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In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.
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## List of Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>AP</td>
<td>Affected Persons</td>
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<tr>
<td>BMH</td>
<td>Beach Manhole</td>
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<tr>
<td>BU</td>
<td>Branching Unit</td>
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<tr>
<td>CLS</td>
<td>Cable Landing Station</td>
</tr>
<tr>
<td>ECD</td>
<td>Environment and Conservation Division</td>
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<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
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<tr>
<td>HDD</td>
<td>Horizontal directional drilling</td>
</tr>
<tr>
<td>IAIA</td>
<td>International Association for Impact Assessment</td>
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<tr>
<td>ICT</td>
<td>Pacific Regional Information and Communication Technology</td>
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<tr>
<td>IEE</td>
<td>Initial Environmental Examination</td>
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<tr>
<td>IPP</td>
<td>Indigenous People’s Plan</td>
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<tr>
<td>LW</td>
<td>Lightweight</td>
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<tr>
<td>LWP</td>
<td>Lightweight Protected</td>
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<tr>
<td>MECCDMM</td>
<td>Ministry of Environment, Climate Change, Disaster Management and Meteorology</td>
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<tr>
<td>MID</td>
<td>Ministry Infrastructure Development</td>
</tr>
<tr>
<td>MoFT</td>
<td>Ministry of Finance and Treasury</td>
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<tr>
<td>NGOs</td>
<td>Non-Government Organisations</td>
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<tr>
<td>OADM</td>
<td>Optical Add-Drop Multiplexer</td>
</tr>
<tr>
<td>PDMCs</td>
<td>Pacific Developing Member Countries</td>
</tr>
<tr>
<td>PER</td>
<td>Public Environmental Report</td>
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<tr>
<td>PLB</td>
<td>Post Lay Burial</td>
</tr>
<tr>
<td>PPC</td>
<td>PIPE Pacific Cable</td>
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<tr>
<td>PPTA</td>
<td>Project Preparatory Technical Assistance</td>
</tr>
<tr>
<td>ROV</td>
<td>Remotely Operated Submersible Vehicle</td>
</tr>
<tr>
<td>RP</td>
<td>Resettlement Plan</td>
</tr>
<tr>
<td>SIA</td>
<td>Social Impact Assessment</td>
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<tr>
<td>SOCC</td>
<td>Solomons Oceanic Cable Company</td>
</tr>
<tr>
<td>SPS</td>
<td>Safeguard Policy Statement (2009)</td>
</tr>
<tr>
<td>STL</td>
<td>Solomon Telekom Limited</td>
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</tbody>
</table>
TCSI - Telecommunications Commission of the Solomon Islands
WB - World Bank
WDM - Wavelength-Division Multiplexing
UXO - Unexploded Ordnances
Executive Summary

This report was commissioned by the Asian Development Bank who engaged GHD to carry out the environmental impact assessment (Initial Environmental Examination, IEE\(^1\)) for the submarine cable placement (international and domestic cables) associated with the Pacific Regional Information and Communication Technology (ICT) Connectivity Project. This report should be read in conjunction with the Social Impact Assessment and the Resettlement Plan.

The government of the Solomon Islands is seeking an Asian Development Bank (ADB) sovereign loan to part finance the Solomon Islands Connectivity Project. This support is required to construct the international submarine cable system that will link to an existing regional cable, and two domestic spurs within the Solomon Islands. The proposed submarine cable system will be commissioned and operated as a wholesale telecommunications business by a new corporate entity, Solomon Oceanic Cable Corporation (SOCC), with majority equity held by the Solomon Islands National Provident Fund.

The cable system will comprise an international spur to Honiara and two domestic spurs from Honiara to Malaita and the Western Province. The international cable will connect to the PPC1 cable which was laid between Sydney and Guam in 2009. The project's primary plan is to insert a new BU (BU5) into the existing PPC1 cable at the closest point of approach to the Solomon Islands, which has been identified as a beach landing site approximately 2 km west of the centre of Honiara.

Domestic distribution will be via two cables, one to Western Province, and one to Malaita. The cable to Western Province may be combined with the international cable for the 40 km from the landing point in Honiara. The cable will terminate in Noro on New Georgia Island, approximately 400 km from its departure point from Honiara. The cable to Malaita will land in Auki, running approximately 140 km from Honiara.

Construction methods for the cable routes, including the beach landings will vary depending on the coastal processes, geomorphology and geology of the proposed routes. At this stage, several construction options are being considered and will be determined based on this IEE, the Desktop Study and Marine Route Survey to be completed during the detailed design phase.

The following organisations were contacted for as part of this engagement to gather data for the IEE:

- Solomon Oceanic Cable Corporation;
- Socio-Economic and Poverty Specialist for the Project;
- Solomons Telekom, Honiara, Noro and Auki;
- Ministry of Lands, Honiara;
- Deputy Director Offshore Fisheries, Ministry of Fisheries, Honiara;
- Ministry of Rural Development and Indigenous Development;
- Office of Special Duties, Western Province Government, Noro;
- Noro Lands Officer;

\(^1\) The original TOR stated that this study was to comprise a combined Environmental and Social Impact Assessment document. During the course of the project ADB advised that this study will now comprise a separate initial Environmental Examination and separate Social Impact Assessment.
This IEE has been undertaken to encompass the area of influence of the cable routes for the physical and biological environments and natural hazard events. Outlined below are lists of potential environmental impacts and data gaps that have been identified during this environmental assessment.

**Physical Environment**

- Currently, the extent of data and information available on substrate (seabed sediments and morphology) of the proposed cable routes is not sufficient. This includes offshore areas where geological features such as hydrothermal vents, seamounts and reefs are present, and the inner shore/beach landings. This data gap could be addressed during the pre-construction phase in the marine route survey and any impacts mitigated during detailed design.

- Presently, the extent of data and information available on currents in the vicinity of the proposed cable routes is not extensive. Currents pose potential threat to cable construction and also to cables during operation (currents have the potential to expose buried cables causing it to move and possibly catch/abrade on geological features causing impacts to the substrate/ecological environment and/or damage the cable). This data gap could be addressed during the pre-construction phase in the marine route survey and any impacts mitigated during detailed design.

- Coastal erosion is already evident at several of the landing sites for this project. Anecdotal information and several reports were available to qualitatively describe the rate or erosion and impact from storm surge at the sites. However there is a lack of basic information that impedes the carrying out of any detailed coastline erosion assessment, storm bite prediction, quantitative analysis of flooding and inundation risk all of which can impact the cable and the beach man hole during operation. This data gap could be addressed during the pre-construction phase in the desktop study and marine route survey and any impacts mitigated during detailed design.

- Cable approaches to the Honiara landing through the Savo Sound, also known as the Iron Bottom Sound, contains numerous shipwrecks and aeroplane wrecks and associated unexploded ordnance (UXOs), however the exact locations of these are unknown. This data gap could be addressed during the pre-construction phase in the desktop study and marine route survey and any impacts mitigated during detailed design.
Natural Hazards

- Risk to construction activities and cable operation may stem from geological hazardous events. The proposed cable routes traverse tectonically active areas and the project area of influence includes active volcanoes. This potential impact could be addressed during the pre-construction phase in the desktop study and marine route survey and any outstanding impacts mitigated during detailed design.

- Risk to construction activities and cable operation may stem from climatic hazardous events. The Solomon Islands lies in an area prone to tropical cyclones (including formation of tropical cyclones) and are low-lying, therefore prone to impacts of sea level rise. This potential impact could be addressed during the pre-construction phase in the desktop study and marine route survey and any outstanding impacts mitigated during detailed design.

- Sightings of saltwater crocodiles are common in the Western Province, especially in parts of Noro and Munda. Crocodile attacks have been recorded. Any potential impacts will need to be managed, including monitoring during cable lay operations.

- Sharks have been known to bite submarine cables while in operation as they seem to be attracted by low frequency vibration from the power fed cable up to a water depth of 2,500 m. Any potential impacts will need to be addressed during detailed design.

Biological Environment

- Laying of the cable (various construction methodologies) at all sites has the potential to minimally impact flora and fauna in terrestrial areas. Any potential impacts could be addressed through detailed design and through implementation of mitigation measures during construction.

- Reefs have been identified around the project area of influence at Noro, Auki and Honiara. There are rocky reef flats at Noro and Honiara and a shallow fringing reef at Auki. Proposed construction methods will have a minimal short-term impact on the reefs at these sites. Any potential impacts could be addressed during the pre-construction phase through detailed design.

- Currently, the extent of data and information available on seagrass meadows along the proposed cable routes is unknown. This data gap could be addressed during the pre-construction phase in the marine route survey and any impacts mitigated during detailed design.

- There is potential during the marine route survey and cable lay operations for disturbance to whales, dolphins, turtles and dugongs, in particular for whales during migration season. Any potential impacts will need to be managed, including motoring during marine route survey and cable lay operations.

- Currently, the extent of data and information available on hydrothermal vents and seamounts and their associated ecological environments along the proposed cable routes is not extensive; however there is general consensus that these environments are ecologically sensitive. This data gap could be addressed during the pre-construction phase in the marine route survey and any impacts mitigated during detailed design.

The summary of impacts outlined can be mitigated, managed or monitored during the pre-construction and/or construction and/or operation phases of the project; in addition the data gaps can be addressed during the pre-construction phase of the project. The impacts will be only minor, short term and localised in nature. Notwithstanding this, mitigation measures and management / monitoring measures have been
recommended in the Environmental Management Plan (Section 6) in order to minimise or avoid environmental impacts.
1. Introduction

1.1 Project Overview

The Asian Development Bank (ADB) and the Pacific Regional Information and Communication Technology (ICT) Connectivity Project have joined to support the Solomon Islands in developing a capability to support a submarine fibre optic cable network. This project has been set up in view of supporting the Solomon Islands to provide affordable and high capacity international bandwidth options. It is believed that this project will enable the population of the Solomon Islands to access lower-cost broadband internet and other communications services, thus contributing to its socioeconomic development2.

The proposed Solomon Islands cable system will entail deployment of an international fibre optic submarine cable from the existing PPC1 cable into Solomon Islands waters with a domestic branching unit just offshore and west of Honiara. Two domestic fibre optic cables will be deployed:

- Honiara to Noro; and
- Honiara to Auki (previously Henderson to Auki).

N.B. Site selection updates by Hibbard Consulting in July 2012, indicated that due to potential land access issues at the site in Henderson (Guadacancal), this site will not be included in the project. This is further outlined in Section 3.1.3.

The proposed route for the international and domestic fibre optic submarine cables is shown in Figure 3-1). As of 2010, Federated State of Micronesia, Papua New Guinea, Marshall Islands, Samoa, and Fiji are connected by submarine cables. The rest of ADB’s Pacific Developing Member Countries (PDMCs) rely on satellite for international connectivity, which is expensive and with limited bandwidth. By the nature of communications networks that enable seamless global communication, the individual cable links can form a virtual regional network as a part of global networks. The regional communication network will accelerate regional integration. A submarine cable link will increase frequency and quality of international communications among the connected countries, subsequently increasing trade in local services, i.e. tourism and back office functions. Improved international connectivity will allow the region to form a sizable market for digital products and services, and connected PDMCs will be able to develop new business opportunities. It will strengthen the existing regional public goods and encourage new ones by allowing countries to share knowledge and limited human resources available in PDMCs.

The Solomon Islands introduced the second mobile operator in 2010 and opened all telecommunications services for competition in April 2011. Competition is expected to lower prices and improve the quality, especially for internet services. Solomon Islands is fully dependent on satellite connectivity, which is very expensive and inadequate to meet growing demand. Total demand for bandwidth is projected to increase from the 2010 level of about 100 Mbps up to over 1,600 Mbps by 2020, driven primarily by increased demand for fixed and mobile broadband services. Satellite dependency will constrain competition since new market entrants will have to obtain satellite links or lease capacity from existing operators.

2 http://pid.adb.org/pid/LoanView.htm?projNo=44382&seqNo=01&typeCd=3
The proposed ICT Connectivity Project is to support the Solomon Islands in developing a submarine fibre optic cable to provide a more affordable, high capacity international bandwidth solution. Improved services and lower cost of international connectivity through the submarine cable will stimulate competition and increase demand for broadband Internet. In turn, this will lower the cost of retail telecommunications services, especially broadband internet.

Faster and cheaper connectivity is expected to have numerous positive development impacts, including reduced transaction costs for business, government and household communications; new business opportunities, i.e. investments in e-commerce and business process outsourcing facilities; improved public service delivery, in particular to support e-education and e-health services which are of great interest to the Government.

As of 2006, overseas satellite links accounted for only 1 percent of international traffic, while the remainder was carried by undersea cable. The reliability of submarine cables is high, especially when multiple paths are available in the event of a cable break. Also, the total carrying capacity of submarine cables is in the order of magnitude of terabits per second while satellites typically offer only megabits per second and display higher latency.\(^3\)

1.2 Purpose and Objective of Initial Environmental Examination

The ADB has engaged GHD to carry out the environmental and social impact assessment for the cable placement from the international and domestic cables, beach landing points and land based placement to the existing telecom stations. The ADB require development projects of this magnitude to comply with their safeguard policies on such theme areas as: the environment, indigenous people and involuntary resettlement. The need for an Initial Environmental Examination (IEE)\(^4\) for this proposed development is due to the following reasons:

- the ICT Connectivity Project is a multi-million dollar investment funded by loans and grants from the ADB.
- it has connections to the land territories of the Solomon Islands, who have recently been very pro-active articulating environmental legislation.
- The cable will traverse over 900 km. As a result the cable may pass through ecologically sensitive areas or through areas with seismically, volcanically and tectonically active seabeds. An IEE is required to examine possible impacts of the cable on the environment.

Due to the nature of the impacts and available mitigations, this environmental assessment has been given an environmental category of B and therefore requires an IEE. This report should be read in conjunction with the Social Impact Assessment and the Resettlement Plan.

In addition to the above, we note that this IEE (and associated documents) has also addressed the relevant Equator Principles as part of the assessment that has been undertaken.

\(^3\) [http://www.wired.com/epicenter/2008/02/googles-submari/](http://www.wired.com/epicenter/2008/02/googles-submari/)

\(^4\) The original TOR stated that this study was to comprise a combined Environmental and Social Impact Assessment document. During the course of the project ADB advised that this study will now comprise a separate initial Environmental Examination and separate Social Impact Assessment.
1.3 Scope and Structure of the Initial Environmental Examination

This IEE presents the results of the environmental assessment that has been undertaken for this project in the period April – June 2012. The report complies with the Terms of Reference provided by the ADB (Appendix A). The content of the report is set out as follows:

- Section 2 is a review of the policy, legal and administrative framework that may have an influence on environmental assessments and maritime operations within the Solomon Islands. It includes consideration of the operational and safeguard policies of the funding institutions of this proposed development. It will conclude with a summary of relevant legislation and agencies responsible in relation to the responsibilities of the project.

- Section 3 is a description of the proposed development, and its component phases, including technical descriptions of possible fibre optic cables and cable-laying methodologies that may be part of this project to provide context to the ensuing assessment sections of the report.

- Section 4 describes the physical and biological environmental and natural hazards associated with the project area of influence.

- Section 5 outlines the potential environmental impacts associated with the project.

- Section 6 presents the Environmental Management Plan (EMP) which includes monitoring, mitigation and management measures recommended as part of this IEE. For completeness, this Section presents the monitoring, mitigation and management recommendations outlined from the Social Impact Assessment undertaken as part of this project.

Appendices at the end of the report contain supporting documentation including the Terms of Reference for this scope of work.
2. IEE Methodology

2.1 Introduction

The IEE has been completed based on a review of relevant primary and secondary information sources, site visits, and consultations to determine the existing environment conditions surrounding the proposed cable routes and landing sites. This was completed in order to carry out a detailed analysis of environmental impacts of the proposed activities. The following is an outline of the broad activities undertaken for the project scoping:

- Inception meeting with the GHD team.
- Meeting the project cable team, including team members from ADB, Hibbard Consulting and Solomons Oceanic Cable Company (SOCC).
- Two week site visit to the Solomon Islands which included the inspection of landing sites at:
  - Honiara (Open air church);
  - Henderson;
  - Noro; and
  - Auki.
- Week long mission in Solomon Islands to gather data and discuss comments made on the interim draft reports. This mission also included:
  - Visiting the Honiara site again;
  - Visiting South Pacific University Library; and
  - Sourcing aerials from the Department of Lands Office in the Solomon Islands.
- Consultation with stakeholders (Appendix B) such as:
  - National Solomon Island Government Offices;
  - Non-Government Organisations (NGOs) ; and
  - Dive shop owners.
- Desktop searches to identify or determine:
  - project’s influence area;
  - marine protected areas;
  - baseline data in the project influence area;
  - review of applicable law;
  - review of applicable World Bank and ADB requirements;
  - physical environment:
    - climate;
    - topography and bathymetry;
    - geology;
wave climate, tides and currents;
coastal erosion and storm surge; and
offshore cultural heritage

Ecological environment:
- terrestrial protected areas;
- marine protected areas;
- critical habitats;
- threatened and protected species; and
- Fish and reptile bites.

Subsequent meetings in the Solomon Islands with the project team to discuss key aspects of the project progress. During this process, consultation with Hibbard Consulting was undertaken to identify the details regarding the proposed survey and cable lay works which have been utilised for this report.

2.2 Overview and Approach to the IEE

The proposed development aligns well with policies covering communications, economic and social development and the environment in Solomon Islands. The development will comply with the relevant Solomon Island legislation, subject to the normal formalities of securing necessary approvals, satisfying reporting requirements, and adhering to the rules and regulations established under law and international agreements which will be the responsibility of the Solomon Oceanic Cable Company (SOCC).

The approach for this IEE was developed based on the following factors:
- Addressing the requirements of ADB Safeguard Policy Statement (2009) (SPS) to identify, assess and minimise impacts of the project on the environment; and
- Relevant policies and regulations in the Solomon Islands.

2.3 Regulatory and Legislative Framework

The following is an outline of legislative, institutional and regulatory frameworks for the Solomon Islands, which may be relevant to this project. It is understood that SOCC will be obtaining legal advice regarding the relevance of the regulatory and legislative framework during the proceeding phases of the project.

2.3.1 Environmental Policy and Legislation

Environmental management including impact assessment in the Solomon Islands is guarded under the Environment Act (1998) and the accompanying regulatory instrument, the Environment Regulations (2008). The Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECCDMM) is the institution that administers this Act. The Environment and Conservation Division (ECD) within MECCDMM implements the Environment Regulations which stipulates the form of assessment, consultation, and development consent process for projects. The ECD is the government agency responsible for reviewing and clearing assessments on behalf of the Government.

The proposed cable development is required to comply with the Environment Act and Regulations.
2.3.2 Environment Act

The Environmental Act (1998) provides for the protection and conservation of the environment, through the establishment of the ECD and the Environment Advisory Committee.

The core objectives of the Act are as follows:

- to provide for and establish integrated systems of development control, environmental impact assessment and pollution control;
- to prevent, control and monitor pollution;
- to reduce risks to human health and prevent degradation of the environment by all practical means, including the following:
  - regulating the discharge of pollution to the air, water and land;
  - regulating the transport, collection, treatment, storage and disposal of wastes;
  - promoting recycling, re-use and recovery of materials in an economically viable manner; and
- to comply with and give effect to regional and international conventions and obligations relating to the environment.

The act is divided into the following four sections:

- Part I Article 4.1 provides the Act with considerable power which states that in the event of conflict between the Environmental Act and other legislation, the Environmental Act shall prevail.
- Part II establishes and defines the powers and role of the ECD.
- Part III establishes the requirements for environmental assessment, review and monitoring. This provides for an environmental assessment to consist of either a Public Environmental Report (PER)\(^5\) or if the development is shown to be of such a nature as to cause more serious impacts then the developer is required to submit an Environmental Impact Statement (EIS) to the MECCDMM.
- Part IV details requirements for pollution control and emissions (noise, odour and electromagnetic radiation) and requirements to permits for the discharge of waste. Noise (restrictions on emitting unreasonable noise) is covered in Article 51(1).

