important fauna habitat components were also recorded during the survey. In addition, all fauna species encountered during the survey were recorded, including indirect evidence of fauna presence (e.g. bird calls).

### 2.1. Limitations

Due to varying flowering times and seasonality of occurrence it is likely that not all flora species that occur at the site were identified in the survey. In particular, short lived annuals that may be present at the site may have been missed because they were not able to be identified (they were not flowering) or they were not evident at this time of year (they were annual plants that had died back or not emerged at the time of survey). It should be noted that there were no threatened short lived annuals that were identified as potentially occurring within the survey area.

### 3. Results

#### 3.1. Flora



Proposed project site looking south

The survey area at the Aitutaki site is overgrown with weeds. The site at the time of the survey looked like an abandoned maniotia (*Manihot esculenta*) plantations with remanent Java plum (*Syzygium cumuni*) trees bordering the western and southern boundaries of the site. A large Barringtonia (*Barringtonia asiatica*) tree stands in the middle of the northern boundary.

Eight mango (*Mangifera indica*) trees grow along the inside of the Java plum lined boundary to the west. Six of the trees are

still very productive and may be around 8 to 10 years old, and the remaining two look like old trees of the lesser preferred variety.

The field survey recorded 21 flora species within the survey area of which two were native species and 19 were introduced species. A full list of flora species is provided in Appendix A. No species were identified during the survey that are recorded as Endangered on the CIBD or listed on the International Union for Conservation of Nature (IUCN) Red List.

##### 3.1.1. Medicinal uses

Of the recorded flora species within the survey area, nine have medicinal uses. Two are trees, the Barringtonia, and Morinda (*Morinda citrifolia*), and the rest are listed as serious to moderate weeds on the CIBD. The distribution of all medicinal species is recorded as very common on the CIBD and the local informants confirmed they were all found in other locations on Aitutaki. Comments by the Director of the CINHT also supported the information provided by the local informants (29 April 2015).

##### 3.1.2. Economic uses

The six mango trees located inside of the remaining Java Plum boundary trees are the only trees with economic use. All other trees have no economic value.

##### 3.1.3. Weeds / invasive species

Of the weeds found on the project site and listed as moderate to serious on the CIBD all are commonly found on the island and on abandoned plantations. Outstanding weeds that require

some attention are the para grass (*Brachiaria mutica*) and the Calopo (*Calopogonium mucunoides*).

The para grass, introduced for stock feed, mainly cattle, is very aggressive and hard to get rid of. Of all the creepers, Calopo is very aggressive and can become a problem in maintaining the solar panels during the operational phase of the project.

### 3.2. Fauna habitat



According to the local informants the Blue Lorikeet (*Vini peruviana*) can be seen regularly at the proposed project site and is commonly seen on the island in areas like the proposed project site and other areas where it has not been used or cleared of weeds for a while. They are known to build their nest in old rotting trees. They feed on ground forage, nectar and insects.

No Blue Lorikeet was sited during the field survey.

The Blue Lorikeet is listed as globally endangered (seriously) under the CIBD and vulnerable under the IUCN Red List.

Blue Lorikeet is primarily endangered by invasive species including rats and cats.

## 4. Recommendations

The survey site has been subjected to continuous use for agricultural purpose and is therefore no longer a site for special species or habitat of a special fauna.

The existing flora is found widely on the island and their removal from the site is not expected to have any significant impact on their existence and access.

Economic uses of some species on site will be lost but will not affect their existence and access on the island. All of the 'tree' species are also found somewhere else on the island.

Control measures of serious weeds, especially the para grass (*Brachiaria mutica*) and the more aggressive creepers like the Calopo (*Calopogonium mucunoides*) should be put in place to ensure ease of maintenance of site after commissioning.

Prepared by:

Teariki-Taoiau Rongo

T 682 75176

E [tiutematangi@yahoo.com](mailto:tiutematangi@yahoo.com)

### References:

Local informants are: Tuangaru Bishop (Senior Environment Officer for NES Aitutaki), Vavia Puapii (Environment Officer for NES Aitutaki).

Cook Islands Biodiversity Database (<http://www.cookislands.bishopmuseum.org>)

IUCN List of Threatened Species (<http://www.iucnredlist.org/search> )

## Appendix A

### Aitutaki Site – Flora

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<b>Trees</b>					
<i>Mangifera indica</i>	Mango	Vī	Introduced	+++	Food/Timber
<i>Syzygium cumini</i>	Jambolan, Java plum	Pītāti	Introduced and listed significance – See use	++++	Food (fruit), serious invasive and weed
<i>Barringtonia asitica</i>	Barringtonia	‘Utu	Native	++	Medicine, material (use to stun fish, a way to catch fish), poisonous to eat the raw seed.
<b>Small Trees (Shrubs)</b>					
<i>Morinda citrifolia</i>	Indian Mulberry	Nono	Native and listed significance – Medicine and Food	++++	Medicine, Ornamental Tree, Food (fruit), material (Dye)
<i>Solanum mauritianum</i>	Tobacco Tree	Rau ‘Ava’ava	Introduced – recent; naturalised and common	+++	Fumery, invasive (moderate), weed (moderate)
<b>Moderate to Serious Weeds<sup>1</sup></b>					
<i>Stachytarpheta cayennensis</i>	Blue Rats tail	Tiāki (MT)	Introduced and listed significance – Serious weed	++++	Weed/Medicinal
<i>Ocimum gratissimum</i>	Wild Basil	Miri Ngangaere (MG)	Introduced and listed significance – Medicine, serious weed -	++++	Weed/medicine
<i>Tithonia diversifolia</i>	Tree Marigold	Pua Renga	Introduced – Recent; naturalised; and very common	++++	Weed (serious)
<i>Cenchrus echinatus</i>	Burr Grass	Piripiri (Pārango)	Introduced and listed significance – See use	++++	Medicine, serious agriculture and lawn weed
<i>Desmodium incanum</i>	Spanish Glover	Ngātoro (piripiri)	Introduced and listed significance - Manure	+++	Serious weed, Manure
<i>Commelina diffusa</i>	Commelina	Mauku-vai	Introduced, recent, naturalised and	++++	Stock food, medicine and weed (moderate)

<sup>1</sup> Found on the outer edge of the Pine Forest and near tracks

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
			very common		
<i>Sorghum bicolor drummondii</i>	Sudan Grass	Tarapī	Introduced and listed significance – See use	++	Serious Weed
<i>Mikania micrantha</i>	Mile-a-minute	Pōkutekute Teatea	Introduced, very common and widespread – See use	++++	Medicine, invasive (serious), weed (serious)
<i>Sida rhombifolia</i>	Broom weed	Purūmu	Introduced, naturalised and common – See use	+++	Material, weed (serious)
<i>Leucaena leucocephala</i>	Leucaena	Nītō	Introduced, recent, naturalised – See use	+++	Forestry, weed (serious)
<i>Mimosa pudica</i>	Sensitive weed	Rākau pikika’a	Introduced, recent, naturalised and very common	+++	Medicine, weed (serious), Injurious spine - moderate
<i>Bidens pilosa</i>	Beggars-tick	Piripiri Kerekere	Introduced, recent, naturalised and very common	++++	Medicine, invasive (moderate), weed (serious)
<i>Brachiaria mutica</i>	Para grass	Mauku Puakatoro/Para Karāti	Introduced, recent, naturalised and very common	++++	Forage, weed (serious)
<i>Calopogonium mucunoides</i>	Calopo		Introduced, recent, naturalised and common on horticulture lands	+++	Cover, weed (serious)
<i>Centrocema pubescens</i>	Centro butterfly-pea	Piriarero	Introduced, recent, naturalised and common	+++	Medicine; cover; Weed (serious)
Crop <sup>2</sup>					
<i>Manihot esculenta</i>	Cassava	Māniota	Introduced, recent, not naturalised	++++ <sup>3</sup>	Food (root), cooked, medicine,

Source: Mr Teariki Rongo (05/02/16), Aitutaki informants, the Cook Islands Biodiversity Database, and IUCN List of Threatened Species (<http://www.iucnredlist.org/search>). Key to status, ++ (not common), +++ (common) and ++++ (very common).

<sup>2</sup> Specie planted for food (root fibre)

<sup>3</sup> Observed (05/02/16)

Aitutaki Site - Fauna<sup>4</sup>

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
<b>Birds</b>					
<i>Vini peruviana</i>	Blue Lorikeet	Kurāmo'o	Introduced, recent, naturalised and common <sup>5</sup>	+++	Globally endangered (seriously) IUCN List of Threatened Species (Vulnerable).

Source: Aitutaki informant (05/02/16), the Cook Islands Biodiversity Database, and IUCN List of Threatened Species (<http://www.iucnredlist.org/search>). Key to status, ++ (not common), +++ (common) and ++++ (very common).

<sup>4</sup> Information given by Aitutaki Informants (05/02/16)

<sup>5</sup> Common according to Tuangaru Bishop, NES Officer for Aitutaki



# AITUTAKI ISLAND GOVERNMENT

GOVERNMENT OF THE COOK ISLANDS

P.O. Box 66, Aitutaki, Cook Islands

Telephone: (682) 31-987, 31-700; Facsimile: (682) 31-986

3rd February 2016

TO: Teariki Rongo

FROM: Tiraa Arere  
Executive Officer

As requested, this letter is to confirm that there is no cultural heritage or marae on the proposed land for the Solar Farm.

This block of land had been used for Agriculture purposes for many years.

Meitaki Atupaka

Regards.

A handwritten signature in black ink, appearing to read 'Tiraa Arere', written over a large, stylized circular flourish.

Tiraa Arere  
Executive Officer.



**NATIONAL ENVIRONMENT SERVICE**

TU'ANGA TAPOROPORO  
COOK ISLANDS



## **ENVIRONMENT SIGNIFICANCE DECLARATION AND PERMIT**

### **KIA ORANA**

Any person, group or organisation that intends to carry out any activity that may impact the environment must fill out this declaration.

The checklist is used to identify physical, biological, social and economic factors, which might be changed by the proposal. Normally a background study will show those factors or issues that the proposal will or will not impact. A "YES" answer indicates further consideration to obtaining more information may be necessary. A "NO" answer in the second column indicates that the activity has no or low impact to the environment.



*E Kura Mana to tatou Aorangi*

Under the Environment Act 2003 – Part 5, it is a requirement that all activities be assessed as to its potential impact upon the environment. Your cooperation in filling out this form will assist the National Environment Service in protecting our environment. Meitaki Maata.

### Section A: General Information

<b>A 1. Name of Applicant:</b>	Renewable Energy Development Division (Office of Prime Minister)			
<b>A 2. Is the application on behalf of a business or organisation? State here</b>				
Cook Islands Government				
<b>A 3. Name of the Project or Activity:</b>	Cook Islands Renewable Energy Project - Rarotonga			
<b>A 4. Project Address:</b>				
Vaka	Te Au O Tonga	Land Title	TBC <sup>1</sup>	
District	Avarua	Part Section	TBC	
Tapere	Puapuautu	Lot	TBC	
<b>A 5. Nature of ownership of land (tick appropriate box)</b>				
Occupation Right:	<input type="checkbox"/>	Lease:	x	
Vesting Order:	<input type="checkbox"/>	Other: Agreement		
<b>A 6. Contact Details:</b>				
Phone Number	Teariki Rongo	Mobile Number	75176	
Email Address	<a href="mailto:tiutematangi@yahoo.com">tiutematangi@yahoo.com</a>			
<b>A 7. Person or persons who have vested interests in this activity</b>				
Renewable Energy Development Division (REDD), Airport Authority, Te Aponga Uira (TAU), Cook Islands Investment Corporation (CIIC), local contractors and appropriately qualified persons who may be part of this work.				
<b>A 8. Environment Significance Checklist (tick appropriate box)</b>				
Will this development -	Yes	No	Unsure	Comments
i. cause erosion on site and neighbouring properties due to rain, surface water, wind or wave action?	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is sealed with drainage structures in place. Run off from the containers will be contained onsite.
ii. take place within 30 metres of the defined foreshore area?	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is not within the defined foreshore area.
iii. take place between the defined foreshore and the reef	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. take place within 5 metres of a bank of a stream, river or lake?	<input type="checkbox"/>	x	<input type="checkbox"/>	There are no water courses in the vicinity of the site.
v. take place on a site with a slope greater than 1:10 (slope of 15 degrees)	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is flat.
vi. take place on or affect the top of a hill or mountain	<input type="checkbox"/>	x	<input type="checkbox"/>	
vii. take place above or affect any water intakes /catchments	<input type="checkbox"/>	x	<input type="checkbox"/>	The development will not affect any water intakes or catchments.
viii. take place in or affect any wetlands areas e.g. taro swamps	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is not located in a wetland.
ix. take place on or affect any motu or makatea areas	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is not located in a motu or makatea area.
x. take place in or affect public and recreation areas or access to these areas	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is located on land leased by TAU and is not accessible to the public.
xi. take place within or affect any reserve, parks or protected area	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is not located in the vicinity of a reserve, park or protected area.
xii. impact on any species or species habitats	<input type="checkbox"/>	x	<input type="checkbox"/>	The site is located on land that is already developed.
xiii. generate waste or pollution of any type	x	<input type="checkbox"/>	<input type="checkbox"/>	Batteries in the BESS will be required to be replaced after approximately 10 years.

<sup>1</sup> The site is leased by TAU from the Airport Authority. There appears to have been no survey completed at the time of the lease and there is no survey map showing the location and boundaries of the site.

## Section B: Proposal

### B 1. Describe your project or activity?

Installation of a 1 MW / 4 MWh Battery Energy Storage System (BESS) co-located at the site of the Rarotonga Airport solar PV array and buried cable connection to existing solar PV array substation. No clearing of vegetation or earthworks are required. The BESS will be housed in containerised modules (e.g. 40ft shipping containers or similar) and take up an area of less than 0.02 Ha.

The key components of the project include:

- *Batteries:* The BESS will be based on high capacity batteries (likely to be lithium ion or sodium sulphur technology).
- *Power conversion:* A four quadrant power conversion system (inverter) will be used to convert electricity from AC to DC for charging batteries and DC back to AC for connection to the substation.
- *Control system:* A control system will be installed to manage the charge and discharge rates of the batteries, system parameters, monitoring, alarms, communications with other network systems and data logging.
- *Cabling and connection:* the BESS will be connected to the existing electricity grid either at the existing solar PV array substation or directly into the West Coast Feeder. Connection cabling will be buried to either of these connection points.
- *Environmental controls:* Dependent on the technology selected environmental controls including fire protection and air-conditioning will be installed.

A conceptual site plan is attached.

### B 2. Does your project or activity take place on or relate to any of these areas of concern?

Foreshore and Cook Islands Waters	<input type="checkbox"/>	Inland Waters	<input type="checkbox"/>
Wetlands	<input type="checkbox"/>	Sloping Land	<input type="checkbox"/>
Low lying area or depression	<input type="checkbox"/>	Makatea	<input type="checkbox"/>
Disposal of Chemicals or Waste	x	Protection of Species	<input type="checkbox"/>
Protected Area e.g. ra'ui	<input type="checkbox"/>	None of the above	<input type="checkbox"/>

### B 3. Do any of these activity types fit the description of your proposal?

Tick all that apply

Foreshore Clearance	<input type="checkbox"/>	Foreshore Development	<input type="checkbox"/>	Foreshore Protection - Gabions	<input type="checkbox"/>
Foreshore Protection - Rock Revetments	<input type="checkbox"/>	Foreshore Protection - Groynes	<input type="checkbox"/>	Foreshore Protection - Coastal Protection Units (CPUs)	<input type="checkbox"/>
Development/clearance within the lagoon and Cook Islands Waters			<input type="checkbox"/>	Coastal Reclamation	<input type="checkbox"/>
Stream Clearance	<input type="checkbox"/>	Stream Development - Rock Revetments	<input type="checkbox"/>	Stream Development - Gabions	<input type="checkbox"/>
Stream Diversion	<input type="checkbox"/>	Stream dredging	<input type="checkbox"/>	Filling of wetlands	<input type="checkbox"/>
Vegetation clearance	<input type="checkbox"/>	Earthworks*	<input type="checkbox"/>	Excavation on sloping land	<input type="checkbox"/>
Mining of sand	<input type="checkbox"/>	Residential Development	<input type="checkbox"/>	Extension to residential development	<input type="checkbox"/>
Commercial Development	<input type="checkbox"/>	Commercial Extension /Reconstruction	<input type="checkbox"/>	Tourism Accommodation	<input type="checkbox"/>
Tourism Accommodation - Extension/Reconstruction	<input type="checkbox"/>	None of the above	x	Other _____	<input type="checkbox"/>

### B 4. Describe any features that are unique about your project or activity?

e.g. it is the only of it's kind

The project will install a BESS into the Rarotonga grid enabling more renewable energy generation to be installed and better utilising it once installed. Installing renewable energy generation in to the Rarotonga grid enables reduction in use of the diesel power station. However, when the difference between the load on the grid and the renewable energy being generated is less than the minimum loading requirement of the generators faults will occur that compromise system reliability. Studies have indicated that the limit of renewable energy generation in Rarotonga's grid is 3.3 MW. Currently, there is approximately 3.0 MW of installed renewable energy on Rarotonga's grid and, with current rates of installation, the 3.3 MW limit will be reached in the first half of 2016. TAU has set a limit of 4.2 WM (expected to be reached by mid 2017) and to reduce system faults will 'curtail' the output of the 1 MW airport solar PV array (owned by TAU) when required to satisfy the 3.3 MW limit. That is, in sunny conditions, where the power demand is low and solar PV output is high, they will provide a set-point to the Airport array to reduce its output (potentially down to zero). The BESS will store the otherwise curtailed output of the renewable generation (primarily solar PV generation) for reinjection into the grid when renewable energy generation is lower (e.g.

overnight).

