Amended in November 2013

REQUEST FOR PROJECT/PROGRAMME
FUNDING FROM THE ADAPTATION FUND

The Appendix form should be completed and transmitted to the Adaptation Fund Board Secretariat by email or fax.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project/programme must be fully prepared (i.e., fully appraised for feasibility) when the request is submitted. The final project/programme document resulting from the appraisal process should be attached to this request for funding.

Complete documentation should be sent to:

The Adaptation Fund Board Secretariat
1818 H Street NW
MSN P4-400
Washington, D.C., 20433
U.S.A
Fax: +1 (202) 522-3240/5
Email: afbsec@adaptation-fund.org

Contents

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT/PROGRAMME INFORMATION

Project/Programme Category:	Regular Project
Country/ies:	Federated States of Micronesia (FSM)
Title of Project/Programme:	ENHANCING THE CLIMATE CHANGE RESILIENCE OF VULNERABLE ISLAND COMMUNITIES IN FEDERATED STATES OF MICRONESIA
Type of Implementing Entity:	RIE
Implementing Entity:	SECRETARIAT OF THE PACIFIC REGIONAL ENVIRONMENT PROGRAM (SPREP)
Executing Entity/ies:	Office of Environment and Emergency Management (OEEM) on behalf of Kosrae State Government, Pohnpei State Government, Yap State Government, Chuuk State Government
Amount of Financing Requested:	**$9,000,000 (in U.S Dollars Equivalent)**

Project / Programme Background and Context:

Provide brief information on the problem the proposed project/programme is aiming to solve. Outline the economic social, development and environmental context in which the project would operate.

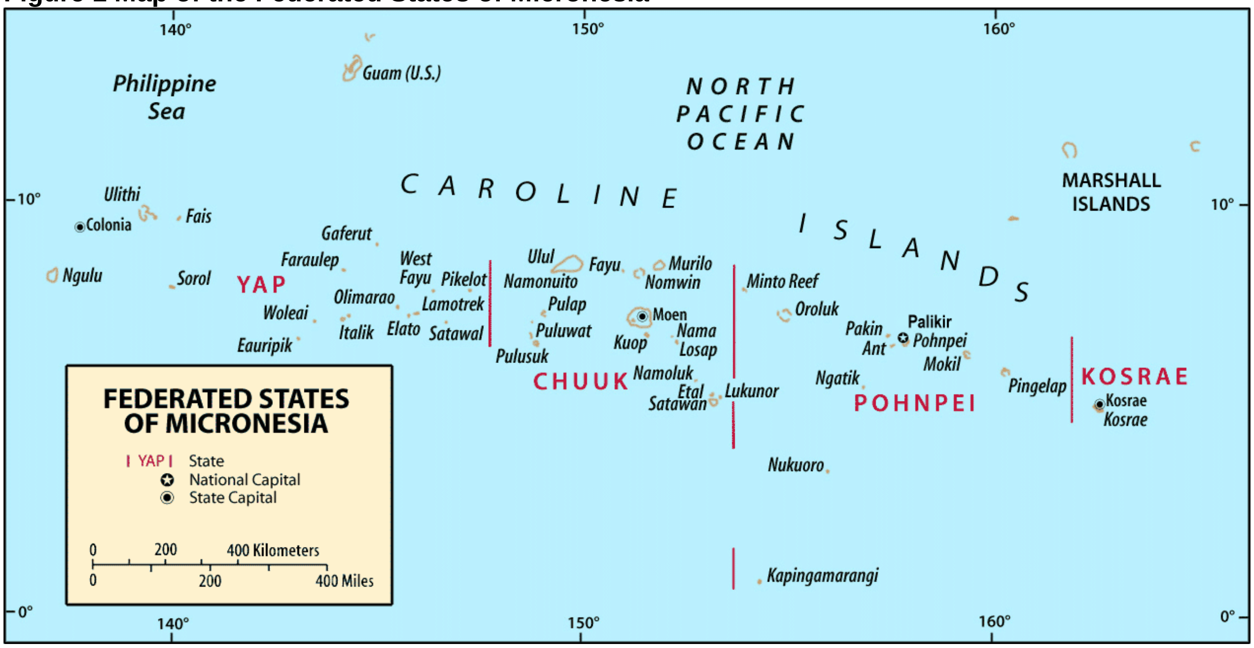
1. National and Local Level Context

1.1. Geography and Climate

The Federated States of Micronesia (FSM) is located near the equator about 4,000 km southwest of the Hawaiian Islands in the Western Pacific Ocean and within the Caroline Islands group. It is a group of approximately 607 islands covering 2,736 km^2 in the western Pacific Ocean (**Figure 1**). The land area totals 704.6 square kilometres, with 7,192 square kilometres of lagoon area. These islands vary from small islets are inundated at high tide, to atolls and large volcanic islands with land area of more than 80 km^2. Approximately 65 of the islands are inhabited. FSM's physical isolation, as well as the distance between states, and between islands within states, combined with limitations in transport, poses particular development challenges.

The FSM, located north of Papua New Guinea, south of Guam, and east of the Philippines, has an exclusive economic zone covering approximately 2,589,998 sq km (1,000,000 sq mi), yet the land mass of its 607 islands and atolls is only 702 sq km (270 sq mi). Four types of island occur: 1) Volcanic ‘High islands’ which can be highly rugged in their basalt interiors and typically surrounded by fringing or barrier reefs; 2) Low lying atolls and 3) Raised coral islands; and 4) Low coral islands. ‘Low lying atoll and coral’ ‘outer islands’ are especially isolated and require significant effort to reach from the main islands by boat or small plane. Of great biological significance are the coral fringing and barrier reefs that surround each island.

Figure 1 Map of the Federated States of Micronesia[1]



Each of the four States is centered on one or more main high islands (**Table 1**). All but Kosrae State includes numerous outlying atolls. The capital of FSM, Palikir, is located in Pohnpei State. Many of the islands in FSM are extinct shield volcanoes, with steep and rugged centers that are densely vegetated and eroded. Mangroves grow around the coastal fringes. Land elevations range up to about 2,500 feet (760m). Other islands are relatively flat, small and swampy, with low-lying, forested atoll islets, typically one to five m above mean sea level[2].