Some of the key functions of the Act are:

- promote coordination among Ministries and government divisions;
- revise and amend the national environmental strategies and programme as necessary;
- develop, coordinate and facilitate implementation of national policy concerning environmental planning, environmental impact assessment and pollution control; and
- monitor and advise on international developments in environmental matters and to ensure the fulfilment of obligations of Solomon Islands under the relevant international and required treaties and conventions.

It is understood that the proposed cable development is required to comply with the Environment Act in order to obtain development consent for the construction.

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\(^5\) PER is equivalent to IEE and therefore this document also meets SIG requirements
2.3.3 Environment Regulations
The Environment Regulations (2008) establishes the procedures for undertaking the environmental assessment of any projects categorised as ‘Prescribed Activities’. The developer is required to first submit a Development Application following which the MECCDMM determines the next step. This will be a choice from the following:

- no further assessment is required,
- a PER is required, or
- where major projects are considered such as logging, large agricultural developments, mining and large scale tourism developments and infrastructure projects, an EIS is required which includes technical, economic, environmental and social investigations.

Both the PER and EIS require public consultation. Following approval by the MECCDMM a Development Consent is issued.

Environmental standards are not provided in the regulations, however the MECCDMM requires the use of WHO standards. Although the regulations provide for licenses to discharge waste or emissions, the enforcement of these will be difficult without defined standards.

It is understood that the proposed cable development is required to comply with the Environment Regulations in order to obtain development consent for the construction.

2.3.4 Communications Act
The Communications Act (2009) provides the regulatory framework for the telecommunication sector and establishes the Telecommunication Commission. The Act repeals the Telecommunications Act (Cap. 115) and the Solomon Telekom (Limitation of Liability) Act (Cap. 114) and related matters.

The principle objective of the Communications Act (2009) is to enhance long-term wellbeing of the population of the Solomon Islands, the inclusiveness and fairness of its society and the productivity of its economy by improving the availability, affordability, quality of service and kinds of telecommunications services in the Solomon Islands.

This act is relevant to the proposed development as this will continue to ensure provision of adequate, sustainable and efficient telecommunication services in all sectors of development, and also this could put in place a reliable telecommunications infrastructure and ensure service inter-connectivity nationally and internationally. It is understood that confirmation of applicability of this Act will be carried out through legal counsel with SOCC.

2.3.5 Fisheries Act
The Fisheries Act (1998) provides the framework for fisheries management and development, including licensing of fishing vessels and processing plants. It also lists prohibited fishing methods and provides for the establishment of Marine Protected Areas (MPAs) and the preparation of coastal management plans. The Act regulates the utilisation and conservation of marine resource.

It is understood that the confirmation of applicability of this Act will be carried out through legal counsel with SOCC.
2.3.6 Shipping Act

The Shipping Act (1998) consolidates and amends the laws relating to shipping and seamen to control the registration, safety and manning of ships, and to give effect to certain international maritime conventions, and other related purposes.

During the construction phase it may be necessary to consider the Shipping Act. It is understood that confirmation of applicability of this Act will be carried out through legal counsel with SOCC.

2.3.7 Continental Shelf Act

The Continental Shelf Act (Cap 94) makes provision for the protection, exploration and exploitation of the Continental Shelf of Solomon Islands, the prevention of pollution in consequence of works in connection with the continental shelf and for matters incidental to and connected there-with.

It is likely that the proposed cable development may need to have consideration for the Continental Shelf Act. Accordingly, the relevance of this Act will be determined through legal counsel to SOCC.

2.3.8 ADB Safeguard Policies

The SPS (2009) covers three key safeguard areas relevant to the project:

- Environment – ADB uses a classification system that focuses on a project’s most environmentally sensitive component, including; direct, indirect, cumulative, and induced impacts. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impact. This project has been classified as a Category B project and accordingly, requires an IEE.

- Involuntary Resettlement – ADB screens all projects to determine whether or not they involve involuntary resettlement. For a project involving involuntary resettlement, a resettlement plan will be prepared that is commensurate with the extent and degree of the impacts. The degree of impacts shall be determined by (i) the scope of physical and economic displacement, and (ii) the vulnerability of the affected persons.6

- Indigenous Peoples – ADB screens all projects to determine whether or not they have potential impacts on Indigenous Peoples. For projects with impacts on Indigenous Peoples, an Indigenous Peoples plan will be prepared. The plan’s level of detail and comprehensiveness will be commensurate with the degree of impacts. The degree of impacts is determined by evaluating (i) the magnitude of the impact on Indigenous Peoples’ customary rights of use and access to land and natural resources; socio economic status; cultural and communal integrity; health, education, livelihood systems, and social security status; or indigenous knowledge; and (ii) the vulnerability of the affected Indigenous Peoples.

The Environment Safeguard has been utilised for this IEE.

2.3.9 International Treaties and Agreements

Solomon Islands is a signatory to a number of International environmental agreements including those for regional agreements; chemicals, waste and pollution; biodiversity and climate. The names of these agreements and the date of ratification are provided in Appendix C. Several of these may likely be

6 Refer Social Impact Assessment (DTC67874) and Resettlement Plan (DTC436410) issued by GHD in conjunction with this IEE.
relevant to the survey and cable laying operations and should be considered in more detail in the subsequent stages of the project.

2.4 Limitations of the Study Report

This report has been prepared utilising readily available data and information sourced and assessed as described in Section 2.1. In addition to the site visits undertaken, numerous and extensive stakeholder engagement has formed a key part of this study, including representatives from the Solomons Islands Ministries and Provincial Governments in Honiara, Auki and Noro, Solomon Islands Telekom and the overall project team.

No detailed field work has been conducted as part of this study; however, site visits were undertaken at all of the proposed landing sites and along the land-based routes, giving an indication of the local environmental conditions at each of the sites. A summary of the stakeholders consulted for the IEE during the site visits and associated consultations are provided in Appendix B. In addition, a summary of the consultations carried out in the communities is available in the accompanying Social Impact Assessment Report.

The environmental assessment undertaken for this report has been based on the latest information on the cable system - proposed location of cable routes/landing sites/land based cable routes and a range of installation methodologies provided by Hibbard Consulting. In the next phase of the Project these details will need to be confirmed in order to determine roles and responsibilities in relation to the Environmental Management Plan, and associated costs for implementing the monitoring, mitigation and management measures outlined in this IEE.

Data gaps that have been identified, namely, sediment composition of the seabed substrate, exact positions of ship and aeroplane wrecks and extent of rock or coral reefs, will be completed during the marine route survey phase of the project. In addition, further ecological assessment of the inner shore areas may also be undertaken during this phase with a local diver. Accordingly, all gaps identified as part of the IEE process will be closed out in due course as part of the overall scope of the Pacific Regional Information and Communications Technology Connectivity Project.
3. **Description of the Solomon Islands Cable System**

The phases of the development that are described in this chapter align with similar divisions in discussions on impacts and environmental management later in this report. A summary of technical detail on submarine fibre-optic cables and cable-laying is included in this section and concludes with a brief discussion of qualifying criteria for an acceptable route and considers an alternative landing site proposed early in the design phase (if required).

It is understood that this assessment feeds into the overarching project plan. Prior to detailed design of the cable placement, further investigations will need to be undertaken along the proposed routes. In the offshore area, these site investigations are likely to include surveying operations and may comprise (where necessary) sidescan sonar survey, seismic survey and drilling of borehole(s) to confirm bathymetry and geotechnical conditions along with any existence of iron and steel hulled shipwrecks, aeroplane wrecks and unexploded ordnances. Similar investigations will also need to be carried out on the inner shore and terrestrial areas that the cable will pass through. This IEE will be updated following completion of these investigations. GHD understands that the overall responsibility of this task will be with SOCC.

3.1 **Description of proposed works**

SOCC has proposed to construct a fibre optic submarine cable system linking Honiara, in Guadalcanal Province, with Sydney or Guam by interconnecting to a Branching Unit on the PPC-1 cable. The base system will be a repeatered system with one or two fibre-pairs, using wavelength-division multiplexing (WDM) technology, linking Honiara to a new Branching Unit on PPC-1. This new optical add-drop multiplexer (OADM) Branching Unit, BU5, will be installed on the PPC-1 cable under a separate contract between TE Subcom and Pipe Networks and then made available to SOCC under a contract between Pipe Networks and SOCC. The assumed location of BU5 is 09°58.590' S 156°47.599 ' E. The size of the submarine cable will vary from 17 mm to 36 mm depending on water depth and therefore the degree or cable armouring applied.

Three cable routes have been proposed as part of this project:

- BU5 – Honiara West
- Honiara – Noro
- Honiara – Auki

Details of each route are provided in the following sections.

Two separate domestic cables to Noro and Auki have also been proposed. One of these cables will connect Honiara to Noro in Western Province. The base implementation arrangement involves the inclusion of additional unrepeatered pairs in the Honiara shore end cable to a full fibre-routing BU approximately 42 km from Honiara from which a stub cable will be laid for subsequent extension to Noro. The assumed location of this BU is 09°10.622 ' S 159°42.214 ' E. Under this scenario, there will be additional 2-6 fibre-pairs which will be unrepeatered. The other domestic cable will connect Honiara to Auki in Malaita Province. The design capacity for the system will be a minimum of 320 Gbit/s per fibre pair, with a possible initial capacity of 10 Gbit/s. This system is shown in the schematic diagram (Figure 3-1) below.
The landing points and cable stations are described below. A description of the range of cable types, applications and features likely to be used in this project are shown in Table 3-1.

Table 3-1 Variety of cable types, applications and features

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Features</th>
<th>Application</th>
</tr>
</thead>
</table>
| Lightweight (LW)                                | Core cable with polyethylene insulation for electrical installation but no additional external protection | • Best used in areas where the seabed is smooth and the cable can be confidently installed in full compliance with the seabed contours  
• Typically used in water depths 2000-8000m |
<p>| Lightweight Protected (LWP) or Special Applications (SPA) | Metallic tape and polyethylene outer jacket applied over core with additional abrasion protection and hydrogen sulphide protection | • Areas of non-uniform or potentially abrasive seabed or where the cable requires extended handling and use in rocky areas with moderate |</p>
<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Features</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-Wire Armoured (LWA) or Single Armour Light (SAL)</td>
<td>Light single armour wire layer applied to core cable</td>
<td>Abrasion and/or attack by marine life&lt;br&gt; Ideal for depths up to 6500m</td>
</tr>
<tr>
<td>Single Armoured (SA)</td>
<td>Heavy armour wire layer applied to core cable</td>
<td>Best for aggressive seabed in water depths up to 2000m or areas in which the cable is to be buried.&lt;br&gt; Ideal for depth up to 2000m</td>
</tr>
<tr>
<td>Double Armoured (DA)</td>
<td>Two armour wire layers applied to core cable</td>
<td>Best for use in shallow water (&lt;800m) where the cable is at risk from environmental or external aggression and cannot be buried.&lt;br&gt; Ideal for depth up to 800m</td>
</tr>
<tr>
<td>Double Armoured High Abrasion (DA-HA)</td>
<td>Two heavy armour wire layers applied to core cable</td>
<td>Best for use in rocky terrain high likelihood of trawler damage and high abrasion risk&lt;br&gt; Ideal for depth up to 800m</td>
</tr>
<tr>
<td>Rock Armoured (RA)</td>
<td>Short-lay armour wire layer applied over SA cable</td>
<td>Best for use in rocky terrain with high risk of abrasion and risk of crushing&lt;br&gt; Ideal for depth up to 200m</td>
</tr>
</tbody>
</table>

### 3.1.1 PPC1 (BU5) – Honiara

The international cable branch off BU5 from PPC1 connecting to Honiara and will follow the route illustrated in Figure 3-1. This cable route is approximately 400 km in length. The cable types suggested for this cable route is shown in Figure 3-2 and a summary of the associated proposed cable types, length and depth range for this cable route is shown in Table 3-2.

![Figure 3-2 – Proposed Cable Types for PPC1 (BU5) – Honiara](image-url)
Table 3-2 – Proposed Cable Type, Length and Depth Range for PPC1 (BU5) - Honiara

<table>
<thead>
<tr>
<th>Cable Length (km)</th>
<th>Cable Type</th>
<th>Depth Range (m)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2.132</td>
<td>DA</td>
<td>0 – 150</td>
<td>Shore end section. Articulated pipe to 25m then plough burial</td>
</tr>
<tr>
<td>2.132 – 6.274</td>
<td>SA</td>
<td>150 – 500</td>
<td>Plough Buried to 1m below seabed</td>
</tr>
<tr>
<td>6.274 – 41.508</td>
<td>SA</td>
<td>500 – 1,050</td>
<td>Surface laid to domestic BU</td>
</tr>
<tr>
<td>41.508 – 78.915</td>
<td>SA</td>
<td>1,050 – 1,012</td>
<td>Surface laid</td>
</tr>
<tr>
<td>78.915 – 395.291</td>
<td>LWP</td>
<td>1,012 – 4,076</td>
<td>Deep water to PPC-1 BU5 (section approaching BU5 may require high strength LWP for deploying BU)</td>
</tr>
</tbody>
</table>

It is noted that the submarine cable will be buried to a depth of 500m by ploughing or jetting mechanisms to protect against snagging, anchors and wave action.\(^7\)

It should also be noted that the figure above only extends as far as the beach manhole at the cable landing point. The land cable (not shown) will then extend from the beach manhole to the existing cable station in Honiara, within a pre-built duct to facilitate future maintenance without further excavation, if required. Further details of the cable landing and land based cable route are provided below.

It is understood that the landing location will be located adjacent to the ‘open air church’ (St Albans Anglican Church, Bishops Dale) located on the Tandai Highway, west of Honiara. It is envisaged that this landing will be used for any cables leaving north and west from Honiara, i.e. the international cable and the Honiara-Noro domestic cable. The landing site shown in Figure 3-3 was inspected in May 2012 and again in June 2012 Figure 3-4.

![Figure 3-3 – Honiara cable landing site – Beach landing (LHS photo) and land based cable route on property (RHS photo)](image)

\(^7\) Solomons International Cable; Segment: Honiara – PPC-1 BU5 v1 – Reference HCPL-SOL-D-006.B.
Figure 3-4 – Honiara cable landing site – Looking onshore (LHS photo) and further west adjacent to the site (RHS photo)

For the land based works, which are estimated to take 4-6 weeks, there is an existing duct route back to Honiara owned by Solomon Telecom Limited (STL) which will be utilised for the installation of the Honiara cable. The cable station for the international route and the Honiara to Noro route is currently proposed to be located in the STL building in Honiara at coordinates (9º25.849’S 159º57.133’E) (Figure 3-5) which is roughly 1.5km km from the landing point. From previous inspection of the station it has been identified that approximately 12 m² of available equipment suite space should suffice for a repeatered system. Figure 3-6 shows the landing point and cable route on land. From the site inspection, it is understood that the cable route on land will typically be adjacent to the main road as shown in Figure 3-5 and Figure 3-6 with a corridor of approximately 2 m.

Figure 3-5 – Location of the cable station
3.1.2 Honiara – Noro

This domestic cable commences at Honiara and follows the western international cable route until the BU before branching north towards Noro as shown in Figure 3-1. This cable route is approximately 400 km in length. The cable type suggested for this cable route is shown in Figure 3-7 and a summary of the associated proposed cable types, length and depth range for this cable route is shown in Table 3-3.

![Figure 3-7 – Proposed Cable Type for Honiara – Noro](image)

<table>
<thead>
<tr>
<th>Cable Length (km)</th>
<th>Cable Type</th>
<th>Depth Range (m)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2.132</td>
<td>DA</td>
<td>0 – 150m</td>
<td>Honiara shore end section. Articulated pipe to 25m then plough burial</td>
</tr>
<tr>
<td>2.132 – 6.274</td>
<td>SA</td>
<td>150 – 500</td>
<td>Plough Buried to 1m below seabed</td>
</tr>
<tr>
<td>6.274 – 41.508</td>
<td>SA</td>
<td>500 – 1,050</td>
<td>Surface laid to domestic BU</td>
</tr>
<tr>
<td>41.508 – 44.901</td>
<td>SA</td>
<td>1,050 – 1,152</td>
<td>Surface laid (BU Stub cable)</td>
</tr>
<tr>
<td>44.901 – 86.966</td>
<td>LWP</td>
<td>1,152 – 1,497</td>
<td>Transition to deep water</td>
</tr>
<tr>
<td>86.966 – 277.005</td>
<td>LW</td>
<td>1,497 – 1,833</td>
<td>Deep water surface laying</td>
</tr>
<tr>
<td>277.005 – 352.461</td>
<td>LWP</td>
<td>800 – 1,833</td>
<td>Transition to shallow water</td>
</tr>
<tr>
<td>352.461 – 374.206</td>
<td>SA</td>
<td>500 – 800</td>
<td>Surface laid single armour</td>
</tr>
<tr>
<td>374.206 – 394.077</td>
<td>SA</td>
<td>25 – 500</td>
<td>Plough Buried to 1m below seabed</td>
</tr>
<tr>
<td>394.077 – 394.378</td>
<td>DA</td>
<td>0 – 25</td>
<td>Noro shore end section protected in Articulated Pipe to landing point</td>
</tr>
</tbody>
</table>

It is noted that submarine cable will be buried into to seabed to a depth of 500 m by ploughing/jetting to protect against snagging, anchors and wave action.
It should also be noted that the figure above only extends as far as the beach manhole at the cable landing point. The land cable (not shown) will then extend from the beach manhole to the cable station within a pre-built duct to facilitate future maintenance without further excavation, if required. Further details of the cable landing and land based cable route are provided below.

Western Province is foreseen as a particular demographic and tourism growth area for the Solomon Islands. Gizo and the surrounding islands are significant and growing tourist areas. Noro is a deepwater port, approximately 12 km northwest of Munda Airport, which has the potential for significant development. Munda airport will be able to receive larger jets and international flights when the currently proposed airport upgrade is completed. These three locations are currently all linked by existing microwave systems with a new terrestrial fibre-optic cable planned between Munda and Noro.

The proposed submarine cable route to Noro will go via New Georgia Sound. The proposed landing point for the cable is located just outside the centre of Noro, the land located adjacent to Markworth area Figure 3-8 (co-ordinates 8.21486S 157.203573E). The proposed Noro landing point is characterised by hard coral flats and the area is subjected to tidal changes. At the low tide mark, a portion of the reef flats are exposed and at high tide they are covered. The beach manhole is proposed to be located at an elevation of approximately 10 m above mean sea level on the hill at the back of the proposed site at the fence junction.

This site was inspected in May 2012. During discussions with land owners and provincial government representatives, GHD was advised that parts of Western Province (including the proposed site) have been subject to subsidence, and subsequently inundation (refer Figure 3-8) since the 2007 earthquake. This subsidence and associated inundation will need to be considered during detailed design phase.

Figure 3-8 – Noro landing site

The cable station is located at the STL station (co-ordinates 8°14.163’S 157°11.939’E) approximately 3 km from the landing site. It is believed that the existing station has sufficient space to house the terminal equipment for the unrepeatered cable and has the advantage of being co-located with STL’s microwave terminal feeding Munda and Gizo. It is also the proposed terminating point for a planned

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8 Solomons Domestic Cable; Segment: Honiara – Noro – Reference HCPL/SOL/S/004.A. Issued on 03/02/2012 – Draft A
9 Co-ordinates to be confirmed by Hibbard Consulting
10 Co-ordinates to be confirmed by Hibbard Consulting
terrestrial optical fibre cable to Munda. Figure 3-9 shows the landing point and cable route on land. This figure also illustrates a typical road easement the cable will be buried along. As evident from the photos, the cable will be laid along an unsurfaced road with dense vegetation on either side for most of the route. This vegetation consists mostly of beach morning glory, vines and grasses. Further inland the vegetation consists mostly of native wetland plants.

