East Coast Road – Slope Stabilization Project (ECR-SSP)

Environmental and Social Impact Assessment (ESIA) Report

Prepared for Kramer Ausenco (Samoa)

by

PSES Consult

(Ver 4; updated 3rd December 2024)

Document Title: Environment and Social Impact Assessment (ESIA) Report					
Date	**Version**	**Description**	**Prepared by**	**Reviewed by**	**Authorized by**
26 July 2024	1	Draft ESIA Report	Sam Sesega	- Sarah McCarter (T&TI) - Nick Valentine (WB) - Tom Callander (WB) - LTA; PMD-MWTI	Chris Freer
20 Sept 2024	2	Updated ESIA Report	Sam Sesega	LTA/ WB	Chris Freer
26 Nov 2024	3	Updated ESIA Report	Sam Sesega	LTA/WB	Chris Freer
3 Dec 2024	4	Final ESIA Report	Sam Sesega	LTA/WB	Chris Freer

Executive summary

SCRPT and ECR-SSP objectives

The Government of Samoa is implementing the World Bank funded Samoa Climate Resilient Transport Project (SCRTP) to improve the resilience of the national transport road network. One sub-project under the SCRTP is the East Coast Road Slope Stabilization Project (ECR-SSP). The ECR-SSP's objective is to significantly reduce the current risk of landslips and rockfalls and the resulting hazards along the ECR from the village of Letogo to the village of Saoluafata through the implementation of approved rockfall protection measures. The ECR-SSP also involves drainage improvements to reduce the increasing effects of flooding due to climate change induced effects along the ECR.[11]

The Environmental and Social Impact Assessment (ESIA) Report

This Environmental and Social Impact Assessment (ESIA) report examines the potential environmental and social impacts of the ECR-SSP on the impacted bio-physical and social environments. The examination is based on the approved project design which includes (i) a widened road reserve (ii) the construction of selected rockfall protection measures (iii) improved drainage in five critical sections of the ECR and (iv) an increase in the road level by 0.44m in two road sections to 2.44m. The ESIA report includes an ESMP which summarizes sources of impacts, recommended measures for either eliminating or reducing adverse environmental and social impacts to acceptable levels and details for their effective monitoring and enforcement.

The ESIA report is based on (i) a baseline survey of the marine environment and a vegetation and avifauna survey of selected locations on the landward side, (ii) review of relevant Government planning documents and studies, census and HIES reports and several peer-reviewed published literature, and (iii) general due diligence and consultations with stakeholders including government agencies and affected communities and households.

Project Area of Influence

Five critical sections of the ECR are targeted for rockfall protection and drainage improvements along the 7.3 km stretch of the ECR from Letogo to Saoluafata. The ECR hugs the narrow coastal flat for most of the project area with the landward side comprising of a rugged terrain with steep-rising slopes frequently within a few meters of the road shoulder.

WB and Samoa Safeguards Policies

The ECR-SSP is assigned a Category B under the World Bank's Safeguards Policy WB OP/BP 4.1 (Environment assessment) requiring the preparation of an ESIA and ESMP. Category B projects have less severe impacts than Category A projects, with impacts that are normally site specific and localized, and with measures for their mitigation readily available. WB's Category B is similar to PUMA's requirements for projects assessed to 'not likely to have significant adverse impacts on the environment', and for which the corresponding safeguards instrument to support

[1] LTA (2023) ECR – Slope Stabilization Project: Terms of Reference (internal document).

a Development Consent Application is a Preliminary Environment Assessment Report (PEAR).

Project Design

Within the five road sections targeted by the Project, the approved design concentrates the construction of rockfall protection measures and drainage on a narrow corridor of about 3 – 5 m wide from the end of seal on the landward side. Within this corridor, the preferred engineering options - catch drains plus barrier fences - will be installed. Improved and or new lateral and cross drains will also be constructed. A short section of the ECR (Site 8 and Sites 28 – 31) will be raised to 2.44m to counter the predicted impact of rising sea level and wave overtopping caused by climate change induced events.

The ECR-SSP also involves the widening of the legal road reserve to varying widths as allowed by the terrain within the surveyed road reserve from Letogo to Solosolo, and to 20m (10m from the road center line each way) from Solosolo to Saoluafata. Affect the involuntary taking of about 38,813 m^2 of customary land between Laulii and Saoluafata.

Stakeholder consultation:

Three formal consultation meetings were conducted to inform affected agencies and organizations, as well as directly affected villages, the first two in July 2023 and the third in October 2024. More than simply informing stakeholders, the consultation afforded the opportunity to stakeholders to understand Government's rationale and objective(s) for the project, reviewed and commented on the preliminary project design, and to be informed about the potential impacts on themselves and their lands. The October 2024 consultation updated stakeholders on the (i) main features of the detailed project design (ii) key findings of baseline studies carried out as part of the environmental assessment, (iii) identified social and environmental impacts and measures for their mitigation (iv) land acquisition and resettlement planning requirements and the cut-off date for assessing affected crops and other non-land assets.

Informal ad hoc consultations were also conducted in the course of site assessments with local people, mostly to gather information on historical and current use of targeted sites, identify sites that may have cultural significance, and general knowledge of issues relevant to biodiversity assessment.

Main ESIA findings – existing (pre-project) environment

The existing marine environment along the ECR coastline is highly modified with its substrate composition 54% non-living and 46% living. The degradation is the result of years of accumulation of silt and organic and inorganic deposits from land-based sources, as well as damage sustained from cyclones, rising sea temperatures and other climate change-induced events.

The vegetation survey on the landward side found the flora to be similarly of a disturbed secondary nature with some regenerations further along the natural succession continuum than others, but overall relatively dense with a high percentage of vegetation cover. However, in the last two months, the vegetation within the Project's area of influence has been largely cleared by villages as part of 'beautification' preparation ahead of the Commonwealth Heads of Government Meeting (CHOGM) in October 2024.

The social environment consists of nine (9) traditional villages – two belonging to the Vaimauga East district and seven belonging to the Anoama'a West District[2] – with population settlements concentrated largely in the coastal flats between the steep slopes along the ECR. The ECR represents the main land-based connectivity to the Apia urban area[3], including direct access to, national centers for social services such as health and education, employment places, commercial activities and opportunities, and national disaster emergency and response services. Village governance is typical of traditional villages in Samoa, with the Council of Chiefs the overarching controlling authority in particular with respect to the allocation and use of communally owned land and other natural resources, and the maintenance of social harmony. Village economies are highly cash-based with household incomes essential for daily living needs including many imported food items, utilities, educational and health expenses etc, and social obligations. Home-based production of traditional food crops continues to feature prominently, mainly for home consumption but with excess production sold for extra income by many households, sometimes in makeshift stalls along the ECR targeting locals and passing motorists.

Project impacts

The ECR-SSP will directly impact the coastal/marine environment during the construction phase. Silt, sediments and debris from construction activities will be washed into the lagoon and will further aggravate an existing highly degraded environment. The volume and types of pollutants can be reduced with appropriate mitigation measures on cleared land where soil is loose and exposed, areas where contractor's machinery will be parked and areas where other construction requirements may be stored. The overall severity of construction impacts on the marine environment is assessed as moderate and can be reduced significantly with the effective implementation of proposed mitigation measures.

For the terrestrial environment, the Project's area of influence is largely cleared of vegetation but remnant tree trunks and root systems need to be grubbed and removed. The project's impact will be minor, mainly limited to soil erosion during construction. The nature of the selected engineering options (catch drains and barrier fences) for rockfall protection is such that they do not require expansive land areas therefore the width of the construction corridor will be quite narrow, varying at between 3 and 5 meters. Standard measures for minimizing and managing any erosion and proper disposal of debris and other waste will be applied. There is no threat to nearby perennial streams and or water catchment areas feeding local water supply networks.

The social impacts are similarly limited. Targeted sites where construction will occur are, with the exception of a few houses in Letogo, Laulii and Leusoalii – relatively distant from village residential areas. Thus the impact of noise, dust, erosion, waste accumulation and vibration on local communities will be limited. These nuisances will however be managed effectively to comply with the required PUMA standards to ensure safety for the public and site workers. The safety of women and children from possible exposure to sex-related abuse and violence is a valid concern and precautionary

[2] Letogo and Laulii in Vaimauga East; Leusoalii, Luatuanu'u, Solosolo, Eva, Salelesi, Fusi and Saoluafata in the Anoama'a West

[3] Accessing Apia through Falealili Street via the South Coast Road is the other alternative.

measures to prevent unauthorized access to working sites, and to eliminate casual social interactions with site workers will be implemented. Regular traffic flow will be impacted during construction, with one lane likely to be closed off thus the movement of motorists will be disrupted and slowed down. This impact is minor but can be severe if not managed effectively.

Customary land will be acquired involuntarily to widen the legal road reserve to 20m from Letogo to Saoluafata. Land to be taken, about 38,813 m^2, is owned by about 26 land owners. The existing pavement is Government-owned and the land to be acquired is measured based on a 10m corridor, nominally centered on the existing road centreline. A separate safeguards instrument – the Abbreviated Resettlement Action Plan (ARAP) - documents in detail the land taking process, identify affected landowners, and sets out the entitlement matrix and compensation packages among other details. T&T (2024) Cadastral Survey Progress Report[4] provides information on how the legal reserve was determined and acquired land surveyed. The acquired land and affected crops will be compensated in accordance with the requirements of the WB Safeguards Policy OP/BP4.12 on Involuntary Resettlement.

Land acquisition requires the identification of landowners and boundaries that are not formally surveyed. There is potential for disagreement between families sharing common boundaries which, if not properly handled, can escalate into serious disputes than can disrupt harmony and tranquility within villages, and may disrupt Project plans. Some crops and trees of value will be lost due to the Project. Therefore, the project will have minimum adverse impact on village livelihoods. On the positive side, the injection of cash from compensation payments will make a difference to low-income households.

The ESIA report contains an Environment and Social Management Plan (ESMP) that sets out details of sources and types of impacts, corresponding mitigation measures and how monitoring will be done.

Overall, the ESIA found the project impacts on the biophysical and social environments to be minor and consistent with the Category B classification assigned to the Project by WB and LTA in the initial screening. The effective implementation of the ESMP can reduce adverse impacts further.

Implementation arrangements:
The Ministry of Finance (MOF) and the Land Transport Authority (LTA) will be the executing and implementing agencies respectively. LTA will be assisted in construction supervision and monitoring by Tonkin & Taylor International in association with Kramer Ausenco (Samoa). The construction contractor will be selected through the established MOF procurement and contracting processes for Government-funded projects under the auspices of the Ministry's Tenders Board.

****

[4] Both reports are submitted separately.

Table of Contents

8

Figures:

List of Acronyms

ARAP	-	Abbreviated Resettlement Action Plan
CEHZ	-	Coastal Erosion Hazard Zone
CFHZ	-	Coastal Flood Hazard Zone
CRRS	-	Climate Resilience Road Strategy
ECR	-	East Coast Road
ECR-SSP	-	ECR Slope Stabilization Project
ESIA	-	Environmental and Social Impact Assessment
ESMF	-	Environmental and Social Management Framework
ESMP	-	Environment and Social Management Plan
GBV	-	Gender Based Violence
IR	-	Involuntary Resettlement
KASA	-	Kramer Ausenco (Samoa)
LARP	-	Land Acquisition and Resettlement Plan
LTA	-	Land Transport Authority
OP	-	Operating Procedures
OP/BP	-	Operating Policies/Bank Procedures
PMD	-	Project Management Division (LTA)
PSES	-	Pacific Social & Environment Safeguards
PUMA	-	Planning and Urban Management Agency
MNRE	-	Ministry of Natural Resources and Environment
MOF	-	Ministry of Finance
MWTI	-	Ministry of Works, Transportation and Infrastructure
SBS	-	Samoa Bureau of Statistics
SCRPT	-	Samoa Climate Resilience Transport Project
SPREP	-	Secretariat for the Pacific Regional Environment Programme
T&T	-	Tonkin and Taylor International Limited
VA	-	Vulnerability Assessment
VAC	-	Violence Against Children
WB	-	World Bank

Glossary of terms:

Construction footprint: the area of all impervious surface, including but not limited to buildings, roads and drives, parking areas, sidewalks and the area necessary for construction of prescribed improvements.

Project area of influence: The area likely to be affected by the project, including all its ancillary aspects, such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, and construction camps, as well as unplanned developments induced by the project (e.g., spontaneous settlement, logging, or shifting agriculture along access roads). The area of influence may include, for example, (a) the watershed within which the project is located; (b) any affected estuary and coastal zone; (c) off-site areas required for resettlement or compensatory tracts; (d) the airshed (e.g., where airborne pollution such as smoke or dust may enter or leave the area of influence; (e) migratory routes of humans, wildlife, or fish, particularly where they relate to public health, economic activities, or environmental conservation; and (f) areas used for livelihood activities (hunting, fishing, grazing, gathering, agriculture, etc.) or religious or ceremonial purposes of a customary nature. (WB OP4.10 definition)

Cover photos:

From top, Photos 1, 2 and 3; Fepuleai & Fepuleai, 2023;. Photo 4 (bottom) – S Sesega, Jul 2024.

SECTION 1 – BACKGROUND

1.1. Problem Definition

The East Coast Road (ECR) is the main road providing connectivity for the population of East Upolu to and from Apia. It runs close to the coastline with steep slopes and rugged terrain rising immediately on the landward side, in several places with the cliff face within a few meters from the road shoulder. The ECR is therefore highly susceptible to damage caused by landslips and rockfall[5] which endangers the lives of road users, cause damage to the road itself and ultimately disrupt the connectivity that is critical to local and national development.

Slope instability leading to rockfall events are triggered by several factors among which are prolonged periods of heavy rain and geological events including earthquakes and tremors. Frequent heavy rainfall events, floods and cyclones are predicted for Samoa[6] over the next 50 years. The risk of land slips, erosion and rockfalls along the ECR is expected to increase.

1 .2. Project Purpose and Justification

In the context of worsening climate change and the increasing threats to the country's critical economic infrastructural assets including the national transport road network, the Government is implementing the Samoa Climate Resilient Transport Project (SCRTP) to improve the resilience of the national transport road network under a funding agreement with the World Bank.

One sub-project under SCRTP is the East Coast Road Slope Stabilization Project (ECR-SSP). Its' specific objective is to significantly reduce the current risk of rockfalls and the resulting hazards along the Apia – Falefa route through the implementation of approved rockfall protection measures. The ECR-SSP also include drainage improvements to reduce the increasing effects of flooding due to climate change (LTA, 2023)[7].

The ECR SSP is one of several initiatives that is implementing a 2013 Cabinet approved plan to strengthen the climate resilience and longevity of road assets throughout the country. In late 2017 the Government adopted the Vulnerability Assessment and Climate Resilience Road Strategy (CRRS) prepared under the Pilot Program for Climate Resilience of the Strategic Climate Fund which identified the ECR among the prioritized areas in the transport sector.

1.3 Profile of project proponent

The Land Transport Authority (LTA) is the government agency responsible for planning, designing, constructing and maintaining the country's national road infrastructure. Road asset management is a core function. As well, LTA oversees road use and is accountable for registering vehicles, issuing drivers' licenses, enforcing vehicle load limits and promoting road safety.

[5] Rockfall is the abrupt movements of masses of geologic materials, such as rocks and boulders, which become detached from steep slopes or cliffs.
[6] including those by the Pacific-Australia Climate Change Science and Adaptation Planning Program (PACCAPP)
[7] LTA (2023) ECR – Slope Stabilization Project: Terms of Reference (internal document).

LTA is the implementing agency (IA) for ECR-SSP with responsibility for its day-to-day management. LTA's Project Management Division (PMD) has had experience with WB projects over the past decade, and as such, is familiar with Bank procedures and requirements. LTA may, as in the past, engage individuals and/or consulting firms to assist with meeting the technical and fiduciary requirements of projects including financial management, safeguards and procurement. LTA will also count on support for some of these activities to come from the MWTI-PMD including in financial management, safeguards, procurement, and monitoring and evaluation (M&E).

LTA's contact address is – Main Office, Vaitele; phone – 26740; fax +685 26739.

SECTION 2 – LEGAL AND POLICY FRAMEWORK

The ESIA is prepared in accordance with the laws, regulations and policies of the Government of Samoa, and the environmental and social safeguards policies of the World Bank as set out in the SCRPT Environmental and Social Management Framework (ESMF) 2017.

2.1. Applicable Laws, Regulations, and Policies of the Government of Samoa

The applicable laws, regulations and policies of the Government of Samoa are summarized below. More information on each legislation etc are in Appendix 3.

i. *Lands, Surveys and Environment Act 1989*
This Act provides for land administration and other matters relating to land, the protection of the environment and several matters relating to the conservation of wildlife and fisheries resources.

ii. *Planning and Urban Management Act 2004*
This Act establishes the Planning and Urban Management Agency (PUMA). One of the declared objectives (sect. 8) of this Act is to provide for the fair, orderly, economic and sustainable use, development and management of land including the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity. The PUM Act 2004 Part V requires developers to apply for a development consent (S. 37), and sets out conditions and requirements for the issuing of Development Consents for development proposals, one of which is an environmental assessment report (S.42) to support a Development Consent Application (DCA).

iii. *Planning and Urban Management (Environmental Impact Assessment) Regulations 2007*
The Regulation elaborates on the provisions of Section 37 of the PUM Act 2004 requiring all developments occurring in Samoa to comply with the Development Consent (DC) and permit system. This system requires the Developer to conduct an EIA, which may be in the form of either a Preliminary Environmental Assessment Report (PEAR), or a Comprehensive EIA depending on the nature and scope of the development. An Environmental Management Plan (EMP) consisting of mitigating measures is further required to help minimize or avoid adverse environmental impacts resulting from the development. The Guidelines for the development of the Assessments are also provided in the regulations. For the ECR-SSP, given the level of impacts envisaged the PEAR is the appropriate safeguards instrument. This ESIA, prepared as per the TOR, satisfies

PUMA's PEAR requirement and is accepted by PUMA to support a DC application for the Project[8].

iv. *The Taking of Land Act 1964*

The Taking of Land Act 1964 empowers the Minister of Lands to take and acquire land for "public purposes" including for roads and similar public infrastructure. It also mandates the payment of full and just compensation to affected landowners.

v. Waste Management Act 2010

The Act provides for the collection and disposal of solid wastes and the management of all wastes in Samoa, and for related purposes. This Act makes provision for the collection, management, recycling and disposal of waste in Samoa.

vi. Samoa Occupational, Health and Safety Act 2002

The Act makes provision for the safety, health and welfare of people at work in Samoa and to establish procedures for the administration of these matters. It sets out the legal framework for implementing actions to improve safety and health at the workplace.

vii. Occupational Safety and Health Regulation 2017

The Regulation elaborates on the OHS Act 2002 requiring employers to take all reasonably practicable steps to ensure the safety, health and welfare at work of employees and to provide and maintain a safe and healthy working environment including substances, systems of work and any building or public or private area in which work takes place. Employers are required to prepare and implement and approved Health and Safety Plan (HSP) and other relevant Plans to manage health and safety impacts of the works on the workers during construction.

viii. Land Transport Authority Act 2007

This Act establishes the Land Transport Authority. It defines the 'road reserve as the area along the length of a national road being 11 metres on each side of the centre points of the carriageway. It also clarifies that where a surveyed boundary of privately owned land adjoining a national road is within the 11 metre area on either side of the centre point of the carriageway, the road reserve shall extend only up to the line of that boundary." It empowers LTA to make regulations relating to national roads – including regulations necessary to (a) vary the dimensions of the road reserve … (e) to prescribe means by which disputes over the existence of road reserves, or by competing users of road reserves, may be resolved" and for purposes of compensation (section 48) – to make regulations prescribing the payment or assessment of compensation to be paid as a result of any land being acquired for the purposes of this Act.

ix. Samoa State of Environment Report, 2023

The 2023 SOE report is the fourth health check report on Samoa's natural environment. It identifies the drivers behind the changes that are happening to the natural environment. The report focuses on four thematic areas – (i) natural environment, (ii) built environment, (iii) atmosphere, climate and disasters; and (iv) environmental governance, using over 50 indicators. The state of the terrestrial, and the marine and coastal environments are a mixture of good, fair and poor. The SOE assessed the overall state for Samoa to be Fair (52%) with only 7% of the indicators in Good state. Most thematic areas were in transition with the exception of the Atmosphere, Climate and Disaster Management, where the state

[8] Email communication - Della (A-CEO PUMA)/S Sesega (author); 11 September 2024

was Poor with one indicator in Good state. Looking forward, the trends are mixed, with some improving, others not. The continuous threat to Samoa's biodiversity, especially endemic and native species, is of concern despite efforts to protect them.

x. *Pathway for the Development of Samoa FY 2021/2022 – FY 2025/2026*

This updated national strategy promotes under Key Strategic Outcome 5: Structured Public Works and Infrastructure, and Infrastructure. Key Priority Area 21: Consolidated Infrastructure Management – advocates for the efficient management of assets for public works and infrastructure development. The expected outcomes envisioned"… the safety and resilience of infrastructure and settlements, enhanced through proper planning."

xi. *Samoa Climate Change Policy 2020*

The Policy sets out Samoa's plan of action and the interventions needed across all sectors, civil society, private sector and at the community level, to build resilience to the impacts of climate change. In line with the nation's sustainable development objectives and to meet it's regional and international obligations.

xii. *PUMA Noise Standards Policy 2006 (revised 2011)*

Provides minimum national standards applicable to development consent approvals to protect citizens against excessive noise in their communities and places of residence. Protects residents from exposure to excessive noise and its effects through appropriate mitigation measures, consent conditions and responsive planning; and creates an environment where noise levels do not exceed a reasonable level.

xiii. *Codes of Environmental Practice (COEPs)*

Defines methods and/or procedures to be followed by consultants, designers and contractors for the avoidance or mitigation of adverse environmental effects that may arise out of infrastructure development projects or maintenance work. Among others, the Codes (i) establish the process and protocols for meaningful participation of stakeholders and affected communities in all aspects of development projects (COEP3); (ii) prescribes the investigation of and design procedures for earth batter slopes as well as the protective measures to be installed to minimize erosion (COEP7); and (iii) provides planning and work guidelines for earthworks activities associated with development projects, with particular regard for the need to avoid or mitigate adverse environmental impacts from such work (COEP13 Draft).

xiv. *Community Integrated Management (CIM) Plan for Vaimauga East District 2018*

xv. *Community Integrated Management Plan for Anoamaa East District 2018*

The CIM Plans for each of the Vaimauga East and Anoama'a East Districts are district level plans that prescribe measures for enhancing climate change resilience and adaptation at the district and village levels. CIM plans identify coastal hazard zones (Coastal Erosion Hazard Zone, Coastal Flooding Hazard Zone, Coastal Landslip Hazard Zones and Tsunami Hazard Zones) and identify options and recommend measures for climate change adaptation and resilience. CIM Plans are advisory in nature only but are increasingly used by funding agencies to inform economic and climate change planning at the community level.

2.2. Environmental and Social Policies of the World Bank

2.2.1. Triggered Operational Policies/Bank Procedures:

The applicable Environmental and Social Policies of the World Bank is set out in the SCRTP 2018 Environmental and Social Management Framework (ESMF). Only the following three WB

safeguard policies are relevant in the ECR-SSP (i) OP/BP4.01 Environmental Assessment, (ii) OP/BP 4.11 Physical Cultural Resources and (iii) OP/BP 4.12 Involuntary Resettlement.

2.2.2. Initial Environmental and Social Screening and Categorization:

The SCRTP ESMF (March, 2018) assigned the overall SCRTP project a Category B for OP/BP 4.01 - Environmental Assessment. It noted that the SCRTP is unlikely to cause any significant adverse environmental impacts. Category B means a proposed project has potential adverse environmental impacts that are less than Category A[9] projects. These impacts are site specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. LTA confirmed the Category B for Environment for ECR-SSP by email on 27 May 2024[10].

For the WB, Category B subprojects require the preparation of an environmental and social assessment (ESIA) that draws on additional subproject-specific data/information and further analysis including site assessment, and analysis of alternatives / environmental and technical constraints to determine the full extent of environmental and social impacts, which cannot be supplied by an Environmental Management Plan (EMP), Environmental and Social Management Plan (ESMP) and/or Codes of Environmental Practice (COEP) (ESMF, Section 5.1).

The WB Category B is comparable to Samoa's environmental safeguards requirements as set out in the PUM Act 2004 and PUMA Regulations 2007. Section 4(2) of the Regulation "… requires the preparation by developer(s) of a Preliminary Environment Assessment report (PEAR) for project proposals the Agency considers is not likely to have significant adverse impacts on the environment. The PEAR should contain the following as a minimum as required under PUM Regulations:

- A description of the proposal/project
- A description of the area affected
- Discussion on the nature of proposed changes to the affected area
- Justification for the proposal/project
- Discussion of the potential adverse effects
- Discussion on the alternatives to mitigate any adverse impacts
- An ESMP describing impact mitigation measures to be addressed in the Contractor's Environmental and Social Management Plan (C- ESMP).

[9] Category A projects are those which are likely to have significant adverse environmental impacts that are irreversible diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. Category A projects require an environmental impact assessment.

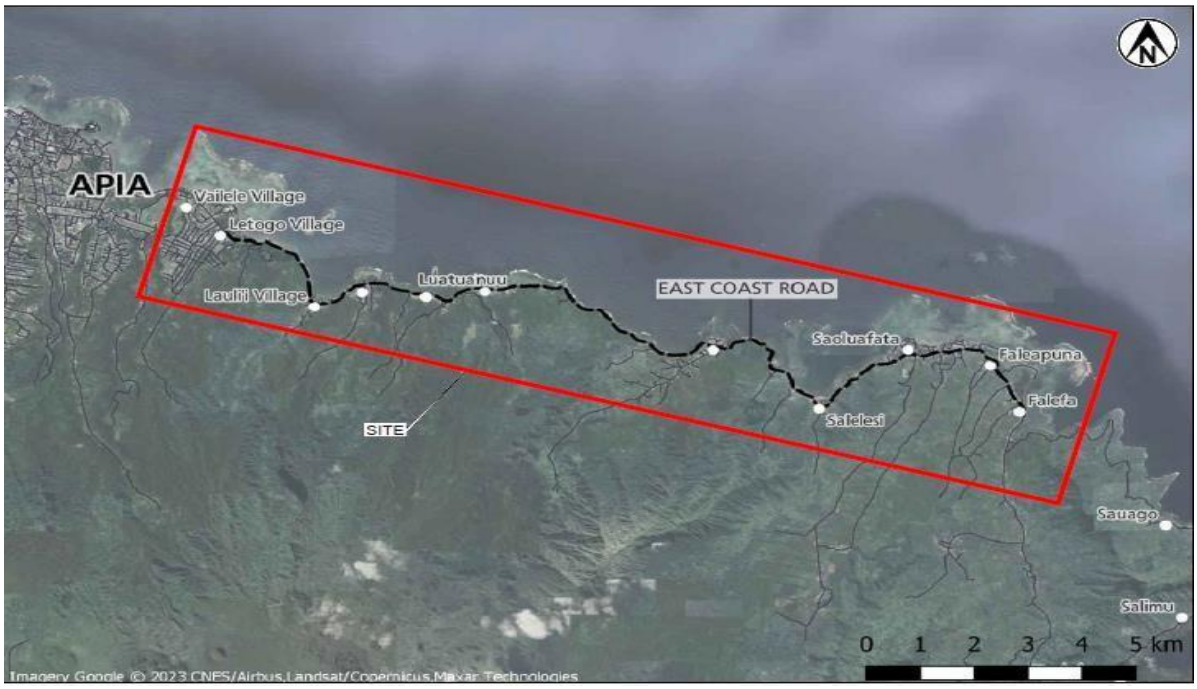
[10] Email communication LTA (V. Iefata) and T&T (C. Freer), 27 May 2024.

SECTION 3 – PROJECT DESCRIPTION

3.1. Project Area of Influence

The Project's area of influence is the coastal zone from Letogo to Saoluafata. The road straddles the coastline for approximately 16 kilometers from Apia before turning inland to the south at Falefa for a further 4 km. Where it bestrides the coastline, the area of influence extends out into the inshore/lagoon area on the coastal side, with the landward side a narrow strip of previously vegetated land of about 3 – 5 m, often to the foot of steep rising cliffs and slopes. No perennial streams cross the ECR in the road sections targeted for project interventions. No village plantation lands, including any access roads to such areas are within or pass through targeted areas. A few houses are located on the coastal side facing Sites 1, 2 and 3 and will be more exposed to dust and noise during construction. Similar individual dwellings on the outskirts of village settlements are within the vicinity of Site 18 and Site 32 in Leusoalii and Saoluafata respectively. For all project affected villages, settlements are concentrated on flats and gentle sloping areas between Project-targeted slopes and are well removed from project sites.

Figure 1: The East Coast Road from Falefa to Letogo



Source: T&TI. February, 2024. ECR – SSP Preliminary Design Report (draft).

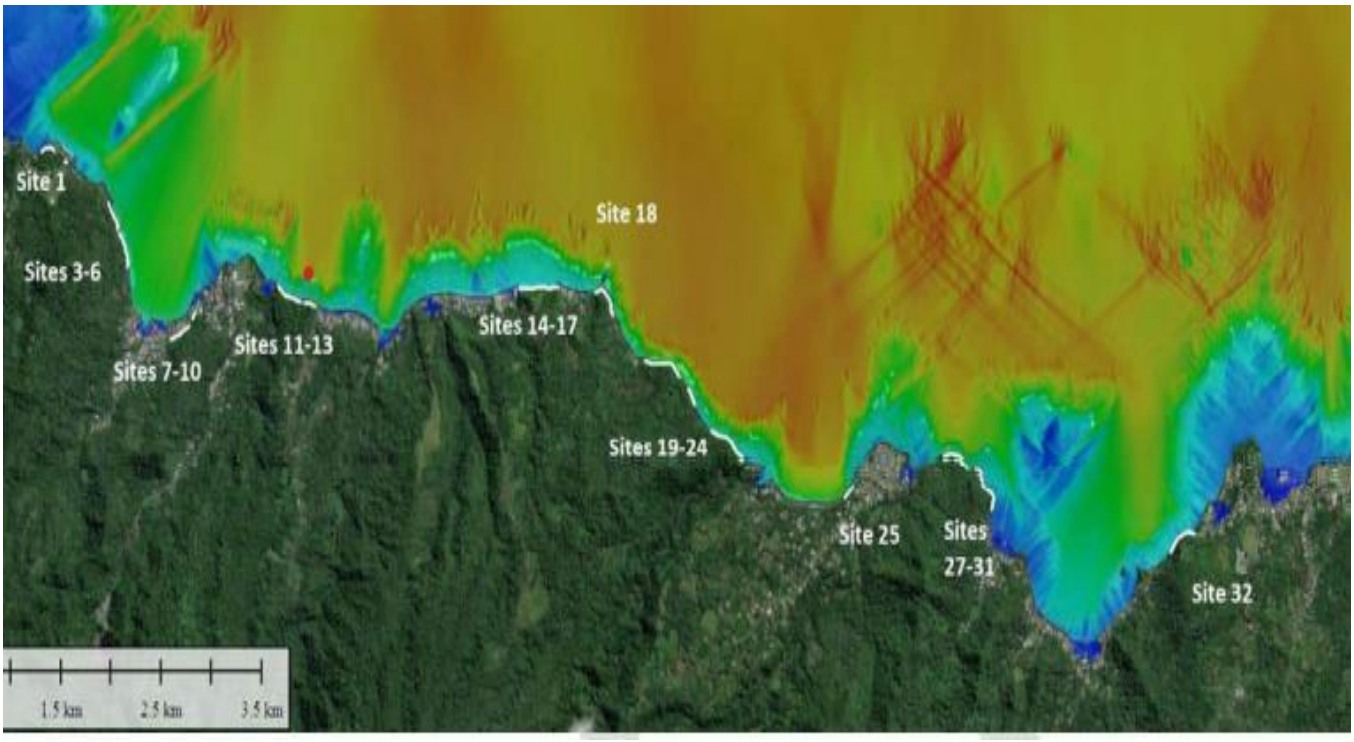
The ECR Slope Stabilization Project (SSP) targets five sections of critical slopes within a 7.3 kilometer section of ECR between Letogo to Saoluafata. Table 1 and Figure 2 detail the five road sections comprising the scope of the ECR-SSP.

Table 1: ECR Sections Targeted for Rockfall Protection and Drainage works

VA ref	ECR section	VA description	Sites	Coastal Hazard	Length (m)
1.10.1.	Saoluafata to Salalesi	from about 500 metres west of Saoluafata to about 200 metres east of Salalesi, apart from about 400 metres centrally	32	High	1100
1.10.2.	Salelesi to Solosolo	from about 1.5 km west of Salelesi to about 300 metres east of the Solosolo junction	26-31	High	2200
1.10.3.	Solosolo to Luatuanuu	from about 1.5 km west of the Solosolo junction, to about 1 km east of Luatuanuu	14-25	High	2800
1.10.4.	Lauli'i to Letogo	immediately west of Lauli'i Village for about 500 metres	7-13	High	500
1.10.5.	Letogo to Letogo Road, Vailele	From about 500 metres west of Letogo Village to about 500 metres east of the Letogo Rd Junction at Vailele	1-6	High / Medium	700 2000
			TOTAL LENGTHS (HIGH)		7300
			TOTAL LENGTH (MEDIUM)		2000

Source: SCRPT - ECR Slope Stabilization Project – Terms of Reference (2017)

Figure 2: Critical Sites Targeted for Rockfall Protection Measures in the ECR-SSP



Source: T&TI, Aug 2024.

3.2. Project Objectives:

The ECR-Slope Stabilization Project (ECR-SSP) addresses Component 2 of the SCRPT. Component 2 involves the study, design and construction of identified priority road assets to improve their resilience to climate-related hazards and/or events using the recommendations of the Vulnerability Assessment (VA) and Climate Resilience Road Strategy (CRRS) adopted by the Government of Samoa in 2017. The specific objective is:

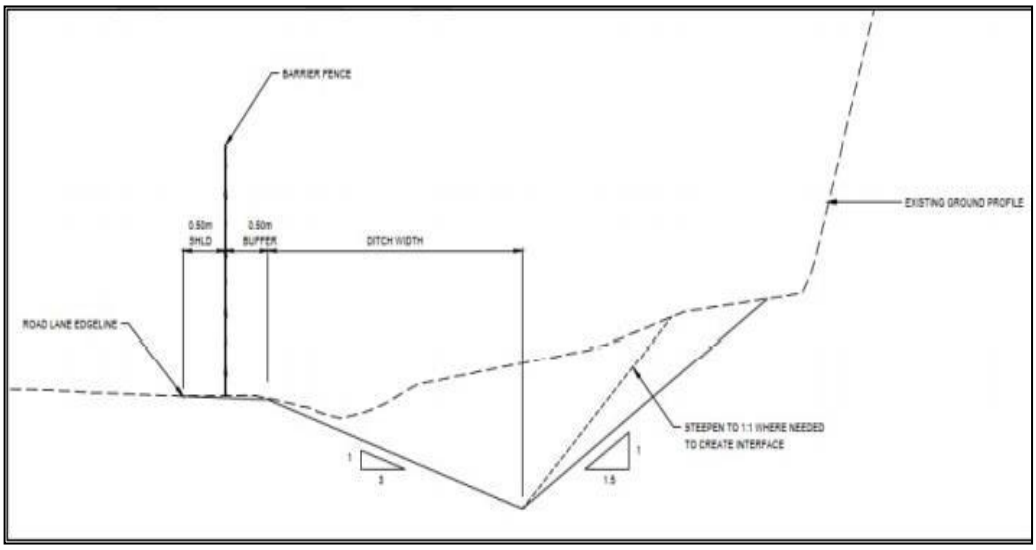
To significantly reduce the current risk of landslips and rockfalls and their resulting hazards along the East Coast Road, through careful assessment, investigation, design and construction supervision of localized slope stabilization initiatives and targeted drainage improvements.

3.3. Summary of the Overall Project Design:

Tonkin and Taylor International (T&T) in association with Kramer Ausenco (Samoa) was contracted to provide design and construction supervision services for the ECR-SSP. The following summarizes the design of the key aspects of the project, extracted from T&T's East Coast Road Slope Stabilization Project – Civil Engineering Design Completion Report (Aug, 2024).

- *Catch ditch plus barrier fence (Option 1)*: The preferred rockfall protection measure. A catch ditch is a shaped catch area, usually constructed at the base of a slope that is used to contain rockfall. Catch ditches are proposed for all sites across the ECR alignment, and will be accompanied by barrier fences installed within the catch ditch area adjacent to the carriageway. A rockfall protection barriers is a wall-type structure used to intercept and contain falling rocks. They are flexible lightweight structures that contain rockfall by deforming downslope and dissipating the impact energy of rock fall debris. The fence is suspended in between a series of posts and cables.

Figure 3: Example of catch ditch plus barrier fence & typical design



Source: Tonkin & Taylor (2024)

Catch ditches are located adjacent to the landward edge of the carriageway, where there is sufficient space between the carriageway and the bottom of the slope. For sites where insufficient space is available to construct a full width catch ditch to achieve 95% mitigation on its own, a roadside rockfall barrier fence is installed. Where the road is raised to achieve minimum design road elevation for climate resilience, the catch ditch and barrier fence design has considered these elevation changes.

Roading

- The approach for the road design, coinciding with the slope stabilization sections of the ECR (East Coast Road), has been to generally match the current alignment in terms of geometry and pavement construction. However, where safety and / or operation improvements can be made with minimal cost implications and effects, nominal upgrades will be achieved. These measures typically consist of increasing curve radii and super-elevation and smoothing out inconsistent geometry.
- Some sections of the existing road on the coastal side will be widened by approximately 2.0 m, to provide more space for catch ditches and longitudinal drainage on the landward

side of the road.

- To provide resilience against sea level rise a minimum road level of RL2.44 m has been adopted, which is 2.0 m above the estimated mean sea level in 2045. This requires the road levels to be raised by up to 0.4 m in two locations:
  - Site 8, Chainage 2800 – 3040 (240 m total length)
  - Sites 28 – 31, Chainage 11840 – 12460 (620 m total length)

Stormwater

Stormwater drainage for the upgraded (slope stabilization) sections of the ECR will maintain the following levels of service:

- Longitudinal drainage works consist of upgrading the longitudinal drainage over sections where slope stability measures are proposed, through the provision of open channels. Longitudinal drainage has been designed to convey a 10-year ARI rainfall event, while ensuring that the central 3 m of the road formation is kept free of surface water.
- New access culverts are provided at all locations where the open channels pass over property access points. Access culverts have been designed to convey a 5-year ARI rainfall event.
- Upgrading existing cross culverts or providing new cross culverts is proposed at various locations along the alignment to pass runoff from upstream catchments under the ECR, to existing overland flow paths which discharge to the sea. Cross-drainage has been designed to convey a 20-year ARI rainfall event. Where possible all coastal outlet levels are to be above RL 0.89 m (Projected 2045 mean higher high-water level).

Drainage works:

Stormwater drainage at the targeted landslip risk sections of the road will be improved / upgraded to avoid flooding at these locations and to improve stability. In some locations, new drains will be formed to improved stormwater management. Similarly, new (and/or increased capacity) culverts to convey water under the road to discharge into the sea will be constructed.

Figure 4: Typical examples of culvert crossing under road (left) and roadside swale drain

Source: Tonkin & Taylor; 2024.

Existing roadside stormwater swale drains will be upgraded and new cross culverts under roads will be installed.

Safety Considerations in Design

Several safety issues including those associated with hazardous road alignment, sight distances, night safety measures, pedestrian safety concerns etc will not be remedied by the Project. However, safety considerations for the effective and safe functioning of rockfall protection barriers, ultimately to enhance road user safety and workers during the installation of barriers, are considered. The following requirements form part of the project design –

- Avoiding any work on slopes above the road alignment
- Planning the installation of the barrier fences and excavation of catch ditches to coincide with the dry, summer season, outside of the cyclonic months, to safeguard workers from potential adverse conditions that could heighten the risk of rockfalls or landslips.
- Balancing fence height with rockfall bounce height to ensure ease of maintenance and accessibility, whilst (where possible) achieving 95% of the modelled rockfall from impacting the carriageway.
- Installing cat eye reflective devices on barrier fence posts to provide a safer environment for night-time travellers.
- Including a minimum shoulder width of 0.5 m from the edge of lane line to front face of barrier fence to provide a safe buffer space for traffic.
- Installing rumble strips

Rumble strips deal with the roadside hazard created by barrier fences which makes the carriageway appear narrower and restrictive to motorists and thus can cause driver-anxiety and heighten the risk of vehicles to veer off-lane. Rumble strips provide a way of reducing roadway departure crashes with the noise and vibration produced which alert drivers when they leave the lane.

3.4. Institutional and Implementation Arrangements

ECR-SSP will be implemented through the following institutional arrangements.

3.4.1. LTA Project Management Division (PMD):

LTA is responsible for planning, designing, constructing and maintaining the country's national road infrastructure. Road asset management is a core function. As well, LTA oversees road use and is accountable for registering vehicles, issuing drivers' licenses, enforcing vehicle load limits and promoting road safety.

LTA is the implementing agency (IA) for ECR-SSP with responsibility for its day-to-day management. LTA's PMD unit has had experience with WB projects over the past decade, and as such, it is familiar with Bank procedures and requirements. LTA may, as in the past, engage individuals and/or consulting firms to assist with meeting the technical and fiduciary requirements of projects including financial management, safeguards and procurement. LTA will also count on support for some of these activities to come from the centralized Transport and Infrastructure Sector Coordination Division (TSCD).

3.4.2. MWTI - Project Management Division.

The MWTI-PMD-MWTI is formerly TISAC (Transport and Infrastructure Sector Advisory Committee). PMD solely focuses on managing/coordinating selected transport and infrastructure projects among which is SCRTP. It is staffed with local specialists including in the areas of financial management, monitoring and evaluation, safeguards and procurement, and provides technical support and assistance to LTA in project implementation. PMD also prepares and submit semi-annual reports on safeguards compliance to WB. MWTI-PMD will receive hands-on support and training from CTSSU for undertaking fudiciary duties in accordance with WB procedures.

3.4.3. Ministry of Finance (MOF)

MOF is the executing agency overseeing the financial management of the SCRTP on behalf of GOS, for all 4 components and also housing the CTSSU. MOF also contributes to ARAP implementation via assistance in securing local funding for compensation payments and in making payments to confirmed beneficiaries.

3.4.4. Centralized Technical Services Support Unit (CTSSU).

Housed in the Aid Coordination and Management Division of the MoF, the CTSSU serves donor projects across all sectors and contractually, only WB funded projects only. It consists of high-level (likely international) specialists in the fields of procurement, financial management, monitoring and evaluation and safeguards. The specialists will work with the PMD to provide implementation oversight, coordination and support.

3.4.5. Support for Safeguards Implementation and Oversight

LTA will work in coordination with the following agencies in relation to environmental and social safeguards aspects of the project:

- Ministry of Works, Transport and Infrastructure (MWTI), Land Transport Division – for road closure and traffic disturbance during construction phase.
- Ministry of Lands and Survey (MLS) – newly formed (2024) government agency responsible for land management and administration; ensure Cabinet approval for land registration and proclamations; negotiation with village chiefs and orators, *matai* and beneficial ownerof affected customary land.
- MWTI Planning and Urban Management Agency (PUMA) – for development approval, community consultation, monitoring compliance of development activities in accordance with development consent conditions and approved environmental management plans;
- Ministry of Women, Community and Social Development (MWCSD) – to notify local leaders (Sui le o nu'u/malo, matai, etc) and communities of consultation activities with affected communities;

3.4.6. Project Design and Supervision

Tonkin and Taylor International, in partnership with Kramer Ausenco (Samoa) is contracted to undertake project supervision.

3.5. Analysis of Alternatives

Samoa is vulnerable to extreme weather events. The Pacific-Australia Climate Change Science and Adaptation Planning Program (PACCAPP) noted that the frequency and intensity of extreme weather and climate events, such as heavy rainfall, strong winds and storm surges is increasing, a trend projected to continue throughout the region.

In the transport sector, Samoa's Cabinet responded to the increasing threat of extreme weather events by approving in 2013, a plan to strengthen the climate resilience and longevity of road assets throughout the country. Building on this, in late 2017 the Government adopted the Vulnerability Assessment and Climate Resilience Road Strategy (CRRS) which identified hazards and prioritized areas in the transport sector. One of these priorities is the East Coast Road highlighting the need for slope stabilization and rockfall protection.

Alternative Approaches -

A number of different approaches to addressing rockfall protection and slips at ECR are conceivable, all requiring some physical modification to the landscape and the installation of appropriate engineering measures.

Alternative 1: Avoid the threat of rockfalls and landslips caused by the unstable slopes and rugged terrain by reclaiming the coastal side to accommodate the road widening and shifting the road centerline more to the seaward side. However, this option would expose the ECR to a significantly higher level of vulnerability to coastal hazards and climate change impacts.

Alternative 2: Relocate the ECR to a completely new route in the interior however this will not escape the rugged terrain and the need for slope stabilization and rockfall protection, not to mention more difficult environmental challenges. Alternatives 1 and 2, intuitively, are significantly more costly with severe adverse environmental impacts.

Alternative 3: Address the need for rockfall protection along the existing ECR footprint.

Alternative 4: The "Do Nothing" or 'Business As Usual' (BUA) option. This is totally untenable. The risk of landslips, rockfalls and erosion will only worsen if left unmitigated. It will delay the inevitable to a future that will be significantly more costly. The 'Do Nothing' or BUA option is also clearly unacceptable given the imperative for achieving road resilience stipulated by the Cabinet- approved 2013 plan to strengthen climate resilience and longevity of road assets and the 2017 Government adopted Vulnerability Assessment[11] and Climate Resilient Road Strategy[12] prepared by the World Bank.

The selection of Alternative 3 reflects considerations of technical, environmental and cost

[11] World Bank. 2017. Vulnerability Assessment of the Samoa Road Network. WB.

[12] [14] World Bank. 2017. Climate Resilience Road Strategy. WB.

factors. The same considerations contributed to the shift in the ECR-SSP focus from slope stabilization to rockfall protection.

Alternative technologies

The detailed design considered a range of engineering options for rockfall protection. The adoption of rockfall containment using catch ditches and rockfall barrier fences, in favour of other technologies including the use of draped meshes, and rock dowels was based on (i) ease/difficulties of constructability (ii) high construction costs and maintenance requirements (T&TI, 2024).

3.6. Project benefits

3.6.1. For economic development – regionally and nationally

Samoa's transport network is of critical importance to the country's socio-economic development. It provides connectivity that supports trade and promotes commercial activities by facilitating the movement of goods and services as well as the safe and efficient access to social services including schools and health facilities. The ECR provides the main connection to services for people residing along the road itself and that part of the route that is susceptible to rockfall.

3.6.2. Disaster preparedness and response

Samoa is highly vulnerable to climate change induced events such as flooding, sea level rise, cyclones and king tides, and geological events such as earthquakes and tsunamis. Past experiences showed these events to have devastating effects socially and economically both locally and nationally. While unavoidable, the country's vulnerability can be alleviated through thorough disaster preparedness, putting in place systems, plans and supporting infrastructure for effective emergency responses and evacuation, and for post disaster relief and rehabilitation.

Land based connectivity through a resilient and robust road network is an integral part of disaster preparation, emergency response and post-disaster implementation. This is of particular relevance to eastern Upolu, where the ECR is highly vulnerable to coastal hazards due to its closeness to the ocean and low-lying topography, and the threat of geological events due to the steep and unstable terrain. Moreover, the ECR is the main land-based lifeline and connection to emergency and disaster management services in urban Apia for the population of Upolu East.

3.6.3. Achieving Government Strategies and Plans:

Goal 2 of the Samoa Government Transport Sector Plan (2014)[13] calls for "…to improve, sustain, and climate-proof [the] road transport network." This goal reflects Government decision calling for the same in 2013 and in subsequent assessments and plans. The ECR-SSP contributes to the overall achievement of this goal. Post-project, a climate resilient ECR will improve the safety of road users, reduce the risk of disruption to the movement of goods and services, and provide a more efficient and reliable connectivity to urban Apia.

[13] MWTI. 2014. Transport Sector Plan 2014-2019. Apia.

3.6.4. Project short term benefits:

Prior to project construction, all land involuntarily acquired for road widening and affected assets (mainly crops) will be compensated financially. Local owners of land and crops will benefit directly. During project construction, some local businesses and contractors in the roading and construction sectors will be involved either directly as subcontractors and or indirectly, through the supply of materials and the provision of other supporting services. The Project will, through construction contractors and subcontractors, generate employment opportunities for unskilled and semi-skilled people. Some workers may be recruited from project-affected villages.

Post-project, all users of the ECR will enjoy a safer and a climate-resilient national asset.

SECTION 4 – DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1. Physical Environment

4.1.1. Rainfall and rainfall events

Heavy and prolonged rainfall events pose the main climate risk to the stability of slopes along the ECR. Fepuleai et al (2023) noted that several factors trigger instability of rocks/soils in the ECR, one of which is exposure to 'climate variations' (alternative hot and wet conditions). Unloading of overburden is also known to be facilitated by wet soil conditions. Available information noted that Eastern Upolu including the ECR districts of Vaimauga East and Anoama'a generally receives more rainfall than the north central and western side of Upolu with extreme rainfall events occurring during the wet/cyclone season from November to March.

The global climate model projections and climate science findings[14] for Samoa over the course of the 21st century (for the period to 2100), indicate that:

- extreme rainfall days are likely to occur more often and be more intense;
- likely increase in the average maximum wind speed of cyclones by between 2% and 11% and an increase in rainfall intensity of about 20% within 100 km of the cyclone center.

The majority of models project that the current 1-in-20-year extreme rainfall event will occur, on average, four times per 20-year period by 2055 under the B1 (low) emissions scenario and three times per 20-year period by 2090 under the A2 (high) emissions scenario.

4.2 Topography

The coastal environment occupied by the ECR is characterized by steep headlands, narrow and winding coastal flats, rock outcrops in several places and steep rising slopes many within a few meters of the road shoulder on the landward side, and rising to heights of upwards of 20-plus meters in several places. The rugged terrain is vegetated by a wide diversity of tree species – many well adapted to the exposed, salt-sprayed and windy conditions. Short, fast flowing rivers and streams flow through several villages into the sea with the main streams traversing the ECR at Letogo, Luatuanu'u and Solosolo.

[14] Samoa Climate Change Policy 2020

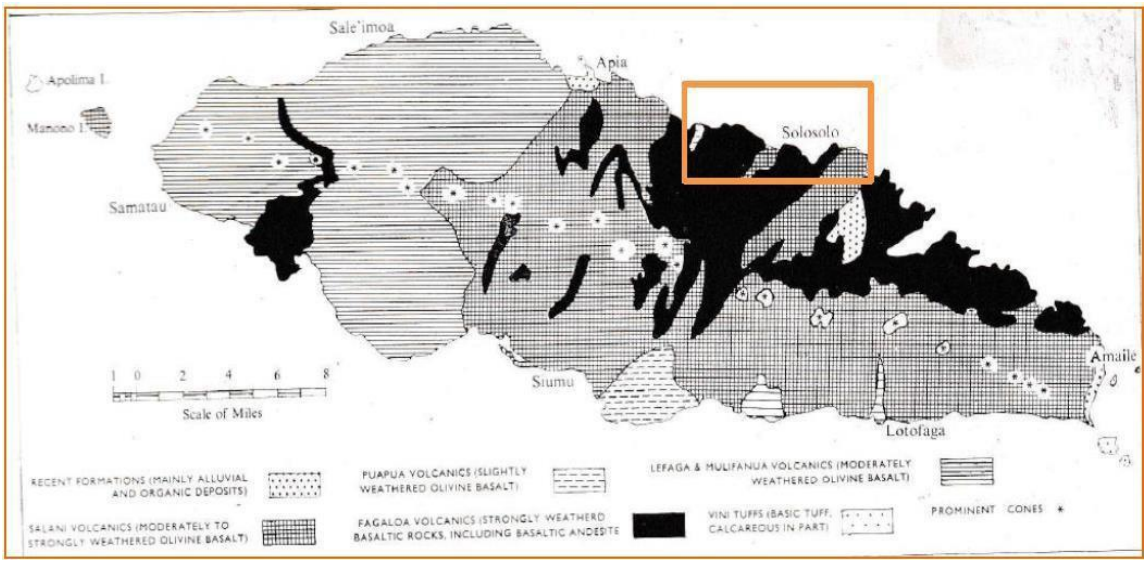
Figure 5: Views of the ECR showing steep rising slopes on the landward side.

Source: Fepuleai & Fepuleai. April-May 2023.

There is no significant area of sheltered lagoon. Beaches in the bay areas are made up of a mixture of fine coral sand, unbroken, dead coral and fine, black, river sand near the mouths of the main rivers. Around the headlands are rocky and steep shores where during high tide, high breaking waves is the normal feature (MNRE, 2018).

4.3. Geology and Soils

Figure 6: Geological map of Upolu highlighting ECR-SSP area



Source: ACS Wright (1963)

The geology of the East Upolu and the two districts where ECR SSP activities will take place is dominated by the Fagaloa Volcanics except for part of Solosolo and Saoluafata where Salani Volcanics formations are found. The Fagaloa Volcanics is described as, the oldest rock formations in the country dating to the early Pleistocene period; are deeply weathered (30-40 ft) basalts and basaltic rocks and are overlain by the younger geological formations namely the Salani, Mulifanua, Puapua, Lefaga and Aopo volcanics respectively (Kear and Wood, 1959)[15]. ACS Wright (1965) describes the Salani Volcanics as having a somewhat dissected landscape consisting of broad, gently sloping ridges separated by deep gorges and there is often abundant permanent water located in deeply incised valleys but very little water on the broad interfluves, where lie the soils best suited for permanent farming.

Fepuleai et al (2023)[16] carried out a geological assessment of areas targeted by the Project to inform and support project preparation and design. It confirmed the dominance of the Fagaloa Volcanics in northeast reported in earlier studies.[17] Fepuleai (ibid) also described in detail the profiles of the critical slopes targeted for rockfall protection works. Among its many features, Fepuleai noted its highly weathered, jointed and fractured nature. This feature (defects or discontinuities in rock (joint/fracture & vesicle) is one of several triggers of rock/soil instability in the ECR (ibid; p. 69). The following are the main features –

- Outcrops along the ECR is commonly the intercalated of thick pahoehoe with scoria intruded by a plagioclase dyke;

[15] Cited by A Fepuleai et al (2023)
[16] Ibid.
[17] Kear and Wood (1959), AC Wood (1963), Nathan and Turner (1985), Fepuleai (1997, 2015).

- Rock units along the ECR are high weathered, jointed and fractured;
- The pahoehoe flow is commonly dissected by two set of joints: parallel and perpendicular with the flow;
- Lava flows along the ECR are strongly porphyritic (Fepuleai, 1997 & Cibik, 1999).
- Olivine is the most abundant mineral phase in lavas of the northeast Upolu, followed, in order of decreasing abundance by plagioclase, pyroxene and iron-titanium oxide (Fepuleai, 1997; 2016);
- The olivine is commonly altered into iddingsite soil mineral indicates *(sic)* by brown reddish stain in many parts of the ECR;

Fepuleai et al (op cit) observed that the thick and deep rooted vegetation along a deep jointed and fractured networks at many sections of the ECR is a contributing factor to landslides and rockfall activities during rainy season. As well, there are signs of continued rockfall activity (pebble to boulder size - 0.3 to 3 m in diameter) as a result of heavy rainfall, strong wind and seismic activities. Fepuleai & Fepuleai noted that these are the main drivers of rockfall in the area.

4.4 Land tenure, zoning and use

4.4.1. Land ownership

Land tenure in Samoa comprises of the following three types: freehold, public and customary. Customary land constitutes about 81% of the total land area, while freehold land is around 4%, and public land is 15%.[18] According to Schoefelle and Meleisea (2021)[19], most of the customary land is rocky land, hinterland forests and steep mountains which villages own with the first-class agricultural lowlands appropriated for Government plantations and private ownership.[20]

The planned land taking of 38,813 m^2 of customary land for the Project excludes three parcels of freehold land at Letogo (CH 250 – CH 1100) which have already been acquired. The land targeted for acquisition will widen the road reserve to the required 20m – 10m from the road centerline on each side, wherever physically possible[21]. The existing pavement is Government-owned and the land targeted for acquisition is measured based on a 10m corridor, nominally centered on the existing road centerline.

Customary lands in Samoa are generally not surveyed therefore most do not have legal descriptions. They are under the overall control of village councils of chiefs, who allocate them to different extended families for dwellings and plantations, and for community facilities such as churches, schools and other development purposes. In most cases, boundaries between extended family parcels or sections are informally marked by physical features such as a stream, gully, a prominent rock formation, planted hedges or trees. Village lands thus generally consist of (i) parcels that have been allocated to various extended families for houses and plantations, (ii)

[18] Taulealo, Fong and Steffano. 2003

[19] Penelope Schoeffel, Tiffany Arthur and Malama Meleisea. 2021. Land and social security in Samoa. National University of Samoa.

[20] Taulealo, Fong and Steffano. 2003

[21] The option of a 16m reserve for sections of the road passing through villages is being considered.

land allocated for communal purposes such as schools, churches etc., and (iii) land that have not been allocated and remaining under the direct control of the Council of Chiefs. Customary land allocated to extended families for their houses and crops falls under the authority of the extended family chief matai, or *Sa'o*. He/She is responsible for its apportioning to all the households of his/her family. For each households, often headed by a matai or chief of lower ranking, this allotted land become quasi-freehold in nature, especially where there is continuous occupation and use over several generations. Village land not allocated to extended families remain under the authority and control of the Council of Chiefs. These lands are allocated to extended families as the need arises, such as for newly anointed *matai*. Over the years, however, novel mechanisms have evolved that have enabled individuals and households to acquire the use and occupation rights over these lands, with the ownership rights retained still by the Council of Chiefs.