The major vegetation types in the FSM are native upland forest, agroforest, mangrove forest and savanna, other shrubs and grasslands. About a third of FSM’s land area is suitable for agriculture, but less than 5% of agricultural land is arable. About half is used for permanent crops, with the remainder being used for other agricultural purposes.

[1] By U.S. Central Intelligence Agency - Federated States of Micronesia (Political) 1999 from Perry-Castañeda Library Map Collection: Federated States of Micronesia Maps, Public Domain, https://commons.wikimedia.org/w/index.php?curid=46492

[2] FSM Second National Communication under the UN Framework Convention on Climate Change, 2015

Table 1 Geography of FSM's four states[3] (* HV = high volcanics; A = atolls, **individuals per square kilometer).

STATE	# IS. GROUPS	# ISLANDS	# INHABITED IS.	TOPOGRAPHY (HV, A)*	LAND AREA (SQ.KM)	LAGOON AREA (SQ.KM)	POPN. (2010)	POPN DENSITY**
Yap	12	139	12	HV + A	119	1049	11,373	247
Chuuk	7	542	55	HV + A	127	2132	48,564	993
Pohnpei	6	26	6	HV + A	342	769	36,196	274
Kosrae	1	1	1	HV	110	0	6,616	156
Total	26	708	74		697	3,950	102,843	379

The tropical climate of FSM is due to its geographical location in the Western Pacific, just north of the equator, and the strong influence of northeast trade winds, thus generating consistently warm temperatures. The trade winds prevail from December through April. Periods of weaker winds and doldrums occur from May to November. Rainfall is generally plentiful, especially on the high volcanic islands of Kosrae, Pohnpei and Chuuk. It can exceed 400 inches (1,016 cm) annually, or 22 inches (559 mm) in any one day. The region is affected by storms and typhoons that are generally more severe in the western islands, as well as by periods of drought and excessive rainfall associated with different phases of the El Niño – Southern Oscillation (ENSO).

From May to November the rainfall is extremely high on the volcanic islands of Kosrae, Pohnpei and Chuuk. Yap lies in an area that generally experiences a monsoon climatic pattern, with more frequent periods of drought. The climate of Chuuk is hot and humid with an average temperature of 81°F (27°C), and little variation throughout the year. Average annual precipitation is 122 in (3,100 mm), with the months of January to March being drier. Pohnpei is generally hot and humid, also with a mean temperature of 81°F (27°C). Temperatures vary little from month to month. The mean annual rainfall is 190 inches (4826 mm), with January and February being slightly drier than the average of all months. Kosrae's climate is characterized by high temperatures, heavy rainfall and high humidity.

The average annual rainfall measured at the weather station in coastal Lelu is 203 inches (5000 mm). In the mountainous interior rainfall is estimated to be as high as 300 inches (7,500 mm) annually. Average temperature is again 81°F (27°C) at sea level. Average monthly temperatures vary from the annual average by no more than 0.5°F (1°C), and the difference between the average minimum and maximum temperatures is less than 14°F (8°C).

1.2. Political and Legislative

Since its inception in 1979, when it formed its own constitutional government, the FSM has worked with the United States government to achieve self-sufficiency through its primary source of assistance, the Compact of Free Association (1986-2003) and the subsequent Compact II (2004- 2023).

[3] Namakin, 2008; FSM Division of Statistics, 2012 *in* FSM Second National Communication under the UN Framework Convention on Climate Change, 2015, p.16)

The country's government is modelled after the federal system of the United States with a national president and four state governors with respective legislatures and judiciaries. The government has four levels of governance – National, State, municipal, and traditional.

The four states − Chuuk, Kosrae, Pohnpei and Yap – where the project is to be implemented, have considerable degree of autonomy. Each State Government has its own constitutional Government, consisting of the three branches: Executive, Legislative and Judicial.

Each FSM state has its own set of environmental laws and regulations geared to protect the islands form the effects of climate change. Under the Compact II, Article VI and section 161 of Title II, FSM is committed to applying the National Environmental Policy Act of 1969 and "to develop and implement standards and procedures to protect its environment."

In June 2012, FSM Environmental Protection Act became Public Law. Its purpose is to:

- reflect the current functions and responsibilities of the National Government in the area of environmental management and protection;
- eliminate duplication of responsibilities between the National and State Governments in the area of environmental management and protection; and
- provide the Office of Environment and Emergency Management (OEEM) with the necessary legal authority to implement, via regulation, the multilateral environmental agreements that FSM had already ratified, including the UNFCCC.

This project will be building on the existing legislative and policy framework that the national government and the state of Kosrae have already put in place.

The FSM Environment Sector Plan 2010-2015, prepared in accordance with the FSM Strategic Development Plan (SDP) 2004-2023, identifies achieving higher rates of compliance with environmental laws as a high priority for FSM National and State Governments. Among the most serious problems of environmental governance in FSM is that the laws and regulations are not enforced consistently or effectively. The new Environment Protection Act endeavors to address this and related issues, in part by strengthening enforcement action and by requiring the Director of OEEM to provide, on an annual basis, an environmental quality report covering the status and conditions of the environment of FSM, and a review of the programs and activities of the National Government, State Governments, municipal Governments and non-governmental organizations (NGOs), with particular reference to their effect on the environment of the country.

The FSM government has put in place national frameworks for adaptation: The Strategic Development Plan (SDP) 2004-2023 and the Infrastructure Development Plan (IDP) 2016-2025 are based on several frameworks which provide mitigation and adaptation measures to limit the impacts of climate change. Mitigation and Adaptation activities are on-going at the government and agency sectors.

The Strategic Development Plan (SDP) for FSM provides a road map for social and economic development for the 20 years, 2004 - 2023.

FSM adopted a national policy on climate change in 2009 and a policy on Disaster Risk Management and Climate Change Adaptation in 2013. Kosrae adopted a Shoreline

Management Plan in 2014. The State of Kosrae is the first state to develop a strategic plan that addresses coastal zone management in view of the adverse impacts of climate change.