![Figure 3-9 – Cable Landing Site at Noro](image)

3.1.3 Honiara - Auki

At the time of the site visits, the proposed Auki cable was to be installed from Henderson, which adjoins the RAMSI property at co-ordinates (9º24.859’S 160º2.995’E). However, as described in Section 1.1, site selection updates developed by Hibbard Consulting in July 2012, indicated that due to potential land access issues at the site in Henderson, this site would not be included in the report. The functions of this site will now be diverted to Honiara, meaning that the Henderson to Auki cable will now be placed from Honiara to Auki. However at the time the IEE site visits were conducted, the Henderson site was assessed and hence it is included in this report.

Details of the domestic cable that commences at Honiara and heads east towards Auki as shown in Figure 3-1 and outlined below. This submarine cable route is approximately 140 km in length. The cable type suggested for this cable route is shown in Figure 3-10 and a summary of the associated proposed cable types, length and depth range for this cable route is shown in Table 3-4.
Figure 3-10 – Proposed Cable Type for Honiara – Auki

Table 3-4 – Proposed Cable Type, Length and Depth Range for Honiara - Auki

<table>
<thead>
<tr>
<th>Cable Length (km)</th>
<th>Cable Type</th>
<th>Depth Range (m)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2.155</td>
<td>DA</td>
<td>0 – 165</td>
<td>Honiara shore end section. Articulated pipe to 25m then plough burial to 1m below seabed</td>
</tr>
<tr>
<td>2.155 – 18.351</td>
<td>SA</td>
<td>165 – 400</td>
<td>Plough Buried to 1m below seabed</td>
</tr>
<tr>
<td>18.351 – 74.320</td>
<td>SA</td>
<td>400 – 1,000</td>
<td>Surface laid SA (to enable future burial)</td>
</tr>
<tr>
<td>74.320 – 118.014</td>
<td>LWP</td>
<td>1,000 – 1,602</td>
<td>Transition to deep water</td>
</tr>
<tr>
<td>118.014 – 134.649</td>
<td>SA</td>
<td>500 – 1000</td>
<td>Surface laid single armour</td>
</tr>
<tr>
<td>134.649 – 136.047</td>
<td>SA</td>
<td>237 – 500</td>
<td>Plough Buried to 1m below seabed</td>
</tr>
<tr>
<td>136.047 – 139.284</td>
<td>DA</td>
<td>0 – 237</td>
<td>Auki shore end section buried to 15m water depth then protected in Articulated Pipe to landing point</td>
</tr>
</tbody>
</table>

It is noted that burial of the submarine cable to a depth of 500 m by ploughing / jetting to protect against snagging, anchors and wave action is likely.

It should also be noted that the figure above only extends as far as the beach manhole at the cable landing points. The land cables (not shown) will then extend from the beach manholes to the cable stations within a pre-built duct to facilitate future maintenance without further excavation, if required. Further details of the cable landings and land based cable routes for Honiara are provided above, while these details for the Auki landing are provided below.

The proposed landing point for the cable at Auki is located at co-ordinates 8°46.173’S 160°41.164’E (Figure 3-11). Once the cable comes on land, it will follow a route along the existing road past the freshwater lagoons to the centre of Auki town centre to the existing cable station. Figure 3-12 illustrates a typical road the cable will be buried along.

* Includes 3.5km final splice allowance
3.2 Design phase

Prior to the construction phase, the project ideally undergoes a four-step Design Process comprising of:

- An initial feasibility study, route selection and project scoping (already completed),
- An environmental examination (this study),
- Desktop study and terrestrial and marine route survey, and
- Detailed design and updating of the IEE/EMP, if required. (GHD understands that the overall responsibility of this task will be with SOCC).

The initial route selection and project scope is complete and is summarised in the section above. This was based on available information sufficient to scope and specify the proposed development with enough accuracy for costing and calling for tenders for components of the construction phase that follows. In addition, it provides the basis for the environmental examination which makes up the second design component. The environmental examination examines the project’s interaction with the environment, considers potential impacts and determines mitigation measures necessary to eliminate or
minimise negative effects on the natural and social environment. This report is the product of the environmental examination.

3.2.1 Desktop Study
Having determined the cable landing sites and proposed cable routes, a review of pertinent available information will be undertaken in order to refine the most efficient and secure routes for the cable. Desktop studies are generally conducted by an experienced team who will gather all available hydrographic and geologic information about the intended route. It is understood that this will be carried out in the next phase of the project. The desktop study will also consider fishing, other maritime activities and practices in addition to identifying the permitting required and consider the location and history of existing infrastructure and other obstructions. A comprehensive desktop study will provide an optimal route design that can be scheduled for a detailed ‘marine route survey’. The desktop study will generally determine the detailed design of the cable landing i.e. – how it enters the littoral zone from the deep sea, crossing of any reef systems and the beach, positioning of the beach manhole and linking to existing cable landing stations.

3.2.2 Marine Route Survey
The marine route survey will need to be conducted along the optimised route to gather specific data that has not been identified in the IEE and/or the desktop study such as:
- Possible hazards e.g. active submerged volcanoes;
- Environmentally significant zones that may not have previously been identified (if done in conjunction with any required ecological survey/dive wash);
- Water depth/confirmation of bathymetry;
- Seabed topography along with sediment type and thickness; and
- Shipwreck locations, existing cables and other anthropomorphic submerged objects.
A marine route survey commonly covers a band of seabed from 0.2 to 10 km (depending on water depth) wide with repeat passes where necessary. The width of the survey corridor can be adjusted largely in response to the expected complexity of the seabed, and the depth to which these complete surveys are conducted will be based on local hazards, particularly bottom trawl fishing if present and shipping activities, which may require the cable to be buried.\(^\text{12}\)

There exists a number of ways to carry out these surveys. Data acquired during such surveys are constantly monitored and reviewed in real-time so that if an unexpected hazard, cable obstruction, or benthic community is identified, the route can be adjusted to avoid any hazardous or ecologically sensitive areas.

The end goal of these phases (desktop study and marine route surveys) will be to precisely define a viable cable route and identify the natural and human activities that could conflict with the cable. This information aids the detailed cable design, manufacture and installation planning in order for the appropriate level of armouring and cable placement to be identified for specific conditions along the

3.2.3 Detailed Design

The information collected in the route survey will provide input to the detailed design phase of the submerged cable and repeaters, if required. During this process decisions will be made on the cable route, types and quantities with the extra information from the previous phases.

The cable landings on each coast will also be finalised. This includes the method of cable lay/depth of burial as it emerges from the sea, any additional armouring, conduit design, and whether to terminate the sea cable at a manhole junction or connect directly to the landing station.

3.3 Construction Phase – Cable Placement Methods

Once the design phase is complete, it is intended that the cable-laying will begin from Honiara and the cable will be laid away from the Solomon Islands towards the BU5 western most point in the route. It is envisaged that the interconnection with the newly inserted BU5 will be performed last to minimise the interruption to PPC-1.

At this stage of the project the proposed cable installation methods are as follows:

- Articulated piping is proposed for cable protection across the reef areas immediately offshore of the landing points. This would be pinned to the seabed (if conducive) typically at 5-10m intervals to prevent movement during storms such as that sourced high energy wave action which would in turn minimise impacts on the reefs. The piping would extend from the landing point to 15m to 25m water depth depending on conditions.

- Cable burial is proposed to 500m off Honiara, Noro and Auki; and is proposed to 400m off Honiara for the Honiara – Auki cable, in order to afford the cable some protection against snagging from small vessel anchors and any future bottom fishing activity that may develop. Although such activities may not currently pose a threat to the cable, with a design life of 25 years, it is pertinent to consider likely potential for such developments within this timeframe.

- Burial of cable, especially across Iron Bottom Sound will clearly be subject to feasibility from a seabed sediment perspective and have regard to unexploded ordnance (UXOs). If found to be necessary / feasible, it is likely that burial would be achieved by cable plough to a target burial depth of 0.6-1.0m.

Notwithstanding this, the construction methodology will be assessed further during the marine route survey and confirmed once the final design is known.

Typically the cable is installed using a purpose built cable laying vessel (‘cable ship’). The entire segment is loaded onto this vessel and payed out slowly until the cable reaches the seabed. This is the touch-down point. The ship can then increase its laying speed up to a practical maximum of about 5-6 knots, periodically slowing down to allow repeaters to pass through the cable-handling machinery that controls cable tension and pay-out speed. Once a steady-state is achieved, the cable pay-out speed should be approximately the ship’s speed plus 2–3%, assuming the seabed topography is fairly constant.

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Laying operations undergo constant and accurate monitoring. The ship's position and speed over the ground are measured by differential GPS, and the water depth by precision echo-sounders and seabed mapping systems (from the marine route survey), whereas cable pay-out speed and length are recorded by a rotometer. On board, the cable engineer, with the assistance of computer modelling software, will scrutinise laying progress with constant reference to the engineered route plan, making adjustments if necessary.  

Cables are commonly buried across the continental shelf, typically 0–130 m deep, and even down to depths of 1000–1500 m where there is risk of damage from bottom-trawling. Where burying is undertaken, the most effective method is by sea plough, towed behind the cable ship. As a cable approaches the seabed, it is fed through the plough, which inserts the cable into a narrow furrow. Burial disturbs the seabed along the path of the cable. When towing a sea plough, the ship carefully controls its operations so that cable slack is kept to a practical minimum as it enters the plough. The aim is to lay the cable with near-zero slack. In areas where the cable crosses another cable, the plough must be either recovered or ‘flown’ over the crossed section and then re-deployed on the opposite side. These skipped sections may be buried later, either by divers or by a remotely operated vehicle. Some of the typical cable laying methodology is highlighted below:

### 3.3.1 Directionally Controlled Horizontal Drilling

The purpose of horizontal directional drilling (HDD) will be to construct a conduit facilitating the shore crossing and landing of submarine cables, where traditional cable landing methods are not possible or desirable. HDD conduits are typically installed where:

- Trenching operations are not possible due to the bathymetry
- Environmental concerns
- Inshore obstructions (shore based industry/development, rocks or surf)
- Areas prone to erosion or where there is a high risk of external recession along the shoreline.

HDD is a process by which a drilling tool is steered along a predetermined path while drilling is in progress. It is often used for the installation of cables or pipelines under obstacles such as rivers, roads, railways and the like.

The process involves a small diameter hole that is directionally drilled from one side of the obstacle to the other. Directional “steering” of the drill head is effected by rotating a small bend (less than 1deg) which is close to the drill head. The drill pipe will have an outside diameter of approximately 100 mm and will be left in place to serve as the conduit for the cable. The internal diameter of the drill pipe will be 95 mm. A typical entry angle of between 8º and 20º to the horizontal will be adopted onshore subject to detailed design of the drill path. The exit angle at the seabed is generally restricted by the bending radius of the cable and will be expected to be about 6º.

Drilling fluids will be used in the drilling process to lubricate the drill string and borehole, cool the drill bit and downhole instruments, provide the motive force for any downhole motor, and carry the cuttings out of the borehole back to the surface. The drilling fluid will comprise water and additives. The main additives will be bentonite (clay formed by the decomposition of volcanic ash) and various polymers. The
mix of additives will be dependent on factors such as ground and seabed conditions which will be established by a prior geotechnical investigation.

3.3.2 Marine Trenching and Beach Landing
Trenching is a method commonly used for the inner shore marine end of cable lay operations and beach landing in order to protect the cable in high energy coastal environments (water depth <15m). Depending on the extent of trenching required and sediment type to be trenched, there several options available, including use of a backhoe or excavator with a rock saw or rock breaker (usually available locally. This equipment could be utilised to the low water mark. In the event that trenching is required beyond the low water mark, a marine rock trencher (e.g. Gator or Travocean TM03) could be used. Often these are not available locally and will need to be mobilised to the site.

3.3.3 Burial by Ploughing
The ploughing method can normally achieve burial depths of up to 1.5 m in the sediment subject to the nature of the seabed. Specialised equipment can achieve burial depths of up to 3 m. Ploughing can be used to bury the cable below the seabed in the sandy or muddy sediments from approximately 15-20 m water depth out to 2000 m water depth after which ploughing is impractical and unnecessary. Ploughing the cable to a nominal target depth of 0.6-1 m normally affords good protection against most forms of fishing activity. To ensure safe plough and cable handling during ploughing operations, the achievable course changes and acceptable seabed gradients are restricted.

The ploughing operation will take place during the actual laying of the cable onto the seafloor. The cable will be threaded through the cable plough which is lowered to the seafloor and then pulled along by the cable ship as it lays the cable. The plough cuts a narrow trench approximately 200 mm wide into which it positions the cable and then partially reburies the cable. In shallower water depths, less than about 80 m, the trench will become infilled and reconsolidated over time by natural sedimentary processes under wave and current action. Below this depth a localised depression along the cable route may exist for some time.

3.3.4 Burial by Jetting
Post Lay Burial (PLB) by a Remotely Operated Submersible Vehicle (ROV) using high pressure water jetting techniques is typically used in areas where ploughing could damage existing cables or pipelines. Jetting techniques could be used to bury the cable approximately 600-1500 mm below the seabed. Jetting could also be used to bury the cable in areas from 1200 to 2000 m water depth. The jetting equipment will either be fitted to an ROV which is deployed and controlled from a support vessel, or be manually operated by divers (maximum depth of 30 m owing to the additional safety restrictions which apply at greater depths). The cable ship will lay the cable on the seabed in advance of the jetting.

The high pressure water jets of the jetting equipment will liquefy the sediments around the cable so that the cable sinks into the seafloor under its own weight. In relatively shallow water depths, i.e. below 80 m, the localised depression in the seabed caused by the jetting action will become infilled and reconsolidated over time by natural sedimentary processes under wave and current action. In water too shallow for vessel support, diver hand-held jetting can usually achieve some cover in soft cohesive sediment or loose sand.
3.3.5 Placement of Cable Directly on the Seabed

This method of placement involves laying the cable directly on the seabed. This method is ideal for water depths greater than 2000 m (or in water depths greater than the limit of required cable burial). However, may also be a method utilised in shallow waters.

3.3.6 Use of Articulated Pipe and Stapling

Use of articulated pipe and stapling usually involves the fitting of a split cast iron piping around the cable which is then stapled or clamped to the seafloor using stainless steel fixtures in order to provide minimal impact on the surface in which the cable is being laid and to provide shallow water abrasion and impact protection to the cable. The tasks for this installation method usually comprise the following:

- Survey swim to confirm status of cable prior to installation;
- Fixing of cast iron articulated half shell pipe sections to the cable;
- Bolting of sections using nuts & bolts (nominal one set every 5-10m);
- Stabilisation of the articulated pipe using saddle clamps pinned into bedrock (nominal spacing 25m); and
- Survey swim of completed works.

A pre-installation survey swim is usually performed at the start of operations to determine local seabed conditions along the route. Following the survey, the area(s) of the cable to be protected by the articulated pipe will be confirmed by the supervising representative on site. The survey is used to identify possible locations for the saddle clamps to be fitted and any areas of coral, where pinning into the seabed must be avoided.

In areas where attachment of articulated pipe is applied and coral is present, the cast iron pipe sections are lowered to the seabed in a manner that avoids damage to the coral. Pipe sections are fitted in one direction (from BMH seawards) such that there are no gaps in the protection in the areas identified by the survey. Each pipe section is checked to ensure that it is interlocked correctly before fitting the next section. Sections of pipe are fixed in place by fitting self-locking stainless steel nut and bolt sets which are fitted at nominal intervals of 5-10m.

Usually following the completion of the works a video survey is performed to demonstrate that the articulated pipe has been fitted correctly and that the seabed has been cleared of any waste associated with the works.

3.3.7 Alternate Methods

A number of alternate methods exist for cable laying in situations where the seafloor material is too hard for cable burial by jetting and ploughing techniques, due to existence of rock or stiff clay or coral reefs. These methods include:

- Placement of a rock berm over the cable;
- Draping of a prefabricated flexible concrete mattress over the cable; and
- Laying of the cable directly on the surface of the hard material.

The requirement for such specialist methods will only be known after the survey. During the detailed design phase the proposed route may also be modified to avoid hard material, particularly rock reef.
Should this not be possible, it is envisaged that a method involving placement of suitably armoured cable directly on the hard surface will be employed.

The GHD team has been informed that the proposed method of construction will be to surface-lay the pipe in the shallow water approaches to the landing site. The pipe will also be surface-laid along the deep water route. GHD was also informed that the RPL indicates burial to 500 m water depth as a precaution at this stage pending more detailed Desktop Study into the risks to the cable at each shore landing site. The IEE has been based on these assumptions.

3.4 Operation Phase

The design life of the cable, the repeaters and the system as a whole is typically 25 years. Once the cable is installed, there is generally no requirement to access the cable. All regular maintenance needed for the satisfactory operation of the optical fibre system is expected to be confined to activities at land-based cable station sites. However, on rare occasions it may be necessary to retrieve the cable from the seafloor, in the event of the need for repair of the cable. Recovery of the cable should only be necessary in the event of damage from some external source (most commonly fishing trawls and lines, ships anchors, and, infrequently, natural events). Recovery generally entails the use of a specialist cable ship for:

- Location of the cable and, if a repair is required, identification of the faulted section;
- Retrieval of the cable with specially designed grapnels deployed from the repair vessel (or with the assistance of an ROV); and
- Lifting to the surface for removal or repair.

It is important to note that since the position of the as-laid cable will be accurately known (to +5 m in depths less than 200 m, and +20 m in depths greater than 2000 m); the grappling activity can be closely controlled.

3.5 Alternatives Considered

No alternatives were required to be assessed to date.
4. Description of the Environment

The Solomon Islands is made up of hundreds of coral atolls and volcanic islands congregated to form an archipelago stretching approximately 1,600 km across the South-western Pacific Ocean. The total land area is approximated to be 28,300 km$^2$. The unique geography and scattered nature of islands has given rise to a heritage of considerable environmental and ecological diversity which is evident at the four sites of interest.

The following section outlines the physical and biological environmental and natural hazards associated with the project area of influence.

Please note that as part of this scope of works, a social impact assessment (SIA) and resettlement plan (RP) were also prepared covering the two main phases of the project – the construction phase and the operations phase. Social impacts were identified and described for both these phases of the project. A summary only is included in this IEE in Section 6.

4.1 Location, Setting and Review of Existing Information

The Solomon Islands rise steeply from the deep ocean floor and have very little underwater shelf area. Coral reefs characteristically surround the islands, either close to the shore (fringing reef) or further offshore (barrier reef). The coastal lagoon is enclosed between the shore and barrier reefs. The total length of the three cable routes is approximately 950 km. The three routes will traverse through various offshore terrains including; seismically and volcanically active areas of irregular relief containing; deep depressions and high ridges. Seismic and volcanic activity is common and sub-sea slope failures and turbidity flows have been recorded previously within Solomon Island waters.

From literature it is understood that most coral reef shelves in the Pacific are at a level close to low tide, and since the maximum tidal range is 1-2 m, it follows that the waves reformed from broken waves passing over the reef will rarely exceed 2 m in height $^{15}$.

The four proposed landing sites are located in four different locations spread across three separate islands, and as a result, the coastal geology and coastal processes are distinctly different at each location. During the site visit the four proposed landing sites were inspected. A brief summary and the observations made during these site visits are described in the following relevant sections along with a description of the environment based in and around the area of influence for the proposed development.