Customary land is inalienable under Samoa's Constitution, therefore cannot be sold. Recent changes in the Constitution now allow the leasing of land for development purposes.

4.4.2. Land-use planning

The absence of legal land descriptions for most customary lands (because there are no legally surveyed boundaries) is one of several stumbling blocks to formal land use planning. However, significant inroads have been made over the last 20 years. The advent of the PUMA Act 2004, PUMA Regulation 2006 and Code of Environmental Practices (COEPs, 2007) provided a legal framework for regulating development activities to ensure their environmental impacts are within acceptable limits. The 2006 World Bank funded Samoa Infrastructure Asset Management (SIAM) Project initiated the nation-wide preparation of district-level coastal infrastructure management (CIM) plans. The plans were reviewed and updated[22] in the follow-up WB-funded SIAM Phase 2 from 2016 to 2019. The CIM Plans promote planning for climate resilience at the district and village levels. It identifies coastal hazard zones (erosion, landslips and tsunami hazard zones) and prescribed measures for minimizing risk and enhancing community resilience. For instance, CIM Plans recommend the relocation to higher elevation areas and away from hazard zones for all new community and family constructions. Other more recent aid-funded projects[23] have adopted CIM Plans recommendations when screening proposals for national and community facilities such as schools, health centres etc.. Prior to SIAM, laws were enacted mandating the protection of special areas, such as river banks, catchment areas and legally designated national parks and reserves. For the most part, enforcement of these laws has not been effective.

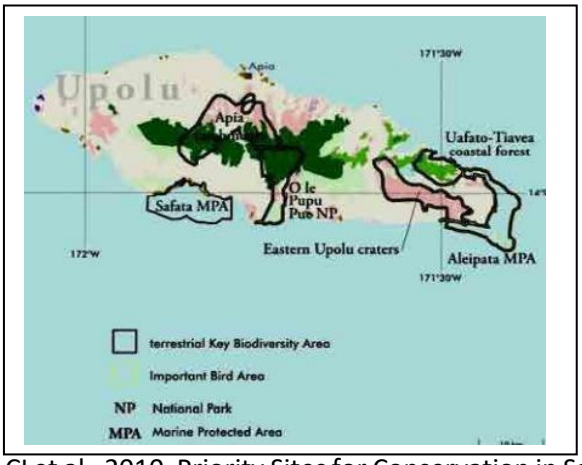
The 2018 CIM Plans for the Vaimauga East and Anoama'a 2 districts mapped the locations of the main physical infrastructure of roads, bridges, utility services and community buildings and homes. It showed the importance to communities of living in close proximity of the East Coast Road for ease of access to services such as public transportation, electricity, telecommunication and reticulated water supplies.

[22] and re-named Community Integrated Management (CIM) Plans

[23] World Banks Pacific Resilience Enhancement Project (PREP); ADB funded Samoa AgriBusiness Support (SABS) Project

According to the 2018 CIM Plans, the ECR from Letogo to Saoluafata lies wholly within the coastal flood hazard zones (CEHZ) and coastal erosion hazard zones (CFHZ). The tsunami zone includes all the low-lying sections of the ECR barring the elevated areas including the steep-cutting slopes in the critical areas (high and medium risk zones) targeted by the Project.

In terms of areas of high biodiversity value prioritized for national conservation, all the Key Biodiversity Areas (KBA) identified by Conservation International (1998) and recognized by the NBSAP (2016) are remotely located and far removed from the critical zones targeted by the Project.



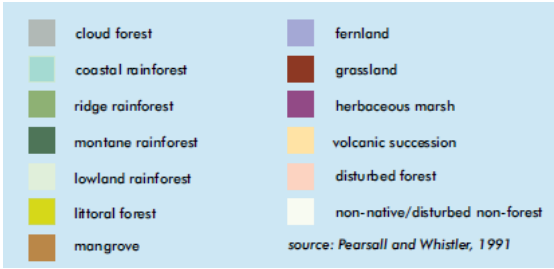


Figure 7: Vegetation types and Key Biodiversity Areas relative to ECR impact

CI et al., 2010. Priority Sites for Conservation in Samoa: Key Biodiversity Areas. Apia, Samoa.

Figure 8: CIM Plan for part of Letogo and Laulii coastal areas showing different hazard zones (Source: MNRE, CIM Plan, 2018).

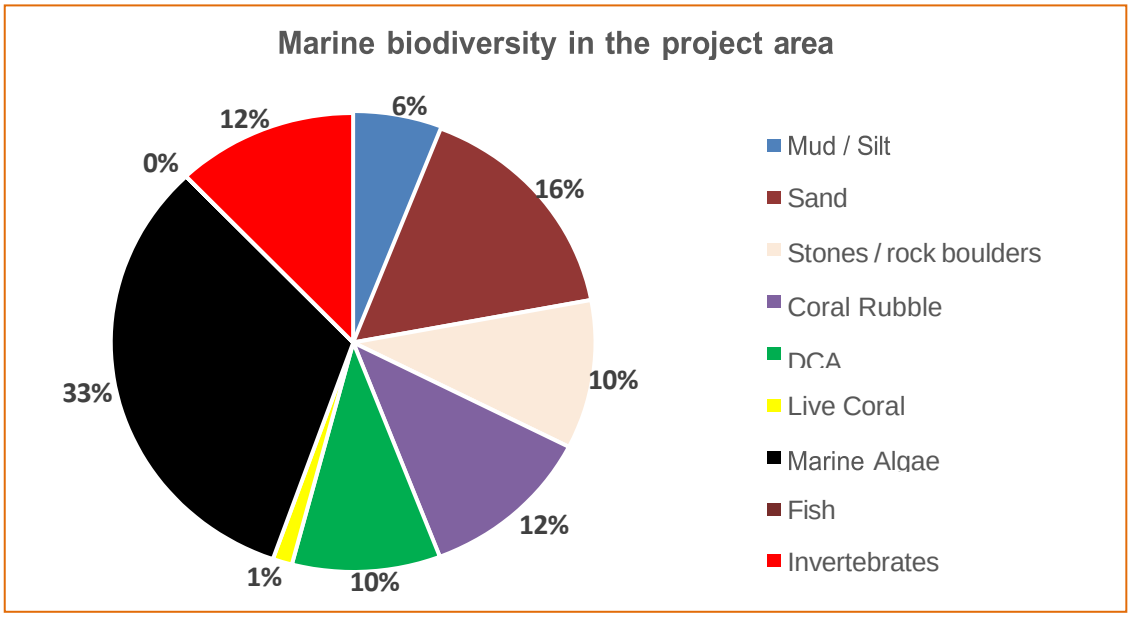
4.5. Biological environment - marine

4.5.1. Marine environment and biodiversity

A marine survey covering an estimated 30m^2 of intertidal zone area in each of the 28[24] assessable target sites along the length of the ECR (from Letogo to Saoluafata) was conducted for this report during December 2023 and January 2024. Based on survey findings, the status of the marine biodiversity within this survey area is shown in Figure 13 with further description provided in the sections following. The surveyed area constitutes the potentially impacted receiving environment from land-based pollution such as siltation and surface-runoff expected during the construction phase.

[24] The other four (4) sites are inland segments of the road therefore survey was not necessary.

Figure 9: Existing marine biodiversity profile of the project area



Source: Siamomua, M. 2024.

4.5.1.1. Abiotic factors

The area assessed is 54% dead or comprising of abiotic (non-living) substrate/factors (S. Siamomua, 2024).

4.5.1.1.1. Substrate cover

Substrate cover comprises of mud and silt, sand, coral rubble and dead corals with algae and stones / rock boulders. The impacts of land-based human activities such as land clearing, coastal reclamation and surface runoff contribute to the muddy and silty substrate observed. This is high in Sites 1, 28, 29 and 30 and lower in Sites 11, 12, 18, 23 and 24. Suspended silt and sediments in water block sunlight penetration, stunting coral growth and promoting mortality. Coral rubbles occur in Site 14 to Site 31 and are most abundant in Sites 29 and 30 – the latter two are less than 10 meters away from the reef and directly exposed to strong wave energy. Strong wave energy and natural disasters break corals and are accounted for the high abundance of rubbles and sand in the area.

4.5.1.2. Biotic factors

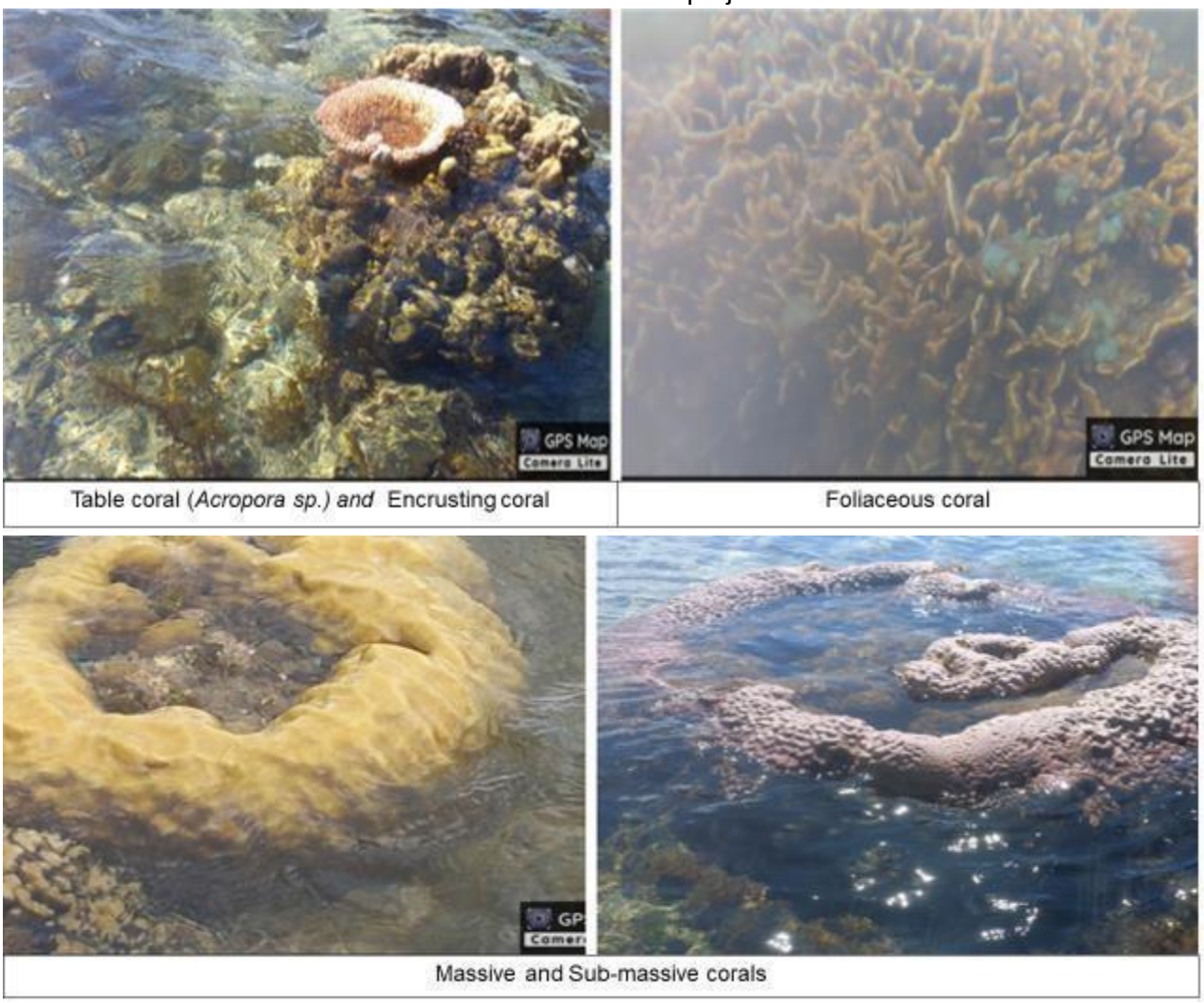
About 46% of the survey area is made up of biotic or living factors which include live coral, marine algae, fish and invertebrates.

4.5.1.2.1. Live Coral forms

The area has only 1% live corals, occurring in Sites 14, 15, 16 and 29. Coral cover is very low and only include the table coral and massive and sub-massive coral forms which also indicates low coral diversity. These types are common in high energy areas being more resilient to wave actions.

Corals are animals that require certain favorable environmental conditions for good growth. The dominant abiotic factors in the coastal areas in addition to exposure during low tide, high energy and high water turbidity in some sites are unfavourable and suppressive to coral growth. However, this assessment is certain that coral growth, diversity and abundance is much better in the outer reef areas than the coastal areas due to the existing environmental conditions.

Plate A: Coral forms recorded in the project coastal area

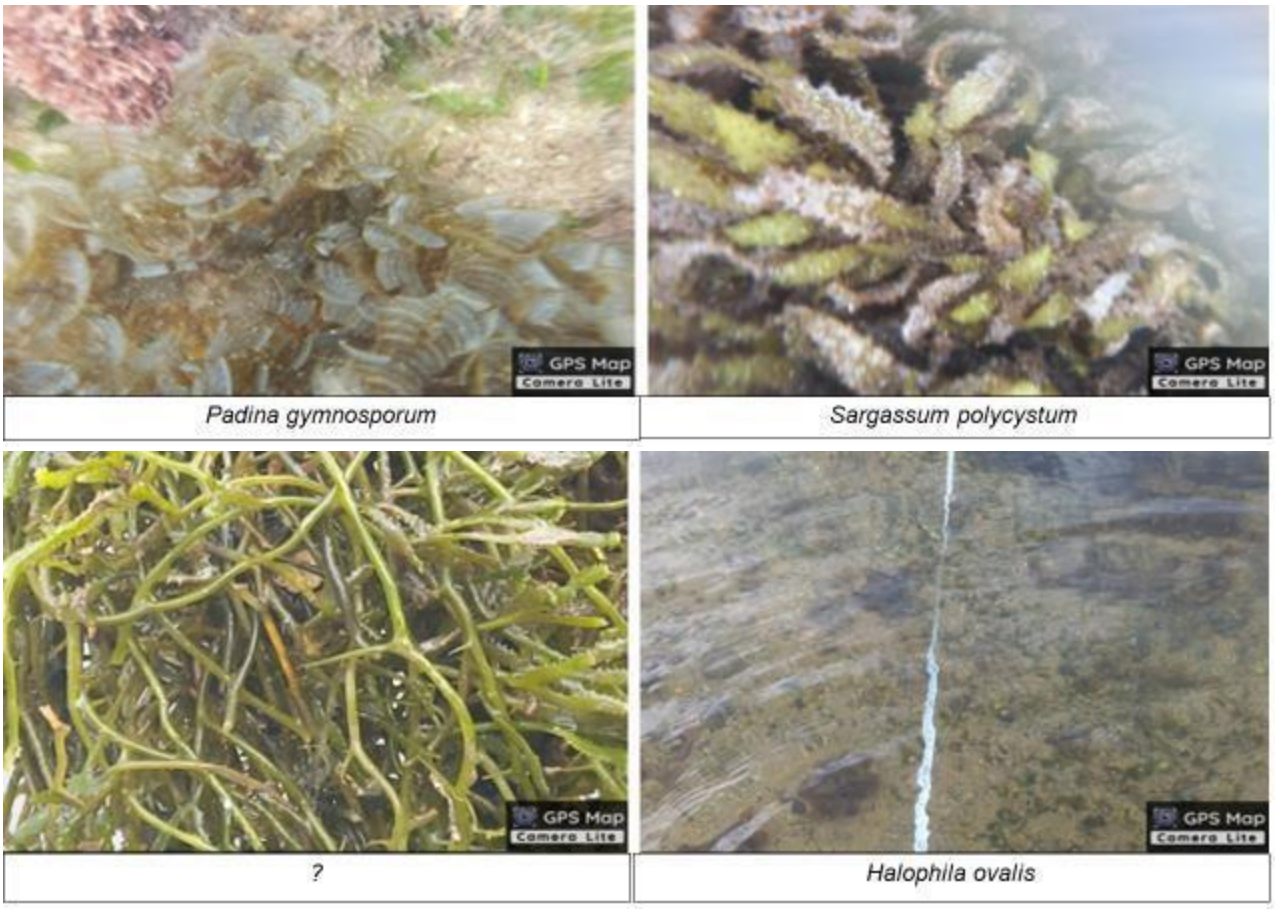


Source: Siamomua, M. 2024

4.5.1.2.2. Marine Algae

Marine algae makes up 33% cover and is the most dominant biodiversity indicator along the coastal area surveyed. Algae prefer certain environmental conditions for good growth however, they occur in abundance as the surveyed areas are directly exposed to excessive sediment and nutrient run-off from the land as well as high temperatures during low tide – these are favourable ingredients for algal growth. The most abundant species recorded include the brown algae *Sargassum polycystum* (Limu faaleagamea), brown algae *Padina gymnosporum* (Limu lautaliga) and paddle weed seagrass *Halophila ovalis.* These species are commonly found in disturbed tidal flat and reef areas with high nutrient supply.

Plate B: Marine algae and seagrass species recorded in the project coastal area



Source: Siamomua, M. 2024.

4.5.1.2.3. Fish and Invertebrates

Not a single fish was spotted throughout the entire coastal survey area. It might have been due to either the exposure at low tide or the high energy from waves and currents. Invertebrate abundance is 12%, dominated by the Greenfish (*Stichopus chloronatus*) followed by Lollyfish (*Holothuria (Halodeima) atra*), Blue starfish (*Linkia sp.*), Peva (*Synapta maculata*) and Surf redfish, *Mama'o* (*Actinopyga echinites*).

The outer lagoon and reef provide nursery areas for a variety of fish and invertebrate species because of the many biological niches and habitats available. The surrounding areas are generally alive and a spill-over corridor for mobile species to forage especially during high tide. However, the intertidal and beach areas surveyed are highly disturbed (habitats and noise) and lack habitats to support fish foraging or residency. Sandy and coarse substrate conditions are favorable for sea cucumber species recorded. These are deposit feeder organisms that extract food particles from the water column or the sediment or the substrate by using their tube feet.

Plate C: Invertebrate species recorded in the project survey area

Source: Siamomua, M. 2024.

The low occurrence of biotic features and the low diversity of corals and invertebrates in the area is indicative of severely degraded habitats. There were no notable signs during the survey of recent runoff events along the coastline that would point to a direct recipient/source relation with the ECR or other land based activities. However, drainage outfalls (several of which are visible from the survey area) do discharge silt, debris and surface water run-off into the beach and intertidal zones. Overall, the survey shows a pre-project receiving environment that is already severely degraded. In so saying, marine biodiversity in the surveyed area is likely to be much lower than the wider marine area.

4.5.1.3. Other environmental factors

4.5.1.3.1. Water clarity

The surveys were undertaken during fine and sunny weather conditions. However, water turbidity was very high particularly in Sites 1, 29, 30, 31 and 32. Poor visibility is attributed to the excessive amounts of sediments or silts suspended in water or deposits on the bottom substrate. Site 1 is impacted by the inflow of the Letogo river and the reclamation activities immediately to the east. Sites 29, 30, 31 and 32 are affected by the debris from the Eva stream emptying into the sea.

Section 4.6 – Biological Environment - Terrestrial

4.6.1. Flora

A flora and fauna assessment covering the 5 ECR-SSP targeted sections (high and moderate risk sites) was carried out from December 2023 to January 2024. The flora and fauna survey concentrated on the 30m wide vegetation belt on the landward side of the ECR[25].

[25] A narrow band of about 5m wide from the road shoulder has since been cleared by villages.

This assessment found the vegetation of all sites to have been modified both by natural (e.g. windthrows) or non-natural (i.e. human) impacts or both, and by the physical modifications and cut batters made during the original road construction. As a result, there is no primary or old growth secondary vegetation. The existing secondary vegetation is at various stages of natural succession with some areas being more advanced along the natural regeneration continuum than others. In terms of Whistler's 2002 vegetation types, the observed mix of species reflect characteristics pertaining to littoral forest, coastal forests, and disturbed lowland forests. Descriptions of these forest types by Whistler (ibid.) can be found in Foliga et al (2024).

Foliga et al (2024) noted the following key features:

- no one forest type dominates or is readily identifiable along the ECR. Species typically associated with each of the three forest type were present but in a random mixed and, from an aerial view, in a mosaic-like pattern of different crowns shapes and colors.
- Further inland (20 – 30m) from the edge of the ECR on steep slopes and near ridge tops, the forest layers are more definable with a canopy, sub-canopy and undergrowth clearly discernible. The forest canopy, often rising up to about 20-25m, is generally dominated by *Albizzia chinensis*, *Falcataria mollucana, Samanea saman*, and *Terminalia catappa*.
- The sub-canopy is vegetated by a wide range of species including *Hibiscus tiliaceus*, *Macaranga harveyana*, *Kleinhovia hospita*, *Adenanthera pavonina*, *Mangifera indica*, and others. Very few native species were observed at the canopy layer.
- Vegetation cover is high, at between 80% and 100% within the 30m wide assessment area.
- The flora survey identified 237 species of flowering plants and 11 fern species.
- No ecologically sensitive ecosystems including mangroves were identified within the critical slopes targeted for slope stabilization and rock protection works.

The list of species identified at the canopy, sub-canopy and undergrowth are given in Appendix 8. The vegetation survey report is in Appendix 13.

A recent development (during July - August 2024) and following the completion of the above assessment now has the vegetation in the Project's area of influence completely cleared and or heavily pruned as part of a Government-led drive to beautify villages 'ahead of the start of the CHOGM being hosted by Samoa. This means ECR-SSP will not impact any existing vegetation.

4.6.2. Avifauna

A bird survey conducted from December 2023 and January 2024 recorded 20 species of land birds, 4 seabirds, 1 shorebird and 1 flying fox species. There are 21 natives including 3 endemics, 4 introduced species and one flying fox species. The full list of birds observed are in Appendix 10.

4.7. Water/Streams

Assessment of existing natural streams, intermittent surface flows and sub-surface flows along the 5 targeted ECR-SSP sections is based on available MNRE reports supplemented by visual assessment and consultation with local communities. In the case of the intermittent surface and sub-surface flows, site assessment followed extended heavy rainfall during the period of 23 – 25 January 2024.

In all, 13 perennial streams cross the ECR between Letogo to Saluafata. The main ones include four (4) between Letogo and Laulii villages, two (2) between Luatuanu'u and Solosolo and one between Solosolo and Eva villages. The streams originate from deep in the interior, coursing through catchments that are physically isolated from the targeted ECR-SSP targeted sections. Consequently, none is impacted by the ECR SSP.

The existing longitudinal and cross drains along the ECR in sections targeted by the Project discharge into the sea in outfalls not connected to or near any of the existing streams.

Figure 10: Intermittent surface stormwater flows off the slopes in the ECR targeted sections zones.

Source: Siamomua, M. February 2024.

Intermittent surface flows were observed in locations along the ECR-SSP sections noted in Table 2 , some were still 'flowing' at the time of the assessment and others evidenced by the presence of observable dry channels of exposed flow paths where surface water flow had recently ceased and or debris of twigs, leaves and soil that have been washed into place mainly at the base of slopes along the road shoulder.

Table 2: Location of intermittent surface flows observed

Chainage	Sections	Comments
Ch 735 - Ch1790	2,3,4,5,6	Located at Letogo and Lauli'i
Ch 4220 – Ch 4335	28	Leusoali'i
Ch 11745 – Ch 11935	13	Unconfirmed

Intermittent sub-surface flows were evidenced by hillside springs and seeps along the exposed high cutting slopes in several zones in particular near Letogo and Luatuanuu. Their presence points to infiltration in the porous soils on higher grounds, facilitated by vegetation interception (via stem-flow and canopy-drip).

It should be noted that visual assessment was restricted by the dense undergrowth in several slopes. Thus it is reasonable to expect the presence of more similar springs and seeps in other slopes, possibly throughout all slopes targeted by ECR-SSP.

Figure 11: Piped outfalls discharging surface water runoff into the sea between Letogo and Laulii.

Source: M. Siamomua, February 2024.

It is evident from discussions on site and from the historical records (and more recently from the LTA rockfall reporting) that the characteristic rockfall and landslide events are typically shallow seated mechanisms occurring within the slope faces and triggered by high rainfall events.

Rockfall consisting of a single large boulder, or a small number of large boulders (less than 2 or 3 boulders) may also occur after rainfall events, and this inferred to be aresult of runoff and surface erosion resulting in the undermining of boulders on soil slopes, or high groundwater

pressures in jointed rock outcrops.

Rockfall can also be attributed to vegetation growth, whereby the root systems of larger plants (small trees) in their search for groundwater can penetrate the jointed rock mass and 'prize-off' boulders. These rockfall events are often weather related and can occur under the combined forces of high groundwater pressures and wind load. Fepuleai et al (2024)[28]. Typically these types of rockfall failures occur at the location of large outcrops and high rockfaces on the rock promontories along the ECR.

The vegetation cover on slopes and plateaus is high (between 80 – 100%) in all but one ECR-SSP section, which facilitates precipitation interception, through fall and stem flow. These hydrological processes enable infiltration, sub-surface flows and storage.

Rockfall events and landslips into proposed catch-ditches will affect conveyance of streams and intermittent surface flows via longitudinal drainage. Complete obstruction of longitudinal drainage would result in flows spilling into the carriageway, contributing to temporary localised flooding issues during rainfall events, in the case of intermittent flows and would likely also cause more persistent ponding behind the obstruction. In the case of permanent stream flows flooding would persist until the obstruction was removed. The risks associated with blockage of longitudinal drainage need to be managed with a proactive maintenance program to keep the drainage network clear of obstructions, whether from rockfall, vegetation or other debris.

4.8. Air & Noise

The site is well ventilated from direct exposure to the easterly and south-easterly trade winds. However, existing vehicle movements release harmful gases such as carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM) and volatile organic compounds (VOC) into the air influencing quality. Populated areas along the ECR concentrate within narrow coastal flats and are relatively removed from the steep slopes targeted by the project.

During the day, the sound of the ocean and wave actions on the rocky shore at high tide is broken regularly by the sound of passing vehicles. Without vehicles, the main background noises are those of the ocean and the rustling sounds of the wind through forest foliage.

4.9. Natural hazards

The ECR from Letogo to Saoluafata is highly vulnerable to climate change induced events such as sea level rise, storm surges, wave overtopping, flooding and inundation, damage from earthquakes and accelerated pavement deterioration due to extreme weather events (MNRE, 2018). It is also vulnerable to tsunami.

According to the districts CIM Plans (MNRE, 2018), areas of Letogo village around the

Letogo stream and watershed management riparian zone – the 20m buffer on either side of the river banks - is within the Coastal Erosion Hazard Zone (CEHZ) and Coastal Flood Hazard Zone (CFHZ) and the Tsunami Hazard Zone. The elevated part of the village is outside the flood and erosion hazard zones (ibid.).

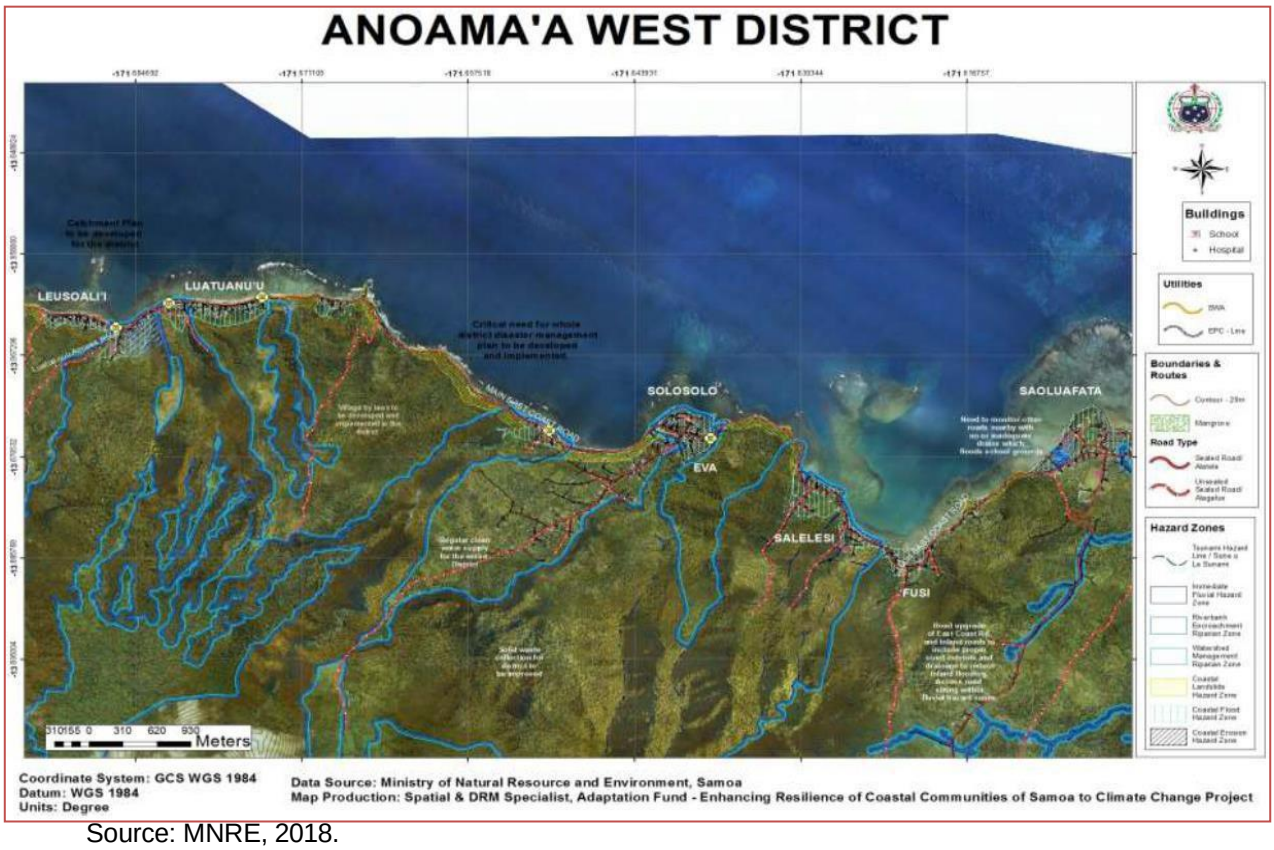
For Laulii village, the first two kilometers of the ECR from the Letogo stream is inside the Coastal Landslide Hazard Zone (CLHZ). This stretch of road also corresponds to the critical areas targeted for rock protection works under the ECR-SSP. The most densely populated part of Laulii village (along the Laulii stream and the Ma'anila river flats) are also within the CEHZ, CFHZ and the Tsunami Hazard zone.

For Anoama'a district, most of the ECR lies within both the CEHZ and CFHZ from Leusoalii to Saoluafata. Within both hazard zones are located 352 of the total 1,036 buildings in the district (MNRE, 2018). About 14.4 ha of the district's total land area of 9,097 ha is in the tsunami shore exclusion zone (Red Zone) and 22 buildings are in this zone. There are also 394 buildings within the district that are in the Watershed Management Riparian Zone (ibid.). The district is prone to landslips.

Figure 12 : Coastal hazard zones (erosion, flood, and tsunami) in Leusoali'i Village

`Source: Anoamaa West District CIM Plan, 2018. MNRE.

Figure 13: Anoma'a West District showing coastal hazard zones.



Source: MNRE, 2018.

The Anoama'a district CIM Plan noted that part of the ECR is exposed to 'extremely high risk hazard zone' or where all four hazards types[34] exist.

SECTION 5: HUMAN ENVIRONMENT

5.1. Project sites relative to village settlements

The five sections of the ECR targeted by project interventions are the hilly and rugged headlands and steep slopes. They are separated by river flats and coastal plains and adjoining gentle sloping areas. Village settlements are concentrated in these flats and sloping areas. The few exceptions are of a few houses on the coastal side in Sites 1,2 and 3 at Letogo and Laulii which are about 20m from the nearest project sites and others houses on the edge near project sites (Site 18 and Site 32) in Leusoalii, Luatuanuu and Saoluafata. Figure 17 to Figure 21 show sites nearest houses.

Fig 14: houses at both ends of a project site (in blue) in Luatuanu'u.

Fig 15: Houses on coastal side of the ECR facing project site in Letogo.

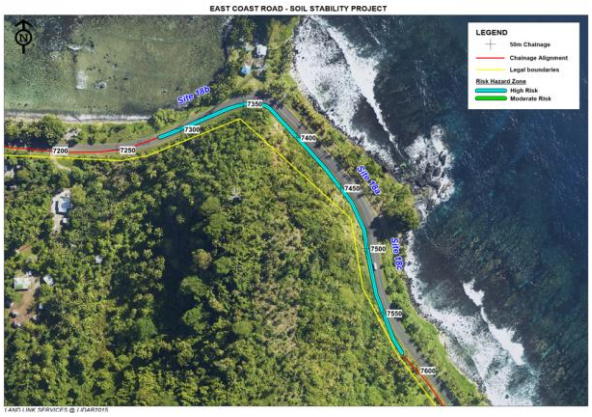


Fig 16: houses on coastal side facing project site (in blue) in Leusoali'i.

Fig 17: houses near both ends of last project site (in blue) in Saolufata.

Fig.18: village settlements on coastal flats in Laulii (without project site).

Fig.19: Project site (in blue) isolated from village settlement in Luatuanu'u

5.2. Key village demographics and other socio-economic features

Two villages in Vaimauga East district and seven in Anoma'a West district will be directly affected by ECR-SSP construction activities. Their main demographic features are tabulated below based on the 2021 census.

Table 3: Main demographic features by village

Key demographic features by villages	Letogo	Laulii	Leusoalii	Luatuanuu	Solosolo	Eva	Salelesi	Fusi	Saoluafata
Population (2021)	1565	2217	478	936	1835	273	374	428	910
Male/Female (%)	52/48	51/49	53/47	50/50	50/50	53/47	50/50	52/48	51/49
Number of hh	231	293	75	125	249	45	41	63	129
Per hh population	6.7	7.6	6.4	7.5	7.4	6.1	9.1	6.8	7.1
Popn (%) 15+ yrs	59.4	61.5	61.9	60.1	58.1	67.7	59.0	62.6	60.9
Popn with walking disability	4	29	7	10	20	4	4	5	6

Source: SBS (2021)

Other salient socio-economic features of affected villages are:

- *Education:* No education facilities are within 300 m of project sites and sites are not used by school children to access education facilities.
- *Drinking water:* All communities have reticulated water supply systems sourced from inland springs . No project sites are used for drinking water supply or as drinking water catchments.
- *Electricity and cooking:* All villages in the area of influence have grid electricity with high HH connection (over 97%). Transmission lines that supply this electricity are present along the road including target project sites. No project sites are used by nearby villages for sourcing wood for cooking.
- *Health facilities*: The closest hospital to Letogo and Laulii villages is the Moto'otua General Hospital. Several private medical clinics in and around the outskirts of eastern Apia are readily accessible. For Anoama'a district, the district hospital is at Lufilufi, Saoluafata's eastern neighbor. The Moto'otua National Hospital however remains the primary source of medical care for most.

Details of villages social characteristics and other aspects are in Appendix 12. Results of the socio-economic survey of affected households are summarized in the Abbreviated Resettlement Action Plan (ARAP).

5.3. Economics and Livelihoods:

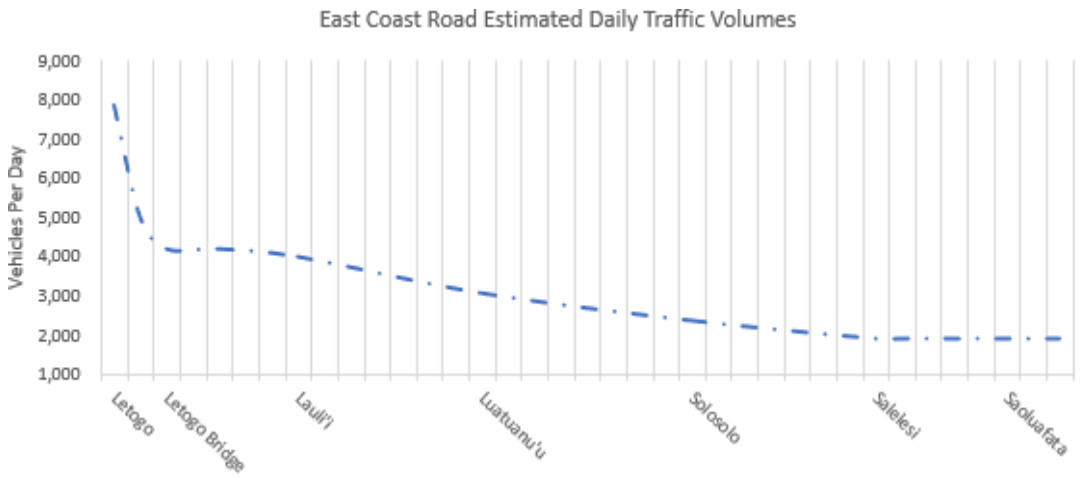
ECR is an important road corridor servicing the local economies of the 7 villages. It provides connectivity to places of employment, schools and social and health services in the Apia urban area. In many villages, the ECR attracts roadside stalls selling fresh produce and cooked food to locals and passing motorists.

Some sites have remnant crops and fruit trees but these are not the primary sources of food and or income sources for local households which are in plantation lands remote from project site and residential areas. Some employment opportunities during the construction will be generated. More significantly, financial compensation for acquired land will be most impactful for many landowner households.

5.4. Road Traffic

Traffic volumes on the East Coast Road have been recorded by LTA at various locations and range from 1,900 per day at Saoluafata to 4,200 near Lauli'i, around 12% of these are trucks and buses. The posted speed limit is 56km/h although the range of speeds observed during site visits varies between 45km/h and 60km/h on average.

Figure 20: ECR Estimated Daily Traffic Volumes

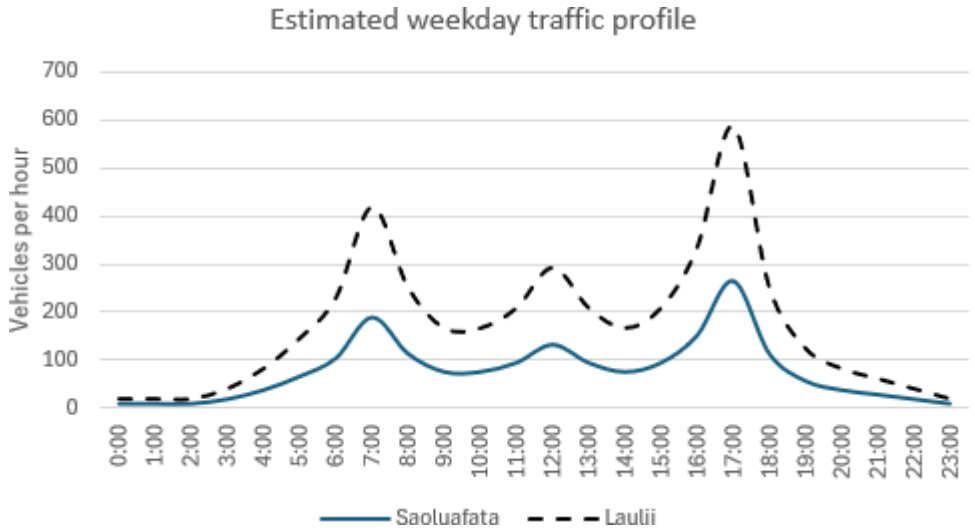


Source: Tonkin& Taylor (2024)

Whilst detailed counts have not been provided, anecdotal and observational evidence indicates that approximately 10% of the daily traffic occurs during the peak travel times. These are generally 7am to 8am with around 80% of traffic heading West towards Apia, with the reverse between 4:30pm and 6:00pm. There is a lesser peak at lunch time (12:00pm to 1:00pm) where people who travelled into Apia return home and those who work later head into the city.

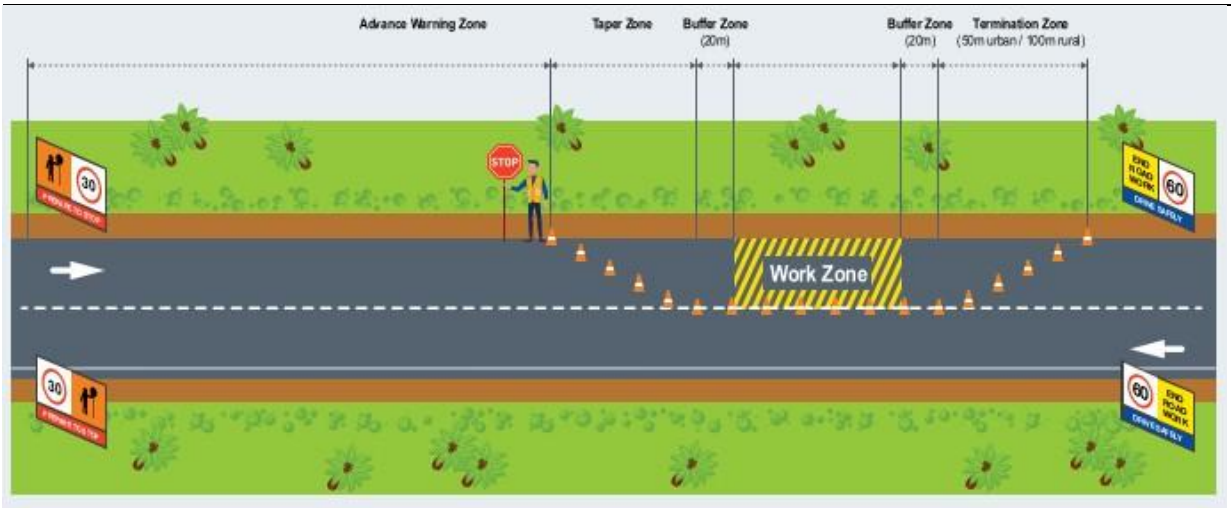
In terms of traffic management, the morning peak traffic is expected to be between 190 and 420 vehicles per hour. The evening peak will have a higher volume of traffic due to the number of businesses which close within that time, which is estimated to be between 250 and 600 vehicles.

Figure 21: Estimated Weekday Traffic Profile



To safely carry out the works, it is assumed that the landside lane will be closed to allow for working space for plant and machinery and to provide an appropriate level of separation and protection to the public. It may also be necessary at some locations and for some construction activities for the full carriageway to be closed to traffic. These closures are likely to be limited to a few hours at a time and would occur outside peak travel hours. The maximum length of roadwork site is unlikely to exceed 500m and traffic will be controlled using shuttle working and stop go in accordance with Figure 16 of the MWTI Safer Road Works Field Guide[26].

Figure 22: Traffic Management During Construction on ECR



Using a high-level assessment of traffic delay at roadworks it is anticipated that during the evening peak hours the maximum delay will typically not exceed 7-10 minutes at each site. During the off peak period this is expected to be less than 5 minutes. Typical travel times from Saoluafata to Letogo are approximately 22 mins in the off peak, increasing to approximately 25 mins in the peak periods. Each worksite is likely to increase this trip by 20 to 30%.

To minimize risk to road users and to reduce frustration for drivers it is good practice to clear lane restrictions in time for the peak hours and to limit the number of consecutive worksites.

[26] Safer Road Works – A field guide for use on Samoan roads (MWTI, 2021)

No works should be carried out between dusk and dawn for safety reasons which limits the effective working day to between 6am and 6pm (depending on weather and daylight savings etc) and any relevant DC conditions. It is important to note that between 6pm and 7pm most villages observe Sa, and vehicles are prevented from passing for about 20mins for the evening devotion. Therefore, works and vehicle movements to and from site should be concluded in advance of this period.

With appropriate community consultation, commencing traffic management during end of the morning is unlikely to have a significant impact on journey reliability, as people will have the informed option of travelling earlier or later. It may also be appropriate to extend into the early part of the evening peak by around 30 mins.

Subject to community consultation and approval of a TMP with LTA, traffic management is appropriate between 8am and 5:00pm to maximise the available daylight. This will involve minor travel time compromises for the public but will ultimately allow works to be completed faster and will therefore reduce the overall impact. Any traffic management should be monitored, and stop times actively managed to minimize queues and delays.

According to a World Bank report (Nov, 2020), Samoa recorded 30,000 vehicles in 2023, a ratio of 3 cars per every 20 people. Most are used imported vehicles (max of 8 years old) from Japan, Australia and New Zealand. The most common vehicle types are family vans and four-door passenger vehicles. Based on the ratio of 3 cars per 20 people, the 8 villages involved in ECR-SSP would have a total vehicle count of 1,346.

A WHO report (2016, cited by WB 2020) estimated a crash fatality rate of 11.3 fatalities per 100,000 of population for Samoa which compares with the global practice of 2.6 – 2.8 fatalities per 100,000 of population for the four best performing countries. Other relevant findings (WB, op cit) are –

- Based on available crash data from Government agencies, 38% of serious injuries (SI) were pedestrians and over 30% of SI victims are aged 15 years or less.
- Over 50% of SI people are below 20 years of age;
- Buses and trucks are over-represented in SI crashes, accounting for 40% of these incidents.
- There is a high percentage of children between 0 – 10 years in the SI data both as pedestrians and vehicle occupants.

In recent years the Ministry of Police has collected crash data, and between 2019 and mid 2024 there have been a total of 79 recorded crashes along the 16km length of the ECR between Letogo and Saoluafata, accounting for COVID when vehicle numbers were reduced, the average is approximately 20 per year, although the data indicates that numbers are increasing annually.

Most crashes are a result of speeding and careless or inattentive driving (around 75%) with a further 10% a result of impairment through intoxication. The data is not specific on road user group, age or gender, nor does it provide specific details of severity of crash or type of injury sustained.

It is therefore essential that all works within the corridor meet strict safety criteria as defined in the 2021 MWTI Safer Road Works Field Guide.

The permanent works have been designed to enhance road safety through the containment of falling rocks and through the improvement of road environment through improved surfacing, delineation during day and night, and speed management on tight bends.

SECTION 6: RISKS AND IMPACTS ASSESSMENT

6.1. Methodology for Risk and Impact Assessment

The following risk assessment methodology is used to examine the consequences, probability of occurrence, and relative significance of potential negative impacts associated with the Project. The methodology is recommended by SPREP[2731] for the Pacific Island context and adapted from SRK Consulting[2832].

Three criteria are used and a rating and score are assigned to each criterion. The criteria are –

i. Extent – the area over which the impact will be experienced;
ii. Intensity – the magnitude of the impact i.e. whether it will result in minor, moderate or major environmental, economic and social (including human health) changes, and
iii. Duration – the timeframe over which the impact will be experienced and its reversibility.

The rating, definition of ratings and score for each criterion are as follow:

STEP 1 - RATING	DEFINITION OF RATING	SCORE
A. Extent – the area over which the impact will be experience		
Local	Confined to the project site or study area	1
Wider catchment or province	Extends beyond the project site to the wider, surrounding area	2
Island or national	Extend to the whole island or nation	3
Regional or global	Extends to the Pacific region and potentially beyond	4
B. Intensity.- the magnitude of the impact i.e. whether the impact will result in minor, moderate or major environmental, economic and social (including human health) changes		
Low	Minor or negligible changes, disturbances, damages, injuries or health effects. Likely to generate minimal interest or concern amongst the local community/affected stakeholders.	1
Medium	Moderate changes, disturbances, damages, injuries or health effects. Likely to generate more prolonged interest or concern amongst the local community/stakeholders.	2
High	Major or severe changes, disturbances, damages, injuries or health effects. Likely to generate widespread and intense interest or controversy amongst local, national or regional communities or stakeholders.	3
C. Duration – the timeframe over which the impact will be experienced and its reversibility		
Short-term	Up to 2 years – impact is reversible or limited to when a particular development activities or environmental events are taking place. Remediation or recovery is possible.	1

[27] SPREP. 2016. Strengthening environmental impact assessment: guidelines for Pacific Island Countries and Territories. Apia. Samoa: SPREP, 2016
[28] SRK Consulting: http://www.srk.com/en

Medium term	2 to 15 years – impact is reversible or limited to when a particular development activities or environmental events are taking place. Remediation or recovery is possible.	2
Long term	More than 15 years – impact is permanent or gradually reversible with sustained remediation and recovery efforts.	3

The combined score of the three criteria (extent, intensity, duration) corresponds to a ***Consequence*** rating, as follows:				
Combined score (A+B+C)	3 – 4	5 – 6	7 – 8	9 – 10
Consequence Rating	Minor	Moderate	Major	Massive

STEP 2: D. Assess the **probability** of the impact occurring according to the following definitions:	
Improbable	Unlikely to occur during project lifetime < 20% chance of occurring
Possible	May occur during project lifetime 20% - 60% chance of occurring
Probable	Likely to occur during project lifetime ➢ 60% - 90% chance of occurring
Highly probable	Highly likely to occur, or likely to occur more than once during project lifetime ➢ 90% chance of occurring

STEP 3: Determine the overall significance of the impact as a combination of the consequence and probability ratings, as set out in the matrix below:

		PROBABILITY OF OCCURRENCE			
		Improbable	**Possible**	**Probable**	**Highly probable**
Consequence of Impact	**Minor**	VERY LOW	VERY LOW	LOW	LOW
	Moderate	LOW	LOW	MEDIUM	MEDIUM
	Major	MEDIUM	MEDIUM	HIGH	HIGH
	Massive	HIGH	HIGH	**VERY HIGH**	**VERY HIGH**

STEP 4:
State the level of confidence in the assessment of the impact as high, medium or low. The level of confidence will depend on the extent and type of information available, whether it is qualitative or quantitative, and whether it is based on direct measurements, extrapolated data, estimations or expert opinion:

STEP 5:
5(a) – Identify and describe practical mitigation measures that can be effectively implemented to reduce the impact.
5(b) – assume mitigation measures have been implemented and reassess the impact, by following steps 1 – 4 again. The point of the second assessment is to examine how impact extent, intensity, duration and /or probability are likely to change.

6.2. Assessment – Pre-Construction Phase

6.2.1. Land taking risks

The involuntary taking of customary land for project purposes has inherent risks. Customary lands are not formally surveyed with shared boundaries informally agreed to often the cause of disputes between neighbouring families, especially when land is being measured for Government land taking

involving financial compensation. In other instances, landowners (i.e. the extended family high chief or 'sa'o') may be absent (e.g. living abroad) or the 'Sa'o' chiefly title is vacant. Sometime contractors may delay taking possession of work sites in disputed areas, out of concern for the security of workers and equipment/machinery. Such circumstances often result in delays in land acquisition and construction activities.

The social impacts of land taking are addressed in accordance with the requirements of WB OP/BP 4.12 Involuntary Resettlement Policy and Samoa's Taking of Lands Act 1964. The Abbreviated Resettlement Action Plan (ARAP) documents in detail the land taking process as well as entitlements of affected owners of land and crops. The satisfactory implementation of the ARAP is the requisite for WB's 'no objection letter' for the construction phase to commence.

	Land taking risks						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	local 1	high 3	medium 2	Moderate 6	Possible	High	High

Proposed mitigation:

i. Implement the approved ARAP swiftly and without delay.
ii. If required, establish and operate an escrow account for disputed compensation payments pending Court confirmation of rightful beneficiaries, to allow Contractor to proceed.
iii. Encourage participation of village representatives in formal project consultation meetings.
iv. Ensure heads of households including family 'sa'o' of both families sharing boundaries are present on-site to identify and agree on shared boundaries, in the presence of LTA and MLS representatives.
v. Work closely with village's Council of Chiefs and affected families' leaders to resolve any conflicts that may arise.

	Land taking risks						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	local 1	Low 1	Short term 1	Moderate 5	Improbable	High	High

6.3. Construction Phase

6.3.1. Sourcing of materials

All road-based materials will be sourced locally. Aggregate resources in Upolu include a variety of basalt rocks derived from lava flows, and given the modest volume of material required for construction, are available from several sources. Sources must be PUMA permitted with permit olders complying with PUMA DC requirements. Non-compliance by supplier(s) may prompt PUMA intervention with stop-notices that result in the disruption of quarry operations and consequently delays in the supply of project construction material.

There are two quarries in Laulii. Both are within 1km from the ECR. Other licensed quarries are in Alafua and Saleimoa.

	Illegal sourcing of materials during construction						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Intensity 1	Duration 1	Minor 3	Possible	Very Low	High

Proposed Mitigation:

i. Sources of material must be approved by the LTA prior to commencement of activities;
ii. Procure materials only from quarries/sites approved by PUMA and prioritize existing and nearby operations to minimize transportation impacts;
iii. Should a new quarry or borrowed pits be required, ensure to check with PUMA that it is compliant with the DCA process and has a valid license to operate.
iv. Ensure no materials are sourced from the unpermitted sources.

	Illegal sourcing of materials during construction						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Low 1	Short term 1	Minor 3	Improbable	Very Low	High

6.3.2. Soil erosion during construction

The area of influence is largely already cleared of vegetation. However, tree trunks and root systems remain in the ground. These and other obstructions to the excavation of drains will be removed. The Detailed Design Report noted that excavation to form catch ditch shape will require an observational approach by a qualified geologist/engineer (Section 6.5.1) on a case-by case basis and there may be instances wherein over-excavation is needed to remove large basalt bounders, with subsequent backfilling to provide allow erosion protection.

The grubbing and excavation will produce loose soil and organic debris that will be washed into the existing road drains and discharged into the marine environment during downpours. Drains may be clogged and blocked as a result, and silt and debris may overflow into other areas.

	Soil erosion during construction						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Intensity 1	Duration 1	Minor 3	Probable	Low	High

Proposed mitigation –

i. Schedule construction works to avoid wet season and rainy weather conditions.
ii. Stabilize all slopes, ditches or any disturbed area as soon as possible after the final grade or final earthworks have been completed within a section or area of the project.
iii. Promptly backfill and stabilize over-excavated areas. Where it is not possible to permanently stabilize a disturbed area immediately after the final earthworks have been completed or where the activity stops for more than 14 days, promptly implement interim stabilization measures.
iv. Ensure that any stockpiles of excavated material intended for reuse, are not located within 10m of a watercourse, or in ecologically sensitive areas, and away from the open road lane used by the public. Stockpiles should be covered to prevent dust, and with berm/barriers to limit erosion.
v. Ensure no runoff from the project area is discharged into water/sea without effective means to prevent sedimentation.

vi. Remove earth and mud from vehicles and machinery before they leave the site.
vii. Ensure that runoff from stockpiles is directed through a stormwater treatment device.

	Soil erosion during construction						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Low 1	Short term 1	Minor 3	Possible	Very Low	High

Air quality at construction sites will be reduced as a result of many factors combined, including dust released from site works, exposed grounds, vehicle fumes, vibration and noise from the use of heavy machinery and equipment, and potential changes to air moisture and wind speed and direction.

Reduced air quality is not only a nuisance and or perceived loss of amenities, but may also result in health issues such as bronchial and respiratory illnesses. Appropriate mitigation measures will be prescribed to guide construction contractors.

	Reduced air quality						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Intensity 1	Duration 1	Minor 3	Highly Probable	Low	High

Proposed mitigation –

Dust control

i. Comply with COEP 2 for Dust Control during road construction.
Apply dust suppression through water spraying. During dry periods water spraying will be applied at least twice a day and or when needed on the exposed surfaces and road area.
ii. Cover haul and dump trucks carrying fill materials etc., with tarpaulin to reduce dust dispersal.
iii. Restrict excavation activities such as removal of top soil during periods of high winds or under more stable conditions when wind could nevertheless direct dust towards adjacent communities;
iv. Restore disturbed areas as soon as possible.
v. Ensure the wearing of face masks by all site workers and operators during dry weather conditions.
vi. Ensure any stockpiles of materials are not allowed to generate waste and where waste is generated, that it is removed promptly and disposed at a PUMA-approved site.
vii. Establish and enforce speed limits in TMP to minimize dust generation.
viii. Protect stockpiles of excavated materials from water and wind dispersion by covering them with geo-textile fabric.

Vibration

i. Where the nearest vibration-sensitive receptor is within 500m, monitor vibrations at the start of and during the use of mechanical equipment and machinery causing vibration.
ii. If vibration levels are monitored and found to exceed the vibration threshold according to referenced criteria, the contractor shall modify the construction activities until compliance with the criteria has been achieved.

Noise:

i. Contractors must ensure compliance with the following noise control limits prescribed by the PUMA Planning Policy: Revised Noise Standards 2011. This will require noise monitoring on site. The permitted noise levels must not exceed the following limits from construction works:

Noise Source (Averge dBA, L_{10mins})	Receiving Property (LAeq. 10 minutes)											
	Residential Use			Commercial Use			Religious Use			Industrial Use		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Construction works	75	60	-	75	60	-	75	60	-	75	65	-

*Note: Day period is defined as 0700 to 1800, evening period is defined as 1800 to 2200 and night period is defined as 2200 to 0700. Construction activities conducted at times not specified in the table above will require special approval from relevant authorities. These may include the Night period, Sundays and all other times within Residential and Tertiary Educational compounds.

ii. Ensure that all powered mechanical equipment is well maintained, engine idling is minimized and that all engines switched off when not in use; and all construction vehicles shall have well-functioning exhaust systems or muffler silencers;

iii. The timing of construction works should comply with the permitted or approved working hours from 7.00am to 5.00pm Monday to Friday; and from 8.00am to 4.00pm on Saturdays to mitigate noise pollution and adhere to village curfews.

iv. No work shall occur on public holidays or Sundays except for emergency works as approved by PUMA.

v. Operations that cannot be reasonably undertaken or completed in normal working hours can be undertaken outside normal working hours subject to providing prior approval from the PUMA and the consent of the affected community.