**B 5. Are there any significant features of the present ecosystem? Describe**

e.g. site for the protection of endangered species from extinction, heritage site

The site is located on land that has already been developed for the Rarotonga Airport and solar PV array. There are no significant ecological features present.

**B 6. Brief description of what the land is currently being used for:**

The specific site of the BESS is currently unused. The parcel of land it sits on is leased by TAU and is used for the Rarotonga Airport solar PV array.

**B 7. Which of these apply to the current use of the land?**

	Yes	No	Unsure	Comments
Agriculture crops (commercial)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The site is currently used for solar PV electricity generation.
Agriculture crops (subsistence)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Live stock	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Residential	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Retail or Commercial Purposes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Tourism	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Industrial	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Native Forest	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Bush or scrubland	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Developed shoreline	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Wetlands	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Reclaimed land (coastal or wetlands)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Low lying or natural depression areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Aquaculture	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Recreational or public area	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Natural & cultural heritage	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Other	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

**Section C: Environment Significance Details (Please tick appropriately)**

This checklist is used to identify physical, biological, social and economic factors which might be changed by your proposed project or activity. Usually a background study will show those factors or areas that an activity will or will not impact. A “YES” answer indicates that further consideration is necessary. A “NO” answer indicates that the activity will not impact those areas or factors.

**NON LIVING THINGS**

**Will your project or activity directly or indirectly:**

C 1. Earth	Yes	No	Unsure	Comments
i. Require the use of earth moving equipment that could change the shape and natural layout of the land or destabilize the area causing land slips?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Destroy, cover or change any landform or natural feature unique to the area?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iii. Will materials* for back filling be brought in from another site? - If yes, what type and from where?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iv. Will any materials* be removed from the site? - If yes, what types?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
v. Involve the construction or erection of any wall or structure within the foreshore or Cook Islands waters?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
vi. Will a new road or access way be required?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The existing access to the solar PV array will be used.
C 2. Water	Yes	No	Unsure	Comments
i. Change the present water flow direction of a lagoon, stream, estuary or natural drainage causeway?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Will the project alter the existing surface water flows?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

iii. Be located in an area where flooding occurs often because of a nearby stream; or the area is likely to be affected by flood waters or sea surge and tropical cyclones?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iv. Cause an increase or decrease in the amount and quality of water on the ground, underground or to the supply of drinking water?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

**\*Materials:** Includes materials such as silt, sand, soil, cobble, gravel, boulder, hard rock, coral, trees, vegetation

<b>Will your project or activity directly or indirectly:</b>				
<b>C 3. Pollution</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Would it produce poisonous gases that could result in the air becoming less clean and dangerous to people?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Would it cause the production of excessive waste?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iii. Would it cause the discharge of any chemical or its waste?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iv. Would it cause noticeable bad smell?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
v. Cause more noise than usual or make the ground to tremble disturbing neighbours?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

## LIVING THINGS

<b>Will your project or activity directly or indirectly:</b>				
<b>C 4. Plants:</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Change the number of different plant species on the area?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Cause the numbers of special plants, or plants already low in numbers to be further decreased; or disturb the places these plants live in. These special plants include those that are not found anywhere else, or that are in danger of dying out completely?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iii. Bring a new kind of plant into the area? If the new plant does not exist in the area naturally, then it might compete with the present plants resulting in other plants dying out?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iv. Reduce the amount of land that could be used for agriculture, business, or other uses that might be important to the community?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>C 5. Animals:</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Destroy or ruin the places that animals live in? (i.e. birds, land animals including reptiles, fish and shellfish, benthic organisms, insects or microfauna)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Change the population numbers of different kinds of animals?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
iii. Bring in a new kind of animal that does not already exist in the place, or that will cause other resident animals to move away from their usual living places?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

## 3. SOCIAL AND ECONOMIC FACTORS

<b>Will your project or activity directly or indirectly:</b>				
<b>C 6. General:</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Cause you to break any law in the Cook Islands?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
ii. Support any existing plans, policies or goals made by the village, communities or by Government?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The project will support the implementation of the Cook Islands Renewable Energy Chart Implementation Plan (CIRECIP) 2012-2020.

iii. Contradicts any existing plans, policies or goals made by the village, communities or by Government	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Alter or impact on any important scenic areas or natural land marks?	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Affect or destroy historical and significant sites such as marae, old buildings or artefacts?	<input type="checkbox"/>	x	<input type="checkbox"/>	
vi. Alter the aesthetics (natural and visual scenery) of the surrounding areas?	<input type="checkbox"/>	x	<input type="checkbox"/>	
<b>C 7. Social:</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Disrupt households and existing businesses in the area?	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Potentially disturb people's lifestyles or usual practices in the community or neighbourhood?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Involve the risk of an explosion or an accident happening thereby endangering people?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Create traffic detours, temporarily restrict access, etc?	x	<input type="checkbox"/>	<input type="checkbox"/>	There will be very minor disruption to traffic as infrastructure is transported to site.
v. Use places commonly used by people such as parks, recreation areas, or wildlife sanctuaries or water flow areas which are protected for public purposes?	<input type="checkbox"/>	x	<input type="checkbox"/>	
vi. Produce more light, glare or shadows, e.g. glaring lights, overshadowing a planter's crop, etc?	<input type="checkbox"/>	x	<input type="checkbox"/>	
<b>C 8. Economic:</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Cause fewer jobs or fewer businesses?	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Cause other businesses or growers to move?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Cause the worth of the property to decrease?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Cause any changes to the inter-island movement of traffic either by air or sea?	<input type="checkbox"/>	x	<input type="checkbox"/>	

## Section D: Operational Activities

Following the completion of this project or activity there may be additional impacts that need to be considered.

<b>Will the ongoing operation of the proposed activity;</b>				
<b>D 1. Generate waste or pollution?</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Liquid waste (include the wash down of machinery, paint, oils, sewage)	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Solid waste	x	<input type="checkbox"/>	<input type="checkbox"/>	Batteries will be replaced after approximately 10 years.
iii. Hazardous waste	x	<input type="checkbox"/>	<input type="checkbox"/>	Batteries will be replaced after approximately 10 years. Batteries will either be disposed of or recycled on Rarotonga at an appropriate facility.
iv. Increase the level of noise	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Chemical pollutants	<input type="checkbox"/>	x	<input type="checkbox"/>	
vi. Gaseous wastes	<input type="checkbox"/>	x	<input type="checkbox"/>	
vii. Storm water runoff	<input type="checkbox"/>	x	<input type="checkbox"/>	
viii. <i>If YES {to the above} can the amount of waste be managed within the site or will it be removed</i>	Batteries will be transported to disposal / recycling facility.			
<b>D 2. Biodiversity</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Impact on any bird, animal, plant or marine species or habitats?	<input type="checkbox"/>	x	<input type="checkbox"/>	
<b>D 3. Social</b>	<b>Yes</b>	<b>No</b>	<b>Unsure</b>	<b>Comments</b>
i. Disrupt households and existing businesses in the area?	<input type="checkbox"/>	x	<input type="checkbox"/>	
ii. Potentially disturb people's lifestyles or usual practices in the community or neighbourhood?	<input type="checkbox"/>	x	<input type="checkbox"/>	

iii. Involve the risk of an explosion or an accident happening thereby endangering people?	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Create traffic detours, temporarily restrict access, etc?	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Use places commonly used by people such as parks, recreation areas, or wildlife sanctuaries or water flow areas which are protected for public purposes?	<input type="checkbox"/>	x	<input type="checkbox"/>	
vi. Produce more light, glare or shadows, e.g. glaring lights, overshadowing a planter's crop, etc.	<input type="checkbox"/>	x	<input type="checkbox"/>	

#### D 4. Could the activity create additional impacts to the country's:

	Yes	No	Unsure	Comments
i. Energy	x	<input type="checkbox"/>	<input type="checkbox"/>	The project will contribute toward increasing the amount of renewable energy in the Cook Islands
ii. Transport and Parking Space	<input type="checkbox"/>	x	<input type="checkbox"/>	
iii. Water	<input type="checkbox"/>	x	<input type="checkbox"/>	
iv. Emergency services (fire, ambulance, cyclone shelters)	<input type="checkbox"/>	x	<input type="checkbox"/>	
v. Waste management facilities	x	<input type="checkbox"/>	<input type="checkbox"/>	The project will generate additional hazardous waste (batteries) that will be disposed of at a waste management facility.
vi. Community Facilities	<input type="checkbox"/>	x	<input type="checkbox"/>	

<b>Foreshore:</b>	Means all that area from the Mean High Water Mark (The line of mean high tide between the ordinary high-water spring and ordinary high-water neap tides. It is the average of all high tides), moving towards inland, to a distance of 30 metres or to where vegetation begins as well as those areas defined in the Environment Act 2003 (see last page)
<b>Cook Islands waters:</b>	Means the internal waters of the Cook Islands as defined by section 4 of the Territorial Sea and Exclusive Economic Zone Act 1977, the territorial sea, and the exclusive economic zone
<b>Inland waters:</b>	Means the waters, banks (5 metres landward from edge) and beds (whether dry or not) of any stream, river or lake.
<b>Wetlands:</b>	Means areas of marsh, swamp or water whether - natural or artificial; permanent seasonally flooded or temporary; with water that is static or flowing, or fresh, brackish or salty, and; includes water storage reservoirs, taro swamps and fish farms.
<b>Sloping Land:</b>	Means any area of land that has a slope greater than a gradient of 1:10 (slope of at least 15 degrees)
<b>Earthworks:</b>	e.g. levelling of land, backfilling, replacing sand with red soil materials etc

#### All applicants are required to provide the following information;

<b>Block Map</b>	This is available from the Survey Division, Ministry of Justice
<b>Site Map</b>	This is available from the Survey Division, Ministry of Justice
<b>Site Plan</b>	This must show; Where the proposed drainage systems will be The slope of the land and the surface water flows Land drainage patterns Access roads Water supply Driveway
If applicable to your activity – the site plan should also show;	Waste treatment system e.g. septic tank Buildings Rock revetments/groynes Excavated land Filled areas (e.g. wetlands)

Additional information may be required at a later stage.

**WARNING:**

Activities carried out without any authorization will result in a breach of the Environment Act 2003 and may be subject to fines and prosecution.

I **Teariki Rongo on behalf of REDD** hereby declare that the above information is true and correct to the best of my knowledge and that anything stated may be held against me.



Signature of Applicant: ..... Date: ...**18/04/16**.....

**For office use only**

National Environment Service

Activity is	* Approved	[ ]	Stamp
	* Not Approved	[ ]	
	* Hold, amendments required	[ ]	

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Building Permit Number: \_\_\_\_\_ Consent Number: \_\_\_\_\_

**At the end of Section D, the National Environment Service, within reasonable time will advise you whether your activity causes or is likely to cause significant environment impacts and what further action will be required from you, if any.**

For any enquiries, contact us via:

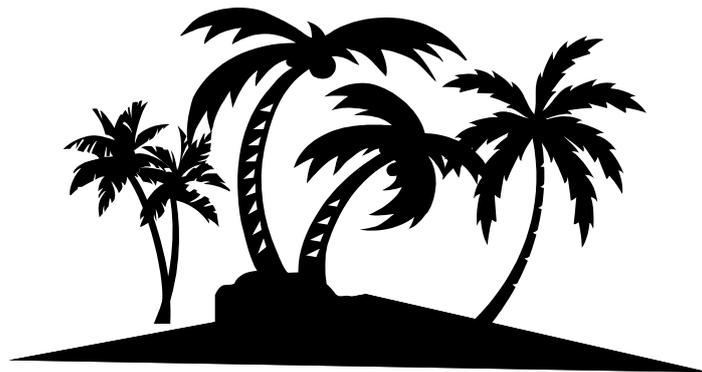
Telephone: (682) 21256

Fax: (682) 22256

PO Box 371 Rarotonga,  
Cook Islands

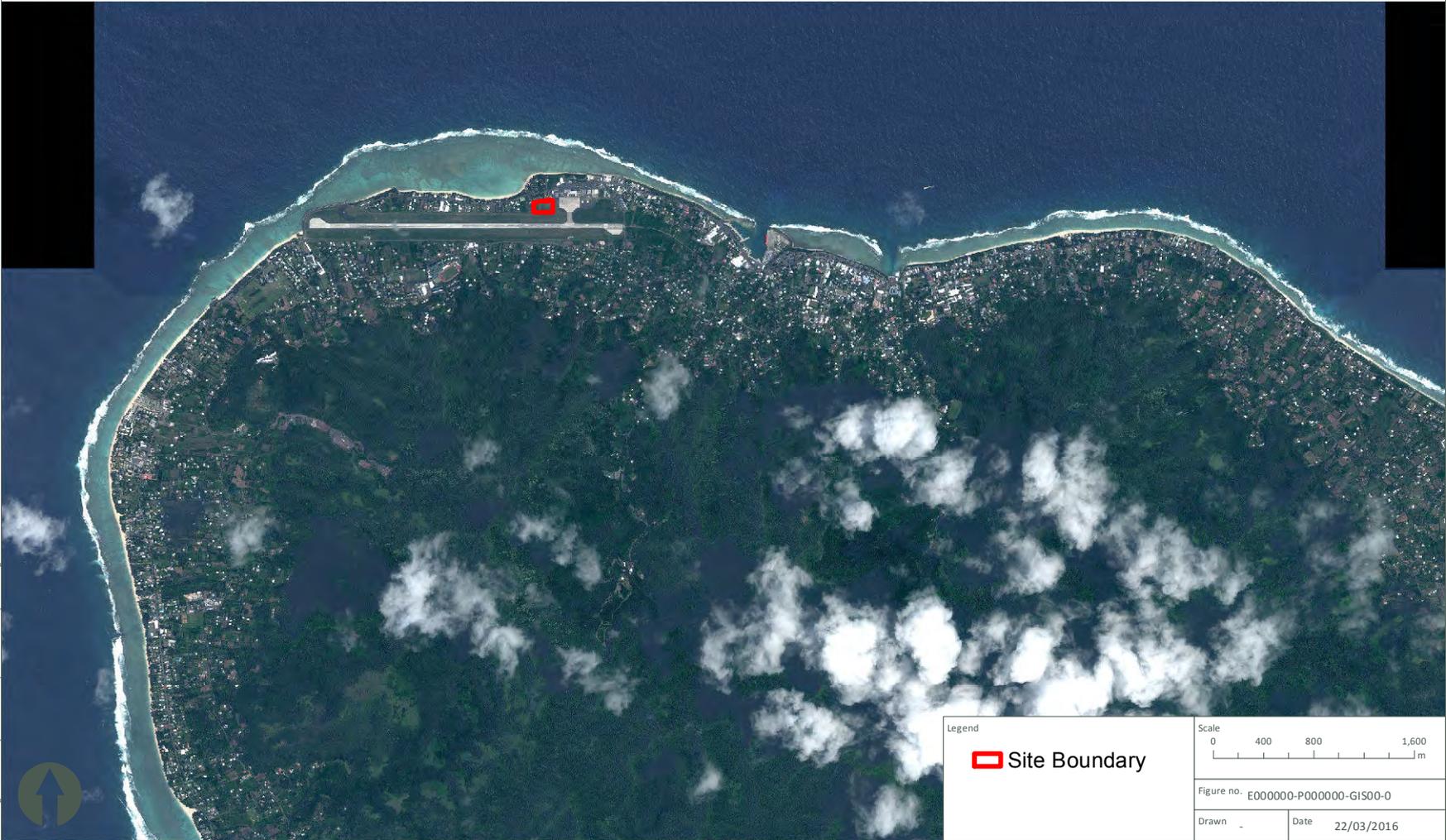
Email: [resources@cookislands.gov.ck](mailto:resources@cookislands.gov.ck)

Web: [www.environment.org.ck](http://www.environment.org.ck)