The relevant environments described here fall under three headings. Under these headings, the following environmental features or processes have been described:

- Physical Environment
  - Bathymetry
  - Substrate - Offshore and Inner shore
  - Hydrothermal Vents and Seamounts
  - Wave Climate, Tides and Currents
  - Coastal Zone and Associated Erosion

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4.2 Physical Environment

4.2.1 Bathymetry

Bathymetric information for this project was sourced from;

- Previous reports produced by Hibbard Consultants,
- Bathymetric charts (BA1713, BA1735, BA1747, BA1750 and BA3995-BA3998) sourced from the Honiara and Noro harbour masters and chart agents in Sydney, Australia;
- Site Visit Observations; and
- A review of aerial photographs.

Honiara to PPC-1 (BU5)

The latest route overview and profile for the proposed international cable route from PPC1 (BU5) to Honiara is shown below (Figure 4-1 and Figure 4-2). Utilising this figure and the additional data sourced, the following key features of the bathymetry for the Honiara to PPC-1 (BU5) route can be observed.

The seabed appears to gradually deepen to about 40 m once the cable has left the beach manhole at Honiara. General geological setting of the route seems to be complex and is characterised by the existence of volcanic features and tectonic faulting. Twenty Kilometres offshore the seabed drops off steeply to a depth of approximately 700 m. A high point in the bathymetry is encountered at Salvo
Volcano, approximately 75 km chainage from Honiara. Savo volcano is surrounded by concentric spurs and furrows. The volcano is bounded on its eastern side by a N-S fault identified on the seismic profiles that cuts the central part of the basin. Savo Island and its associated geology is possibly due to the present of this fault. Additionally, this route passes through the Iron Bottom Sound, where numerous ship wrecks are known to be located. This portion of the route requires accurate survey data to identify location of all wrecks and any exploded ordnance.

Past Savo Island, the route appears to follow a deep depression reaching a maximum depth of about 4500 m. For much of the remainder of the route the depth ranges between 2000 and 3500 m in general.

Figure 4-1 – International Cable Route Overview

Figure 4-2 – International Cable Route Profile
**Honiara to Noro**

The route from Honiara to Noro follows the same route as the new international cable route for the first 42 km, as far as Savo Island, before continuing north west into New Georgia Sound. New Georgia Sound appears to be undulating yet grading gradually down to approximately 1800 m before gradually inclining to 600 m as the route turns South West into Noro (Figure 4-3 and Figure 4-4)).

![Figure 4-3 – Noro – Honiara Route Overview](image)

**Figure 4-4 – Noro – Honiara Route Profile**
**Honiara to Auki**

The original route from Henderson to Auki was to extend seaward offshore of Henderson and descend into Sealark Channel. However, with the change in route (as outlined in Section 3.1.3), the new proposed route will be an extension of the original route through the Sealark Channel from Auki to the landing point at Honiara.

Once traversed having traversed through Sealark Channel the route drops to 1500 m and follows the Indispensable Strait before ascending towards Auki, to the south of Alite Reef (Figure 4-5). Coral reefs are present just offshore of the Auki landing point.

![Figure 4-5 – Honiara - Auki Route Overview](image)

**4.2.2 Substrate – Offshore and Inner shore**

Knowledge of seabed conditions and sediment types are a key component of submarine cable installation projects as the nature of seabed sediment and existence of reef may impose constraints on cable placement methods and result in unnecessary impacts on the local environment. There is little information available on the distribution of seabed sediments and associated morphology throughout the Solomon Islands for both the offshore and inner shore coastal zones along any of the proposed routes. This environmental constraint will need to be detailed and assessed later in the project (refer Section 5 for details).

**4.2.3 Hydrothermal Vents and Seamounts – Geological**

Deep-sea hydrothermal vents form as a result of volcanic activity on the ocean floor. Water seeps through cracks in the earth's crust, dissolving metals and minerals as it becomes super-heated from nearby magma. Active hydrothermal vent and seamount fields have recently been discovered at Grover
Seamount in the San Cristobal Arc and Starfish Seamounts in the northern New Hebrides arc in the eastern Solomon Islands. The arc-related vent field discoveries in the eastern Solomons are associated with quite localised, gas-rich hydrothermal plumes (methane and carbon dioxide). The figure below (Figure 4-6) shows the locations of some known hydrothermal vents and seamounts. It is believed that the location of these vents and seamounts, along with others, will be picked up during the marine survey. Hydrothermal vents in the Solomon Islands are common in parts of Marovo, Vella lavela, Simbo and Kavachi in the Western Solomon’s and also in Santa Cruz and Savo.

Figure 4-6 – Location of some known hydrothermal vents and seamounts

4.2.4 Wave Climate, Currents and Tides

The coastal zone is generally defined as the interface between the land and the sea and includes the relevant components of the adjacent terrestrial and marine area. The wave environment of the Solomon Islands is generally made up of four major components:

- Prevailing northeast to southeast seas and swell waves associated with prevailing easterly trade winds;
- Periods of westerly seas generated by westerly gales during the wet season in equatorial regions;

Short-term, large seas and swell waves from variable directions generated by tropical storms and cyclones; and
Seasonal north and south swell waves generated by mid-latitude storms in both the north and south Pacific Ocean.

It is understood that on eastward-facing coastlines, such as Honiara and Henderson, local seas and swell waves generated by trade winds are generally persistent and form the dominant component of the local wave environment\(^{18}\). Typical current strength in the region has been measured to be around 4 knots. The tidal gauge at Honiara indicates that the tides are usually diurnal, i.e. one high and one low tide each day. This is a common occurrence for the Solomon Islands. The tide levels between mean lower low water (MLLW) and mean higher high water (MHHW) ranges between 0.3 and 0.8 m for Honiara. It is clear that the tidal ranges are relatively small. The relevant tidal ranges for the sites are summarised below Table 4-1.

**Table 4-1 – Tidal ranges at site (Sourced from Hydrographic Charts)**

<table>
<thead>
<tr>
<th></th>
<th>MHHW (m)</th>
<th>MLHW (m)</th>
<th>MHLW (m)</th>
<th>MLLW (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honiara</td>
<td>0.8</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>Henderson*</td>
<td>0.8</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>Noro (Hathorn Sound)</td>
<td>0.8</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>Auki Harbour</td>
<td>1.4</td>
<td>1.1</td>
<td>0.6</td>
<td>0.4</td>
</tr>
</tbody>
</table>

* Assumed based on Honiara data

Data sourced from the Integrated Global Ocean Services System (IGOSS), demonstrate that the sea level for Honiara is usually higher from November to March\(^{19}\). This is believed to be a seasonal effect due to fluctuations in temporal and spatial wind patterns from nearby cyclones. It is also understood that sea level variations occur annually depending on the strength of the El Nino - Southern Oscillations (ENSO).

Another local phenomenon occurs when the sea level drops to its lowest level around the month of June and this phenomenon is typically referred to as ‘dry reef’. This phenomenon impacts the beaches with low lying coral reefs and hardstand features such as Honiara, Noro and Auki.

**4.2.5 Coastal Zone and Associated Coastal Erosion**

Coastal erosion is already evident at several of the landing sites for this project. There is both anecdotal evidence and observations on site that demonstrate coastal erosion, such as the undermining of trees. Typically, the shore-normal position of a beach profile fluctuates 5-20 m over 2-10 years\(^{20}\).

The impact of this sea level fluctuation was discussed in consultations undertaking during the May 2012 site visit and is evident in the photographs taken during the site visits on two separate occasions (Figure

\(^{18}\) Gillie R 1992, Ranadi Beach Coastal Erosion Study Honiara, Guadalcanal, Solomon Islands, SOPAC Technical Report 152

\(^{19}\) Gillie R 1992, Ranadi Beach Coastal Erosion Study Honiara, Guadalcanal, Solomon Islands, SOPAC Technical Report 152

\(^{20}\) Gillie R 1992, Ranadi Beach Coastal Erosion Study Honiara, Guadalcanal, Solomon Islands, SOPAC Technical Report 152
In these photos at Henderson, the change in beach profile has mirrored the seasonal difference between November and March where a higher sea level generates a higher beach profile with a greater sediment budget on the upper beach profile. In the May 2012 photo the beach has less sediment in the upper portion of the beach profile, i.e. the beach level has dropped/eroded by approximately 0.5 m across the beach profile, and sediment has likely moved offshore. The sediment remains however, still part of the overall coastal compartment sediment budget.

From the literature review it is apparent that only a few coastal areas in the South Pacific have been surveyed or mapped often enough to develop consistent and reliable data on shoreline changes and rates of change. Furthermore, no information is available on the magnitude of storm surges associated with cyclones. Nor does there appear to be high resolution contour data. The landing sites for this project have not been monitored previously and hence this lack of basic information impedes the carrying out of any detailed coastline erosion assessment, storm bite prediction, and quantitative analysis of flooding and inundation risk.

Observations and consultations undertaken during the site visits have provided the following information about each of the four landing points.

**Figure 4-7 – Seasonal Changes at Henderson (Photo on left taken in December 2011 and Photo on right taken in May 2012)**

**Honiara**

Honiara near St Albans Anglican Church, can be broadly described as a mix of rocky reef and coral rubble/sandy beach and is characterised by low energy processes (Figure 4-8 and Figure 4-9). Away from the intertidal zone the beach profile increases gradually into a coral rubble foredune and is surrounded by well-established vegetation which then leads to the developed area at the back of the foredune. Beach sediments consist of pebbles and broken coral approximately 1-5 cm in length (Figure 4-10). It is possible the beach is subject to high energy waves and/or erosion based on the observation of:

- Seawalls constructed and the undermining of trees at the high tide mark along the beach adjacent to the site; and

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A conversation at the site with the local church Minister who advised that the beach had receded approximately 15-20 m in the last 35 yrs. This equates to an approximately 0.4-0.6 m/yr recession on average.

Figure 4-8 – Overview aerial photograph of Honiara landing site (St Albans Anglican Church, Bishops Dale) and its surroundings

Figure 4-9 – Annotated aerial of the Honiara landing site surroundings
Figure 4-10 – Typical sediment unit found at Honiara landing site

*Noro*

During the site visit it was observed that the beach has an approximate grade of 1:20 and is characterised by reef flats. Based on the aerial images (Figure 4-11 and Figure 4-12), and observations on site, the coral reef extends approximately 45-50 m out to sea before a steep drop off. The 20 m depth contour is approximately 120 m off the landing point, increasing to more than 100 m water depth within 260 m of the landing point. Typical sediments found on site are shown below (Figure 4-13).

During discussions on site there was mention that this area of Western Province is prone to a seasonal tidal range called ‘dry reef.’ ‘Dry reef’ occurs over period of several weeks, during which, the tidal range differs enough that the majority of the approximate 45 m of reef flat is exposed. A storm water drain is located in close proximity to the landing site. Localised erosion was identified near the storm water discharge outlet.
Figure 4-11 – Overview aerial photograph of Noro landing site and its surroundings

Figure 4-12 – Annotated aerial of the Noro landing site surroundings
Auki

The beach at Auki (Kelakwai beach) is an approximate grade of 1:7 and is approximately 5-7 m wide. A vegetated fore dune is located at an elevation of about 1.5 m above mean sea level. Observations during the site visit suggest that there is a reef flat offshore from the beach that extends to the end of the groyne, approximately 100-150 m offshore (Figure 4-14 and Figure 4-15). The beach sediment (Figure 4-16) is composed of medium gravel, shelly sand with minimal shell and coral pieces (3-10 cm in length).

A groyne located in close proximity to the landing site was constructed for the local logging industry, which closed approximately 30 years ago. It is important to note that numerous logs and tree stumps were observed along the beach and in the inner shore area.
Figure 4-14 – Overview aerial photograph of Auki landing site and its surroundings

Figure 4-15 – Annotated aerial of the Auki landing site surroundings
Figure 4-16 – Typical sediments found at Auki landing site

The surrounding area behind the beach is of relatively low gradient and will need to be considered when identifying appropriate locations for the BMH. The sediment along the cable route is predominantly compacted sandy clay with some shell and pebble content. Stormwater culverts were identified along the cable route adjacent to the freshwater lake.

4.2.6 Offshore Cultural Heritage

The cable approach to the Honiara landing through the Savo Sound, is known as the Iron Bottom Sound. The region contains numerous shipwrecks and aeroplane wrecks as illustrated in Figure 4-17, and is considered by some government agencies (including the US Navy) as sacred waters from World War II which took place in the Solomon Islands between 1942 and 1943.
4.3 Biological Environment

4.3.1 Hydrothermal Vents and Seamounts – Ecology

Hydrothermal vents support an abundance of ecological values which inhabiting the vent surroundings. Fauna near vents depend on bacteria that are able to convert sulfur found in the vent's fluids into energy through chemosynthesis. The organisms are short lived in their nature and they depend on the lifespan of the vents. Likewise, seamounts are a unique ecosystem with high biodiversity in the open ocean.

4.3.2 Marine Protected Areas (MPAs) and Community Managed Areas

There are a total of 22 marine protected areas in the Solomon Islands and one designated marine conservation area (Arnavon Marine Conservation Area).

The other marine protected areas are informally designated and include the customary management areas established in Roviana and Vonavona Lagoons. These two lagoons have high marine diversity and are important nurseries for bumphead parrotfish and humphead wrasse. They form part of the Bismarck Solomon Seas Ecoregion (BSSE), an ecoregion defined by WWF. The figure below illustrates the MPA in the Solomon Islands (Figure 4-19) and a list of names of these areas is presented in Appendix E.

Additionally, a number of marine conservation areas have been established by communities in Marau Sound, Ngella, Marovo Lagoon, Tetepare, Roviana Lagoon and Gizo. Similar areas are likely to be established for marine resource management in the Shortland Islands, Russell Islands, Three Sisters Islands, Leli Island, Lau Lagoon, Suafa Bay, Langalanga Lagoon, Are'Are Lagoon and Small Malaita, Northern Isabel and Northern Choiseul (Figure 4-19).
4.3.3 Threatened and Protected Species

As with other Pacific Nations, there is currently little understanding of threatened and protected species knowledge in the Solomon Islands. At present there are no regional resource documenting the types of species that exist and/or are threatened in the Solomon Islands or the Pacific region. Data is often dispersed, taxonomic expertise is absent, and nomenclature and classification systems can be disputed for various species.

The International Union for Conservation of Nature & Natural Resources (IUCN) undertakes a global assessment to classify species at varying risk of global extinction. The 2008 IUCN Red List provides the most up-to-date collated information for the Solomon Islands. It identifies and assesses the list of threatened species which includes 245 bird species, 19 amphibians, 75 fishes, 60 plants, 75 mammals, 522 invertebrates and 6 reptiles. (Appendix F)

Two species of bird have been declared Extinct in the Solomon Islands – the Thick-billed Ground Dove, *Gallicolumbasalamonis* and the Choiseul Pigeon, *Microgourameeki*. 
Turtle species found in the Solomon Islands are listed as protected and include: *Dermochelys coriacea* (Leatherback turtle), *Eretmochelys imbricate* (Hawksbill turtle), *Chelonia mydas* (Green turtle), *Lepidochelys olivacea* (Olive Ridley turtle) and *Caretta caretta* (Loggerhead turtle). The identified nesting sites for the turtles in Solomon Islands include:

- Arnavon Islands (Isabel/Choiseul);
- Ramos Island (Malaita);
- Russell Islands;
- Litoghahira (Isabel);
- Rendova and Tetepare Island in the Western Province; and
- Vacho and Sasamunga in Choiseul.

Cetacean species are common in Solomon waters and their habitat is usually major rivers, mangroves and open ocean environments such as oceanic islands, oceanic fronts and upwelling, seamounts, canyons, deep-sea trenches and the water column itself. As one of the few equatorial regions worldwide where hemispherical oceanic exchange of a wide variety of marine life occurs, The Nature Conservancy conducted a survey in 2006 to trace movements of these cetaceans. According to a survey, cetacean movements between the South Pacific and North Pacific are known or suspected (depending on the species) to occur through the major island passages of the Solomon Islands' archipelago, such as Indispensable Strait, Bougainville Strait - separating the Solomon Islands from Papua New Guinea (PNG), Manning Strait and New Georgia Sound. These areas have been classified as the migratory corridor for these marine mammals. There is no known readily available information on their seasonal migrations.

### 4.3.4 Coral Reefs

According to a study conducted by Coral Reef Initiatives for the Pacific (CRISP) in 2007, the Solomon Islands has one of the highest coral diversities in the world. 494 species were recorded (485 known species and 9 unknown species, which may be new species). Coral reefs in the Solomon Islands have one of the richest concentrations of reef fishes in the world with a total of 1,019 fish species identified. The coral reefs are mainly fringing and intermittent around islands and occur along most shallow coastlines where the water is clear and warm and maintains a constant level of salinity. Coral reefs support extraordinary diversity of species by providing food, shelter, nursery and feeding grounds for many fish species and crustaceans. The reefs protect coastal areas from storms and erosions by forming natural break waters. Furthermore, Solomon Islanders depend on the coral reefs for subsistence fishing.

Reefs have been identified around the project area of influence in Noro, Auki and Honiara. There are rocky reef flats at the Noro and Honiara sites and a shallow fringing reef at Auki. Seasonally, the rocky reef flats are exposed during low tides when the water mark is below 'knee height'. This is referred to locally as ‘dry reef’. There is a diversity of marine organisms found on these reef flats and shallow fringing reef. During the site visit, organisms such as starfish, beach-der-mers, shell fish, sea snakes, lolly fish were identified (Figure 4-20).
4.3.5 Seagrass Meadows

Seagrass meadows are a significant coastal habitat and contain high biodiversity value in the Solomon Islands. The seagrasses grow fully submerged and rooted in soft bottom estuarine and marine environments can be found in habitats extending from the intertidal zone to sub tidal, along mangrove coastlines, estuaries, shallow embayments and also coral reef, inter reef and offshore islands. In the Solomon Islands there are ten species of seagrass identified and Malaita Province has been identified in having the most extensive meadow, including one that is more than 1,000 ha in size.

4.3.6 Mangroves

According to a report by the Nature Conservancy, there are 20 species and two hybrids of mangrove found in the Solomon Islands. They include: *H. littoralis, Aegiras corculatum, Sonneratia alba, S. caseolaris, S x guingai, Osbornia octodonata, Lumnitsera littorea, Rhiphara apiculata, R stylosa, R x lamarckii, R mucronata, Bruguieragymnorrhiza, B parviflora, B sexangula, Ceriostagal, Excoecaria agallocha, Xylocarpus granatum, X mekongensis, Avicennia alba, A marina, Scyphiphora hydrophyllacea and Nypafruticans.*

4.3.7 Lagoons and Estuaries

Lagoons, estuaries and other inshore marine waters are exceptionally fertile ecosystems, and have high levels of biological productivity. They are home to a diverse combination of species and ecosystems. These ecosystems can serve as sinks for terrestrial run-off and sediment and pollutant traps which can damage the fragile offshore ecosystems.

4.3.8 Beach Ecology / Coastal Zone Ecology

Some of the identified vegetation at the landing sites and the land based routes to the cable stations are listed below for each site.

**Honiara**

Limited coastal vegetation was observed at the Honiara landing site. Minimal information is known about the fauna inhabiting the coastal vegetation at this site.
**Auki**

The beach vegetation includes (Figure 4-21): beach hibiscus (*Hibiscus tiliaceus*), beach morning glory (*Ipomoea pescaprae*) pandanus, swamp taro (*Cyrtosperma chamissonis*), coconut, Tahitian chestnut (*Inocarpus lagifer*), sago palm. There is no known information on the types of marine fauna present in the area. Along the road (which follows the cable route) and approximately 500 m inland from the beach is a large freshwater lake that is habitat for wildlife such as crocodiles, tilapia, wild ducks, water lilies and pandanus.