	Reduced air quality						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Intensity 1	Duration 1	Minor 3	Possible	Very Low	High

6.3.4. Safe handling of hazardous materials

Diesel and lubricants will be used as part of plant operation, but not likely to be stored at working sites. Other hazardous materials for machine maintenance shall be stored at laydown areas. The main risk to the health and safety of workers will be in any mishandling when refueling excavators, vehicles etc.. Accidental spills and leakages from plant and equipment is a risk to the environment and to the health of site workers.

Contractors shall consult and comply with the requirements of the OSH Regulation 2017 Part 11 regarding hazardous substances. In addition, the following measures shall be included in the construction ESMP.

	Safe handling of hazardous material						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Intensity 1	Duration 1	Minor 3	Probable	Low	High

Intensity (1) assumes volume of stored materials on site is low.

Proposed mitigation:

The Contractor shall prepare a waste management plan, which shall include the following measures -

i. Store hazardous materials (fuels, lubricants and oils in particular) in laydown areas and not on ECR road-side work sites.
ii. Ensure the safe transfer of fuel to and from the storage tanks with the use of devices such as dry-break couplings, automatic flow cutoff devices, and tank overflow controls.
iii. Refueling in the field will be done from road-licensed fuel tanks away from watercourses or other environmentally sensitive areas. Any ground that could be contaminated from spillages of more than 5 liters (or less if a sensitive location), will be excavated and removed as soon as possible, or remediated through other approved means.
iv. Make sure a spill kit is provided at work locations and workers are trained in their use;
v. Maintain a tidy appearance of the laydown areas by proper storage of materials and the regular disposal of waste.
vi. All fuel storage areas and refueling vehicles are to be provided with spill-containment kits.
vii. Prepare and include in WMP an emergency response spill plan and train personnel in its use.
viii. Ensure the effective implementation of the approved WMP;

	Safe handling of hazardous material						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Intensity 1	Duration 1	Minor 3	Possible	Very Low	High

6.3.5. Management of solid waste

Waste expected to be generated at sites include: (a) tree roots, tree trunks and other organic matter, (b) excavated material that is not suitable for reuse as fill onsite; and (c) general municipal waste such as empty containers, plastics, etc.. The expected volume is low however proper management and disposal is necessary.

Mitigation measures for waste arising from the project will be managed following the principles of reduce, reuse and recycle. Proposed measures in ESMP should be integrated and elaborated in a Waste Management Plan to be prepared by the contractor.

	Management of solid waste						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Minor	Probable	Low	High

Proposed mitigation:

i. Ensure the timely removal and proper disposal to a PUMA approved location of organic waste (tree trunks, roots etc), humus and of excavated material not suitable for reuse as fill onsite.

ii. Practice waste segregation, reduction, reuse, and recycling at the work sites.
iii. Ensure the sites are regularly cleaned and waste material disposed at the Tafaigata landfill.

	Management of solid materials/waste						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Low 1	Short term 1	Minor 3	Possible	Very Low	High

6.3.6. Disruption to Services and Utilities

Table 4 summarizes Tonking & Taylor's (2024) assessment of impacted utilities and services along the ECR-SSP sites. It found Vodafone cables along the entire length of the ECR-SSP sites affected, and will need relocation. One power pole at Ch765m will be relocated, while several others in Ch 3020m and Ch 9320m are close to the road and may need shifting further back. Other poles on the landward side with the targeted sections (Ch 15320m – Ch15,565m) were assessed and found 'relocation not likely'. Of water supply, 765m of pipelines between Letogo and Luatuanuu will be impacted, with relocation is assessed as 'highly likely'. Between Luatuanuu and western Saoluafata, local water supply networks under the auspices of the Independent Water Scheme will not be impacted.

Table 4: Utilities/Services and 'likelihood of clash'

Service	**Potential extent of clash**	**Likelihood of clash**	**Comment**
Vodafone cables	6,400m of cable	High Likelihood	- Cable runs along entire length of design footprint, typically under landward edge of road shoulder. - Potential to clash with new cross culverts in addition to ditches.
Water supply	765 m of pipe	High Likelihood Of particular risk is where barrier fence footings are being installed.	- Potential to clash with new cross culverts in addition to ditches - Between Letogo and Loatuanuu.
Overhead power	Pole @ Ch 765 landward side	High Likelihood	- OSH hazard; mitigation measures required in ESMP.
	Poles @ Ch 3020 & 9320, landward side	Low likelihood	-
	Poles @ Ch 15320, 15380, 15450, 15510 & 15565, seaward side	Low Likelihood Poles are located close to road widening works; pole stability needs monitoring .	- It is not anticipated that relocation of the pole will be required (T&T, 2024)

Source: Based onTonkin & Taylor. August 2024. East Coast Road – Slope Stabilization Project: Civil Engineering Design Completion Report. Tonkin&Taylor, Auckland, New Zealand Table 12.2; page 65.

The contractor must refer to and comply with PUMA COEP 14 regarding safety requirements related to cellular telecommunication facilities, and OSH Regulation 2017 Part 6 regarding safety requirements for electrical works, and international best practices. In addition, the following measures shall be incorporated into the contractor's ESMP.

	Disruption to services/utilities						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 2	Medium 2	Short term 1	Moderate 5	Highly probable	Medium	High

Proposed measures:

i. Issue advanced public notices for public and community information and awareness about any disruptions using newspaper, radio and television.
ii. Disclose and discuss the impact on services during pre-construction community consultation meetings.
iii. Collaborate with utility providers to plan disruptions and to ensure quick resumption of utility services;
iv. Provide alternative supplies where applicable, e.g. water supply by tankers to affected communities; and
v. Quickly restore all disrupted services.

	Disruption to services/utilities						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Low 1	Short term 1	Minor 3	Possible	Very Low	High

During construction, traffic will be disrupted along the ECR project sites. One lane of the ECR will be closed to allow project construction. It is possible that both lanes will, at times, be closed albeit briefly. Consequently, motorists and commuters including school children will require more travel time than normal to get to work places and schools in the morning and to return home in the afternoon.

	Disruption to Traffic during construction						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Medium 2	Short term 1	Minor 4	Highly probable	Medium	High

The contractor shall prepare a Traffic Management Plan (TMP) in accordance with the requirements of COEP 12, referencing the 2021 MWTI publication "Safer Road Works – A field guide for use on Samoan roads", and to be reviewed and approved by LTA prior to the start of construction. The contractor shall also incorporate the following measures**.**

Proposed Mitigation:

i. Traffic management to reference figure 4 of the 2021 MWTI publication "Safer Road Works – A field guide for use on Samoan roads" and actively monitor and manage traffic conditions during the works.
ii. Use signboards and other public information means to inform the public and community in advance of construction work, schedule of closures or diversion, etc.;
iii. Avoid or otherwise minimize working at peak travel hours (7 – 9am in the morning, 4 – 7pm in the evening) during week days.
iv. Educate machinery operators, haul truck drivers and others to understand posted signs to minimize traffic disturbance and avoid accidents;

v. Install traffic control measures, e.g. roadside reflectors, speed limits, particularly at night in sensitive work areas, erection of warning signs, etc.;
vi. Arrange for the delivery of materials to the storage or work sites during off-peak hours of the day;
vii. Place appropriate reflectors on hanging materials from trucks for the safety of vehicles following;
viii. Employ flagmen to control traffic and assist construction vehicles as they attempt to enter and exit project storage and or work sites.
ix. Park all loaded trucks at designated spots at the worksite for offloading and not on the main road.
x. Place traffic warning signs in strategic locations to ensure easy visibility and to provide adequate forewarning.

	Disruption to traffic during construction						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Medium 2	Duration 1	Minor 4	Improbable	Very Low	High

6.3.8. Sewage management

Sanitary facilities such as toilets and wash rooms will be needed on site or nearby for construction workers during the construction stage. Without toilets, workers will resort to practices for defecation that may be both unhealthy and undignified, and which may cause health issues due to bad odour, fly infestation etc..

	Sewage management						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Minor 3	Probable	Low	High

Proposed mitigation:

i. Provide portable toilets on site or have some available nearby for construction workers to use;
ii. Ensure toilets are washed down daily and holding tanks emptied regularly into a sewage truck for disposal at the Tafaigata landfill.

	Sewage management						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Low 1	Short term 1	Minor 3	Improbable	Low	High

6.3.9. Environment, Social Health and Safety (ESHS)

The health and safety of workers and road users will be at risk on the work site during construction where they will be exposed to hazardous conditions including noise, reduced air quality, vibration from the use of power tools, possible injury from moving machinery and sharp tools, etc. The Samoa Occupational Safety and Health (OSH) Act 2002 and OSH Regulation (2007) mandates employers to take all reasonably practicable steps to protect the safety, health and welfare at work of employees and to provide and maintain a safe and healthy working environment.

T&TI (2024)[29] recommends ways to enhance the safety of workers during construction, in particular in installing the rockfall fences and the excavation of the catch ditches and drainaage. As well, measures for the safety of road users during the operational phase are proposed. These measures, OSH 2007 Regulation requirements and international best practice, will be incorporated into the Construction Environment and Social Management Plan (CESMP) for the contractor to comply with.

	Occupational Safety and Health						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Medium 2	Short term 1	Moderate 5	Highly Probable	Medium	High

Proposed mitigation –

i. Avoid possible work on slopes above the road alignment such as scaling, vegetation removal, bolting or installing draped mesh.
ii. Schedule work to avoid the cyclone season and rainy conditions.
iii. Ensure fence heights are balanced with rockfall bounce height to ensure ease of maintenance and accessibility.
iv. Install cat eye reflective devices for improved visibility and safer night-time navigation and
v. Have a minimum shoulder width of 0.5m from the edge of the lane line to provide a safe buffer space for traffic.

The above safety measures will complement the standard OSH Act 2002 and OSH Regulation 2021 requirements such as the use of PPE, and safe working methods to ensure a safe environment for workers and the visiting public.

	Occupational Safety and Health						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Low 1	Short term 1	Moderate 3	Possible	Low	High

6.3.10. Gender Based Violence (GBV), Violence Against Children (VAC) and Sexual Exploitation, Abuse and Harassment (SEAH)

Impacts such as GBV, VAC and SEAH are generally associated with a significant influx of foreign workers and the establishment of workers camps in the near vicinity of local communities. For ECR-SSP, construction contractor(s) is envisaged to engage a small number of professionals and technical specialists for the duration of construction however the majority of contractors' work force are expected to be locals including some from the project-affected villages. As well, no workers camps are expected.

Notwithstanding, the presence of workers near villages may create opportunities for casual social interactions with women and children that may lead to unwanted sexual exploitation, abuse and or harassment (SEAH), and violence against children (VAC). The probability of an event is low yet a single confirmed incident of SEAH is one too many and any mishandling of such can generate serious reputational risk for some project stakeholders.

[29] Design Report, Section 6.8.

The contractor is required to support a gender equality policy with respect to employment, but local experience show that women rarely show interest in and or are employed in heavy-lifting outdoor work in the roading sector. Still, opportunities for casual social interactions with workers may arise and may result in SEAH related impacts.

The Project's SEA/SH prevention and response measures will be implemented including the following.

	GBV, VAC and SEAH related risks						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Intensity 3	Duration 1	Moderate 5	Possible	Medium	High

Proposed mitigation:

(i) Install Project signage at prominent and strategic locations to alert and inform communities and general public of project activities;

(ii) Ensure information of contact persons (name, phone number and email) for the Grievance Redress Mechanism is prominently displayed in Project signage.

(iii) Strictly limit access to work sites to authorized people only.

(iv) Engage the project affected communities early in the design phase to raise awareness of the project and its potential social risks. Notify the communities in advance about the construction works before commencing as well as updates on progress from time to time;

(v) Conduct proper induction and cultural orientation of workers prior to deployment to sites, including information on local customs, taboos and other cultural sensitivities.

(vi) Restrict and monitor closely workers access to local shops, road-side stalls etc. outside of the work site. Collaborate with local community leaders to assist in enforcing these restrictions.

(vii) Ensure the signing and enforcement of the Code of Conduct (CoC) agreements by all workers. Ensure they understand the consequences for non-compliance.

	GBV, VAC and SEAH related risks						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Intensity 3	Duration 1	Moderate 5	Possible	Low	High

6.3.11. Site closure:

Construction works are likely to be carried out incrementally over the five sections of the ECR-SSP with work focusing on one (possibly two) sections initially, before shifting. Assuming this scenario, construction will require proper closure of worked sites before moving to the next until the five sections are completed.

At the completion of work at a particular site, the contractor will be responsible for removing all equipment and structures, cleaning up and disposing all waste materials, and rehabilitating all construction sites and work areas so that they are returned as much as possible to their previous use.

	Safe and timely closing of sites						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	low 1	Short term 1	Minor	Possible	Very Low	High

Proposed Mitigation:

i. Stabilize all construction sites and tracks.
ii. Rehabilitate all borrow pits, quarries and sand winning areas.
iii. Close all fuel and oil depots properly. Remove any contaminated soil and restore the area fully.
iv. Reshape and revegetate all spoil heaps.
v. Reapply topsoil in areas where topsoil was removed, and revegetate if required.
vi. Dispose all wastes that cannot be recycled at Tafaigata Landfill, and fill and close the site from which the waste came.
vii. Dispose all wastes assigned a Hazchem classification in accordance to the Hazchem requirements.

	Safe and timely closure of sites						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Intensity 1	Duration 1	Minor	Improbable	Very Low	High

6.3.12. Unanticipated impacts

The ECR is highly vulnerable to climate-induced events such as cyclones, flooding, wave surges etc and unpredictable geological events such as earthquakes and tsunamis. Hazard maps in CIM Plans (MNRE, 2018) clearly show significant segments of the ECR are located inside Coastal Erosion Hazard Zones (CEHZ), Coastal Flooding Hazard Zones (CFHZ)FHZ and the Tsunami zone. With widely accepted climate change models predicting more frequent and more intense cyclones and heavy rainfall events, events previously considered unanticipated have become more predictable, except perhaps geological events.

National strategies across all sectors promote the strengthening of resilience and adaptability of the built and natural environments to minimize the worst impacts of such events. An integral part of resilience is planning for and expecting the unexpected.

	Risk of major unanticipated events						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 2	Moderate 2	Medium term 2	Moderate 6	Probable	Medium	Medium

Proposed Mitigation –

i. Ensure that design specifications for project physical infrastructure ensure climate resilience to extreme climatic events, and that construction quality comply with the prescribed engineering specifications and standards.

ii. Respond swiftly to unanticipated impacts threating the integrity and functionality of the ECR in coordination with other relevant agencies and organizations including NEOC.

	Risk of major post-project unanticipated events						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence

With mitigation	Wider 2	Medium 2	Duration 1	Moderate 5	Probable	Medium	High

6.4. Operational Phase

6.4.1. Maintenance of rockfall barriers and catch ditches

The risk of rockfall will remain although significantly reduced. Over time, both catch barriers and barrier fences will suffer wear and tear. The occurrence of extreme weather and geological events may cause more serious damage. Longitudinal and cross drains may be damaged and clogged, resulting in extensive flooding. To ensure the optimum and effective performance of the installed rock protection measures, regular maintenance is necessary.

Maintenance measures of catch ditches, barrier fences and drains during the design life are prescribed by T&TI (DD report).

	Effectiveness of rock protection measures						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Low 1	Short term 1	Minor 3	Possible	Very Low	High

Proposed mitigation:

i. Clear catch ditches when 100m thickness of debris has accumulated.
ii. Conduct clearance of ditches towards end of dry season (i.e. October/November) and in advance of cyclones and severe weather events.
iii. Conduct regular inspection of barrier fence especially following reported rockfall events, or following earthquake and storm events.
iv. Conduct maintenance between one to three years checking (i) tension of clamped connections; (ii) removal of vegetation within the area local to the fence; (iii) removal of any accumulated rock debris; and (iv) check the state of corrosion protection and patching as necessary

	Effectiveness of rock protection measures						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Intensity 1	Duration 1	Minor 3	Improbable	Very Low	High

6.4.2. Safety of road users and roadside communities

Post-project, assuming on-going maintenance, the risk of rockfalls affecting road users will be significantly reduced. The all-weather driveability of the road including during heavy downpours is enhanced by design measures that ensure 3m of the road formation remain free of inundation, based on a 10-year ARI event. The presence of barrier fences can and sometimes make the road appear narrower and more restrictive to motorists. This is expected to encourage cautious and defensive driving.

The maintenance of barrier fences and drains where extensive damages are involved, may require partial road closure to allow excavators and work crews to operate. While this will cause disruption to the normal flow of traffic, this impact can be mitigated by ensuring contractors avoid working at peak travel hours.

The risk of rockfalls and inundation is more likely during and immediately following extreme

climate and geological events. The following measures are proposed in that context.

	Safety of road users						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Local 1	Intensity 1	Duration 1	Minor	Probable	Low	High

Proposed mitigation:

v. Alert road users and the public of periods of high risk for rockfalls along the ECR.
vi. Use appropriate signage along ECR to warn drivers of specific sections of the road most vulnerable to rockfall and other hazards.
vii. Implement emergency road traffic management strategies to ensure traffic disruption is minimized while road maintenance crews are at work.
viii. Conduct awareness programs on road safety, and regular road checks for speed limits and unlicensed drivers on the road.

	Safety of road users						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 1	Intensity 1	Short term 1	Minor 3	Possible	Low	High

6.4.3. Unanticipated impacts

Unanticipated events during the operational phase should be planned for. The ECR is highly vulnerable to extreme climate-induced events not to mention less predictable geological events such as earthquakes and tsunamis.

	Risk of major unanticipated events						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
Without mitigation	Wider 2	Medium 2	Medium 2	Moderate 6	Probable	Medium	Medium

Proposed Mitigation –

i. Anticipate and prepare for extreme climate change and geologically induced extreme events that may cause extensive damage to the ECR.

ii. Coordinate closely with all relevant agencies including NEOC to respond swiftly and effectively to national disaster events.

	Risk of major post-project unanticipated events						
	Extent	Intensity	Duration	Consequence	Probability	Significance	Confidence
With mitigation	Local 2	Intensity 2	Medium term 2	Moderate 5	Probable	Medium	High

SECTION 7: ENVIRONMENT AND SOCIAL MANAGEMENT

7.1. Background

This ESIA Report has identified the full range of environmental and social impacts associated with the construction and operation phases, the risk/likelihood of occurrence and the severity of impacts if left unmitigated. Mitigation measures are proposed to avoid or minimize these impacts to

acceptable levels.

Section 7.5 presents the Environmental and Social Management Plan (ESMP) for the project as per PUMA's and WB environmental safeguards requirements. The ESMP matrix includes the environmental issue/project activity, and mitigation and monitoring plans. identifying mitigation measures, assigning responsibilities and timing for implementation; and monitoring plans. following information:

(a) Implementation arrangements for the ESMP including:
- Institutional roles and responsibilities for implementation throughout project construction and operation;
- Grievance Redress Mechanism (GRM).

(b) Environmental mitigation and monitoring matrix containing:
- Potential environmental impacts that could occur during the construction and operation stages of the project;
- Proposed mitigation measures to address each impact identified;
- Agency responsible for implementing each mitigation measure;
- Monitoring tasks to ensure mitigation measures have been implemented effectively during construction and operation stages; and
- Schedule and responsibility for monitoring

(c) Costs associated with implementation of all aspects of the ESMP.

7.2. Implementation arrangements for environmental management

The following institutional arrangements sets out how the environmental and social impacts of the ECR-SSP as identified and set out in the ESMP, and any additional conditions prescribed by PUMA will be managed.

(i) **Ministry of Finance:** The executing agency for the project is the Ministry of Finance (MOF).

(ii) **LTA:** The LTA is the implementing agency for the project and as such will be responsible for overall project implementation including procurement, construction, and operation and for ensuring that sufficient resources are in place to undertake its environmental and social safeguards responsibilities. Within LTA, a PMD has been established to oversee procurement construction and commissioning of the project and a Safeguards Unit exists that will be directly responsible for the effective monitoring of the project's environmental and social impacts and the effective implementation of the ESMP. The LTA through the PMD will also be responsible for applying for and obtaining a development consent from PUMA before construction works commences and for ensuring environmental and social safeguards requirements including the ESMP form part of the construction contractors' contract. LTA will be supported by Tonkin and Taylor International (T+TI) in association with Kramer Ausenco (K A) in project construction monitoring including the monitoring of the Construction ESMP.

(iii) **Construction Contractor:** The contractor will prepare a Construction ESMP, using the approved ESMP, detailing the site-specific methodologies and processes for implementing the ESMP. This CESMP, will be reviewed and approved by LTA prior to commencement of works. Thus the contractor will be responsible for ensuring that all environmental and social mitigation requirements specified in the ESMP, contract documents, and the Development Consent (to be issued by the PUMA) are fully implemented during construction.

(iv) **PUMA:** PUMA is responsible for the administration and enforcement of the PUMA Act 2004 and Environmental Assessment Regulations 2007. As such the PUMA is responsible for (i) issuing a development consent for the project by way of review and approval of the ESIA Report; (ii) reviewing applications; and (iii) monitoring and enforcing compliance of the project with the conditions of the development consent.

(v) **MWTI-PMD**: Has expertise in safeguards that will assist and support LTA in ESMP implementation and monitoring. PMD also compile semi-annual progress reports on safeguards compliance to the WB, collaborating with LTA who will ensure PMD access to CSC's fortnightly/quarterly reports.

7.3. Grievance Redress Mechanism (GRM)

The Project has a GRM in place to receive and address complaints from by the public including project affected communities. The LTA is the complaints administrator in charge of managing and monitoring the GRM.

GRM Contact for lodging any complaints is:

C/- Project Management Division
Principal Safeguard Officer
Phone: (685) 26740
Email:
perina.sila@lta.gov.ws
Location: LTA
Headquarter, Vaitele-tai.

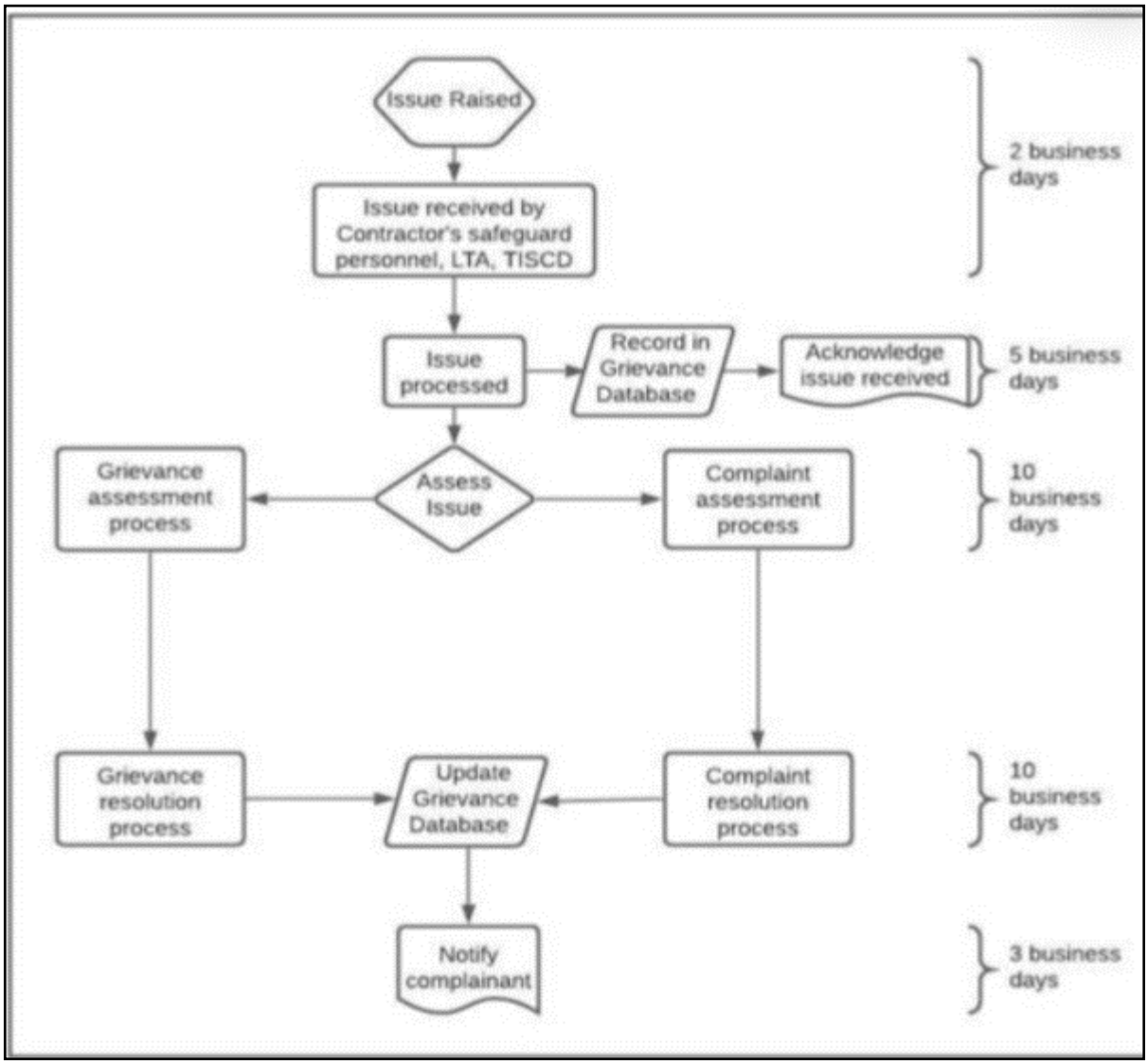
7.3.1. GRM Procedure

The GRM Process includes the following steps:

Table 5: **Project GRM Procedure**

Step	Description	Timeframe
1: Issue raised and received – Submission /Lodging of Complaint.	The issue is raised by an affected person or the affected community member. Submission can be done orally, in writing, through social media (LTA Facebook page) or in person. The issue is then registered	2 Business Days
	on the standard form by the receiver. Any request by the person raising the grievance to remain anonymous shall be respected.	
2. Issued Processed	Recipient (either contractor or IA) records the complaint in the GRM spreadsheet for record keeping. Responsible party is then informed and assigned the responsibility and issuant of the acknowledge letter to the complainant.	5 Business Days
3. Issue is assessed	The recorded issue then undergoes the grievance assessment process. This step requires the contractor and/or the IA to address and resolve the issue that has been lodged within the allocated time. The committee is able to intervene should the issue be severe, serious or one that may cause any delayed.	10 Business Days
4. Complainant Resolution Process	Once the issue is meet with a resolution, the grievance data base is then required to be updated.	10 Business Days
5. Complainant Notified	After appropriate actions are executed by the contractor and/or the IA, the complainant is then informed of the proposed resolution including actions taken or actions that will be undertaken. The grievance register is updated regarding any progress made.	3 Business Days
Escalation:	Complainants can request the grievance be escalated if they are not satisfied with the process proposed resolution. This would involve escalation from contractor to IA or from IA to the Safe Committee.	
Legal Recourse:	This course of action is not considered part of the 30 days process given it is solely reliant on the complainant if they are displeased with the outcome or resolution. In such cases, the complainant is informed that a legal avenue is available to him/her should he/she wish to seek a more satisfactory outcome and resolution to his/her grievance.	

Figure 23: Project GRM Flow Chart



Source: Samoa SARIP SEP Final_Jan 2022

7.4. Environmental and Social Mitigation and Monitoring

The ESMP matrix for the project is given below. It proposes measures to effectively mitigate identified risks, and requirements for monitoring to verify their effectiveness. Properly implemented, monitoring should indicate that the prescribed measures are either effective or not effective and in the case of the latter, provide the basis for the implementation of corrective measures. Monitoring also provides evidence of non-compliance with performance standards and reliable data in the events of complaints.

The Risk Assessment conducted using the SPREP-endorsed methodology found that the 'significance'[33] of all risks and impacts identified are, with mitigation, either 'very low', or 'low'. Monitoring will ensure mitigation measures are fully implemented so as the projected results are achieved. Or otherwise, any potential 'red flags' are identified and remedied early. Monitoring will also respond quickly to unanticipated events including extreme climate events where the risk of rockfall will increase significantly. In general, however, the focus of monitoring is full compliance with the ESMP and any additional Development Consent conditions. The monitoring time-frame will require daily visits by the Monitoring Contractor and at least twice-weekly inspections by LTA during the construction phase.

7.5. Environment and Social Management Plan (ESMP)

Environmental issue/project activity	Mitigation Plan				Monitoring Plan			
	Measures and actions	Responsible	Timing	Cost	Parameter	Frequency & Verification	Responsible	Cost
PRE CONSTRUCTION PHASE								
Involuntary Land Acquisition	i. Work closely throughout project planning with village representatives and MWSCD. ii. Ensure participation of village representatives in formal project consultation meetings. iii. Ensure heads of households including family 'sa'o' of both families sharing boundaries are present on- site to identify and agree on shared boundaries, in the presence of LTA and MLS representatives. iv. Implement ARAP swiftly and without delay. v. When land disputes remain unresolved, explain and get all parties to agree to the use of a Government- managed escrow account to hold compensation monies pending the resolution of disputes.	MLS, LTA, MOF, MWCSD	Pre-construc-tion	LTA , MLS	LARP approved and implementation completed	Once-off	LTA, MLS, CSC	LTA, MLS

	vi. Ensure the village's councils of chiefs are supportive of project implementation and provide 'presence' when contractors take possession of sites, while any unresolved disputes are being addressed by the Court.	LTA	Before construc-tion starts			On-going	LTA, CSC	LTA
CONSTRUCTION PHASE								
Sourcing of materials	i. Sources of material to be approved by the LTA prior to commencement of activities; ii. Priority shall be given to existing and nearby operations to minimize environmental impacts;	LTA / Contractor	Before construc-tion starts	Cost included in contract	Approval for material source	Once	LTA, CSC	Includ project cost. in service
	iii. Procure materials only from PUMA licensed quarries/sites. iv. Should a new quarry or borrow pits be required, PUMAs DC process including a thorough environmental impact assessment is followed.	Contractor	Obtain DCA prior to Supply of materials	Cost included in contract	Quarry DC	Once for the DCA at start and once at one month before DCA expiry date	LTA, PUMA, CSC	PUMA
Storage of materials	i. Assign laydown areas for the contractor. Materials should only be stockpiled in these areas and to be supplied to the site when required;	LTA Contractor	Before construc-tion commen-ces	Cost included in contract	Materials storage management measures implementation	Weekly schedule of delivery and works	LTA, CSC	Included in project cost.
	ii. Place low berms around the piles and/or use tarpaulin to cover open piles;	Contractor	Through-out con-struction phase			Weekly according to schedule of delivery and works	LTA, CSC	Included in project costs

	iii. Store all hazardous chemicals (e.g. fuels) safely in sealed containers, at least 20 away from any watercourse, and safely locked away, with a spill provided at each location;	Contractor	Through-out cons-truction phase			Weekly according to Schedule of works.	LTA, CSC	Included in project costs
Storage of materials	i. Conspicuous warning signs (e.g. 'Danger') should be posted around hazardous waste storage and handling facilities;	Contractor	Before start of constructi on	Costs included in contract	Waste management plan	Weekly according to schedule of works	LTA, CSC	Include in project costs
	ii. Maintain a tidy appearance of the laydown areas by proper storage of materials and disposal of waste regularly.	Contractor and workers	Througho ut constructi on phase	Cost included in contract	Waste management measures implementation	Weekly according to schedule of delivery and works	LTA CSC	Include ir project cost.

Erosion control	i. Schedule construction works to avoid wet season and rainy weather conditions. ii. Stabilize all slopes, ditches or any disturbed area as soon as possible after the final grade or final earthworks have been completed within a section or area of the project. iii. Where it is not possible to permanently stabilize a disturbed area immediately after the final earthworks have been completed or where the activity stops for more than 14 days, promptly implement interim stabilization measures. iv. Ensure no runoff from the project area is discharged into water /sea without effective means to prevent sedimentation. v. Remove earth and mud from vehicles and machinery before they leave the site.	Contractor and workers	Through out construction phase	Cost included in contract	Waste management measures implementation	Weekly according to schedule of delivery and works	LTA , CSC	Included in project costs

Air quality	**i.** Ensure that all powered mechanical equipment is well maintained, engine idling is minimized and that all engines switched off when not in use; and all construction vehicles shall have well-functioning exhaust systems or muffler silencers; **ii.** Apply dust suppression through water spraying. During dry periods water spraying will be applied at least twice a day on the exposed surfaces and road area. iii. Use tarpaulins to cover fugitive loads (soils and other loose excavated materials) on haul trucks moving off-site; **iv.** Restrict excavation activities such as removal of top soil during periods of high winds or under more stable conditions when wind could nevertheless direct dust towards adjacent communities; **v.** Ensure the wearing of face masks by all site workers and operators during dry weather conditions. **vi.** Ensure any stockpiles of materials are not allowed to generate dust. **vii.** Establish and enforce speed limits in TMP to minimize dust generation. viii. Protect stockpiles of excavated materials from water and wind dispersion by covering them with geo-textile fabric.	Contractor and workers	Throughout construction phase	Cost included in contract	Air quality management measures implemented.	Weekly according to schedule of delivery and works.	LTA , CSC	Include in Project cost.

	Vibration i. Where the nearest vibration-sensitive receptor is within 500m, monitor vibrations at the start of and during the use of mechanical equipment and machinery causing it. ii. If vibration levels are monitored and found to exceed the vibration threshold according to referenced criteria, the contractor shall modify the construction activities until compliance with the criteria has been achieved.	Contractor and workers	Throughout construction phase	Cost included in contract	Air quality management measures implemented.	Weekly according to schedule of delivery and works.	LTA, CSC	Included in project costs

	Noise: i. Contractors must ensure compliance with the following noise control limits prescribed by the PUMA Planning Policy: Revised Noise Standards 2011. This will require noise monitoring on site. The permitted noise levels must not exceed the following limits from construction works: Refer to p49. ii. The timing of construction works should comply with the permitted or approved working hours from 7:00 am to 5:00pm Monday to Friday; and from 8:00am to 4:00pm on Saturdays to mitigate noise pollution and adhere to village curfews. iii. No works shall occu on public holidays or Sundays except for emergency works as approved by PUMA. iv. Operations that cannot be reasonably undertaken or completed in normal working hours can be undertaken outside normal working hours subject to providing prir approval from the PUMA and the consent of the affected community.	Contractor and workers	Throughout construction phase	Cost included in contract	Air quality management measures implemented	Weekly according to schedule of delivery and works	LTA, CSC	Included in project costs

Waste Management –	1. Contractor shall prepare a Waste Management Plan and to include the following: i. Expected types of waste and volumes of waste arising; ii. Waste reduction, reuse and recycling methods to be employed; iii. Methods for treatment and disposal of all solid and liquid wastes; iv. Establishment of regular disposal schedule for hazardous waste; v. Program for disposal of general waste;	Contractor and workers	Throughout construction phase	Cost included in contract	Waste management measures implementation	WMP preparation – Once before works commence Waste storage & disposal - Daily or 3 times weekly based on schedule of works.	LTA , CSC	Included in project costs
	2. For excavated waste material – i. Reuse suitable spoils where possible, (e.g. as a source of concrete aggregate) or for community use. ii. Ensure there is no risk of contamination of nearby watercourses or bodies of water from material placed there as a result of erosion or leaching. iii. Dispose excavated material unsuitable for fill in an environmentally safe manner.	Contractor and workers	Throughout construction phase	Cost included in contract	Waste management measures implementation	WMP preparation – Once before works commence Waste storage & disposal – Daily or at least 3 times weekly based on schedule of works.	LTA, CSC	Included in project costs

	iv. Topsoil awaiting utilization should be stockpiled for use in post-construction landscaping.					& disposal – Daily or 3 times weekly based on schedule of works		
	3. For other types of solid and liquid waste that may be generated on site from construction activities or from contract facilities - i. Arrange for any waste disposal licenses to be obtained. ii. Ensure that the waste management measures (collection, sorting and disposal) are correctly implemented on the project site. iii. Arrange for cleared vegetation to be used by local communities if there is interest. iv. Ensure that materials with the potential to cause land/water contamination or odor problems are not disposed of on the site. v. Enforce the practice of leaving work areas tidy. vi. Ensure that correctly signed waste containers are available at convenient locations for the disposal of wastes. vii. Ensure that adequate toilet and washing facilities are provided. viii. If chemical toilets cannot be ovided at work site, ensure that all	Contractor and workers	Throughout construction phase	Cost included in contract	Waste shall management measures implementa-tion	Waste storage & disposal – Daily or minimum of 3 times weekly based on schedule of works	LTA , CSC	Includ in project cost.

	sewage and grey water from these facilities are retained on-site and are subject to suitable treatment, with no sewage or grey water discharged directly into the environment under any circumstances. viii. Disposed of all used oil and fuel filters in a PUMA approved landfill, unless they can be recycled. ix. Ensure that an adequately sized area is made available for the safe storage of wastes prior to collection. x. Ensure that on-site wastes are suitably contained or prevented from escaping into neighboring fields, properties and waterways, and that the waste contained does not contaminate soil, surface, or groundwater, or create unpleasant odors for neighbors and workers. xi. Ensure the site is regularly cleaned and waste material appropriately removed, i.e. to a landfill in accordance with regulations. xii. Provide employees with training in waste minimization and safe disposal; xiii. Erect signs regarding waste minimization. xiv. Establish regular disposal schedules for hazardous waste.							
	4. Incorporate WMP in construction contract specifications;	LTA	Prior to contract signing		Contract document		LTA	

Hazardous substances and hazardous waste management	1) The contractor shall include hazardous substances and hazardous waste in the WMP and implement accordingly. The WMP shall include the following; i. Store hazardous materials in laydown areas and not on roadside work sites. ii. Ensure safe transfer of fuel to and from storage tanks with the use of devices such as dry-break couplings, automatic flow cutoff devices, and tank overflow controls. iii. Refueling in the field will be done from road-licensed fuel tanks away from watercourses or other environmentally sensitive areas. Any ground that could be contaminated from spillages of more than 5 liters (or less if a sensitive location), will be excavated and removed, or remediated through other approved means. iv. Make sure a spill kit is provided at work locations and workers are trained in their use. v. Maintain a tidy appearance of the laydown areas by proper storage of materials and the regular disposal of waste. vi. All fuel storage areas and refueling vehicles are to be provided with spill-containment kits. vii. Prepare and include in WMP an emergency response spill plan and train personnel in its use. viii. Ensure the effective implementation of the approved WMP.	Contractor and workers	WMP development prior to construction commencing and WMP implementation through out the construction phase	Cost included in contract	Hazardous substances and hazardous waste management measures implementa-tion	WMP preparation – Once before works commence Waste storage & disposal – Daily or 3 times weekly based on schedule of works	LTA , CSC	Included in project costs

	2) Measures for mitigating the impact of contaminated run-off, sediments and silt discharged into the marine environment – i. Install sediment control measures along the seaward side to trap sediments before reaching the sea. ii. Prepare and implement relevant Work Method Statements (WMS) and follow site instructions when undertaking rock works. iii. Ensure all construction debris and waste are removed daily from the site for disposal at a MNRE-approved site.	Contractor	Before construction commences and throughout construction . Before construction commences On-going during construction .	Costs included in contract	CESMP	Multiple times weekly, throughout construction phase.	LTA, CSC	Included in project costs
Erosion and sedimentation control	1) Above the construction area – i. Construct diversion banks above excavated areas to intercept and divert runoff away from the exposed areas. ii. Diversion channels should have stable outlets that will not erode. 2) Within excavated – i. Construct temporary cutoff drains across the excavated area. These should be constructed at 2.0m vertical intervals with channel slopes <0.05%. Check if stable outlets are available.	Contractor	Before construction of engineering measures.	Costs included in contract		Once	LTA, CSC	Included in project costs

Erosion and sedimentation control (contd).	i. Erect temporary silt fences using a porous geotextile fabric that will allow the runoff to pass through the structure but retain sediment. ii. Silt fences should be erected at the base of the construction area or alongside a buffer area to prevent sediment from entering watercourses. iii. Ensure silt fences are built as a continuous structure across the slope, and are limited to an upper collection area of 0.3 ha hectares/100 m length of silt fence. Check if stable outlets are available. 3) Sediment control methods – i. Carefully plan the siting of temporary facilities and the design of stormwater drainage facilities so that these do not collect and channel water flows at erosive sites.							

Utility Disruption Impacts	i. Disclose and discuss the impacts on services during pre-construction community consultation meetings.	LTA	Prior to works commencing				LTA, CSC	Included in project costs
	ii. Issue advanced public notices for public and community information and awareness about any disruptions.	LTA	In advance of event happening		Utility manage-ment measures implementation	Based on schedule of works	LTA, CSC	Included in project costs
	iii. Collaborate with utility providers to plan disruptions and to quickly resume utility services;	LTA, EPC, SWA & Contractor						
	iv. Provide alternative supplies where needed, e.g. water supply by tankers, to affected communities.							
	v. Quickly restore utility lines and other structures either rerouted or damaged during construction.		As required					

Traffic management	1. Prepare a Traffic Management Plan (TMP) incorporating the requirements of COEP 12.	Contractor	Prior to start of construction phase.	Cost included in contract	TMP implementation	Daily based on works schedule	LTA , CSC	Include in project costs
	2. Consider and incorporate into TMP the following measures, as necessary – i. Use appropriate signage and other public information means to inform the public and communities in advance of construction works, schedule of closures or diversions, etc.. ii. Educate machine operators, truck drivers and others to understand posted signs to minimize traffic disturbance and avoid accidents. iii. Install traffic control measures, e.g. roadside reflectors, speed limits, warning signs etc.. iv. Arrange for delivery of materials to the storage or work sites during off-peak hours of the day, oPlace appropriate reflectors on hanging materials from trucks for the safety of vehicles following.	Contractor and workers	During construction		TMP implementation	Minimum 3 days/week during construction.	LTA, CSC	Include in project costs

	v. Ensure warning signs are in strategic locations to ensure easy visibility and to provide adequate forewarning to road users and pedestrians. vi. Employ flagmen to control traffic and assist construction vehicles as they attempt to enter and exit project storage and or work sites. vii. Park all loaded trucks at designated spots at the work site for offloading and not on the main road.	Contractor and workers	During construction		TMP			
Air Quality – dust, vibration and noise control	1. Dust control – i. Comply with COEP 2 for Dust Control during road construction; ii. Cover haul and dump trucks carrying fill materials, etc. with tarpaulin and practice in-time delivery of materials to the works site to reduce dust dispersal; iii. Spray exposed dry ground areas regularly to suppress dust. All care shall be taken to ensure excess water does not flood neighboring lands and cause sedimentation of watercourses. iv. Restore disturbed areas as soon as work is completed. v. Ensure the wearing of face masks by all site workers and operators during dry weather conditions. vi. Enforce speed limits in TMP to minimize dust generation. vii. Protect stockpiles of excavated materials from water and wind dispersal by covering them with	Contractor and workers	Throughout the construction phase	Cost included in contract	Air quality management measures implementa-tion	Daily based on works schedule	LTA, CSC	Include in project cost.

	2. Noise and Vibration – i. Enforcement of noise control limits in compliance with the PUMA Planning Policy: Revised Noise Standards 2011. This will require noise monitoring on site. ii. Ensure that all powered mechanical equipment are well and regularly maintained; i. Minimize engine idling to reduce vibration and fume emission; ii. Locate material storage areas away from communities and sensitive receptors. iii. The timing of construction works should comply with the permitted or approved working hours from 7:00am to 5:00pm Monday to Friday; and from 8:00am to 4:00pm on Saturdays. iv. No work shall occur on public holidays or Sundays except for emergency works as approved by PUMA. v. Operations that cannot be reasonably undertaken or completed in normal working hours can be undertaken outside normal working hours subject to providing prior approval from PUMA and the consent of the affected community. vi. Use modern and well maintained equipment (with mufflers where appropriate)	Contractor and workers	Throughout the construction phase	Cost included in contract	Air quality management measures implementation; Compliance with permitted noise levels (refer to table below).	Daily based on works schedule.	LTA, CSC	Include in project costs

	vii. Turn off engines when possible to reduce idling and noise emissions. viii. Operators of noisy equipment or any other workers in the vicinity of excessively noisy equipment are to be provided with ear protection equipment. ix. Under noisy conditions, do not allow operators or other workers to exceed the threshold that has been established for exposure to noise.						LTS, CSC	

Ave. dBA, L 10 min	**Residential Use**			**Commercial Use**			**Religious Use**			**Industrial Use**		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Construction works	75	60	-	75	60	-	75	60	-	75	65	-

Sewage management	i. Ensure to provide toilets on site or have some available nearby for construction workers to use;	Contractor and workers	Throughout the construction phase	Cost included in contract	Sewage management measures implementation	Daily based on works schedule	LTA, CSC	Included in project costs.
	ii. Workers should clean the toilet daily and empty septic tank on a daily basis or when needed at Tafaigata landfill only.	Contractor and workers	Throughout the construction phase	Costs included in contract		Weekly	LTA, CSC	
Workers Occupational Safety and Health	i. The contractor shall prepare a Health and Safety Plan (HSP) before works commence. The HSP shall be in accordance with the requirements of	Contractor	HSP preparation - before works commence	Cost included in contract	Workers OSH management measures implementation	Daily based on works schedule	LTA CSC	Include in project costs

	the OSH Act 2002 and OSH Regulation 2017, and shall include: • activity/job safety procedures and protocols; • plan for "toolbox" sessions for workers; • first aid facilities (on-site and in vehicles), personal protective equipment (PPE); • routine safety and accident prevention measures; • emergency response and preparedness; and • accidental environmental ○ incidents (e.g. oil spill) procedures.		HSP Implementa-tion - throughout the construction phase				LTC, CSC	Include in project costs
	ii. The contractor shall also comply with and observe PUMA-approved working hours and official national holidays as set out in national law and regulations shall be observed;	Contractor	Throughout construction phase	Cost incl in contract			LTA, CSC	Include in project costs
	iii. The construction contractor shall - • run safety toolboxes before work starts every day; • Ensure First Aid Kit is available on site • Ensure workers only operate equipment they are licensed and/or trained to use;	Contractor	Throughout construction phase	Cost included in contract			LTA, CSC	Include in project costs

Community Safety and Health	i. Ensure signing and enforcement of workers Code of Conduct Agreements.	Contractors and workers	Throughout construction phase	Cost included in contract	Community SH management measures implementation	CoC check at start of construction; As deem necessary	LTA CSC	Includ ed in projec t costs

	ii. Install Project Signage at the affected project area for community and public awareness of related activities;	Contractor and workers	Prior to works commencing	Cost included in contract	Community SH management measures implementation		LTA, CSC	Included in project costs
	iii. Strictly limit access to work sites to authorized people only.	Contractor and workers	Throughout construction phase	Cost included in contract	Community SH management measures implementation	On-going during construction	LTA ,CSC	Included in project costs
	iv. Notify the communities in advance about the construction works before commencing as well as updates on progress from time to time;	Contractor	Throughout the construction phase	Cost included in contract		Multiple times, dependent on schedule of works	LTA ,CSC	
	v. Wherever possible, give preference to employing members of project-affected communities by the Contractor.	Contractor and workers	Throughout construction phase	Cost included in contract	LIMP prepared and implemented	From time to time.	LTA, CSC	
	vi. Institute a working project-level GRM that is known to and accessible by the host community to manage labor influx related risks. vii. Comply with the project GRM that to manage labor influx related complaints and risks;	Contractor	Before construction commences	Costs included in contract	Project level GRM	Ongoing;	LTA, CSC	

Site closure	i. Stabilize all construction sites and tracks. ii. Rehabilitate all borrow pits, quarries and sand winning areas. iii. Close all fuel and oil depots properly. iv. Remove any contaminated soil and restore the area fully. v. Reshape and revegetate all spoil heaps. vi. Reapply topsoil in areas where topsoil was removed, and revegetate if required. vii. Dispose all wastes that cannot be recycled at Tafaigata Landfill, and fill and close the site from which the waste came. viii. Dispose all wastes assigned a Hazchem classification in accordance to the Hazchem requirements.	Contractor and workers	Before shifting work to a new site.	Cost included in contract.	CESMP - Site closure implementa-tion	Daily, as per schedule of work	LTA, CSC	Include in project costs.
Unanticipated impacts	i. Ensure that construction of physical infrastructure comply with prescribed engineering specifications. ii. Respond swiftly to unanticipated impacts threatening the integrity and the effective functionality of the ECR. iii. Coordinate closely with all relevant agencies including NEOC to respond swiftly and effectively to emergency situations.	LTA; MWTI	Throughout the construction phase	GOS;	Government - approved response plan.	Daily based monitoring	LTA/ CSC	GOS

OPERATIONAL PHASE								
Road maintenance	Clear catch ditches (i) when 100mm thickness of debris has accumulated; (ii) towards end of dry season and in advance of cyclones and severe weather events.	LTA	Throughout operation phase	LTA	Road maintenance measures implementation	Monthly based on Monitoring Plan	LTA	LTA operating budget
	ii. Carry out regular inspection of barrier fence especially following reported rockfall events, or following earthquake and storm events. iii. Conduct clearance of ditches towards end of dry season. Ensure channels, drains etc are free of debris by removing them on a regular basis to avoid blockages and flooding of road surface causing contamination risks to the water discharged into the sea.	LTA	Throughout the operation phase.	LTA		Monthly based on Monitoring Plan	LTA	

		iv. Conduct maintenance between 1 and 3 years checking (1) tension of clamped connections (ii) removal of vegetation (iii) removal of any accumulated rock debris, and (iv) check state of corrosion protection and patching as necessary.							
	Safety and health risks of local community and road users	i. Alert road users and the public at large of periods of high risk rockfalls along the ECR. ii. Use appropriate signage along the ECR to warn drivers of specific sections of the road most vulnerable to rockfalls and other hazards. iii. Implement emergency road traffic management strategies to temporarily direct traffic onto safer (coastal) lanes in high risk road sections during extreme climate events.	LTA SPS	Throughout operation phase	LTA	Safety and health risks measures implementation	Monthly based on Monitoring Plan	LTA	LTA
		iv. Continue with awareness programs on road safety as well as road checks for speed limits and unlicensed drivers on the road;	LTA SPS	Throughout the operation phase	SPS			SPS	

	Unanticipated impacts	i. Anticipate and prepare for extreme climate change induced events during the cyclone season and extreme geological events capable of causing extensive damage to the ECR. ii. Coordinate closely with all relevant agencies including NEOC to respond swiftly and effectively.	LTA; MWTI	Throughout the construction phase	GOS;	Government - approved response plan.	Daily based monitoring	LTA	GOS

7.6. Reporting

The CSC will assist the LTA Safeguards Unit in carrying on-going monitoring and reporting on the construction contractor's implementation of the approved SEMP. CSC will prepare and submit to LTA a fortnightly progress reports that will include a description of the SEMP implementation, any non-compliances or corrective actions required, and will include records of daily/weekly monitoring and public information disclosure activities undertaken.

The LTA will submit CSC reports to the MWTI-PMD to prepare and submit to the WB quarterly progress reports, which includes a section reporting on safeguards compliance, and a semi-annual safeguards compliance report.

SECTION 8: STAKEHOLDER ENGAGEMENT AND CONSULTATION

Stakeholder consultation is a mandatory requirement of the World Bank's OP 4.1 (Environment) and OP/BP 4.12 (Involuntary Resettlement) policies, and of PUMA's COEP 3. Both the WB and PUMA recognize the importance of open and transparent engagement between the Government as the Borrower/Grantee and project stakeholders as an essential element of good international practices. PUMA's COEP 3 also establishes the process and protocols for meaningful participation of stakeholders and affected communities in all aspects of development projects.

For ECR-SSP, an updated Stakeholder Engagement Plan (SEP) is in Appendix 4. Formal and informal consultations with Government agencies and affected communities started in May 2023. Informal in-situ consultation between LTA, project consultants and village representatives took place to support baseline studies, and recently (June 2024) to identify affected lands and landowners.

The two formal consultation meetings were held with key stakeholders in May 2023, the first with government agencies, NGOs and private sector and the second with representatives of project-affected villages. The meetings introduced the project and its main goals and objectives. It explained the problem of unstable slopes along the ECR and its implications for connectivity and road resilience, and the key findings from the geological assessment report.

A third community consultation meeting was held on 2 October 2024 at the Eliza Hotel. Participants listened to a presentation of the key design features of the Project for rockfall protection, findings of baseline studies for the EIA, details of the land acquisition for a 20m road reserve, land and crops compensation and the cut-off date for the inventory for crops and other non-land assets. Participants also completed socio-economic survey questionnaires. Reports of all three formal consultations are in Appendices 5, 6, 7 and 8.

Several formal and informal consultations and engagements are scheduled for the immediate future to finalized beneficiaries for compensation, to discuss and agree on valuation for land and crops and to sign compensation packages.

Table 7: Consultations completed as of 31 October 2024

#	Consultation	Venue & Date	Participants
1	Initial Key Stakeholder/Utility Consultation for the ECR Slope Stabilisation Project	23/5/2023, MWTI Conference Room, TATTE Building	34 participants from MPPCS, EPC, SWA, MWTI, T&T, KASAM, NOLA.
2	Initial Key Stakeholder consultation for the ECR Slope Stabilization Project.	24/5/2023, MWTI Conference Rm, TATTE Building	38 participants from 17 villages in project affected districts.
3	Planning meeting (general)	LTA Conference Room,	LTA, MNRE, MWTI, KASA, Tonkin& Taylor
4	Planning meeting (safeguards)	4 April, 2024; LTA, MNRE, KASA	KASA Meeting Room, Alaimoana Hotel.
5	Community consultation for Project Affected Villages	2 October, 2024	30 participants; Hotel Eliza Conference Room.

SECTION 9: CONCLUSIONS AND RECOMMENDATIONS

The ECR-SSP is a subproject under Component 2 of the World Bank's Samoa Climate Resilience Transport (SCRTP) Project. In terms of the WB's safeguards policy for Environment, SCRTP is a Category B for Environment and the ESMF noted that the expected environmental impacts are limited and site specific, with measures for mitigation readily available. The screening and categorization of the ECR-SSP subproject was carried out by LTA with Category B for Environment confirmed. The corresponding safeguards instrument required for a WB Category B project is an Environment and Social Assessment (ESIA) report. The equivalent documentation as per PUMA's safeguards requirements is a Preliminary Environment Assessment Report (PEAR).

This ESIA report adopts the recommended SPREP template. It is based on the careful examination of the following sources of information: project's approved final design prepared by the Design Contractor, site assessments, baseline studies of the marine environment and terrestrial flora and avifauna of the project's area of influence, review of relevant literature, project documentation including the SCRPT ESMF, TOR, and WB safeguards documents, and consultations with LTA, Design Contractor and with representatives of ECR-SSP affected villages.

The ESA found the main impacts to be generated by and during the construction phase. In the pre-construction phase, however, there is a low risk of disputes among landowners over land acquisition – land ownership and location of shared boundaries - that may delay project construction. Working closely with village authorities and approved representatives early and throughout the planning phase is essential to resolving these issues.

The following findings are highlighted:

- There is no vegetation in the project's area of influence, having been cleared by villages recently for other purposes. There are therefore no impacts on sensitive habitats and avifauna.
- Construction activities will generate minimum health and safety issues for site workers and road users, mostly associated with reduced air quality, and

occupational hazards associated with the use of heavy machinery and powered tools, etc..

- Discharges into the sea of silt, sediments, debris and surface run-off from excavation and construction works will further aggravate a severely degraded marine environment.
- Limited wastes, both hazardous and non-hazardous, will be generated.
- The normal flow of road traffic will be disrupted during construction, potentially severely during peak hours in the mornings and evenings. But added travel times for commuters will be minimum and in the vicinity of 10 -15 minutes.
- Services such as telecommunication, water and power will be disrupted albeit minimally.
- The probability of SEAH related incidents is 'possible' but the significance is low. Still, precautionary measures will be implemented and, in the unlikely case of an 'event', remedial measures.

The proposed rockfall protection measure – catch ditches and barrier fences – will require minimum site clearance and excavation within a narrow 'area of influence' between 3 - 5m in width from the road shoulder. Identified environmental impacts are minor, site specific and temporary with standard measures for mitigation readily available. Some, such as impacts on services - electricity and water supply in particular - require quick restoration by service providers to minimize the impact on communities.

Overall, the ESIA confirms the Category B classification assigned to ECR-SSP. The attached ESMP details the different impacts and recommend measures for reducing their impact to acceptable levels. It also provides a monitoring plan for LTA and its agents. The ESMP will guide the contractor and will form the basis of the contractor's site-specific Construction ESMP and other accompanying subplans – all of which will be monitored closely by LTA and the CSC to ensure effective implementation and safeguards compliance.