The Kosrae Shoreline Management Plan (2014) states: “much development on Kosrae over the last two to three generations has occurred in low-lying coasal areas…many of the approaches we currently use…will be increadingly effective or inaffordable as sea levels rise. It will involve thinking differently than we have done in the past, particularly concerning where we locate infrastructure, our communities and our homes”.

There is an immediate need for capacity to support adaptation at the national level, and specific legislation, regulation and policy frameworks in the other 3 states so that they can deliver effective climate resilient measures for greater protection in the coastal zones.

1.3. Institutional Arrangements for Climate Change

FSM has ratified the UNFCCC and its Kyoto Protocol as well as Montreal Protocol (also known as the ozone treaty). FSM signed the Paris Agreement in 2016. In 2009, the FSM was awarded a Climate Protection Award from the U.S. Environmental Protection Agency for its contributions to Climate Protection under the ozone treaty.

FSM has a Multi-State Hazard Mitigation Plan 2005, which was developed after an extensive process of consultation, led by what was then the National Emergency Management Office, involving stakeholders across all states within and outside government.

FSM has commenced integration initiatives from a common institutional platform for disaster risk reduction and climate change adaptation overseen by the Office of Environment and Emergency Management.

A Nationwide Climate Change Policy was adopted by FSM in 2009. The focus is to mitigate climate change especially at the international level, and adaptation at the national, state and community levels to reduce the FSM’s vulnerability to climate change adverse impacts. The Policy outlines the integration of climate change into the Strategic Development Plan/Infrastructure Development Plan (SDP/IDP) and into other policies, strategies and action plans, including disaster preparedness and mitigation, as necessary. The Office of Environment and Emergency Management is designated as the focal point for all government climate change activities by law under Title 25 the FSM Environmental Protection Authority Act.

The Nationwide Climate Change Policy identifies the following sectors and the agency responsible for implementing climate change adaptation actions:

- Department of Education
- Department of Health and Social Affairs
- Department of Resources and Development
- Department of Transportation, Communication & Infrastructure
- FSM Weather Service Station
- National Oceanic Resource Management Authority
- Office of Environment and Emergency Management
- Office of President

FSM is presently in the process of developing a joint policy for climate change adaptation and disaster risk management.[4]~~.~~

A Framework National Water and Sanitation Policy for the Federated States of Micronesia was developed in 2011. The objective of the framework is to provide the rationale and direction for a Comprehensive National Water and Sanitation Policy for the Federated States of Micronesia. Key elements of comprehensive policy will include a “Federated States of Micronesia National Water Outlook” and Water Sector Investment Plan. The intent of this policy is to mainstream the principles of Integrated Water Resource Management and Water Use Efficiency into national and state development planning and resource management.

1.4. Demography

The population of FSM reached 102,843 at the last census taken in 2010. This was a decline of 4,344 persons relative to the 2000 census total of 107,008. The rate of population growth in FSM and its composite states has declined dramatically over the past three decades. At the national level, annual growth had dropped from 3.0 percent in the 1980-89 period, to minus 0.4 percent over the 2000-2010 period. At the state level, Chuuk and Kosrae have negative growth while in Pohnpei and Yap the rate of growth is still positive but very low at 0.4 and 0.1 percent, respectively. While declining fertility has contributed to the drop in the population growth rate, out-migration to the United States and other parts of Micronesia is the primary cause of negative growth.

Table 2 Population and household distribution of FSM[5]

STATE	% OF TOTAL FSM POPULATION	% OF TOTAL NO. OF FSM HH
Yap	11.1	13.8
Chuuk	47.3	41.9
Pohnpei	35.2	37.5
Kosrae	6.4	6.8

The population of the FSM is unevenly distributed between states in terms of total numbers and per sq. km (Table 2). Chuuk State represents 47% of the population, Kosrae 6%, Pohnpei 35% and Yap 11%. The population is young, with 36% between 0 and 14 years, 59% 15-59 years and 5.5 percent 60 or older, though the average age is increasing. There are 4% fewer women of child bearing age in the FSM today than 10 years ago and the population is declining for the first time in recent history. This demographic change has been influenced by a Compact between the FSM and U.S. The Compact transfers significant funds to the FSM, and promotes outmigration by allowing FSM citizens to go to the U.S. and join its military (the FSM also has its own U.S. mailing zip code). In return it provides the U.S. strategic regional Asian and Pacific military considerations. On high islands a mariner culture and rough interior has concentrated populations along the coasts[6].

[4] GCCA:PSIS. 2013. Climate Change Profile. Federated States of Micronesia. Version 2, July 2013.
[5] Smith, W.J., J Mount, D. Bennet and P. Shed. 2014. Collaborative research methodologies and the construction of a national geospatial clearinghouse to conserve biodiversity in the Federated States of Micronesia. Applied Geography 54:198-208.
[6] Ibid.

1.5. Economy

The National and State governments account for over one-half of the nation's employment and 38% of its GDP. Agriculture is primarily subsistence farming. Natural resources available for economic purposes are limited to timber, marine products, deep-seabed minerals, and phosphate. Commercial fishing is an important source of revenue through licensing fees and exportation of fish. A wide range of financial and project assistance has been provided through a variety of governments, international institutions, and non-governmental organizations, resulting in limited success in developing an integrated, self-supporting, and sustainable economy.

In the era of Compact II (2004-2023) FSM is at a critical point in its development. In a relatively short time frame, each FSM State is challenged not only to continue developing a self-sufficient economy, but also to modernize without sacrificing valued cultural traditions and natural resource assets. Geographical isolation and poorly developed infrastructure are major impediments to FSM's long-term growth. Over the years, agriculture's socio-cultural role as a safety net for the disadvantaged has greatly diminished. Inequality of income and the incidence of families with incomes below the poverty line are among the highest in the Pacific region. Poverty is a concern and FSM has, in general, made only limited progress towards achieving the Millennium Development Goals (MDGs) by 2015.