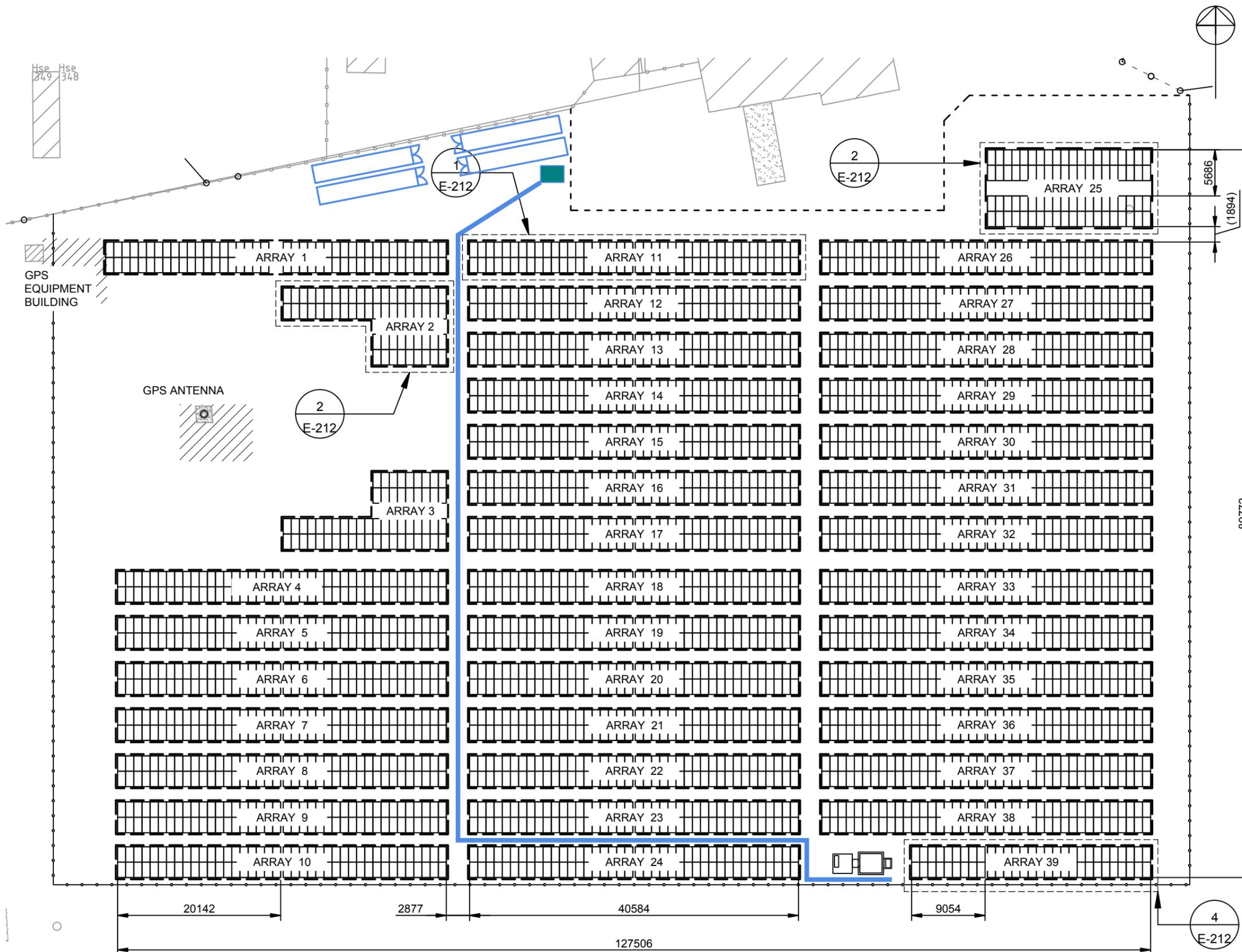
**“Foreshore”** means:

- (a) in relation to Rarotonga –
  - (i) all that area between the mean high water mark and a line connecting those points landward and measured at right angles to a distance 30 metres from the mean high water mark or to the edge of the vegetation, whichever shall be the greater distance; and
  - (ii) every estuary, stream or river together with the bed of any stream or river and includes that area extending landward and measured at right angles from the mean high water mark in that estuary to a distance 5 metres landward from the edge of the vegetation; and
- (b) in relation to any Outer Island to which this Act applies–
  - (i) any area specified to be foreshore by the Island Environment Authority for the island concerned and approved for this purpose by the Queen’s Representative by Order in Executive Council; and
  - (ii) in the absence of any such order for an island, any area prescribed by regulations to be foreshore for the island, after consultation with the Island Environment Authority for the island concerned;



Data source(s):  
Service layer source(s):

Legend	
	Site Boundary
Scale 0 400 800 1,600 m	
Figure no. E000000-P000000-GIS00-0	
Drawn -	Date 22/03/2016



NOTES:

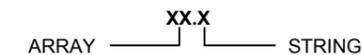
####

**MODULE TYPE:** JA SOLAR JAP6 72-315/3BB

**ARRAY PITCH:**

**FRAME TYPE:** SCHLETTER PV MAX 3 2V

**LABELLING SCHEDULE**



06	ISSUED FOR CONSTRUCTION	19/08/14	TH	-
05	ADDED CALLOUTS TO E-212	22/07/14	TH	LF
04	REVISED	11/07/14	TH	LF
03	REVISED FOR GPS EXCLUSION ZONE	20/16/14	TH	LF
02	ISSUED FOR FRAMING SPECIFICATION	14/04/14	LF	ME
01	ISSUED FOR TENDER	20/02/14	LF	KV

REV	CHANGE	DATE	DWN	CKD
-----	--------	------	-----	-----

# FOR CONSTRUCTION

JOB NUMBER: J001819-E-211      DRAWING NUMBER:      REV: 06

DESCRIPTION: ARRAY LAYOUT

PROJECT: RAROTONGA AIRPORT WEST 960KW PV SYSTEM

ADDRESS: RAROTONGA INTERNATIONAL AIRPORT  
RAROTONGA  
COOK ISLANDS

CLIENT: NZ MFAT

DRAWN: LF      CHECKED: KV      DATE: 20/06/14      SCALE: 1:500 @ A3

APPROVED - ITP:      APPROVED - TAU:      APPROVED - BECA:



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218 Hardy Street      Fax +64 3 548 3138  
Nelson, 7010      www.solarcity.co.nz  
New Zealand      info@solarcity.co.nz

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**1** ARRAY LAYOUT  
Scale: 1:500

**Appendix 2: Flora and Fauna Assessments**



# Cook Islands Renewable Energy Sector Project Flora and Fauna Assessment - Mangaia

17 August 2015

## 1. Introduction

The Office of the Prime Minister – Renewable Energy Development Division is currently implementing the Cook Islands Renewable Energy Sector Project (CIRESPP). The CIRESPP aims to install solar photovoltaic power stations on Rarotonga, Aitutaki, Atiu, Mitiaro, Mangaia and Mauke. Construction of the solar photovoltaic power station at Mangaia will include the clearing and levelling of land for the installation of solar panels and a new solar power house containing batteries and inverters. Connection to the existing electricity distribution network will include the installation of a new high voltage cable connecting the new power house to the existing power station and the rehabilitation of the existing distribution network (refer to Figure 1).

This flora and fauna assessment was undertaken to identify flora and fauna values present within the clearing footprint of the proposed project on Mangaia. The following tasks were undertaken as part of the assessment:

- A review of terrestrial flora and fauna data held on the Cook Islands Biodiversity Database to identify the occurrence of native species and potential occurrence of threatened flora and fauna species recorded as Endangered (Moderate and Serious).
- A review of the IUCN Red List of Threatened Species (Version 2014.3) to identify the potential occurrence of listed flora and fauna species.
- Consultation with Gerald McCormick (Director for the Cook Islands Natural Heritage Trust (CINHT)) to identify the potential occurrence of significant flora and fauna species.
- A field survey was undertaken to investigate and verify the potential fauna and flora issues identified in the desktop review. The field survey included:
  - identification of vegetation communities present
  - a survey of terrestrial flowering annual and perennial plants
  - the identification and assessment of existing terrestrial flora and fauna values including for environmental, medicinal and economic use.
  - the identification and assessment of potential habitat for threatened terrestrial and aquatic fauna species.

The results of the database review, consultation and field survey were used to identify any potential impacts from the proposed project which may require further assessment and/or mitigation strategies to avoid and minimise impacts.



Figure .1: Proposed Mangaia solar power station site and site layout

## 2. Methods

The vegetation and fauna habitat survey was carried out on the 7<sup>th</sup> May, and 3<sup>rd</sup> of June 2015 by Teariki Rongo and David Procter. A meandering survey for flora was carried out within the works area. A timed meander search method involves walking over the survey area with local informants with local knowledge in a random manner and recording all flora species encountered. The search was stopped when no new flora species were identified following at least 20 minutes of searching since the previous species record. All species of flora encountered during the survey were recorded. Threatened species locations if recorded were mapped using a hand held GPS.

Important fauna habitat components were also recorded during the survey. In addition, all fauna species encountered during the survey were recorded, including indirect evidence of fauna presence (e.g. bird calls) and information from local informants.

### 2.1. Limitations

Due to varying flowering times and seasonality of occurrence it is likely that not all flora species that occur at the site were identified in the survey. In particular, short lived annuals that may be present at the site may have been missed because they were not able to be identified (they were not flowering) or they were not evident at this time of year (they were annual plants that had died back or not emerged at the time of survey). It should be noted that there were no threatened short lived annuals that were identified as potentially occurred within the survey area.

### 3. Results

#### 3.1. Flora



The survey area at Aratane is forested with secondary forest dominated by the following canopy species: *Cocos nucifera*, *Syzygium cumini*, *Elaeocarpus tonganus*, *Hernandia moerenhoutiana*, *Aleurites moluccana*, *Adenanthera pavonina* and *Falcataria moluccana*. The lower tree species were comprised mainly of *Eugenia uniflora* and *Morinda citrifolia*.

The survey recorded 36 species in the survey area of which 16 were native species and 20 were introduced species. A full list of flora species is provided in Appendix A. No species were identified during the survey that are recorded as Endangered on the Cook Islands Biodiversity Database or listed on the IUCN Red List. Of the 20 introduced plants 10 are from the moderate to serious weeds category and the

others are shared almost evenly in the other categories.

#### Medicinal uses

Of the recorded flora species 19 have medicinal uses. According to the local informants all plants of medicinal use are also found in other places on the island and are therefore not at risk of being endangered. All species are listed as very common on the CIDB supporting the information provided by local informants.



#### Economic uses

The survey site was dominated by secondary growth forest and the only trees within the survey area that were considered to have economic value were the coconut trees. Ninety coconut trees were counted in the survey area (as at 3<sup>rd</sup> of June). The trees, based on 16 dried nuts a year with 30 years remaining life on each of the trees at \$0.10 per nut have an estimated economic value of NZD 4,320.00.

As with the Pa Enea of the Cook Islands, the use of plants for medicine does have an economic and social value to the local community. The economic value of these plants to the local population has not been assessed. Most of the medicinal plants are weeds and those native species used are widely distributed on the island. It is therefore unlikely that the project will have adverse impact on medicinal species.

#### Weeds / invasive species

Of the weeds recorded on the CIDB as moderate to serious weeds all were found on the edge of the road bordering the north western side of the survey site. Two creepers; the hard and soft shell passion fruits (*Passiflora edulis* and *Passiflora maliformis*) are listed on the CIDB as moderate and serious invasive species respectively and two small trees the menemene (*Eugenia uniflora*) and the guava (*Psidium guajava*) are listed as serious weeds. *Syzygium cumini* and *Adenanthera pavonina* are both trees that are listed as both serious invasive species and serious weed species.

### 3.2. Fauna habitat

The Mangaia Kingfisher (*Todiramphus rufficollaris*) a native species endemic to Mangaia is reported by local informants to be regularly sighted in the vicinity of the survey site. The species was not sighted or heard during either of the site surveys. No siting of the bird or of its call was heard during the survey times. The survey site is likely to provide foraging habitat for the Mangaia Kingfisher but is unlikely to provide breeding habitat. Nesting areas are inland in the secondary forest and below the cliff line especially in the barringtonia forests (G. McCormack *pers comm*). The Cook Islands Reed-Warbler (*Acrocephalus kerearako*) was not sighted or heard during either of the site surveys. The Cook Islands Reed-Warbler is listed as moderately threatened on the CIBD and Near Threatened on the IUCN Red List.

## 4. Conclusion and Recommendations

The flora found on the project site is dominated by species that are widespread and clearing of the survey site will not have a significant impact on any native species.

No species were recorded that are listed as Endangered on the CIBD or listed on the IUCN Red List. The survey site is reported as utilised by both the Mangaia Kingfisher and Cook Islands Reed-Warbler though neither species are likely to nest on the site. The vegetation on the survey site is widespread and the clearing of the survey site is not expected to have a negative impact on potential foraging habitat for either species.

The owners of coconut trees removed for the project should be compensated.

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## Appendix A

### Mangaia Site – Flora

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<b>Trees</b>					
<i>Cocos nucifera</i>	Coconut	Nū	Native and listed significance – see use	++++	Food/Timber/Medicine
<i>Hibiscus tiliaceus</i>	Tree Hibiscus	‘Au	Native and Listed significance – invasive and weed, see use	++++	Medicine and Material (fibre/ wood)
<i>Syzygium cumini</i>	Jambolan, Java plum	Pītāti	Introduced and listed significance – serious invasive and weed, see use	++++	Food (fruit)
<i>Polynesian Elaeocarpus</i>	Polynesian Elaeocarpus	Orotea	Native and listed significance – food for Pacific Dove	++++	Material (Wood), fruits for birds
<i>Hernandia moerenhoutiana</i>	Mountain Lantern-tree	Turina	Native and listed significance – See use	++++	Medicine
<i>Aleurites moluccana</i>	Candle nut	Tuitui	Native and listed significance – See use	++++	Medicine, food (dried nut), light
<i>Barringtonia asiatica</i>	Barringtonia	Utu	Native and listed significance – See use	++++	Medicine, poison
<i>Adenanthera pavonina</i>	Red-bead Tree	Mata Kōviriviri	Introduced and listed significance – serious invasive and moderate weed	+++	Food and Material
<i>Falcataria moluccana</i>	Albizia	‘Ārapitia	Introduced and listed significance - Forestry and moderate invasive and serious weed.	++++	Timber
<b>Small Trees (shrubs)</b>					
<i>Eugenia uniflora</i>	Surinam Cherry	Menemene	Introduced and listed significance – serious invasive	++++	Food (fruit)

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
			and weed, see use		
<i>Citrus sinensis</i>	Sweet Orange tree	‘Ānani	Introduced and listed significance – See use	++++	Medicine and Food
<i>Cordyline fruticosa</i>	Cordyline	Rauti	Introduced and listed significance – See use	++++	Medicine, ornamental leaves, cultural significance, food (root)
<i>Psidium guajava</i>	Common guava	Tūava	Introduced and listed significance – moderate invasive and serious weed, see use	++++	Medicine and food (fruit)
<i>Pipturus argenteus</i>	Pipturus	Ōrongā	Native and listed significance, see use	+++	Medicine, fruits formerly eaten, fibre
<i>Morinda citrifolia</i>	Indian Mulberry	Nono	Native and listed significance – see use	++++	Medicine, Ornamental Tree, Food (fruit), material (Dye)
<b>Ferns and small plants on Makatea including Creepers</b>					
<i>Asplenium australasicum</i>	Sharp bird’s nest fern	Kōta’a Tua Koi	Native and listed significance – see uses	++++	Wrapping food/ornamental fern
<i>Asplenium nidus</i>	Smooth bird’s nest fern	Kōta’a Tua Rua	Native and listed significance – see uses	++	Wrapping food/ornamental fern
<i>Microsorium grossum</i>	Unscented Oak-leaf fern	Maire Tutae-puaka	Native and listed significance – see uses	++++	Medicine and ornamental
<i>Nephrolepis hirsutula</i>	Lobed Sword Fern	Turoutou	Native and listed significance – see uses	++++	Medicine and ornamental
<i>Passiflora edulis</i>	Yellow Passion fruit	Pārapōtini Papa’ā	Introduced and listed significance – Invasive	++++	Food
<i>Passiflora maliformis</i>	Hard passionfruit	Pārapotini Enuā	Introduced and listed significance – serious invasive, see uses	++++	Food and Medicine
<i>Peperomia pallida</i>	Bold-Vein Peperomia	Pikimato	Native and listed significance –	++++	Medicine

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
			see uses		
<i>Momordica charautia</i>	Balsam Pear	Menemena-te-kiore	Introduced and listed significance – moderate weed, see uses	++++	food for the rats
<i>Morinda myrtifolia</i>	Morinda vine	Pirita	Native and listed significance – see use	+++	Fibre
<i>Pandanus tectorius complex</i>	Pandanus	'Ara-ta'atai	Native and listed significance – injurious spine, see use	++++	Medicine, ornamental leaves and material (Fibre)
<b>Moderate to Serious Weeds<sup>1</sup></b>					
<i>Stachytarpheta cayennensis</i>	Blue Rats tail	Tiāki (MT)	Introduced and listed significance – weed, see uses	++++	Medicinal
<i>Ocimum gratissimum</i>	Wild Basil	Miri Ngangaere (MG)	Introduced and listed significance – weed, see use Medicine	++++	medicine
<i>Tithonia diversifolia</i>	Tree Marigoki	Pua Renga	Introduced and listed significance – serious weed, see uses	++++	No known use
<i>Indigofera suffruticosa</i>	Indigo	Initiko	Introduced and listed significance – serious weed, see uses	+++	No known use
<i>Caesalpinia major</i>	Yellow Nickernut	Tātaraka (Tātarāmoa)	Native and listed significance – Moderate injurious spined, see use	++	No known use
<i>Cenchrus echinatus</i>	Burr Grass	Piripiri (Pārango)	Introduced and listed significance – serious agriculture and lawn weed, see use	++++	Medicine

<sup>1</sup> Found mainly on the outer edge of the Makatea (near the road)

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<i>Desmodium incanum</i>	Spanish Glover	Ngātoro (piripiri)	Introduced and listed significance – Serious weed, see use	+++	Manure
<i>Elephantopus mollis</i>	Elephant's foot grass	Tapuae Erepani	Introduced and listed significance – moderate weed, see uses		Medicine
<i>Brachiaria mutica</i>	Para Grass	Mauku Puakatoro	Introduced and listed significance – serious weed, see uses	-	Not usually found on Mangaia
<i>Sida rhombifolia</i>	Broom weed	Purūmu	Introduced and listed significance – serious weed, see uses	+++	Material (Fibre)
<i>Sorghum bicolor drummondii</i>	Sudan Grass	Tarapī	Introduced and listed significance – serious weed, see use	++	Livestock feed

Source: Mr Tangi Mouauri (Site guide 07/05/15), Teariki Rongo, and the Cook Islands Biodiversity Database. Key to status, ++ (not common), +++ (common) and ++++ (very common).