****

APPENDICES:

Appendix 1: Literature Consulted

1. Asian Development Bank – Safeguards Unit. (undated). Mitigation Measures for Construction: Guidelines for the Selection of Suitable Mitigation Measures During Environmental Assessment. Manila, Philippines. Pp.17.
2. Conservation International – Pacific Islands Programme, Ministry of Natural Resources and Environment, Secretariat for the Pacific Regional Environment Programme. 2010. Priority Sites for Conservation in Samoa: Key Biodiversity Areas. Apia*, Samoa.* 32 pp.
3. Department of Housing and Urban Development. Aug 1997. Guide to a Native Vegetation Survey using the Biological Survey and South Australia Methodology – Section 1. Information and Data Analysis Branch.
4. Fepuleai, A & Fepuleai,T. 2023. Geological Field Assessment Report of the East Coast Road, North-east Upolu. Unpublished. Blaq Sand Enterprise, Apia, Samoa.
5. International Bank for Reconstruction and Development/World Bank. 2017. Environmental and Social Framework. Washington DC, USA.Ministry of Natural Resources and Environment (MNRE) (a). 2015. National Biodiversity Strategy and Action Plans (NBSAP) 2016 - 2020, Government of Samoa. 80 pp.
6. Ministry of Natural Resources and Environment. (b) 2013. Samoa 2013 State of Environment (SOE) Report. Government of Samoa.
7. Ministry of Natural Resources and Environment. 2014. Samoa's Fifth National Report 2014 to the Convention on Biological Diversity (CBD). Government of Samoa.
8. Pearsall, S.H. and W.A.Whistler. 1991. Ecosystem Mapping for Western Samoa: Technical Report and Appendices. Unpublished photocopy. The Nature Conservancy, Pacific Conservation Data Centers Program, Honlulu Hawaii.
9. Pearsall, S.H. and W.A.Whistler. 1991. Ecosystem Mapping for Western Samoa: Summary, Project Report, and Proposed National Parks and Reserves Plan.. Unpublished. Prepared by SPREP and East West Center, for the Government of Samoa. Honlulu Hawaii.
10. Penelope Schoeffel, Tiffany Arthur and Malama Meleisea. 2021. Land and social security in Samoa. National University of Samoa.
11. Samoa Bureau of Statistics. 2021. Fa'amaumauga ma Fa'amatalaga ole Itumalo Anoama'a 2. Apia, Samoa. 46 pp.
12. Samoa Bureau of Statistics. 2021. Fa'amaumauga ma Fa'amatalaga o le Itumalo o Vaimauga Sasa'e. Apia, Samoa. 45 pp.
13. Samoa Bureau of Statistics. January, 2024. Samoa Labour Force and Child Labour Survey 2022. Apia, Samoa. 127 pp.
14. Samoa Bureau of Statistics. 2021. Samoa Agriculture Census 2019. Apia, Samoa. 313 pp.
15. Samoa Bureau of Statistics. 2020. Samoa Household Income and Expenditure Survey 2018. Apia, Samoa. 205 pp.
16. Siamomua, M. 2024. ECR-SSP Marine Biodiversity Assessment Report. Unpublished. PSES Consult, Apia, Samoa.
17. Suemalo,T.F and Enoka, F. 2024. ECR-SSP Flora and Avifauna Assessment Report. Unpublished. PSES Consult. Apia, Samoa.

18. Taulealo, TI; Fong, SD; and Stefano, PM. 2003. "Samoan customary lands at the crossroads – options for sustainable management." Proceedings at the National Environment Forum 2002. Department of Lands, Surveys and Environment. Apia.
19. Tonkin & Taylor. August 2024. East Coast Road – Slope Stabilization Project: Civil Engineering Design Completion Report. Tonkin&Taylor, Auckland, New Zealand.
20. Whistler, W. A. 1992: Flowers of the Pacific Island Seashore. Isle Botanica Honolulu Hawaii 96826 U.S.A.
21. Whistler, W.A. 2002. The Samoan Rainforest – A Guide to the Vegetation of the Samoan Archipelago. Isle Botanica, Honolulu, Hawaii, USA.
22. Whistler, W. A. 2022. Flora of Samoa: Flowering Plants. National Tropical Botanical Garden, 3530 Papalina Road, Kalaheo, Kauai, Hawaii 96741 USA.
23. Whistler, W. A. 2004, Rainforest Trees of Samoa: A guide to the common lowland and foothill forest trees of the Samoan Archipelago. East-West Centre, Univ of Hawaii.
24. Whitmore, T.C. 1984.Tropical Rainforests of the Far East. 2nd ed. English Language Book Society, Oxfor University Press.
25. World Bank. 2020. Road Safety Management Capacity Assessment for Samoa. @ World Bank.
26. World Bank. 2017. The World Bank Environmental and Social Framework. IBRD/WB. Washington DC. pp. 106.
27. World Bank. 2016. "Samoa Climate Resilience Transport Project (SCRPT) – Environmental and Social Management Framework (ESMF)." Unpublished. World Bank.

Appendix 2: People Consulted

1. Allan Fitzgerald, Tonkin and Taylor International
2. Alan Ferguson, Tonkin and Taylor International
3. Ata Salanoa, Land Links Services, Apia.
4. Chris Freer, Tonkin and Taylor International
5. Della Savaiinaea, ACEO, PUMA
6. Hillary Tanielu-Okesene; ex Kramer Ausenco (Samoa)
7. Fa'amaile Etuale, Samoa Bureau of Statistics (SBS)
8. Krishant Kumar, Kramer Ausenco (Samoa)
9. Lili Anetelani, ACEO, SBS
10. Malama Siamomua, Think Environment Consult
11. Nick Valentine, World Bank
12. Perelaaroi Tumaai, Safeguards Unit, LTA
13. Perina Sila, Safeguards Unit, LTA
14. Sarah McCarter, Tonkin and Taylor International
15. Suemalo Talie Foliga, DEC,
16. Tafaoata Solomona, SBS
17. Taiaopo Faumuina, ACEO, SBS
18. Tom Callander, World Bank.
19. Toleafoa Mara Hunter, Kramer Ausenco (Samoa)
20. Tuputa Fainuulelei Uliate, ex Kramer Ausenco (Samoa)
21. Vailoa Iefata, Safeguards Unit, LTA

Appendix 3: Relevant Laws, Regulations, and Policies of the Government of Samoa

1. Lands, Surveys and Environment Act 1989

This Act establishes the principal functions of the Ministry of Natural Resources and Environment (MNRE) and provides for the protection and proper management of the environment in Samoa and the promotion of sustainable development, and to facilitate compliance with Samoa's international environment related obligations, and for related purposes. The Act mandates the MNRE to administer and co-ordinate all environmental activities in Samoa. It covers all environmental aspects that include (i) Policies for influencing the management of natural and physical resources and ecosystems; (ii) The potential environmental impact of any public or private development proposal; (iii) Ways of ensuring that effective provision is made for public participation in environmental planning and policy formulation processes in order to assist decision making at the national and local level; (iv) Procedures for the assessment and monitoring of environmental impacts;
(i) Pollution control and analysis of pollutants in the environment; (vi) Control and management of hazardous and potentially hazardous substances including the management of the manufacture, use, storage, transport and disposal of such substances; and (viii) Investigations and research relevant to the protection and conservation of natural resources and the environment. Division 5 Sections 119 and 120 specifically provide for the protection of the foreshore and coastal waters from human activities such as among others onsite construction. Division 6 Section 123 sets provisions for the pollution of seas and inland waters. The Act also provides for the alienation of government land and land administration. The Minister may approve purchase of any land for public purpose (s23) or lease of government land for up 20 years (s37).

The proposed Development shall adhere to the relevant provisions of the Act throughout construction.

2. Planning and Urban Management Act 2004

This Act sets out the framework for the planning, use, development, management and protection of land and resources in Samoa. Under Section 34, all development requires consent, unless a sustainable management plan or regulation provides otherwise. The project site is not subject to any sustainable management plan. To initiate project activities a development consent must be applied for and acquired before a project can be undertaken. Section 42 describes the triggers for, and process to be followed, when an EIA will be required. If an EIA in relation to a proposed development is required, PUMA will specify the format, structure, subject matter of any such assessment and any other related matter, in writing to the applicant. The Act also outlines the process of notification of applications and the process for submissions and hearings on development applications. Subject to s37, a development consent application with the prescribed fee (SAT$2,000 for a proposal that is above $10,000,000) must be lodged before road construction works commence. This stage involves the submission of all relevant documentation and supporting evidence with the Development Consent Application. This EIA and related plans will be part of the submission. No works shall commence prior to the issuance of a development consent.

3. Water Resources Management Act 2008

This Act which is administered by the MNRE brings together all the relevant laws in Samoa for the effective and sustainable management and utilisation of Samoa's water resources and covers pollution of water supplies such as rivers, lakes and boreholes. It provides for the (i) regulations for the taking of water and pollution of water supplies. The proposed road slope

stabilization project does not require taking water or abstraction from the water resource.

4. The Taking of Land Act 1964

The Act establishes the taking of lands for "public purposes" (i.e. alienation of freehold or customary land). Once land is identified for acquisition reasonable notice is required to be given to the owner or occupier of freehold land or the matai who has the rule over customary land. Public notice of 28 days is allowed for any objections. If no written objection is received, the Minister may then proceed to take the land by Proclamation.

Any land to be taken for the purpose of the proposed stabilization project requires the LTA to comply with this law by following the indicated process.

5. Alienation of Customary Lands Act 1965

Customary land cannot be alienated except by the Minister of Lands in accordance with s4 of the Act which also appoints the Minister to act for and on behalf of all beneficial owners in signing a lease for registration. The Minister may grant a lease or license of customary land for authorized purposes (which are defined). The maximum lease in aggregate for a public, commercial, business or religious purpose is 40 years. Leases of public land and customary land are administered by MNRE and are based on standard terms.

6. Waste Management Act 2010

The Act provides for the collection and disposal of solid wastes and the management of all wastes in Samoa, and for related purposes. It provides for general offences related to wastes and involves any person who deposits or dumps wastes at a place other than an approved landfill or waste dump so as to cause pollution to a public area or to land belonging to the government or to another person. The Act provides for the registration of waste management operators and assigns related responsibilities. A permit is not required for waste management or discharge. However, fees may be set and imposed for: (a) depositing wastes at landfill sites and approved dumping grounds; (b) the collection, storage or disposal of hazardous wastes.

The proposed road slope stabilization project should comply with this Act by implementing waste management measures during construction works. All waste must be disposed of at Tafaigata landfill.

7. Occupational, Health and Safety Act 2002

The Act mandates the general duty of employers taking all reasonably practicable steps to protect the safety, health and welfare at work of employees and to provide and maintain a safe and healthy working environment including substances, systems of work and any building or public or private area in which work takes place.

The proposed road slope stabilization project should adhere to the provisions of this Act by having in place a Health and Safety Plan (HSP) and other relevant Plans to manage health and safety impacts on the workers during construction.

8. Occupational Safety and Health Regulation 2017

The Regulations elaborates on the OHS Act 2002 requiring employers to take all reasonably practicable steps to ensure the safety, health and welfare at work of employees and to provide and maintain a safe and healthy working environment including substances, systems of work and

any building or public or private area in which work takes place. Employers are required to prepare and implement and approved Health and Safety Plan (HSP) and other relevant Plans to manage health and safety impacts of the works on the workers during construction.

9. Land Transport Authority Act 2007

The Act provides for the establishment, management and operations of a Land Transport Authority (LTA) in Samoa. It mandates LTA functions which include the designation and management of national roads and road reserves; identification and acquisition of lands required for roads and infrastructure; regulation and enforcement of road use, safety and standards among other things. The regular maintenance for the ECR and road reserves is the mandated responsibility of LTA.

10. Environmental Impact Assessment Regulations 2007

The Regulations set out what level of EIA is required, the components required for an EIA and the process for review and approval. Section 4 of the regulations prescribes two forms of EIA: (i) PEAR; and (ii) comprehensive environmental assessment report (CEAR). A PEAR is required when PUMA considers an activity requiring consent is not likely to have a significant adverse impact on the environment. A CEAR is required when a development is likely to have a significant adverse impact on the environment. The Regulations also outline: (i) baseline and compliance monitoring (Section 8); (ii) reviews of the EIA (Section 9 and 10); and (iii) public consultation (Section 11). Schedules attached to the Regulations detail the content of a PEAR and CEAR.

This EIA Report will be submitted to the PUMA to support the DCA for the proposed project which satisfies this requirement.

11. Pathway for the Development of Samoa FY2021/22 – FY2025/26

Samoa's national vision for the immediate future is set out in the Pathway for the Development of Samoa. This National Development Policy **/** Strategy FY2021/22 – FY2025/26 'fosters social harmony, safety, and freedom for all'. The theme is 'empowering communities, building resilience, and inspiring growth'. The achievement of the vision relies on implementing the 5 national Key Strategic Outcomes, which in turn requires effective implementation of 21 key priority areas. The Key Strategic Outcomes include:

a. Improved Social Development;
b. Diversified and Sustainable Economy;
c. Security and Trusted Governance;
d. Secured Environment and Climate Change; and
e. Structured Public Works and Infrastructure

ECR-SSP contributes to the achievement of Key Strategic Outcome e.

12. National Environment Sector Plan (NESP) 2017 – 2021

The Plan lays out the framework for actions to address the key environmental challenges and opportunities that Samoa faces such as climate change, biodiversity loss, water quality, land degradation, natural disasters and waste management. It prioritizes improved sustainable management and development of natural resources and environment; and commits the sector to the following among others:

(a) continue to prioritize efforts to enhance the sustainability of Samoa's water resources through ongoing rehabilitation of degraded watershed areas in partnership with communities; protection of critical riparian zones from unsustainable socio-economic developments; and regulation of

water abstraction activities;

(f) protection and conservation of terrestrial biological diversity strengthened through improvements to the planning, policy and legislative framework for the conservation and sustainable management of biological resources (marine and terrestrial) in targeted Key Biodiversity Areas (KBAs), expansion and legalization of the Protected Area Network in close collaboration with other implementing focal points such as the Forestry Division and rehabilitation and restoration of critical ecosystems including concerted efforts to promote recovery of threatened species.

13. Samoa Climate Change Policy 2020

This policy addresses national responses needed across all sectors, civil society, private sector and at the community level, to build resilience to the impacts of climate change as identified in Samoa's latest State of the Environment (SOE) Report 2013[50]. Observed trends include increased maximum air temperatures, increased frequency in extreme daily rainfall events and sea level rise of 5.2mm a year and similarly the predicted increase in the frequency and intensity of tropical cyclones.

14. PUMA Noise Standards Policy 2006 (revised 2011)

Provides minimum national standards applicable to development consent approvals to: (i) protect citizens against excessive noise in their communities and places of residence; and (ii) protect residents from exposure to excessive noise and its effects through appropriate mitigation measures, consent conditions and responsive planning. It also provides for the creation of an environment where noise levels do not exceed a reasonable level. The policy provides the following permitted noise standards to be complied with during demolition works.

Table 8: Noise Standards – PUMA Noise Policy 2011

Noise Source (Averge dBA, L_{10mins})	Receiving Property (LAeq. 10 minutes)											
	Residential Use			Commercial Use			Religious Use			Industrial Use		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Residential use	55	50	45	60	55	50	60	55	50	60	55	50
Commercial use	60	55	50	60	55	50	60	55	50	65	60	55
Religious use	65	55	50	70	60	50	70	60	50	70	65	60
Industrial use	65	60	55	70	65	60	70	65	60	75	70	65
Construction works	75	60	-	75	60	-	75	60	-	75	65	-

*Note: Day period is defined as 0700 to 1800, evening period is defined as 1800 to 2200 and night period is defined as 2200 to 0700. Construction activities conducted at times not specified in the table above will require special approval from relevant authorities. These may include the Night period, Sundays and all other times within Residential and Tertiary Educational compounds.

The proposed road slope stabilization project will be required to comply with these noise standards.

15. PUMA Signage Policy 2016

This Policy applies to all developments of signage structures in Samoa and include signage

for advertising on or in public places or on a building that is in view of a public place for the attention of the public. It provides guidance for government authorities, public and private developers, designers and property owners to determine appropriate signage that will improve the streetscapes and landscapes of Samoa. The Policy will also ensure public safety through appropriate signage design and location. It does not regulate or apply to traffic control devices and road signs such as speed limit signs, pedestrian crossing signs and signage identifying temporary road works.

16. Codes of Environmental Practice (COEPs)

In 2007 PUMA developed the Codes of Environmental Practice (COEP) which present procedures to be followed in design and construction for the avoidance and/or mitigation of adverse environmental impacts arising from infrastructure development or maintenance. The COEPs are to be implemented by all works which require development consent. There are three implementation mechanisms for the COEPs:

(i) the COEP is specified in Terms of Reference (TOR) for design of works with relevant design directives of the COEP incorporated in the TOR;

(ii) the COEP is included in the specifications for the construction of physical works (including relevant suggested specifications stated in the COEP being incorporated in the specifications); and

(iii) environmental approvals are granted with the condition that works proceed under the provisions of the COEP. Table 9 lists the 14 COEPs and indicates the ones applicable to the Project.

Table 9: Contents of Codes of Environmental Practices

COEP	Content	Applicable
1	Administrative Procedures	Yes
2	Road Planning, Design and Construction	Yes
3	Consultation	Yes
4	Land Acquisition and Compensation	Yes
5	Construction Camps	Yes
6	Road Construction Erosion Control	Yes
7	Slope Stability	Yes
8	Quarry Development and Operations	Yes
9	Gravel Extraction	Yes
10	Coastal Protection	Yes
11	Drainage	Yes
12	Traffic Control During Construction	Yes
13	Earthworks	Yes
14	Cellular Telecommunications Facilities	Yes

17. Community Integrated Management (CIM) Plan for Vaimauga East District 2018

The ECR runs through Letogo and Lauli'i, villages which are part of the district of Vaimauga East. The CIM Plan identifies and suggests possible solutions and integrated approaches to "enhance the resilience of community livelihoods, infrastructure, environment and natural resources. The following interventions from the CIM Plan are relevant for the ECR:

- Drainage systems to be improved in high risk areas: Assess and upgrade culverts on main

East Coast road especially at junctions with access roads (Letogo Plantation Road; Tuli'alomalala Street;, Tuli'olovalu Street; Manuma Street sitting within combined hazard zones (IFHZ, CEHZ, CFHZ) and in accordance with *Vulnerability Assessment of the Samoa Road Network* recommendations; Implement national standards for culverts and drains to facilitate the overland flow of storm water and reduce flooding; Implement regular drainage inspection and maintenance;

- Flood protection measures for fords and bridges: Upgrade waterways; Upgrade all crossings; Upgrade or repair riverine embankment protection work upstream of Letogo and Vailele:

18. Community Integrated Management Plan for Anoamaa West District 2018

The ECR runs entirely through the district villages of Leusoali'I, Luatuanu'u, Solosolo, Eva, Salelesi, Fusi and Saoluafata. The CIM Plan identifies and suggests the following interventions for improving resilience of the ECR:

- Slope stabilization and road armouring to avoid landslips and erosions in most high risk hazard zones: Implement slope stabilization or 'forced collapse' under controlled conditions at most vulnerable landslide areas of Anoama'a West as identified in the Vulnerability Assessment of the Samoa Road Network report;
- Parts of main East Coast Road exposed to extremely high risk hazard zones: Continue to road and Solosolo uta Rd, Eva Access Road, Fusi Saoluafata and Manunu;
- Roads to increase regulation of water flow and reduce flooding onto roads in extremely high risk hazard zones in accordance with Vulnerability Assessment of the Samoa Road Network recommendations: Assess and upgrade approved access roads to include adequate sized culverts; and Implement regular drainage inspection and maintenance
- Flood protection measures for fords and bridges: Upgrade waterways; Upgrade all crossings; and Assess and upgrade approved access roads to include adequate sized culverts;

19. Community Integrated Management Plan for Anoamaa East District 2018

The ECR runs through the villages of Lufilufi and Falefa which are located by the coast, on both sides of the road. Best solutions identified for the ECR include:

- Drainage systems require maintenance and upgrade in high risk areas of main East Coast

- Road: Implement national standards for culverts and drains to facilitate the overland flow of storm water and reduce flooding; and Implement regular drainage inspection and maintenance.

'*******

Appendix 4: Stakeholder Engagement Plan

STAKEHOLDERS COMMMUNICATION AND CONSULTATION PLAN (updated 26 Jul 2024)						
	Objectives	**Target Stakeholders**	**Messages / Agenda**	**Means of Communication**	**Schedule/ Frequency**	**Responsible Agencies/Groups**
	PROJECT PREPARATION / DESIGN STAGE					
1	High level consultation - to inform key stakeholders of the project, its impact on the assets/services provided by various agencies; work program.	• MNRE (LMD, DEC, WRD), MWTI (PUMA, Infrastructure), MOF, MWCSD, EPC, SWA; Police (Traffic Div)	a) Overview of the project (objectives, outputs, funding, implementers and consultants, etc.) b) Implications on the community c) Work Program for project preparation incl tasks requiring various agencies support / assistance.	• Facilitated and structured meeting at LTA chosen venue.	• Week 22 – 27, May 2023. completed	• LTA supported by the Design Consultant
2	Community level consultation - to introduce the project to stakeholders, introduce design consultants, and set forth program of work incl tasks requiring community	• Community representatives (i.e. Sui o Nu'u, sui o tamaitai, youth reps, others); affected freehold landowners.	a) Overview of the project (objectives, outputs, funding, implementers and consultants, etc.) b) Implications on the community c) Work Program for project preparation incl tasks requiring village support / assistance.	• Facilitated and structured meeting at LTA chosen venue.	• Week 22 – 27, May 2023. completed	• LTA supported by the Design Consultant

	support / assistance.					
3	To identify and discuss land taking issues, areas and confirmation of respective roles and responsibilities for LARP preparation and implementation.	• MNRE (Land Management Division), LTA	a) Clarify project affected areas; status of Letogo-Solosolo road reserve boundary; and associated issues of compensation etc..	• Face to face • In-situ face-to-face meeting	• Intermittent, over several sessions. • January – Dec 2024 (this is on-going)	• Design Consultant (Safeguards Specialist), with surveyor, MNRE-LD and LTA (Safeguards Unit)
4	To facilitate access to sites for field investigations etc for environment and social assessments	• Community liaison reps/contact person(s); heads of affected households; village committee members.	a) Potential environ and social impacts and options available for mitigation;	• Informal in-situ face-to-face discussions with heads of affected households.	• Jul – Dec, '23 (completed)	• Design Consultant (Safeguards Specialist)
5	To present the final/approved project design and key findings of ESIA.	• Government agencies, organizations, NGOs, etc • Community representatives	Present key features of the finalized ECR-SSP design, chosen engineering options, land taking requirements; and main findings of ESIA report. Explain LARP process, announce cut-off date for LARP preparation purposes.	• 2 separate formally organized and facilitated meetings	2 October 2024 Completed	• LTA, Design Consultants
5	To identify and mark boundaries between	• Community liaison reps/contact person(s); heads of affected	To confirm - a) name of landowners (*sa'o*),	• LTA to liaise with village reps (sui ole Malo, Sui o le Nuu);	• TBC (tentatively Jan – Feb 2025; assuming approval	• LTA (safeguards reps), Design Consultant (surveyor

	landowners on the ground; confirm identify of affected land and crop owners .	households; village committee members;	b) name of crop/asset owner(s); c) shared boundaries between landowners (customary);	• Informal in-situ meeting and walk-through targeted sites.	by MNRE of cadastral survey results by Dec 2024)	and resettlement planner); MNRE rep;
6	To conduct IOL for LARP preparation.	• Affected land and crop owners; community contact rep; MNRE; LTA; Design Consultant (Surveyor and Safeguards Specialists)	a) Tallying of affected crops, assets etc. per affected person; b) Verify and sign inventory results forms;	• Physical counting (in-situ) of affected assets.	• TBC (tentatively Jan – Feb 2025 assuming approval by MNRE of cadastral survey results by Dec 2024)	• LTA and Design consultants (Safeguards /Resettlement Specialist). MNRE (LMD) to assist.
7	To inform affected landowners of how much (m^2) of their land is affected and of result of IOL; and financial compensation payable.	• Affected landowners or their reps; community liaison /contact person;	Inform each landowner of - a) Area to be taken (m2); b) Options available for compensation. c) Results of IOL; d) Financial compensation payable for land and lost assets e) Finalize arrangements for payment of compensation.	• Individual (face-to-face) meetings with affected landowner(s); •	• TBC (dependent on completion and prior approval of LARP).	• LTA, MNRE and Design Consultants (Safeguards Specialists); • LTA to take lead in communicating with affected landowners and determining venue of meetings;
8	Obtain PUMA consent and approvals - Application for Development Consent	• Village reps; affected household heads	a) Signing of PUMA Affected Persons Consent form to support DC application.	Informal in-situ one-on-one meetings	• TBC (dependent on	• LTA, Design Consultant (safeguards), PUMA
9	LARP implementation	• Affected landowners (sa'o or their reps) and other confirmed beneficiaries;	a) How and when payment of financial compensation will be	• Sui-ole-nu'u to convey message to confirmed beneficiaries personally.	• TBC; before project construction	• LTA, MNRE and MOF.

			made to confirmed beneficiaries. b) If relevant, how any other resettlement measure(s) in the approved LARP will be delivered.			
10	Project construction commencement	• Affected communities	c) Project commence	• Sui-ole-nuu will be informed through an announcement made in the MWCSD monthly meeting	• TBC; prior to start of mobilization of construction contractor.	• LTA to make announcement during the MWCSD organized meeting of sui-o-nuu.
	CONSTRUCTION PHASE					
12	Project implementation progress monitoring	• Construction Contractor, LTA, Project Supervision Consultant , WB rep.	• Regular internal review of progress report from Project Contractor • Discuss and address any issues arising	• Formal face-to-face meetings	• Fortnightly	• LTA/Project Supervision Consultant
2	Addressing Project related grievances received	• Complainant; LTA (PMU)	• To understand and find ways to redress project related grievances	• Face-to-face meetings as per GRM	• As necessary in response to complaints received.	• LTA • Project Supervision Consultant

Appendix 5: Stakeholder Consultations (1): Government agencies, NGOs etc

ECR Slope Stabilisation: GoS Stakeholders Consultation Meeting Minutes

Date:	23/05/2023		
Time:	10:30 am		
Duration:	Approx. 1.5 hr		
Location:	TATTE Building, Level 4 MWTI conference room	Meeting No:	1
Meeting Leader:	LTA - facilitator		

Attendance/Invitations – attendance sheet attached

Facilitator/Presenter Name	Initials	Office/Company
Leauanae Tuputa Uliate	TU	KASAM
Lealaivailuú Hillary Okesene	HO	KASAM
Tuaifaiva Sam Sesega	TSS	KASAM
Dr Aleni Fepuleai	AF	KASAM
Futialo Philip Kerslake	FPK	SWA
William Roberts	WR	T&T
Tiumalu Malcolm Esera	TME	LTA
Lenataí Taupisi Faamatuainu	LTF	LTA
Vailoa Iefata	VI	LTA
Perina Sila	PS	LTA

ITEM	AGENDA ITEM	ACT.	DUE
1	**WELCOMING REMARKS**		
	Welcoming remarks and introduction by TME		
	Prayer by TU		
2	**PROJECT OVERVIEW**		
	LTF • Introduced the ECR Slope Stabilisation Project – rationale, objectives, expected outputs, funding, institutional/implementation arrangements and timelines.		
	TME • Informed the stakeholders that there is provision under the project for the relocation of existing assets and this is also a good opportunity for expansion should the 10 providers require an extension or replacement of their existing assets.		
	TU		
	• Introduced the T&T and KASAM team and their involvement to provide design, procurement assistance and supervision services. • Also introduced the next presenters – AF for the geological assessment and TSS for the environmental and social impacts.		
3	**GEOLOGICAL ASSESSMENT PRESENTATION**		

	AF • Presented the geological assessment between Letogo and Saoluafata (specific details can be found in the geological presentation attached)		
	TU • Informed the participants that the extent of the design works is 16km from Letogo to Saoluafata with the possibility of a further extension to 20km from Solosolo to Saoluafata		
4	**SAFEGUARDS PRESENTATION**		
	TSS • Presented the potential environmental and social impacts and the mitigation measures that will be set out in the Environmental and Social Management Plan (ESMP) (specific details can be found in the attached ESS presentation) TU • Requested that each key stakeholder confirms a representative or focal point of contact for ease of communication and correspondences. FPK • Confirmed that the Samoa Water Authority does not have any existing assets along East Coast Road from Letogo to Saoluafata. • Added that the 20m road reserve width might be difficult to achieve especially with lots of houses near the road. TU • The road reserve width will depend on the design recommendations and MNRE's approval. LTA and MNRE will need to discuss options and confirm a viable road width.		
5	**GRIEVANCE REDRESS MECHANISM**		
	PS • Presented the GRM and introduced the government stakeholders that will be working closely with LTA and the consultant to mitigate complaints raised • Introduced the GBV/VAC a new safeguard requirement by the donor (specific details can be found in the attached GRM presentation)		
6	**Closing remarks by TME and lunch**		

Registration Sheet Removed for Disclosure

Appendix 6: Stakeholder Consultation: Community representatives ECR Slope Stabilisation: Community Consultation Meeting Minutes

Date:	24/05/2023		
Time:	10:30 am		
Duration:	Approx. 2.5 hr		
Location:	TATTE Building, Level 4 MWTI conference room	Meeting No:	1
Meeting Leader:	LTA - facilitator		

Attendance/Invitations

Facilitator/Presenter Name	Initials	Office/Company
Leauanae Tuputa Uliate	TU	KASAM
Lealaivailuú Hillary Okesene	HO	KASAM
Tuaifaiva Sam Sesega	TSS	KASAM
Dr Aleni Fepuleai	AF	KASAM
Lenataí Taupisi Faamatuainu	LTF	LTA
Vailoa Iefata	VI	LTA
Perina Sila	PS	LTA
Manumaleuga Filisita Heather	MFH	MNRE

ITEM	AGENDA ITEM	ACT.	DUE
1	**WELCOMING REMARKS**		
	Welcoming Remarks and introduction by LTF		
	Prayer by TSS		
2	**PROJECT OVERVIEW**		
	VI • Introduced the ECR Slope Stabilisation Project – rationale, objectives, expected outputs, funding, institutional/implementation arrangements and timelines.		
	TU • Introduced KASAM's involvement in collaboration with Tonkin and Taylor to provide design, procurement assistance and supervision services. • Also introduced the next presenters – AF for the geological assessment and TSS for the environmental and social impacts.		
3	**GEOLOGICAL ASSESSMENT PRESENTATION**		
	AF • Presented the geological assessment between Letogo and Saoluafata. • Displayed the high and medium risk sections according to his investigations.		

	• The high risk sections include 3 sites at Solosolo and 2 sites at Saoluafata • The medium risk sections include 3 sites at Luatuanuu and 2 sites at Leusoalii • Most of the rock boulders along ECR are a combination of scoria and pahoehoe rocks. • Noted multiple rock fractures along the ECR slopes with tree roots embedded within. • The coastline needs to be rehabilitated; some coastal areas are impacted by longshore drift caused by backfilling towards the ocean. • Noted multiple natural water streams and groundwater aquifers along ECR that need to be safeguarded. • Recommends that the open drainage along ECR should be widened to accommodate any landslips or rockfalls and maintenance to be carried out regularly. • Another type of weathering noted on the slopes is onionskin. • The main cause of the rockfalls and landslips are earthquakes, hurricanes and heavy rains allowing water to seep easily in between the rock fractures. • Cape Utumauu is one of the most vulnerable sites. Olivine is commonly found in this area and once it is weathered it is prone to landslides and slips (more details can be found in the geological assessment presentation prepared by AF)		
	TU • Informed the participants that the extent of the design works is 16km from Letogo to Saoluafata • The first phase looks at mitigation measures to stabilize the vulnerable high and medium risk slopes along ECR. The road, drainage and coastal protection will be considered at a later stage under a separate World Bank funded project.		
4	**SAFEGUARDS PRESENTATION**		
	TSS • Presented the potential environmental and social impacts and the mitigation measures that will be set out in the Environmental and Social Management Plan (ESMP) • Explained that the World Bank recognizes the safeguards aspect of any project as one of the most significant requirements that would impact the implementation of any project. Depending on the severity of the impacts, the World Bank has categories for specifying the types of environmental and social threats that may arise and the donor can also decide to halt a project if the impacts are detrimental and create serious issues for the residents and public.		

	• Touched on potential issues during construction – water quality (freshwater and marine), air quality, soil erosion, waste generation etc • There are no inland routes at ECR thus the Traffic Management Plan needs to be effectively monitored to ensure access to properties is not impeded during the construction phase (more details can be found in the safeguards presentation prepared by TSS)		
	TU • Noted that this is the initial consultation for the project and there will be more in the pipeline once the affected lands are identified at a later stage in the design. • The utmost and highest priority in any engineering work is the safety of the public, residents, workers and any project affected persons. • Once LTA confirms the construction program, another consultation will be carried out to inform the residents and public of the works • We will require a contact person from each village for further consultations down the line.		
5	**GRIEVANCE REDRESS MECHANISM**		
	PS • Presented the GRM and introduced the government stakeholders that will be working closely with LTA and the consultant to mitigate complaints raised • Introduced the GBV/VAC a new safeguard requirement by the donor		
	Meeting Closed at 12:30pm		

Registration Sheet removed for disclosure.

Appendix 7: Record of Q&A during the first community consultation with Pulenuu & Sui o Nuu

Subect	Questions, concerns and comments raised by the participants	Answers and comments by the Project Team
Slope height measurements, tree removal, Gender Based Violence & Violence Against Children.	**Resident:** 1. Since AF mentioned in his presentation that rocks are easily weathered, will the height of the slopes change? 2. How would you remove the trees located in the highest peaks of the slopes? 3. Will the road be widened or will the contractor backfill the coastal line towards the ocean during the construction phase? 4. Can you explain how violence ties into the construction activities?	**KASAM (TU)** 1. Height of slopes – that is the next phase of the project. As mentioned by LTA, surveyors from overseas and our local surveyors will work on this. 2. Tree removal – methodology is currently being discussed by the consultant and the Specialists overseas. Similar works were conducted in American Samoa. We may require specific contractors and machinery from overseas for these works. This can only be confirmed once the design is complete. 3. Road – Impacts to the traveling public will be minimized via effective traffic management during the construction phase. It is proposed that by June next year, the road works would commence. ESS will look at how safety issues can be addressed during the project. 4. GBV – an example could be harassment. The LTA and its Donor Partners like the World Bank take violence during projects very seriously. We know there is a possibility of disputes between contractors and villagers. It is known to us that some single men could be looking for wives in villages where these project affected villages and those can cause violence.
Impacts of tree removal and construction activities on properties.	**Resident:** 1. Solosolo never used to be prone to landslides however	**KASAM (TU)** 1. I am also from Solosolo. In terms of dynamites, I am unaware of the previous works that were completed however it is not a preferred option in the design as it is

	when SBDC was commissioned to build the road, this had a huge impact to the stability of the slopes. The contractor used dynamites and should have cleared the top of the slopes during the construction works 2. Trees – from SWA's consultation I learnt that trees need to be retained and maintained to stabilize the slopes however from the presentations this morning, one of the recommendations is to remove trees, please explain how this would help mitigate the landslides 3. Land – my land is on the slope and I am interested to find out if it would be affected during the construction phase. There are burial grounds in the village that are likely to be affected. Our village needs to consider this issue urgently.	quite unsafe. Regarding your concerns with the contractor's capabilities and skills to perform well and provide efficient results during the construction period, the consultant will be involved during the evaluation and the supervision stages to ensure the contractor is working within the standards and quality expected. 2. Trees – yes there are trees that cannot be removed however according to the geological presentation, the tree roots causing fractures and vulnerabilities in the rocks on the slopes need to be cleared. 3. Land – yes this will all be covered under our safeguard activities. Affected crops and lands will be identified and further consultations will be carried out with the relevant families for the compensation of these assets. We would also like to find out from you if there are activities such as agricultural development and livestock happening on top of the slopes.
Crops compensation	**Resident:** Will the trees be compensated? Our only comment is that we have been living here since 1987 and the floods dissipate quickly.	**KASAM/LTA** PS – most of the complaints received are regarding trees compensation. Only fruit bearing trees will be compensated however hedges (pa aute) and beautifying trees will not be compensated TU – I would like to clarify that the World Bank only funds the construction works however land and crops are compensated by the government.

Freehold lands	**Resident:** Some of the lands in Letogo (Vaoto especially) are freehold. Do you have any plans of notifying these families as they are residing in one of the critical sections according to the presentations. Do we need to contact them?	**KASAM** TU – yes we will need to consult them all. MFH – MNRE will assist LTA and the consultant with land and crops compensation. MNRE is responsible for any land taking that will be required during the construction phase and will be heavily involved in this process. We will only meet once the design of the slope stabilization and road are completed.
Coastal protection, EPC overhead lines and coconut trees	**Resident:** 1. Thank you for the informative presentations. There was a consultation held about two years ago on this project and we are happy that it will finally be implemented. Another critical issue to look at for the design is the coastal line. What is the standard width of the road? Is it 5m from the centerline? If this is so then there will be minimal impacts to the surrounding crops and properties. 2. EPC – Overhead lines are too close to the road and may be an obstruction during road construction. EPC also leaves their large logs in the open drains and during heavy rains the flooding would bring up these logs onto the road. Please inform EPC to rectify this issue 3. Suggestion – Coconut trees are grown on the slopes too close to the road and the coconuts are falling on the road utithe traffic. 4. AF's book – need a free copy per village as the investigations are informative and good to have on hand.	**KASAM/LTA** LTF - Noted comments on EPC. LTA will inform them regarding these clearance works. The surveyor's works will confirm the road reserve width TU – the initial phase of this project considers the slope stabilization however the road and coastal design and construction will come at a later stage.

Critical section in Solosolo	**Resident:** Would you be able to implement the netting mitigating measure that was done in American Samoa for the ECR project? It seems like an effective way of stabilizing vulnerable slopes.	**KASAM** TU – the design works will consider this method however the final design will only be known at a later stage and further consultations will be conducted to inform the residents of the design options.
Slope clearance	**Resident:** There is a slope next to our property that has a waterfall behind it. Will the geologist be able to investigate this slope as part of the project please as the rocks seem vulnerable to landslides? Is there a contractor that would want to clear the slope for their quarry and we can get compensated for it? Children – The roads are too narrow that it is unsafe for the children who usually go across the roads to the seaside Crop compensation – do we get compensated for nonu trees?	**KASAM/LTA** PS - Will reconfirm from the list of fruit bearing trees if nonu is included TU – The road works will be implemented at a later stage and will definitely be focusing on widening the corridor so it is safer not just for the residents but also the traveling public.
Road opposite Fusi – Mormon church	**Resident:** The road opposite Fusi needs to be rehabilitated as it is unsafe for the residents. The road is too near the sea – perhaps LTA can construct a seawall?	**LTA** LTF – noted and will consider this if possible under the project.

Annex 8 : Minutes of Community Consultations – 2 October 2024

2024 ECR Slope Stabilisation Project: Community Consultation - Meeting Minutes

Date:	2/10/2024
Time:	10:00 am
Duration:	Approx. 2.5 hr
Location:	Eliza Hotel Conference Room, Sogi
Meeting Leader:	Tiumalu M Esera (TME) LTA

	Facilitator/Presenters	Initials	Agency/Company
	Tiumalu Malcolm Esera	TME	LTA
	Lenataí Taupisi Fa'amatuainu	LTF	LTA
	Perina Sila	PS	LTA
	Eileen Peni	EP	LTA
	Tuaifaiva S Sesega	TSS	KASA
	Malama Siamomua	MS	KASA
	Foliga Mundia	FM	KASA

ITEM	AGENDA ITEM	ACT.	DUE
	OPENING PRAYER - TME offered opening prayer.		
1	**WELCOMING REMARKS AND PROJECT OVERVIEW**		
	TME • Extended a warm welcome to all participants, thanking them for their attendance and continuing interest in the ECR-SSP. • TME introduced the ECR Slope Stabilisation Project – presented the rationale, objectives, expected outputs, funding, institutional/implementation arrangements and timelines. He referred to previous consultation and the importance of community engagement to the planning process. TME noted that this Project is the first stage of improving the ECR with focus on reducing the risk of damage to the road and to the safety of road users from rockfall and landslips. • He noted some of the issues of interest to communities, land taking in particular to widen the road. TME wished everyone a productive and successful exchange of views and dialogue.		
2	**DESCRIPTION OF THE PROJECT & PROJECT DESIGN**		
	TSS		

	• Described the ECR – in particular its rugged and mountainous terrain. Using images of the road and map highlighting the 11 targeted sections, which contain the rugged and steep slopes that are most vulnerable to rockfall and slips. He clarified that ECR-SSP focuses only on the 11 sections, with the rest of the ECR (including through villages) not part of the ECR SSP, but of a separate subproject to follow. • TSS explained the key features of the project design (i) road widening to 20m; selected measures for rockfall protection i.e. catch ditches, barrier fences, lateral and cross drains. • Photos of examples of the engineering measures were shown to clarify what these technologies will look like once installed.
3	**POTENTIAL ENVIRONMENTAL IMPACTS**
	TSS • Discussed the potential environmental and social impacts of the Project. He emphasized the importance of having a good understanding of the existing environment, in order to fully appreciate the extent of potential impacts and the likely changes to the environment as a result of the Project. • Regarding the terrestrial environment, TSS explained that a narrow strip of land immediately adjacent to the ECR on the landward side will be impacted, and it is where the proposed engineering structures will be located. He noted that this narrow strip of land, previously densely vegetated, is now virtually cleared of vegetation as a result of villages' 'beautification' activities ahead of Samoa hosting the CHOGM in late October. This means, the Project will have minimal impact on the terrestrial flora with the vegetation already removed. TSS concluded that the Project will have no impact on the existing terrestrial environment – flora and fauna in particular. • TSS noted that silt, organic debris and loose soil from construction activities will be washed into the marine environment but measures will be implemented to ensure much of this will be removed and disposed in an approved site, and not in the lagoon. MS • Explained the marine survey conducted to assess the marine environment. She explained the existing environment as already severely degraded with about 56% consisting of dead corals, rubble and rocks, and the 44% living portion consisting of a variety of corals and sea weeds. MS explained the potential impacts resulting from the increase in siltation and land-based pollution on the marine ecosystem. She highlighted that the marine environment is already seriously degraded from many years of land-based pollution, impacts of cyclones and global warming and the ECR-SSP will further aggravate this situation. She noted however that appropriate means of mitigating the adverse impacts of ECR_SSP construction activities on the coastal environment will be implemented. Overall the impact of the Project on the marine environment is limited.
4	**POTENTIAL SOCIAL IMPACTS**
	TSS

	• Explained the main social impacts being (i) land taking (ii) traffic disruption during construction (iii) impact on services / utilities (iv) potential risk of sexual exploitation, harm to women, girls and children as a result of uncontrolled access to working sites, and random casual social interactions, and (v) impacts such as noise, dust and vibration during construction that will pose a health and safety risk for workers, some households near working sites, and possibly on road users. Overall, these impacts are assessed as minor and can be readily mitigated. • For land taking, TSS explained the 20m wide road reserve and the land taking this required. Noted that while GOS has powers of eminent domain, GOS never resort to the use of these powers, preferring instead to consult with affected village councils and leaders, and affected landowners to mutually agree to land taking for project purposes, noting that all land to be taken will be fairly compensated. • TSS discussed the impact on traffic during construction. The landward land will be closed at working sites, and normal traffic will be slowed and disrupted especially during peak travel hours from 7 – 8 am and 4-6pm. TSS estimated however that motorists will be delayed by, at worst 7 -10 minutes during peak hours at working sites, and by 5 minutes during non-peak hours. Overall, traffic impacts on motorist and road users will be minor. • TSS noted that the potential risk on women, girls and children re SEAH, from having foreign workers nearby is an important issue to the WB. There was general agreement the risk is minor and the assistance and support of Village chiefs is essential to ensure this risk is effectively managed.
5	**ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)**
	TSS • Briefly described that all the identified risks and issues are addressed in the Environmental and Social Management Plan (ESMP) which identifies each risk and prescribes specific actions that the Contractor and or government agencies will implement to eliminate and or reduce these adverse impacts to acceptable levels. The ESMP will form part of the contractor's contract therefore it is legally enforceable. Monitoring and enforcement will be by LTA and its agents.
6	**CUT-OFF DATE FOR ASSESSMENT OF IMPACTED AREAS**
	TSS • Explained the need to assess the project's impact on livelihood sources and built assets. He explained that LTA will carry out this assessment on **4 October 2024.** This date is the Cut-Off date, meaning that any crops planted and or structure build or installed inside the area taken for project purposes, after the 4 October, is not eligible for compensation.
7	**QUESTIONS AND COMMENTS FROM PARTICIPANTS**
	Resident from Eva village • The rep expressed gratitude for the consultation and confirmed his village's support for the Project. He noted that road safety is of paramount importance at the same time noted that in the previous consultation, the focus of the project was on slope stabilization.

	• He noted that his village has cleared the area earmarked for the Project's rock stabilization measures and drains, up to 5m from the edge of the seal, and asked if his village (as well as others) could get financial compensation for the work already done. Resident from Solosolo • This rep noted that he attended the previous consultation at TATTE Building (Nov 2023) and noted that the project is no longer on slope stabilization but now about catch ditches and drainage. • He noted that most of the land likely to be affected belong to his extended family and in this land, there are gravesites that shouldn't be affected. He advised that he had previously advised LTA about the gravesites.[30] • Whilst concern about the shift in focus of the project, he sought reassurance that this family's gravesites are not affected. LTA (LTF) • *LTF responded to the community rep's issues by explaining that the cadastral survey report is being reviewed and if the approved land for the reserve will adversely impacts his family's gravesite, then appropriate measures will be mplemented to avoid this impact. LTF also explained the connection between ditches and drainages and slope stabilization indicating that this link remains an important part of the Project.* Resident from Leusoalii Village • This rep noted that the Project is well received and fully supported by his village and do not see one objecting. He expressed his thanks to the Government and LTA for the initiative. Resident from Laulii Village. • This rep noted that several land parcels affected his village, and noting the limited space on the landward side for road widening, suggested if the option of widening on the coastal side (possibly including land reclamation) is not the better option in this case. • He requested that the next community consultation be held in his village community hall in Laulii which is more easily accessible to all Project-affected villages. ***LTA (LTF)*** • *LTF responded that these issues will be reviewed and considered once the cadastral survey report is approved and the boundaries for land taking are known.* Resident from Saoluafata village

[30] Gravesites are on land not affected by ECR-SSP and will not be affected by the road widening whether its 16m or 20m wide.

	• This rep expressed concern about the potential impact of the project on the marine environment. He noted the reef is an important resource for their livelihood and it is not far from the shoreline. He noted also that his village has a fisheries reserves project that LTA should be aware of. • He also expressed interest in the overburden and unused loose soil, requesting he is willing to take it for his family's use. *TSS responded that this is something he is free to take up with the contractor during the construction phase.* *[TSS encouraged the women representatives to ask questions and expressed their views of the Project.].* *Unidentified village participant –* • Noted that in his village, some rock fences will be affected. He also noted that the affected slopes in his village are under the authority of the Village Council. (This means these lands have not been allocated by the Village Council to any families.]. *TSS explained that all livelihood sources and or built assets (including cemeteries) affected will be properly compensated and or replaced once the cadastral survey report is confirmed and affected land is known following further assessments by LTA.* Representative from Eva Village • This rep noted there is some confusion among some participants who refer to 5m width in road clearing and the 20 wide reserve. He encouraged LTA to stick with the 20m width – 10m each side of the road centre line – reiterating that his family's gravesites are his main concern. • He expressed disappointment that LTA had asked that he invited representatives of landowning families to the consultation and now it seems their presence is not so relevant to the discussion. *LTA (LTF)* • *LTF responded that land likely to be acquired for the Project are uninhabited and so no homes and or other built structures will be affected.* Resident from Laulii Village • This rep reiterated his offer to host the next community consultation at his community hall at Laulii. *TSS again encouraged women to express their views.* Laulii – Sui o Tamaitai (Village Women's representative) • The village rep noted that her committee has committed resources and labour to clearing all the vegetation along the road side for CHOGM, and it will now benefit the LTA and GOS. She then expressed support for one of the earlier speakers who request that LTA provide some financial compensation for the work they've carried out in clearing these areas.

	In the absence of further comments, TSS introduced the questionnaire survey and requested all participants to complete the questionnaire while awaiting lunch. No further remarks or comments were received from participants. Lunch was served.		
8	**CLOSURE**		
	LTF: • Whilst participants were completing the questionnaire survey, LTF seized the opportunity to close the workshop formally. Speaking on behalf of the LTA CEO and Management, she expressed thanks to all village representatives for their attendance and participation, for the expressed support for the Project and for the constructive comments received. She also thanked the KASA team for their contribution and support. She emphasized that further consultation will be organized with communities - particularly with affected landowners once these are confirmed - to identify land boundaries, measure areas that will be legally acquired, and to discuss issues related to compensation, and any other issues of concern to communities. LTF then declared consultation meeting closed.		
	CONSULTATION MEETING CLOSED at 12:45 pm		

Signed Registration Sheet Removed for Dsiclosure

Appendix 9: Common forest tree species along the ECR corridor

Common forest canopy species

Species	Family	Local name	Status
Falcataria moluccana	Fabaceae	*Tamaligi paepae*	i
Samanea saman	Fabaceae	*No Samoan name*	i
Terminalia catappa	Combretaceae	*Talie*	n
Mangifera indica	Anacardiaceae	*Mago*	n
Garuga floribunda	Burseraceae	*Manaui*	n
Rhus taitensis	Anacardiaceae	*Tavai*	n
Albizia chinensis	Fabaceae	*Tamaligi enaena*	i
Alphitonia zizyphoides	Rhamnaceae	*Toi*	n

Source: Foliga, T and Enoka, F. 2024. n = native; i = introduced

Common sub-canopy species

Species	Family	Local name	Status
Hibiscus tiliaceus	Malvaceae	Fau	n
Adenanthea pavonina	Fabaceae	Lopa	i
Ficus tinctoria	Moraceae	Mati	n
Castilla elastica	Moraceae	Pulu mamoe	i
Macaranga harveyana	Euphorbiaceae	Lau pata	n
Ficus scabra	Euphorbiaceae	Mati mageso	n
Morinda citrifolia	Rubiaceae	Nonu	i
Kleinhovia hospita	Malvaceae	Fuafua	n
Trema andersonii	Cannabaceae	Magele	n
Ficus tinctoria	Moraceae	Mati	n
Funtumia elastica	Moraceae	Puluvao	i

Source: Foliga, T and Enoka, F. 2024.

Appendix 10: List of Terrestrial Birds Observed along the ECR

	Common name	Scientific name	Local name	Category/ Status	High Risk zones surveyed												
					1	2	3	4	5	6	7	8	9	10	11	12	13
1	Polynesian Starling	*Aplonis tabuensis*	Fuia Vao	N	√	√	√	√	√				√	√	√	√	√
2	Banded Rail	*Gallirallus philippensis*	Ve'a	N	√	√	√		√		√			√	√	√	√
3	White Tern	*Gygis alba*	Manusina	N	√	√	√	√	√	√	√	√		√	√	√	
4	Pacific Pigeon	*Ducula pacifica*	Lupe	N	√			√	√		√	√			√	√	
5	Common Mynah	*Acridotheres tristis*	Maina fanua	I	√	√								√			
6	Jungle Mynah	*Acridotheres fuscus*	Maina vao	In	√	√	√	√	√	√	√	√	√	√	√	√	
7	Crimson crowned dove	*Ptilinopus porphyraceus*	Manutagi	N	√	√	√	√	√	√		√	√	√	√	√	√
8	Samoan Starling	*Aplonis atrifusca*	Fuia	*E	√	√		√	√		√	√	√		√	√	√
9	White rumped swiftlet	*Aerodramus spodiopygius*	Pe'ape'a	N	√			√		√						√	√
10	Flat billed kingfisher	*Todirhamphus halcyon recurvirostris*	Ti'otala	*E	√	√			√	√			√		√	√	
11	Polynesian triller	*Lalage maculosa*	Miti tai	N	√	√	√	√	√	√	√	√	√	√		√	√
12	Wattled honeyeater	*Foulehalo carunculata*	Iao	N	√	√	√	√	√		√	√		√		√	√
13	Red vented bulbul	*Pycnon0tus cafer*	Manu palagi	In	√	√		√		√	√		√	√	√	√	√
14	Cardinal honeyeater	*Myzomela cardinalis*	Segasega-mau'u	N	√	√	√		√	√	√	√	√	√	√	√	√
15	Blue- crowned Lory	*Vini australis*	Segavao	N	√						√		√	√	√		
16	Feral pigeon	*Columba livia*	Lupe palagi	In		√											
17	Samoa Whistler	*Pachycephala flavifrons*	Vasavasa	*E				√	√		√			√			
18	White-throated Pigeon	*Columba vitiensis*	Fiaui	N				√						√			
19	Samoan Broadbill	*Myiagra albiventris*	Tolaifatu	N				√		√	√						
20	Many-coloured	*Ptilinopus perousii*	Manuma	N												√	√

[32] IUCN (2024) Red List of Threatened Species. Version 2023-1. http:://www.iucnredlist.org. Downloaded 17/3/2024; 10am.
[33] IUCN Red List of Threatened Species defines Least Concern as when a species has been evaluated against the Red List criteria and does not qualify for Critically Endangered (CR), Endangered € Vulnerable (VU) or Near Threatened (NT).

	fruit-dove																

*N = native, naturally occurs in Samoa and elsewhere; I = introduced, non-native; *E = endemic, occurs only in Samoa; **E = endemic, occurs in both Samoa and Am. Samoa only.

Shore and Sea Birds Observed along the ECR

	Common name	Scientific name	Local name	Category	High Risk zones surveyed												
					1	2	3	4	5	6	7	8	9	10	11	12	13
1	White Tern	*Gygis alba*	Manusina/Gogo	N	√	√	√	√	√	√	√	√		√	√	√	
2	Reef heron	*Egretta sacra*	Matu'u	N	√		√			√			√	√	√		
3	Pacific Golden Plover	*Pluvialis fulva*	Tuli	N	√	√	√			√	√			√	√		
4	Brown noddy	*Anous stolidus*	Gogo	N			√			√	√	√	√		√		
5	Brown booby	*Sula leucogaster*	Fua'o	N						√		√					

*N = native, naturally occurs in Samoa and elsewhere; I = introduced, non-native; *E = endemic, occurs only in Samoa; **E = endemic, to both Samoa and American Samoa.

Flying mammals

1	Samoa flying fox	*Pteropus samoensis*	Pe'a vao	**E		√	√										

*N = native, naturally occurs in Samoa and elsewhere; I = introduced, non-native; *E = endemic, occurs only in Samoa; **E = endemic to both Samoa and Am. Samoa

Appendix 11: The IUCN's Assessment of the Four Listed Endemic Species.

Bird Species of Conservation Significance & IUCN conservation Statuses

	Species	*Botanical name*	Local name	Status	Comment/IUCN Assessment
1	Samoa flying fox	*Pteropus samoensis*	Pe'a vao	NT	Last assessed in July 2019. Listed as Near Threatened as its global population is suspected to have declined by an estimated 25-29% over the past 24.3 years (three generations; generation length = 8.1 years, Pacifici et al. 2013). Main threats – habitat loss and fragmentation due to storms, agriculture, logging, and hunting; (IUCN Red List, 2024.
2	Samoan whistler	*Pachycephala flavifrons*		LC	Last assessed in 2016. Population trend appears to be stable hence species dones approach the thresholds for Vulnerable under the population trend criterion. Range is restricted however it is not believed to approach the thresholds for Vulnerable
					under the range size criterion. Thus the Least Concern status. (IUCN, 2024)
3	Samoan starling	*Aplonis atrifusca*	Fuia	LC	
4	Flat-billed kingfisher	*Todirhamphus recurvirostris*	Tiotala	LC	Last assessed in October 2016; species has a restricted range but does not approach the thresholds for Vulnerable under the range size criterion. Population trend is not known but is believed to be decreasing sufficiently rapidly to approach the thresholds under the population criterion. Under the population size criterion, it is not believed to approach the thresholds for Vulnerable. For these reasons, species is evaluated as Least Concern. (IUCN, 2024)

NT – Near Threatened; LC – Least Concern

Appendix 12: Physical setting – ECR-SSP Affected Communities

Physical and natural resource setting

Vaimauga East District

The district of Vaimauga East is located at the northern side of Upolu between the districts of Anoama'a West and Vaimauga West. There are four villages with only the two eastern-most villages - Letogo and Laulii – forming part of the ECR SSP affected communities. The entire district comprise of a mix of customary, government-owned and free-hold land. For Letogo and Laulii, the terrain is rugged with steep slopes and gullies extending from the interior to the coast. In Laulii, this terrain includes a narrow coastal flat and two river plains where the majority of the population is concentrated. The physical infrastructure of paved roads, bridges and drainage, on the village's eastern flank, lie mainly within this narrow coastal flat. High powered electricity lines run along the ECR shoulder except between Letogo and Laulii, where these are routed inland over the Vaoto headland.

A large lagoon and reef system close to the coastline extends from the western villages of Vaimauga East from Fagalii, Vailele and Letogo providing a source of protein from inshore fishing. In Laulii, however, there is no reef and the presence of rock outcrops and steep beaches create conditions for high energy wave action (Vaimauga East CIM Plan, 2018).

Anoama'a West District

The Anoma'a West district comprises of 9 villages, 7 of whom (on the western flank) forming the larger part of the ECR-SSP scope. These villages are Leusoali'i, Luatuanu'u, Solosolo, Eva, Salelesi, Fusi and Saoluafata.

The Anoama'a West district is characterized by a series of steep headlands separated by bays that extends from the interior to the coast. The rugged terrain offers protection from strong winds for the natural vegetation in valleys and troughs but also makes the villages highly vulnerable to flooding from upland rivers and streams. Short, fast flowing rivers and streams flow through Leusoalii, Luatuanuu, Solosolo and Eva. The accompanying river plains provide gentler terrain where homes and other social structures are concentrated. There is no significant area of sheltered lagoon. Beaches in the bay areas are made up of a mixture of fine coral sand, unbroken, dead coral and fine, black, river sand near the mouths of the main rivers (MNRE, 2018).

Populations

The 2021 census recorded a combined population of 3,782 for Letogo and Laulii, and 5,234 for the 7 villages of Anoama'a West. Table 10 gives the 2021 population for Vaimauga East and Anoama'a by village and gender. For comparison purposes, the 2011 population is included.