The mainstays of the FSM economy are subsistence farming and fishing. There is limited tourism due to lack of access and facilities, although it has increased in recent years with a number of small hotels opening in Pohnpei, Yap and Kosrae. Geographic isolation and poorly developed infrastructure are major impediments to FSM's economic growth, and poverty is among the highest in the Pacific region. FSM has, in general, made only limited progress towards achieving the Millennium Development Goals by 2015.

The public sector plays a central role in the economy, the national and state-level governments employ over half of the country's workers and government services and public enterprises account for 38% of GDP. Since the 1995 Economic Summit, the private sector has been a focus of economic development. There are now 22 private locally owned construction companies that also undertake road maintenance.

Daily life in most of the FSM is run on an extended family scale, with village or island functions integrated into this routine. National and state levels of government lack a sustained influence in this routine in most islands. Thus, conservation efforts must connect to the local scale and people with traditional ties into communities if they are to be sustained. The human and physical geography that define the FSM make this a major challenge. Conversely, it is undeniable that given the relative autonomy of islands and villages, but mobile and common nature of many marine resources such as coral, sea turtles, and fish, that large-scale planning may need to span 'ecoregions'[7].

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[7] Smith, W.J., J Mount, D. Bennet and P. Shed. 2014. Collaborative research methodologies and the construction of a national geospatial clearinghouse to conserve biodiversity in the Federated States of Micronesia. Applied Geography 54:198-208.

1.6. Education

Education in the FSM is compulsory for all children, including those with disabilities, from ages six to fourteen or until completion of grade eight. Secondary schooling (grades 9-12) is not compulsory.

Quality of education is a key concern as more than forty per cent of pupils in grade eight score far below the minimum benchmarks for math and reading in performance assessments.

As more people have migrated to the state capitals, urban schools have become crowded and outer-island schools depleted of students. Many school buildings are old and in poor repair, textbooks and other teaching aids are in short supply. Outer island schools are typically very small, access is slow and expensive, and they can only be contacted by short wave radio. This makes it difficult for state and national agencies to provide technical assistance and support.

1.7. The Water Security Problems in Outer Islands

Areas of small island countries, such as the FSM, exceed well over 5000 mm of precipitation annually. These communities are in some of the wettest places on earth. Nevertheless, their geologic and geographic settings, technology, government capacity, village-scale governance and knowledge base can still make accessing safe drinking water exceedingly difficult. Despite billions of dollars in aid, labour, and local spending, inadequate progress has been made in recent years in much of the less wealthy communities in improving access to safe drinking water[8].

Despite high national precipitation rates, water supplies on smaller, low-lying atoll islands are extremely vulnerable to droughts and to saltwater inundation caused by high tides. Water for drinking and other uses comes from two sources: rainwater catchments and shallow wells that draw from a layer or “lens” of freshwater that is underlain by brackish water or saltwater. Groundwater in the part of the lens that is near the ground surface in the central depression of the island is also important for taro cultivation. On some atoll islands, the freshwater lens is thin and highly vulnerable to contamination from the saltwater below, especially if too much freshwater is drawn from the lens.

The El Niño event of 1997–1998 caused severe droughts and water shortages on many of the Pacific Islands including FSM. During the drought, public were concerned about high level of demand and increased groundwater withdrawals because of the potential impact of saltwater intrusion on taro, breadfruit, and banana crops. The case demonstrates the vulnerability of freshwater resources on atoll islands. Data from monitoring are needed to manage rainwater and groundwater resources conjunctively and increase the adaptive capacity of low islands to meet the challenges posed by climate variability and change.

The water resources of the islands composing the 32 atolls of the FSM are under continual threat due to El Niño-induced drought events and potential sea-level rise. The contamination from septic tanks and waste-water runoff from pig pens is also a major issue.

[8] Smith, W.J. 2008. *Geographical Journal* Vol. 174 No. 3, pp. 251–268, 2008

Another risk is the high-sea/surf events. In December 2007 and again in 2008, several atoll islands in the Federated States of Micronesia were flooded by series of high wave events. These saltwater floods had a significant impact on taro crops that are commonly cultivated in a depression near the center of the island. In December 2007, on the outer islands of Chuuk State, where 13,000 people or one-fourth of the state population resides, an estimated 90% of all taro crops were destroyed by saltwater inundation[9].

Water use within atoll island communities is derived from either captured rain water (typically through a roof-gutter system that feeds a large storage tank) or groundwater. Rain catchment water is preferred for most domestic purposes such as drinking and cooking, whereas groundwater, typically accessed through hand-dug wells lined with concrete or rocks, is used for bathing and washing clothes. Communities may also use coconut juice to supplement drinking water.

Rain catchment tanks vary in construction material and size. Older tanks are made from concrete, whereas newer ones are made from fiber glass. Depth to water in the hand-dug wells ranges from 1 to 3 m, and fluctuates with the rise and fall of the tides. The water is extracted by either a rope and bucket or a small electric pump, and is typically shared by several households.

In general, only large leeward islands appear to be able to maintain substantial freshwater lens during both average and drought conditions. The majority of FSM atoll islands are windward and hence contain only a thin lens, irrespective of the rate of rainfall. These results provide water-resources managers of atoll island communities with important generalizations regarding the sustainability of island resources, and can be used for future planning within these communities.

The sustainability of water resources on atoll islands is therefore of serious concern due to their small catchment area, low-lying topography, isolation from other island communities, and the continual threat of El Niño-induced droughts. Most of the 32 atolls within the FSM are permanently inhabited, but their residents have always been continually at risk of water shortages. Groundwater resources are particularly important reserves, since the small exposed area of the island land surface and the high permeability of the carbonate sediments preclude the development of natural surface-water bodies or reservoirs. Man-made storage tanks are used to collect rainwater, but these can become depleted quickly during droughts. At such times, island residents rely on groundwater to fulfill their domestic water needs. The fresh ground-water, residing in the "freshwater lens", however, is itself subject to stress and threat of depletion during El Niño-droughts. Atoll island groundwater is thus an inherently precarious resource.