![Figure 4-21 – Typical vegetation around Auki](image)

**Noro**

There is little vegetation at the Noro landing site (Figure 4-22). The proposed landing site consists mostly of beach morning glory, vines and grasses. Further inland is a swamp and the vegetation consists mostly of native swamp plants. During the site visit several marine organisms were found during the low tide. These included; star fish, beach-der-mer, shell fish and the like.

![Figure 4-22 – Typical vegetation around Noro](image)
4.3.9 Terrestrial Protected Areas
There are 17 reported potential terrestrial protected areas in the Solomon Islands and these are summarised below and detailed in Appendix D:

- Four areas in the Western province;
- Three in Choiseul Province;
- Three in Isabel Province;
- Two in Guadalcanal Province;
- Two in Makira Province;
- Two in Malaita Province; and
- One in Temotu Province.

4.4 Natural Hazards

4.4.1 Geological Hazards
A summary of relevant geological information for the three cable routes and landing sites is outlined below:

- Volcanoes are located at proximity to the proposed international route from PPC1 to Honiara. These are located on Mborukua Island and also Kavachi Submarine Volcano.
- Honiara is located on Guadalcanal Island. The landing sites will be on alluvium soils. Volcanoes have been identified on the Northern end of the island. The cable will be at a safe distance away from these volcanoes.
- On the proposed route from Honiara to Noro, there exists at least one volcano on the island of Savo.
- Noro is located on the New Georgia Islands which has a number of active volcanoes scattered around the island. Based on the geological maps, the geology of the island comprises mainly of volcanic rock such as Andesite. Limestone raised reefs are located offshore of the landing site at Noro. In the interest of protecting the submarine cable from abrasion it is best to minimise the reef areas where the cable may be placed and/or ensure appropriate armouring for both the protection of the cable and the reef substrate.
- The proposed route from Honiara to Auki does not appear to traverse near any extreme geological features; however the proposed route does pass through Sealark Channel.
- Auki is located on Malaita Island and the landing point is surrounded by shallow rocky reefs. Malaita Island comprises of Micocene Sediments. No volcanoes have been identified on this island.

Volcanoes
The volcanoes of the Solomon Islands form a NW-SW trending island chain continuing along to the Bougainvilla Island chain (which forms part of Papua New Guinea) as seen in Figure 4-23. The islands belong to a volcanic arc caused by the subduction of the oceanic crust of the small Solomon Plate under the Pacific Plate. New Georgia Sound constitutes the junction between the New Georgia-Kolombangara-Vella Recent volcanic province and the older Choiseul Cretaceous-Early Tertiary basaltic platform. The
main observed faulting is NW-SE\textsuperscript{22}. It is understood that this area is tectonically complex, marked by the interaction of several closely spaced oceanic microplates separated by subduction zones and short spreading centres, such as one extending from SE New Guinea to Kavachi volcano\textsuperscript{23}. The volcanoes in the vicinity of the Solomon Islands are listed in the table below and shown in Figure 4-24.

It is understood that four volcanoes in the Solomon Islands have been active in recent history. They are Savo, Kavachi, Cook and Tinakula. Kavachi is a submarine volcano which erupts frequently. Cook is also a submarine volcano however there are doubts of its level of activeness. Both Savo and Tinakula are island volcanoes that have erupted frequently in recent history and have been responsible for considerable damage to surrounding areas of the islands resulting in high death tolls.

\textbf{Figure 4-23 – Volcanoes in the Solomon Islands}

\textsuperscript{22} SOPAC Final Report – CST Area - SOPACMAPS
\textsuperscript{23} http://www.volcanodiscovery.com/solomon-islands.html
Table 4-2 – List of Volcanoes around the Solomon Islands (refer to Figure 4-23 for proximity to cable routes)

<table>
<thead>
<tr>
<th>Name of Volcano</th>
<th>Type of Volcano / Current Status</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonda</td>
<td>Stratovolcano - Dormant</td>
<td>Solomon Islands, -7.67°S / 156.6°E</td>
</tr>
<tr>
<td>Kolombangara</td>
<td>Stratovolcano - Dormant</td>
<td>Western Province, Solomon Islands, -7.95°S / 157.08°E</td>
</tr>
<tr>
<td>Cook</td>
<td>Submarine volcano – Dormant (Last eruption 1991)</td>
<td>Western Province, Solomon Islands, -8.25°S / 157.06°E</td>
</tr>
<tr>
<td>Simbo</td>
<td>Stratovolcano – Dormant (Last eruption ~1910)</td>
<td>Simbo Island, Solomon Islands, -8.28°S / 156.52°E</td>
</tr>
<tr>
<td>Kana Keoki</td>
<td>Submarine volcano – Dormant</td>
<td>Western Province, Solomon Islands, -8.75°S / 157.03°E</td>
</tr>
<tr>
<td>Coleman Seamount</td>
<td>Submarine volcano - Dormant</td>
<td>Western Province, Solomon Islands, -8.83°S / 157.17°E</td>
</tr>
<tr>
<td>unnamed</td>
<td>Submarine volcano - Dormant</td>
<td>Western Province, Solomon Islands, -8.92°S / 158.03°E</td>
</tr>
<tr>
<td>Savo</td>
<td>Stratovolcano - Dormant</td>
<td>Central Province, Solomon Islands, -9.13°S / 159.82°E</td>
</tr>
<tr>
<td>Gallego</td>
<td>Volcanic field - Dormant</td>
<td>Guadalcanal Province, Solomon islands, -9.35°S / 159.73°E</td>
</tr>
</tbody>
</table>

Adjacent to the proposed routes volcanoes have been overlayed on the cable route map (Figure 4-23).
Earthquakes

Owing to its location in the Pacific Ocean, the Solomon Islands are subject to earthquakes and tsunamis. It is understood that seismic activity in the Solomon Islands is generally due to the underthrusting of the Solomon Sea Plate beneath the north western islands of the Solomons, however the tectonic system is complex and the distribution and intensity of earthquakes is varied.

The most recent and devastating earthquake was the 2007 earthquake that took place on 2 April 2007. Its magnitude was calculated by the United States Geological Survey (USGS) as being at 8.1 on the moment magnitude scale. The tsunami that followed the earthquake killed 52 people and resulted in extensive damage to the natural environment. According to the USGS, the focus was 10 km deep and 40 km South South-East of Gizo township on New Georgia Islands. There were numerous aftershocks, the largest of which had a magnitude of 6.2.  

Local earthquakes in the coastal zone may directly result in the subsidence or uplift of the shore zone and adjacent terrestrial and marine areas. Subsidence of this nature has been observed at locations such as Noro.

Tsunami

Tsunamis are caused by vertical displacement of seabed fault lines during earthquakes, or by other processes such as a volcanic eruption, volcanic collapse or submarine landslide. Tsunami-generating earthquakes tend to be shallow and of relatively-large magnitude (i.e. greater than Richter Magnitude 7), hence the occurrence of a large, shallow earthquake located beneath the ocean will more often than not produce a tsunami, providing there is vertical offset of the sea floor. Currently, the Pacific Tsunami Warning Centre in Hawaii provides tsunami warning advice for the Pacific Island Countries, including the Solomon Islands.

24 http://volcano.si.edu/world/region.cfm?rnum=05
It is understood that the tsunamis experienced in the Solomon Islands originate from earthquakes occurring in the following locations:

- locally;
- elsewhere in the Solomon Sea (near Bougainville); or
- other parts of the Pacific Rim.

Most of the tsunamis recorded in the past have been generated by submarine earthquakes. The damage and impacts from tsunamis to the coastal zone in the areas of interest have not been well documented, with the exception of the 2007 tsunami associated with the earthquake that occurred on 2 April 2007.

4.4.2 Climatic Hazards

Tropical Cyclones

Solomon Islands lies in the area prone to tropical cyclones. A number of tropical low pressure systems occur each year over the Solomon Islands at times when the equatorial trough is in the vicinity; however few of these develop into tropical cyclones. Average frequency of cyclone occurrence is between one and two per year, tending to increase southward as illustrated in Figure 4-25 to Figure 4-27. Figure 4-25 has been generated based on 36 years of data from 1969 to 2005.

Tropical cyclone season in the Solomon Islands is generally considered to extend from November to April. However, there have been cyclones such as Cyclone Namu and Cyclone Ida that have occurred in mid-May, 1986 and late May-early June 1972.26

In addition, tropical cyclones will naturally result in abnormally high ocean tides which may rise up to 3-6 m above the regular tide. This is due to the pooling of sea water by the frictional effect of very strong winds persistently gusting on shore as the cyclone approaches a shallow coastline. This can result in inundation of low lying coastal plains which in turn impacts on beach profile change/seasonal beach oscillation (at some areas as much as 0.5-1 m in beach elevation and 5-10 m in beach width).

Figure 4-25 – Map showing Average Annual Number of Tropical Cyclones for Australia and the Pacific Region

Tropical Cyclone Information for the Australian Region

Figure 4-26 – Tropical Cyclone Tracks from 1986 – 2006 for the Pacific Region

Figure 4-27 – Historical Cyclone Tracks for the Solomon Islands (Note: Location of the four original proposed cable landing sites)29

Sea Level Rise

Historical rates of local sea-level change in the Pacific region are variable and dependent on both local and regional factors. In addition changes in sea level can also be associated with non-climatic change processes such as:

- movements in tectonic regimes; and
- "abnormal" conditions associated with El Nino/Southern Oscillation (ENSO) events (such events have occurred in 1972, 1977/78, 1982/83, 1987, and a recent prolonged moderate event from 1990-1994);

The South Pacific Sea Level and Climate Monitoring Project is an initiative to establish a regional network to monitor the sea level and the possible impact of climate change. The project was developed by the Australia Government in response to concerns raised by the member countries of the South Pacific Forum on the potential impacts of the enhanced greenhouse effect on climate and sea levels in the region. Monitoring stations in the Pacific have only recently been setup and hence the available records cover 10-20 years of data only. The sea level rise predictions gathered during the literature review indicate various and ranging records of both increasing and decelerating sea level rise.

29 www.met.gov.sb
4.4.3 Sharks and Crocodiles

Sharks and crocodiles are found throughout the Solomon Islands and sightings/attacks are common. Sightings of saltwater crocodiles are common in the Western Province, especially in parts of Noro and Munda. A recent crocodile attack was recorded in May 2012, within the Noro-Munda area in Western Province where a boy was killed by a crocodile whilst in his canoe. In Auki, the lake located in the vicinity of the cable route, is crocodile habitat however there are no records of crocodile attacks to date.

In regards to shark bites, sharks have been known to attack submarine cables as they seem to be attracted by low frequency vibration from the power fed cable. Research indicates that sharks confuse the electrical cable with natural prey therefore triggering instinctive response. Sharks are usually found in the depth range from the surface to 2,500 m water depth.
5. Assessment of Potential Environmental Impacts

5.1 General
This Section outlines the potential environmental impacts of the project to the physical environment, biological environment and additional environmental impacts for the following stages of the project:

- Pre-construction – desktop study, marine route survey, detailed design;
- During construction – cable laying activities from the existing cable stations, along the land based routes, through the beach/intertidal zone and offshore; and
- Post-construction- during operation of the cable and any maintenance that may be required.

The influence of natural hazards and geological features on the project has also been assessed.

Please note that as part of this scope of works, a social impact assessment (SIA) and resettlement plan (RP) were also prepared covering the two main phases of the project – the construction phase and the operations phase. Social impacts were identified and described for both these phases of the project. A summary only is included in this IEE in Section 6.

5.2 Physical Environment

5.2.1 Bathymetry
The placement and maintenance of the cable will not in any way affect bathymetry (water depths) for any of the proposed cable routes.

Bathymetry may restrict the method of cable placement especially in shallow near shore areas. This will need to be considered during subsequent stages of the project i.e. detailed design phase.

5.2.2 Substrate – Offshore and Innershore
During consultation with the broader project team, there was mention that seismic survey and extraction of sediment cores will be undertaken during the marine survey. This survey will provide information relating to seabed sediments and associated morphology along the proposed cable routes in the offshore zone. A similar measure may also be required for the inner shore coastal zone in order to understand the sediment types and morphology at each of the landing sites.

This data gap will be addressed during the pre-construction phase in the marine route survey, and any potential impacts identified will be mitigated during detailed design.

5.2.3 Wave Climate, Tides and Currents
Placement and maintenance of the cable will not affect the wave climate, tides and currents for any of the proposed cable routes.

Wave climate has the potential to be a constraint during construction. Prevailing wave conditions, especially near the shore, may be too rough for construction activities (placement and maintenance). Depending on their magnitude, currents have the potential to affect cable laying operations and expose
buried cables. Where a cable is exposed to currents, forces could act on the cable possibly causing it to move and disturb the seabed and/or abrade the protective armouring.

This will be assessed and addressed during the pre-construction phase in the desktop study and marine route survey and any potential impacts identified will be mitigated during detailed design.

### 5.2.4 Coastal Zone Processes

Placement and maintenance of the cable will not affect the coastal zone processes at any of the proposed cable landing sites.

Impacts from coastal processes predominantly occur in the active portion of the coastal zone which extends from the upper beach profile out to the active zone limit. The upper beach profile is subject to waves and storm surge. At the active zone limit, mobilisation of sediment from tide, current and wave energy dissipates. Determination of preferred cable laying method and the depth of installation will need to consider the impacts of the active coastal zone in order to minimise the risk of the cable being exposed during operation. In addition, impacts of coastal erosion and storm surge will need to be understood to determine the location of the beach manholes at each site, in order to avoid inundation and undermining.

This data gap will be addressed during the pre-construction phase in the desktop study and marine route survey, and any potential impacts will be mitigated during detailed design.

### 5.2.5 Offshore Cultural Heritage

The proposed cable routes have been selected with the intention of avoiding all shipwrecks and aeroplane wrecks. However, there is a lack of information surrounding the exact locations of these wrecks. Accordingly, it is possible that the proposed cable routes may intersect wreck sites.

Appropriate mitigation measures are proposed in the EMP in order to avoid impacts to the aeroplane and ship wrecks.

### 5.2.6 Geology of Hydrothermal Vents and Seamounts

Geologically, the placement and maintenance of the cable will not affect hydrothermal vents and seamounts geologically for any of the proposed routes.

Consideration may be required to ensure that the cable routes are at an appropriate distance from these geological features during both cable laying and cable operations. This will be addressed during the pre-construction phase in the desktop study and marine route survey, and any potential impacts will be mitigated during detailed design.

### 5.3 Biological Environment

#### 5.3.1 Ecology of Hydrothermal Vents and Seamounts

The proposed development will only have an impact on ecological communities at hydrothermal vents and seamounts if the cable is laid upon active vent sites in its route. If the cable is placed on seamounts, there will likely be some minimal and short-term effects on the biological communities along this placement.
Appropriate mitigation measures are proposed in the EMP in order to avoid these potential impacts.

5.3.2 Marine Protected Areas and Community Managed Areas
There are no known Marine Protected Areas or Community Managed Areas within the project area of influence.

5.3.3 Threatened and Protected Species
It is unlikely that the proposed development will have an impact on threatened and protected species. Nevertheless, appropriate monitoring and mitigation measures will be required during the marine route survey and cable lay activities to ensure that the proposed works do not have an impact on threatened and protected species.

Monitoring and mitigation measures are proposed in the EMP in order to avoid potential impacts.

5.3.4 Reefs
Reefs have been recorded along several of the cable routes and adjacent to the project area influence at Noro, Auki and Honiara. The proposed construction methods will likely have a minimal short-term impact on the reefs at these sites. Damage to reef benthos may be due to the use of articulated pipe and pinning of the cable where it is laid on reef. It is expected that this will occur only along a very small footprint over which the cable is laid. Impacts of cables being laid on reefs are minimal and of short nature as reefs readily recolonise on and over the cable once in place.

This will be addressed during the pre-construction phase in the desktop study and marine route survey, and any potential impacts will be mitigated during detailed design.

5.3.5 Seagrass Meadows
There are no records of seagrasses in the project area of influence. In the event that the marine route survey identifies seagrass beds along the proposed route appropriate mitigation measures will need to be implemented during the detailed design phase.

5.3.6 Mangroves
There are no mangroves in the vicinity of the project influence area.

5.3.7 Lagoons and Estuaries
There is one lagoon located within the vicinity of the cable route at Auki. Measures will need to be implemented to minimise any impacts during construction. No additional lagoons or estuaries have been recorded in the vicinity of the project area.

5.3.8 Innershore and Beach Ecology
In the event that the cable placement occurs via ploughing or jetting, minor resuspension of sediment and disturbance to the benthos could occur. It is expected that benthos will be expected to recover in less than 2 months and the resuspension of sediment will be rapidly diluted and dispersed by ocean currents.
The proposed development is likely to have minimal impact on beach ecology. This is expected to be of a short term nature and localised. It is not considered a significant environmental impact. Appropriate mitigation measures will need to be devised during the detailed design phase.

5.3.9 Terrestrial Protected Areas
There are no known Terrestrial Protected Areas within the project area of influence.

5.4 Natural Hazards
There is potential for project activities to influence and be influenced by the natural hazards that occur in the Solomon Islands.

5.4.1 Geological Hazards
During the preparation of the desktop study, details of geological features/processes (magnitudes and potential extent of damage) should be considered. These factors may influence the survey and cable placement method. Considerations as to how these geological features/processes could impact cable installation or operation of the cables will need to be assessed in subsequent stages of the project (i.e. detailed design phase).

The placement and maintenance of the cable will not in any way affect the geological features/processes (volcanoes, earthquakes and tsunamis) for any of the land and/or marine environments proposed routes.

5.4.2 Climatic Hazards
The high wave energy and wave run-up resulting from a cyclone and its associated storm surge can cause coastal damage and erosion of shorelines. The influence of cyclone damage and changes in sea level on beach profile, will need to be considered during the detailed design phase for each of the cable landing site and associated installation methods at the sites. This is most important for Honiara, Henderson and Auki, as these beaches are considered unconsolidated and therefore subject to erosion.

Project activities, such as the placement and maintenance of the cable, will not in any way affect the climatic processes (tropical cyclones and sea level rise).

5.4.3 Sharks and Crocodiles
Sharks have been known to attack submarine cables as they seem to be attracted by low frequency vibration from the power fed cable. The placement and maintenance of the cable need to consider the risks associated with potential shark bite of the cable during the pre-construction phase.

Precautionary measures will need to be considered when working in areas where crocodile sightings are common in order to manage the risk of crocodile attacks on humans.

5.5 Additional Potential Impacts

5.5.1 Workforce Impacts
Potential workforce impacts have been assessed in the SIA and RP as part of the overall scope of works.
SOCC anticipates a workforce of 10-15 workers will be required at each site. The majority of the workforce will be sourced locally, with an additional two to three specialists or supervisors sourced from Honiara for the sites at Noro and Auki. These specialists will be temporarily accommodated in Noro and Auki during parts of the construction period. It is anticipated that there will be no workforce related environmental impacts generated by the project. The project has the potential to generate limited local employment during construction.

At the time of the SIA and RP it was considered that there was neither potential for risk of spread of communicable diseases nor potential for conflict associated with this project and therefore was not considered an issue.

Once built, the cables will require little or no maintenance, and therefore no ongoing operational workforce impacts are anticipated.

5.5.2 Noise and Dust

As mentioned in the SIA, cable construction will be achieved manually with little use of heavy machinery. This means that the project will only generate intermittent noise, which will quickly dissipate into the ambient noise. It is predicted that during construction there will be temporary noise and dust impacts to residents along the cable routes and the church users at the Honiara site. There are no noise standards in Solomon Islands to be applied to the Project.
6. Environmental Management Plan

6.1 General

The Environmental Management Plan (EMP) contains a number of components crucial to effective management within the project, and these include:

- institutional assessment to undertake the impact assessment
- grievance management procedure
- recommendations for mitigating, monitoring and managing potential impacts – both those identified in this IEE and those identified in the SIA;
- monitoring and reporting mechanisms; and
- conclusions.