Table 10: Main demographic features by village

Key demographic features by villages	Letogo	Laulii	Leusoalii	Luatuanuu	Solosolo	Eva	Salelesi	Fusi	Saoluafata
Population (2021)	1565	2217	478	936	1835	273	374	428	910

Male/Female (%)	52/48	51/49	53/47	50/50	50/50	53/47	50/50	52/48	51/49
Number of hh	231	293	75	125	249	45	41	63	129
Per hh population	6.7	7.6	6.4	7.5	7.4	6.1	9.1	6.8	7.1
Popn (%) 15+ yrs	59.4	61.5	61.9	60.1	58.1	67.7	59.0	62.6	60.9
Popn with walking disability	4	29	7	10	20	4	4	5	6

Source: SBS (2021). Samoa National Census Reports

The Samoa Agriculture Census (2019), provided the following statistics of households involvement in agricultural activities:

- 91% and 98% of all households in Vaimauga East and Anomaa West respectively are classified as agricultural households or "households that grow some crops or raise some livestock". The national percentage is 94%.
- The average size of holding cultivated per household in Vaimauga East is 0.7 acres, and for Anoamaa, 1,7 acres, compared to the national average holding of 1.1 acre.

Regarding employment, the 2021 census (SBS, 2022) reported (Table 11) the following village level statistics of adults (15+ years) and their main activities. It showed that the villages of Letogo and Laulii from Vaimauga East have an average of 25% of their populations of 15+years in paid employment. For Anoma'a district, the percentage of population in paid employment ranged from 13% (Fusi and Salelesi) to 22% (in Leusoalii). The percentage of 15+ population engaged in farming and fishing averages 28.5% in Letogo and Laulii, and 23% in Anoama'a. An average of 30% of 15+ years population is engaged in 'domestic duties "and other activities in Letogo and Laulii. In Anoama'a district, the average is 45%, with the highest being Fusi at 50% and lowest being Leusoalii village at 41%.

Table 11: Population 15 years and older and main occupation

Village	Total	People in Paid employment	Employers and business owners	People engaged in agriculture, livestock, nd fisheries	In training, school	Other occupation and domestic duties
Letogo	921 (100%)	262 (28%)	26 (3%)	247 (27%)	139 (15%)	247 (27%)
Laulii	1364 (100%)	296 (22%)	59 (4%)	404 (30%)	150 (11%)	455 (33%)
Leusoalii	296 (100%)	65 (22%)	1 (0.3%)	68 (23%)	49 (17%)	121(41%)
Luatuanu'u	567 (100%)	110 (19%)	8 (1%)	119 (21%)	66 (12%)	264 (47%)
Solosolo	1067 (100%)	167 (16%)	26 (2%)	247 (23%)	139 (13%)	488 (46%)
Eva	185 (100%)	25 (14%)	0 (0%)	48 (26%)	34 (18%)	78 (42%)
Salelesi	221 (100%)	29 (13%)	1 (0.5%)	61 (28%)	32 (14%)	98 (44%)
Fusi	268 (100%)	35 (13%)	8 (3%)	51 (19%)	40 (15%)	134 (50%)
Saoluafata	554 (100%)	112 (20%)	10 (2%)	118 (21%)	82 (15%)	232 (42%)

A poverty analysis from Samoa's HIES 2018 shows levels of poverty by region, with the Project affected villages of Vaimuaga East and Anoama'a district forming part of the 'Rest of Upolu' (ROU) region.

The following statistics from HIES provide a glimpse of the socio-economic statuses at the regional and national levels.

- *Where the poor people live*: 43,946 people were living below the basic needs poverty line in 2018; up by 22% from the 2013/2014 figure; 24.4% live in AUA; 39.1% in NWU, **19.0% in RoU** and 17.6% in Savaii.
- Between 2013/2014 and 2018, there were increases in the number of people below the BNPL in all four regions, with the largest increase (37.3%) being in RoU.
- *Gender of the poorest people:* HIES 2018 found little difference in the rates of poverty incidence between males and females in the four regions, although the average rates are higher in AUA (females 27.5%, males 28.1%) and NWU (23.4% and 24.3%), compared to RoU (18.6% and 17.4%) and Savaii (17.2% for both females and males).

****

UPOLU EAST COAST ROAD (ECR) STABILISATION PROJECT

MARINE BIODIVERSITY ASSESSMENT REPORT

January, 2024

EXECUTIVE SUMMARY

The Samoa Climate Resilient Transport Project focuses on improving the climate resilience of the country's road network and to provide an immediate response to the Eligible Crisis or Emergency. Component 2 involves the study, design and construction of identified priority road assets to improve their resilience to climate-related hazards and/or events. Sub-component 2.2 covers interventions to reduce the risk of rock falls and land-slips along the East Coast Road on Upolu, through the implementation of slope stabilization measures, and targeted drainage to reduce the effects of flooding due to intense rainfall and storm surge.

This marine biodiversity baseline assessment is vital to the project's environmental safeguard considering the adjoining and or adjacent location of the marine environment to the main ECR and the associated impacts. The purpose is to assess and describe the existing (baseline and pre-construction) conditions of the potentially affected coastal areas along the main ECR; and to determine the impacts of the proposed road stabilization works and formulate appropriate measures for mitigation. The findings of the assessment will also provide the basis for ongoing monitoring of any consequent changes that may occur in the coastal area post-construction.

The following overall baseline marine biodiversity conditions of the ECR have been discovered from the assessment:

- The surveyed coastal area comprises 46% biotic (living) factors which include live coral, marine algae, fish and invertebrates. On the other hand, 54% makes abiotic or non-living cover which comprises mud and silt, sand, coral rubble and dead corals with algae and stones / rock boulders. This overall shows only the conditions in the coastal area that will be potentially impacted by the proposed road stabilization project.
- It appears that marine biodiversity in the area assessed is possibly much lower than the wider marine area. This is because these intertidal and beach areas are highly disturbed (habitats and noise) from land-based activities and lack habitats to support fish foraging or residency. In comparison, the outer lagoon and reef provide nursery areas for a variety of fish and invertebrate species because of the many biological niches and habitats available. The surrounding areas are generally alive and a spill-over corridor for mobile species to forage especially during high tide.
- The low occurrence of biotic features is indicative of severely degraded habitats and low diversity of corals and invertebrates in the area.
- There were no notable signs of recent runoff events along the coastline to be able to determine any effect associated with the road.
- Natural recovery is possible but for the longer-term with the effective management of upland and land-based activities.

The measures proposed by the project for road stabilization include rock stabilization, soil slope stabilization and catch ditch. Due to the adjoining and nearby location of the sea, the main potential impacts on the adjoining coastal and marine environment which have been identified for consideration in the next project phase relate to:

(1) Water quality resulting from stormwater discharge into the sea and runoff of sediment and silt;
(2) Waste entering the sea from construction areas; and
(3) Safety and health risks associated with rock fall / rock slide / landslide.

Appropriate measures proposed for mitigating these impacts include:
1) Installation of sediment control measures along the seaward side to trap sediment from falling into the sea.
2) Preparation and implementation of relevant Work Method Statements (WMS) and following site instructions when undertaking rock works.
3) Ensuring that construction debris and waste are removed daily from the site for disposal at a designated dumpsite.
4) Minimizing disturbance and unnecessary vegetation removal on the coast by marking out the work areas prior to works commencing.
5) Workers to wear appropriate PPE at all times on construction site.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1. Project Background

Samoa like many PICs is vulnerable to extreme weather and climate events that include heavy rainfall, strong winds and storm surges. The frequency and intensity of these events according to the Pacific-Australia Climate Change Science and Adaptation Planning Program (PACCSAP), is increasing, a trend projected to continue throughout the region[31].

In 2013, the Government of Samoa (Cabinet) approved a plan to strengthen the climate resilience and longevity of road assets throughout the country and is taking steps to strengthen the resilience of Samoa's economic assets to extreme climatic events. In late 2017 the Government adopted the Vulnerability Assessment (VA) and Climate Resilient Road Strategy (CRRS) prepared under the Pilot Program for Climate Resilience of the Strategic Climate Fund financed Enhancing the Climate Resilience of the West Coast Road (CRWCR) project, which identified hazards and prioritized areas for investment in the transport sector.

1.2. Samoa Climate Resilient Transport Project (SCRTP)

The development objective of the SCRTP is to improve the climate resilience of Samoa's road network and in the event of an Eligible Crisis or Emergency, to provide an immediate response to the Eligible Crisis or Emergency.

Component 2 involves the study, design and construction of identified priority road assets to improve their resilience to climate-related hazards and/or events using the recommendations of the VA and CRRS. Sub-component 2.2 will provide funding for interventions to reduce the risk of rock falls and land-slips along the East Coast Road on Upolu, through the implementation of slope stabilization measures, and targeted drainage to reduce the effects of flooding due to intense rainfall and storm surge.

1.3. Upolu East Coast Road

The East Coast Road (ECR) inks Apia with the east coast of Upolu (Figure 1). Approximately 4 kilometers from Apia, the topography becomes more rugged, with a coastal plain that is very narrow in places. The road runs close to the coast for approximately 16 kilometers before turning inland to the south for a further 4km. In several locations along this coastal section the road has very steep, high cuttings close to the landward side of the road. Some of these areas are clearly unstable and cause frequent landslides and rock falls that result in obstruction to drainage channels, partial or sometimes full closure of the road, and pose a danger to road users. This hazard was highlighted as a high priority for rectification within the VA. An initial inspection indicates that there is a wide variety of slope, geotechnical, vegetation and moisture conditions in the cuttings, from vertical solid rock formations to highly mobile soils supporting trees and grass, and it is expected that a range of interventions will be required to suit the different

[31] Samoa Climate Resilience Transport Project (SCRTP). Terms of Reference for Investigation, Design & Documentation, Procurement Assistance & Construction Supervision of East Coast Road Slope Stabilization.

conditions.

Figure 1: Location of Upolu ECR (black broken line)

Project implementation is currently at Stage 1 of a 2-stage approach as indicated below:

- Stage 1 – Hazard and Risk Assessment, Investigations & Design
  - ✓ Initial hazard and risk assessment of slopes and identification of critical sections
  - ✓ Fieldwork, surveys and site investigation, preliminary design (including preparation of a Land Acquisition and Resettlement Plan and preparation of Planning & Urban Management Agency (PUMA) application for the preferred option)
  - ✓ Detailed design and documentation ready for construction procurement for the identified slope stabilization measures

- Stage 2 – Procurement Assistance & Construction
  - ✓ Provision of assistance to LTA during the procurement process
  - ✓ Supervision of construction and administration of contract(s)

2. MARINE BIODIVERSITY BASELINE ASSESSMENT

The marine biodiversity baseline assessment (MBBA) is vital to the project's environmental safeguard considering the adjoining and or adjacent location of the marine environment to the main ECR and the associated impacts. As part of the project's environmental and social baseline assessment survey component, the MBBA was undertaken from 2 – 21 August 2023 in the coastal areas along the identified priority segments of the ECR. Some of these segments contain culvert pipes under the road which discharge stormwater directly into the sea.

2.1. Purpose

The purpose of the MBBA is to assess and describe the existing (baseline and pre-construction) conditions of the potentially affected coastal areas along the main ECR; and to determine the impacts of the proposed road stabilization works and formulate appropriate measures for mitigation. The findings of the assessment will also provide the basis for ongoing monitoring of any consequent changes that may occur in the coastal area post-construction.

2.2. Survey Areas

The survey assessed 28 of the 32 priority sites along the ECR starting from Letogo village going eastwards to Saoluafata village as indicated in the Maps shared for safeguards survey purposes. These respective sites respectively adjoins directly with the coastline while the other four (4) sites are inland segments of the road therefore survey was not necessary. Refer Figures below for the general locations of the survey sites.

Survey Site 1

Survey Sites 10 - 13

Survey Sites 14 - 17

Survey Sites 18 a,b,c

Survey Sites 19 - 20

Survey Sites 21 - 24

Survey Site 25

Survey Sites 26 - 31

Survey Site 32

2.3. Methodology

The survey covered an estimated 30 m^2 (15 m transect line x 1 m on either side of the transect) of beach and intertidal area in each of the 28[32] assessable sites along the length of the main ECR. Low tide was more appropriate and preferable for the nature of the survey area and importantly the type of information required to inform the purpose of the assessment.

Transect lines of at least 15m (where practicable) long were used to collect quantitative and qualitative information from the 32 target sites. In a team of two surveyors, one was to secure the first end of the transect line at the coastline while the other walked seaward laying the 15m transect in place. Observations and recordings covered an area of 30m^2 (15m x 2m (1m wide on either side) for every transect line and taken at every 2-meter interval starting from the coastline to the sea.

Both surveyors recorded information whilst walking along the transect lines including capture of still photos. The information included those on sand, sand and rubble, dead coral with algae (DCA), live coral, marine algae and fish and invertebrates. Other information gathered are water visibility, wind and current direction. Low tide water level was mostly up to the waist at the accessible sites so this facilitated walking and good visibility for the benthic community.

2.4. Indicators of Marine Biodiversity

The assessments collected information on the following indicators:

a) Substrate cover in terms of Sand and Rubble, Dead Coral with Algae (DCA) and Sand
b) Marine Algae
c) Live Coral forms
d) Fish and Invertebrates

[32] The other four (4) sites are inland segments of the road therefore survey was not necessary

e) Other environmental factors such as water visibility and silt or sediment deposits, water level and tidal / current movement.

2.5. Data limitations

- The assessment was undertaken during low tide for ease of method deployment and data collection, as well as importantly for safety. However, three of the 32 sites could not be assessed due to the steepness and rough conditions even at low tide. Surveyors subsequently tried making closer observations on these sites from the coastline in order to obtain the required information.
- The assessment was done during fine and sunny days therefore no impacts of road surface runoff or drainage discharge on the coastline were noted.

3. DESCRIPTION OF THE BASELINE MARINE BIODIVERSITY ALONG THE ECR

The following describes the existing (baseline) marine biodiversity conditions in the ECR priority coastal areas.

3.1. Site: 1 (Chainage: 450 – 600, Letogo)

Site 1 is highly sheltered therefore low energy and minimal flushing. The Letogo river (bridge) mouth located about 200m to the southwest of the site discharges alluvium debris to the sea.

The site is dominated by a muddy substrate (100%) measuring at knee height from the coastline extending out about 30m towards the open sea. The muddy substrate is a significant and cumulative impact of previous coastal reclamation (about 50m seaward) which have been undertaken on the eastern side. Silt carried by the northeasterly currents are deposited in and along this area. Mud significantly reduces water clarity and visibility.

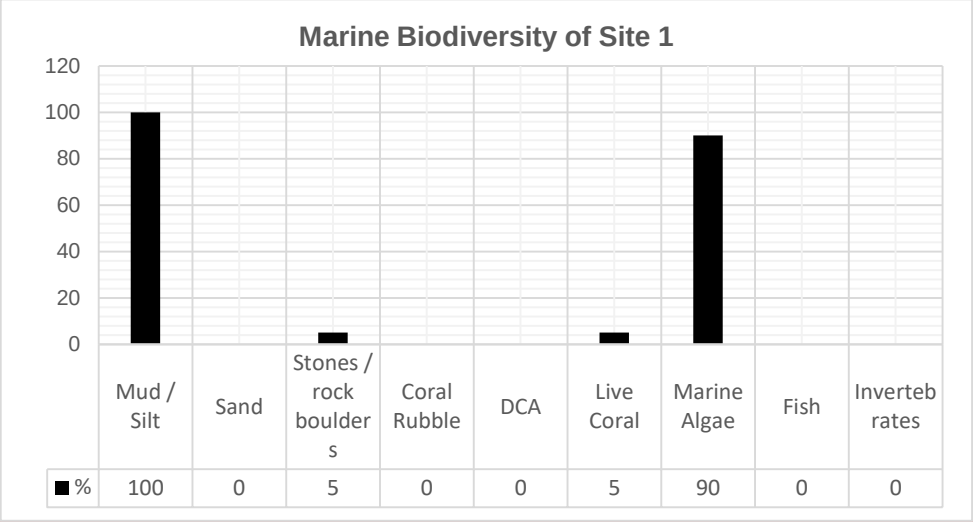


Figure 3: Marine biodiversity of Site 1

Marine algae (*Sargassum sp*.) and Seagrass (*Halophila ovalis*) cover about 90% of the area surveyed as they are favorably established in the muddy substrate. An estimated 5% live encrusting corals were noted between 20m and 30m distance from the coastline where the substrate becomes slightly sandy and partly exposed at low tide. Some rocks / stones were also noted being well grounded in the mud.

?

Sargassum sp.

Encrusting coral boulders

3.2. Site: 10 (Chainage: 3950 – 4000)

About 60m from the coastline is the barrier reef and currents flow westward due to the easterly winds.

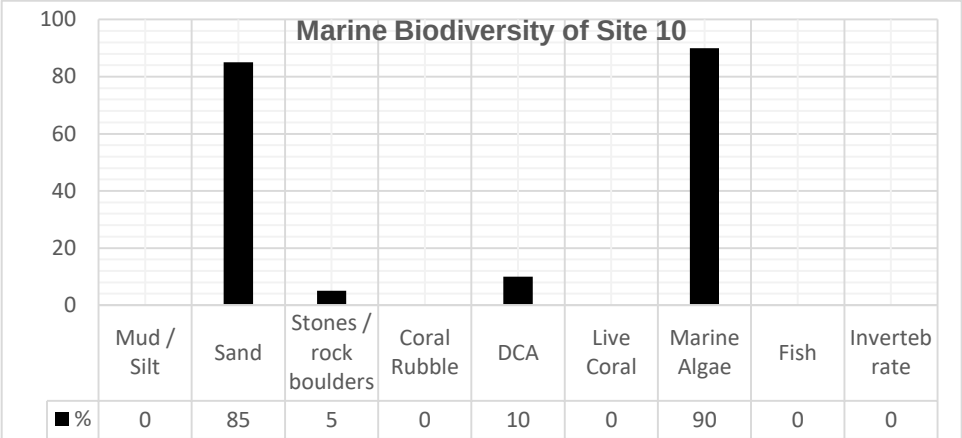
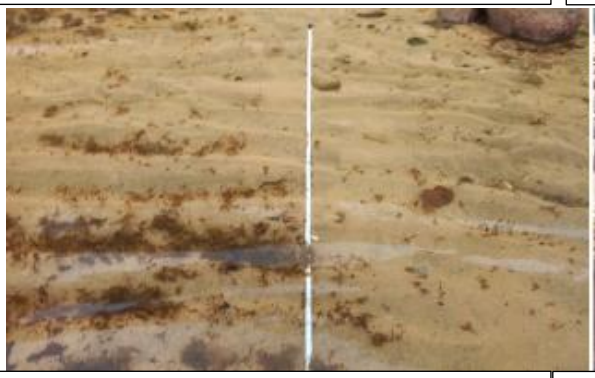


Figure 4: Marine biodiversity of Site 10

This site is about 85% sandy with very good water clarity. Marine algae species Sargassum and Padina are highly abundant (90%) and well established on sandy bottom. No invertebrates, fish or live corals were recorded in the survey area. Few medium-size rocks and stones occur in the vicinity of the coastline.

Padina pavonica

Sargassum sp. & Halophila ovalis



Sandy substrate

Rocks / stones near coastline

3.3. Site: 11 (Chainage: 4000 – 4050, Lauli'i village)

There were no fish or live coral recorded in this site but only a number of holothurians / sea cucumbers namely the Loll fish (*Holothuria (Halodeima) atra*) and Greenish (*Stichopus chloronatus*).

Sand is the dominant substrate (70%) although silt was also noted. This is slightly a high energy area and some coral rubbles were also noted amongst the rock boulders. Marine algae i.e. *Sargassum sp.* is highly abundant. There are some weathered rocks favorable for algal growth in addition to dead coral hosts (DCA).

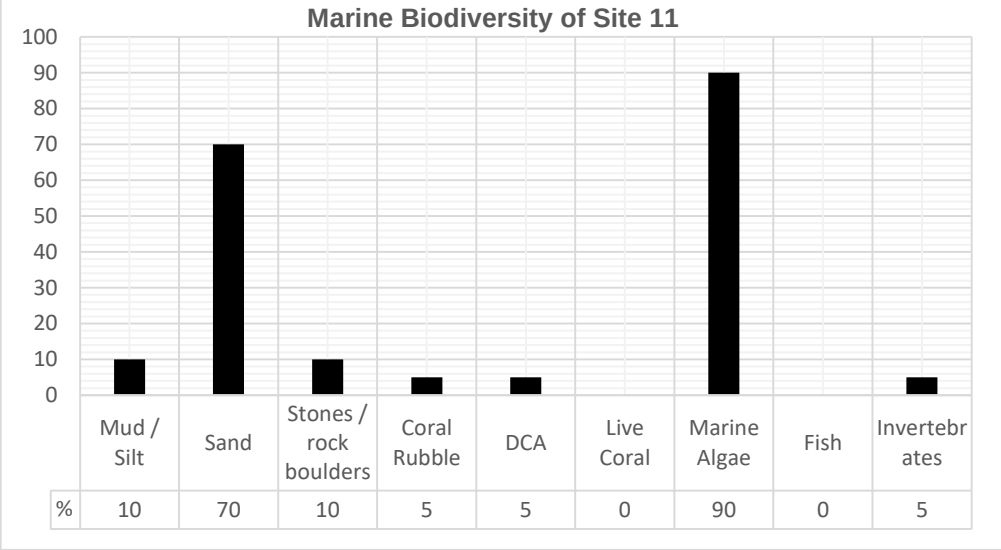


Figure 5: Marine biodiversity of Site 11

Stichopus chloronatus) and *Holothuria atra*

Sargassum sp.

3.4. Site: 12 (Chainage: 4100 – 4150)

More sea cucumbers (10 loll fish ((*Holothuria (Halodeima) atra*), 15 green fish (*Stichopus*

chloronatus) and 1 Peva (*Synapta maculata*) were recorded in this area along with 1 starfish (*Linkia sp*.). There were no live corals or fish. Marine algae are highly abundant covering about 90% of the area surveyed. Some grow on the rocks along the coastline. Some coral rubbles were noted amongst the rock boulders, some weathered with algae growing on them. Suspended silt were noted in the water within 2m from the coastline.

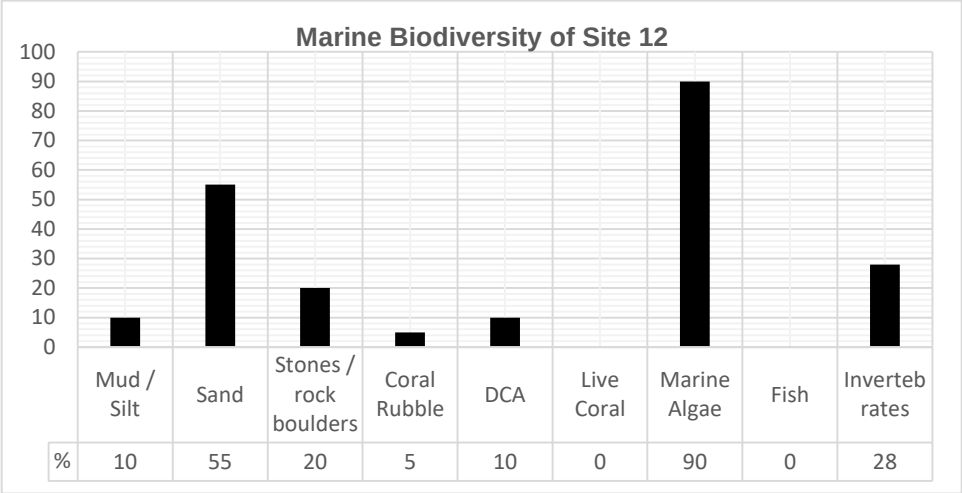


Figure 6: Marine biodiversity of Site 12

Sargassum sp.

Padina pavonica

Holothuria (Halodeima) atra

Stichopus chloronatus

3.5. Site: 13 (Chainage: 4250 – 4300)

Marine algae of mainly the *Sargassum sp*. covers about 90% of the area and some were noted to be well established on weathered rocks and dead corals. Sea cucumbers are as abundant as site 12 and comprise of Green fish (*Stichopus chloronatus*), Lolly fish (*Holothuria (Halodeima) atra*) and Peva (*Synapta maculata*). No live corals occur or fish spotted in the area surveyed. Silty water was noted at 2m from the coastline.

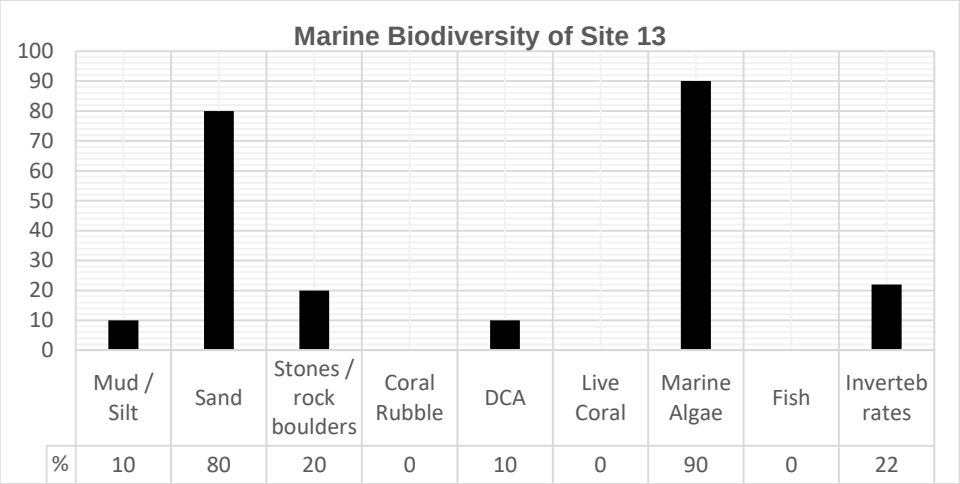


Figure 7: Marine biodiversity of Site 13

Sargassum sp.

Padina pavonica

Sargassum sp. well established on weathered rocks and dead corals

3.6. Site: 14 (Chainage: 6500 – 6650)

This site is a high energy area with the barrier reef about 300 meters further out from the coastline. Winds from the east blow currents towards the west. Water clarity is about 90% and there are no traces of siltation or runoff along the beach or coastline.

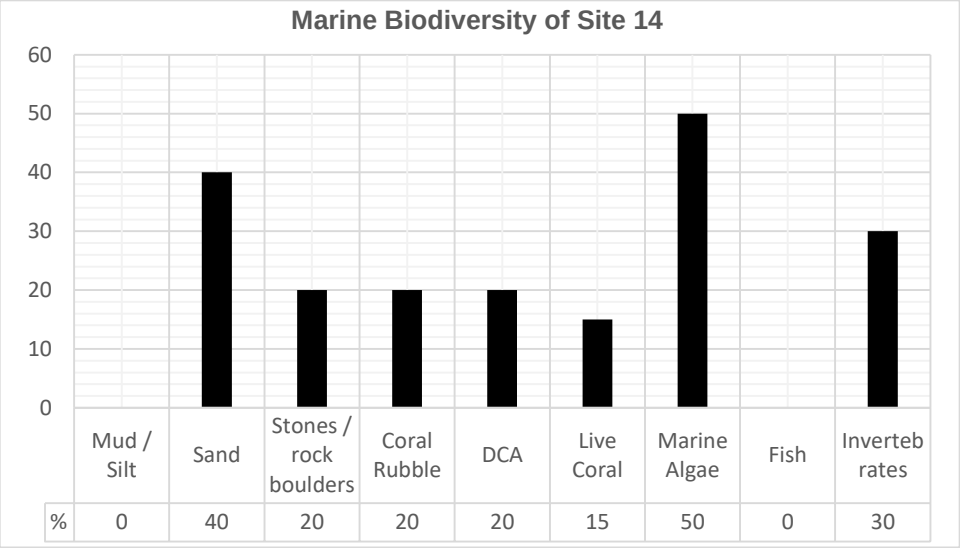


Figure 8: Marine biodiversity of Site 14

The *Sargassum* marine algae is highly abundant and well established in this area, noted to be overgrowing dead corals and weathered rocks. Live table corals and massive corals exist here with several sea cucumbers (Green fish and Lolly fish). Sand is the dominant substrate (40%) with many small stones among the rubbles and a rocky protrusion. The rubbles are indicative of a high energy area and have mostly been brought to shore by strong wave actions.

Sargassum sp. well established and overgrowing dead corals and weathered rocks

Massive coral

Rocky protrusion

Synapta maculata and *Holothuria (Halodeima) atra*

Stichopus chloronatus on rubbles

3.7. Site: 15 (Chainage: 6700 – 6750)

This site is a high energy area similar to Site 14. The substrate is dominantly sand (40%) with several scattered stones and rock boulders and coral rubbles (20%). Some dead corals overgrown with algae (20%) were noted. Live coral cover is about 15% and mainly of the table form (*Acropora sp*.) which are commonly found in high energy areas. Brown macro algae (seaweed) of the types *Padina pavonica* and *Sargassum sp*. are very abundant with an estimated cover of 70%. Sea cucumbers both green fish and lolly fish are more abundant in this area.

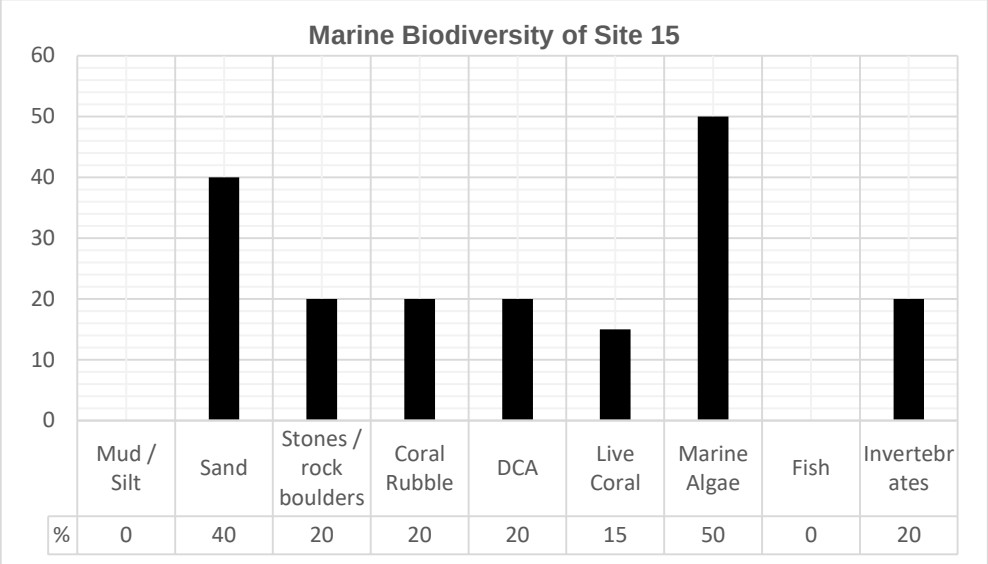


Figure 9: Marine biodiversity of Site 15

Acropora sp.

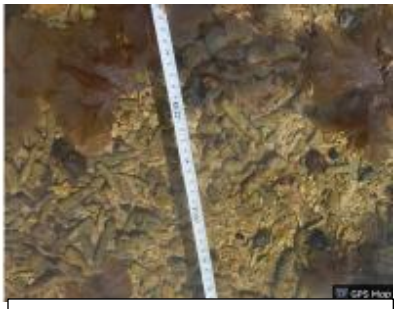
Encrusting coral

Sargassum sp. on weathered rocks

Sargassum sp. on dead corals

Rocky protrusion

Sandy substrate



Padina pavonica

3.8. Site: 16 (Chainage: 6800 – 6850)

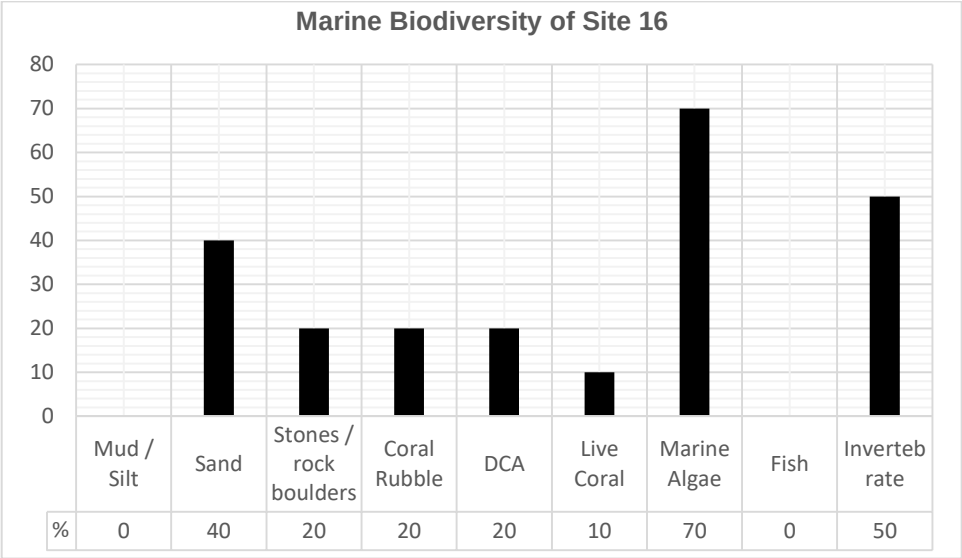
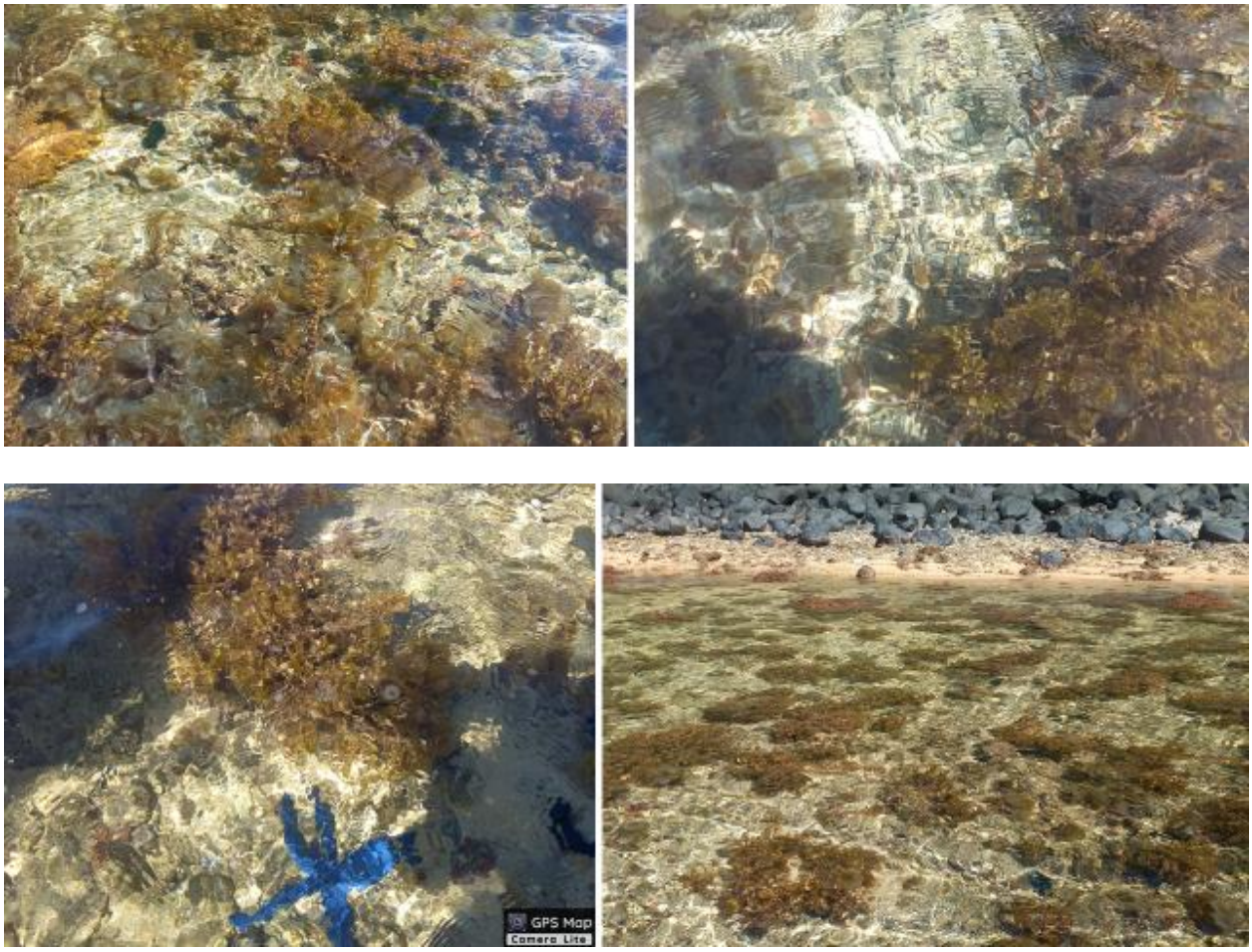


Figure 10: Marine biodiversity of Site 16

Sea cucumbers mostly green fish were noted to be increasingly abundant in this site. No fish was recorded but a few live digitate corals (10%). Marine algae cover is about 70% and well established on a sandy substrate (70%). The site is influenced by strong waves (high energy) which is indicative of an estimated 20% coral rubble. Some rock boulders exist in the area with a few dead corals overgrown by algae.



3.9. Site: 17 (Chainage: 6850 – 6900)

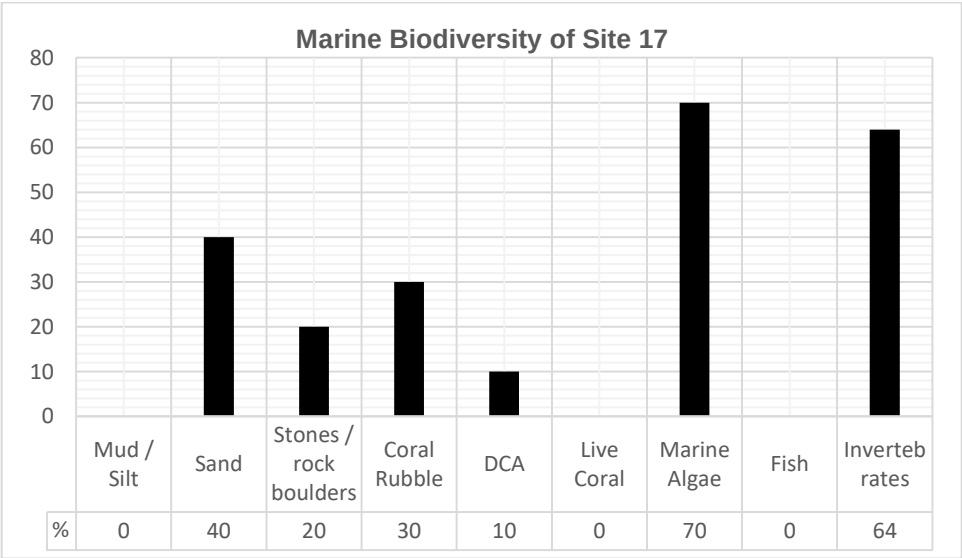


Figure 11: Marine biodiversity of Site 17

This is a high energy area with good flushing and thus very good water clarity. No fish or live

coral was noted. Sea cucumbers mainly the green fish are more abundant here compared to the previous sites. A blue starfish (*Linkia sp.*) was also recorded. There are several scattered stones and weathered rocks well-grounded in the sandy substrate. Coral rubble cover is quite high (30%) as well as some dead boulders overgrown by algae.

3.10. Site: 18(a), (b), (c) (Chainage: 7300 – 7550)

This is a very high energy site as the reef is about 30 meters further out from the coastline. Coastline erosion was noted as indicative of trees with exposed roots and a silty beach dominated by algae. Also noted is the road drainage culvert that discharges surface water into the sea.

Marine algae (Padina & Sargassum) cover about 50%. Invertebrates recorded include juvenile green fish and blue starfish. Coral rubble cover is about 30% occurring mostly within 10 meters from shoreline. Sand and silt are equal dominant with scattered stones. There were no live coral or fish noted.

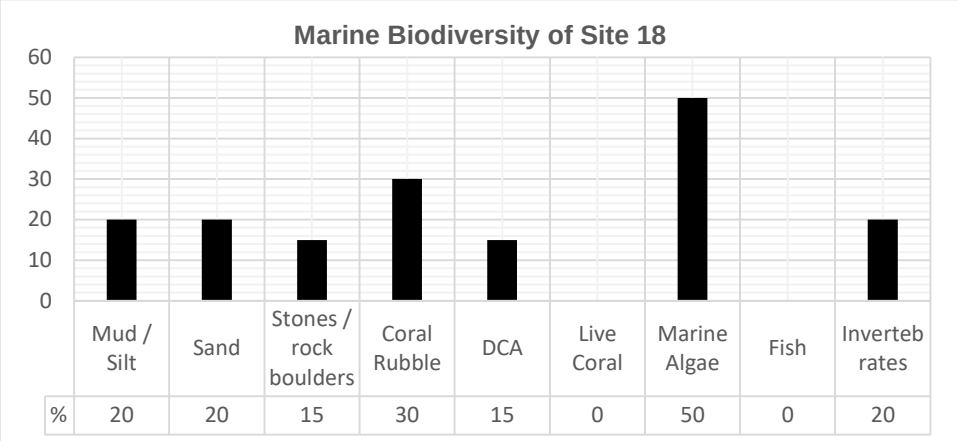


Figure 12: Marine biodiversity of Site 18

Exposed roots with a thick layer of coral rubble

Scattered stones

Synapta maculate (Peva)

Blue Starfish (*Linkia sp.)*

Sargassum sp on coral rubbles and stones

Road drainage culvert

3.11. Site: 19(a), (b), (c) (Chainage: 8050 – 8450)

This site is extremely high energy as the reef is about 10 meters to the east of the coastline. To the west the waves break into the Utumau'u islet. Around the islet is a drop off and is inaccessible even during low tide. The site has a visible sandy substrate in the vicinity of the coastline, with many scattered rock boulders (50%) and coral rubbles (20%). The *Sargassum* algae was notable and dominant species with a cover of about (30%). Some rocks are overgrown with algae. There were no invertebrates, live corals or fish recorded in this area.

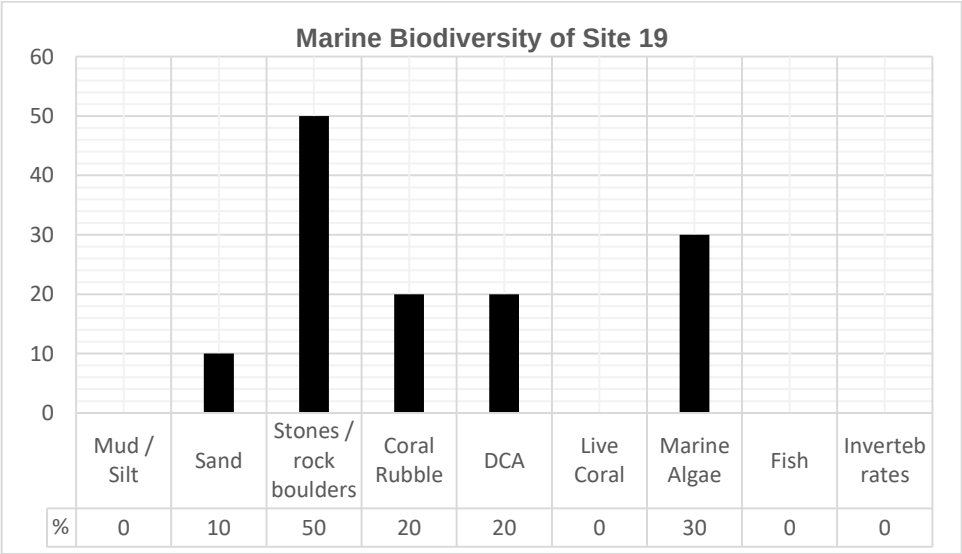


Figure 13: Marine biodiversity of Site 19

3.12. Site: 20 (Chainage: 8565 – 8705)

This site is has similar conditions with Site 19, being a high energy area with the reef as close as 20 meters to the coastline. The water is about 90% clear that the sandy bottom within the coastline area was highly visible. Coral rubbles were noted amongst scattered stones and rock boulders. There were dead corals covered with algae. Marine algae cover is about 70% and mainly of *Padina pavonica* and *Sargassum sp.* No fish or live corals were noted. Invertebrate cover is 10% and comprises of green fish, lolly fish and blue starfish.

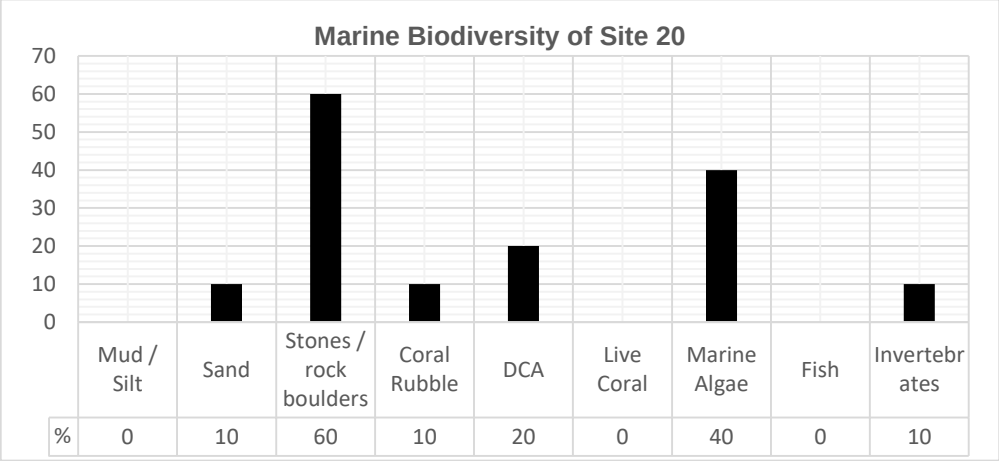
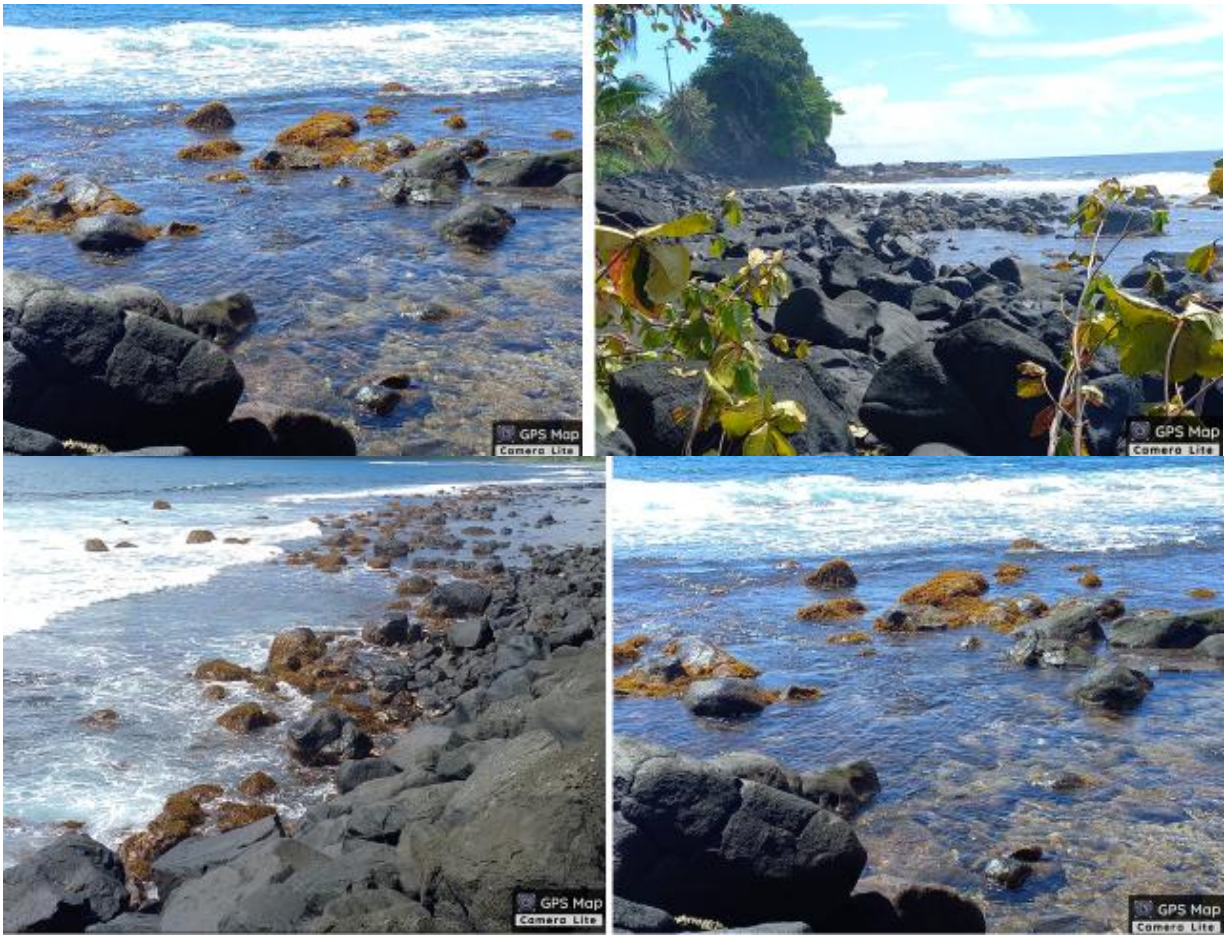


Figure 14: Marine biodiversity of Site 20



3.13. Site: 21 (Chainage: 8950 – 9000)

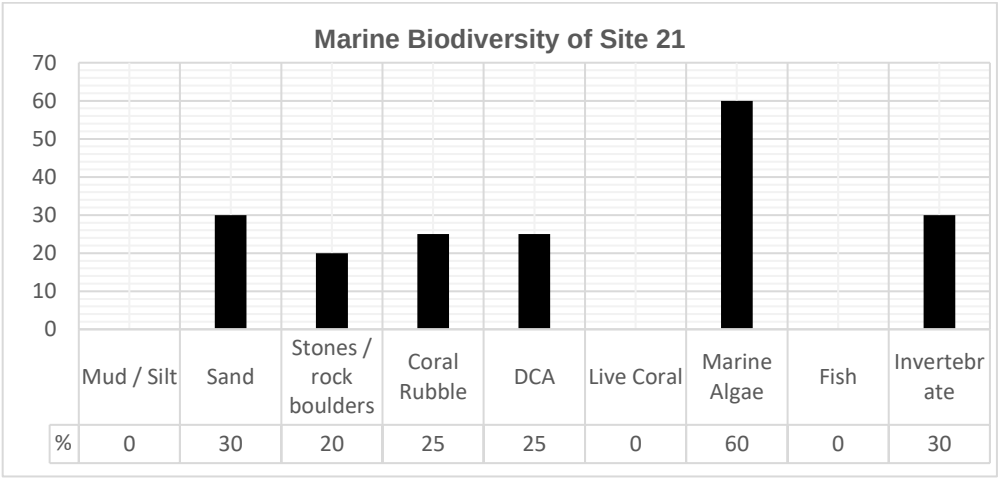


Figure 15: Marine biodiversity of Site 21

Similar to Site 20, this site is a high energy area with the reef located about 20 meters away from the coastline. There is good flushing and water clarity is very good (90%). Sand makes the dominant substrate with scattered stones and rock boulders. Coral rubbles (25%) were also noted with dead corals covered by algae (25%). Marine algae (Padina and Sargassum)

cover about 60% of the survey area. Invertebrates recorded include green fish and blue starfish. The survey did not note any fish or live corals.

Visible sandy substrate with clusters of marine algae

Sargassum sp and Padina pavonica on coral rubbles and stones

3.14. Site: 22 (Chainage: 9000 – 9100)

Site 22 is a high energy area with the reef located about 10 meters away from the coastline. There is subsequently good flushing and water clarity is very good that the sandy bottom is highly visible. There are several rock boulders amongst the coral rubbles. Some weathered rocks were noted together with dead corals being overgrown by algae. Similar to previous sites, this area is highly favorable for marine algal growth (both Sargassum and Padina) covering about 60%. Invertebrates noted include the green fish and blue starfish. There were no fish or live corals noted.

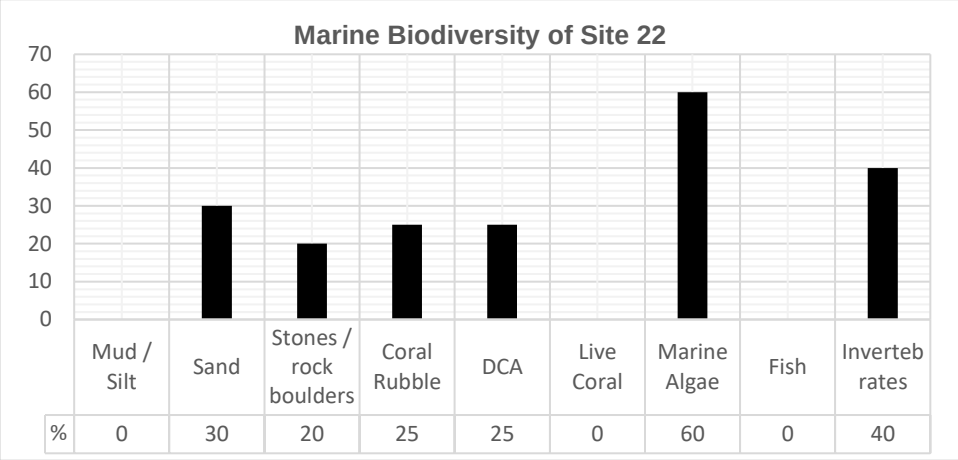


Figure 16: Marine biodiversity of Site 22

Sargassum sp.

Padina pavonica

3.15. Site: 23 (Chainage: 9100 – 9200)

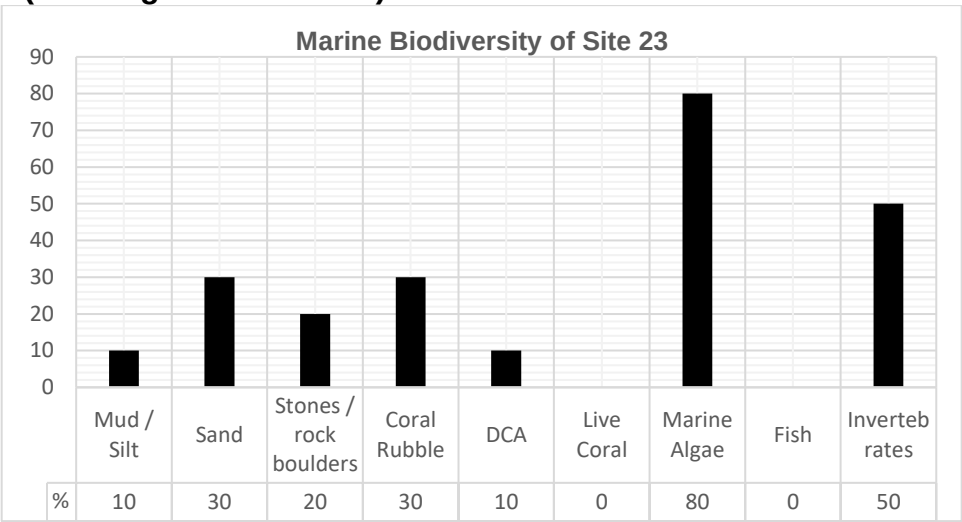


Figure 17: Marine biodiversity of Site 23

Site 23 extends from Site 22 and is a high energy area with the fringing reef located about 10 meters away from the coastline. Water clarity is very good (90%) although silty water was noted along the coastline areas. Sandy substrate covers about 30% with scattered rock and coral boulders (20%) and coral rubbles (30%). Some of these boulders are overgrown by algae mostly the *Sargassum sp.* which piles up on boulders. Marine algae cover is about 80% with *Sargassum sp*. more abundant than *Padina pavonica*. Invertebrates such as green fish and blue starfish were noted to be more abundant (50%). No fish or live coral were noted in the survey area.

3.16. Site: 24 (Chainage: 9200 – 9350)

Site 24 extends from Site 23 and it is also a high energy area with the fringing reef lying about 20 meters northwest of the coastline. Water clarity is very good as flushing is strong as well. Sand is the dominant substrate although silty water was notable in the coastline areas. There were rock boulders noted amongst coral rubbles. Some dead corals are overgrown by algae including Sargassum which was specifically noted to have firmly established in thick layers on boulders. Marine algae (Sargassum and Padina) are highly abundant (80%) as well as the sea cucumber species of Surf Redfish, *Mama'o* (*Actinopyga echinites*), Green fish and Blue starfish.