The FSM government seeks to make each atoll island community sustainable in regards to water resources. Success obviously depends on maintaining sufficient potable water on each atoll island during even the most severe droughts. Therefore, the volume of freshwater reserves must be predicted for periods of scarce rainfall rather than for normal climate conditions.

[9] Keener, V. W., Marra, J. J., Finucane, M. L., Spooner, D., & Smith, M. H. (Eds.). (2012). Climate Change and Pacific Islands: Indicators and Impacts. Report for The 2012 Pacific Islands Regional Climate Assessment. Washington, DC: Island Press.

1.8 Proposed Focus Area

The Government of FSM has identified two outer islands each in Pohnphei, Chuuk and Yap states as priorities for the water security component of this proposal to the Adaptation Fund. These are Kapingamarangi and Nukuoro in Pohnpei; Satawan and Lukunor in Chuuk and Eauripik and Woleai in Yap. The majority are among the atolls most remote from their respective main lands. The government has also focused on building the capacity of the communities of Malem and Utwe in Kosrae to respond to climate as well as improving the resilience of its infrastructure and natural environment to climate change under the coastal component of the proposal. The socio economic profiles of each of the States and the proposed sites are summarised below.

1.9 Yap State

Yap State consists of four main islands of Yap Island, Tomil-Gagil, Maap and Rumung and eight smaller islets sharing a common coral reef. Colonia is the capital of Yap State. It administers both Yap proper and 14 atolls reaching to the east and south for some 800km, namely Eauripik, Elato, Fais, Faraulep, Gaferut, Ifalik, Lamotrek, Ngulu, Olimarao, Piagailoe (West Fayu), Pikelot, Sorol, Ulithi, and Woleai atolls, as well as the island of Satawa. Yap accounts for 84 percent of the state's total landmass, is home to two-thirds of Yap State's population of 12,055 (FSM 2010 Census).

The significance of climate change to the State of Yap is set out in the Joint State Action Plan. As the westernmost state of FSM, Yap is exposed to a range of threats that create significant vulnerabilities for the state. Yap is located in 'Typhoon Alley', is likely to be disturbed by earthquakes and tsunamis, and suffers droughts due to the impact of El Niño Southern Oscillation (ENSO). ENSO is also the cause of both excessive and below average rainfall. Yap is drier than the other states of FSM, and is highly susceptible to drought. The lack of adequate water storage capacity on the outlying islands increases the inhabitant's vulnerability to the impacts of drought. Yap is very vulnerable to flooding during typhoons and storm surges. The state does not regularly receive large amounts of rain and thus the damage from extreme surge and rainfall events is usually much more intense.

The distances between islands makes it difficult to get much-needed food, water and medical supplies to residents after a disaster, meaning Yap is more vulnerable to health and other secondary impacts of disasters than the other FSM states. Through July 2015 and January 2016 island leader and community consolations, facilitated by the government of Yap through the Department of Resources & Development and SPREP, the atoll islands of Eauripik and Woleai are nominated for water security measures (Section II.H). The most recent impacts caused by Typhoon Maysak and the recent 2015-2016 El Nino phenomena was felt strongly at these islands requiring water resources to be secured.

1.10 Chuuk State

Chuuk is located (830nm) to the west of Yap state, with Pohnpei (1208nm) and Kosrae (1500nm) to the east. It is the most populated state of FSM. Chuuk State consists of several island groups with a combined population of 48,615 (FSM Census, 2010). The 2010 Census reported fewer residents in the state compared to 2000 (-1.0 percent decline) as a result of substantial net-migration to neighboring US Territories, Hawaii and US Mainland. This was associated with the recent mixed economic fortunes of the state.

Satawan with a population of 692 and Lukunor with 848 are the two Chuuk atoll communities that will be addressed by the project. These islands are only three to five meters above sea level and are therefore prone to impacts of sea level rise. The islands water wells are brackish and provide only limited water. Some wells are only used to draw water for washing and cooking during drought, as it is unsafe for general consumption. Most water wells are not covered, and therefore contamination from sea water, e-coli, and humus is common. Most of the households on both islands have at least one water tank, which has found to be unsustainable during drought. The rainwater harvesting systems are in poor condition as a result of sustaining damage from typhoons, lack of spare parts and poor maintenance, leaving these communities highly vulnerable to drought. During periods of drought, people and animals often resort to coconuts and root trees for water and hydration.

1.11 Pohnpei State

Pohnpei is a “high” volcanic island, having a rugged, mountainous interior with some peaks as high as 760 meters. It measures about 130 kilometres in circumference and is roughly circular in shape. Pohnpei Island is the largest, highest, most populated, and most developed island in FSM. A coral reef surrounds the island, forming a protected lagoon. There are no beaches on Pohnpei – the coast is surrounded by mangrove forests/stands growing on muddy substrate eroded from interior wetlands in the rainy environment. Several smaller islets, many of them inhabited, lie nearby within the lagoon-reef complex. The population of Pohnpei is approximately 34,840. Pohnpei is more ethnically diverse than any other island in the FSM. This is largely due to it being home to the capitol of the national government, which employs hundreds of people from the other FSM States having distinct ethnic and cultural origins.

Kapingamarangi and Nukuoro are the two Pohnpei atolls that will be addressed by the project, with a population of 350 and 210 respectively. The atoll’s ground water resources are already susceptible to sea water intrusion, underground water pollution and surface water pollution from agricultural practices. The western reef rim of Kapingamarangi atoll is almost submerged at high water. Much of the islets on this western reef that is used for growing fruit and vegetables are now under threat. As a result, the islanders are now looking to move the growing of such fruit and vegetables to the same islets where they are raising livestock, as well as on the main island of Touhou where people reside. This is already putting pressure on the water resources on Touhou, where the highest point is only 90 cm. On Nukuoro, the staple food crop is taro. Taro is highly susceptible to salt water intrusion. During drought, the communities use raised swamp taro patches as water reservoirs to catch water for cooking and washing. Buckets and recycled oil-drums are a common method of storing water at the household levels. The population of Nukuoro are highly vulnerable to water and vector-borne diseases as a result of poor quality of water.