#### Mangaia Site – Fauna

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
<b>Birds</b>					
<i>Acrocephalus kerearako</i>	Cook Islands Warbler	Kerearako (Mangaia), Ka'oko (Miti'aro)	Native to Mangaia and Mitiaro. Endemic of Cook Islands and moderately endangered. Listed as Near Threatened under the IUCN Red List of Threatened species (v.2014.3)	+++?	Native of Mangaia and Miti'aro, native scrubland and horticulture lands
<i>Todiramphus rufficollaris</i>	Mangaia Kingfisher	Tanga'eo	Native to Mangaia and endemic to	++	Endemic of the Cook Islands, found only on Mangaia, Live on land

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
			Cook Islands and globally and moderately endangered. Listed as Vulnerable under the IUCN Red List of Threatened species (v.2014.3)		and on Barringtonia, Makatea and inland lowlands

Source: Mr Tangi Mouauri (Site guide 07/05/15), Teariki Rongo and the Cook Islands Biodiversity Database. Key to status, ++ (not common), +++ (common) and ++++ (very common).

References:

Local Informants are: Tangi Mouauri (MIG).

Cook Islands Biodiversity Database (<http://www.cookislands.bishopmuseum.org>)

IUCN List of Threatened Species (Version 2014.3)



# Cook Islands Renewable Energy Sector Project Flora and Fauna Assessment - Mauke

30 July 2015

## 1. Introduction

The Office of the Prime Minister – Renewable Energy Development Division is currently implementing the Cook Islands Renewable Energy Sector Project (CIRESPP). The CIRESPP aims to install solar photovoltaic power stations on Rarotonga, Aitutaki, Atiu, Mitiaro, Mangaia and Mauke. Construction of the solar photovoltaic power station at Mauke will include the clearing and levelling of land for the installation of solar panels and a new power house containing batteries, inverters and new backup diesel generators (Refer to Figure 1). The solar photovoltaic power station will be connected to a refurbished electricity distribution network. Refurbishment of existing electricity distribution network will be part of the project and will include replacing existing grid equipment including cables, poles, substation, transformers, and switchgear along the existing lines.

This assessment was undertaken to identify flora and fauna values present within the clearing footprint of the proposed project on Mauke. The following tasks were undertaken as part of the assessment:

- A review of terrestrial flora and fauna data held on the Cook Islands Biodiversity Database (CIBD) to identify the occurrence of native species and potential occurrence of threatened flora and fauna species recorded as Endangered (Moderate and Serious).
- A review of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Version 2014.3) to identify the potential occurrence of listed flora and fauna species that are recorded as threatened.
- Consultation with Gerald McCormick (Director for the Cook Islands Natural Heritage Trust (CINHT)) to identify the potential occurrence of significant flora and fauna species.
- A field survey was undertaken to investigate and verify the potential flora and fauna issues identified in the desktop review. The field survey included:
  - identification of vegetation communities present
  - a survey of terrestrial flowering annual and perennial plants
  - the identification and assessment of existing terrestrial flora and fauna values including for environmental, medicinal and economic use.
  - the identification and assessment of potential habitat for threatened terrestrial and aquatic fauna species.

The results of the database review, consultation and field survey were used to identify any potential impacts from the proposed project which may require further assessment and/or mitigation strategies to avoid and minimise impacts.

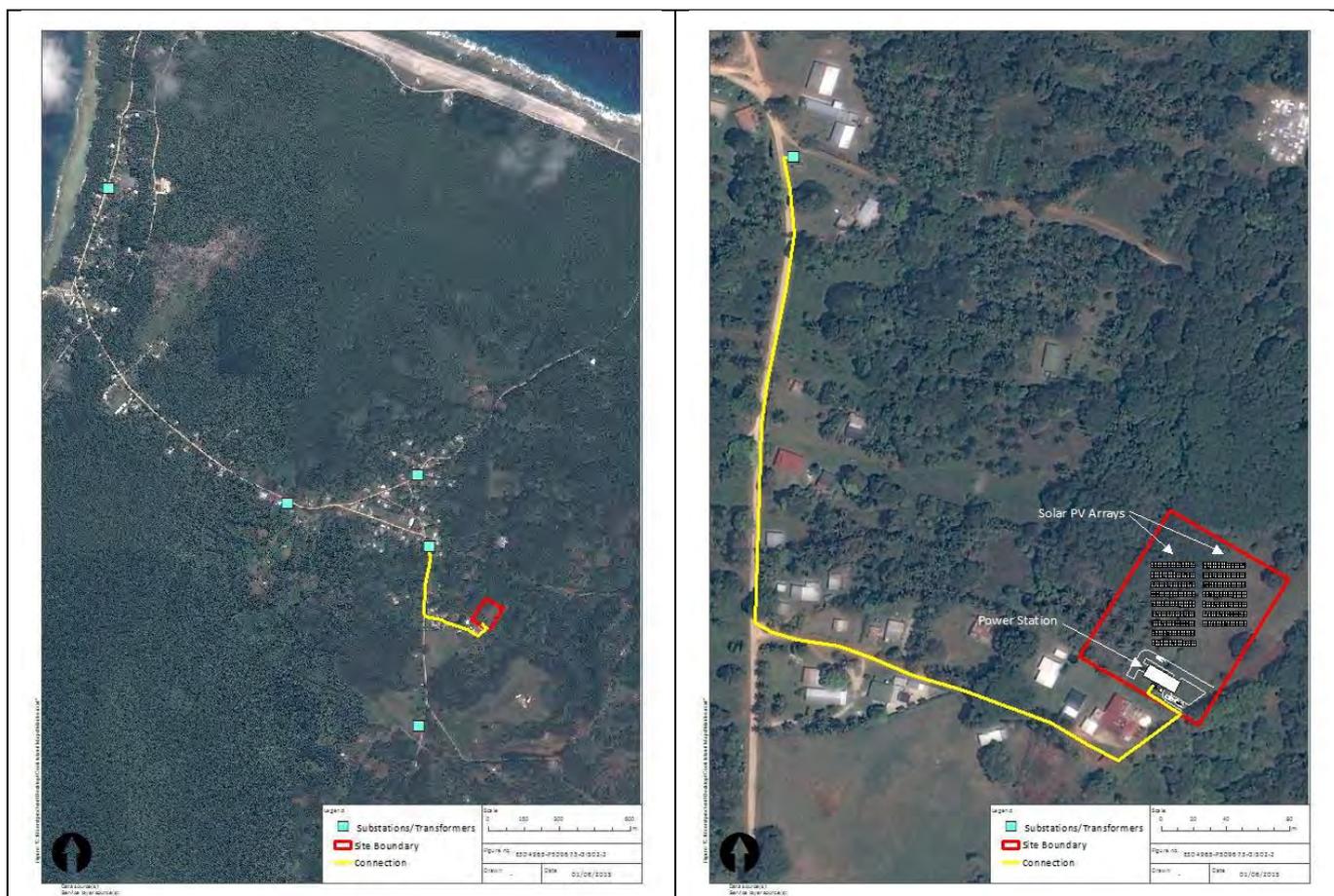


Figure 1.00: Proposed Mauke solar power station site and site layout

## 2. Methods

The vegetation and fauna habitat survey was completed 28<sup>th</sup> of May 2015 by Teariki Rongo. A meandering survey for flora was carried out within the works area. A timed meander search method involves walking over the survey area and recording all flora species encountered. The search was stopped when no new flora species were identified following at least 20 minutes of searching since the previous species record. All species of flora encountered during the survey were recorded. Threatened species locations if recorded were mapped using a hand held GPS.

Important fauna habitat components were also recorded during the survey. In addition, all fauna species encountered during the survey were recorded, including indirect evidence of fauna presence (e.g. bird calls).

### 2.1. Limitations

Due to varying flowering times and seasonality of occurrence it is likely that not all flora species that occur at the site were identified in the survey. In particular, short lived annuals that may be present at the site may have been missed because they were not able to be identified (they were not flowering) or they were not evident at this time of year (they were annual plants that had died back or not emerged at the time of survey). It should be noted that there were no threatened short lived annuals that were identified as potentially occurred within the survey area.

### 3. Results

#### 3.1. Flora

The survey area at Tengarū 6B, in Areora Village, is mainly grassed. It is bordered in the south east corner by nine Teak trees (*Tectona grandis*) and to the north east by Java Plum (*Syzygium cumini*). There are twenty nine Macadamia trees (*Macadamia integrifolia*), thirteen coconut trees (*Cocos nucifera*), one local banana trees (*Musa ABB Group*) and one lime tree (*Citrus aurantifolia*) on the south end of the site.



The field survey recorded 31 flora species within the survey area of which four were native species, two Polynesian introduced and twenty five introduced species. A full list of flora species is provided in Appendix A. No species were recorded that are listed as Endangered on the CIBD or listed on the IUCN Red List.

#### Medicinal uses

Of the recorded flora species within the survey area eleven have medicinal uses. All medicinal plants are labelled as 'very common' on the CIBD and therefore widely distributed on Mauke.

#### Economic uses

Ten species recorded have economic value. These are: Coconut, Teak, Mango (*Mangifera indica*), Macadamia, Lime, dry land taro (*Xanthosoma sgittifolium*), Kumara (*Ipomoea botatas*), Nono (*Morinda citrifolia*), Banana (*Musa ABB group*) and Pineapple (*Ananas cosmosus*).

Only four of the species listed above are considered for evaluation. These species once removed will no longer be productive (see Table 1 below). The other species can be transferred to other lands outside of the survey site and they are short term crops.

The species listed have the following values: Coconut for its oil and multiple general uses, Teak for its timber, Macadamia for its nuts and Lime for its juice. Other species include the plant crops of dry land taro valued for its edible tuber root (Taruā), kumara also valued for its edible tuber roots and Nono, bananas and pineapples for their fruits.

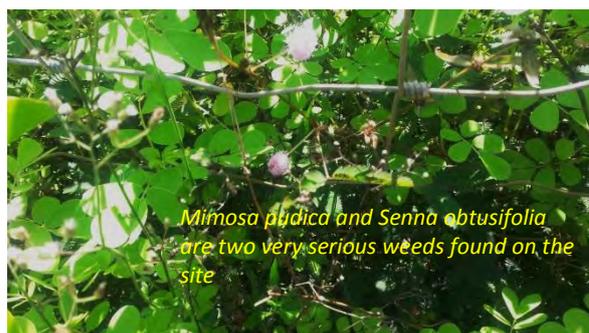
The estimated economic value of the species is NZD3, 680.00. A breakdown of value is provided in Table 1. Nine of the species recorded are also used for fuel for cooking however; this is not valued as an economic use.

**Table 1: Estimated Value for Non-Land Assets**

Asset	Est. age (yr.)	#	Description of Estimation of Value	Estimated Total Cost (NZD)
Teak trees	>60	9	2m <sup>3</sup> wood/tree x 9 mature trees x \$85.00/m <sup>3</sup> wood	1,530.00
Macadamia trees	10	29	\$2.50/tree/yr. x 20-years (remaining economic lifespan) x 29 trees	1,450.00
Lime trees	3	1	\$10.00/tree/yr. x 16 years (remaining economic lifespan) x 1 tree	160.00
Coconut trees	20	13	16 dry nuts/tree/yr. x \$0.10/nut x 13 trees x 30-years (remaining economic life-span/tree)	540.00
<b>TOTAL</b>				<b>3,680.00</b>

### Weeds / invasive species

Species recorded as moderate to serious weeds were found scattered on throughout the survey site and on the edge of the track along the eastern side of the site. Six of the weeds are medicinal. The Java Plum and Acacia (*Acacia mangium*) are both trees that are classified on the CIBD as serious invasive species and series weed species. The photo to the right shows the two most common ground weeds on the site; the Mimosa (*Mimosa pudica*) and the Sickie pod (*Senna obtusifolia*). Bermuda grass (*Cynodon dactylon*), a moderate weed, was also recorded.



*Mimosa pudica and Senna obtusifolia are two very serious weeds found on the site*

### 3.2. Fauna habitat

The survey site has been under the management and use of the National Ministry of Agriculture for agriculture research development purposes for the last 50 years. No habitat for species listed as Endangered on the CIBD or listed under the IUCN Red List was recorded. The Chattering Kingfisher (*Todiramphus tuta*) is reported to utilise the area but was not seen or heard during the survey.

## 4. Conclusion and Recommendations

The survey site has been subjected to continuous use for agricultural purposes and is highly modified.

No species or fauna habitat was recorded that are listed as Endangered on the CIBD or listed on the IUCN Red List. The flora found on the site is commonly found throughout Mauke and the clearing of the site will not have a negative impact on any species recorded.

Site clearance will result in the loss of some species of economic values and owners will be compensated. *Tectona grandis*, if removed, the best part of mature trees, be milled and made available to the landowners to remove from site. All other 'trees' removed will be cut into firewood sizes and be made accessible to landowners to remove from site.

Control measures for serious weeds, especially the Mimosa and Sickle pod must be put in place to prevent their spread to land disturbed by clearing for the project. Bermuda grass was recorded on the site and this species, although a moderate weed is easy to control and would make a good long term ground cover for the project site. Consideration should be given to the collection and propagation of Bermuda grass seed for use in revegetating the site. Regular mowing of the site would also prevent the establishment of many of the other weed species recorded during the survey.

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## Appendix A

### Mauke Site – Flora

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<b>Trees</b>					
<i>Cocos nucifera</i>	Coconut	Nū	Native and listed significance – See use	++++	Food/Timber/Fire wood for cooking/Medicine
<i>Hibiscus tiliaceus</i>	Tree Hibiscus	‘Au	Native and Listed significance – Invasive and weed, see use	++++	Medicine, Material (fibre/ wood)/Fire wood for cooking
<i>Syzygium cumini</i>	Jambolan, Java plum	Pītāti	Introduced and listed significance – Serious invasive and weed, see use	++++	Food (fruit)/Fire wood for cooking
<i>Acacia mangium</i>	Acacia	‘Ākātia	Introduced and listed significance Serious invasive, Forestry, see use	++++	Forest, Material (timber)/Fire wood for cooking
<i>Tectona grandis</i>	Teak	Tiki	Introduced and listed significance - see use	+	Material (timber) for furniture/Fire wood for cooking
<i>Falcataria</i>	Albizia	‘Arapītia	Introduced and listed significance Moderate invasive, Forestry, see use	+++	Material (timber)/Fire wood for cooking
<i>Mangifera indica</i>	Mango	Vī	Introduced and listed significance – Food and export, see use	++++	Food and Fruit/Fire wood for cooking
<b>Small Trees and Crops</b>					
<i>Macadamia integrifolia</i>	Macadamia	Macadamia Nuts	Introduced and listed significance – See use	+	Fruit and food
<i>Citrus aurantifolia</i>	Lime	Tiporo	Introduced and	++	Medicine and

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
			listed significance – See use		food/Fire wood for cooking
<i>Carica papaya</i>	Pawpaw	Vi-puaka	Introduced and listed significance – See use	++++	Medicine and food.
<i>Xanthosoma sgittifolium</i>	Dry land Taro	Taruā	Introduced and listed significance – see use	++	Food (root crop)
<i>Ipomoea balatas</i>	Sweet Potato	Kumara	Polynesian Introduced and listed significance – see use	+++	Food (root crop and leaves used as vegetable), some species are endangered
<i>Musa ABB Group</i>	Banana	Mario Taruā	Polynesian Introduced and listed significance – see use	+++	Fruit, Food, Medicine and Food
<i>Morinda citrifolia</i>	Indian Mulberry	Nono	Native and listed significance – Medicine and Food, see use	++++	Fruit, Food, Medicine, Ornamental, Material (dye)
<i>Ananas cosmosus</i>	Pineapple	‘Ara Painapo	Introduced and listed significance – see use	++++	Fruit, Food, Medicine
<b>Moderate to serious weeds</b>					
<i>Stachytarpheta cayennensis</i>	Blue Rats tail	Tiāki (MT)	Introduced and listed significance – see uses	++++	Weed/Medicinal
<i>Ocimum gratissimum</i>	Wild Basil	Miri Ngangaere (MG)	Introduced and listed significance – see use	++++	Weed/medicine
<i>Tithonia diversifolia</i>	Tree Marigoki	Pua Renga	Introduced and listed significance – see uses	++++	Weed/serious
<i>Indigofera suffruticosa</i>	Indigo	Initiko	Introduced and listed significance – see uses	+++	Serious weed
<i>Caesalpinia major</i>	Yellow	Tātaraka	Native and	++	Moderate