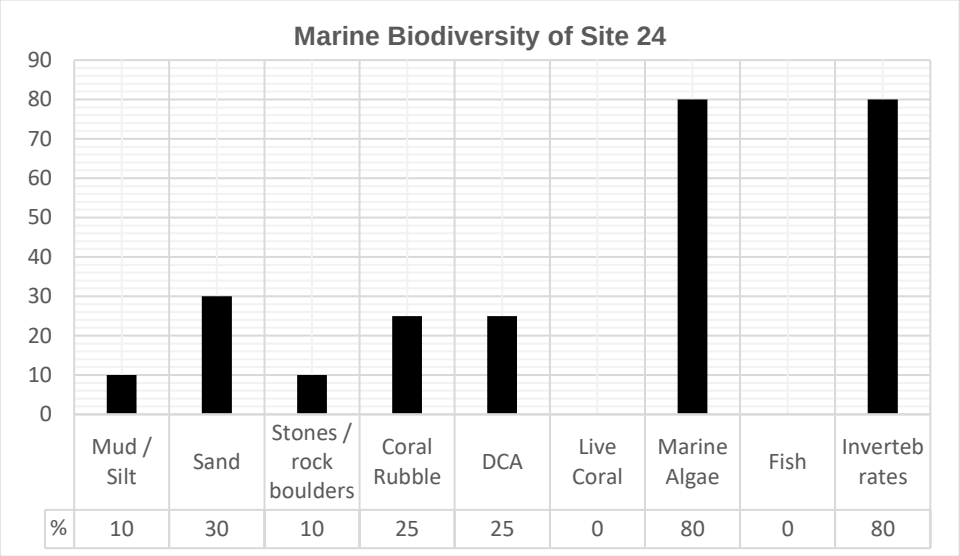


Figure 18: Marine biodiversity of Site 24

3.17. Site: 25 (Chainage: 10450 – 10600), Solosolo

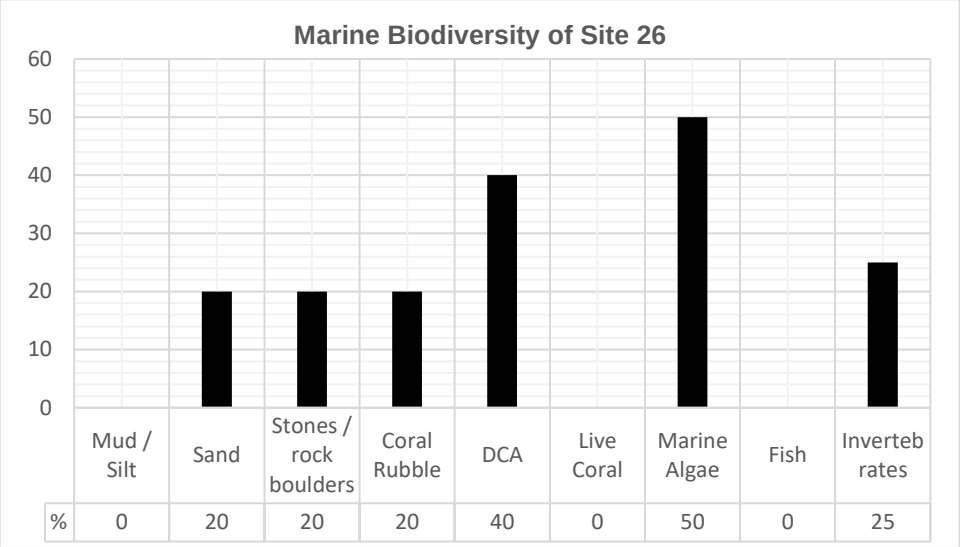


Figure 19: Marine biodiversity of Site 25

The fringing reef is about 10 meters away from the coastline so this site is well exposed to strong wave actions and currents flowing from the eastern direction. Water clarity is 100% that the sandy substrate with coral rubbles were highly visible. There are scattered rock boulders (20%) and small stones mixed with rubbles. Some weathered rock boulders and dead corals are overgrown by algae (40%). Marine algae cover of mainly Sargassum and Padina is about 50%. Green fish is also quite abundant in this area (25%). No live corals or fish were recorded and this is typical of shallow but high energy areas.

3.18. Site: 26 (Chainage: 11650 – 11700), Solosolo east

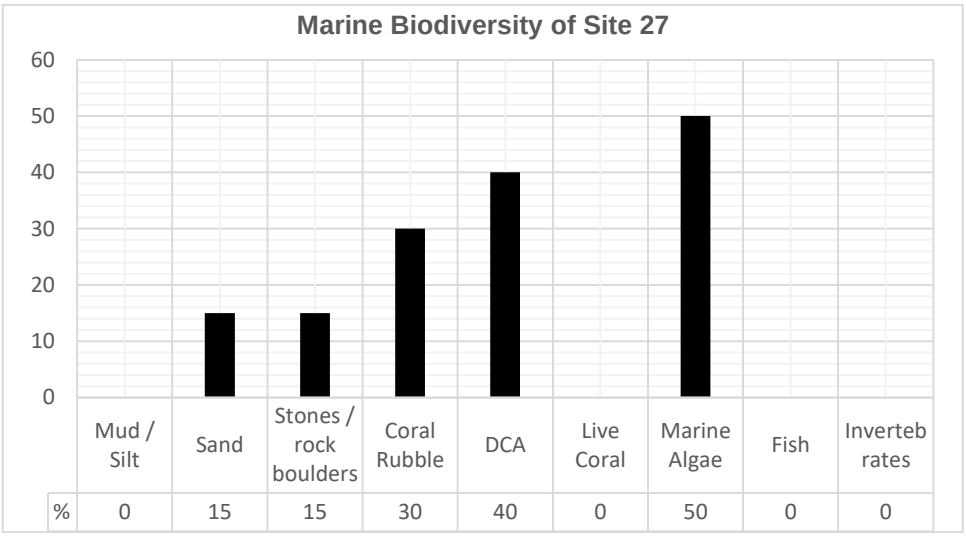


Figure 20: Marine biodiversity of Site 26

Site 26 extends from Site 25. It is a high energy area as it is exposed to the fringing reef lying on the east about 10 meters away from the coastline. The currents flow from the east and water clarity is very good. Scattered rock boulders were noted as well as coral rubbles (30%) mixed with small stones. Dead corals and some weathered rock boulders overgrown by algae covers about 40% of the survey area. Overall marine algae (Sargassum and Padina) cover is about 50%. No live corals, fish or invertebrates were noted.

3.19. Site: 27 (Chainage: 11700 – 11750), Solosolo east

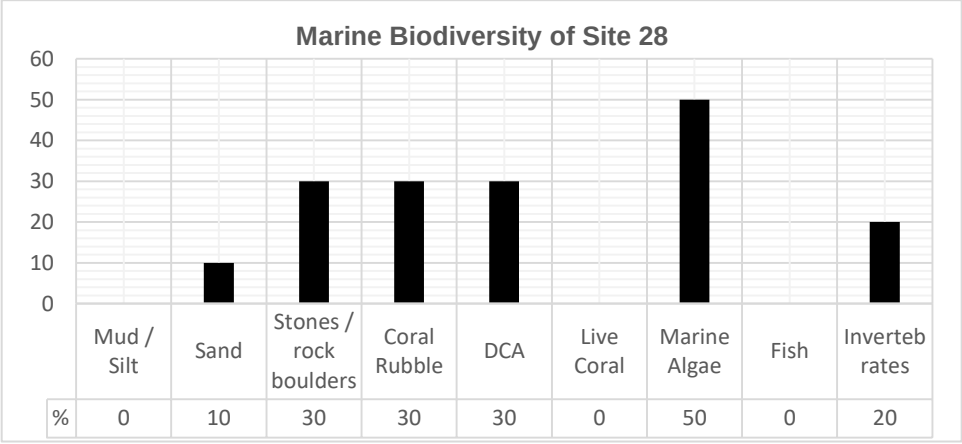


Figure 21: Marine biodiversity of Site 27

Extending from Site 26, Site 27 is well exposed to the reef where waves break in less than 8 meters away from the coastline. Flushing and water clarity is 100%. The sandy substrate is visible but mixed with dead coral rubbles (30%) and small stones. There is about 30% cover of rock boulders as well as 30% cover of dead corals overgrown by algae. Marine algae abundance is about 50% mainly of the species of Sargassum and Padina. Invertebrates noted

include mostly green fish. No live corals or fish recorded. Noted here are two road drainage culvert pipes that discharge surface water into the sea. The opposite inland side of the road is visible through the pipe as it is clear of debris.

3.20. Site: 28 (Chainage: 11750 – 11900))

Site 28 is also a high energy area although the reef is about 200 meters further out from the coastline. There is 100% flushing and water clarity. The site is recorded with the highest coral rubble (50%) mixed with sand (10%) and small stones. Scattered rock boulders and medium-sized rocks were also noted as well as dead coral with algae growing on them (25%). Marine algae cover is about 40% comprising of the common species of *Sargassum* and *Padina paviona*. Live corals noted are table corals which are the usual species found in high energy areas as they are more resilient to wave actions. Invertebrates recorded include Green fish and Lolly fish. No fish was noted in the survey area.

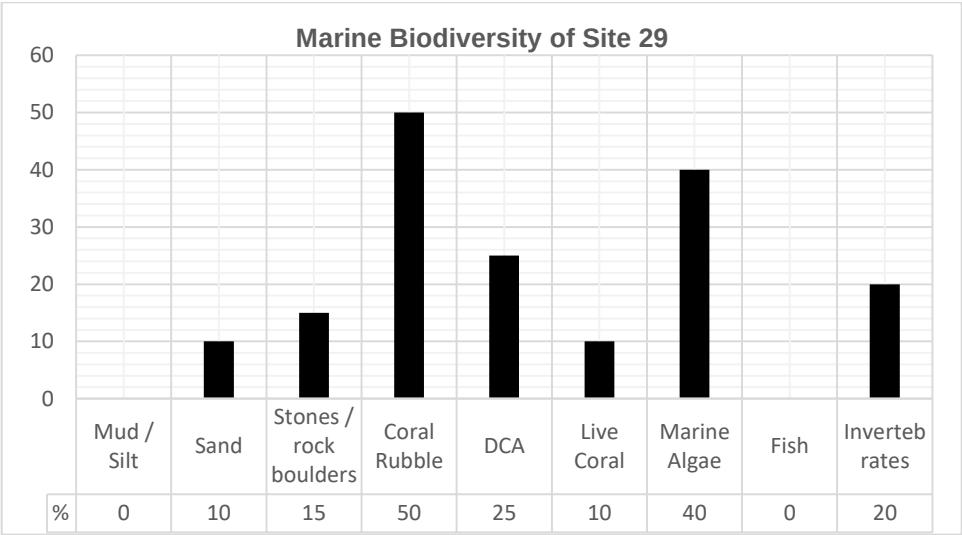


Figure 22: Marine biodiversity of Site 28

3.21. Site: 29 (Chainage: 12000 – 12100)

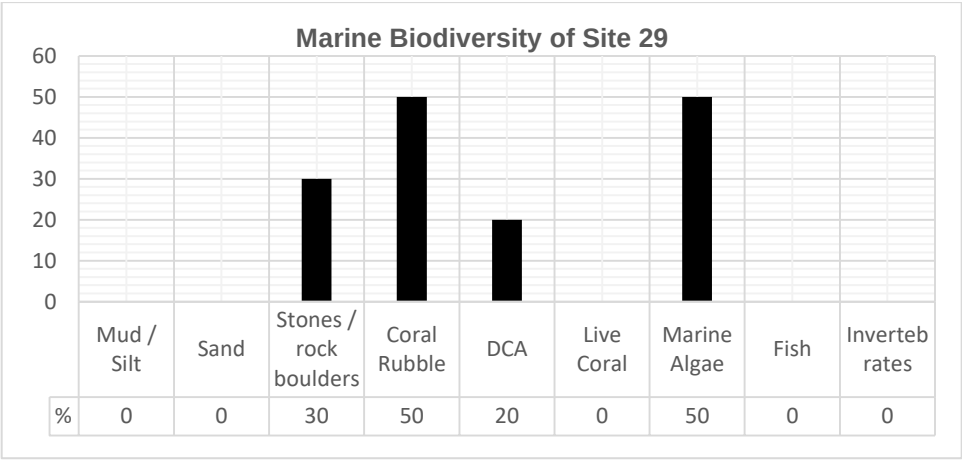


Figure 23: Marine biodiversity of Site 29

The coastline of Site 29 is about 300 meters away from the fringing reef on the eastern side and the currents flow towards the southeast. Good water clarity was noted. Scattered medium sized stones cover is about 30%. This site is recorded with the second highest coral rubbles

(50%) mixed with small stones. Marine algae cover is about 50% of both *Sargassum sp*. and *Padina paviona*, some overgrowing dead corals. No live corals, invertebrates or fish were noted in the area during the survey.

3.22. Site: 30 (Chainage: 12100 – 12250, Eva village)

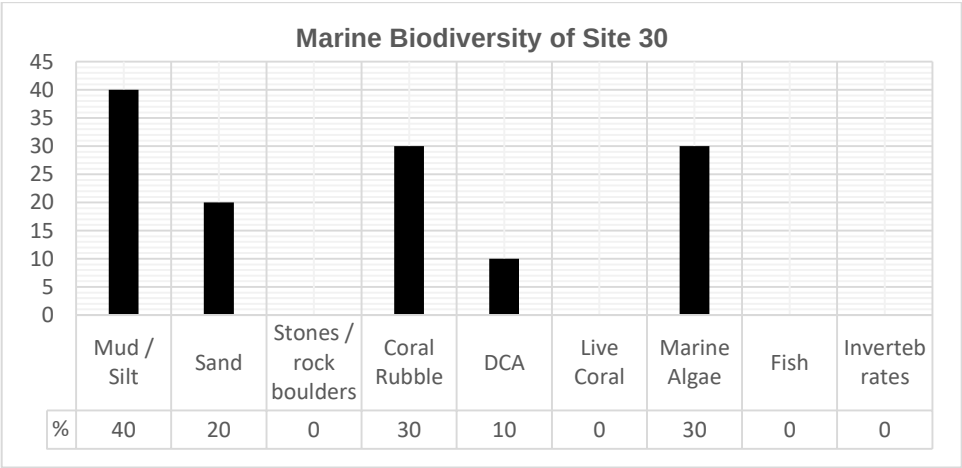


Figure 24: Marine biodiversity of Site 30

At Site 30, the reef is more than 300 meters further out to the east. There is limited flushing as the site is slightly sheltered and this explains the dominant muddy and silty substrate (40%). There is also poor water visibility. Sand was noted at 20 meters from the coastline. Coral rubbles (30%) mixed with small stones occur mostly along the sheltered coastline. The paddle weed seagrass (*Halophila ovalis*) and Brown seaweed (*Sargassum sp.)* grow well on the silty bottom covering about 30% of the area. Some algae grow on dead rubbles. *Sargassum sp*. was also noted along the coastline which is suspected to have been floating and carried by currents from high energy and lagoon areas.

3.23. Site: 31 (Chainage: 12250 – 12400, Eva village, river discharge area)

Site 31 extends from Site 30 and it is a very sheltered lagoon area which receives discharge from the river flowing from inland Eva. There is very poor flushing as the reef is located more than 400 meters further to the east. There is a sandbank located about 8 meters from the river discharge (mouth).

Mud and or silt is the dominant substrate (40%). Scattered stones / small rocks cover is about 30% amongst coral rubbles (20%) and small stones which the currents still managed to move and deposit mostly along the coastline. The paddle weed seagrass (*Halophila ovalis*) grow well on the muddy bottom with a cover of about 20%. Some brown seaweed (*Sargassum sp.) and Padina sp.* grow on dead rubbles (10%). Also noted was Sargassum seaweed floating along the coastline which is suspected to have been carried by currents from high energy areas.

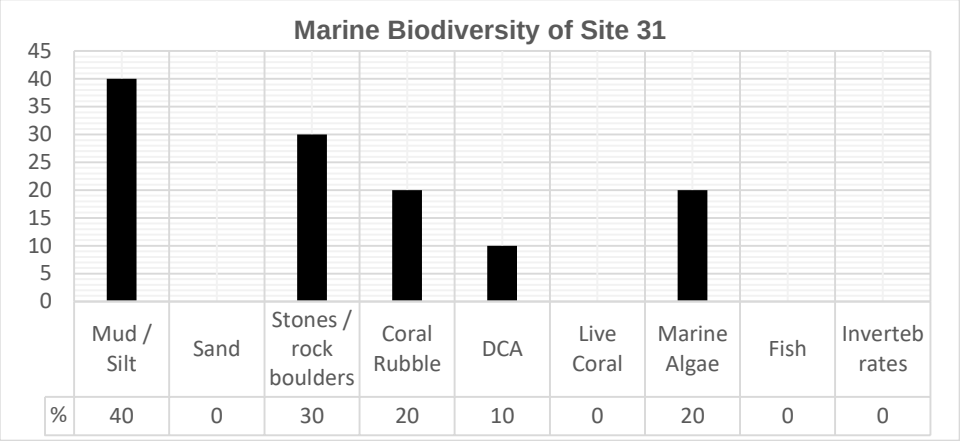


Figure 25: Marine biodiversity of Site 31

3.24. Site: 32 (Chainage: 15350 – 15600, Saoluafata village)

Site 32 covers the eastern part of Saoluafata village. The western side is less sheltered or fairly exposed to the open sea. The eastern side is a more sheltered lagoon area and little flushing as reef is more than 500 meters further out. Rocks and stones are abundant along the coastline forming a seawall. Dead tree trunks were noted along the coastline towards the eastern side. These must have been discharged by rivers to the area and got carried eventually by the current and deposited them in this sheltered area of the village coast.

The substrate is predominantly sandy (70%) and notable from the coastline towards the lagoon on the western side. Small stones mixed with rubbles (30%) were noted mostly on the sheltered eastern side where current strength are minimal. The brown seaweed (*Sargassum sp.) and Padina sp.* grow on dead rubbles and silty sand (80%). No live corals or fish were noted. Invertebrates observed were mainly Green fish (40%) and mostly juveniles.

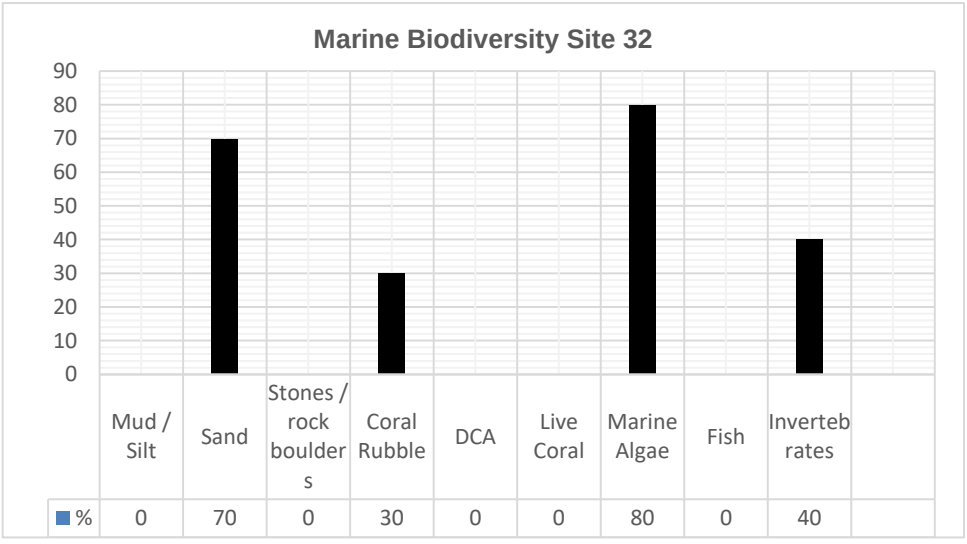
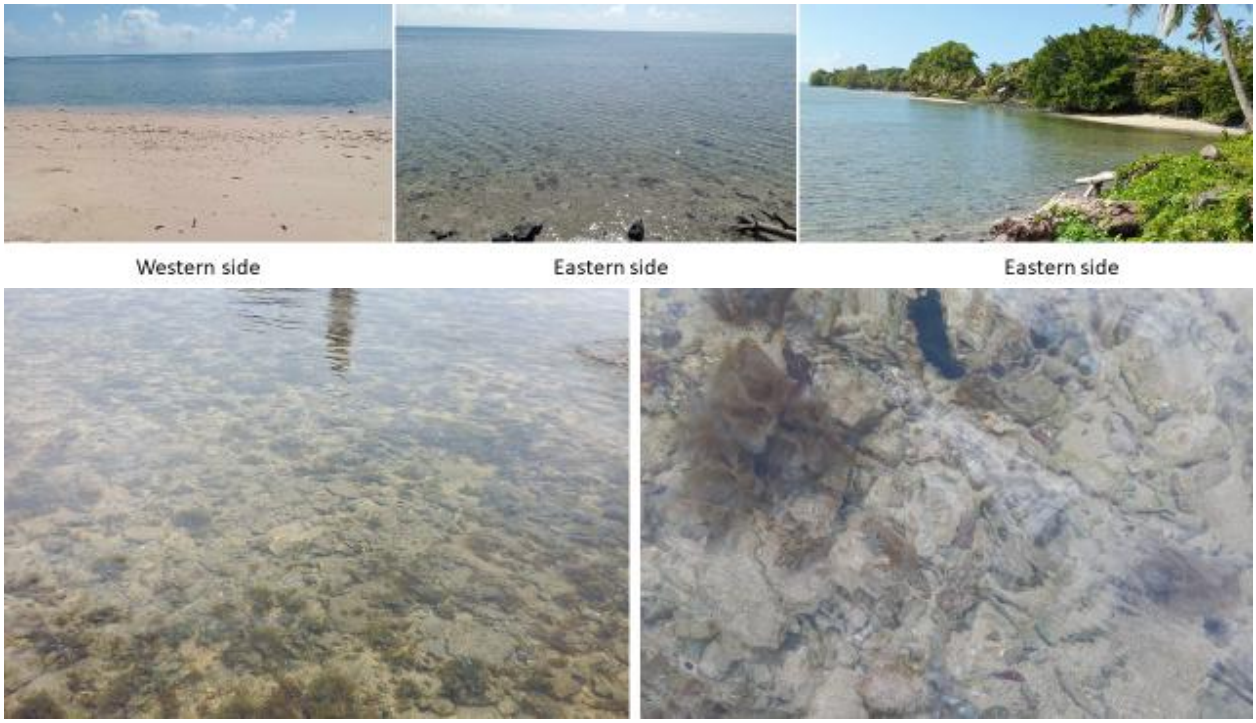


Figure 26: Marine biodiversity of Site 32



4. OVERALL STATUS OF MARINE BASELINE BIODIVERSITY

The overall status of marine biodiversity in the proposed project area from Letogo to Saoluafata is summarized below.

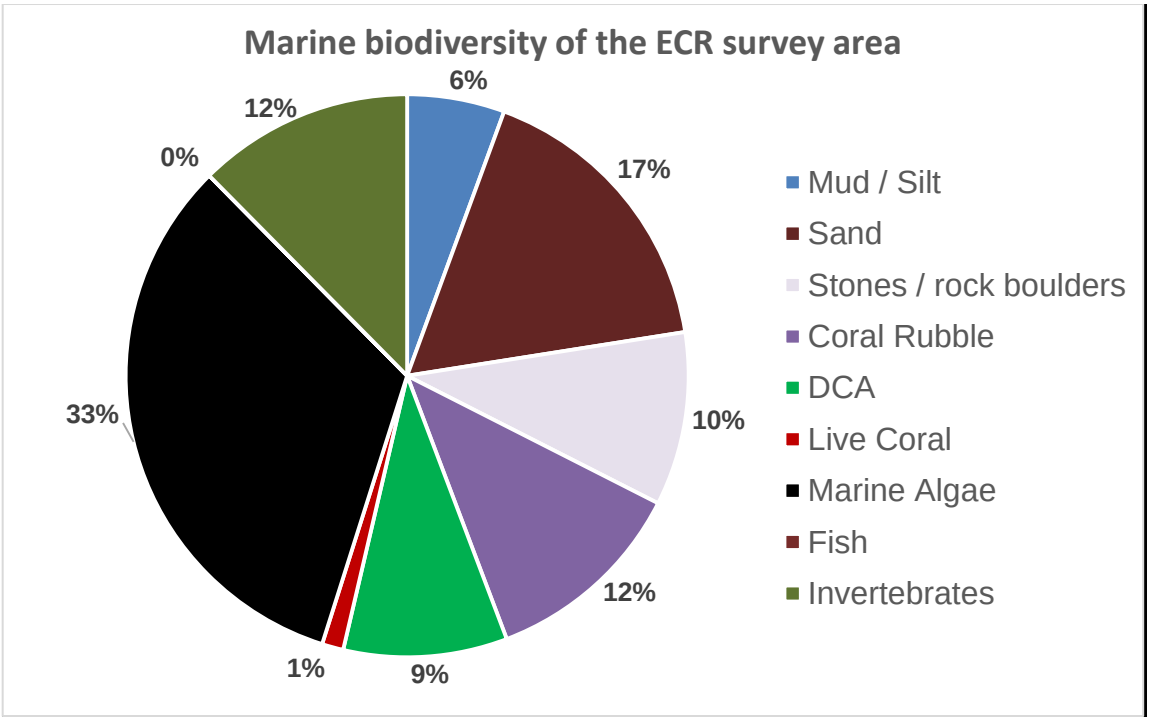


Figure 27: Existing marine biodiversity of the ECR survey area

4.1. Abiotic factors

The area assessed is generally dead with a substrate cover dominated by abiotic (non-living or dead) factors that make up about 54% of the area.

4.1.1. Substrate cover

Substrate cover comprises mud and silt, sand, coral rubble and dead corals with algae and stones / rock boulders. The impacts of land-based human activities such as coastal reclamation and surface runoff contribute to the muddy and silty substrate as recorded to be high in Sites 1, 28, 29 and 30 and lower in Sites 11, 12, 18, 23 and 24. Suspended silt and sediments in water discourage coral growth but promote mortality. Coral rubbles occur in Site 14 to Site 31 being high energy areas but are most abundant in Sites 29 and 30 which are less than 10 meters away from the reef or directly exposed to the reef. Strong wave energy and natural disasters break corals and are accounted for the high abundance of rubbles and sand in the area.

4.2. Biotic factors

About 46% of the survey area is made up of biotic or living factors which include live coral, marine algae, fish and invertebrates.

4.2.1. Live Coral forms

The area has only 1% live corals, occurring in Sites 14, 15, 16 and 28. Coral cover is very low and only include the table coral and massive and sub-massive coral forms which also indicates low coral diversity. These types are common in high energy areas being more resilient to wave actions. Corals are animals that require certain favorable environmental conditions for good growth. The dominant abiotic factors in the coastal areas in addition to exposure during low tide, high energy and high water turbidity in some sites are unfavourable and suppressive to coral growth. However, this assessment is certain that coral growth, diversity and abundance is much better in the outer reef areas than the coastal areas due to the existing environmental conditions.

Plate A: Live coral forms recorded in the ECR survey area

4.2.2. Marine Algae

Marine algae makes 33% cover and is the most dominant biodiversity indicator along the coastal area surveyed. Algae prefer certain environmental conditions for good growth however, they occur in abundance as the surveyed areas are directly exposed to excessive sediment and nutrient run-off from the land as well as high temperatures during low tide – these are favourable ingredients for algal growth. The most abundant species recorded include the brown algae *Sargassum polycystum* (Limu faaleagamea), brown algae *Padina gymnosporum* (Limu lautaliga) and paddle weed seagrass *Halophila ovalis.* These species are commonly

found in disturbed tidal flat and reef areas with high nutrient supply.

Plate B: Marine algae and seagrass species recorded in the ECR survey area

4.2.3. Fish and Invertebrates

Not a single fish was spotted throughout the entire coastal survey area. It might have been due to either the exposure at low tide or the high energy from waves and currents. Invertebrate abundance is 12%, dominated by the Green fish (*Stichopus chloronatus*) followed by Lolly fish (*Holothuria (Halodeima) atra*), Blue starfish (*Linkia sp.*), Peva (*Synapta maculata*) and Surf redfish, *Mama'o* (*Actinopyga echinites*).

The outer lagoon and reef provide nursery areas for a variety of fish and invertebrate species because of the many biological niches and habitats available. The surrounding areas are generally alive and a spill-over corridor for mobile species to forage especially during high tide. However, the intertidal and beach areas surveyed are highly disturbed (habitats and noise) and lack habitats to support fish foraging or residency. Sandy and coarse substrate conditions are favorable for sea cucumber species recorded. These are deposit feeder organisms that extract food particles from the water column or the sediment or the substrate by using their tube feet.

Plate C: Invertebrate species recorded in the ECR survey area

4.3. Other environmental factors

4.3.1. Water clarity

The surveys were undertaken during fine and sunny weather conditions. However, water turbidity was very high particularly in Sites 1, 29, 30 and 31. Poor visibility is attributed to the

excessive amount of sediments or silts suspended in water or deposits on the bottom substrate.

4.4. Overall marine biodiversity

The coastal area surveyed comprises 46% biotic cover and 54% abiotic cover. Overall, it only shows the conditions in the coastal area that will be potentially impacted by the proposed road stabilization project. In so saying, marine biodiversity is possibly much lower than the wider marine area.

The low occurrence of biotic features is indicative of severely degraded habitats and low diversity of corals and invertebrates in the area. There were no notable signs of recent runoff events along the coastline to be able to determine any effect of the road. Natural recovery is possible but for the longer-term with the effective management of upland and land-based activities.

5. POTENTIAL IMPACTS AND MITIGATION MEASURES

The measures proposed by the project for road stabilization include barrier fences and catch drains to capture any falling rocks or stones from upland, as well as surface drainage channels and culverts for conveyance and discharge. Due to the adjoining and nearby location of the sea, the main potential impacts on the adjoining coastal and marine environment which have been identified relate to: (1) water quality resulting from storm water disposal into the sea and runoff of sediment and silt; (2) waste entering the sea from construction areas; and (3) Safety and health risks associated with rock fall / rock slide / landslide.

Appropriate measures proposed for mitigating these impacts include:
1) Install sediment control measures along the seaward side to trap sediment from falling into the sea.
2) Follow relevant Work Method Statements (WMS) and site instructions when undertaking rock works.
3) Ensure that construction debris and waste are removed daily from the site for disposal at a designated dumpsite.
4) Minimize disturbance and unnecessary vegetation removal on the coast by marking out the work areas prior to works commencing.
5) Workers to wear appropriate PPE at all times on construction site.

6. CONCLUSION AND RECOMENDATIONS

The MBS has described the existing baseline conditions of the potentially affected coastal areas along the main ECR. It has also determined and assessed the anticipated impacts of the proposed road stabilization works; and proposes appropriate measures for mitigating such impacts.

The survey has revealed the following findings:

1) The area assessed has a substrate cover dominated by abiotic (non-living or dead) factors that make up about 54%. Substrate cover comprises mud and silt, sand, coral rubble and dead corals with algae and stones / rock boulders.

2) About 46% of the survey area is made up of biotic or living factors which include live coral, marine algae, fish and invertebrates.
3) None of the marine algae or invertebrate species identified within the survey area is listed as threatened or endangered in Samoa.
4) Overall marine biodiversity is possibly much higher in the wider reef areas than the intertidal areas surveyed which are mostly shallow and or exposed at low tide.
5) Abiotic and biotic conditions discovered are common in areas affected by human land-based activities let alone natural disasters and climate change.
6) Higher occurrence of abiotic features is indicative of severely degraded habitats which are unfavourable for biotic factors.

7. REFERENCES

1. Samoa Climate Resilience Transport Project (SCRTP). Terms of Reference for Investigation, Design & Documentation, Procurement Assistance & Construction Supervision of East Coast Road Slope Stabilization.

8. APPENDICES

Appendix A: Live Coral species recorded in the ECR survey areas

English Name	Scientific Name	Samoan Name
Foliaceous coral		
Table coral	*Acropora sp.*	Amu mafolafola / Amu laulau
Encrusting coral		Amu sosolo
Massive and Sub-massive corals		Amu atoa

Appendix B: Invertebrate species recorded in the ECR survey areas

English Name	Scientific Name	Samoan Name
Green fish	*Stichopus chloronatus*	Maisu
Lolly fish	*Holothuria (Halodeima) atra*	Loli
Surf redfish	*Actinopyga echinites*	*Mama'o*
	Synapta maculata	Peva
Blue starfish	*Linkia sp.*	Aveau

Appendix C: Marine Algae and Seagrass species recorded in the ECR survey areas

English Name	Scientific Name	Samoan Name
Brown algae	*Sargassum polycystum*	Limu faaleagamea
Brown algae	*Sargassum sp.*	Limu faaleagamea
Brown algae	*Padina sp.*	Limu lautaliga
	Hydropuntia edulis (Gracilaria edulis)	Limu
	Turninaria ornata	Limu
Paddle weed seagrass	*Halophila ovalis*	Vaovao

Appendix 14: Flora ad Avifauna Assessment Report

EAST COAST ROAD – SLOPE STABILIZATION PROJECT (ECR-SSP)

FLORA AND AVIFAUNA ASSESSMENT REPORT

By

Su'emalo Talie Foliga and Laulu Failelei Enoka

July, 2024

Prepared for PSES Consult, USP Rd Alafua in support of the ECR-SSP Environment and Social Impact Assessment Report

About the authors:
Suemalo Talie Foliga is the Principal Officer and **Laulu Failelei Enoka**, Ranger Officer, for the Reserves and Protected Areas Unit, Division of Environment and Conservation, Ministry of Natural Resources and Environment (MNRE).

ACRONYMS

ECR	East Coast Road
ECR-SSP	East Coast Road – Slope Stabilization Project
CR	Critically Endangered (IUCN)
DEC	Division of Environment and Conservation
IUCN	International Union for the Conservation of Nature
LC	Least Concerned (IUCN)
MNRE	Ministry of Natural Resources and Environment
NT	Not threatened (IUCN)
PUMA	Planning and Urban Management Agency
SPREP	Secretariat for the Pacific Community
SCRPT	Samoa Climate Resilience Project
T&TI	Tonkin and Taylor International
WB	World Bank
OP/BP	Operational Policies/Bank Procedures

TABLE OF CONTENTS

Appendices:

1. INTRODUCTION

This report describes the results of the vegetation and bird surveys conducted at the East Coast Road of Upolu Island. The purpose of this report is to provide through interpretation of these results the status of the terrestrial flora and fauna that comprise the existing environment within the ECR Slope Stabilization Project's area of impact.

2. METHODOLOGY

The vegetation component was assessed in thirteen (13) survey sites identified as high risk by Tonkin and Taylor International (T&TI, 2023) along the East Coast Road (ECR). Sites corresponded to discrete chainages 450m and 15,650m from Letogo to Saoluafata.

The ruggedness and sheer steepness of the targeted slopes heavily influenced the methodology used. It was impractical and unsafe to establish random quadrants. Consequently a variation of the stratified sampling method was adopted. Quadrants of 50m in length along the ECR and extending inland to 30m were estimated using drone and LIDAR aerial images in areas that were accessible, in each of the 13 zones. All plant species were identified at canopy, subcanopy and the undergrowth tiers. Most trees and plants were readily identifiable to the species level by the authors, with some requiring consultation with colleagues within the DEC and supported by internet-based research.

The vegetation survey focused on species 'presence'. Estimation of species 'abundance' requiring measurements of dbh for basal area was not considered necessary. It was also considered unsafe due to the difficult terrain. The use of binoculars and drone images was heavily relied on for the assessment the composition of different forest layers and vegetation cover.

Alongside to the flora and vegetation types, all land, sea and shore birds observed and heard were also recorded both inside the quadrants and outside.

The nature of the methology reflects the limitations imposed by the difficult terrain and safety considerations. The expansive list of species recorded attest to the wide diversity of species of the area's flora. It may still be considered incomprehensive with further validation required in some areas. However, for purposes of the ESIA, sites were carefully selected to ensure coverage of different structural and floristic communities across the study area thus the collected information is considered sufficient to provide an adequately accurate description of the forest composition and structure in the Project's area of impact. It also commensurates the level of analysis required for a Category B project under WB OP/BP 4.1 (Environment) safeguards policy.

3. TYPES OF VEGETATION

Whistler (2002) estimates the native flora of Samoa to comprise of 550 angiosperms with two-thirds of the native flowering plants being dicots and one-third monocots[33]. The native plants can be divided into two types, indigenous and endemic. Indigenous species are found here and elsewhere; endemic plants are found only in Samoa, and some are endemic to only one Samoan island.

The level of endemism of the flowering plants in Samoa is estimated to be about 30% (Whistler, 1992a) at the species level. Two genera[34] were previously considered to be endemic to the Samoa archipelago. However, they have since been re-classified[35] and consequently there are no genera considered endemic to the Samoa archipelago (Whistler, 2022). Another 290 or so intentionally or accidentally introduced

[33] This number is continually being added to as post- 2002 investigations and studies such as the BIORAP (2013) which reported two new orchid species in the uplands of Savaii. (Whistler and Atherton, 2013)

[34] *Sarcopygme* (Rubiaceae) and *Solfia* (Arecaceae),

[35] *Sarcopygme* is now considered to be a synonym of *Morinda* and *Solfia* a synonym of *Balaka*,

flowering plants have become naturalized and most of them are usually referred as 'weeds' (Whistler, 1988), (Whistler, 2022) or invasives. Whistler (2011) listed 108 rare and threatened plants. [36]

Whistler (2002) also divided Samoa's vegetation into 6 broad categories – Littoral vegetation, Wetland vegetation (marshes, mangroves, freshwater, swamps), Rainforest, Upland Scrub (summit scrub and montane scrub), volcanic vegetation and Disturbed vegetation. These are further divided into 14 smaller units (plant communities as shown in the table below.

Table 1: Plant communities of Samoa

1	Littoral vegetation	Littoral strand
2	Wetlands	Marshes
3		Mangroves
4		Freshwater Swamps
5	Rainforest	Lowland forest
6		Montane forest
7		Cloud forest
8	Upland scrub vegetation	Summit scrub
9		Montane scrub
10	Volcanic Vegetation	Volcanic scrub
11	Disturbed Vegetation	Managed land vegetation
12		Successional vegetation
13		Secondary forest
14		Fernlands

Source: Whistler.2002.

A flora and avifauna assessment covering the 5 ECR-SSP targeted sections (high and moderate risk sites) was carried out from 10 December 2023 to 31 January 2024. The survey methodology is described above. A separate rapid ecological assessment of the vegetation types along the ECR's high-risk zones was carried out during early November 2023. This confirmed the prominence of littoral, coastal and disturbed lowland forests in the Project's area of impact.

Brief descriptions of the three vegetation types identified during the pre-survey assessment to be common within the survey area.

(i) Littoral forest

Littoral vegetation refers to all types of natural vegetation occurring on the seashore and dominated by plant species whose presence and distribution are affected either directly or indirectly by the sea. Littoral vegetation is sometimes called coastal vegetation (Whistler 2002).

Littoral forest is one of several distinct identifiable zones making up the littoral vegetation. This is the forest found directly on the seashore and dominated by trees that owe their distribution and dispersal directly or indirectly to the effects of the sea. It occurs on nearly all undisturbed shores but it rarely occupies a zone of more than 50 – 100m wide. It predominates in areas at 1 – 10m elevation, but may extend higher, particularly on steep slopes. Common species are *Barringtonia asiatica* (*futu*), *Calophyllum inophyllum (fetau*), and *Pisonia grandis (pu'a vai*), *Terminalia catappa* (*talie*) *Hernandia nymphaefolia* (*pu'a*), and *Erythrina variegate (gatae).*

(ii) Coastal rainforest

Coastal rainforest is an uncommon ecosystem sometimes found between the littoral and lowland forests. Whistler (2002) noted that they tend to be situated on the more exposed portions of some coasts adjacent

[36] Whistler (in preparation); cited by Pearsall and Whistler, 1991.

to, but never directly, on the shore. It differs from littoral forest in being dominated by medium-size trees species whose seeds, borne in edible fruits, are usually dispersed by birds rather than by sea water and by it inland location. In actuality, it appears to be intermediate between littoral and lowland forest, but is more similar to the latter. It is commonly dominated by species of *Diospyros* and *Syzygium* as well as other species such as *Erythrina variegate (gatae*), *Barringtonia asiatica (futu*) and *Terminalia catappa (talie)* which are also found in the littoral forests.

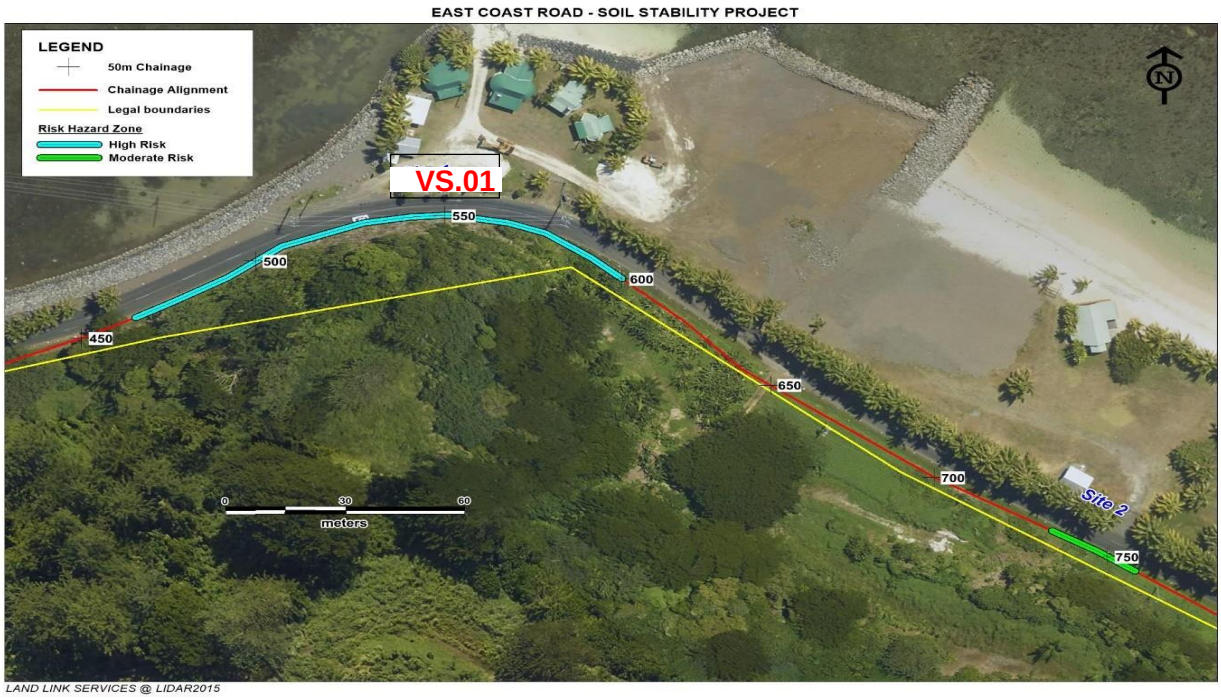
(iii) Disturbed vegetation – successional vegetation
Disturbed successional vegetation is described by Whistler (2002) as the scrubby vegetation found on recently disturbed land or recently abandoned managed land. The first stage following abandonement or following deVere disturbance is dominated by herbaceous adventive plants such as weeds and vine as well as woody plants such as *Macaranga harveyana, Morinda citrifolia, Cestrum nocturnum, Mussaenda raiateensis* and others. These species are known for their fast-growing, light-loving nature, most of which are short and do not reach the height of typical forest trees.

4. VEGETATION SURVEY RESULTS

4.1 SITE 1: (CHAINAGE: 460M TO 600M, LETOGO)

Site 1 (Map 01) is a 150m strip along the ECR adjacent to the Ott's family reclaimed land on the northern seaside part of the road immediately afterLetogo village. The vegetation at the site is a mixture of littoral shrub and disturbed vegetation in which *Samanea saman* (monkey pod) is the dominant canopy tree (about 80%) alongside the *Albizia chinensis* (tamaligi enaena) and *Falcataria moluccana* (tamaligi paepae). The latter two are listed as priority invasive species for management in Samoa due to their rapid spread and transformative behavior in most of the lowland areas and mid montane forests on Upolu and Savaii islands. The most common species in the littoral shrub vegetation of the site are thickets of *Hibiscus tiliaceus* (beach hibiscus -fau) (about 70%), *Kleinhovia hospita* (fuafua), *Macaranga harveyana* (laupata), *Ficus tinctoria* (mati), *Adenanthera pavonina* (lopa) and *Catilla elastica* (pulu mamoe). *C. elastica* is another problematic tree and major concern for Samoa due to their mono-dominant and rapid occupation of forest gaps as result of degradation and cyclone damages. The less common trees and shrubs in this community include*Morinda citrifolia* (nonu), *Clerodendrum inerme* (aloalotai/tititai), *Cananga odorata* (mosooi), *Diospyros samoensis* (auauli) and *Colubrinaasiatica* (fisoa). The forest floor is mostly open on the upper road cliff and ridge flat with scattered seedlings of the canopy trees, *Tectaria dissecta* (terrestrial fern), *Oplismenus compositus* (introduced weed – sefa) and *Balaka sp.* (introduced ornamental palm). The most common epiphytic and sometimes terrestrial are bird nested fern *Asplenium nutans* (laugapapa), *Davalia solida* (laugasese) and *Pyrrosia serpens* (lautasi). The latter three species are common epiphytes on huge trunks and old branches of *Samanea saman* (monkey pod) trees at the site.

Site 1: Map 01



4.2 SITE 2: (CHAINAGE 1,270 TO 1,305M, LETOGO TO LAULII)

Site 2 is about a 25m strip between chainage 1,270 and 1,305m respectively. The dominant canopy tree in this area is *Samanea saman* (monkey pod) about 90%, *Terminalia catappa* (talie) and *Mangifera indica* (mago) 10% combining the population of the latter two species. The sub-canopy trees are *Castilla elastica* (pulumamoe), *Macaranga haveyana* (laupata), *Kleinhovia hospita* (fuafua), *Morinda citrifolia* (nonu). *Hibiscus tiliaceus* continue to be the dominant species in this community - about 60% and *Adenanthera pavonina* (lopa) another problematic tree in rocky soil and high temperature areas like Ole PupuPu'e National Park at the south coast part of Upolu and Aopo to Falealupo villages on the northwest end of Savaii. Also mixed in with the sub-canopy trees are shrubby trees such as *Colubrina asiatic* (fisoa)and *Ficus tinctoria* (mati). Down the moderate slope immediately after the roadside drainage of the site, there seems once cultivated as noted by the presence of edible crops such as *Musa sp* (fai), *Cocos nucifera* (niu), *Garica papaya* (esi), *Hibiscus manihot* (pele/laupele), *Colocasia esculenta* (taro) and *Alocasia macrorrhiza* (ta'amu). The understory is amixture of prostrate vines and weeds. The most common vines are *Opeculina diffusa* (indigenous vine – with no Samoan name), *Mikania micrantha* (fuesaina) and *Coccina grandis* (ivy gourd - a recent introduced weed) in association with *Eragrostis tenella* (introduced OldWorld tropic weed common on roadsides and disturbed sunny places).

4.3 SITE 3: (CHAINAGE 1325 TO 1485M)

Site 3 (Map 02) represents the strip from 1,325 and 1,485 between Letogo and Laulii to the east. The dominant canopy trees of the upper road cliff are *Albizia chinensis* (tamaligi enaena), *Falcataria moluccana* (tamaligi paepae) about 70% combining *A. chinensis* and *F. moluccana*,*Samanea saman* (monkey pod) about 20%, *Terminalia catappa* (talie) about 7% and *Garuga floribunda* (manaui) about 3%. *S. saman* tree population is significantly reduced and less common in this area compared to the past two sites.

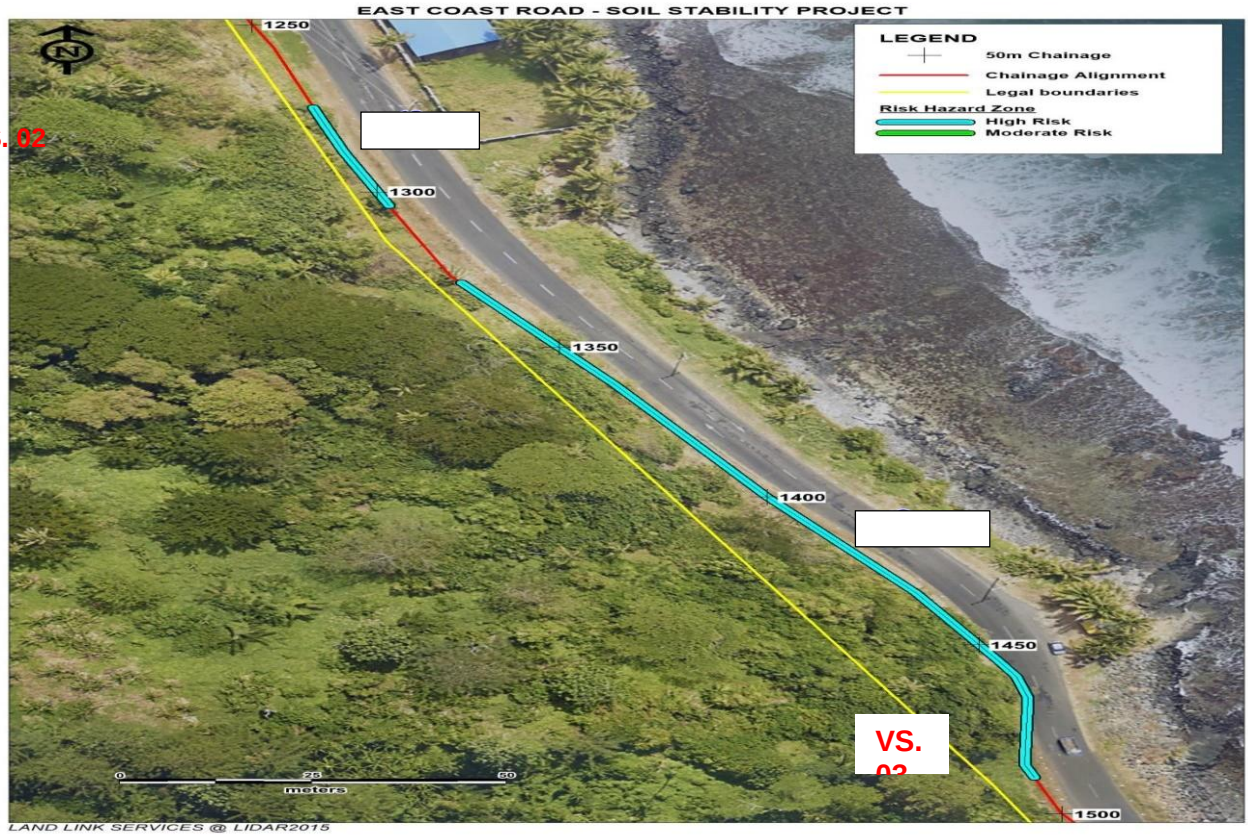
Species that are notable in the sub-canopy layer are *H. tiliaceus* (fau) about 65%, and the rest 35% occupies by *K. hospita* (fuafua, *M. harveyana* (laupata), *A. pavonina* (lopa), *Drancontomelon dao*, (no Samoan name), *C. elastica* (pulumamoe), *C. nucifera* (niu), *Artocarpus altilis* (ulu), *Calophyllum inophyllum* (fetau), *Planchonella garberi* (alaa), *Aleurites moluccana* (lama), *M. citrifolia* (nonu), *M. indica* (mago), *Glochidion*

ramiflorum (masame), *Paratrophis anthropophagorum* (ficus like plant), *C. odorata* (mosooi) and *Syzygium clusiifolium* (asi vai).

The understory and ground cover is a mixture of woody shrubs, vines and herbaceous weeds. Shrubs that are commonly found in open areas include *C. asiatica* (fisoa), *Dendrolobium umbellatum* (lala/laulala), *Miconia crenata* (laumamoe), *Lantana camara* (latana), *Clerodendrum inerme* (aloalotai/tititai), and prostrate vines like *O. diffusa*, *Passiflora foetida* (pasio vao), *Passiflora suberosa* (recent introduced vine), *M.micrantha* (fuesaina), *Dioscorea bulbifera* (soi), and *Pueraria lobata*(a'a).

Other shade tolerant species recorded at the site underneath the open fau(*H. tiliaceus*) thickets and canopy trees are *Aidia cochinchinensis* (olamea/aso), *Microsorum grossum* (lauauta/alofilima/laumagamaga), *Asplenium nidus* (laugapapa) and *Humata banksia* (Polynesia humata fern).

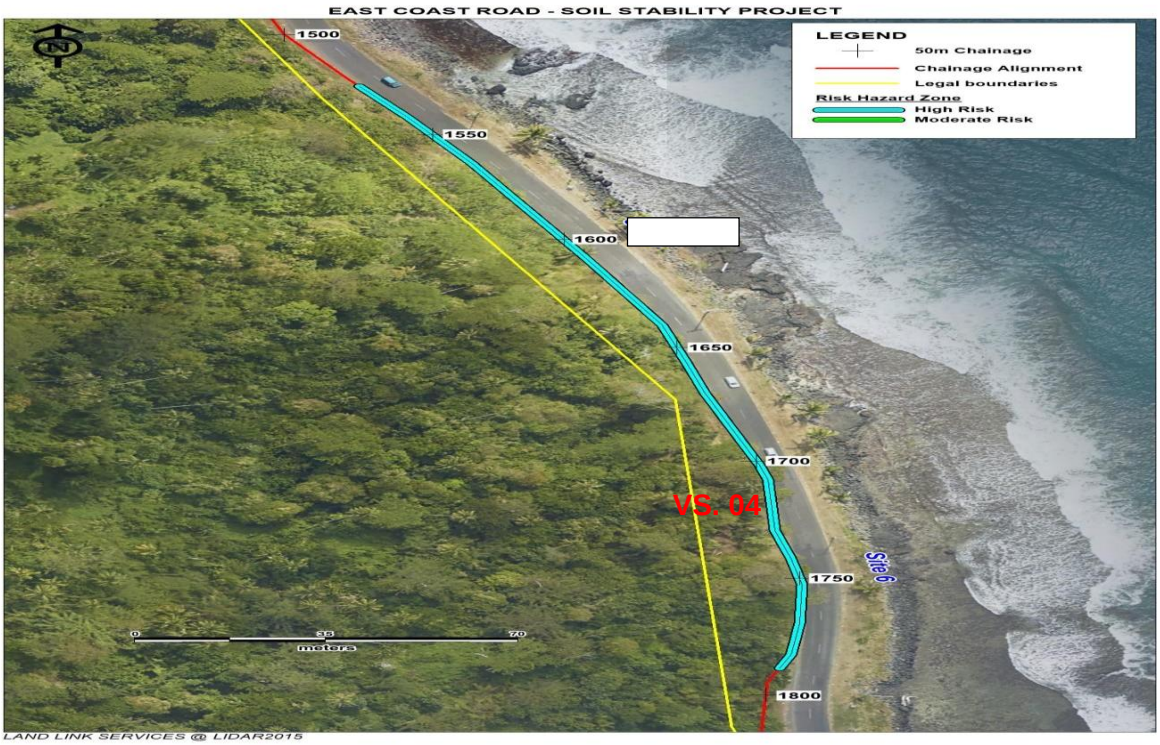
Site 2 & 3: Map 02



4.4 SITE 4: (CHAINAGE 1,275 TO 1,780)

Site 4 is an expansion of the winding road from site 3 towards the west end of Laulii village. Species that are commonly found as canopy trees include *A. chinensis, F. moluccana, Terminalia catappa,* and few of *S. saman* trees. Unlike in site 3, some species are scarcely found and sometimes absent like the *Garuga floribunda* and other sub canopy treesand shrubs. *A. chinensis*, *F. moluccana* and *Terminalia catappa* shared about 100% of the upper and emergent canopy while *H. tiliaceus* continue to be the dominant tree/shrub (about 80%) of the sub-canopy layer. *C. nucifera* are noticeable along the steep upper road cliff and ridge flat margin presumably an old plantation site belongs to the people and village of Laulii. Dry coconuts and heavy fruits of high canopy trees rolled fromthe upper slopes such as *Inocarpus fagifer* (ifi) combine with *K. hospita*, *C. odorata*, *Barringtonia asiatica* (futu), *M. harveyana*. *P. garberi*, *C. inophyllum*, *G. ramiflorum*, *M. citrifolia* and *Grewia crenata* to form thesub-canopy structure of this site. There are few vines and ground cover species found in this area compared to the disturbed and open areas at previous sites, this could be an impact of the slope direction (slope facingeastward direction of the bay-like formation of Laulii).

Site 4: Map 03



4.5 SITE 5: (CHAINAGE 3,920 TO 3,970M LEUSOALII)

Site 5 is only about a 50m strip between chainage 3,920 and 3,970 just at the beginning of Leusoalii, a sub village of Lotuanuu. The dominant canopy trees of the site are *Falcataria moluccana* (tamaligipaepae) about 70%, *Intsia bijuga* (ifilele) about 10%, *Dysoxylum samoensis* (maota mamala) about 5%, *Garuga floribunda* (manaui) about 3% and *Mangifera indica* (mago) about 12%. The most commonsub-canopy trees and shrubs are *H. tiliaceus* about 60%, and another 40% is shared between *A. pavonina*, *C. elastica*, *M. harveyana*, *F. tinctoria*, *A. cochidiensis*, *C. asiatica*, *Adissa eliptica* (togovao), *Flacourtia rukam* (filimoto), *K. hospita* (fuafua), *C. nucifera*, *M. citrifolia* and *Ixora samoensis* (filofiloa). The less common trees foundin this community are *C. odorata* (mosooi), *Grewia crenata*, and *Myristica fatua* (atone). The common understory species are clumps of *Zingiber zerumbet* (ava pui/faua povi), *Codyline fruticosa* (ti vao), *Nethrolepis hirstula* (vaotuaniu), *Asplenium nidus* (laugapapa), *Faradaya amicorum* (an indigenous woody vine commonly found in lowland to montane forest – mamalupe) and *Microsorum grossum* (lauauta). The other notable plants are *Mikania micrantha*, *Epiprenum pinnatum* (tuafaga/fuelaufao), *Clerodendrum inerme*, *Dioscorea bulbifera*, *Operculina diffusa*, *Ipomea micrantha*, *Ipomea pers carprae*

(common littoral vine along the seaside of the road – fuemoa) and *Freycinertia stockii* (an indigenous tree climber pandanus like plant ascending tree trunks in lowland to montane forest – ieie).

4.6 SITE 6: (CHAINAGE 4,220 TO 4,330M, LEUSOALII)

The canopy trees that are notable in this area include *F. moluccana*, *Dysoxylum samoensis*, *Calophyllum inophyllum*, *Mangifera indica* (mago), *Rhus taitensis* (tavai), *Alphitonia zizyphoides* (toi), and *Intsia bijuga* (a high valued timber tree for its high density wood used for carving and making piles for heavy construction works – ifilele). Of all *F. moluccana* is dominant about 60%, second dominant are *I. bijuga* in small patches towards the east and scattered individuals of *A. zizyphoides*, and *R. taitensis*.