1.12 Kosrae State

Kosrae is the easternmost and second largest island of the FSM, located approximately 372 miles southeast of Pohnpei. Kosrae has a land area of 42 square miles (112 square km) and an EEZ of 200 nautical miles. Between 1997 and 2010, Kosrae’s population declined by 12 percent to its current population of 6,616 people (FSM Census 2010), and constitutes 6 percent of FSM’s population. The negative population growth is largely due to considerable out-migration to the US and its territories. Accordingly, the working population age has dramatically declined, significantly reducing the productive work force and local production (UNFPA, 2013). This trend is mainly attributed to poor economic performance and reductions in the public sector, which has traditionally been the main employer. As at 2010, the unemployment rate in Kosrae was significantly high at 23 percent.

Kosrae is the only state without an outer island. It is divided into four municipalities, with respective populations as follows: Lelu (2,160), Malem (1,300), Tafunsak (2,173) and Utwe (983). Geographically, the state is characterized by steep mountains and deep valleys covered with thick, fertile tropical vegetation and forests, and dense mangrove forests in coastal areas. The island's main natural resources are its abundant forests with significant agricultural potential, marine products and deep-seabed minerals[10].

Kosrae is a high volcanic island surrounded by a fringing reef, mangroves and coastal strand forests that have been historically used for lumber and fuel by residents. There is a shallow fringing reef spotted with boulders of coral heads that have been dislodged from the fore – reef during occasional cyclone events. There are no outer islands. The island has steep, heavily vegetated watersheds, which in the mid to upper parts of the catchment are in relatively natural state. Where clearing or deforestation on sloping areas does occur, however, intense rainfall quickly denudes exposed soil. Invasive vegetation is a significant problem and has taken a foothold in many of the lower parts of many of the catchments.

[10] Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025. Volume 6 Yap State Infrastructure Development Plan

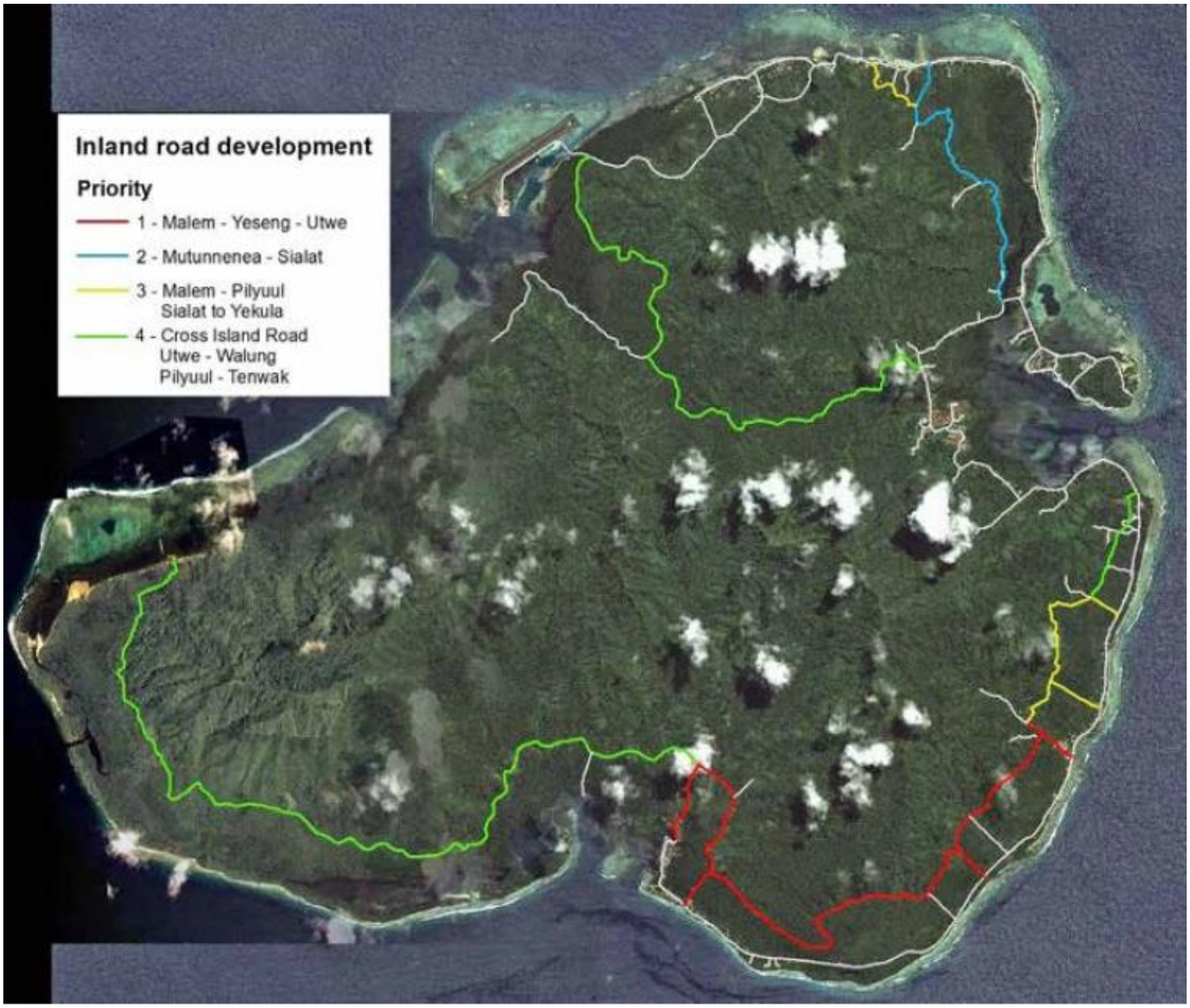


Figure 2 Priority section (Malem – Yeseng – Utwe) inland road development in Kosrae, denoted in red. (Source: KIRMA, 2014)

The lack of a lagoon and the rugged interior are among the factors that have led Kosraens to become more dependent on earnings from wage and salary employment than other Micronesians. The estimated population of Kosrae in 2014 stood at 5,758 persons living in 1,089 households (HH). The urban to rural ratio in 2010 was 48.5%. The population increased steadily from the 1920s to a peak of 7,676 in 2000 but has declined sharply since. Outmigration is driving the decline, and is related to the drop in formal sector employment associated with the transition to an Amended Compact arrangement with the United States. The remaining population remains largely dependent upon fishing, subsistence farming, remittances and the state sector for their livelihoods.