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
	Nickernut	(Tātarāmoa)	listed significance – see use		injurious spines
<i>Cenchrus echinatus</i>	Burr Grass	Piripiri (Pārango)	Introduced and listed significance – see use	++++	Medicine, serious agriculture and lawn weed
<i>Cynodon dactylon</i>	Bermuda Grass	Matie 'Enea	Introduced, and listed significance – moderate weed	+++	Medicine and lawn grass
<i>Desmodium incanum</i>	Spanish Glover	Ngātoro (piripiri)	Introduced and listed significance – see use	+++	Serious weed, Manure
<i>Elephantopus mollis</i>	Elephant's foot grass	Tapuae Erepani	Introduced and listed significance – see uses	++++	Moderate weed
<i>Brachiaria mutica</i>	Para Grass	Mauku Puakatoro	Introduced and listed significance – see uses	-	Serious weed and livestock feed
<i>Sida rhombifolia</i>	Broom weed	Purūmu	Introduced and listed significance – see uses	+++	Material (Fibre) and serious weed
<i>Sorghum bicolor drummondii</i>	Sudan Grasss	Tarapī	Introduced and listed significance – see use	++	Serious Weed
<i>Senna obtusifolia</i>	Sickle pod	Pī 'Aungakino	Introduced and listed significance – see use	++++	Very serious weed, good for the soil (nitrogen fixing)
<i>Mimosa pudica</i>	Sensitive weed	Titā 'Āvarevare	Introduced and listed significance – see use	++	Medicine, serious weed and injurious spine
<i>Leucaena leucocephala</i>	Leucaena	Nītō	Introduced and listed significance – see use	++++	Serious weed, used for tomato stakes and fire wood for cooking
<i>Bidens pilosa</i>	Beggar's-tick	Piripiri Kerekere	Introduced and listed significance – see use	++++	Medicine, moderate invasive, serious weed
<i>Ocimum gratissimum</i>	Wild basil	Miri Taratoni	Introduced and	++	Medicine, serious

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
			listed significance – see use		weed

Source: Mr Teariki Rongo and the Cook Islands Biodiversity Database. Key to status, ++ (not common), +++ (common) and ++++ (very common).

#### Mauke Site – Fauna

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
<b>Birds</b>					
<i>Todiramphus tuta</i>	Chattering Kingfisher	Ngōtare	Native and listed significance – widespread, see use	+++	Ecotourism

Source: Mr Teariki Rongo and the Cook Islands Biodiversity Database. Key to status, ++ (not common), +++ (common) and ++++ (very common).

#### References:

Cook Islands Biodiversity Database (<http://www.cookislands.bishopmuseum.org>)

IUCN List of Threatened Species (Version 2014.3)



# Cook Islands Renewable Energy Sector Project Flora and Fauna Assessment - Mitiaro

17 August 2015

## 1. Introduction

The Office of the Prime Minister – Renewable Energy Development Division is currently implementing the Cook Islands Renewable Energy Sector Project (CIRESPP). The CIRESPP aims to install solar photovoltaic power stations on Rarotonga, Aitutaki, Atiu, Mitiaro, Mangaia and Mauke. Construction of the solar photovoltaic power station at Mitiaro will include the clearing, filling and levelling of Makatea land for the installation of solar panels and a new power house containing batteries, inverters and new backup diesel generators. Connection to the existing electricity distribution network will be carried out and will include refurbishment of the existing distribution system. (Refer to Figure 1).

This flora and fauna site assessment was undertaken to identify flora and fauna values present within the clearing footprint of the proposed project on Mitiaro. The following tasks were undertaken as part of the assessment:

- A review of terrestrial flora and fauna data held on the Cook Islands Biodiversity Database to identify the occurrence of native species and potential occurrence of threatened flora and fauna species recorded as Endangered (Moderate and Serious).
- A review of the IUCN Red List of Threatened Species (Version 2014.3) to identify the potential occurrence of listed flora and fauna species.
- Consultation with Gerald McCormick (Director for the Cook Islands Natural Heritage Trust (CINHT)) to identify the potential occurrence of significant flora and fauna species.
- A field survey was undertaken to investigate and verify the potential fauna and flora issues identified in the desktop review. The field survey included:
  - identification of vegetation communities present
  - a survey of terrestrial flowering annual and perennial plants
  - the identification and assessment of existing terrestrial flora and fauna values including for environmental, medicinal and economic use.
  - the identification and assessment of potential habitat for threatened terrestrial and aquatic fauna species.

The results of the database review, consultation and field survey were used to identify any potential impacts from the proposed project which may require further assessment and/or mitigation strategies to avoid and minimise impacts.



Figure 1.0: Proposed Mitiaro solar power station site and site layout

## 2. Methods

The vegetation and fauna habitat survey was carried out on the 20<sup>th</sup> of May 2015 by Teariki Rongo and David Procter with the assistance of a local informant. A meandering survey for flora was carried out within the works area. A timed meander search method involves walking over the survey area in a random manner and recording all flora species encountered. The search was stopped when no new flora species were identified following at least 20 minutes of searching since the previous species record. All species of flora encountered during the survey were recorded. Threatened species locations if recorded were mapped using a hand held GPS.

Important fauna habitat components were also recorded during the survey. In addition, all fauna species encountered during the survey were recorded, including indirect evidence of fauna presence (e.g. bird calls and knowledge of local informant).

### 2.1. Limitations



Rugged and sharp Makatea terrain

The rugged and sharp coral rocks of the Makatea terrain (refer to photo) made it extremely difficult to walk over the survey site which restricted the survey area to one survey path on the western boundary of the survey site. The remainder of the site was visible from the area surveyed and the distribution of species appeared to be uniform. The survey area was therefore considered to provide an adequate sample for the survey site.

Due to varying flowering times and seasonality of occurrence it is likely that not all flora species that occur at the site were identified in the survey. In particular, short lived annuals that may be present at the site may have been missed because they were not able to be identified (they were not flowering) or they were not evident at this time of year (they were annual plants

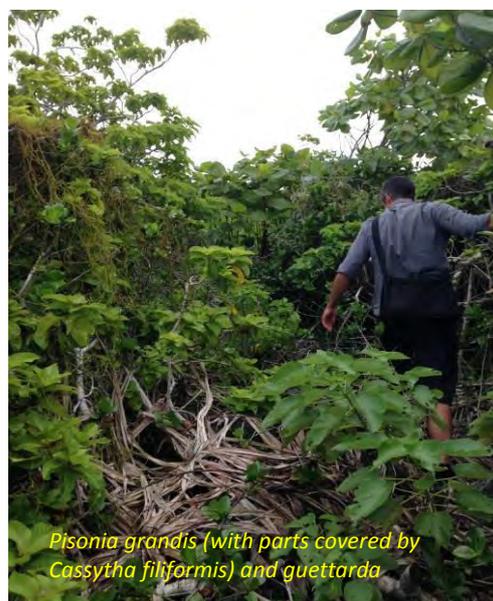
that had died back or not emerged at the time of survey). It should be noted that there were no threatened short lived annuals that were identified that potentially occurred within the survey area.

## 3. Results

### 3.1. Flora

Of the larger plant species, the dominant species found in the survey area were *Timonius polygamus*, *Guettarda speciosa*, *Pisonia grandis*, *Myrsine cheesemanii* and *Pipturus argenteus*. Patches of *Pandanus tectorius* complex were recorded with *Pouteria grayana*. *Cassytha filiformis*, a minor invasive creeper, covered parts of the survey area. This is apparent in the photo to the right where *Pisonia grandis* is partly covered.

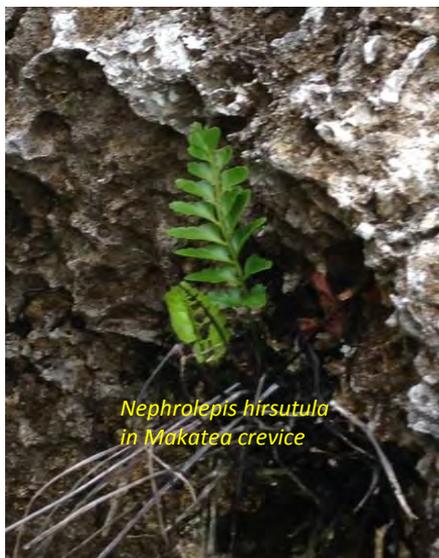
Below the larger plant species were the more shade tolerant species comprising of ferns and small plants. The field survey recorded 28 flora species



*Pisonia grandis* (with parts covered by *Cassytha filiformis*) and *guettarda*

within the survey area of which 18 were native species and 10 were introduced species. A full list of flora species is provided in Appendix A. Two species were identified that were recorded as Locally Endangered on the Cook Islands Biodiversity Database however; neither was listed on the IUCN Red List. The two species; *Pouteria grayana* and *Pisonia grandis* are recorded as very common on Mitiaro on the CIBD and the Locally Endangered listing refers to other islands where they occur less commonly.

#### Medicinal uses



Of the recorded flora species within the survey area 18 have medicinal uses. The local informant advised that all plants of medicinal use are also found elsewhere on Mitiaro and are therefore not at risk. All the medicinal plants reordered are listed as very common on the CIBD supporting the information provided by the local informant.

#### Economic uses

As with the Pa Enea of the Cook Islands, the use of plants for medicine does have an economic and social value to the local community. The economic value of these plants to the local population has not been assessed. Most of the medicinal plants are weeds and those native species used are widely distributed on Mitiaro. It is therefore unlikely that the project will have adverse impact on medicinal

species.

#### Weeds / invasive species

Of the weeds recorded on the CIBD as moderate to serious weeds all were found on the edge of the Makatea and along the access road. Without adequate control it is expected that these species will spread into the project site once it is cleared and levelled. It is expected that these species will spread into the project area once the area is cleared and levelled. *Cassytha filiformis*, listed as minor invasive on the CIBD, covered a significant part of the survey area. According to the local informant this species has become widespread on the island.

Bermuda grass (*Cynodon dactylon*), a moderate weed that was found along the newly formed access road, may be useful ground cover to prevent the spread of more serious weeds on the project site.

### 3.2. Fauna habitat

The Pacific Pigeon (*Ducula pacifica*) is very common in the area. Although none were sighted on the survey area during the survey they were seen nearby. The Pacific Pigeon feeds on the berries of species such as *Guettarda speciosa*, *Alyxia stellate*, *Myrsine cheesemanii* and *Timonius polygamus* which occur on the project site. It is unlikely that the Pacific Pigeon will utilize the project site once all the trees with berries are removed.

According to local informant, the Cook Islands Warbler (*Acrocephalus kerearako*), normally more visible along the Makatea side of the villages, can also be seen in the Makatea area including the project site. This species is endemic to the Cook Islands and is listed as Locally Endangered on the CIBD but very common on Mitiaro. It is not listed on the IUCN Red List of Endangered species.

#### 4. Conclusion and Recommendations

The survey site is a typical naturally rugged and sharp coral Makatea terrain. It is extremely difficult to walk over and for this reason has remained unused.

The survey recorded 18 native flora species and all are widespread on Mitiaro including two species that are listed as Locally Endangered on the CIBD.

The survey site is likely to provide habitat for the Cook Islands Warbler as it is attracted to places where people are present.

Clearing of the project site will not have a negative impact on any native species or species listed as Endangered on the CIBD or listed on the IUCN Redlist.

Several serious weeds occur on the cleared boundary of the site (adjacent to the road) and these have the potential to spread on to the site once cleared. Control measures for serious weeds, must be put in place.

Bermuda grass was recorded on the site and this species, although a moderate weed, is easy to control and would make a good long term ground cover for the project site. Consideration should be given to the collection and propagation of Bermuda grass seed for use in revegetating the site.

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## Appendix A

### Mitiaro – Flora

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<b>Trees</b>					
<i>Pouteria grayana</i>	Pouteria	Karaka Mitiaro	Native, and listed significance - Locally endangered, Not listed on the IUCN Red List for Threatened Species, See use	+++	No use provided
<i>Guettarda speciosa</i>	Guettarda	'Ano	Native, and listed significance See use	++++	Material (Wood)
<i>Pandanus tectorius complex</i>	Pandanus	'Ara-ta'atai	Native, and listed significance See use	++++	Medicine, ornamental leaves. Material (Fibre), injurious spine.
<i>Pisonia grandis</i>	Pisonia	Pukatea	Native, and listed significance - locally endangered, Not Threatened under the IUCN Red List for Threatened Species, see use	++++	Medicine
<b>Small Trees</b>					
<i>Timonius polygamous</i>	Timonius	Kopara	Native, and listed significance see use	++++	Medicine, fruits are poisonous to eat
<i>Myrsine cheesemanii</i>	Cook Islands Myrsine	Kaika Makatea	Native, and listed significance - endemic to the Cook Islands (4 islands including Mitiaro), Food	++++	Fruit and Food
<i>Pipturus argenteus</i>	Pipturus	Ōrongā	Native, and listed significance, see use	+++	Medicine, fruits formerly eaten, fibre
<b>Ferns and Small Plants on Makatea including creepers</b>					
<i>Asplenium australasicum</i>	Sharp bird's nest fern	Kōta'a Tua Koi	Native, and listed significance, see use	++++	Wrapping food/ornamental fern
<i>Davallia solida</i>	Polynesian Davallia	Poenū	Native, and listed significance, see	++++	Medicine

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
				use	
<i>Microsorium grossum</i>	Unscented Oak-leaf fern	Tureimang amanga	Native, and listed significance, see use	++++	Medicine and ornamental
<i>Nephrolepis hirsutula</i>	Lobed Sword Fern	Turoutou	Native, and listed significance, see use	++++	Medicine and ornamental
<i>Cassytha filiformis</i>	Cassytha or Devil's Twine	Tainoka	Native, and listed significance – minor invasive, See use	++++	Medicine
<i>Alyxia stellate</i>	Alyxia	Maire	Native, and listed significance, see use	+++	Ornamental
<i>Eugenia reinwardtiana</i>	Reinwardt's Cherry	Nī'oi	Native, and listed significance, see use	++	Fruit
<i>Peperomia pallida</i>	Bold-Vein Peperomia	Pikimato	Native, and listed significance, see use	++++	Medicine
<i>Aclypha lanceolata</i>	Aclypha weed	Puapua	Introduced, and listed significance, see use	+	Medicine
<i>Morinda myrtifolia</i>	Morinda vine	Pirita	Native, and listed significance, see use	+++	Fibre
<i>Charmaesyce forsbergii</i>	Polynesian Beach-Spurge	Tototo	Native, and listed significance, see use	++++	Weed
<b>Moderate to serious weeds<sup>1</sup></b>					
<i>Stachytarpheta cayennensis</i>	Blue Rats tail	Tiāki (MT)	Introduced, and listed significance - weed, see use	++++	Medicinal
<i>Phyllanthus amarus</i>	Weedy Phyllanthus	Moemoe	Introduced, and listed significance – minor weed, see use	+++	Medicine
<i>Catharanthus roseus</i>	Rosy Periwinkle	Tiare Mākūrāta	Introduced, and listed significance, see use	++++	Medicine, ornamental flowers
<i>Cenchrus echinatus</i>	Burr Grass	Piripiri (Pārango)	Introduced, and listed significance – serious agriculture and	++++	Medicine

<sup>1</sup> Weeds found mainly in the outer edge of the Makatea along roads

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
			lawn weed, see use		
<i>Desmodium incanum</i>	Spanish Glover	Ngātoro (piripiri)	Introduced, and listed significance – serious weed, see use	+++	Manure
<i>Vigna marina</i>	Beach Pea	Pō'ue	Native, and listed significance – minor weed, see use	++++	Medicine
<i>Bidens pilosa</i>	Beggar's-tick	Piripiri Kerekere	Introduced, and listed significance – moderate invasive and serious weed, see use	++++	Medicine,
<i>Sorghum bicolor drummondii</i>	Sudan Grass	Tarapī	Introduced, and listed significance – serious weed, see use	++	Livestock feed
<i>Eleusine indica</i>	Wire grass	'Ātangaroa	Introduced, and listed significance – moderate weed, see use	++++	No use identified
<i>Cynodon dactylon</i>	Bermuda Grass	Matie 'Enea	Introduced, and listed significance – moderate weed	+++	Medicine and lawn grass

Source: Informant Mr Nooroa Pouao (20/05/15), Teariki Rongo, and the Cook Islands Biodiversity Database. Key to status, ++ (not common), +++ (common) and ++++ (very common).