The ground cover is mostly open that only shade tolerant shrubby species like *Aidia cochidiensis*, and *Adissia eliptica* are dominant. Among the latter species are *Cyathea lunulata* (a common tree fern of the lowland to montane forest - olioli), *Pteris tripartita*, *Microsorum grossum*, and *Asplenium nidus*, (terrestrial ferns). The latter two sometimes epiphytic and tree trunk climber on old stumps of the canopytrees. The dominant plants of the ridge flat and upper road cliff are *Nephrolepis hirstula* (vaotianiu), *M. citrifolia*, seedlings of *I. bijuga*, *Casytha filiformis* (fetai vine), *H. tiliaceus*, *P. foetida*, *Stachytarpheta urticifolia*, *Psidim guajava* (kuava). *Miconia crenata* (laumamoe), *Aidiacochidiensis*, *Dyospyros samoense* (auauli), *Funtumia elastica* (pulu vao), *Davalia solida*, *Hoya australis* (laumafiafia/lauolive/fueselela), *Zingerber zerumbet*, *Cinamonum verum* (tinamoni), *D. bulbifera*, *M. grossum*, *C. nucifera*, *M. micrantha*, *Paspalum conjugatum* (vaolima) and *Santalum alba* (asi manogi). This is typical of disturbed vegetation common along the upper road cliff of the current and sites previously surveyed.

H. tiliaceus (fau) in clumsy stand dominates the sub-canopy layer. Alsomixed in with it are *A. pavonina* (lopa), *F. tinctoria* (mati), *C. elastica* (pulumamoe), *M. harveyana* (laupata), *Ficus scabra* (mati mageso), *C. asiatica* (fisoa) and *Pandanus tectorius* (an indigenous screwpine common in littoral areas – fasa).

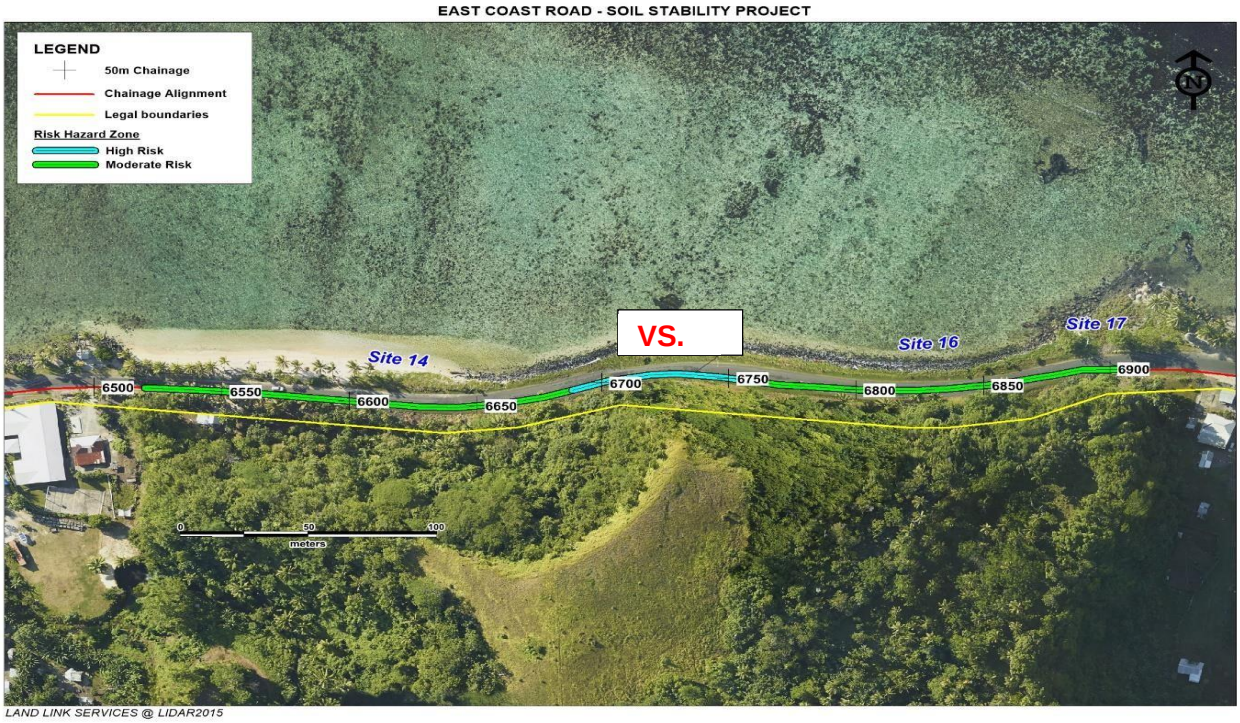
Site 5 & 6: Map 04

4.7 SITE 7: (CHAINAGE 6,680 TO 6,750M, LOTUANUU)

Site 7 is a 50m long strip of forest between chainage 6,680 and 6,750m towards the east end of Lotuanuu village. The vegetation of the site is a disturbed lowland forest with a mixture of littoral strand vegetation where *Falcataria mollucana* (tamaligi paepae) being the dominant canopy tree with scattered *Rhus taitensis*

(tavai), *Intsia bijuga* (ifilele), *Mangifera indica* (mago), *Elattostachys apetala* (taputoi), *Ficus obliqua*(aoa) and *Terminalia catappa* (talie). The sub-canopy layer is a mixture of trees and shrubs species particularly *Adenanthera pavonina* (lopa) and invasive tree of the lowland forest dominanting about 40%, *Ficus tinctoria* (mati), *Morinda citrifolia* (nonu), *Dyospyros samoensis* (auauli), *Macaranga harveyana* (laupata), *Cerbera manghas* (leva), *Cocos nucifera* (niu) and *Neiosperma oppositifolium* (fao) notably planted on the seaside. *H. tiliaceus* (fau) is the second dominant tree or shrub withdense thickets covering almost 30% of the sub-canopy layer. In additionto clumps of fau are pockets of shrubby vegetation like *Dendrolobium umbellatum* (laulala), *Clerodendrum inerme* (aloalotai), *Miconia crenata*(laumamoe), *Colubrina asiatica* (fisoa), *Aidia cochidiensis* (aso/olamea), *Codyline fruticosa* (lauti/tivao) and *Leucosyke corymbulosa* (alaalatoa) and indigenous shrub occurring only in Samoa, Futuna and the Cook Islands of the Polynesian group. Other tree species present but are less common are *Inocarpus fagifer* (ifi), *Cananga odorata* (mosooi) and *Kleinhovia hospita* (fuafua). The common vines found in the area are *Mikania micrantha* (fuesaina), *Ipomea pescarpre* (fue moa) along the coast, *Passiflora foetida* (pasiovao) *Alyxia stellata* (gau/lava), *Dioscorea bulbifera* (soi), *Mucuna gigantea* (tupe/tifa), *Epipremnum pinnatum* (tuafaga/fue laufao) and *Casytha filiformis* (fetai). The ground cover is mostly open except in few areas occupied by scattered seedlings of canopy trees with *Microsorum grossum* (lauauta) being the dominant undergrowth species.

Site 7: Map 05

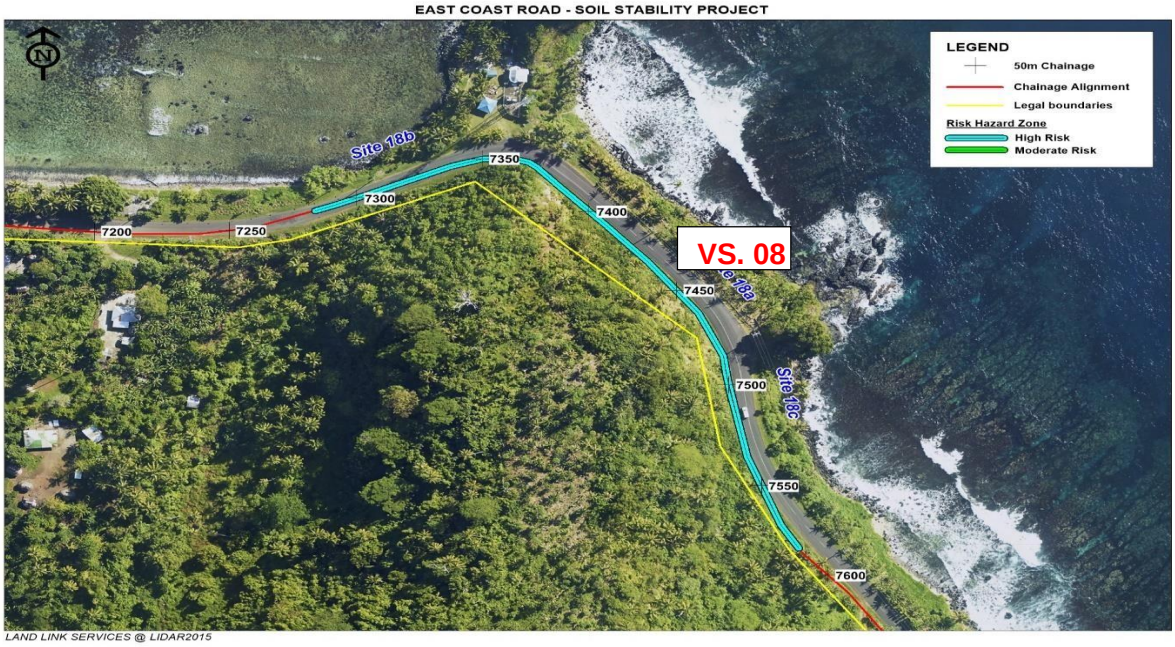


4.8 SITE 8: (CHAINAGE 7,280 TO 7,580)

Site 8 is the area opposite Utuma and Utumau'u capes (Map 06) which are historical land marks in the legends of Samoa. Cape Utumau'u is well known for surfing in Samoa today. The vegetation of the site is mostly secondary and disturbed lowland and littoral forest with *Falcataria moluccana*, *Albizia chinensis*, *Rhus taitensis* and *Terminalia catappa* the most common canopy trees of the upper slope. The mid slope range are *Cocos nucifera*, *Calophyllum inophyllum* (fetau), *Mangifera indica, Macarang harveyana*, *Inocarpus fagifer*, *Planchonella garberi*, *Dysoxylum samoensis* and *Hernandia nymhaefolia* (pu'a). *H. tiliaceus* is the dominant species of the sub- canopy combining with small sized trees and shrubs such as *Ficus tinctoria, Scaevola taccada* (toitoi), *Psychotria insularum*, *Aidia cochidiensis, Geniostoma rupestre* (taipoipo/laumafatifati), *Dendrolobium umbellatum*, *Barringtonia asiatica*, *Colubrina asiatica* and *Pandanus tectorius* (fasa). *P. tectorius* is one of the indicator species of the littoral vegetation that sometimes form a

dense monodominant strip immediately after the littoral and herbaceous strand vegetation at rockiest shores of Samoa. The ground cover is a combination of herbaceous weeds and vines that occur on the roadside and sometimes occur as pioneer weeds in forest gaps. These include *Mikania micrantha*, *Stachytarpheta cayenensis*, *Mimosa pudica, Passiflora foetida*, *Commelina diffusa, Sida rhombifolia, Nephrolepis hirstula (vaotuaniu), Lantana camara*, *Asplenium nutans*, *Microsorum grossum* and clumps of *Zingiber zerumbet* (avapui) in the Zingiberaceae family.

Site 8: Map 06



4.9. SITE 9: (CHAINAGE 8,040 TO 8,450)

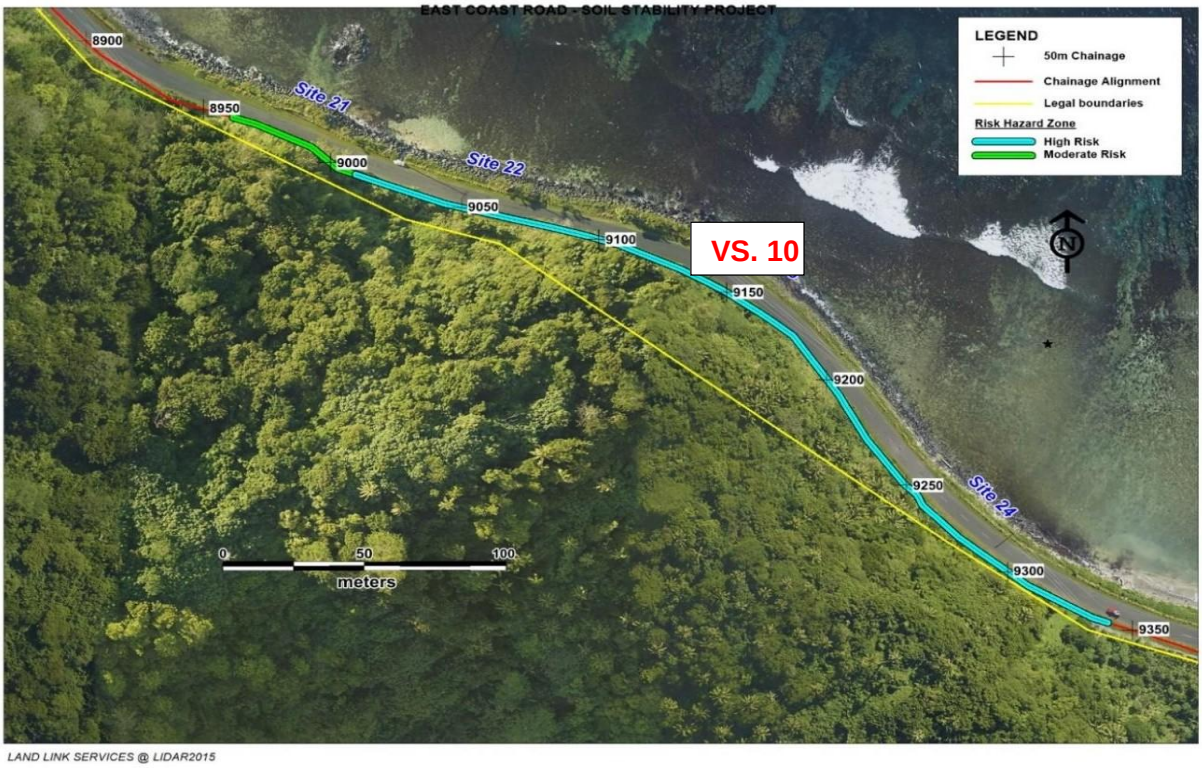
Site 9 is about a 400m long strip between chainage 8,040 and 8,450 to the east of Lotuanuu village. The upper canopy trees of this site are mostly *Terminalia catappa* about 70% and scattered *F. moluccana* and *Albizia chinensis* combine about 30%. Other important trees that are less common in the upper canopy are *R. taitensis*, *Inocarpus fagifer,* and *Elattostachys apetala*. *H. tiliaceus* is the most common sub-canopy tree about 50% with *A. pavonina* the second dominant about 30% and *M. haveyana* about 20%. The less common sub-canopy trees include *K. hospita*, *Flacourtia rukam*, *Ficus tinctoria*, *Crewia crenata*, *Allophylus timorensis*, *Barringtonia asiatica, Neonauclea forsteri, Pipturus argenteus, Barringtonia samoensis*, *Sterculia fanaiho, Cananga odorata, Morinda citrifolia, Hernandia nymphaefolia, Glochidion ramiflorum,* (masame), *Fagraea beteroana* (pualulu), *Thespesia populnea* (milo), *Calophyllum inophyllum* and *Dyospyros samoensis* (the black ebony tree – auauli). Agricultural cropslike *A. incisus* (ulu), *C. nucifera* (niu), *Musa sp* (fai), *Colocasia esculenta* (taro), *Alocasia macrorrhiza* (taamu) are also found in small number near the roadside except *C. nucifera* that it scattered throughout the entire site. The understory species are *Dendrolobium umbellatum, Colubrina asiatica, Arundo sp, (fiso), Geniostoma rupestre, Psidium guajava, Adissia eliptica* (togovao), *Aidia cochidiensis* (aso), *Cytandra samoensis, Pandanus tectorius, Codyline fruticosa* (lauti), *Ficus scabra* (mati mageso) where *D. umbellatum* and *C. asiatica* the most commonspecies in this layer. Other species that are common on the ground floor and on top of the sub-canopy layer are vines like *Opeculina ventricosa, D. bulbifera, M. micrantha, Hoya australis,* and *Ipomea pescapre* (fuemoa) along the coastline. The ground cover are *Derris malaccensis* (ava Niukini) currently forming dense thickets in several areas, *Epipremnum pinnatum,* and two common indigenous ferns *Asplenium nutans* and *Microsorum grossum.*

Site 9: Map 07

4.10 SITE 10: (CHAINAGE 9,000 TO 9,350)

This site is a 350m long strip between chainage 9,000 and 9350 further eastof Lotuanuu to the western end of the village of Solosolo. Species that are common as canopy trees from the roadside to the upper road cliff of this site are *Terminalia catappa, Falcataria moluccana* and *Mangifera indica*. The less common are *Garuga floribunda*, *Calophyllum inophyllum*, *Intsia bijuga*, *Inocarpus fagifer*, *Hernandia nymphaefolia*, and *Syzygium clusifolium.* Like in other areas *H. tiliaceus*and *A. pavonina* are common sub-canopy species and often indicative of former disturbance. These two species often form monodominant thickets/clumps in littoral and lowland forests from near sea level to 650m elevation of all the main islands of Samoa. The other notable plants at this layer are *Castilloa elastica* (naturalized invasive alien rubber native to tropical America – Pulumamoe), *Cananga odorata, Crewia crenata, Macaranga harveyana, Pipturus argenteus, Ficus tinctoria, Morinda citrifolia and* coastal tree like *Cerbera manghas.* The understorey are littoral shrubs like *Colubrina asiatica, Premna serratifolia*, *Ardissa eliptica, Homalanthus nutans, Geniostoma rupestre, Clerodenrum inerme* and *saplings of Diospyros samoensis.* Theground floor of the site is mostly open except in forest gaps where tropical weeds and vines are often dominant. The common vine and weeds are *Opeculina diffusa, Mikania micrantha, Dioscorea bulbifera, Ipomoea micrantha, Passiflora foetida* and *Mucuna gigantea.*Combining with vines on the forest floor are *Mimosa pudica, Digitaria ciliaris, Kyllinga memoralis, Kyllinga polyphylla, Oxalis corniculata* and *Derris malacensis.*

Site 10: Map 08



4.11 SITE 11: (CHAINAGE 11,740 TO 11,930M)

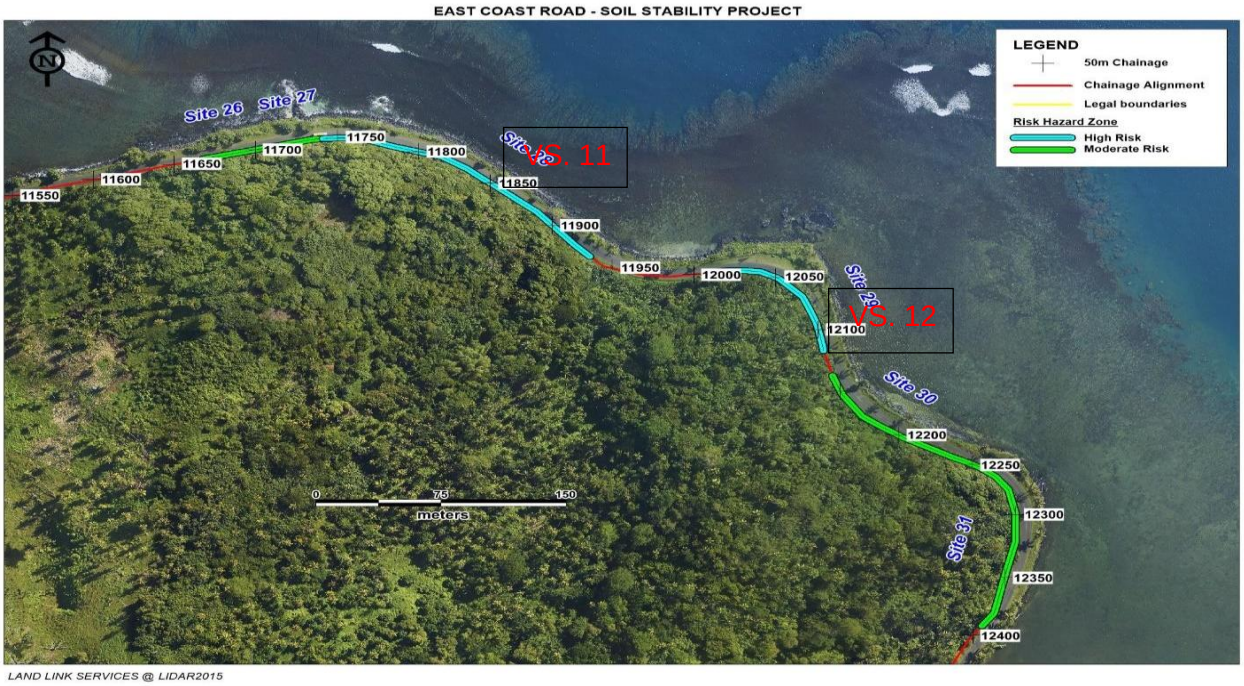
The vegetation of site 11 is similar to other survey sites with *Falcataria molucanna, Terminalia catappa*, *Rhus taitensis*, *Mangifera indica* and *Inocarpus fagifer* the common canopy trees along this roadside strip. Other canopy trees that are less common are *Dysoxylum samoensis*, *Elatostachys apetala*, and *Syzygium clusifolium* (asivai). *M. indica* (mago), *Cocos nucifera* (niu), *A. zyzyphoides* (toi), and *Artocarpus altilis* (ulu) are common edible crops not only at this particular site but the same as in previous sites surveyed. These trees were naturally grown from drifted and dispersed fruits considering the steepness and in- eligibility of the site for formal agriculture. *H. tiliaceus* is the common sub-canopy tree in combination with *M. harveyana, S. clusifolium, C. elastica, F. tinctoria L. corymbulosa (alaalatoa), C. odorata, P. agenteus, P. garberi, G. ramiflorum, N. forsteri* (afa), *E. apetala* (taputoi), *H. nutans*, *M. fatua* (atone), *C. crenata*, *M. citrifolia*, and shrubby species like *C. asiatica*, *D. umbellatum* and *C. inerme.* Alsomix in with the sub-canopy trees are *F. amicorum* (native woody vine/tree climber – mamalupe), *C. elastica, A. cochidiensis, C. samoensis* and several vines including *D. bulbifera, I. micrantha, M. micrantha, O. ventricosa and P. foetida.* The ground floor is mostly opened with scattered seedlings of the canopy trees and clusters of *Z. zerumbet* (avapui), dispersed *A. nidus* (laugapapa), *M. grossum* (lauauta) and *P. serpens* (lautasi) mostly on tree trunks and moist rock face.

4.12 SITE 12: (CHAINAGE 12,030 TO 12,120)

Site 12 is a sharp corner called Faga between chainage 12,030 and 12,120 to the east of Solosolo village. The canopy trees along the upperroad cliff is a mixture of *A. falcataria*, *Rhus taitensis* and *Terminalia catappa* whereas *P. falcatria* the dominant of the three at about 80%. The less common canopy trees are *Dysoxylum samoensis*, *Calophyllum inophyllum* and *Planchonella garberi* (alaa). Like in other areas *H. tiliaceus* is the dominant sub-canopy alongside the *K. hospita, M. harveyana*, *M. indica, C. nucifera, C. odorata*, *P. agenteus*, *F. tinctoria*, *C. elastica*, and *A. pavonina* as sub dominant secondary species. The understorey is a mixture of invasive weeds such as *Arundo donax* and vines like *Opeculina diffusa*, *Passiflora foetida*, *Pueraria montana* (a'a), and *Ipomea pescarpre* (fuemoa). Other notable trees but are less common include *H. nutans* (mamala),

Cyathea lunulata (olioli), *Morinda citrifolia,* and *Cerbera manghas. Leucaena leucocephala is* another invasive tree of major concern for Samoa. Other invasive weeds such as *Lantana camara*, *Mimosa invisa* are also found in this area. It may be a recent introduction to the site by birds or earth movement during road construction. The area is less bio-diverse with only two species of ferns found at both on the ground and as epiphytes (i.e. *Psilotum nutans* and *Microsorum grossus)* with several species of herbaceous weeds and grasses.

Site 11 & 12:

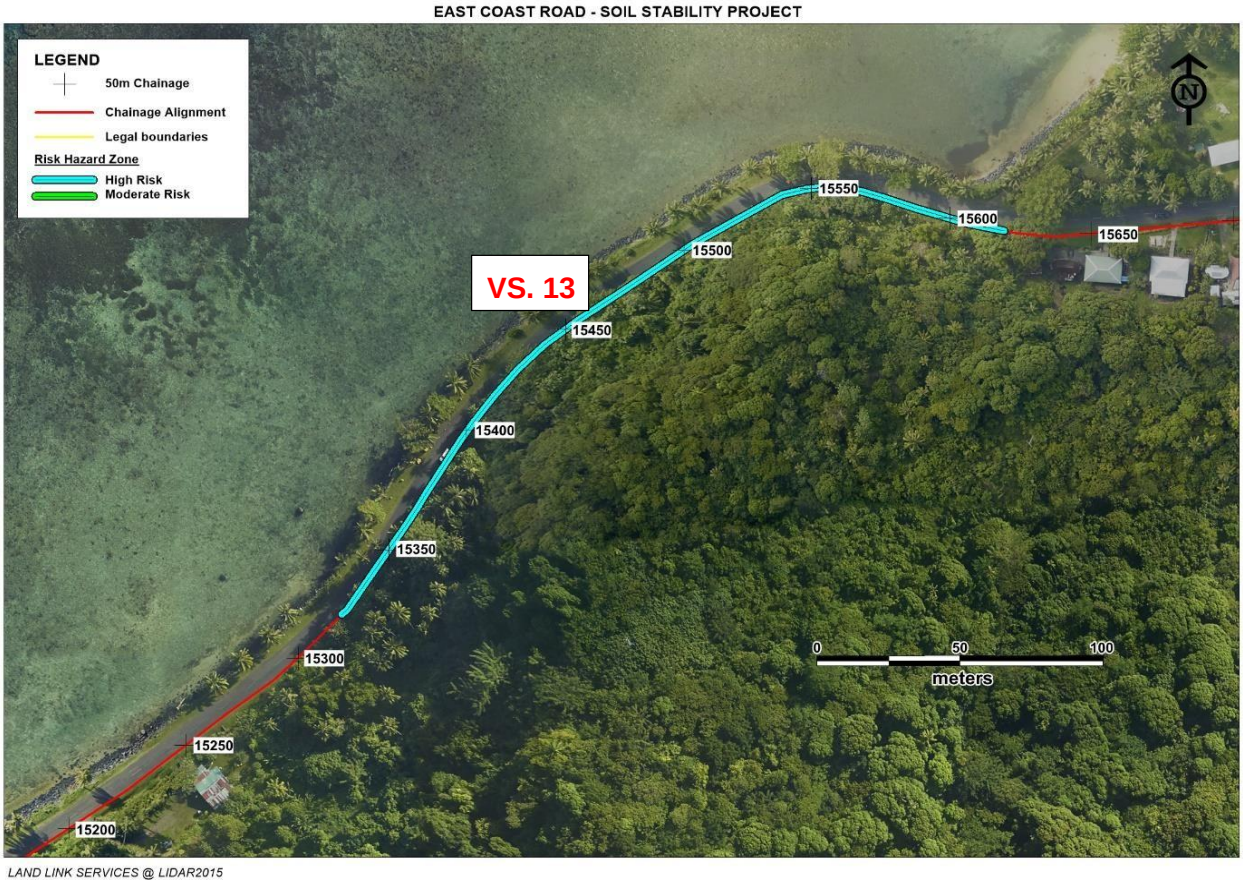


4.13 SITE 13: (CHAINAGE 15,320 TO 15,650)

Site 13 is a 330m strip immediately before the village of Saluafata. The vegetation is a mixture of disturbed, littoral and lowland forest species. The common canopy trees of the strip are *Falcataria moluccana*, and *Albizia chinensis* and the less common are *Inocarpus fagifer, Artocarpus altilis, Altphitonia zyzyphoides, Rhus taitensis, Mangifera indica, Bombax pentarda* (vavae)*, Cocos nucifera,* and few ofthe coastal lowland native species like *Dysoxylum samoensis* and *Dyospyros samoensis*.

H. tiliaceus is the most common shrub/tree of the sub-canopy layer in association with other secondary vegetation/pioneer trees such as *Macaranga harveyana, Cerbera manghas, Kleinhovia hospita*, *Cananga odorata*, *Morinda citrifolia, Ficus tinctoria*, and invasive *Adenanthera pavonina* (lopa). The presence of crop trees like *Artocarpus, Cocos, Alocasia, Colocasia, Garica, Musa* and trees like *Flueggea flexuosa* (poumuli), *Bombax* (vavae) and *Pandanus* at moderate slope edges of the strip signifies past cultivation impacts. Interestingly, a single *Terminalia richii* (malili) specimen (seedling size) was observed near the roadside - a possible regeneration from bird droppings or presumably a dropped-off seedling during the transportation of seedlings to support community tree planting programs for the villages on the east. The understorey are *Colubrina, Miconia, Geniostoma, Aidia, Fradaya, Codyline* and *Cyathea.* In between the existing vegetation and forest gaps are lianas like *Passiflora*, *Derris, Epipremnum, Ipomea, Dioscorea, Opeculina, Mikania*, and weedy species such as *Stachytarpheta, Nethrolepis*, *Kylinga* and clumps of Zingiber (avapui). The shade tolerant species of ferns like *Asplenium, Microsum* and *Humata* are quite common in the understorey and on the exposed rocks.

Site 13: Map 10



5. ANALYSIS OF RESULTS:

5.1. FLORA

5.1.1. Forest types

In general, the flora assessment found the vegetation on all sites to have been modified either by natural (e.g. wind damaged, windthrows) or non-natural (i.e. human) impacts or both. All are at various stages of natural regeneration with some areas being more advanced along the regeneration continuum than others. The list of recorded species represents those typically associated with three main forest types as per Whistler's classification (2002) namely littoral forests, coastal lowland forests and disturbed vegetation – the latter mainly belonging to successional vegetation. Some individuals normally associated with primary or old growth secondary vegetation were observed scattered throughout the areas surveyed.

Species generally attributed to each of these forest types exist not in clearly identifiable homogenous or semi-homogenous areas, but in highly mixed composition, forming a mosaic of colours and shapes. Consequently, no single forest type is dominant. Some sites show a marginally higher presence of littoral strand species (e.g. part of Site 8) while others show the presence of species more commonly associated with coastal rainforest. Except in some locations, where *Hibiscus tiliace*us and *Macarange pavinova* are clearly discernible – forming a two-species strip that in some cases extend for up to 100m along the road shoulder. Truncating these mixed stands are clearly identifiable patches of recent disturbances where gaps – likely human-induced – are dominated by vines and weeds with scattered individuals of both littoral and coastal forest species. This fits Whistler's category of disturbed forests although they are small and not significant in area.

On the seaward site, considerable lengths of coastline are now covered with built rockwalls aimed to protect the ECR against sea level rise and strong wave action. This is particularly evident along parts of Letogo, Laulii, Leusoalii, Luatuanuu and Solosolo. Natural vegetation along the seawall is sparse and scattered clumps of littoral shrubs and vines can be seen. In some sections, planted coconut palms - some already bearing fruits - and ficus trees (pulu) intended to provide protection against strong winds and to prevent coastal erosion - are common. Along the road shoulder and exposed drainage, several introduced plants- many in planted hedges of euphorbias - and *heliophyte* weeds are abundant.

4.1.2. Forest structure and tree species

Within the 30m wide strip, the canopy, subcanopy and undergrowth were clearly discernible. Tables 2,3, and 4 below present the common species identified in each forest layer. Many canopy trees rise up to 20m in height.

The survey recorded a total of 237 terrrestrial plants of which 175 were dicots, 51 monocots and 11 species of ferns. There were 50 families of dycotyledons represented by 89 genuses and 10 families of monocotyledons represented by 34 genuses. Ferns are represented by 7 families and 9 genuses. Five native species of trees are categorized as Endangered by the IUCN Red List of Endangered Species (2023-1).

The results show a high number of natives (n), and introduced species (i) and a low level of species endemism. Less obvious from the tables is the relative 'abundance' of different species, a result of the methodological focus on species 'presence'. Of note, in terms of 'abundance' based on visual observations, there is a disproportionally high 'abundance' of introduced species than native ones in all forest layers – especially in the canopy and subcanopy layers.

With the aid of lidar and drone images, assessment of vegetation cover found most sites to be 'high' ranging from between 80% to 100%. The exception is Site 7 wherein a grassy rocky plateau is the dominant feature.

Table 2: Most common canopy species along ECR-SSP critical sites

Species	Family	Local name	Status
Falcataria moluccana	Fabaceae	*Tamaligi paepae*	i
Samanea saman	Fabaceae	*No Samoan name*	i
Terminalia catappa	Combretaceae	*Talie*	n
Mangifera indica	Anacardiaceae	*Mago*	n
Garuga floribunda	Burseraceae	*Manaui*	n
Rhus taitensis	Anacardiaceae	*Tavai*	n
Albizia chinensis	Fabaceae	*Tamaligi enaena*	i
Alphitonia zizyphoides	Rhamnaceae	*Toi*	n

Table 3: Most common sub-canopy species along ECR

Species	Family	Local name	Status
Hibiscus tiliaceus	Malvaceae	Fau	n
Adenanthea pavonina	Fabaceae	Lopa	i
Ficus tinctoria	Moraceae	Mati	n
Castilla elastica	Moraceae	Pulu mamoe	i
Macaranga harveyana	Euphorbiaceae	Lau pata	n
Ficus scabra	Euphorbiaceae	Mati mageso	n
Morinda citrifolia	Rubiaceae	Nonu	i
Kleinhovia hospita	Malvaceae	Fuafua	n
Trema andersonii	Cannabaceae	Magele	n
Ficus tinctoria	Moraceae	Mati	n
Funtumia elastica	Moraceae	Puluvao	i

Table 4: Common shrubs and undergrowth species along ECR

Species	Family	Local name	Status
Hibiscus tiliaceus	Malvaceae	fau	n
Colubrina asiatica	Rhamnaceae	Fisoa	n
Aidia cochinchiensis	Rubiaceae	Aso / Olamea	n
Dyospyros samoensis	Ebenaceae	Auauli	n
Premna serratifolia	Lamiaceae	Aloalo	n
Pipturus argenteus	Urtiaceae	Soga	i
Lantana camara	Verbenaceae	Latana	i
Geniostoma rupestre	Loganiaceae	Taipoipo/Laumafatifati	n
Miconia crenata	Melastomaceae	Laumamoe	i
Ardisia elliptica	Pimulaceae	Togovao	i

n = native; i – indigenous.

The full list of all flora species identified in all the surveyed sections are given in Appendix 2.

5.1 BIRDS

Appendix 7 presents all bird species recorded present in each of the 13 surveyed zones of the ECR-SSP.

Twenty five bird species (including 4 seabird, 21 land birds) and one flying mammal (flying fox) were recorded. Three bird species and one flying mammal (flying fox) species are endemic and of national conservation interest. IUCN's Red List of Globally Endangered Species recognizes them, and provides the following assessments of their respective considervation statuses.

Table 5: Samoa's Avifauna Species of Conservation Interest and IUCN's Assessment

	Species	*Botanical name*	Local name	Status	Comment/IUCN Assessment
1	Samoa flying fox	*Pteropus samoensis*	Pe'a vao	NT	Last assessed in July 2019. Listed as Near Threatened as its global population is suspected to have declined by an estimated 25-29% over the past 24.3 years (three generations; generation length = 8.1 years, Pacifici *et al*. 2013). Main threats – habitat loss and fragmentation due to storms, agriculture, logging, and hunting; (IUCN Red List, 2024.
2	Samoan whistler	*Pachycephala flavifrons*		LC	Last assessed in 2016. Population trend appears to be stable, hence species dones approach the thresholds for Vulnerable under the population trend criterion. Range is restricted however, it is not believed to approach the thresholds for Vulnerable under the range size criterion. Thus the Least Concern status. (IUCN, 2024)
3	Samoan starling	*Aplonis atrifusca*	Fuia	LC	
4	Flat-billed kingfisher	*Todirhamphus recurvirostris*	Tiotala	LC	Last assessed in October 2016; species has a restricted range but does not approach the thresholds for Vulnerable under the range size criterion. Population trend is not known but is believed to be decreasing sufficiently rapidly to approach the thresholds under the population criterion. Under the population size criterion, it is not believed to approach the thresholds for Vulnerable. For these reasons, species is evaluated as Least Concern. (IUCN, 2024)

NT = Near Threatened; LC = least concern; IUCN Red List; 2024.

6. CONCLUSIONS

6.1. Flora

Forest types

The vegetation survey identified and recorded trees, shrubs, ferns and vines species within quadrants corresponding to each of the 13 targeted critical sites. The survey found all sites to be secondary regenerations, some more advanced than others along the natural regeneration continuum. While three forest types – littoral, disturbed and lowland forests - would typically be expected along the surveyed area, the survey found no distinctly discreet and identifiable forest types with species normally associated with each of the three forest types all mixed in a random and mosaic-like pattern within the surveyed area. In some sites, littoral species or coastal species may be marginally more abundance, but not significantly dominant to warrant a discrete type. Strands of shrubs of *Hibiscus tiliaceus* and *Macaranga pavinova* straddling the ECR shoulder in Laulii and Leusoalii is the nearest to a discrete forest type observed. Similarly, small patches of disturbed vegetation near the roadside are observed in several places. Otherwise most sites are generally mixed and highly heterogenous. terms of species composition of species typically associated with littoral, coastal and disturbed forest types.

Species diversity

Species diversity is high with dicotyledons represented by 50 families and 143 genera and monocotyledons represented by 10 families and 35 genera. There were 9 ferns genuses in 7 fern families. Of the total of 239 species identified, 80 species are native, 7 of which endemic, and 159 introduced. A significant percentage of introduced are considered invasive. Species endemism is low, and of the two plant species listed in the IUCN Red List as threatened[37], neither was not recorded in the survey area.

Forest structure:

A clearly discernible canopy, subcanopy and undergrowth layers was observed along all surveyed sites. Disturbed sites – most likely human-induced - truncated the continuity of secondary vegetation in several places at most sites, mostly near the roadside. Disturbed areas are more open, and mainly covered by vines, weeds, and scattered shrubs of *Hibicus tiliaceus, Macaranga pavonina* and in some cases, remanent agricultural crops including *C. nucifera, Musa spp*, and *Morinda spp.*. Prominent and most common canopy species include *Falcataria mollucana, Terminalia samoense, Samanea saman, and Mangifera spp*. Vegetation cover is generally high, at between 80% and 100% except in Site 7 where an open grassy area is prominent.

6.2. Avifauna

A wide diversity of birds was recorded (seen and heard) within the 23 critical sites of ECR-SSP. Twenty are landbirds, 4 seabirds and one flyng mammal (flying fox) were recorded in the study area. Four endemic species of national conservation interest (Samoan whistler, Samoan starling, flat-billed kingfisher and Samoan flying fox) were observed. These species according to IUCN's red List of Globally Endangered Species, are either Near Threatened (flying fox) or of Least Concern (LC) indicating that their national populations are relatively safe.

[37] *Clinostigma samoensis* (EN) and *Drymophloeus samoensis* (CR)

APPENDIX 1: LITERATURE CONSULTED

1. Conservation International – Pacific Islands Programme, Ministry of Natural Resources and Environment, Secretariat for the Pacific Regional Environment Programme. 2010. Priority Sites for Conservation in Samoa: Key Biodiversity Areas. Apia*, Samoa.* 32 pp.
2. Goldin, Meryl R. 2002. Field Guide to the Samoa Archipelago: Fish, Wildlife and Protected Areas. Bess Press Inc., Hawaii.
3. Ministry of Natural Resources and Environment (MNRE) (a). 2015. National Biodiversity Strategy and Action Plans (NBSAP) 2016 - 2020, Government of Samoa. 80 pp.
4. Ministry of Natural Resources and Environment. (b) 2013. Samoa 2013 State of Environment (SOE) Report. Government of Samoa.
5. Pearsall, S.H. and W.A.Whistler. 1991. Ecosystem Mapping for Western Samoa: Technical Report and Appendices. Unpublished photocopy. The Nature Conservancy, Pacific Conservation Data Centers Program, Honlulu Hawaii.
6. Pearsall, S.H. and W.A.Whistler. 1991. Ecosystem Mapping for Western Samoa: Summary, Project Report, and Proposed National Parks and Reserves Plan.. Unpublished. Prepared by SPREP and East West Center, for the Government of Samoa. Honlulu Hawaii.
7. Whistler, W. A. 1992: Flowers of the Pacific Island Seashore. Isle Botanica Honolulu Hawaii 96826 U.S.A.
8. Whistler, W.A. 2002. The Samoan Rainforest – A Guide to the Vegetation of the Samoan Archipelago. Isle Botanica, Honolulu, Hawaii, USA.
9. Whistler, W. A. 2022. Flora of Samoa: Flowering Plants. National Tropical Botanical Garden, 3530 Papalina Road, Kalaheo, Kauai, Hawaii 96741 USA.
10. Whistler, W. A. 2004, Rainforest Trees of Samoa: A guide to the common lowland and foothill forest trees of the Samoan Archipelago. East-West Centre, Univ of Hawaii.
11. Whistler, W.A. 1992. Flowers of the Pacific Islands Seashore: A guide to the littoral plans of Hawaii, Tahiti, Samoa, Tonga, Cook Islands, Fiji and Micronesia. Isla Botanica – University of Hawaii.
12. SPREP. 2024. Samoa Country Dossier for Aichi Target 12: Reducing the Risk of Extinction. file:///C:/Users/HP/Desktop/Kramer%20-%20SCRTP/EIA/aichi-12-data-dossier-reducing-risk-extinction-summary.pdf . Downloaded 16 Jul 2024.

APPENDIX 2: FLORA SPECIES AND DISTRIBUTION AMONG ECR-SSP CRITICAL SITES

Genus/Species name	Local name	High Risk Zones												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Adenanthera pavonina	lopa	√	√	√		√		√		√	√		√	√
Aidia cochinchinensis	Olamea/aso			√		√	√	√	√	√		√		√
Adissia eliptica	togovao						√			√	√			
Albizzia chinensis	tamaligi enaena	√		√	√		√		√	√				√
Albizzia falcataria	tamaligi	√		√	√		√		√	√		√		
Aleurites mollucana	lama			√	√									
Allophylus timorensis					√						√	√		√
Alocasia macrorhizza	ta'amu		√							√				
Alphitonia zizyphoides	toi					√	√					√		√
Alyxia stellata	gau/lava							√						
Artocarpus altilis	ulu									√	√	√		√
Artocarpus incisus	ulu			√			√			√		√		
Arundo spp	fiso									√			√	
Asplenium nidus	lauga papa			√			√					√		√
Asplenium nutans	laugapapā	√		√					√	√				
Balaka spp	oriental palm (I)	√												
Barringtonia asiatica	futu				√				√	√				
Barringtonia samoense	futu									√				
Bombax pentarda	Vavae (kapok)													√
Calophylum inophyllum	fetau			√	√		√		√	√	√		√	
Cananga ordorata	mosooi	√		√	√	√	√	√		√	√	√	√	√
Castilloa elastica	pulu mamoe	√	√			√	√				√	√	√	
Casytha filiformis							√	√						
Cerbera manghas	leva							√			√		√	√
Cinnamon verum							√							
Clerodendrum inerme	aloalotai/titi-tai	√				√	√	√			√	√		
Coccina grandis	Ivy gourd		√											
Cocos nucifera	niu		√	√	√	√	√	√	√	√		√	√	√
Codyline fruticosa	Ti vao					√		√		√				√
Colocasia esculenta	taro		√							√				√
Colubrina asiatica	fisoa	√	√			√	√	√	√	√	√	√		√
Commelina diffusa									√					
Crewia crenata										√	√	√		
Cyathea lunulata	olioli						√						√	√
Cytandra samoense										√		√		
Davalia solida	lauga sesē	√					√							
Dendrolobium umbellatum	laulala			√				√	√	√		√		
Derris malaccensis	Ava niukini									√	√			√
Dioscorea bulbifera						√	√	√		√	√	√		√
Diospyros samoensis	auauli	√					√	√			√			√
Drancondomelon dao				√			√							
Dysoxylum samoensis	Maota mamala					√	√		√	√		√	√	√
Elattostachys apetala	taputoi							√		√		√		
Epiprenum pinnatum	Tuafaga/fuelaufao					√		√		√				√

Eragrostis tenella	common roadside weed		√											
Fagraea beteroana	pualulu									√				
Falcataria molucanna	tamaligi pa'epa'e	√		√	√	√	√	√	√	√	√	√		√
Faradaya amicorum	mamalupe					√						√		√
Ficus obliqua	aoa							√						
Ficus scabra	mati mageso						√			√				
Ficus tinctoria	mati	√	√			√	√	√	√	√	√	√	√	√
Flacourtia rukam										√				
Fluggea flexuosa	poumuli													√
Freycinertia ctockii	Tree climber					√								
Funtumia elastica	Pulu vao													
Garica papaya	esi		√											√
Garuga floribunda	magaui					√					√			
Geniostoma rupestre	taipoipo/laumafatifati								√	√	√			√
Glochidion ramiflorum	masame			√			√			√		√		
Grewia crenata	(understory spp)					√								
Hernandia nymhaefolia	pu'a								√	√	√			
Hibiscus manihot	lau pele		√											
Hibiscus tiliaceous	beach hibiscus, fau	√	√	√	√	√	√	√	√	√	√	√	√	√
Homolanthus nutans											√	√	√	
Hoya australis	Lau mafiafia/lauolive						√			√				
Humata banksia	Polynesia humata fern			√										√
Inocarpus fagifer	ifi							√	√	√	√	√		√
Intsia bijuga	ifilele					√	√	√			√			
Ipomea micrantha	fue					√					√	√		√
Ipomea perscarprae	fuemoa					√		√		√			√	√
Ixora samoensis	filofiloa					√								
Kleinhovia hospita	fu'afu'a	√	√	√	√	√		√		√			√	√
Kyllinga polyphylla											√			√
Lantana camara	latana			√					√				√	
Lucaena leucocephala	lusina												√	
Leucosyke corymbulosa	alaalatoa							√				√		
Macaranga harveyana	lau pata	√	√	√	√	√	√	√	√	√		√	√	√
Mangifera indica										√	√	√	√	√
Mangifera minor	mango		√	√		√	√	√	√		√	√		√
Miconia crenata	laumamoe			√			√	√						
Microsorum grossum	Lauauta/alolima)			√		√	√	√	√	√		√	√	√
Mikania micranthra	fue saina		√			√	√	√	√	√	√	√		√
Mimosa invisa									√		√		√	
Morinda citrifolia	nonu	√	√	√	√	√	√	√		√	√	√	√	√
Mucuna gigantea	tupe/tifa							√			√			
Musa spp	fa'i		√							√				√
Myristica fatua	atone					√						√		
Neiosperma oppositifolium	fao							√						
Neonauclea forsteri	afa								√			√		
Nethrolepis hirstula	vaotuaniu					√			√					√

Opeculina diffusa			√			√				√	√		√	√
Oplimimenus compositus	sefa (I)	√												
Oxalis corniculata											√			
Pandanus tectorius	fasa						√		√	√				√
Paspalum conjugatum	vaolima						√							
Planchonella garberi	ala'a			√			√		√			√	√	
Paratrophis anthropophagorum	(ficus-like tree)			√										
Passiflora foetida	Pasio vao			√			√	√	√		√	√	√	√
Passiflora suberosa	Pasio			√		√								
Pipturus argenteus										√	√	√	√	
Premna serratifolia											√			
Psidium guajava	kuava						√			√				
Psilotum nutans	fern												√	
Psychotria insularum									√					
Pteris tripartita							√							
Pueraria montana	A'a												√	
Pyrrosia serpens	lautasi	√										√		
Rhus taitensis	tavai						√	√	√	√		√	√	√
Samanea saman	monkey pod	√	√	√	√									
Santalum alba	asi manogi						√							
Scaevola taccada	toitoi								√					
Sida rhombifolia									√					
Stachytarpheta urticifolia							√		√					√
Sterculia fanahio										√				
Syzygium clusifolium	asi vai/asi vao			√							√	√		
Tectaria dissecta	terrestrial fern	√				√								
Terminalia catappa	talie		√	√	√			√	√	√	√	√	√	
Terminalia richii	malili													√
Thespesia populnea	milo									√				
Zingerber zerumbet	avapui						√		√			√		√

APPENDIX 3: LIST OF DICOTYLEDONS RECORDED

Family	Samoan	Species	Status	Habit
1. Acanthaceae		*Blechum pyramidatum*	Introduced	Herb
		Justicia betonica	Introduced	Shrub
		Justicia procumbens	Introduced	Herb
		Pseuderanthemum carruthersii	Introduced	Herb
	Vaouli	*Ruellia prostrata*	Introduced	Herb
2. Agavaceae		*Dracaena angustifolia*	Introduced	Shrub
3. Amaranthaceae	Tamatama	*Achyranthes aspera*	Introduced	Herb
		Alternanthera sessilis	Introduced	Herb
		Amaranthus spinosus	Introduced	Herb
		Amaranthus viridis	Introduced	Herb
4. Anacardiaceae		*Drancondomelon vitiense*	Introduced	Tree
	Tavai	*Rhus taitensis*	Native	Tree
5. Anonaceae	Mosooi	*Cananga odorata*	Introduced	Tree
6. Apocynaceae	Lava/Gau	*Alyxia stellata*	Native	Shrub
		Asclepias curassavica	Introduced	Herb
	Leva	*Cerbera manghas*	Native	Tree
	Puluvao	*Funtumia elastica*	Introduced	Tree
	Laumafiafia/Fueselela	*Hoya australis*	Native	Vine
	Fao	*Ochrosia oppositifolia*	Native	Tree
	Pua fiti	*Plumeria rubra*	Introduced	Tree
7. Araliaceae	Tagitagi	*Polyscias filicifolia*	Introduced	Shrub
	Tagitagi	*Polyscias fruticosa*	Introduced	Shrub
8. Asteraceae		*Ageratum conyzoides*	Introduced	Herb
		Bidens alba	Introduced	Herb
		Crassocephallum crepidioides	Introduced	herb
		Emilia forsbergii	Introduced	Herb
	Fuesaina	*Mikania micrantha*	Introduced	Vine
	Vaoelefane	*Pseudelephantopus spicatus*	Introduced	Herb
	Taeoti	*Synedrella nodiflora*	Introduced	Herb
	Taeoti	*Tridax procumbens*	Introduced	Herb
		Vernonia cinerea	Introduced	Herb
9. Asteraceae		*Sphagneticola trilobata*	Introduced	Herb
	Aamia	*Sigesbeckia orientalis*	Introduced	Herb
	Ateate	*Wollastonia biflora*	Introduced	Herb
10. 3 Bignoniaceae	Futu	*Barringtonia asiatica*	Native	Tree
	Falaga	*Barrintonia samoense*	Native	Tree
11. Brassicaceae	Aatasi	*Rorippa sarmentosa*	Introduced	Herb
13. Burseraceae	Manaui	*Garuga floribunda*	Native	Tree

14. Calophyllaceae	Fetau	*Calophyllum inophyllum*	Native	Tree
13. Cannabaceae	Magele	*Trema andersonii*	Native	Tree
14. Cannaceae	Fanamanu	*Canna indica*	Introduced	Herb
15. Capparaceae	Esi	*Carica papaya*	Introduced	Tree
		Drymaria cordata	Introduced	Herb
16. Ceratophyllaceae		*Cleome viscosa*	Introduced	Herb
17. Combretaceae	Talie	*Terminalia catappa*	Native	Tree
	Malili	*Terminalia richii*	Native (E)	Tree
18. Convolvulaceae		*Operculina ventriosa*	Native	Vine
	Fuemoa	*Ipomoea pes-caprae*	Native	Vine
19. Cucurbitaceae		*Coccinia grandis*	Introduced	Vine
	Sanatoto/Melenivao	*Momordica charantia*	Introduced	Vine
20. Ebenaceae	Auauli	*Dyospyros samoensis*	Native	Tree
21. Euphorbiaceae		*Acalypha alopecuroidea*	Introduced	Herb
		Acalypha indica	Introduced	Herb
	Lama	*Aleurites moluccana*	Introduced	Tree
	Lauulu	*Codiaeum variegatum*	Introduced	Shrub
		Acalypha lanceolata	Introduced	Herb
		Euphorbia chamissonis	Introduced	Herb
		Euphorbia heterohylla	Introduced	Herb
	Apulupulu	*Euphorbia hirta*	Introduced	Herb
	Apulupulu tai	*Euphorbia hypericifolia*	Introduced	Herb
	Laupata	*Macaranga harveyana*	Native	Tree
	Mamala	*Homalanthus nutans*	Native	Tree
22. Fabaceae	Matamoso	*Abrus precatorius*	Native	Vine
	Lopa	*Adenanthera pavonina*	Introduced	Tree
	Tamaligi uliuli	*Albizia chinensis*	Introduced	Tree
	Tamaligi paepae	*Falcataria moluccana*	Introduced	Tree
		Alysicarpus vaginalis	Introduced	Herb
		Canavalia cathartica	Native	Vine
		Canavalia rosea	Native	Vine
		Centrosema molle	Introduced	Vine
		Crotalaria incana	Introduced	Herb
		Crotalaria pallida	Introduced	Herb
	Laulala	*Dendrolobium umbellatum*	Native	Shrub
	Ava niukini	*Derris trifoliata*	Native	Vine
		Desmodium incanum	Introduced	Subshrub
	Ifilele	*Intsia bijuga*	Native	Tree

22. Fabaceae	Gatae	*Erythrina fusca*	Native	Tree	77
		Grona triflora	Introduced	Herb	78
	Ifi	*Inocarpus fagifer*	Introduced	Tree	79
		Lablab purpureus	Introduced	Herb	80
	Lusina/Fuapepe	*Leucaena leucocephala*	Introduced	Tree	81
		Macroptilium lathyroides	Introduced	Herb	82
	Vaofefe tele	*Mimosa diplotricha*	Introduced	Herb	83
	Vaofefe	*Mimosa pudica*	Introduced	Herb	84
	Tupe/Tifa	*Mucuna gigantea*	Native	Vine	85
		Mucuna glabra	Native	Vine	86
	A'a	*Pueraria montana*	Introduced	Vine	87
		Senna accidentalis	Introduced	Shrub	88
		Senna sophera	Introduced	Herb	89
	Laupinati	*Senna tora*	Introduced	Herb	90
	Fuefuesina	*Vigna marina*	Native	Vine	91
23. Gentiaceae	Pualulu	*Fagraea berteroana*	Native	Tree	92
24. Gesneriaceae		*Cytandra samoensis*	Native (E)	Shrub	93
25. Goodeniaceae	Toitoi	*Scaevola taccada*	Native	Shrub	94
26. Hernandiaceae	Pu'a	*Hernandia nymphaefolia*	Native	Tree	95
27. Lamiaceae		*Clerodendrum bucananii*	Introduced	Shrub	96
	Vaomigi	*Hyptis capitata*	Introduced	Herb	97
		Mesosphaerum pectinatum	Introduced	Herb	98
	Mamalupe	*Oxera amicorum*	Native	Vine	99
	Aloalo	*Premna serratifolia*	Native	Shrub	100
	Mautofu tai	*Salvia occidentalis*	Introduced	Herb	101
	Pate	*Solenostemon scutellarioides*	Introduced	Herb	102
	Mautofu tai	*Teucrium vesicarium*	Introduced	Herb	103
28 Lauraceae	Fetai	*Cassytha filiformis*	Native	Vine	104
	Tinamoni	*Cinnamomum verum*	Introduced	Tree	
29. Loganiaceae	Taipoipo/Laumafatifati	*Geniostoma rupestre*	Native	Tree	
30. Malvaceae	Mao ui	*Crewia crenata*	Native	Tree	
	Fau	*Hibiscus tiliaceaus*	Native	Tree	
	Mautofu	*Malvastrum coromandelianum*	Introduced	Shrub	
	Aute	*Hibiscus rosa sinensis*	Introduced	Shrub	
	Mautofu	*Sida acuta*	Introduced	Shrub	
	Mautofu	*Sida rhombifolia*	Introduced	Shrub	
	Milo	*Thespesia populnea*	Native	Tree	
	Fanaio	*Sterculia fanaiho*	Native	Tree	
31. Melastomaceae		*Heterotis rotundifolia*	Introduced	Herb	
		Medinilla samoensis	Native	Shrub	
	Laumamoe	*Miconia crenata*	Introduced	Shrub	
32. Meliaceae	Maota/Tufaso	*Dyxoxylum maota*	Native	Tree	
	Maota mamala	*Dysoxylum samoense*	Native (E)	Tree	
	Sila	*Melia azedarach*	Introduced	Tree	