Geographic isolation and poorly developed infrastructure are major impediments to Kosrae's (and FSM's) economic growth, and poverty is among the highest in the Pacific region. The 2010 MDG Report (based on 2005 data) places 34.1% of Kosrae's population (27.1% of HH) below the Basic Needs Poverty Line with 8.8% or people (7.1% of HH) below the Food Poverty Line. It should be noted, however, that while this is measured against more conventional definitions of poverty that most people through their extended family have some access to land and subsistence agriculture. 80.4% of HH were categorised as Working Poor (HH with one or more workers and in the lowest 30% expenditure bracket). While access to piped drinking water and improved sanitation is generally higher in Kosrae than in the other FSM States, of concern is the relatively lower access to health dispensaries and other health facilities and higher rates of childhood obesity combined with under-nutrition. Although educational quality and attainment tend to be higher in Kosrae than in the other states, 63% and 51% of children leaving primary school fall below minimum competency levels for maths and reading respectively.

Kosrae's GDP growth has declined by 0.7% per annum since the beginning of the Amended Compact. A major issue is the size of the public sector in the economy, accounting for 40 percent of GDP activity. Salary and wage expenditure is high, and represented 53% of KSG's current expenditure in FY2013. These factors suggest the Kosrae economy is in a highly volatile state as it approaches 2023 and has no significant financial reserves to fall back on.

While FSM currently has no national strategy for coastal zone management, Kosrae has developed a strategic plan that addresses coastal zone management in view of adverse impacts of coastal hazards and climate change on development and infrastructure of Kosrae. Known as the Kosrae Shoreline Management Plan (SMP) this was initially developed with considerable community consultation between 1998 and 2000 and updated with further consultation in each Municipality in 2013. The SMP sets out the principles for coastal development in Kosrae over the coming decades, and details eight key strategies for responding to climate change and sea level rise and increasing the resilience of Kosrae's coastal communities over the next one to two generations (20 – 50 years) .

Over the last century changes in the position of the shoreline around Kosrae shows considerable variability. The most significant long-term coastal retreat over this time has occurred along the eastern front facing Lelu and Malem coastlines. Much of the east and south coastline on Kosrae has been built by storm and typhoon events over many years. The east coast is characterised by relatively narrow fringing reef, a narrow storm berm upon which the coastal road and most development has occurred, with areas of low lying infill swamp, farmland or lagoon mangrove, behind the berm to the volcanic part of the island. This coastal retreat is both related to natural changes primarily linked to a series of typhoon events (seethe Kosrae SMP) and due to human impacts including past offshore mining of coral rubble and sand over the fringing reef flat for construction materials, beach mining for sand and gravel resources, and interruptions to alongshore sediment transport by engineering projects whilst sand and gravel removal from beaches and reef flat have long been controlled ,the impacts from activities in the period between 1950s to 1980s are still being felt. The rate of coastal retreat is also being exacerbated by sea-level rise and this will continue to have an even greater influence on the rate of coastal change, and associated impacts on coastal infrastructure and development located on the berm, going forward.

Similarly overwash on the berm, and hence flooding of the road and property, due to high tide and wave conditions are extremely sensitive to sea-level rise. For example a high tide level of 2 m(relative to vertical land datum on Kosrae) is presently a very high tide on Kosrae, and results in overwashing and flooding problems. Such a high tide is experienced on average 2.8% of all high tides at present. Put another way, approximately 97% of all high tides in Kosrae are less than 2m high. With a mid-range sea level rise scenario, however, these statistics will change, by the:

- 2030s, the high tide level of 2m will be exceeded by 12% of all high tides
- 2050s, the high tide level of 2m will be exceeded by 27% of all high tides
- 2070s, the high tide level of 2m will be exceeded by 69% of all high tides

- 2090s, the high tide level of 2m will be exceeded by 95% of all high tides

In 2009 the Pacific Adaptation to Climate Change (PACC[11]) project focused on coastal zone management in Kosrae, and specifically on 'climate proofing' a section of the Tafunsak to Walung circumferential road. The circumferential road on Kosrae plays a vital transport role for the people of the island, and also directs the location of other infrastructure and development. It is therefore critical to the resilience of the community that the road be able to withstand current and future impacts of climate and sea. The choice of project was influenced by earlier work under the Asian Development Bank (ADB)-funded Climate Adaptation in the Pacific (CLIMAP) project in 2005, which identified the need for climate proofing of the road, and carried out various assessments and analyses, but did not complete the on-the-ground work.

The CLIMAP analyses found that the original road design had been based on inaccurate rainfall data, i.e. they had not accounted for increases in rainfall in the design and engineering. The road had been built with drainage works designed for a maximum hourly rainfall of 178 mm, which supposedly had a return period of 25 years. An analysis of more reliable data indicated that an hourly rainfall with a return period of 25 years is 190 mm. By 2050, however, the hourly rainfall with a 25-year return period is projected to increase to 254 mm as a consequence of climate change. Based on these results some aspects of the road design were amended, specifically the culverts were redesigned to accommodate the higher rainfall. These lessons are incorporated in to the proposed Kosrae component of the Adaptation Fund Project.

Kosrae's proposed project within the Adaptation Fund proposal targets the municipalities of Malem and Utwe for construction of a climate-proofed inland road, with the long-term objective of enabling the gradual relocation of households to safer inland areas. Of Kosrae's four municipalities Malem and Utwe are considered to be the most vulnerable to climate change-related impacts. A majority of households from both municipalities are currently located in the coastal zone.