Please note that during the preparation of this version of the IEE, several details of the project as a whole are yet to be determined. These include:

Confirmation of cable installation methods. This will need to be determined at a latter stage of the project, and environmental impacts outlined herein confirmed and/or revised prior to construction by a suitably qualified environmental representative. This will be the responsibility of SOCC.

Roles and responsibilities for each stage of the project and associated existing environmental capacity. This will be the responsibility of SOCC and will be determined at a latter stage of the project. In particular, it will be necessary to have an appropriate environmental representative involved in the construction phase of the project to ensure compliance with recommendations made in this IEE and EMP.

6.2 Institutional Assessment to Undertake Impact Management

This section briefly outlines the institutional framework responsible for executing the environmental monitoring, mitigation and management strategies. It is envisaged that the following organisations will be primarily involved in ensuring that the project complies with ADB’s social safeguards by way of implementing the mitigation measures suggested in this report:

- Ministry of Finance and Treasury in the Solomon Islands;
- The Solomon Oceanic Cable Company; and
- Telecommunications Commission of the Solomon Islands (TCSI).

However, it is understood that the overall responsibility of the IEE and associated EMP (i.e. this Section) will lie with SOCC.

6.2.1 Ministry of Finance and Treasury

The MoFT will be the chief executing agency of the Project. It will be responsible for the overall supervision and co-ordination of the project.
6.2.2 Solomon Oceanic Cable Company

The overall responsibility of developing and implementing the environmental management plan will rest with SOCC and will include overseeing that environmental considerations are addressed in the pre-construction, construction and operation phases. In order to fulfil these responsibilities SOCC will have to undertake the following tasks:

- Prior to project implementation/construction SOCC will engage legal services to seek legal advice on the appropriate legislations;
- Prior to construction, SOCC will ensure that environmental considerations (addressing data gaps and implementing mitigation measures where possible prior to construction) are implemented during the pre-construction phase (i.e. during desktop study, marine route survey and detailed design);
- Supervise the construction contractor and ensure that environmental considerations as outlined in the EMP as undertaken; and
- Implement the grievance management procedure.

6.2.3 Telecommunications Commission of the Solomon Islands

The role of Telecommunications Commission of the Solomon Islands (TCSI) is to regulate the telecommunications sector in the Solomon Islands, allow competition in the sector, which will result in availability of diverse and affordable services.

6.3 Grievance Management Procedure

Details of the Grievance Management Procedure as outlined in the SIA, have been included below for completeness, and are to be adopted where relevant in addressing any potential environmental impacts.

6.3.1 For Land Access

The Project Resettlement Plan (RP) describes the inclusion of an independent third party in land access negotiations to provide for an independent advisor to land owners. Should land owners not be satisfied that SOCC is progressing with fair and reasonable intentions, it will be the independent parties role to represent the land owners interests in identifying and/or raising this as an issue with SOCC and seeking resolution.

The Land and Titles Act does not include grievance redress mechanisms for negotiated agreements (be they transfers, leases or easements) where these are not under the auspices of the Commissioner of Lands. However the Telecommunications Act requires service providers to advise land owners as to how they can access impartial legal advice, with this advisory service pre-empting a grievance redress requirement, as the negotiation is not underpinned by default compulsory acquisition.

6.3.2 During Construction

During the construction and to a lesser extent, operation of the project it is possible that people may have concerns with the project’s environmental performance. Given the nature of this project it is likely that concerns may arise more during construction than during operations phase of the project. In order to capture and address these concerns the grievance management procedure will allow affected persons to register their complaints and provide the project an opportunity to resolve them.
The grievance management procedure places ultimate responsibility for grievance resolution with SOCC, however on site complaints can be directly addressed by the Construction Site Supervisor.

If the complaint is straightforward then the site supervisor will resolve the complaint immediately. If the complaint is complicated and outside the control of the site supervisor, it will then be referred to the SOCC Manager or equivalent of that in Auki, Noro or Honiara who will then have two days to resolve the complaint and communicate the outcome to the affected person.

If the affected person is not satisfied with the complaint resolution, they may be able to take the complaint to the SOCC Head Office or the Telecommunications Commission of the Solomon Islands. If the affected person is dissatisfied with the outcome, they may appeal to the National Court, which will initially be at their own cost.

All complaints arriving are to be documented in a register that will be maintained at the local SOCC Office or equivalent of that. Details of the complaint should be recorded by date, name, contact address and reason for the complaint. A duplicate copy of the entry will be given to the affected person for their record at the time of registering the complaint and another copy of the complaint to be attached to SOCC’s monthly report.

Complaints are to be responded to within the first 24 hours and then further updated if required to be provided every two days, until the complaint is resolved. Complaints resolution will be free of charge to the affected person. The complaints register will show a record of who has been directed to deal with the complaint and the outcome of the complaint. The register will also record other details such as the date and time when the action was commissioned, complaint was resolved, when and how the affected person was informed of the decision. The register is then signed off by the person who is responsible for the decision and dated. The register is to be kept at the front desk of the SOCC Offices or equal of that near the project sites and is a public document.

6.3.3 During Operation

Very few complaints are expected to arise during operations. It is anticipated that complaints during operations will be mainly about cable vandalism, unlikely incidences where anchors or fishing gear might be caught in the cable and potential environmental impacts during cable maintenance works.

During this phase complaints will be directed to SOCC, who will follow the same complaints resolution procedure.

6.4 Consultation, Participation, Disclosure and Negotiation

6.4.1 Activities to Date

During the project in May and June 2012, project consultants met with representatives of Solomon Islands Ministries and Provincial Government at Honiara, Noro and Auki in order to discuss the main issues of the project and the potential environmental and social impacts with appropriate representatives of all relevant stakeholders. All Ministries and Provincial Governments were supportive of the project (refer Appendix B for list of stakeholders consulted for the IEE).

In addition, during May and June 2012, project consultants met with identified landowners and users to better understand them and their relationship to the land. The consultations also sought to inform them of the project and ascertain their attitudes to the proposals.
Consultations with potentially affected landowners have commenced, initiated by STL under the auspices of SOCC. STL has contacted land owners in Honiara, Noro and Auki, and consulted with local Land Officers and government officials.

Importantly, these consultations and investigations included informal gardeners in Noro, who, as a consequence of project rerouting will no longer be impacted by the project. Subsequently, STL has advised these gardeners and the provincial government that they will no longer need to relocate their gardens as a result of the project.

6.4.2 Further Consultation

Whilst preliminary discussions have been initiated in Auki and Honiara, future consultations will focus on detailed notification and negotiation. The notification process will differ between private and customary land, as guided by the Land and Titles Act and Telecommunications Act. In advance of notification, SOCC will formally identify land owners and verify their ownership (existing legal title, or valid basis for claiming an interest).

Notification

Official notifications will be provided to land owners outlining the nature of the project and the land access requirements relevant to their land parcels. The notification will indicate the nature of the agreement sought, the timeline for the project and the agreement, that the notification represents the date for cut-off of eligibility for any compensation, and the proposed process for negotiation. The notification will also advise owners of their entitlement to, and suggestions for accessing impartial legal advice, explain the process for negotiation, and seek commencement of the negotiation process. At Notification, relevant information from the RP will be provided to land owners, adjacent communities (in the case of Auki) and relevant local government officials.

In the case of private land, this notification will be provided to registered land owners. In the case of customary land, the notification must be issued to all members of the group, and also made known to local members of the community. The notification will include advertisement of a public meeting and set this as the date for raising any claims relevant to the site. A public meeting will be held, and all issues raised will be recorded. The validity of any claims to the land must be established. In the case of Auki, the formerly contested claims over the subject land have been resolved through the Malaita Local Court in 1989, as would not currently be considered valid. If no petitions are raised, then the negotiation process will be commenced.

Process for negotiation

The timing and nature of negotiations will vary between sites; however they will be conducted adhering to the following principles:

- Adequate time and information will be provided to land owners to prepare for negotiations;
- Negotiations will be entered into in good faith;\(^{30}\);
- Due consideration will be given to all land owner requests; and
- No party to the negotiation will be forced to arrive at an outcome.

\(^{30}\) Good faith negotiation is a joint exploration of key outstanding issues with the main intention to mutually resolve those issues. Operationally, good faith negotiation will have the following elements: (i) a willingness to engage in a reasonably extended process and be available to meet at reasonable times and frequency; (ii) provision of information necessary for informed negotiation; (iii) exploration of key issues of importance; (iv) use of mutually acceptable procedures for the negotiation; (v) willingness to change initial positions and modify offers, where possible; and (vi) allowance for provision of sufficient time for decision-making.
SOCC will be responsible for the availability of two key elements of the negotiation process to ensure fairness:

- Entitlement of land owners to get relevant information and seek impartial legal advice at the expense of the project; and
- Engagement by the project of a third party to validate the fairness of the negotiation process.

Records of all negotiations activities will be prepared by SOCC. Terms of Reference for the role of Third Party Validator is provided in Error! Reference source not found. in the RP. The Third Party Validator’s report will be submitted to MoFT and ADB for approval before implementation of agreements and entry to land.

These two approaches will be adopted to counter the otherwise asymmetrical relationship between the two negotiating parties, where SOCC is likely to otherwise have greater access to information, services, advice and experience. These approaches provide the opportunity for land owners to avail services to counter this imbalance.

6.4.3 Disclosure of the RP

The RP will be endorsed by EA/IA, disclosed to APs and stakeholders, and posted on ADB website in July 2012 before the project’s appraisal. The RP will be made available in English in accessible public locations. SOCC will also arrange to interpret and explain the key provisions of the RP in local language as needed. Brochures summarising the RP in English and Pidgin are provided in Appendix C.

6.5 Environmental Management Plan

6.5.1 Environmental Impact Assessment and associated Mitigation and Management Recommendations

This section describes the mitigation and management measures recommended in this IEE. Table 6.1 summarises the environmental management recommendations based on the environmental assessment set out in Section 5. The recommendations are grouped under the headings physical environment, biological environment and natural hazards as they have been assessed in this report and relate to the phases of the project- pre-construction, construction and operation.

It is important to note that during the course of this IEE, data and information gathered has given light to gaps in the data that will be required for the detailed design phase of the project and are required to complete the environmental assessment. Accordingly, these are outlined in Table 6.2 for completeness with recommendations made for subsequent stages of the project.

PHYSICAL ENVIRONMENT

Offshore Cultural Heritage

During the marine route survey, any wrecks and unexploded ordnance will be identified. In the event that the proposed cable routes traverse over wrecks, the cable route should be modified, based on the results of the survey in order to avoid laying cable through, over or immediately adjacent to any wrecks. If required, a qualified maritime archaeologist should review the findings of the marine geophysical survey and assist the marine geophysicists to choose a suitable cable route that will avoid identified cultural material. The archaeologist will also assess the impact of the finalised route on the cultural significance of the submerged heritage sites.
If, during cable laying operations, a wreck is encountered, measures should be undertaken to lay the cable around the wreck, where possible. If a wreck is disturbed, measures will need to be undertaken to minimise the impacts, inform the appropriate authorities, keep records of the impact and notify a qualified maritime archaeologist, where required.

BIOLOGICAL ENVIRONMENT

Threatened and Protected Species

By implementing the following monitoring and mitigation measures during the marine route survey and cable lay operations, the proposed development is highly unlikely to have an impact on these threatened and protected species:

- vessel crews should keep watch when laying cable in areas where there are possible occurrences of dolphins, whales, turtles and dugongs. Any citations should be reported including date and location, identification and description; and
- should there be any sightings of any of the marine mammals in the vicinity of the work area, the vessel will execute measures to avoid collisions or disturbances.

Reefs

Preference is for cables to not be laid across reefs, however where it is not possible to avoid reefs (e.g. immediately offshore of landing sites), the impact of laying cable is understood to be short-term and localised, and historically coral environments readily recolonise. It is proposed that articulated pipe be used and the pipe be pinned to the reef to both protect the cable across reef areas and to minimise the impact of the cable moving and causing abrasion to the reef. If additional reefs are identified along the route it is suggested that the route be altered, where possible to avoid them. This will be determined during the pre-construction phase in which the desktop study and marine route survey is undertaken.

Lagoons and Estuaries

Any activities located within the vicinity of the lagoon at Auki will need to minimise runoff and associated water quality issues resulting from sediment disturbances during cable laying.

Terrestrial Areas

The following mitigation measure is recommended to manage potential impacts associated with terrestrial areas:

- minimise runoff and associated water quality issues resulting from sediment disturbances during cable laying, trenching and construction of the beach man hole.
- all sediment that is disturbed during the trenching process will be restored as trenches are backfilled.
- Avoid clearing of vegetation.

NATURAL HAZARDS

Sharks and Crocodiles

The following mitigation and monitoring measures should be implemented during construction:

- vessel crews and hired workers should keep watch when laying cable in areas where there are possible occurrences of crocodiles. Any citations should be reported including date and location, identification and description;
in regards to cable protection from possible shark bite it is recommended that appropriate cable armouring protection be considered during the design phase to a water depth of 2,500 m.
Table 6-1 – Summary of EMP Actions Required to Mitigate or Manage Potential Environmental Impacts

<table>
<thead>
<tr>
<th>Project Timing of Potential Impact</th>
<th>Environmental Consideration</th>
<th>Type of Impact (either environmental, cable or both)</th>
<th>Issue</th>
<th>Suggested Measure for Mitigation or Management</th>
<th>Project Timing to Implement Mitigation or Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Environment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore cable lay</td>
<td>Wrecks and Unexploded Ordnance (UXOs)</td>
<td>Potential impact on the environment (ship wrecks and aeroplane wrecks) and cable (UXOs)</td>
<td>Cable approach to the Honiara landing through the Savo Sound, also known as the Iron Bottom Sound, contains numerous shipwrecks and aeroplane wrecks and associated UXOs, however the exact locations of these are unknown.</td>
<td>During marine route survey, any wrecks and UXOs will be identified. In the event that the proposed cable routes traverse over wrecks, the cable route should be modified, based on the results of the survey. If required, a qualified maritime archaeologist should review findings of the marine geophysical survey and assist marine geophysicists to choose a suitable cable route that will avoid identified cultural material as much as possible, and assess the impact of the finalised route on the cultural significance of the underwater cultural heritage. If, during cable laying operations, a wreck is encountered, measures should be undertaken to lay the cable around the wreck, where possible. If a wreck is disturbed, measures will need to be undertaken to minimise the impacts, inform the appropriate authorities, keep records of the impact and notify a qualified maritime archaeologist, where required.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design) and Construction</td>
</tr>
<tr>
<td><strong>Biological Environment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Land based cable lay             | Terrestrial areas           | Potential impact on the environment                | Laying of the cable (various construction methodologies) at all sites has the potential to minimally impact flora and fauna in terrestrial areas. | The following mitigation measures should be adopted where necessary:  
  - minimise runoff and associated water quality issues resulting from sediment disturbances during cable laying, trenching and construction of the beach man hole.  
  - all sediment that is disturbed during the trenching process will be restored as trenches are backfilled.  
  - avoid clearing of vegetation. | Pre-construction (desktop study, marine route survey and detailed design) and Construction. Monitoring plan (if required) to be prepared as part of EMP update – based on outcomes during the desktop study, marine route survey |
<table>
<thead>
<tr>
<th>Project Timing of Potential Impact</th>
<th>Environmental Consideration</th>
<th>Type of Impact (either environmental, cable or both)</th>
<th>Issue</th>
<th>Suggested Measure for Mitigation or Management</th>
<th>Project Timing to Implement Mitigation or Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innershore cable lay</td>
<td>Reefs</td>
<td>Potential impact on the environment</td>
<td>Reefs have been identified around the project area of influence at Noro, Auki and Honiara. There are rocky reef flats at Noro and Honiara and a shallow fringing reef at Auki. Proposed construction methods will have a minimal short-term impact on the reefs at these sites. It is proposed in the inner shore areas/landing sites where reef is known to exist, that articulated pipe be used and the pipe be pinned to the reef to both protect the cable across reef areas and to minimise the impact of the cable moving and causing abrasion to the reef. Where additional reefs are identified it is suggested that if feasible reefs are to be avoided and the route altered.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design)</td>
<td></td>
</tr>
<tr>
<td>Offshore cable lay</td>
<td>Threatened and Protected Species (Whales, dolphins, turtles, dugongs)</td>
<td>Potential impact on the environment</td>
<td>There is potential during the marine route survey and cable lay operations for disturbance to whales, dolphins, turtles and dugongs, in particular for whales during migration season. Care should be taken during cable laying as there is a small risk of collision and/or entanglement. Preparation of a plan to minimise disturbance to whales, dolphins, turtles and dugongs may be appropriate.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design) and Construction.</td>
<td></td>
</tr>
<tr>
<td>Land based cable lay</td>
<td>Lagoons and Estuaries</td>
<td>Potential impact on the environment</td>
<td>Laying of the cable (various construction methodologies) adjacent to the lagoon at Auki has the potential to minimally impact this environment if not managed appropriately. Any activities located within the vicinity of the lagoon at Auki will need to minimise runoff and associated water quality issues resulting from sediment disturbances during cable laying.</td>
<td>Pre-construction (detailed design) and Construction</td>
<td></td>
</tr>
</tbody>
</table>

Natural Hazards

<p>| Innershore / intertidal cable lay | Crocodiles | Potential impact on the cable | Sightings of saltwater crocodiles are common in the Western Province, Safety measures should be put in place in areas where crocodile sightings are common and there | Pre-construction (desktop study, |</p>
<table>
<thead>
<tr>
<th>Project Timing of Potential Impact</th>
<th>Environmental Consideration</th>
<th>Type of Impact (either environmental, cable or both)</th>
<th>Issue</th>
<th>Suggested Measure for Mitigation or Management</th>
<th>Project Timing to Implement Mitigation or Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Shark bite</td>
<td>Potential impact on the cable</td>
<td>Sharks have been known to attack submarine cables as they seem to be attracted by low frequency vibration from the power fed cable up to a water depth of 2,500 m.</td>
<td>Appropriate cable armouring protection may need to be considered during the design phase to a water depth of 2,500 m to minimize this risk.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design), Construction and Operation</td>
</tr>
</tbody>
</table>

especially in parts of Noro and Munda. Crocodile attacks have been recorded. is the potential for work to be undertaken in these areas in order to minimize risk. marine route survey and detailed design) and Construction Emergency response plan to be prepared as part of EMP update prior to Construction. This will be the responsibility of SOCC to prepare.
Table 6-2 – Outline of Data Gaps Required to be Addressed in Order to Mitigate Against Potential Environmental Impacts