33.	Moraceae	Ulu	*Artocarpus altilis*	Introduced	Tree	
		Pulumamoe	*Castilla elastica*	Introduced	Tree	
		Aoa	*Ficus obliqua*	Native	Tree	
		Pulu lau mumu	*Ficus elastica*	Introduced	Tree	
		Aoa	*Ficus prolixa*	Native	Tree	
		Mati mageso	*Ficus scabra*	Native	Tree	
		Mati ata	*Ficus tinctoria*	Native	Tree	
		Mati lautaliga	*Ficus uniauriculata*	Native (E)	Tree	
			Paratrophis anthropophagorum	Native	Tree	
34.	Myrtistaceae	Atone	*Myristica inutilis*	Native	Tree	
		Kuava	*Psidium guajava*	Introduced	Tree	
		Asivai	*Syzygium clusifolium*	Native	Tree	
35..	Orchidaceae		*Coelogyne lycasdoides*	Native	Orchid	
			Dendrobium dactylodes	Native	Orchid	
			Phreatia inversa	Native	Orchid	
			Spathoglottis plicata	Native	Orchid	
36.	Onagraceae		*Ludwigia octovalvis*	Introduced	Herb	
			Oxalis barrelieri	Introduced	Herb	
		l'i	*Oxalis corniculata*	Introduced	Herb	
37.	Passifloraceae	Pasiovao	*Passiflora foetida*	Introduced	Vine	
		Pasio	*Passiflora laurifolia*	Introduced	Vine	
		Pasiovao	*Passiflora suberosa*	Introduced	Vine	
38.	Phyllanthaceae	Poumuli	*Flueggea flexuosa*	Introduced	Tree	
			Phyllanthus amarus	Introduced	Herb	
			Phyllanthus debilis	Introduced	Herb	
39.	Piperaceae		*Peperomia pellucida*	Introduced	Herb	
		Avaaitu sosolo	*Piper macropiper*	Native	Vine	
40.	Plantaginaceae	Namupululole	*Polygala paniculata*	Introduced	Herb	
41.	Portulaceae	Tamole tai	*Portulaca oleracea*	Introduced	Herb	
42.	Primulaceae	Togo vao	*Ardisia elliptica*	Introduced	Shrub	
			Maesa tabacifolia	Native	Tree	
43.	Rhamnaceae	Toi	*Alphitonia zizyphoides*	Native	Tree	
		Fisoa	*Colubrina asiatica*	Native	Shrub	
44.	Rubiaceae	Aso/Olamea	*Aidia cochinchiensis*	Native	Shrub	
		Filofiloa	*Ixora amplifolia*	Native (E)	Tree	
		Nonu	*Morinda citrifolia*	Introduced	Tree	
		Afa	*Neonauclea forsteri*	Native	Tree	
		Matalafi	*Phychotria insularum*	Native	Tree	
			Spermacoce assurgens	Introduced	Herb	
			Spermacoce remota	Introduced	Herb	
45.	Rutaceae	Filimoto	*Flacourtia rukam*	Native	Tree	
46.	Sapindaceae		*Allophylus timoriensis*	Native	Tree	
		Taputoi	*Elattostachys apetala*	Native	Tree	
			Harpullea arborea	Native	Tree	
47.	Sapotaceae	Alaa	*Planchonella garberi*	Native	Tree	
			Planchonella grayana	Native	Tree	
48.	Solanaceae	Vine vao	*Physalis angulata*	Introduced	Herb	

	Polo feu	*Capsicum frutescens*	Introduced	Herb	
49. Urticaceae	Alaalatoa	*Leucosyke corymbulosa*	Native	Shrub	
		Laportea ruderalis	Native	Herb	
	Soga	*Pipturus argenteus*	Native	Tree	

50. Verbenaceae		*Clerodendrum buchananii*	Introduced	Shrub
	Latana	*Lantana camara*	Introduced	Shrub
		Stachytarpheta australis	Introduced	Shrub
		Stachytarpheta jamaicensis	Introduced	Shrub

APPENDIX 4: LIST OF MONOCOTYLEDONS RECORDED

1. Amaryllidaceae	Teve	*Amorhpophallus paeoniifolius*	Introduced	Herb
2. Arecaceae	Tuafaga/Fuelaufao	*Raphidophora graeffei*	Native (E)	Vine
	Tivao	*Cordyline fruticosa*	Native	Shrub
	Niu	*Cocos nucifera*	Introduced	Palm
3. Cannaceae	Mauutoga	*Commelina diffusa*	Introduced	Herb
4. Cyperaceae		*Cyperus aromaticus*	Introduced	Sedge
		Cyperus brevifolia	Introduced	Sedge
		Cyperus compressus	Introduced	Sedge
		Cyperus rotundus	Introduced	Sedge
		Cyperus mindorensis	Introduced	Sedge
		Cyperus pilosus	Introduced	Sedge
		Fimbristylis cymosa	Native	Sedge
5. Dioscoreaceae	Soi	*Dioscorea bulbifera*	Introduced	Vine
		Dioscorea pentaphylla	Introduced	Vine
6. Musaceae	Fai	*Musa spp*	Introduced	Vine
7. Pandanaceae	Lauieie	*Freycinetia reineckei*	Native (E)	Tree climber
	Fasa	*Pandanus tectorius*	Native	Tree like
	Paogo	*Pandanus whitmeeanus*	Introduced	Tree like
	Laufala	*Pandanus sp*	Introduced	Tree like

8. Poaceae		*Axonopus compressus*	Introduced	Grass
		Cenchrus purpureus	Introduced	Grass
	Sefa	*Centotheca lappacea*	Native	Grass
	Mumuta	*Chloris barbata*	Introduced	Grass
	Fugafuga mutia	*Chrysopogon aciculatus*	Introduced	Grass
	Taataa	*Cynodon dactylon*	Introduced	Grass
		Dactyloctenium aegyptium	Introduced	Grass
		Digitaria ciliaris	Introduced	Grass
		Digitaria horizontalis	Introduced	Grass
	Taataa	*Elusine indica*	Introduced	Grass
		Eragrostis pilosa	Introduced	Grass
		Ischaemum aristatum	Introduced	Grass
		Lepturus repens	Native	Grass
		Megathysus maximus	Introduced	Grass
	U/Fiso	*Miscanthus floribundus*	Native	Grass
	Sefa	*Oplismenus compositus*	Introduced	Grass
	Vaolima	*Paspalum conjugatum*	Introduced	Grass
		Paspalum paniculatum	Introduced	Grass
		Paspalum scrobiculatum	Introduced	Grass

		Paspalum setaceum	Introduced	Grass
	Vaomageso	*Setaria palmifolia*	Introduced	Grass
		Setaria pumila	Introduced	Grass
		Sporobolus diandrus	Introduced	Grass
		Urochola distachya	Introduced	Grass
		Urochola distachy	Introduced	Grass
		Urochloa mutica	Introduced	Grass
		Urochloa reptans	Introduced	Grass
9. Zingiberaceae		*Costus speciosus*	Introduced	Herb
	Masoa	*Tacca leontopetaloides*	Native	Herb
	Avapui/Faua povi	*Zingiber zerumbet*	Introduced	Herb
	Teuila mumu	*Alpinia purpurata*	Introduced	Herb
10. Angiopteridaceae	Gase	*Antiopteris evecta*	Native	Terrestrial fern

APPENDIX 5: LIST OF FERN SPECIES IDENTIFIED

1.	Aspleniaceae	Laugapapa	*Asplenium nidus*	Native	Fern
2.	Cyathaceae	Olioli	*Cyathea lunulata*	Native	Tree Fern
3.	Davalliaceae	Laugasese	*Davallia solida*	Native	Fern
		Laugasese	*Davallia heterophylla*	Native	Fern
			Humata serrata	Native	Fern
4.	Gleicheniaceae	Asaua	*Dicranopteris linearis*	Native	Fern
5.	Polypodiaceae		*Microsorum grossum*	Native	Fern
			Microsorum commutatum	Native	Fern
		Lautasi	*Pyrrosia serpens*	Native	Fern
6.	Pteridaceae		*Pteris tripartita*	Native	Fern
7.	Thelypteridaceae		*Sphaerostephanos invisus*	Native	Fern

APPENDIX 6: BIRD SPECIES RECORDED IN EACH ECR-SSP SITE

Site 1 (CHAINAGE: 460M TO 600M, LETOGO): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status** (**endemic, native, invasive**)
1	Polynesian Starling	*Aplonis tabuensis*	Fuia Vao	Native
2	Banded Rail	*Gallirallus philippensis*	Ve'a	Native
3	White Tern	*Gygis alba*	Manusina	Native
4	Pacific Pigeon	*Ducula pacifica*	Lupe	Native
5	Common Mynah	*Acridotheres tristis*	Maina fanua	Introduced
6	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
7	Reef Heron	*Egretta sacra*	Matu'u	Native
8	Crimson crowned dove	*Ptilinopus porphyraceus*	Manutagi	Native
9	Samoan Starling	*Aplonis atrifusca*	Fuia	Endemic
10	White rumped swiftlet	*Aerodramusspodiopygius*	Pe'ape'a	Native
11	Flat billed kingfisher	*Todirhamphusrecurvirostris*	Ti'otala	Endemic
12	Polynesian triller	*Lalagemaculosa*	Miti tai	Native
13	Watt led honeyeater	*Foulehalocarunculata*	Iao	Native
14	Red vented bulbul	*Pycnonotuscafer*	Manu palagi	Introduced
15	Cardinal honeyeater	*Myzomela cardinalis*	Segasegamau'u	Native
16	Pacific Golden Plover	*Pluvialis fulva*	Tuli	Native
17	Pacific Pigeon	*Ducula pacifica*	Lupe	Native
18	Blue- crowned Lory	*Vini australis*	Segavao	Native

Site 2 (CHAINAGE 1,270 TO 1,305M, LETOGO TO LAULII): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status** (**endemic, native, invasive**)
1	Pacific Pigeon	*Ducula pacifica*	Lupe	Native
2	Common Mynah	*Acridotheres tristis*	Maina fanua	Introduced
3	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
4	Red vented bulbul	*Pycnonotuscafer*	Manu palagi	Introduced
5	Watt led Honeyeater	*Foulehalocrunculata*	I'ao	Native
6	Crimson crowned dove	*Ptilinopus porphyraceus*	Manutagi	Native
7	Banded Rail	*Gallirallus philippensis*	Ve'a	Native
8	Samoa Flying Fox	*Pteropus samoensis*	Pea vao	Native
9	Polynesian Starling	*Aplonis tabuensis*	Fuia vao	Native
10	Samoan Starling	*Aplonis atrifusca*	Fuia	Endemic
11	Feral Pigeon	*Columba livia*	Lupe palagi	Introduced
12	Polynesian Triller	*Lalage maculosa*	Miti tai	Native
13	Pacific Golden Plover	*Pluvialis fulva*	Tuli	Native

14	White Tern	*Gygis alba*	Manusina	Native
15	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamau'u	Native
16	Flat-billed Kingfisher	*Todirhamphus recurvirostris*	Tiotala	Endemic

Site 3 (CHAINAGE 1325 TO 1485M): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status** (**endemic, native, invasive**)
1	White Tern	*Gygis alba*	Manusina	Native
2	Samoa Flying Fox	*Pteropus samoensis*	Pe'a vao	Native
3	Polynesian Starling	*Aplonis tabuensis*	Fuia vao	Native
4	Samoan Starling	*Aplonis atrifusca*	Fuia	Endemic
5	Reef Heron	*Egretta sacra*	Matu'u	Native
6	Pacific Golden Plover	*Pluvialis fulva*	Tuli	Native
7	Polynesian Triller	*Lalage maculosa*	Miti tai	Native
8	Pacific Pigeon	*Ducula pacifica*	Lupe	Native
9	White-rumped swiftlet	*Aerodramus spodiopygius*	Peapea	Native
10	Brown Noddy	*Anous stolidus*	Gogo	Native
11	Crimson crowned dove	*Ptilinopus porphyraceus*	Manutagi	Native
12	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
13	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
14	Watt led Honeyeater	*Foulehalocrunculata*	Iao	Native
15	Blue- crowned Lory	*Vini australis*	Sega vao	Native
16	Banded Rail	*Gallirallus philippensis*	Ve'a	Native

Site 4 (CHAINAGE 1,275 TO 1,780): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status** (**endemic,native, invasive**)
1	Watt led Honeyeater	*Foulehalocrunculata*	Iao	Native
2	Crimson crowned dove	*Ptilinopus porphyraceus*	Manutagi	Native
3	White-rumped swiftlet	*Aerodramus spodiopygius*	Peapea	Native
4	Samoan Starling	*Aplonis atrifusca*	Fuia	Endemic
5	White Tern	*Gygis alba*	Manusina	Native
6	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Native
7	Pacific Pigeon	*Ducula pacifica*	Lupe	Native
8	Polynesian Triller	*Lalage maculosa*	Miti tai	Native
9	Red vented bulbul	*Pycnonotuscafer*	Manu palagi	Introduced
10	Polynesian Starling	*Aplonis tabuensis*	Fuia vao	Native
11	Samoa Whistler	*Pachycephala flavifrons*	Vasavasa	Native
12	White-throated Pigen	*Columba vitiensis*	Fiaui	Native
13	Samoan Broadbill	*Myiagra albiventris*	Tolaifatu	Native

Site 5 : (CHAINAGE 3,920 TO 3,970M LEUSOALII): Bird species recorded

	Common Name	Scientific Name	Samoan Name	Status (endemic,native, invasive)
1	Samoan Starling	*Aplonis atrifusca*	Fuia	Endemic
2	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
3	Watt led Honeyeater	*Foulehaio carunculata*	Iao	Native
4	Crimson crowned dove	*Ptilinopus porphyraceus*	Manutagi	Native
5	Pacific Pigeon	*Ducula pacifica*	Lupe	Native
6	Samoa Whistler	*Pachycephala flavifrons*	Endemic	Native
7	White-rumped swiftlet	*Aerodramus spodiopygius*	Peapea	Native
8	Polynesian Triller	*Lalage maculosa*	Miti tai	Native
9	Blue- crowned Lory	*Vini australis*	Segavao	Native
10	Polynesian Starling	*Aplonis tabuensis*	Fuia vao	Native
11	Banded Rail	*Gallirallus philippensis*	Ve'a	Native
12	White Tern	*Gygis alba*	Manusina	Native
13	Flat-billed Kingfisher	*Todirhamphus recurvirostris*	Tiotala	Endemic
14	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native

Site 6 (CHAINAGE 4,220 TO 4,330M, LEUSOALII): Bird species recorded

	Common Name	Scientific Name	Samoan Name	Status (endemic,native, invasive)
1	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
2	Red vented bulbul	*Pycnonotuscafer*	Manu palagi	Introduced
3	Cardinal Honeyeater	*Myzomela cardinalis*	Segaegamauu	Native
4	Pacific Golden Plover	*Pluvialis fulva*	Tuli	Native
5	Samoan Broadbill	*Myiagra albiventris*	Tolaifatu	Native
6	Polynesian Triller	*Lalage maculosa*	Miti tai	Native
7	White-rumped swiftlet	*Aerodramus spodiopygius*	Peapea	Native
8	Samoan Starling	*Aplonis atrifusca*	Fuia	Endemic
9	Watt led Honeyeater	*Foulehaio carunculata*	Iao	Native
10	Crimson crowned Fruit dove	*Ptilinopus porphyraceus*	Manutagi	Native
11	Brown Noddy	*Anous stolidus*	Gogo	Native
12	White Tern	*Gygis alba*	Manusina	Native
13	Reef Heron	*Egretta sacra*	Matu'u	Native
14	Flat-billed Kingfisher	*Todirhamphus recurvirostris*	Tiotala	Endemic

Site 7 (CHAINAGE 6,680 TO 6,750M, LOTUANUU): Bird species recorded

	Common Name	Scientific Name	Samoan Name	Status (endemic,native, invasive)
1	Red vented bulbul	*Pycnonotus cafer*	Manu palagi	Introduced

2	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
3	Polynesian Triller	*Lalage maculosa*	Miti tai	Native
4	Samoan Starling	*Aplonis atrifusca*	Fuia	Endemic
5	Brown Booby	*Sula leucogaster*	Fua'o	Native
6	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
7	Blue-crowned Lory	*Vini australis*	Segavao	Native
8	Wattled Honeyeater	*Foulehaio carunculata*	Iao	Native
9	White Tern	*Gygis alba*	Manusina	Native
10	Pacific Pigeon	*Ducula pacifica*	Lupe	Native
11	Samoa whistler	*Pachycephla flvifrons*	Vasavasa	Native
12	Samoan Broadbill	*Myiagra albiventris*	Tolaifatu	Native
13	Banded Rail	*Gallirallus philippensis*	Ve'a	Native
14	White Tern	*Gygis alba*	Manusina	Native
15	Brown Noddy	*Anous stolidus*	Gogo	Native
16	Pacific Golden Plover	*Pluvialis fulva*	Tuli	Native

Site 8 (CHAINAGE 7,280 TO 7,580): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status (endemic, native, invasive)**
1	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
2	Samoa Starling	*Aplonis atrifusca*	Fuia	Introduced
3	Crimson-crowned fruit-dove	*Ptilinopus porphyraceus*	Manutagi	Native
4	Pacific Pigeon	*Ducula pacific*	Lupe	Native
5	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
6	Wattled honeyeater	*Foulehaio caruncilata*	Iao	Native
7	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
8	Polynesian Triller	*Lalage maculosa*	Miti tai	Native
9	Brown Booby	*Sula leucogaster*	Fua'o	Native
10	Brown Noddy	*Anous stolidus*	Gogo	Native
11	White Tern	*Gygis alba*	Manusina	Native
12	Many-coloured fruit-dove	*Ptilinopus perousii*	Manuma	Native
13	Blue-crowned Lory	*Vini australis*	Segavao	Native
14	White-rumped Swiftlet	*Aerodramus spodiopygius*	Peapea	Native

Site 9 (CHAINAGE 8,040 TO 8,450): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status (endemic, native, invasive)**
1	Crimson-crowned Fruit-dove	*Ptilinopus porphyraceus*	Manutagi	Native
2	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
3	Samoa Starling	*Aplonis atrifusca*	Fuia	Endemic
4	Polynesian Triller	*Lalge maculosa*	Miti tai	Native

5	Reef Heron	*Egretta sacra*	Matu'u	Native
6	Red-vented bulbul	*Pycnonotus cafer*	Manu Palagi	Introduced
7	Blue-crowned Lory	*Vini australis*	Segavao	Native
8	Pacific Pigeon	*Ducula pacific*	Lupe	Native
9	Polynesian Starling	*Aplonis tabuensis*	Fuia vao	Native
10	Brown Noddy	*Anous stolidus*	Gogo	Native
11	Fat-billed Kingfisher	*Toirhamphus recurvirostris*	Tiotala	Endemic
12	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native

Site 10 (CHAINAGE 9,000 TO 9,350): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status** (**endemic, native, invasive**)
1	Crimson-crowned Fruit-dove	*Ptilinopus porphyraceus*	Manutagi	Native
2	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
3	Samoan Whistler	*Pachycephala flavifrons*	Vasavasa	Native
4	Pacific Pigeon	*Ducula pacific*	Lupe	Native
5	Reef Heron	*Egretta sacra*	Matu'u	Native
6	Blue-crowned Lory	*Vini australis*	Segavao	Native
7	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
8	White Tern	*Gygis alba*	Manusina	Native
9	Wattled honeyeater	*Foulehaio caruncilata*	Iao	Native
10	Polynesian Triller	*Lalage Maculosa*	Miti tai	Native
11	Red-vented bulllbul	*Pycnonotus cafer*	Manu palagi	Introduced
11	Pacific Golden Plover	*Pluvialis fulva*	Tuli	Native
12	Banded Rail	*Gallirallus philippensis*	Ve'a	Native
13	Polynesian Starling	Aplonis tabuensis	Fuia vao	Native
14	Common mynah	Acridotheres tristis	Maina	Introduced

Site 11 (CHAINAGE 11,740 TO 11,930M): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status** (**endemic,native, invasive**)
1	Pacific Pigeon	*Ducula pacific*	Lupe	Native
2	Crimson-crowned Fruit-dove	*Ptilinopus porphyraceus*	Manutagi	Native
3	Jungle Mynah	*Acridotheres fuscus*	Maina vao	Introduced
4	Wattled honeyeater	*Foulehaio caruncilata*	Iao	Native
5	Reef Heron	*Egretta sacra*	Matu'u	Native
6	Pacific Pigeon	*Ducula pacific*	Lupe	Native
7	White Tern	*Gygis alba*	Manusina	Native
8	Samoa Starling	*Aplonis atrifusca*	Fuia	Endemic
9	Polynesian Starling	Aplonis tabuensis	Fuia vao	Native
10	Brown Noddy	*Anous stolidus*	Gogo	Native
11	Banded Rail	*Gallirallus philippensis*	Ve'a	Native

12	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
13	Flat-billed Kingfisher	*Toirhamphus recurvirostris*	Tiotala	Endemic
14	Blue-crowned Lory	*Vini australis*	Segavao	Native
15	Pacific Golden Plover	*Pluvialis fulva*	Tuli	Native

Site 12: (CHAINAGE 12,030 TO 12,120): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status (endemic,native, invasive)**
1	Jungle Mynah	*Acridotheres fuscus*	Maina vao	
2	Crimson-crowned Fruit-dove	Manutagi	Manutagi	Native
3	White-rumped swiftlet	*Aerodramus spodiopygius*	Peapea	Native
4	Samoa Starling	*Aplonis atrifusca*	Fuia	Endemic
5	Wattled honeyeater	*Foulehaio caruncilata*	Iao	Native
6	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
7	White Tern	*Gygis alba*	Manusina	Native
8	Pacific Pigeon	*Ducula pacific*	Lupe	Native
9	Polynesian Starling	Aplonis tabuensis	Fuia vao	Native
10	Red-vented bulllbul	*Pycnonotus cafer*	Manu Palagi	Introduced
11	Polynesian Triller	*Lalage Maculosa*	Miti tai	Native
12	Many-coloured fruit-dove	*Ptilinopus perousii*	Manuma	Native
13	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
14	Banded Rail	*Gallirallus philippensis*	Ve'a	Native
15	Flat-billed Kingfisher	*Toirhamphus recurvirostris*	Tiotala	Endemic

Site 13 (CHAINAGE 15,320 TO 15,650): Bird species recorded

	Common Name	**Scientific Name**	**Samoan Name**	**Status (endemic, native, invasive)**
1	Crimson-crowned Fruit-dove	Manutagi	Manutagi	Native
2	White-rumped swiftlet	*Aerodramus spodiopygius*	Peapea	Native
3	Samoa Starling	*Aplonis atrifusca*	Fuia	Endemic
4	Wattled honeyeater	*Foulehaio caruncilata*	Iao	Native
5	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
6	Polynesian Starling	Aplonis tabuensis	Fuia vao	Native
7	Red-vented bulllbul	*Pycnonotus cafer*	Manu Palagi	Introduced
8	Polynesian Triller	*Lalage Maculosa*	Miti tai	Native
9	Many-coloured fruit-dove	*Ptilinopus perousii*	Manuma	Native
10	Cardinal Honeyeater	*Myzomela cardinalis*	Segasegamauu	Native
11	Banded Rail	*Gallirallus philippensis*	Ve'a	Native

APPENDIX 7: BIRDS RECORDED IN EACH OF THE CRITICAL ZONES TARGETED BY THE ECR-SSP

	Common English name	**Scientific name**	Samoan name	High Risk Zones												
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1	White rumped swiftlet	*Aerodramusspodiopygius*	Pe'ape'a	√		√		√	√		√				√	√
2	Common Mynah	*Acridotheres tristis*	Maina fanua	√	√								√			
3	Jungle Mynah	*Acridotheres fuscus*	Maina vao	√	√	√	√	√	√	√	√	√	√	√	√	
4	Samoan starling	*Aplonis atrifusca*	Fuia	√	√	√	√	√	√	√		√		√	√	
5	Brown noddy	*Anous stolidus*	Gogo			√			√	√	√	√		√		
6	Polynesian Starling	*Aplonis tabuensis*	Fuia Vao	√	√	√	√	√					√	√	√	√
7	Feral pigeon	*Columba livia*	Lupe palagi		√											
8	White-throated Pigeon	*Columba vitiensis*	Fiaui				√									
9	Pacific Pigeon	*Ducula pacifica*	Lupe	√	√		√	√		√	√			√	√	
10	Reef Heron	*Egretta sacra*	Matu'u	√		√			√				√	√		
11	Wattled honeyeater	*Foulehalocarunculata*	Iao	√	√	√	√	√	√	√	√		√	√	√	
12	White Tern	*Gygis alba*	Manusina	√	√	√	√	√	√	√	√		√	√	√	
13	Banded Rail	*Gallirallus philippensis*	Ve'a	√	√	√		√		√			√	√	√	√
14	Polynesian triller	*Lalagemaculosa*	Miti tai	√	√	√	√	√	√	√	√		√		√	√
15	Cardinal honeyeater	*Myzomela cardinalis*	Segasegamau'u	√	√	√		√	√	√	√	√	√	√	√	√
16	Samoan Broadbill	*Myiagra albiventris*	Tolaifatu				√		√	√						
17	Pacific Golden Plover	*Pluvialis fulva*	Tuli	√	√	√			√	√			√	√		
18	Samoan whistler	*Pachycephala flavifrons*	Vasavasa				√	√		√			√			
19	Samoan Flying fox	*Pteropus samoensis*	Pea vao		√	√										
20	Crimson crowned dove	*Ptilinopus porphyraceus*	Manutagi	√	√	√	√		√		√	√	√	√	√	√
21	Many-coloured fruit-dove	*Ptilinopus perousii*	Manuma								√				√	√
22	Red vented bulbul	*Pycnonotuscafer*	Manu palagi	√	√		√		√	√			√		√	√

23	Brown booby	*Sula leucogaster*	Fua'o							√	√					
24	Flat billed kingfisher	*Todirhamphusrecurvirostris*	Ti'otala	√	√			√	√			√		√	√	
25	Blue-crowned Lory	*Vini australis*	Segavao	√		√		√		√	√		√	√		

Appendix 15: Cadastral Survey Progress Report, 18 Sept 2024

Land Link Services
Macdonald Building
Savalalo; APIA, SAMOA

LAND LINK SERVICES
"Delivering Professional Service on Time"

Telephone: 22427/7660327
Website: www.landlink.ws
Email: llssamoa@gmail.com

05 November 2024

CADASTRAL SURVEY PROGRESS REPORT

Pending the approval of our Land Taking Survey Plans by the Ministry of Lands and Survey (formerly housed under MNRE), I thought it best and timely to provide a summary report highlighting the progress and status of our cadastral survey thus far. This will not only provide answers to some of the queries raised but for our team to be on the same collective understanding of the progress/ status of work relative to the cadastral survey. In this respect, it will serve as a reference by other team members who are preparing to start their side of the work required under this project.

I am aware that we had discussed some parts of this in previous meetings. However, from ongoing email correspondences shared, I've picked up on emails querying the status of the cadastral survey from Laulii to Solosolo and Solosolo to Saoluafata.

Original Scope of Work

Upon the commencement of our cadastral survey for the soil stability project, our task was to;

1. Conduct a survey search from MNRE to obtain road boundary data. (Office work)
2. Enter all existing road boundaries from old survey plans and define a 10m road corridor derived from the existing road for those areas that have not been surveyed to create a legal boundary road data. (CAD work)
3. Locate all old survey marks and transform them from a local datum to a worldwide datum (WGS84). (Fieldwork)
4. Redefine boundary stones and road boundaries.

(Fieldwork) Existing Cadastral Survey Dataset: MNRE

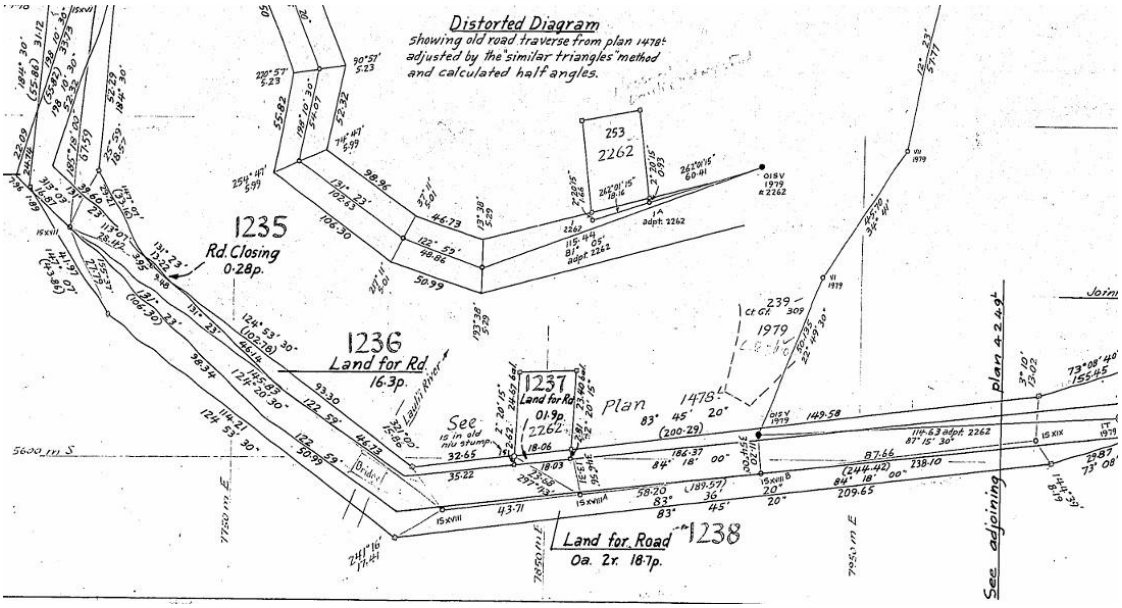
The East Coast Road Survey is a composition of Various Survey Plans. These survey plans were created for the purpose of land taking to maximise the width of East Coast Road, being classified as a Primary Road.

Table 1: presents the extent of these surveys, together with the year of survey and areas that have not been surveyed.

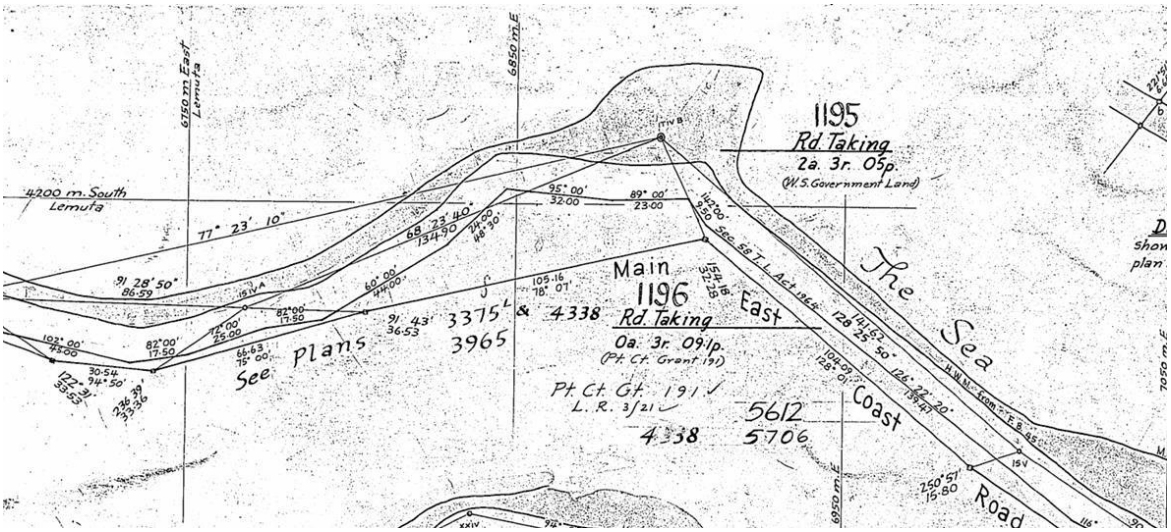
Village Name	Site#	Survey Plan	Year of Survey	Road Legal Description
Letogo	Site 1 -3	4214	1979	Road dedication on Plan 4214
Laulii	Site 4-6	4238	1980	Road dedication on Plan 4238
Laulii	Site 7-9	4249	1980	Road dedication on Plan 4249
Leusoalii	Site 10 -13	4252	1980	Road dedication on Plan 4252
Luatuanuu	Site 14-19c	4304	1980	Road dedication on Plan 4304
Solosolo	Site 20-24	4331	1980	Road dedication on Plan 4331
Solosolo	Site 25	Not surveyed	-	Sec 58 of LT Act 1964
Solosolo	Site 25-28	Not surveyed	-	Sec 58 of LT Act 1964
Eva	Site 29-31	Not surveyed	-	Sec 58 of LT Act 1964
Saoluafata	Site 32	Not surveyed	-	Sec 58 of LT Act 1964

With reference to Survey Plan 4238 below, it is observed that the survey was based on a 20m wide road corridor. As noted, most if not all roads that run through inland areas are seen with a symmetric 20m wide (4238). However, for the costal and hillside areas, we have found that this symmetric 20m wide is not consistent in these areas due to the topography of the sites (refer Plan 4212). Moreover, the hillside is pegged at the most possible position accessible. For the coastal side, the old survey had mostly adopted the Mean High-Water Mark (MHWM) as all parts of the land required for road purposes.

Survey Plan 4238: East Coast Road that run inland of Laulii



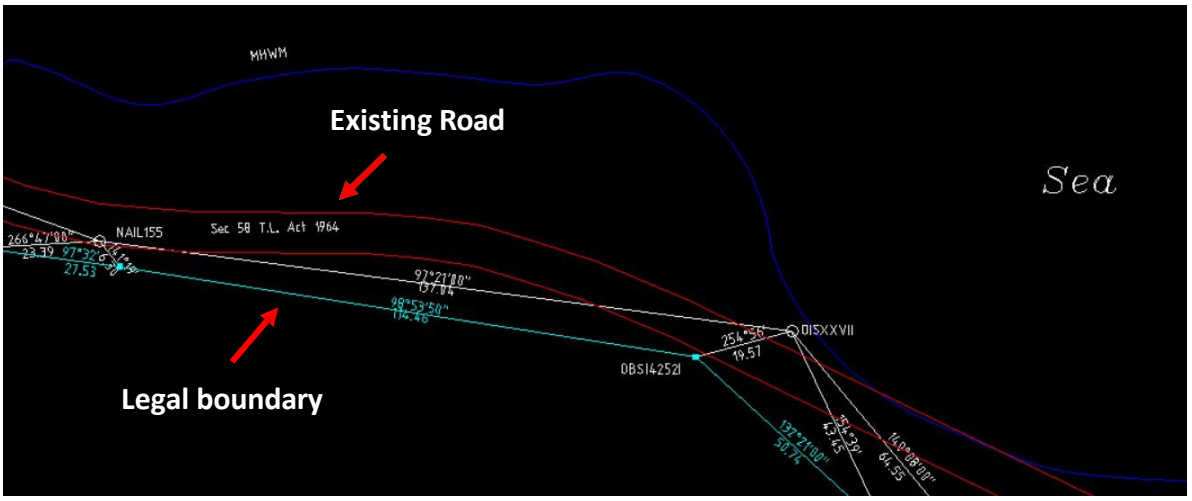
Survey Plan 4212: The East Coast Road at Letogo where the inner side of the road is hilly and the other side is the Mean High-Water Mark (MHWM) area.



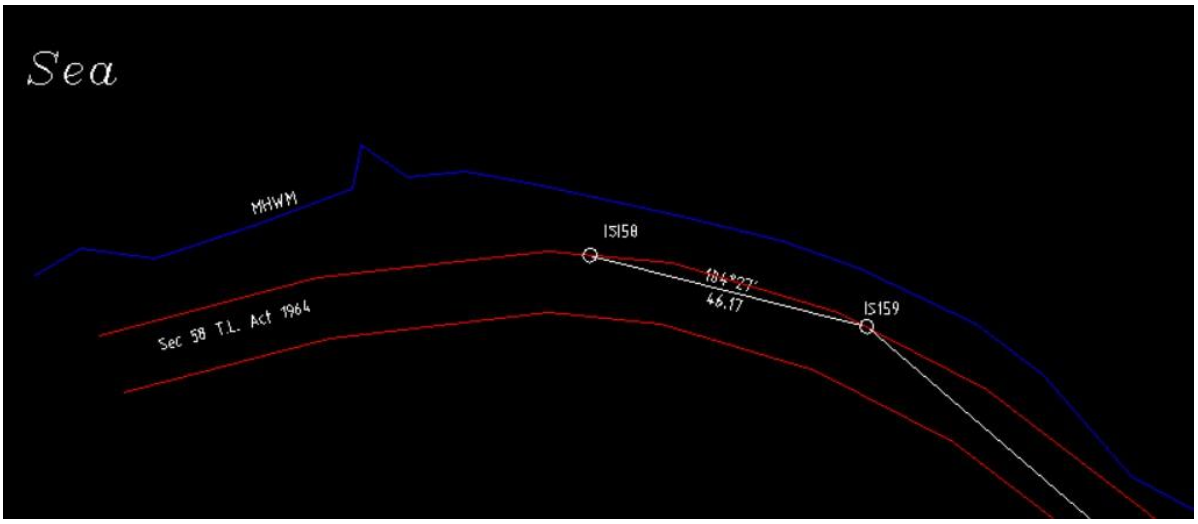
Road Definition

The first Cadastral submission to Kramer Ausenco (Samoa) Ltd and T&T on 6 November 2023 included all sites with existing legal road boundaries from the above survey plans, the Mean High-Water Mark (MHWM), and the existing carriageway all in CAD format. The areas surveyed had dedicated roads on those plans. But for the areas that have yet to be surveyed, the existing road is considered the legal road boundary (Table 1).

Drawing 1: CAD for Survey Plan 4252 (road boundary dedicated on survey plan 4252)



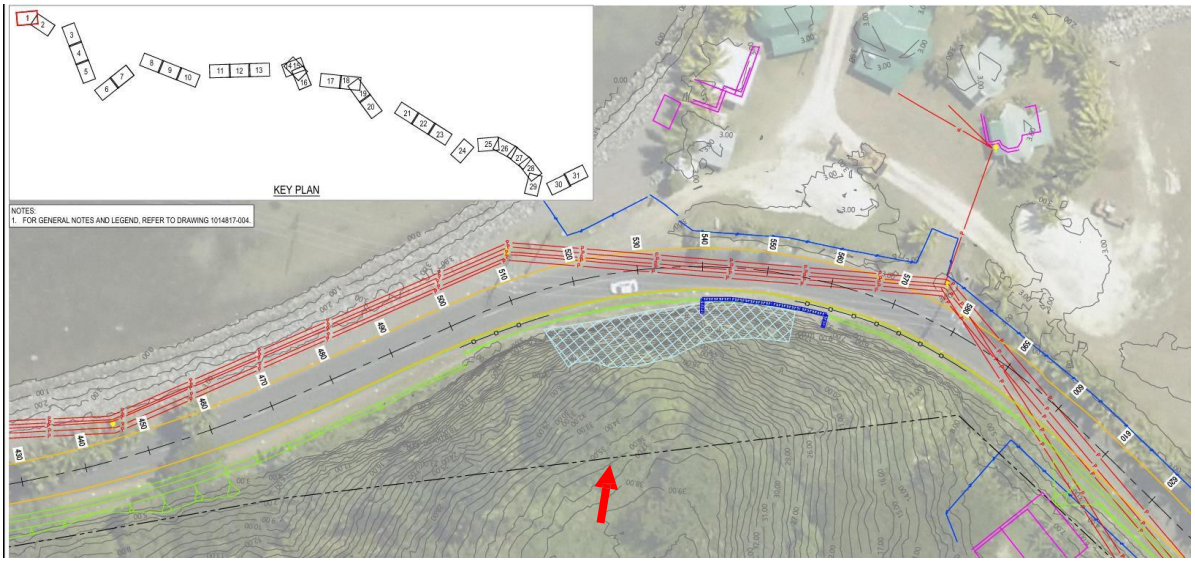
Drawing 2: CAD for Solosolo Site 26-29 (existing road as the road boundary - Section 58 of LT Act 1964)



With the submitted data, T&T overlayed this with the Lidar data together with the proposed design which is shown in our preliminary report (referenced below).

Preliminary Design Report

Drawing 3: Site 1- Boundary shown on Survey Plan 2414 is illustrated with a black pecked line.



Drawing 4: Site 25 - Existing Road as the Boundary illustrated with a black line.

With the preliminary design report from T&T, we observed that all proposed designs were within the road reserve; therefore, were only required to prepare land-taking plans from Solosolo to Saoluafata as these parts of the East Coast Road have yet to be surveyed.

Meeting with MNRE and LTA (21/11/2023)

At our meeting with representatives of MNRE and LTA on 21/11/2023, they had raised a number of issues which majorly affected and impacted the cadastral data that was initially submitted to Kramer Ausenco & T&T in our Preliminary Report. These issues are as follows;

1. MNRE informed that some of the old survey plans were not gazetted which also meant the families were not yet compensated for the land taking survey already done and approved.
2. LTA in response to this informed that according to the World Bank processes, they cannot proceed with the intended work if the compensation for these lands (mentioned by MNRE) have not been executed.

At conclusion of this meeting, MNRE was tasked to confirm all relative information pertaining to the status of compensation of these lands before any further work.

Subsequently, during our site visits and boundary redefinition surveys execution, we observed that a lot of the old survey data had changed overtime in comparison with the current condition of the sites. Incidentally, I had raised this with the MNRE representatives present at the site visits, that it was inaccurate to base compensations of land taking on survey data from 40+ years ago. As a result of this, I was advised by MNRE that their only solution to the challenges raised in our meeting with LTA as well as for the matters raised at the site visit, was for us to proceed with a re-survey for these areas and therefore consider them all as new surveys.

Table 2: Table below presents the Plan Gazette status of existing survey data from MNRE

Village Name	Site#	Survey Plan	Gazette
Letogo	Site 1 -3	4214	yes
Laulii	Site 4-6	4238	no
Laulii	Site 7-9	4249	no
Leusoalii	Site 10 -13	4252	no
Luatuanuu	Site 14-19c	4304	no
Solosolo	Site 20-24	4331	no
Solosolo	Site 25-28	Not surveyed	-
Eva	Site 29-31	Not surveyed	-
Saoluafata	Site 32	Not surveyed	-

In reference to table 2 & 3, with the exception of Site 1-3, all sites from Laulii to Solosolo were now of the same status as the sites form Solosolo to Saoluafata (new surveys). In this respect, all new surveys created will supersede the old survey plans.

Despite the limited timeframe and challenges aforementioned, our team had successfully managed to complete all these plans in a timely manner.

Table 3: Land Taking Survey Plan

Village Name	Site#	Survey Plan	Year of Survey	Road Legal Description
Laulii	Site 4-6	13214	2024	Section 58 of LT Act 1964
Laulii	Site 7-9	13215	2024	Section 58 of LT Act 1964
Leusoalii	Site 10 -13	13216	2024	Section 58 of LT Act 1964
Luatuanuu	Site 14-17	13217	2024	Section 58 of LT Act 1964
Luatuanu'u	Site 18	13218	2024	Section 58 of LT Act 1964
Luatuanu'u	Site 19-20	13219	2024	Section 58 of LT Act 1964
Solosolo	Site 21-24	13220	2024	Section 58 of LT Act 1964
Solosolo	Site 25	13221	2024	Section 58 of LT Act 1964
Eva&Solosolos	Site 26-29	13222	2024	Section 58 of LT Act 1964
Eva	Site 30-31	13223	2024	Section 58 of LT Act 1964
Saoluafata	Site 32	13224	2024	Section 58 of LT Act 1964

Land Taking Survey Plan - First Approach

At the outset in creating these new survey plans, all existing legal road boundaries under Section 58 of LT Act 1964 were defined with a 10m corridor derived from the existing road centreline. As for the new boundary line, the coastal side of the road was extended towards the sea side (Mean High-Water Mark). These areas will not be subject to land taking; however, I have defined them as areas required for the road (Appendix 2). The hilly side on the other hand was pegged in the accessible areas as presented in Drawing 5. Some areas were not accessible incidental to their steepness. Thus, the new boundary line does not follow the existing road sequence but rather cuts through corners in the areas that were accessible for pegging (yellow line). The Magenta line depicts the 20m corridor, however

incidental to the inaccessible steepness for the corners aforementioned (marked below as 'X') the new legal boundary is therefore depicted by the two boundary stones mark in red.

Drawing 5: Survey Site 18 at Luatuanu'u

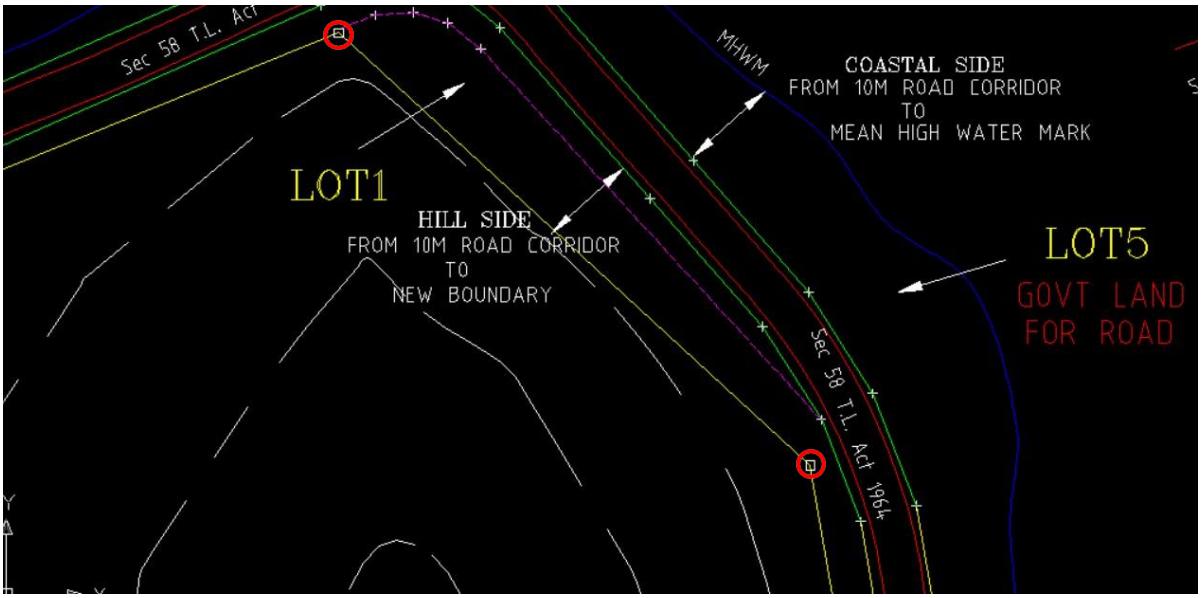
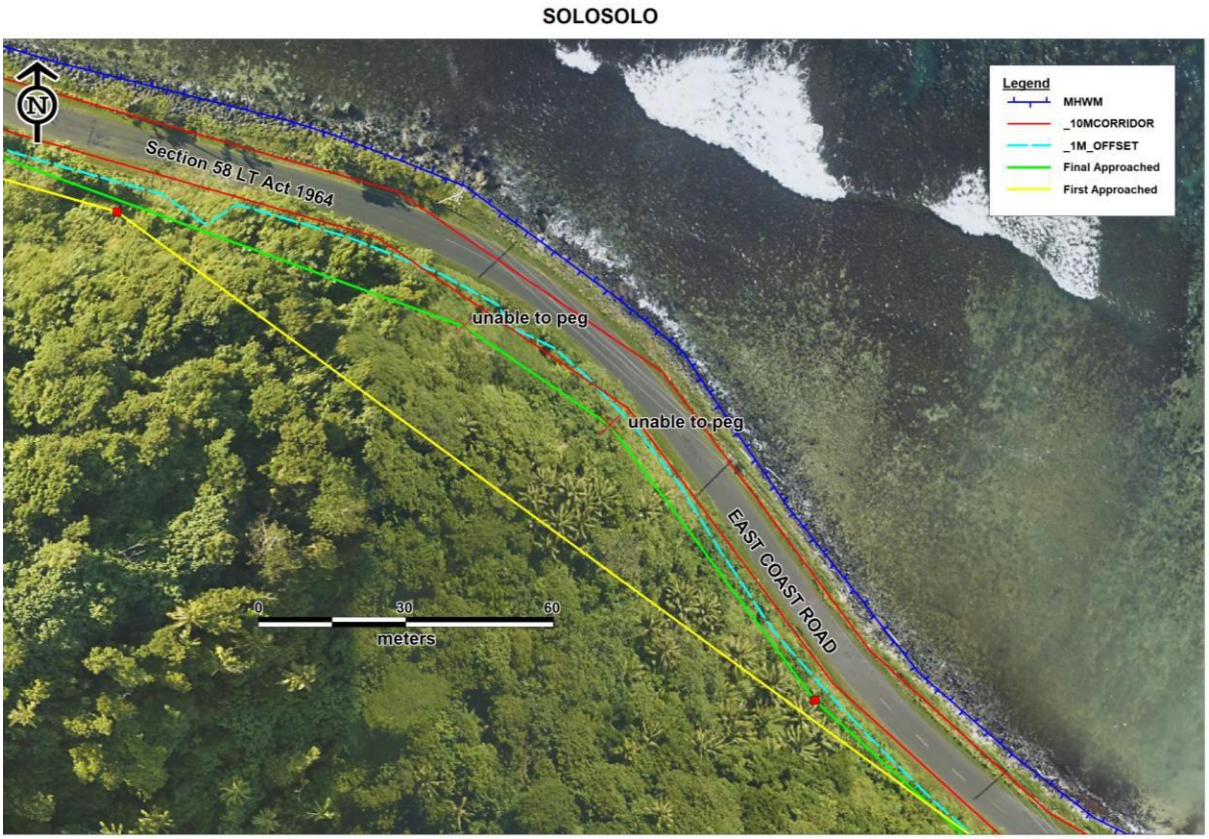


Table 4: Summary of Land Taking for Soil Stability Project

SUMMARY AREA			
DESCRIPTION	**TITLE/REF**	**AREA**	**OWNER**
PT CUST LAND	CUSTOMARY	**10,138m²**	[redacted]
PT CUST LAND	CUSTOMARY	**24,581m²**	[redacted]
		34,719 m²	

The total area for land taking owned by individual Matai (family own) is 24,581m² while 10,138m² is communally owned by Alii and Faipule, totalling an area of 34,719 m². (Note: T&T had queried this initial approach, thus advised to adjust the new boundary accordingly so the design does not encroach the boundary and to ensure the proposed design is within the road reserve). A challenge we faced with this, was it required numerous corner cuts which resulted in large areas for land taking. Nonetheless, the revised approach taking into consideration recommendation from T&T and to satisfy all aspects was to establish the new boundary to follow the sequence of the existing road boundary (10m corridor) with the exception of the corner marked 'X' due to its topography.

Drawing 6: Survey Site 23&24 at Solosolo



The diagram shows the boundary of our first approach and the boundary of our final approach with corner marked 'X' (unable to peg)

Final Approach

Our final approach was to first define the 10m road corridor and added 5m both sides of the defined 10m corridor to obtain a 20m full road corridor. Also overlay a 1m offset of the design and examined any encroachment or overlap on the 20m corridor. With this new boundary, there were a few areas that required adjustment to overcome design encroachment. This approach brings the total area of land to compensate up to 36,231m².

Table 4: Summary of Land Taking for Soil Stability Project

SUMMARY AREA			
DESCRIPTION	**TITLE/REF**	**AREA**	**OWNER**
PT CUST LAND	CUSTOMARY	**12,181m²**	[redacted]
PT CUST LAND	CUSTOMARY	**26,632m²**	[redacted]
		38,813 m²	

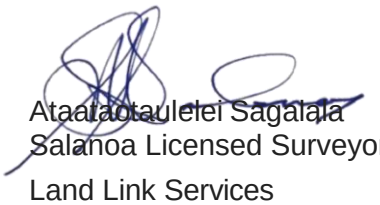
The total area for land taking owned by individual Matai (family own) is 26,632m². A 12,181m² area is communally owned by Alii and Faipule, which sums up to a total of 38,813m². I have attached the revised CAD file presenting the revised areas from that submitted to MNRE with aid of Tables attached as Appendix of this report.

Conclusion

All survey plans for the Land Taking Survey have been completed and submitted to the Ministry of Land and Survey (MLS) formerly under MNRE on 8 July 2024 for assessment and subsequent approval. The revisions presented in this progress report will be addressed and incorporated into the Plans submitted by way of requisitions upon receipt from MLS prior the timely approval.

Summary for the Cadastral Data for Slope Stability Project;

1. The Sites 1 to 3 on survey plan 4214 have already been Gazetted, and no land taking is required due to all the proposed designs being within the road reserve parameters.
2. The Survey Plan 13214 to 13224 supersedes the old survey plan of East Coast Road.
3. The Land Taking Area is calculated from the existing boundary (10m road corridor) to the new boundary.
4. The only roads that run inland areas have a symmetric 20m wide, but for the coastal and hillside areas these have irregular width.



Ataaitaotaulelei Sagalala
Salanoa Licensed Surveyor
Land Link Services

APPENDIX 1 – TABLE OF AREAS OF LAND TAKING

EAST COAST ROAD SLOPE STABILITY - LAND TAKING SURVEY								
SHOWN	DESCRIPTION	TITLE/REF	AREA (m²)	AREA (m²)	VILLAGE	SITE	OWNER	
LOT2	PT CUST LAND	CUSTOMARY	150		LAULII	7, 8 & 9	[redacted]	exclude
LOT3	PT CUST LAND	CUSTOMARY	280		LAULII	7, 8 & 9	[redacted]	exclude
LOT4	PT CUST LAND	CUSTOMARY	202	170	LAULII	7, 8 & 9	[redacted]	
LOT5	PT CUST LAND	CUSTOMARY	203	214	LAULII	7, 8 & 9	[redacted]	
LOT6	PT CUST LAND	CUSTOMARY	138	214	LAULII	7, 8 & 9	[redacted]	
LOT7	PT CUST LAND	CUSTOMARY	105	141	LAULII	7, 8 & 9	[redacted]	
LOT8	PT CUST LAND	CUSTOMARY	125	207	LAULII	7, 8 & 9	[redacted]	
LOT9	PT CUST LAND	CUSTOMARY	166	269	LAULII	7, 8 & 9	[redacted]	
LOT10	PT CUST LAND	CUSTOMARY	366	453	LAULII	7, 8 & 9	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	1586	2302	LEUSOALII	10, 11, 12 & 13	[redacted]	
LOT2	PT CUST LAND	CUSTOMARY	884	842	LEUSOALII	10, 11, 12 & 13	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	810	462	LUATUANU'U	14, 15, 16 & 17	[redacted]	
LOT2	PT CUST LAND	CUSTOMARY	1574	1108	LUATUANU'U	14, 15, 16 & 17	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	2226	1658	LUATUANU'U	18	[redacted]	
LOT2	PT CUST LAND	CUSTOMARY	548	1329	LUATUANU'U	18	[redacted]	
LOT3	PT CUST LAND	CUSTOMARY	345	391	LUATUANU'U	18	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	3240	1830	LUATUANU'U	19 & 20	[redacted]	
LOT2	PT CUST LAND	CUSTOMARY	1656	2105	LUATUANU'U	19 & 20	[redacted]	
LOT3	PT CUST LAND	CUSTOMARY	716	2179	LUATUANU'U	19 & 20	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	5297	2264	SOLOSOLO	21, 22, 23 & 24	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	793	1442	SOLOSOLO	25	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	1574	4865	SOLOSOLO	26, 27, 28 & 29	[redacted]	
LOT1	PT CUST LAND	CUSTOMARY	595	1198	SAOLUAFATA	32	[redacted]	
LOT2	PT CUST LAND	CUSTOMARY	1002	989	SAOLUAFATA	32	[redacted]	
		1ST APPROACH	**24581**	**26632**	FINAL APPROACH			

EAST COAST ROAD SLOPE STABILITY - LAND TAKING SURVEY							
SHOWN	DESCRIPTION	TITLE/REF	AREA (m²)	AREA (m²)	VILLAGE	SITE	OWNER
LOT2	PT CUST LAND	CUSTOMARY	5356	3012	LAULII	4, 5 & 6	[redacted]
LOT1	PT CUST LAND	CUSTOMARY	2375	4282	LAULII	7, 8 & 9	[redacted]
LOT2	PT CUST LAND	CUSTOMARY	1023	1580	EVA	26, 27, 28 & 29	[redacted]
LOT1	PT CUST LAND	CUSTOMARY	1384	3307	EVA	30 & 31	[redacted]
		1ST APPROACH	**10138**	**12181**	FINAL APPROACH		

APPENDIX 2 – TABLE OF AREAS OF GOVERNMENT LAND REQUIRED FOR ROAD

EAST COAST ROAD SLOPE STABILITY - LAND TAKING SURVEY							
SHOWN	DESCRIPTION	TITLE/REF	AREA	NEW AREAS	VILLAGE	SITE	OWNER
LOT1	PT GOVT LAND	GOVERNMENT	5736	6575	LAULII	4, 5 & 6	GOVERNMENT
LOT3	PT GOVT LAND	GOVERNMENT	5777	5912	LEUSOALII	10, 11, 12 & 13	GOVERNMENT
LOT3	PT GOVT LAND	GOVERNMENT	3088	3185	LUATUANU'U	14, 15, 16 & 17	GOVERNMENT
LOT4	PT GOVT LAND	GOVERNMENT	578	947	LUATUANU'U	18	GOVERNMENT
LOT5	PT GOVT LAND	GOVERNMENT	4458	6042	LUATUANU'U	18	GOVERNMENT
LOT4	PT GOVT LAND	GOVERNMENT	9514	9899	LUATUANU'U	19 & 20	GOVERNMENT
LOT2	PT GOVT LAND	GOVERNMENT	2352	2350	SOLOSOLO	21, 22, 23 & 24	GOVERNMENT
LOT2	PT GOVT LAND	GOVERNMENT	2317	4658	SOLOSOLO	25	GOVERNMENT
LOT3	PT GOVT LAND	GOVERNMENT	4337	5109	SOLOSOLO & EVA	26, 27, 28 & 29	GOVERNMENT
LOT2	PT GOVT LAND	GOVERNMENT	1708	1904	SOLOSOLO & EVA	30 & 31	GOVERNMENT
LOT3	PT GOVT LAND	GOVERNMENT	1936	1916	SAOLUAFATA	32	GOVERNMENT
			41801.00	48497.00			
Note:							
	Government Land is not subject to land taking (no compensation required)						