### Mitiaro Site – Fauna

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
<i>Acrocephalus kerearako</i>	Cook Islands Warbler	Ka'oko (Miti'aro)	Native, and listed significance - resident Breeder, endemic of the Cook Islands, Globally endangered (moderate), Not Threatened under IUCN Red List for Threatened Species	++?	Native of Mangaia and Miti'aro, native scrubland and horticulture lands
<i>Ducula pacifica</i>	Pacific Pigeon	Rupe	Native, and	++++	Food, spreads

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
			listed significance – resident breeder, see use		seeds of fruits, e.g. 'Ano.

Source: Mr Noo Pouao (20/05/15), Teariki Rongo, and the Cook Islands Biodiversity Database. Key to status, ++ (not common), +++ (common) and ++++ (very common).

#### References:

Local Informants are: Noo Pouao (Environment Officer for Mitiaro).

Cook Islands Biodiversity Database (<http://www.cookislands.bishopmuseum.org>)

IUCN List of Threatened Species (<http://www.iucnredlist.org/search> )



# Cook Islands Renewable Energy Sector Project Flora and Fauna Assessment - Atiu

17 September 2015

## 1. Introduction

The Office of the Prime Minister – Renewable Energy Development Division is currently implementing the Cook Islands Renewable Energy Sector Project (CIRESPP). The CIRESPP aims to install solar photovoltaic power stations on Rarotonga, Aitutaki, Atiu, Mitiaro, Mangaia and Mauke. Construction of the solar photovoltaic power station at Atiu will include the clearing and levelling of approximately 1.5 Ha of land for the installation of solar panels. Connection to the existing electricity distribution network will include the installation of a new high voltage cable connecting a new renewable power house to the existing power house (refer to Figure 1).

This assessment was undertaken to identify flora and fauna values present within the clearing footprint of the proposed project on Atiu. The following tasks were undertaken as part of the assessment:

- A review of terrestrial flora and fauna data held on the Cook Islands Biodiversity Database to identify the occurrence of native species and the potential occurrence of threatened flora and fauna species recorded as Endangered (Moderate and Serious).
- A review of the IUCN Red List of Threatened Species (Version 2014.3) to identify the potential occurrence of listed flora and fauna species.
- Consultation with Gerald McCormick (Director for the Cook Islands Natural Heritage Trust (CINHT)) to identify the potential occurrence of significant flora and fauna species.
- A field survey was undertaken to investigate and verify the potential fauna and flora issues identified in the desktop review. The field survey included:
  - identification of vegetation communities present
  - a survey of terrestrial flowering annual and perennial plants
  - the identification and assessment of existing terrestrial flora and fauna values including for environmental, medicinal and economic use.
  - the identification and assessment of potential habitat for threatened terrestrial fauna species.

The results of the database review, consultation and field survey were used to identify any potential impacts from the proposed project which may require further assessment and/or mitigation strategies to avoid and minimise impacts.



Figure 1: Proposed Atiu solar power station site and site layout

## 2. Methods

The vegetation and fauna habitat survey was completed on the 19<sup>th</sup> and 20<sup>th</sup> of May 2015 by Teariki Rongo and David Procter together with local informants with knowledge of local species. A meandering survey for flora was carried out within the works area. A timed meander search method involves walking over the survey area in a random manner and recording all flora species encountered. The search was stopped when no new flora species were identified following at least 20 minutes of searching since the previous species record. All species of flora encountered during the survey were recorded. Threatened species locations, if recorded, were mapped using a hand held GPS.

Important fauna habitat components were also recorded during the survey. In addition, all fauna species encountered during the survey were recorded, including indirect evidence of fauna presence (e.g. bird calls).

### 2.1. Limitations

Due to varying flowering times and seasonality of occurrence it is likely that not all flora species that occur at the site were identified in the survey. In particular, short lived annuals that may be present at the site may have been missed because they were not able to be identified (they were not flowering) or they were not evident at this time of year (they were annual plants that had died back or not emerged at the time of survey). It should be noted that there were no threatened short lived annuals that were identified as potentially occurring within the survey area.

### 3. Results

#### 3.1. Flora

The survey area was forested with Caribbean pine (*Pinus Caribaea*) and Java plum (*Syzygium cumini*). These two introduced species dominated the top canopy of the forest. The fine needle leaves of the Caribbean pine cover the forest floor allowing only a few shade tolerant species to prevail.



The field survey recorded 15 flora species within the survey area of which four were native species and 11 were introduced species. A full list of flora species is provided in Appendix A. No species were identified during the survey that are recorded as Endangered on the CIBD or listed on the International Union for Conservation of Nature (IUCN) Red List.

##### 3.1.1. Medicinal uses

Of the recorded flora species within the survey area five have medicinal uses. Three of these species are found mainly on the edge of the Pine forest and are listed as serious weeds on the CIBD. The distribution of all medicinal species is recorded as very common on the CIBD and the local informants confirmed they were all found in other locations on Atiu. Comments by the Director of the CINHT also supported the information provided by the local informants.

### 3.1.2. Economic uses

Four species of tree found on the project site were introduced for economic purposes and all four have become invasive species (some are listed on the CIBD as serious weeds). Albizia (*Folcataria moluccana*) was introduced in the 1930s as a source of timber for making crates used to pack and export tomatoes and bananas. Caribbean pine, the most common tree on the project site, was introduced for the purpose of protecting soil from further erosion and therefore has a strong conservation value. Its economic value is not in the form of timber but more in the conservation of soil resources to curb soil erosion. Caribbean pine was planted in the early 1980s after the collapse of the pineapple industry on Atiu which left lands on slopes vulnerable to sheet and rill erosion. Acacia (*Acacia mangium*) on the other hand was introduced to Atiu as a source of fuel wood for the purpose of wood burning power generation in the mid-1980s. Java plum, one of the most aggressive and serious invasive species and weeds on Atiu was introduced as a wind breaker for the citrus industry in the Southern Group islands that included Atiu. Protecting orange plantations from moderate to strong winds aid the fruiting process of oranges. Today acacia has become a serious invasive, Albizia and Java plum are moderate invasive and a serious weeds, and Caribbean pine is spreading fast threatening native species outside the project site.

### 3.1.3. Weeds / invasive species

Of the weeds found on the project site and listed as moderate to serious on the CIBD all are found on the edge of the Caribbean pine forest. Albizia and Java Plum, as mentioned above, are the two serious tree weeds found growing inside the Caribbean pine forest.

## 3.2. Fauna habitat

According to the local informants the Chattering Kingfisher (*Todiramphus tuta*) and Cook Islands Fruit Dove (*Ptilinopus rarotongensis*) are regularly found at the project site where they feed on the fruit of the Java plum during its fruiting season. Neither species was observed or heard during the survey. The Cook Islands Fruit Dove is listed as moderately endangered under the CIBD and vulnerable under the IUCN Red List.

The Java plum and the native Polynesian Elaeocarpus (*Polynesian Elaeocarpus*) both provide fruit and potential habitat for several species of birds found on Atiu. The distribution of the Java plum and Polynesian Elaeocarpus is recorded as very common on the CIBD and are widespread on Atiu.

## 4. Conclusion and Recommendations

The flora found on the project site is dominated by introduced species that are widespread on Atiu. Five species with medicinal uses and four with economic uses were recorded on the project site. All are listed on the CIBD as very common and are widespread on Atiu.

The proposed Atiu solar power station will not have a significant negative impact on native species nor will it result in the loss of significant source of medicinal or economic species.

It is important for the project to note that the existence of the Caribbean pine on the project site has conservation values and their removal will require the implementation of best practice environmental management that will include managing potential soil erosion.

The loss of a small area (1.5 Ha) of potential habitat containing the Java plum and Polynesian Elaeocarpus is unlikely to have a negative impact on the Cook Islands Fruit Dove as both species are widespread on Atiu. It is likely that the Cook Islands Fruit Dove will continue to use the project site as it moves between surrounding habitat.

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## Appendix A

### Atiu Site – Flora

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<b>Trees</b>					
<i>Acacia mangium</i>	Acacia	‘Ākātia	Introduced and listed significance - Forestry	++++	Timber, serious invasive (introduced in 1985)
<i>Cocos nucifera (not mature)</i>	Coconut	Nū	Native and listed significance – See use	++++	Food/Timber/Medicine
<i>Syzygium cumini</i>	Jambolan, Java plum	Pītāti	Introduced and listed significance – See use	++++	Food (fruit), serious invasive and weed
<i>Pinus Caribaea</i>	Caribbean pine	Paina Papa’a	Introduced and listed significance - Forestry	++++	Timber, spreading fast
<i>Polynesian Elaeocarpus</i>	Polynesian Elaeocarpus	Rare	Native and listed significance – Material (Wood)	++++	Material (Wood), fruits for birds, i.e. pigeons
<i>Adenanthera pavonina</i>	Red-bead Tree	Mata Kōviriviri	Introduced and listed significance – Food and Material	+++	Food, Material, Serious invasive and moderate weed
<i>Falcataria moluccana</i>	Albizia	‘Ārapitia	Introduced and listed significance - Forestry	++++	Moderate invasive, serious weed
<b>Small Trees (Shrubs)</b>					
<i>Morinda citrifolia</i>	Indian Mulberry	Nono	Native and listed significance – Medicine and Food	++++	Medicine, Ornamental Tree, Food (fruit), material (Dye)
<i>Mangifera indica</i>	Mango	Vī (young plant)	Introduced and listed significance – Food and export	++++	Food and Timber (used for making canoes)
<b>Moderate to Serious Weeds<sup>1</sup></b>					
<i>Stachytarpheta cayennensis</i>	Blue Rats tail	Tiāki (MT)	Introduced and listed significance – Serious weed	++++	Weed/Medicinal
<i>Ocimum gratissimum</i>	Wild Basil	Miri Ngangaere (MG)	Introduced and listed significance – Medicine, serious weed -	++++	Weed/medicine

<sup>1</sup> Found on the outer edge of the Pine Forest and near tracks

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<i>Caesalpinia major</i>	Yellow Nickernut	Tātara (Tātārāmoa)	Native and listed significance – See use	++	Moderate injurious spines
<i>Cenchrus echinatus</i>	Burr Grass	Piripiri (Pārango)	Introduced and listed significance – See use	++++	Medicine, serious agriculture and lawn weed
<i>Desmodium incanum</i>	Spanish Glover	Ngātoro (piripiri)	Introduced and listed significance - Manure	+++	Serious weed, Manure
<i>Sorghum bicolor drummondii</i>	Sudan Grass	Tarapī	Introduced and listed significance – See use	++	Serious Weed

Source: Mr Teariki Rongo (19/05/15), Atiu informants, the Cook Islands Biodiversity Database, and IUCN List of Threatened Species (Version 2014.3). Key to status, ++ (not common), +++ (common) and ++++ (very common).

### Atiu Site - Fauna<sup>2</sup>

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
<b>Birds</b>					
<i>Todiramphus tuta</i>	Chattering Kingfisher	Ngōtare	Native and listed significance – widespread, Ecotourism	+++	Native to Atiu and Mauke, and live on land. None spotted during survey
<i>Ptilinopus rarotongensis</i>	Cook Island Fruit Dove	Kūkupa	Native and listed significance – Moderately endangered (Vulnerable under IUCN Red List), Ecotourism	++++	Native to Atiu, Mauke and Rarotonga, and live on land. None spotted during survey

Source: Atiu informant (19/05/15), the Cook Islands Biodiversity Database, and IUCN List of Threatened Species (IUCN List of Threatened Species 2014.3). Key to status, ++ (not common), +++ (common) and ++++ (very common).

### References:

Local informants are: Upokoina Tearai (Mayor), Apii Polio (Manager for Infrastructure Division, AIG), Teariki Maurangi (Executive Officer for AIG).

Cook Islands Biodiversity Database (<http://www.cookislands.bishopmuseum.org>)

IUCN List of Threatened Species (Version 2014.3 )

<sup>2</sup> Information given by Atiu Informants (19/05/15)



# Cook Islands Renewable Energy Sector Project Flora and Fauna Assessment - Aitutaki

05 February 2016

## 1. Introduction

The Office of the Prime Minister – Renewable Energy Development Division is currently implementing the Cook Islands Renewable Energy Sector Project (CIRESPP). The CIRESPP aims to install solar photovoltaic power stations on Rarotonga, Aitutaki, Atiu, Mitiaro, Mangaia and Mauke. Construction of the solar photovoltaic power station at Aitutaki will include the clearing and levelling of approximately 1.1 Ha of land for the installation of solar panels. Connection to the existing electricity distribution network will include the installation of a new high voltage cable connecting a new renewable power house to the existing power house (refer to Figure 1).

This assessment was undertaken to identify flora and fauna values present within the clearing footprint of the proposed project on Aitutaki. The following tasks were undertaken as part of the assessment:

- A review of terrestrial flora and fauna data held on the Cook Islands Biodiversity Database (CIBD) (accessed 5th February 2016) to identify the occurrence of native species and the potential occurrence of threatened flora and fauna species recorded as Endangered (Moderate and Serious).
- A review of the IUCN Red List of Threatened Species (Version 2014.3) to identify the potential occurrence of listed flora and fauna species.
- Consultation with Gerald McCormick (Director for the Cook Islands Natural Heritage Trust (CINHT)) to identify the potential occurrence of significant flora and fauna species (29 April 2015).
- A field survey was undertaken to investigate and verify the potential fauna and flora issues identified in the desktop review. The field survey included:
  - identification of vegetation communities present
  - a survey of terrestrial flowering annual and perennial plants
  - the identification and assessment of existing terrestrial flora and fauna values including for environmental, medicinal and economic use.
  - the identification and assessment of potential habitat for threatened terrestrial fauna species.

The results of the database review, consultation and field survey were used to identify any potential impacts from the proposed project which may require further assessment and/or mitigation strategies to avoid and minimise impacts.

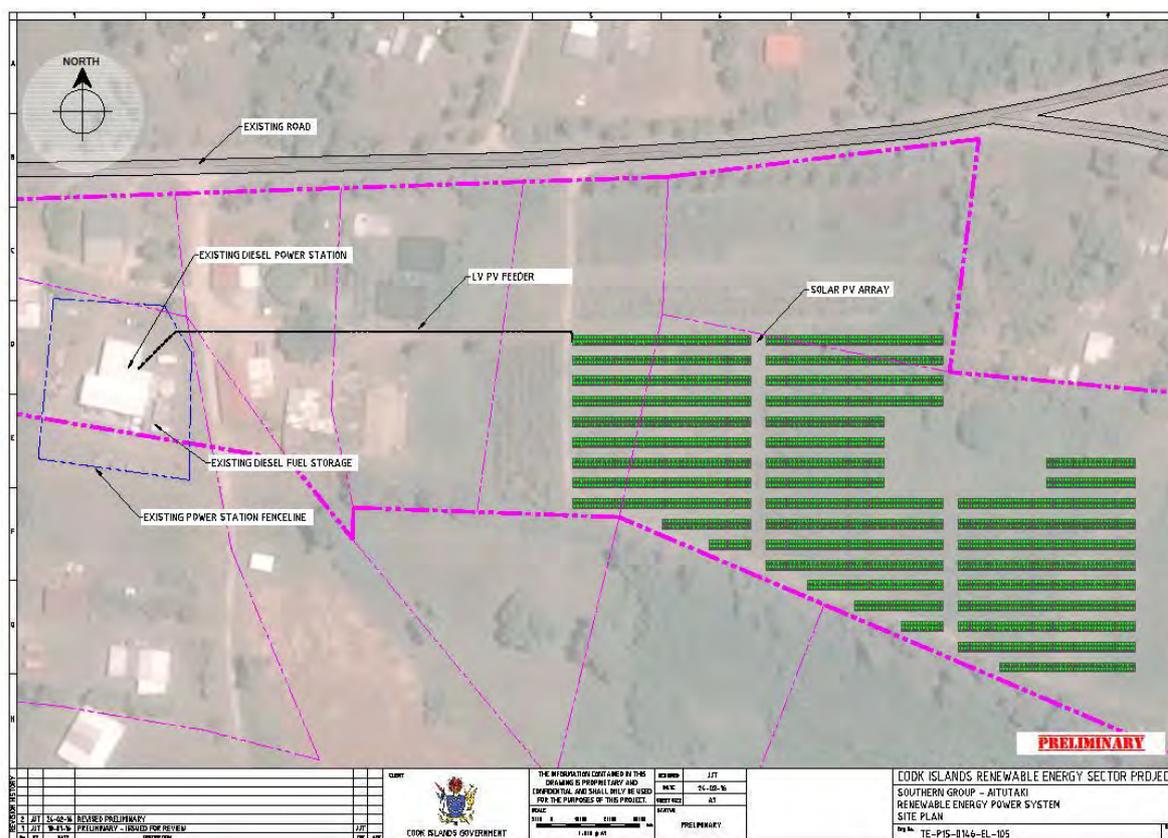


Figure .1: Proposed Aitutaki solar power station site layout

## 2. Methods

The vegetation and fauna habitat survey was completed on the 5<sup>th</sup> of February 2016 by Teariki Rongo with local informants with knowledge of local species. A meandering survey for flora was carried out within the works area. A timed meander search method involves walking over the survey area in a random manner and recording all flora species encountered. The search was stopped when no new flora species were identified following at least 20 minutes of searching since the previous species record. All species of flora encountered during the survey were recorded. Threatened species locations, if recorded, were mapped using a hand held GPS.