<table>
<thead>
<tr>
<th>Project Timing of Potential Impact</th>
<th>Environmental Consideration</th>
<th>Type of Impact (either environmental, cable or both)</th>
<th>Issue</th>
<th>Suggested Action to Address Data Gaps and any associated Mitigation Measures (if required)</th>
<th>Project Timing to Address Data Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Environment</td>
<td></td>
<td>Physical Environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Substrate</td>
<td>Currently, the extent of data and information available on substrate (seabed sediments and morphology) of the proposed cable routes is not sufficient. This includes offshore areas where geological features such as hydrothermal vents, seamounts and reefs are present and the inner shore/beach landings.</td>
<td>Further investigations (as part of the marine route survey and extraction of sediment cores) are to be conducted along the proposed routes to confirm bathymetry, seabed sediment types, morphology, location of geological features for both the offshore areas and inner shore/beach landings. This will mitigate the threat that geological features pose to the cable prior to cable lay.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Currents</td>
<td>Presently, the extent of data and information available on currents in the vicinity of the proposed cable routes is not extensive. Currents pose potential threat to cable laying construction and cables during operation (currents have the potential to expose buried cables causing it to move and possibly catch/abrade on geological features causing impacts to the substrate/ecological environment and/or damage the cable).</td>
<td>Further investigations (as part of the desk top study and marine route survey) to minimise the risks associated with currents may be required to confirm current magnitudes in the vicinity of the cable routes. Note this issue could be addressed during detailed design instead.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coastal Erosion and Storm Surge</td>
<td>Coastal erosion is already evident at several of the landing sites for this project. Anecdotal information and a couple of reports were available to qualitatively describe the rate or erosion and impact from storm surge at the sites. However there is a lack of basic information that impedes the carrying out of any detailed coastline erosion assessment, storm bite prediction, quantitative analysis of flooding and inundation risk all of which can impact the cable and the beach man hole during operation.</td>
<td>Further investigations (as part of the desk top study and marine route survey) to minimise risk may be required to confirm extent of coastal erosion and storm surge at the beach landings. Note this issue (coastline erosion assessment, storm bite prediction, quantitative analysis of flooding and inundation risk) also could be addressed during detailed design.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design)</td>
</tr>
<tr>
<td>Biological Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Timing of Potential Impact</td>
<td>Environmental Consideration</td>
<td>Type of Impact (either environmental, cable or both)</td>
<td>Issue</td>
<td>Suggested Action to Address Data Gaps and any associated Mitigation Measures (if required)</td>
<td>Project Timing to Address Data Gaps</td>
</tr>
<tr>
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<td>-----------------------------</td>
<td>------------------------------------------------------</td>
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<td>------------------------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Cable lay</td>
<td>Seagrass meadows</td>
<td>Potential impact on the environment</td>
<td>Currently, the extent of data and information available on seagrass meadows along the proposed cable routes is unknown.</td>
<td>Further investigations (as part of the marine route survey) are to be conducted along the proposed routes and will confirm extent of any seagrass meadows in the project area of influence. In the event that seagrass meadows are identified in the project area of influence where feasible seagrass meadows are to be avoided.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design)</td>
</tr>
<tr>
<td>Cable lay and Operation</td>
<td>Hydrothermal vents and seamounts</td>
<td>Potential impact of the environment</td>
<td>Currently, the extent of data and information available on hydrothermal vents and seamounts and their associated ecological environments along the proposed cable routes is not extensive; however there is general consensus that these environments are ecologically sensitive.</td>
<td>Further investigations (as part of the desk top study and the marine route survey) are to be conducted along the proposed routes and will confirm extent of any hydrothermal vents and seamounts in the project area of influence. In the event that hydrothermal vents and seamounts are identified in the project area of influence the cable route should be altered in order to be at an appropriate distance from these ecological features.</td>
<td>Pre-construction (desktop study, marine route survey and detailed design)</td>
</tr>
</tbody>
</table>

**Natural Hazards**

| Cable lay and Operation           | Geological hazards (volcanoes, earthquakes, tsunamis) | Possible impact of the cable | Risk to construction activities and cable operation may stem from natural hazardous events. The proposed cable routes traverse tectonically active areas and the project area of influence includes active volcanoes. | Further investigations (as part of the desk top study and marine route survey) to minimise risks associated with geological hazards may be required to confirm location and historical trends in the vicinity of the cable routes. Note this issue could be addressed during detailed design instead. | Pre-construction (desktop study, marine route survey and detailed design) |

| Cable lay and Operation           | Climatic hazards (tropical cyclones, sea level rise) | Possible impact of the cable | Risk to construction activities and cable operation may stem from natural hazardous events. The Solomon Islands lies in an area prone to tropical cyclones including formation of tropical cyclones and are low-lying, therefore prone to impacts of sea level rise. | Further investigations (as part of the desk top study) to minimise risks associated with climatic hazards may be required to understand the potential impacts including those on operation of the cables along the beach landings. Note this issue could be addressed during detailed design instead. | Pre-construction (desktop study, marine route survey and detailed design) |
6.5.2 Summary from Social Impact Assessment, associated Mitigation, Monitoring and Management Recommendations and SIA Consultation Plan

Tables 6.2 and 6.3 presented below presents the summary of the mitigation measures and categorises them into the key strategies.

Table 6-3 – Summary of Social Impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>Project Timing</th>
<th>Impact Rating</th>
<th>Status of Impact</th>
<th>Impacted Site and Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Access Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary inconvenience for church users</td>
<td>Construction</td>
<td>Low</td>
<td>Negative</td>
<td>Honiara - Private property owners, church users</td>
</tr>
<tr>
<td>Temporary inconvenience for road users</td>
<td>Construction</td>
<td>Low</td>
<td>Negative</td>
<td>Honiara Henderson - Road users</td>
</tr>
<tr>
<td>Proposed cable duct along private road on Customary land</td>
<td>Project Planning</td>
<td>Medium</td>
<td>Neutral</td>
<td>Auki - Customary owners</td>
</tr>
<tr>
<td>Three other claimant groups dispute the customary ownership of the land, which pose a risk to the project</td>
<td>Project Planning</td>
<td>Medium</td>
<td>Negative</td>
<td>Auki - Project, other unregistered claimants</td>
</tr>
<tr>
<td><strong>Workforce Impacts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential to generate local employment in Noro, Auki and Honiara</td>
<td>Construction</td>
<td>Low</td>
<td>Positive</td>
<td>Honiara, Auki and Noro - Local Communities</td>
</tr>
<tr>
<td><strong>Traffic Safety and Access Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible temporary disruption to church access and parking due to construction of cable ducts is proposed</td>
<td>Construction</td>
<td>Low</td>
<td>Negative</td>
<td>Honiara - Church users and private property owners</td>
</tr>
<tr>
<td>Temporary disruption to local traffic along the road where construction of cable ducts is proposed</td>
<td>Construction</td>
<td>Low</td>
<td>Negative</td>
<td>Honiara Henderson, Auki and Noro - Local Communities</td>
</tr>
<tr>
<td>Temporary disruption to RAMSI depot traffic in Honiara Henderson</td>
<td>Construction</td>
<td>Low</td>
<td>Negative</td>
<td>Honiara Henderson - RAMSI Depot</td>
</tr>
<tr>
<td><strong>Noise and Dust Issues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The project will generate temporary noise and dust</td>
<td>Construction</td>
<td>Low</td>
<td>Negative</td>
<td>Honiara, Auki and Noro - Local Communities and church users and private property owners</td>
</tr>
<tr>
<td><strong>Impacts on Commercial Fishing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary disruption to commercial fishing vessels during survey and cable laying</td>
<td>Construction</td>
<td>Low</td>
<td>Negative</td>
<td>All project area - Commercial Fisheries</td>
</tr>
<tr>
<td>Possibility of fishing gear being</td>
<td>Operations</td>
<td>High</td>
<td>Negative</td>
<td>All project area - SOCC</td>
</tr>
</tbody>
</table>
### Impacts on Subsistence Fishing

Possible temporary disruption to subsistence fishers during cable laying  
**Construction** | **Low** | **Negative**  | Honiara, Auki and Noro - Local Fisheries

### Impacts on ADB Safeguards - Involuntary Resettlements

- **Anticipated negotiation for land access agreement with private property owners the Church of Melanesia Trust Board in Honiara and Pacific SEG Corporation in Henderson**  
  **Construction** | **Low** | **Negative**  | Honiara - Private property owners and church users
- **Anticipated land access negotiation with customary owners in Auki for proposed cable duct along private road on Customary land**  
  **Project Planning** | **Medium** | **Neutral**  | Auki - Customary owners

### Impacts on ADB Safeguards - Indigenous People

No impacts on indigenous people  

### Impacts on ADB Safeguards - Gender Issues

No impacts on gender issues

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**Table 6-4 – Summary of Impacts, Mitigation Measures and Corresponding Key Management Strategies**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Impacted Sites</th>
<th>Suggested Mitigation Measures</th>
<th>Key Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Access Issues</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary inconvenience for church users</td>
<td>Honiara</td>
<td>Seek legal advice for all land access negotiations. Further land access consultations and negotiations will need to be conducted with the Church of Melanesia Trust Board to determine appropriate access to the private property, and consult with the Church Trust and provide adequate information about the construction activities so that the church users can be informed of any changes to access or parking in the church premises.</td>
<td>RP Stakeholder Consultation Plan</td>
</tr>
<tr>
<td>Temporary inconvenience for road users</td>
<td>Honiara Henderson</td>
<td>Land access consultations and negotiations will need to be conducted with the property owners, the Pacific SEG Corporation Limited to determine appropriate access to the property. These negotiations will be held in accordance with the RP developed.</td>
<td>RP Stakeholder Consultation Plan</td>
</tr>
</tbody>
</table>
### Impact

<table>
<thead>
<tr>
<th>Impact</th>
<th>Impacted Sites</th>
<th>Suggested Mitigation Measures</th>
<th>Key Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>for this Project; and Further consultations should be held with the road users particularly RAMSI, Honiara Baptist Church Academy, Don Bosco Technical School and the residents prior to construction to inform them of the construction activities and determine the best ways to manage traffic and access needs of the road users.</td>
<td></td>
<td>RP Stakeholder Consultation Plan</td>
<td></td>
</tr>
<tr>
<td>Proposed cable duct along private road on Customary land legally registered in single ownership</td>
<td>Auki</td>
<td>The Project will have to engage in further consultations and land access negotiations (including compensation negotiation) with the customary owners - Mr Jonathan Malai who is the leader of the Aisisiki group; and Further consultations should be held with the road users particularly RAMSI, Honiara Baptist Church Academy, Don Bosco Technical School and the residents prior to construction to inform them of the construction activities and determine the best ways to manage traffic and access needs of the road users.</td>
<td>RP Stakeholder Consultation Plan</td>
</tr>
<tr>
<td>Three other claimant groups dispute the customary ownership of the land, which pose a risk to the project</td>
<td>Auki</td>
<td>To avoid excluding the other three (unrecognized) claimants of the land called the GST group, it is recommended that separate consultations and information sessions are held with them. This will help to minimize group conflicts therefore minimize the risk to the project.</td>
<td>Stakeholder Consultation Plan</td>
</tr>
</tbody>
</table>

### Workforce Impacts

<table>
<thead>
<tr>
<th>Workforce Impacts</th>
<th>Impact Sites</th>
<th>Suggested Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential to generate local employment in Noro, Auki and Honiara</td>
<td>Convey project conditions to the construction contractor of maximizing local employment</td>
<td>Stakeholder Consultation Plan</td>
</tr>
</tbody>
</table>

### Traffic Safety and Access Issues

<table>
<thead>
<tr>
<th>Traffic Safety and Access Issues</th>
<th>Impact Sites</th>
<th>Suggested Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible temporary disruption to church access and parking due to construction of cable ducts is proposed</td>
<td>Honiara</td>
<td>Consult with the Church Trust to determine the best possible cable route to minimize disruption to church users, inform/provide notifications to the church about project construction activities, Since the church is mainly used on a Sunday and for morning and evening services on week days, avoid any construction activities on Sunday ad early morning or evenings when the services are running; Consult with property owner and regular road users in particular the residents and the two schools and RAMSI depot in Honiara Henderson to determine best possible access and traffic management during construction; Provide signs, notifications and other appropriate safety features to road users to inform them of changed traffic conditions and indicate construction works are running;</td>
</tr>
<tr>
<td>Temporary disruption to local traffic along the road where construction of cable ducts is proposed</td>
<td>Honiara Henderson, Auki and Noro</td>
<td>EMP Stakeholder Consultation Plan</td>
</tr>
<tr>
<td>Temporary disruption to RAMSI depot traffic in Honiara Henderson</td>
<td>Honiara Henderson</td>
<td>EMP Stakeholder Consultation Plan</td>
</tr>
<tr>
<td>Impact</td>
<td>Impacted Sites</td>
<td>Suggested Mitigation Measures</td>
</tr>
<tr>
<td>------------------------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td><strong>Impacted Sites</strong></td>
<td><strong>Suggested Mitigation Measures</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>being undertaken;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inform local communities through notifications and key informants about dates of project construction activities; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide safe access across the work sites for all road users.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Noise and Dust Issues</strong></td>
</tr>
<tr>
<td>The project will generate temporary noise and dust</td>
<td>Honiara, Auki and Noro</td>
<td>Limit construction activities from Monday to Saturday. No construction activities will be undertaken on Sunday to minimize impacts on church users at the Honiara Site; Limit construction activities to day time, all construction activities to be prohibited from 7pm to 6am; Any noise generating machinery to be maintained in good working order; and If any noise and dust related complaints arise they will be to be dealt with as per the grievance procedure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Impacts on Commercial Fishing</strong></td>
</tr>
<tr>
<td>Temporary disruption to commercial fishing vessels during survey and cable laying</td>
<td>All project area</td>
<td>It is suggested that additional consultations are held by the Project planning team with the Department of Fisheries, Maritime Operations Officer in Honiara, Harbor Masters’ for Honiara, Noro and Auki to provide them with project specific information such as dates of the survey work and cable laying, so that they can further convey notifications to commercial fishing vessels and other vessels expected in the vicinity at the time</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Impacts on Subsistence Fishing</strong></td>
</tr>
<tr>
<td>Possible temporary disruption to subsistence fishers during cable laying</td>
<td>Honiara, Auki and Noro</td>
<td>Inform Department of Fisheries with the intention that they will further provide notifications and advice local subsistence fisheries about the dates of project construction activities and measures to avoid fishing in the project footprint for the duration of construction; and Inform local communities through notifications and key informants</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Stakeholder Consultation Plan</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>EMP Stakeholder Consultation Plan Grievance Management Procedure</td>
</tr>
</tbody>
</table>
Table 6-5 presents a consolidated consultation plan for managing potential social impacts and to comply with ADB requirement of meaningful consultations through the project implementation and operations phases.

**Table 6-5 – SIA Consultation Plan**

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Stakeholders to be Consulted</th>
<th>Purpose of Consultations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to construction</td>
<td>Community at proposed project sites – Honiara, Henderson, Noro and Auki (including the GST group in Auki)</td>
<td>Create general awareness about the project, disseminate project information and engage with community for confirmation and further identification and management of social impacts</td>
</tr>
<tr>
<td>Prior to construction</td>
<td>Land owners of proposed project sites – private property owners in Honiara, Henderson and customary land owners in Auki</td>
<td>Initiation of land access process, land access negotiations to arrive at an agreement as per the project RP</td>
</tr>
<tr>
<td>Prior to construction</td>
<td>Department of Fisheries, maritime office, provincial governments of Gadacanal, Malaita and Western Province and local governments of Honiara, Noro and Auki</td>
<td>To generate awareness about the project, its potential social impacts, timing of project construction, discussing required co-operation from the agencies and providing notifications within their jurisdictions</td>
</tr>
<tr>
<td>Prior to construction</td>
<td>Construction contractor</td>
<td>To inform project terms and conditions about maximising local workforce at each site, minimising impacts around noise, dust, traffic and access and safety and their role in grievance redress.</td>
</tr>
<tr>
<td>During construction</td>
<td>Land owners at project sites, local community around project sites</td>
<td>Maintain contact to inform any changes to project construction program or any</td>
</tr>
</tbody>
</table>
### 6.6 Monitoring and Reporting Mechanisms

To address ADB’s safeguard requirements SOCC will be responsible for environmental management and monitoring through the pre-construction, construction and operations phases of the project. This will also include supervision and monitoring of its sub-contractors and ensuring compliance with the EMP.

Monthly progress reporting by SOCC to its Board of Directors will record compliance and shortfalls with the environmental management strategies. These progress reports will be consolidated and submitted to ADB on a monthly basis during project planning and construction phases and on an annual basis during the operations phase.

Monitoring and reporting of environmental safeguards will also occur through the third party involvement and their reporting mechanisms which will be established through their Terms of Reference.

### 6.7 Equator Principles

As mentioned earlier in Section 1.2, this IEE also addresses the relevant Equator Principles. Those principles addressed are outlined below:

- **Principle 1:** Review and Categorisation (ADB’s Safeguard Policy Statement);
- **Principle 2:** Social and Environmental Impact Assessment (this report and associated documents);
- **Principle 3:** Applicable Social and Environmental Standards (assessed in accordance with ADB’s Safeguard Policy Statement);
- **Principle 4:** Action Plan and Management System (Section 6 of this report);
- **Principle 5:** Consultation and Disclosure (this report and associated documents); and
- **Principle 6:** Grievance Mechanism (this report and associated documents).

At this stage, based on the findings of the IEE the project would be classified as a Category B under the Equator Principles. Please note though that data gaps have been identified in this IEE which need to be addressed during the additional desktop study, marine route survey and detailed design phases of the project. Based on the outcomes of these phases, the Category for the project would be confirmed.

Principles 7-10 (Principle 7: Independent Review; Principle 8: Covenants; Principle 9: Independent Monitoring and Reporting; Principle 10: EPFI Reporting) will be undertaken in subsequent stages of the project and will be the responsibility of SOCC. At the time of completing this IEE, consultation with SOCC indicated that the likely process for these remaining Equator Principles would be as follows:
• Principle 7: Independent Review – SOCC will engage a third party to undertake this task.
• Principle 8: Covenants – SOCC will ensure compliance with this Principle and this could likely be verified during the Independent Review.
• Principle 9: Independent Monitoring and Reporting – SOCC will engage an appropriately qualified specialist to undertake independent monitoring and reporting at the completion of cable installation.
• Principle 10: EPFI Reporting – SOCC will ensure the EPFI reporting is undertaken based on the review, monitoring and reporting outlined in previous Principles.

6.8 Conclusions and Recommendations
The IEE has assessed the potential environmental impacts of this project from a physical, ecological and natural hazards perspective and has concluded that potential impacts are relatively minor in nature. Impacts are able to be monitored, mitigated or managed through the implementation of strategies at the three stages of the project – pre-construction, construction and operation. Recommendations for monitoring, mitigation and management of these impacts are presented in the EMP above. The EMP will be updated based on outcomes in the desktop study, marine route survey and detailed design. This will be the responsibility of SOCC.