Important fauna habitat components were also recorded during the survey. In addition, all fauna species encountered during the survey were recorded, including indirect evidence of fauna presence (e.g. bird calls).

### 2.1. Limitations

Due to varying flowering times and seasonality of occurrence it is likely that not all flora species that occur at the site were identified in the survey. In particular, short lived annuals that may be present at the site may have been missed because they were not able to be identified (they were not flowering) or they were not evident at this time of year (they were annual plants that had died back or not emerged at the time of survey). It should be noted that there were no threatened short lived annuals that were identified as potentially occurring within the survey area.

### 3. Results

#### 3.1. Flora



The survey area at the Aitutaki site is overgrown with weeds. The site at the time of the survey looked like an abandoned maniota (*Manihot esculenta*) plantations with remanent Java plum (*Syzygium cumuni*) trees bordering the western and southern boundaries of the site. A large Barringtonia (*Barringtonia asiatica*) tree stands in the middle of the northern boundary.

Eight mango (*Mangifera indica*) trees grow along the inside of the Java plum lined boundary to the west. Six of the trees are

still very productive and may be around 8 to 10 years old, and the remaining two look like old trees of the lesser preferred variety.

The field survey recorded 21 flora species within the survey area of which two were native species and 19 were introduced species. A full list of flora species is provided in Appendix A. No species were identified during the survey that are recorded as Endangered on the CIBD or listed on the International Union for Conservation of Nature (IUCN) Red List.

##### 3.1.1. Medicinal uses

Of the recorded flora species within the survey area, nine have medicinal uses. Two are trees, the Barringtonia, and Morinda (*Morinda citrifolia*), and the rest are listed as serious to moderate weeds on the CIBD. The distribution of all medicinal species is recorded as very common on the CIBD and the local informants confirmed they were all found in other locations on Aitutaki. Comments by the Director of the CINHT also supported the information provided by the local informants (29 April 2015).

##### 3.1.2. Economic uses

The six mango trees located inside of the remaining Java Plum boundary trees are the only trees with economic use. All other trees have no economic value.

##### 3.1.3. Weeds / invasive species

Of the weeds found on the project site and listed as moderate to serious on the CIBD all are commonly found on the island and on abandoned plantations. Outstanding weeds that require

some attention are the para grass (*Brachiaria mutica*) and the Calopo (*Calopogonium mucunoides*).

The para grass, introduced for stock feed, mainly cattle, is very aggressive and hard to get rid of. Of all the creepers, Calopo is very aggressive and can become a problem in maintaining the solar panels during the operational phase of the project.

### 3.2. Fauna habitat



According to the local informants the Blue Lorikeet (*Vini peruviana*) can be seen regularly at the proposed project site and is commonly seen on the island in areas like the proposed project site and other areas where it has not been used or cleared of weeds for a while. They are known to build their nest in old rotting trees. They feed on ground forage, nectar and insects.

No Blue Lorikeet was sited during the field survey.

The Blue Lorikeet is listed as globally endangered (seriously) under the CIBD and vulnerable under the IUCN Red List.

Blue Lorikeet is primarily endangered by invasive species including rats and cats.

## 4. Recommendations

The survey site has been subjected to continuous use for agricultural purpose and is therefore no longer a site for special species or habitat of a special fauna.

The existing flora is found widely on the island and their removal from the site is not expected to have any significant impact on their existence and access.

Economic uses of some species on site will be lost but will not affect their existence and access on the island. All of the 'tree' species are also found somewhere else on the island.

Control measures of serious weeds, especially the para grass (*Brachiaria mutica*) and the more aggressive creepers like the Calopo (*Calopogonium mucunoides*) should be put in place to ensure ease of maintenance of site after commissioning.

Prepared by:

Teariki-Taoiau Rongo

T 682 75176

E [tiutematangi@yahoo.com](mailto:tiutematangi@yahoo.com)

### References:

Local informants are: Tuangaru Bishop (Senior Environment Officer for NES Aitutaki), Vavia Puapii (Environment Officer for NES Aitutaki).

Cook Islands Biodiversity Database (<http://www.cookislands.bishopmuseum.org>)

IUCN List of Threatened Species (<http://www.iucnredlist.org/search> )

## Appendix A

### Aitutaki Site – Flora

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
<b>Trees</b>					
<i>Mangifera indica</i>	Mango	Vī	Introduced	+++	Food/Timber
<i>Syzygium cumini</i>	Jambolan, Java plum	Pītāti	Introduced and listed significance – See use	++++	Food (fruit), serious invasive and weed
<i>Barringtonia asitica</i>	Barringtonia	‘Utu	Native	++	Medicine, material (use to stun fish, a way to catch fish), poisonous to eat the raw seed.
<b>Small Trees (Shrubs)</b>					
<i>Morinda citrifolia</i>	Indian Mulberry	Nono	Native and listed significance – Medicine and Food	++++	Medicine, Ornamental Tree, Food (fruit), material (Dye)
<i>Solanum mauritianum</i>	Tobacco Tree	Rau ‘Ava’ava	Introduced – recent; naturalised and common	+++	Fumery, invasive (moderate), weed (moderate)
<b>Moderate to Serious Weeds<sup>1</sup></b>					
<i>Stachytarpheta cayennensis</i>	Blue Rats tail	Tiāki (MT)	Introduced and listed significance – Serious weed	++++	Weed/Medicinal
<i>Ocimum gratissimum</i>	Wild Basil	Miri Ngangaere (MG)	Introduced and listed significance – Medicine, serious weed -	++++	Weed/medicine
<i>Tithonia diversifolia</i>	Tree Marigold	Pua Renga	Introduced – Recent; naturalised; and very common	++++	Weed (serious)
<i>Cenchrus echinatus</i>	Burr Grass	Piripiri (Pārango)	Introduced and listed significance – See use	++++	Medicine, serious agriculture and lawn weed
<i>Desmodium incanum</i>	Spanish Glover	Ngātoro (piripiri)	Introduced and listed significance - Manure	+++	Serious weed, Manure
<i>Commelina diffusa</i>	Commelina	Mauku-vai	Introduced, recent, naturalised and	++++	Stock food, medicine and weed (moderate)

<sup>1</sup> Found on the outer edge of the Pine Forest and near tracks

Species	Common name	Traditional name	Cook Islands Status	Distribution	Use
			very common		
<i>Sorghum bicolor drummondii</i>	Sudan Grass	Tarapī	Introduced and listed significance – See use	++	Serious Weed
<i>Mikania micrantha</i>	Mile-a-minute	Pōkutekute Teatea	Introduced, very common and widespread – See use	++++	Medicine, invasive (serious), weed (serious)
<i>Sida rhombifolia</i>	Broom weed	Purūmu	Introduced, naturalised and common – See use	+++	Material, weed (serious)
<i>Leucaena leucocephala</i>	Leucaena	Nītō	Introduced, recent, naturalised – See use	+++	Forestry, weed (serious)
<i>Mimosa pudica</i>	Sensitive weed	Rākau pikika’a	Introduced, recent, naturalised and very common	+++	Medicine, weed (serious), Injurious spine - moderate
<i>Bidens pilosa</i>	Beggars-tick	Piripiri Kerekere	Introduced, recent, naturalised and very common	++++	Medicine, invasive (moderate), weed (serious)
<i>Brachiaria mutica</i>	Para grass	Mauku Puakatoro/Para Karāti	Introduced, recent, naturalised and very common	++++	Forage, weed (serious)
<i>Calopogonium mucunoides</i>	Calopo		Introduced, recent, naturalised and common on horticulture lands	+++	Cover, weed (serious)
<i>Centrocema pubescens</i>	Centro butterfly-pea	Piriarero	Introduced, recent, naturalised and common	+++	Medicine; cover; Weed (serious)
Crop <sup>2</sup>					
<i>Manihot esculenta</i>	Cassava	Māniota	Introduced, recent, not naturalised	++++ <sup>3</sup>	Food (root), cooked, medicine,

Source: Mr Teariki Rongo (05/02/16), Aitutaki informants, the Cook Islands Biodiversity Database, and IUCN List of Threatened Species (<http://www.iucnredlist.org/search>). Key to status, ++ (not common), +++ (common) and ++++ (very common).

<sup>2</sup> Specie planted for food (root fibre)

<sup>3</sup> Observed (05/02/16)

Aitutaki Site - Fauna<sup>4</sup>

Species	Common name	Traditional name	Cook Islands Status	Distribution	Status/Habitat
<b>Birds</b>					
<i>Vini peruviana</i>	Blue Lorikeet	Kurāmo'o	Introduced, recent, naturalised and common <sup>5</sup>	+++	Globally endangered (seriously) IUCN List of Threatened Species (Vulnerable).

Source: Aitutaki informant (05/02/16), the Cook Islands Biodiversity Database, and IUCN List of Threatened Species (<http://www.iucnredlist.org/search>). Key to status, ++ (not common), +++ (common) and ++++ (very common).

<sup>4</sup> Information given by Aitutaki Informants (05/02/16)

<sup>5</sup> Common according to Tuangaru Bishop, NES Officer for Aitutaki

**Appendix 3: Marae Letters**

14 June 14, 2015

Mangaia.

Tangi ke Teariki Rongo.

Ko au teia ko te mata o te au atu enua, te akapapu atu nei e kare e Historical site me kare e marae I runga I te enua o te solar power e kare katoa e cultural significance site I runga I teia enua.

Meitaki ngao.

Periki Poila.

Atu-Enua;

Teremoana Poila

Aerenga Matapo

Pareina Ngatupuna

*Perila*  
*Atap*  
*Pareina*



**MAUKE ISLAND GOVERNMENT**  
**GOVERNMENT OF THE COOK ISLANDS**

**OFFICE OF THE  
EXECUTIVE OFFICER**

P.O.BOX 18, Mauke, Cook Islands  
Tel: (682) 35 025, Fax (682) 35 142  
Email:execoff@mauke.net.ck

**“FOR MY PEOPLE, FOR MY HERITAGE”**

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**9<sup>th</sup> June 2015**

**Teariki-Taoiau Rongo**  
Monitoring and Environmental Specialist  
Sub-Contractor to Entura  
Rarotonga

Kia orana

This is to confirm that there is no marae or important historic sites on each of the identified solar project sites on Mauke Island. This includes the site for the solar farm and 6x sub stations.

Regards

A handwritten signature in black ink, appearing to read 'Josephine Ivirangi', written over a horizontal line.

Josephine Ivirangi  
Executive Officer  
Mauke Island

A handwritten signature in black ink, appearing to read 'George Samuela', written over a horizontal line.

George Samuela  
Mayor of Island



Mitiaro Island Government

*All Correspondence should be address to the Mayor, & Executive Officer*

Mitiaro Cook Islands • Phone (682) 36108 • Fax (682 36 157) • Email: [danra@mitiario.gov.ck](mailto:danra@mitiario.gov.ck) • [isgovexo@mitiario.net.ck](mailto:isgovexo@mitiario.net.ck)

11 June 2015

**Ref: 10/2015**

Teariki-Taoiau Rongo  
Monitoring and Environmental Specialist  
Sub-Contractor to Entura  
Rarotonga  
COOK ISLANDS

**Marae or Historic sites on the identified solar project site**

Kia orana,

This letter is to confirm the solar project site is free and does not dwell any marae and historic features on Mitiaro.

Kia Manuia

Frederick Tereva  
Mayor  
Mitiaro Island Government



# ATIU ISLAND GOVERNMENT

## GOVERNMENT OF THE COOK ISLANDS

P O Box 26

Atiu, Cook Islands.

Telephone: (682) 33-269; Facsimile: (682) 33-369

12<sup>th</sup> June 2015

Mr Teariki Rongo  
Avatiu  
Rarotonga.

Re: Marae on Solar Sites

Kia Orana.

I am pleased to confirm that there are no Marae or important historical significant on the proposed land required for the Solar Energy Project. The findings include landowner's verbal clearance of any distractions on the site such as family cemetery.

Meitaki ranuinui

Teariki Maurangi  
Excecutive Officer



# AITUTAKI ISLAND GOVERNMENT

GOVERNMENT OF THE COOK ISLANDS

P.O. Box 66, Aitutaki, Cook Islands

Telephone: (682) 31-987, 31-700; Facsimile: (682) 31-986

3rd February 2016

TO: Teariki Rongo

FROM: Tiraa Arere  
Executive Officer

As requested, this letter is to confirm that there is no cultural heritage or marae on the proposed land for the Solar Farm.

This block of land had been used for Agriculture purposes for many years.

Meitaki Atupaka

Regards.

A handwritten signature in black ink, appearing to read 'Tiraa Arere', written over a large, stylized circular flourish.

Tiraa Arere  
Executive Officer.

## Appendix 4: List of Stakeholders / Communities Consulted PPTA and Project Implementation

### List of people consulted during PPTA 2013

No.	Name	Designation and Organization
<b>RAROTONGA</b>		
1.	Roger de Bray	Energy Commissioner, Office of the Prime Minister, Rarotonga, Cook Islands
2.	Tangi Tereapii	Director, Renewable Energy Development Division, Office of the Prime Minister, Rarotonga, Cook Islands
3.	Apii Timoti	Chief Executive Officer, Te Aponga Uira (TAU), Rarotonga, Cook Islands
4.	Ngateina Rani	PEC Fund Coordinator, Renewable Energy Development Division, Office of the Prime Minister, Rarotonga, Cook Islands
5.	Vanessa Jenner	ADB Liaison Officer, Development Coordination Division, MFEM, Rarotonga, Cook Islands
6.	Vavia Tangatataia	Manager, Advisory and Compliance Division, National Environment Service, Rarotonga, Cook Islands
7.	Celine Dyer	Climate Change Coordinator, Climate Change Division, NEW, Rarotonga, Cook Islands
8.	Tamari'i Tutangata	Chief Executing Officer, CIIC, Rarotonga, Cook Islands
9.	Morgan Hanks	Statistics Officer, Statistics and Economic Department, Rarotonga, Cook Islands
10.	Kevin Hosking	Sr. Statistician, Statistics and Economic Department, Rarotonga, Cook Islands
11.	Otherniel Tangianau	Director, Pa Enuia Division (Outer Islands), Office of the Prime Minister, Rarotonga, Cook Islands
<b>MANGAIA</b>		
12.	Anthony Whyte	Energy Manager, Mangaia Power House, Mangaia Island, Cook Islands
13.	Teremoana Atariki	Mayor, Mangaia Island Council, Mangaia Island, Cook Islands
14.	Nena Ngametua	Executive Officer, Mangaia Island Council, Mangaia Island, Cook Islands
15.	Allan Tuara	President, Mangaia Environment Society, Mangaia Island, Cook Islands
16.	Thaine Tuara	Member, Mangaia Environment Society, Mangaia Island, Cook Islands
		Island council member and community leaders, Mangaia Island, Cook Islands
		Women groups and affected landowners, Mangaia Island, Cook Islands
<b>MAUKE</b>		
17.	George Samuela	Mayor, Mauke Island Council, Mauke Island, Cook Islands
18.	Taukea Raui	Executive Officer, Mauke Island Council, Mauke Island, Cook Islands
19.	Basilio Kaokao	Environment Officer, Island Environment Authority, Mauke Island, Cook Islands
20.	Maara Kimiora	Manager, Mauke Power Plant, Mauke Island, Cook Islands
		Island council member and community leaders, Mauke Island,

		Cook Islands
		Women groups and affected landowners, Mauke Island, Cook Islands
<b>MITIARO</b>		
21.	Vaine Putiare	Dy. Mayor, Mitiaro Island Council, Mitiaro Island, Cook Islands
22.	Nga Tama	Executive Officer, Mitiaro Island Council, Mitiaro Island, Cook Islands
23.	Maara Kimiora	Manager, Mitiaro Power House, Mitiaro Island, Cook Islands
24.	Nooroa Pouao	Environment Officer, Island Environment Authority, Mitiaro Island, Cook Islands
		Island council member and community leaders, Mitiaro Island, Cook Islands
		Women groups and affected landowners, Mitiaro Island, Cook Islands

### Summary of views and stakeholder consultations

<b>Date / Venue / No. of participants</b>	<b>Issues discussed / remarks<sup>8</sup></b>
05.12.13 (6 pax) TAU Boardroom	<p>Discussions were held with Officials from the Office of the Energy Commissioner, REDD and TAU on following aspects.</p> <p>Objectives and scope of project in each island, technical details of interventions being proposed, clarifications of status and land ownership of land being proposed for solar power plants, environmental issues associated with implementation of solar power plants such as management of used batteries, current institutional and capacity building need, implementation arrangements, applicability and requirements of EIA for proposed interventions under Environment Act 2003.</p> <p>Current capacity and capacity building needs are incorporated in the IEE. Also mechanisms to handle discarded batteries and used oil from existing diesel generator sets are discussed in the IEE and appropriate mitigation measures were recommended in the project EMP.</p>
05.12.13 (5 pax) MFAI Boardroom Officials from National Environment Service (NES)	<p>Scope of proposed project, roles and responsibilities of NES, national environmental policies and regulatory framework, as well as requirements for preparing EIA and permits, applicability of the Cook Islands' Environment Act 2003 to this project, EIA approval process and time frame. Officials from NES informed that NES is responsible to issue environmental permit for developmental projects in the Cook Islands. For this project, project proponent (REDD here) should submit application to NES with project details to determine whether project needs an EIA or not.</p> <p>National policy and regulatory framework and requirements of NES for project implementation are incorporated in the IEE.</p>
05.12.13 (4 pax) MFEM Boardroom	<p>Discussions were held with Officials from Statistics and Economics Division on following aspects.</p> <p>Socioeconomic and demographic data for target islands, major economic activities and development projects in the target islands,</p>

<sup>8</sup> Queries raised by people were answered to their satisfaction and it was assured that their concerns would be addressed in the process of project design.

Date / Venue / No. of participants	Issues discussed / remarks <sup>8</sup>
	social/poverty issues, etc.
05.12.13 (3 pax) CIIC Boardroom /03	<p>Together with social expert, discussions were held with CEO of CIIC on following aspects.</p> <p>Scope of proposed project, roles and responsibilities of CIIC, ownership status of the land proposed for power plants, policies and regulatory framework for land acquisition, timeframe and process for land acquisition as per government laws. It is informed by CEO that CIIC will be responsible for acquiring the land on behalf of the government as per Cook Islands laws.</p>
06 .12.13 (21 pax) Mangaia Island Council Chamber, Island council members, community leaders, landowners, women groups	<p>Information about existing power generation system, status of land proposed for power plant, presence of environmental sensitive areas on and around the proposed site, existing capacity of Island Electricity Committee in managing environmental issues were assessed. It is informed by Island Council representative that the land proposed for solar power plant belongs to 3 landowners (private). He informed that landowners agreed to give their land for solar PV plant and necessary discussion was held with landowners by Island Council. Local community leaders informed that there are no environmental sensitive areas in and around the proposed site and land use is makatea (volcanic deposit with invasive trees and bushes). Mayor of Mangaia informed that there is a need of capacity building in managing the solar plant plants. Necessary capacity building and training requirements are proposed in the IEE.</p> <p>Mayor informed that local communities support the project.</p> <p>Landowner's greed to let their land for the solar PV plant.</p>
10.12.13 (14 pax) Island Council Court Room, Mauke/ Island Council Members, Comm. Leader, women groups, land owners	<p>Discussions were held together with social team to inform communities about the proposed project and understand their concerns, if any. Communities were informed about the benefits both socio-economic as well as environmental benefits of the project. All the participants consulted fully support the project. Women groups recommended need for the support for women groups and other community facilities. Present of environmental sensitive areas were discussed with the Island Mayor and Environment Officer and they informed that there are no such area on the island.</p>
12.12.13 (18 pax) Mtiaro Representatives from Island Council Utility, Island Environment Authority, landowners and community leaders	<p>Discussions were held together with representative from REDD. Island council members were informed about project and its objectives. Land use and ownership status were discussed with Dy. Mayor and he informed that proposed land is private land belonging to six families.</p> <p>Local communities and landowners were consulted to inform them about the proposed project and to understand their concerns, if any. Communities were informed about the benefits both socio-economic as well as environmental benefits of the project. All the participants consulted fully support the project. Women groups recommended need for the support for women groups and other community facilities. When asked about participation of women in the project, President of CICC informed that women are willing to participate at admin level. She also suggestion training and awareness program for local women groups on energy conservation and efficient use of appliances. Training and awareness programs for women groups are recommended in the social report. Present of environmental sensitive areas were discussed with the Island Mayor and Environment Officer and they informed that</p>

Date / Venue / No. of participants	Issues discussed / remarks <sup>8</sup>
	<p>there are no such area on the island.</p> <p>Landowners also support the project and they are willing to give land for the project.</p>
<p>17.12.13 (11 pax) Island Council Secretariat Rep. from Island Council, Utility, Island Environment Authority</p>	<p>Discussions were held together with representative from REDD. Island council members were informed about project and its objectives. Land use and ownership status were discussed with Mayor and he informed that proposed is Crown Land but need to check status with CIIC as they do not have documents with them about ownership of the land.</p> <p>Proposed land is open land adjacent to the existing power plant. Local communities were consulted to inform them about the proposed project and to understand their concerns, if any. Communities were informed about the benefits both socio-economic as well as environmental benefits of the project. All the participants consulted fully support the project.</p> <p>Present of environmental sensitive areas were discussed with the Mayor and Environment Officer and they informed that there are no such area on the Island. When asked about the issue of battery disposal, environment officer informed that used batteries should be sent back to the manufacturers for treatment and disposal. Measures to handle and disposal of used batteries are included in the project EMP.</p> <p>APS Officer informed that their existing capacity to manage solar technology and environmental issues is inadequate and they need training and capacity building on these issues. Training on technical aspects to IA staff is included in the scope of the POE as part of the project management support.</p>

#### List of people consulted at Phase 1 subproject sites 2015

##### Atiu (4 May and 20 May, 2015)

No.	Name	Designation and Organization
1.	Ina Mokoroa	Mayor, landowner
2.	Vaine Paretoa	Deputy Mayor
3.	Tuainekore Samuel	Areora Council Member
4.	Teura Kea	Ngatiarua Council Member/Energy Manager
5.	Teremoana Windy	Mapumai Council Member
6.	Teariki Teiotu	Tegatangi Council Member, landowner
7.	Teariki Maurangi	Executive officer
8.	Henry Ngamaru	Ngamaru Ariki
9.	Maara Tairi	Parua Ariki Representative, Agriculture Manager
10.	Tapuni William	Council Clerk
11.	Tereapii Porio	Infrastructure Manager, landowner
12.	Tangata Vainepoto	Landowner/ Justice Department
13.	Kau Henry	Environment Officer
14.	Teina Toru	Landowner
15.	Upokoina Rau	Power Crew
16.	Maire George	Power Crew
17.	Adrian Teiotu	Power Crew
18.	Rouru Georg	Power Crew
19.	Vaine Potoro	Landowner
20.	Teupoko Ioana	Landowner
21.	Janet Paretoa	Landowner
22.	Ina Toti K. Ioaina	Landowner

No.	Name	Designation and Organization
1.	Ina Mokoroa	Mayor, landowner
2.	Vaine Paretoa	Deputy Mayor
3.	Tuainekore Samuel	Areora Council Member
4.	Teura Kea	Ngatiarua Council Member/Energy Manager
5.	Teremoana Windy	Mapumai Council Member
6.	Teariki Teiotu	Tegatangī Council Member, landowner
7.	Teariki Maurangi	Executive officer
8.	Henry Ngamaru	Ngamaru Ariki
9.	Maara Tairi	Parua Ariki Representative, Agriculture Manager
10.	Tapuni William	Council Clerk
11.	Tereapii Porio	Infrastructure Manager, landowner
12.	Tangata Vainepoto	Landowner/ Justice Department
13.	Kau Henry	Environment Officer
23.	Clara Matapakia	Landowner
24.	Tupuna Rau	Landowner
25.	Takai Uringarangi o Tangaroa Murare	Landowner
26.	Upokoina Matapakia	Landowner
27.	Moana Mingi	Landowner
28.	Koronui Tura	Landowner
29.	Teina Toru	Landowner
30.	Tupuna Rouru Upoko Tuariki	Landowner
31.	Tini Tivini Rau Isaaka	Landowner
32.	Ngatokorua Rau Isaaka	Landowner
33.	Tauu Porio	Landowner
34.	Dr. Roger Malcolm	Private sector, Owner of Atiu Villas

#### Mitiaro (5 May and 20 May, 2015)

No	Name	Designation and Organization
1.	Fred Tereva	Mayor
2.	Aunty Mii, Atu Enuā	Councillor, Ariki
3.	Makera Murare	Councillor, landowner
4.	Nane Hodson	House of Ariki
5.	Teata Teava	Councillor and Rep for Tetava Ariki
6.	Ngarouru Tou	Councillor and Rep for Tou Ariki
7.	Kau Kaiui	Government Representative
8.	Ngametua Tama	
9.	Nooroa Pouao	Environment Officer, landowner
10.	Toru Ngatoko	Landowner
11.	Nga Patia	Landowner
12.	Moetu Aurupe	Landowner
13.	Ake Pouao	Landowner
14.	Mama Temou Raeputa	Landowner
15.	Turagatura Turangatura	Councillor
16.	Tunoa Raeputa	Councillor
17.	Shirley Patia	Landowner
18.	Tere Patia	Landowner
19.	Maara Kimiora	Councillor and Energy Person
20.	Cecilia Kimiora	
21.	Teremoana Patia	Landowner
22.	Ake Pouaao	Landowner
23.	Tunoa Raipota	Landowner
24.	Matara Murare	Island Council
25.	Akeunga Taua Pouao	Landowner
26.	Mata Tunoa Rae Puta	Landowner

**Mauke (6 May and 28 May, 2015)**

No	Name	Designation and Organization
1.	Tangata Ateriano	
1.	George Samuela	Mayor
2.	Terepai Tuakana	Deputy Mayor
3.	Tetai Teatai	Council Member
4.	Vaine Aberahama	Council Member-
5.	Dennis Tararo	Council Member
6.	Johnstone Dyer	Government Representative
7.	Josephine Ivirangi	Executive Officer, landowner
8.	Clema Vainetutai	Energy Operator
9.	Lucky Vainetutai	Energy Operator, landowner
10.	Arapo Tutai	Overseer-Energy
11.	Ngatuaine Tutere	Manager-Energy
12.	Martina Vaeruarangi	
13.	Prisca Oariki	
14.	Timeni Oariki	Landowner
15.	Ngavaine John Makitae	Landowner
16.	Edwin Ngariki	
17.	Tiraa Putai Kairae	Landowner
18.	Temakave Tua	Landowner
19.	Ngate Oti	Landowner
20.	Ngavarue Tuakangaro	
21.	Melita Tapoki	
22.	Tuangane Oti	
23.	Samuela Ariki	
24.	Taunga Tararo	
25.	Bele Tararo	
26.	Apii Teao	
27.	Mata Lucky	
28.	Kura Uraarii	
29.	Moumou Moetaua	
30.	Arekaoati Uraii	
31.	Pickering Taripo	
32.	Hon. Tai Tura	Member of Parliament, landowner
33.	Roura Tura	
34.	Mareta Teaukiaua	
35.	Terepai Tuakana	Deputy Mayor
36.	Tekura S. Kura	Financial Administrator
37.	Marce Akamoeau	Landowner
38.	Eti Ngaiki	Landowner
39.	Archie Taripo	Landowner
40.	Metua Rongoape	Landowner
41.	Teariki Aoa Teao	Landowner
42.	Matina Oti	Landowner
43.	Timeni Oariki	Landowner
44.	Matanoanoa Vainetutai	Landowner
45.	Tuakana Noetana	Landowner
46.	Tangata Tufai	Landowner
47.	Arekava Uraarii	Landowner
48.	Ngatokorua Vaeruarangi	Landowner
49.	Mareta Tutaikaokao	Landowner
50.	Vainetutai Samuela	Ariki (high chief)
51.	Noo Puaapii	Landowner

## Mangaia (7 May and 3 and 4 June, 2015)

No.	Name	Designation and Organization
1.	Teremoana Atariki	Mayor
2.	Maara Peraua	Acting Councillor for Ivirua
3.	Daddy Mauriati	Mangaia Aronga Mana
4.	Paster Periki Poila	Chair, Religious Advisory Council, landowner
5.	Ngametua Toko	Island Councillor, Karanga
6.	Nga Ivaiti	Island Councillor,, Veitatei
7.	Andy Matapo	Island Councillor, Tamarua, landowner
8.	Tiare Mangara	Island Councilor, Keia
9.	Hon Wesley Kareroa	Member of Parliament for Oneroa
10.	Hon Tangi Matapo	Member of Parliament for Tamarua
11.	Aerenga Matapo	Policeman, landowner
12.	Thomas Kareroa	Energy and Water Staff
13.	Ngametua College	Executive Officer, Mangaia Island Government
14.	Tangi Moeauri	Energy and Water Staff
15.	Anthony Whyte	Public Utilities Manager, Mangaia
16.	Ngametua Papatua	Landowner
17.	Pareina Ngatupuna	Government employee
18.	Mata Herman	Public Utilities Supervisor, landowner
19.	Teremoana Poila	Landowner
20.	Porua Poila	Landowner
21.	Tereapii Taokia	Landowner
22.	Ngatamaroa Pekepo	Landowner
23.	Teokotai Pekepo	Landowner
24.	Tangimama Pekepo	Landowner
25.	Teremoana Atariki	Landowner
26.	Taoi Nooroa	Secretary, <i>Aronga Mana</i>
27.	Teina Ngametuatoe	Rangatira (subchief)
28.	Tuatane Pakatoe	Rangatira (subchief)
29.	Ngametua C. Pokino	Executive Office, Mangaia Island Council
30.	Povitai Poila	Landowner
31.	Tako Ruatoe	Kavana (district chief)
32.	Ngaariki e Toru o Enuamanu Adams	Landowner
33.	Mrs. Takaruatoe	Representing Kavana (district chief)
34.	Aerenga Matapo	Landowner

### List of government representatives consulted 2015

No	Name	Designation and Organization
1.	Tangi Tereapii	Director, Renewable Energy Development Division (REDD)
2.	Ngateina Rani	PEC Fund Coordinator, REDD
3.	Alex Henry	Project Officer, REDD
4.	Elizabeth Wright-Koteka	Chief Secretary, Office of the Prime Minister (OPM)
5.	Repeta Puna	OPM
6.	Roger de Bray	Energy Commissioner, OPM
7.	Tamarii Tutangata	CEO, Cook Islands Investment Corporation (CIIC)
8.	Lloyd Miles	CIIC Counsel
9.	Mike Henry,	CIIC Board of Directors
10.	Malcolm Sword	CIIC Board of Directors

No	Name	Designation and Organization
11.	Enea Pakitua	Senior Statistician/Acting Statistician
12.	Tanga Morris	Senior Statistician
13.	Mata	Chairman of the Board, Te Apunga Uira (TAU)
14.	Apii Timoti	Chief Executive Officer (CEO), TAU
15.	Steve Anderson	Board of Directors, TAU
16.	Liz Tome	Finance Director, TAU
17.	Otheniel Tangaianu	Director, Pa Enea Division (Outer Islands)
18.	Vavia Tangatataia Jr.	Manager, Advisory and Compliance Division, National Environmental Services (NES)
19.	Celene Dyeoer	Climate Change Coordinator
20.	Elizabeth Ponga	Policy Officer, Ministry of Culture
21.	Ruth Pokura	Director for Gender and Development, Ministry of Internal Affairs
22.	Noora Numanaga	Director, Disability Issues
23.	Richard Neves	Secretary of Finance, Ministry of Finance and Economic Management (MFEM)
24.	Peter Tierney,	Manager, Development Coordination Division, MFEM
25.	Charmaine Dolan	MFEM
26.	James	MFEM
27.	Catherine Evans	Senior Counsel, Crown Law
28.	Woo Yul Lee	ADB Project Officer, Manila
29.	Vanessa Jenner	ADB Liaison Officer, Cook Islands
30.	Martin	New Zealand Ministry of Foreign Affairs and Trade (MFAT)
31.	Joseph Mahew	NZ MFAT
32.	Steve Henderson	New Zealand High Commission, Cook Islands

#### List of people consulted Phase 2 subprojects 2015 / 2016

##### Aitutaki (4 May 2015)

Person Met	Position
Hon. Teina Bishop	Member of Parliament
John Baxter	Mayor
Tekura Bishop	Deputy Mayor
Tuararu Bishop	Island Council, Vaiepeka District Representative
Temanu Unuka	Island Council, Vaipae District Representative
Ookotai Tangi	Island Council, Tautu District Representative
Ngatokorua Rota	Island Council, Reureu District Representative
Junior Rikiau	Island Council, Arutanga District Representative
Strickland Henry	Island Council, Ureia District Representative
Terepoto Williams	Island Council, Amuri District Representative
Pumati Isaraela	Mataiapo District Representative (Traditional Leader)
Ina Solomona	Council Clerk
Tiraa Arere	Council Executive Officer
Manarangi Ariki	<i>Ariki</i> (Traditional Chief)
Allan Mills	Chairman, Power Station Board of Directors
Long Tuiravakai	General Manager, Power Station

##### Rarotonga (23 February 2016)

Person Met	Position
Joe Ngamata	Chief Executive Officer, Airport Authority
Tamarii Tutangata	Chief Executive Officer, CIIC
Lloyd Miles	Legal Advisor, CIIC
Apii Timoti	Chief Executive Officer, Te Aponga Uira

Dallas Young	Commercial Manager, Te Aponga Uira
Tama Heather	Electrical Engineer, Te Aponga Uira
Steve Anderson	Board Member, Te Aponga Uira
Elizabeth Wright-Koteka	Chief of Staff, Office of the Prime Minister