The IEE has also identified numerous data gaps. It is envisaged that these issues will be addressed in the proceeding stages of the project, such as the desktop study, marine route survey and detailed design prior to construction.
Appendix A

Terms of Reference

As issued by the ADB
Appendix B

List of Stakeholders Consulted for the IEE
<table>
<thead>
<tr>
<th>Date of Consultation</th>
<th>Person Consulted</th>
<th>Organisation</th>
<th>Contact Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.05.2012</td>
<td>Robin Russell</td>
<td>CEO, SOCC</td>
<td>7495922</td>
</tr>
<tr>
<td>09.05.2012</td>
<td>John Standingford</td>
<td>Socio-Economic and Poverty Specialist for the Project</td>
<td>7645888</td>
</tr>
<tr>
<td>09.05.2012</td>
<td>George Ngaingeri</td>
<td>Head of Operations, Solomons Telekom, Honiara</td>
<td>7494005</td>
</tr>
<tr>
<td>09.05.2012 and 17.05.2012 and 14.06.2012</td>
<td>Harry Waitara</td>
<td>Ministry of Lands, Housing and Survey, Honiara</td>
<td>7471320</td>
</tr>
<tr>
<td>09.05.2012</td>
<td>Nester Maelanda</td>
<td>Ministry of Lands, Housing and Survey, Honiara</td>
<td>7613552</td>
</tr>
<tr>
<td>10.05.2012</td>
<td>Edward Honiwala</td>
<td>Deputy Director Offshore Fisheries, Ministry of Fisheries, Honiara</td>
<td>7428098</td>
</tr>
<tr>
<td>10.05.2012</td>
<td>John Misitee</td>
<td>Ministry of Rural Development and Indigenous Development</td>
<td>7475435</td>
</tr>
<tr>
<td>11.05.2012</td>
<td>David Riapitu Mamupio</td>
<td>Office of Special Duties, Western Province Government, Noro</td>
<td>7466485</td>
</tr>
<tr>
<td>11.05.2012</td>
<td>Steven Kwalemanu</td>
<td>Noro Lands Officer</td>
<td>-</td>
</tr>
<tr>
<td>11.05.2012</td>
<td>Drelly Lianga</td>
<td>Officer Incharge, Solomon Telekom, Noro</td>
<td>7470015</td>
</tr>
<tr>
<td>11.05.2012</td>
<td>Chris Sade</td>
<td>Harbour Master, Noro</td>
<td>-</td>
</tr>
<tr>
<td>14.05.2012</td>
<td>Mike Salaga</td>
<td>Solomon Telekom Manager, Auki</td>
<td>-</td>
</tr>
<tr>
<td>14.05.2012 and 15.06.2012</td>
<td>Jonathan Malai</td>
<td>Aisisiki Group Leader and Landowner Auki Site</td>
<td>7484851</td>
</tr>
<tr>
<td>14.05.2012</td>
<td>Augustine Falionica</td>
<td>Provincial Secretary, Malaita Provincial Government, Noro</td>
<td>-</td>
</tr>
<tr>
<td>14.05.2012</td>
<td>Alick Maealag</td>
<td>Deputy Premier, Malaita Provincial Government, Noro</td>
<td>-</td>
</tr>
<tr>
<td>14.05.2012</td>
<td>Jimmy Namoriu</td>
<td>Minister of Education, Noro</td>
<td>-</td>
</tr>
<tr>
<td>14.05.2012</td>
<td>Fuiramo Ganita</td>
<td>Physical Planner, Auki</td>
<td>-</td>
</tr>
<tr>
<td>15.05.2012</td>
<td>Douglas Billy</td>
<td>Geologist, Ministry of Mines (Geology)</td>
<td>-</td>
</tr>
<tr>
<td>Date of Consultation</td>
<td>Person Consulted</td>
<td>Organisation</td>
<td>Contact Phone Number</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>15.05.2012</td>
<td>David Hiriasia</td>
<td>Director of Meteorology</td>
<td>-</td>
</tr>
<tr>
<td>15.05.2012</td>
<td>Capt. Brian Aonima</td>
<td>Maritime Operations Officer, Honiara</td>
<td>7559162</td>
</tr>
<tr>
<td>15.05.2012</td>
<td>Scott Mcnamara</td>
<td>Ausaid, Honiara</td>
<td>-</td>
</tr>
<tr>
<td>15.05.2012</td>
<td>Jonathan Tafariiki</td>
<td>Natural Disaster Council of Solomon Islands</td>
<td>-</td>
</tr>
<tr>
<td>16.05.2012</td>
<td>Harry Rini</td>
<td>Deputy Director Policy Planning, Ministry of Infrastructure Development, Honiara</td>
<td>7475559</td>
</tr>
<tr>
<td>16.05.2012</td>
<td>Varonica Wale</td>
<td>Honiara City Council, Honiara</td>
<td>8666424</td>
</tr>
<tr>
<td>16.05.2012 and 14.06.2012</td>
<td>Bernard Hill</td>
<td>Commissioner, Telecommunications Commission of the Solomon Islands, Honiara</td>
<td>7496906</td>
</tr>
<tr>
<td>Throughout project</td>
<td>John Hibbard, Robin Russell, Hugh McGarry, Brett Worrall, Robin Webb, Hans van Rijn, Nogendra Sapkota, Jean Williams</td>
<td>PPTA Team including Hibbard Consulting, SOCC, ADB</td>
<td>-</td>
</tr>
</tbody>
</table>
Appendix C

Summary of International Treaties and Agreements
<table>
<thead>
<tr>
<th>Convention/Treaty</th>
<th>Status</th>
<th>Purpose/Aim</th>
<th>Agency Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regional Multi-Lateral Agreements</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollution Protocol for Dumping</td>
<td>Ratified 10/9/98</td>
<td>Prevention of pollution of the South Pacific region by dumping</td>
<td>Marine Div/ECD</td>
</tr>
<tr>
<td>Natural Resources &amp; Environment of South Pacific Region (SPREP Convention)</td>
<td>Ratified 10/9/98</td>
<td>Protection of natural resources and environment; management and development of the marine and coastal environment in the South Pacific Region.</td>
<td>ECD</td>
</tr>
<tr>
<td>Waigani Convention on Hazardous &amp; Radioactive Wastes 1995</td>
<td>Ratified 7/10/1998</td>
<td>Bans the importation of hazardous and radioactive wastes into FICs and to control the trans-boundary movement and management of hazardous wastes within the South Pacific.</td>
<td>ECD</td>
</tr>
<tr>
<td><strong>Chemicals, Wastes and Pollution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liability for Oil Pollution Damage</td>
<td>Ratified</td>
<td>Strict liability of ship owner for pollution damage to a coastal state within a certain amount.</td>
<td>Marine Div</td>
</tr>
<tr>
<td>Marine Pollution Convention (London)</td>
<td>Ratified</td>
<td>Prevention of marine pollution by dumping of wastes and other matter.</td>
<td>ECD/Foreign Affairs</td>
</tr>
<tr>
<td><strong>Biodiversity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convention on Biological Diversity (UNCBD)</td>
<td>Ratified 3/10/1995</td>
<td>Conserve biological diversity through the sustainable use of its components and the fair and equitable sharing of the benefits arising out of utilising genetic resources.</td>
<td>ECD Project: National Capacity Self-Assessment (NCSA); National Biodiversity Strategy and Action Plan (NBSAP); International Waters Program (IWP); 3rd National Report</td>
</tr>
</tbody>
</table>
Appendix D

Terrestrial Protected Areas
<table>
<thead>
<tr>
<th>Province</th>
<th>Potential protected areas</th>
<th>Size</th>
<th>Details of biodiversity (Flora and Fauna)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Western</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marovo lagoon</td>
<td>70000ha</td>
<td></td>
<td>Lowland forest, small island and barrier island forest, mangrove forest, montane forest and heaths.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>52 species of land and fresh water birds were recorded and 9 species are endemic to the lagoon. 10 species of Sea and shorebirds.</td>
</tr>
<tr>
<td>Kolombangara</td>
<td>All forest above 460m.</td>
<td>12 principle species of forest trees. Moss covered montane forest caps.(Less, 1990)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The island is 70000ha</td>
<td></td>
<td>Richest avifauna with 80 species recoded. 2 species are confined to montane forest and are unique to the island. (Less, 1990)</td>
</tr>
<tr>
<td>Rendova</td>
<td>The island is 40000ha</td>
<td></td>
<td>Common Montane forest trees species are Casuarina papuana, lower altitude forest predominance of Canicosperma brevipelotolatum, Others include mosses, palms, pometia pinnata, pterocarpus indicus. (Less, 1990)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Support unique white eye species Zosterops rendova. Crocodiles are evident in lakes and lagoon. Two species of frogs have been recorded from Rendova (Less, 1990)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Best nesting sites for turtles. Presence of Skink Triblonotus ponceleti known from only tree specimen, two from Shorthlands and one from Bouganville (Less, 1990).</td>
</tr>
<tr>
<td>Choiseul</td>
<td>Mt Maetambe</td>
<td>22500ha</td>
<td>Dominate tree species akwa and Vasa. These two trees and Laelae are characteristics of valley bottoms, on ridge crest Eugenia spp, buni and kaumau Calophyllum spp are common. (Less, 1990)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Seven spp of frogs, one endemic spp. Two rare butterfly spp. Presence of three giant rats, two of which are new record. 26 bird species. 6 are endemic spp. (Less, 1990)</td>
</tr>
<tr>
<td>South Choiseul</td>
<td>30000ha</td>
<td></td>
<td>Different forest composition from Ysabel and Guadacanal growing on ultra-basic rock. Forest is species poor with an open canopy and straggling emergent trees over dense undergrowth of pandanus, gingers, ferns and climbers. Mangrove forest found Ologholata in the north of the proposed reserve.(Less, 1990)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crocodiles are evident. Has significant nesting beach for turtles. Forest growing on ultra-basic rock noticeably has low bird numbers. 35 bird spp, 11 spp are endemic. (Less, 1990)</td>
</tr>
<tr>
<td>Province</td>
<td>Potential protected areas</td>
<td>Size</td>
<td>Details of biodiversity (Flora and Fauna)</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------</td>
<td>-------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Mt Televodo</td>
<td></td>
<td></td>
<td>The features are closely similar to the description given for the limestone forest cover occurring in Mt Maetabe (Less, 1990)</td>
</tr>
<tr>
<td>Isabel</td>
<td>North Western Ysabel</td>
<td>120000ha</td>
<td>Peninsula dominated with kekete (Campnosperma brevipetiolata) indicating exposed to prevailing high winds and cyclones. Akwa, vasa, andoa, lu usi are also found on ridges that run through the peninsula. Where slopes are fa alo, bamboo, gingers and Macaranga spp. Akwa is common in lowland forest. Smaller trees include Agaia spp, ai aasila Neoscortchhinia forbesii, laelae, Myristica sp, palms and pandanus. Patches of beach forest containing 5 species of trees (Less, 1990)</td>
</tr>
<tr>
<td>Mt Kubonitu</td>
<td></td>
<td></td>
<td>Crocodiles were evident. It contains 65% of nesting sites of green and hawksbill turtles. Sea eagles, Brahminy kite, osprey and terns are also evident. Migratory birds use the islands and tidal flats as resting and feeding area during November to January eg whimbrel Numenius phaeopus (Less, 1990)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Province</th>
<th>Potential protected areas</th>
<th>Size</th>
<th>Flora</th>
<th>Fauna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casuarina swape</td>
<td></td>
<td>2500ha</td>
<td>Dominated with hardy malasalu Casuarina papuana and Dacrydium xanthadrum. On swapy grounds Calophyllum vexans, bou Fagrea gracilipes and gwarogwaro Calophyllum vitiense. Ferns and Savanna (Less, 1990)</td>
<td></td>
</tr>
<tr>
<td>Guadalcanal</td>
<td>Lauvi lake</td>
<td>200ha</td>
<td>Floating meadows include three species eg Cyperaceae. Extensive areas of pandanus. Beach side dominated with fu'u Barringtonia asiatica. Other species are also common in the community eg Hibiscus tiliaeus. Thus, there are also many other species growing around the areas (Less, 1990)</td>
<td>Outstanding habitat for crocodiles. Wetland birds and around the lake was the Australian dabchick which was a new record for the Solomon islands. About 40 bird spp are found, 9 are endemic spp in the Solomon islands (Less, 1990).</td>
</tr>
<tr>
<td>Province</td>
<td>Potential protected areas</td>
<td>Size</td>
<td>Details of biodiversity (Flora and Fauna)</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------</td>
<td>----------</td>
<td>------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Malaita</td>
<td>Central Malaita highlands</td>
<td>12500ha</td>
<td>Common in the lowland forests are 4 spp of trees eg akwa rosswood and vasa. On lower riverine terraces 3 species are also common eg lamilami, liki and akwa (Less, 1990). 57 bird spp are recorded, 9 endemic to Solomon islands, 13 endemic to Malaita (Less, 1990).</td>
<td></td>
</tr>
<tr>
<td>Malaita</td>
<td>Maramasike</td>
<td>15000ha</td>
<td>Large figs and 11 tree species eg akwa are common at Excellent habitat for crocodiles. About 60 bird spp are recorded, 7</td>
<td></td>
</tr>
<tr>
<td>Makira</td>
<td>Central Makira Bauro highlands</td>
<td>35000ha</td>
<td>Akwa dominate lowland forest and lower hill slopes. 8 spp of trees are also common in the zone eg Rosswood. Above the zone where akwa is predominant 6 spp of trees are common eg abalolo. Common small trees are Myrtica spp and aisubu Pimeliodendron amboinicum. Above 700m 5 spp of trees are common eg aitootoo (surukakahu) Weinmannia blumei, Cyathea tree ferns and palms are also common. At highest altitude montane forest is found with 8 different spp of trees. Forest floor is covered with moss (Less, 1990). Several of Makira’s endemic spp are restricted to the mossy cloud forest of the highest ridges eg Keea (Makira mountain tail), waisure (Makira ground trash), ghoghoharighi (shade warbler) and the dusky fantail are found in these forest and nowhere else in the world. 49 Birds recorded, 5 endemic to Solomon and 5 endemic to Makira (Less, 1990).</td>
<td></td>
</tr>
<tr>
<td>Western wetlands</td>
<td></td>
<td>2500ha</td>
<td>A tall mixed swamp forest featuring dafa Terminalia brassii and rufa Eugenia tierneyana on wet land edges. In the wetted parts of the swamps pandanus, bamboo and ferns form a complete cover one to three meters high (Less, 1990).</td>
<td></td>
</tr>
<tr>
<td>Are'are</td>
<td>The hill forest behind both Maramasike and Are'are commonly features 7 of the species mentioned above together with 5 other spp e.g. Cryptocarya spp (Less, 1990).</td>
<td>Are'are is endemic to Solomon islands and 10 endemic to Malaita (Less, 1990).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temotu Kauri reserve</td>
<td>200ha</td>
<td>Kauri Agathis macrophylla in the Solomon islands is found only in Temotu Province (Less, 1990).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E

List of Marine Protected Areas
## MPA's for the country **Solomon Islands**

<table>
<thead>
<tr>
<th>MPA Site Name</th>
<th>Designation <em>international</em></th>
<th>Designation Status</th>
<th>Date Designated</th>
<th>Total Area (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arnavon Islands</td>
<td>Marine Conservation Area</td>
<td>Designated</td>
<td>1995</td>
<td>82.70</td>
</tr>
<tr>
<td>Barasipo</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2004</td>
<td>3.533</td>
</tr>
<tr>
<td>Baraulu/Bule Lavata</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2002</td>
<td>1.032</td>
</tr>
<tr>
<td>Barivuto</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2004</td>
<td>1.622</td>
</tr>
<tr>
<td>Buni</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2004</td>
<td>1.428</td>
</tr>
<tr>
<td>Dundee</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2004</td>
<td>1.046</td>
</tr>
<tr>
<td>Ha'apai</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>1.261</td>
</tr>
<tr>
<td>Iriri Pasapasa</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2004</td>
<td>0.421</td>
</tr>
<tr>
<td>Kekehe</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2004</td>
<td>2.721</td>
</tr>
<tr>
<td>Kida</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>0.725</td>
</tr>
<tr>
<td>Kinamara</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>1.363</td>
</tr>
<tr>
<td>Kindu</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>0.764</td>
</tr>
<tr>
<td>Koqu Rua</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2005</td>
<td>0.359</td>
</tr>
<tr>
<td>Kozou</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2002</td>
<td>0.452</td>
</tr>
<tr>
<td>Lodu Hokata</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2005</td>
<td>0.335</td>
</tr>
<tr>
<td>Nazareti</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>2.120</td>
</tr>
<tr>
<td>Niumala</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2005</td>
<td>3.114</td>
</tr>
<tr>
<td>Nusa Hope Mangrove</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2005</td>
<td>0.884</td>
</tr>
<tr>
<td>Nusa Hope/Heloro</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2002</td>
<td>1.138</td>
</tr>
<tr>
<td>Nusa Roviana</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>2.017</td>
</tr>
<tr>
<td>Olive</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>1.567</td>
</tr>
<tr>
<td>Saika</td>
<td>Marine Protected Area</td>
<td>Informally designated</td>
<td>2003</td>
<td>1.602</td>
</tr>
</tbody>
</table>

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31 UNEP-WCMC & WWF. www.mpaglobal.org
Appendix F
List and Maps of Threatened and Protected Species
Globally Threatened Avifauna in Solomon Islands

<table>
<thead>
<tr>
<th>Species</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beck's Petrel <em>Pseudobulweria becki</em></td>
<td>CR</td>
</tr>
<tr>
<td>Heinroth's Shearwater <em>Puffinus heinrothi</em></td>
<td>VU</td>
</tr>
<tr>
<td>Sanford's Sea-eagle <em>Haliaeetus sanfordi</em></td>
<td>VU</td>
</tr>
<tr>
<td>Imitator Sparrowhawk <em>Accipiter imitator</em></td>
<td>VU</td>
</tr>
<tr>
<td>Makira Moorhen <em>Gallinula silvestris</em></td>
<td>CR</td>
</tr>
<tr>
<td>Bristle-thighed Curlew <em>Numenius tahitiensis</em></td>
<td>VU</td>
</tr>
<tr>
<td>Yellow-legged Pigeon <em>Columbia palliceps</em></td>
<td>VU</td>
</tr>
<tr>
<td>Santa Cruz Ground-dove <em>Gallicolumba sanctaeccruicis</em></td>
<td>EN</td>
</tr>
<tr>
<td>Chestnut-bellied Imperial-pigeon <em>Ducula breachleyi</em></td>
<td>VU</td>
</tr>
<tr>
<td>Palm Lorikeet <em>Charmosyna palmarum</em></td>
<td>VU</td>
</tr>
<tr>
<td>Fearful Owl <em>Nesasio solomonensis</em></td>
<td>VU</td>
</tr>
<tr>
<td>Black-faced Pitta <em>Pitta anerythra</em></td>
<td>VU</td>
</tr>
<tr>
<td>Malaita Fantail <em>Rhipidura malaitae</em></td>
<td>VU</td>
</tr>
<tr>
<td>Santa Cruz Shrikebill <em>Clytorhynchus sanctaeccruicis</em></td>
<td>EN</td>
</tr>
<tr>
<td>Sombre Leaf-warbler <em>Phylloscopus amoenus</em></td>
<td>VU</td>
</tr>
<tr>
<td>Ranongga White-eye <em>Zosterops splendidus</em></td>
<td>VU</td>
</tr>
<tr>
<td>Splendid White-eye <em>Zosterops luteirostris</em></td>
<td>EN</td>
</tr>
<tr>
<td>White-eyed Starling <em>Aplonis brunneicapillus</em></td>
<td>EN</td>
</tr>
<tr>
<td>Guadalcanal Thrush <em>Zoothera turipavae</em></td>
<td>VU</td>
</tr>
</tbody>
</table>

*Source: Birdlife International [www.birdlife.org](http://www.birdlife.org)*
List of Threatened Fishes for Solomon Islands

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>FishBase name</th>
<th>Threat Category</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcharhinidae</td>
<td><em>Carcharhinus longimanus</em></td>
<td>Oceanic whitetip shark</td>
<td>Vulnerable (VU)</td>
<td>native</td>
</tr>
<tr>
<td>Rhinobatidae</td>
<td><em>Glaucostegus granulatus</em></td>
<td>Granulated guitarfish</td>
<td>Vulnerable (VU)</td>
<td>native</td>
</tr>
<tr>
<td>Rhinobatidae</td>
<td><em>Glaucostegus typus</em></td>
<td>Giant shovel nose ray</td>
<td>Vulnerable (VU)</td>
<td>native</td>
</tr>
<tr>
<td>Syngnathidae</td>
<td><em>Hippocampus kuda</em></td>
<td>Spotted seahorse</td>
<td>Vulnerable (VU)</td>
<td>native</td>
</tr>
<tr>
<td>Lamnidae</td>
<td><em>Isurus oxyrinchus</em></td>
<td>Shortfin mako</td>
<td>Vulnerable (VU)</td>
<td>native</td>
</tr>
<tr>
<td>Rhincodontidae</td>
<td><em>Rhincodon typus</em></td>
<td>Whale shark</td>
<td>Vulnerable (VU)</td>
<td>native</td>
</tr>
<tr>
<td>Scombridae</td>
<td><em>Thunnus obesus</em></td>
<td>Bigeye tuna</td>
<td>Vulnerable (VU)</td>
<td>native</td>
</tr>
</tbody>
</table>
Geographic positions of marine mammal encounters in Solomon Islands.

Source: Solomon Islands Dolphin Project – Interim report SPWRC – revised June 2011