A key risk is the potential for environmental degradation associated with inland development. The magnitude of this risk in Kosrae is clear from earlier proposals and studies (e.g. Bell. 1992; Gorenflo. 1993; Naylor et al. 2002). The environmental risks together with social and cultural issues including land tenure (see Box 1) and access are well summed up by Monnereau and Abraham (2013).

The significance to Kosrae of the Kuplu Wan Plateau (See Box 2) located in Utwe is described by Bell (1992) The importance of finding culturally sound solutions to land access matters and the avoidance of degradation through effective community-based ecosystem management cannot be overemphasized

Box 1. Land in FSM

Land in FSM is managed under a complex mix of modern and traditional systems. Land is intricately connected to people's perception of inheritance and community. This needs to be tackled with a long-term perspective. The majority of transactions for commercial ventures transpire with survey; titling and documentation completed under modern land management institutions. Chuuk is an exception, due to long-standing unresolved

[11] www.sprep.org/pacc

disputes between individuals and clan groups. Disputes also arise periodically in the other states and can take an inordinately long period of time to resolve.

In Kosrae, Chuuk and Yap land rights may be legally sold to FSM citizen, but in Pohnpei land can only be sold to Pohnpeians. The FSM Constitution forbids the ownership of land by foreigners, but they are permitted to lease land. Multiple ownership of land still exists throughout the FSM, requiring the consensus of families, clans and traditional leaders for leases and development. This can present a constraint to development depending on the ability to achieve consensus. In all states the market for land is characterized by few transactions, limited market information, no formal mechanisms for public dissemination of market transaction data and price demands from (often multiple) landowners. As a result of these conditions, together with prevailing cultural factors influencing the perceived value of land, it can be said that transactions are only partly influenced by economic market forces and the potential productive value of land.

Distortions and rigidities in land market transactions will be difficult to reduce and change will undoubtedly be gradual. A focus on public education and information dissemination may result in accelerating this process It is important that the current program of surveying and recording land titles of land available for development in the states is completed. Improvements in mortgage laws, leasehold mortgages and land management in general require actions within each state.

Chuuk State has taken action by passing leasehold mortgage law but has not yet promulgated regulations to implement the law. The extent to which land can be leveraged and mortgaged is important for increasing productive activity and incomes. Land assets that become locked outside the modern market economy cannot be leverage or redeployed for production. The overall effect is that many landowners are asset rich and income poor.

Currently all land in Kosrae above the so-called *Japanese Line* (indicated in blue in map at right) is under government control. During the Japanese occupation of Kosrae, public lands were expanded to include the shoreline below the mean high water mark, the mangroves and the upland forests above the Japanese Line, which includes approx. 67% of the total land area of Kosrae. As much as 50% of this area is too steep for any development and should be maintained as forest for watershed protection. A recent Constitutional amendment (Amen 19, 1995) was passed which allows reclamation of land above the Japanese Line by the original landowners. Land will be awarded by issuing a Certificate of Title to an individual or to the Tenancy-in-Common. A procedure for reclamation must be established by law before any advancement can be made and should be guided by this land use plan.

Sources: FSM 2023 Action Plan (pgs 47-48); Kosrae State Land Use Plan 2003

Box 2. The Significance of the Kuplu Wan Plateau According to Bell (1992)

Kuplu Wan (red area in map) is the only relatively flat plateau area in Kosrae about 250 feet above sea level and was inhabited by the early Kosraens from about AD 1280 to 1850. They left behind stone foundations, rock walks and underground ovens as evidence of their habitation

The soils are deep, well drained igneous basalt-based soils. The Infal Palusrik river bisects the plateau, and then cuts down to mangrove swamps and the village of Utwe below. After the Infal Palusrik leaves the village of Utwe, it enters Utwe Harbor, which is fringed by coral reefs. Vegetation in Kuplu Wan is comprised of a tall multi-storied rainforest, inhabited by the full array of Kosraen birds.

Although Kuplu Wan's isolation has left it largely untouched for the past hundred years, the pressure to develop Kuplu Wan will be intense in the future as it is considered to have the best soils for agriculture in all of Micronesia. Historically there have been a number of attempts to try agriculture in Kuplu Wan, including attempts it the 1950s to grow coffee and cacao. Although these attempts did not result in much success, the failure was largely due to using crops that were not really suited to Kosrae, and crop processing problems rather than land deficiencies.

The vast majority of flat arable land on Kosrae is used in either agroforestry, agriculture or is urbanized. In addition to the 5,439 acres of relatively flat arable land, there are also 12,622 acres of land on slopes greater than 30%, but less than 60% are marginally suited for agroforestry. Out of a land base of approximately 5,400 acres of flat arable land about 300 acres have been urbanized, about 4,100 acres are currently being used for agroforestry/agriculture and about 1,000 acres are in native vegetation. Most of the 1,000 acres of flat arable land not currently being used by people is not accessible by road. Of this 1,000 acres Kuplu Wan represents about 300 acres and there is an additional 40 acres on the ridge due south. The Kuplu Wan area has the best soils and would be the easiest area to access with a road of any of the arable areas not currently in food production. Most of the other unused areas are fairly small and difficult to access.

2. Climate change impacts and risks

The future for FSM does not look favourable for any development that is based on a business as usual approach. In the current period to 2100, according to PCCSP and PACCSAP (Australian BoM and CSIRO, 2011, 2014); the latest global climate model (GCM) projections and climate science findings for FSM indicate that:

- Surface air temperature and sea surface temperature are projected to continue to increase (very high confidence)

- El Niño and La Niña events will continue to occur in the future (very high confidence), but there is little consensus on whether these events will change in intensity or frequency;
- Average annual rainfall is projected to increase (medium confidence), with more extreme rain events (high confidence);
- Drought frequency is projected to decrease (medium confidence);
- Ocean acidification is expected to continue (very high confidence);
- The risk of coral bleaching will increase in the future (very high confidence);
- Sea level will continue to rise (very high confidence); and
- Wave height is projected to decrease in December–March (low confidence), and waves may be more directed from the south in June–September (low confidence).

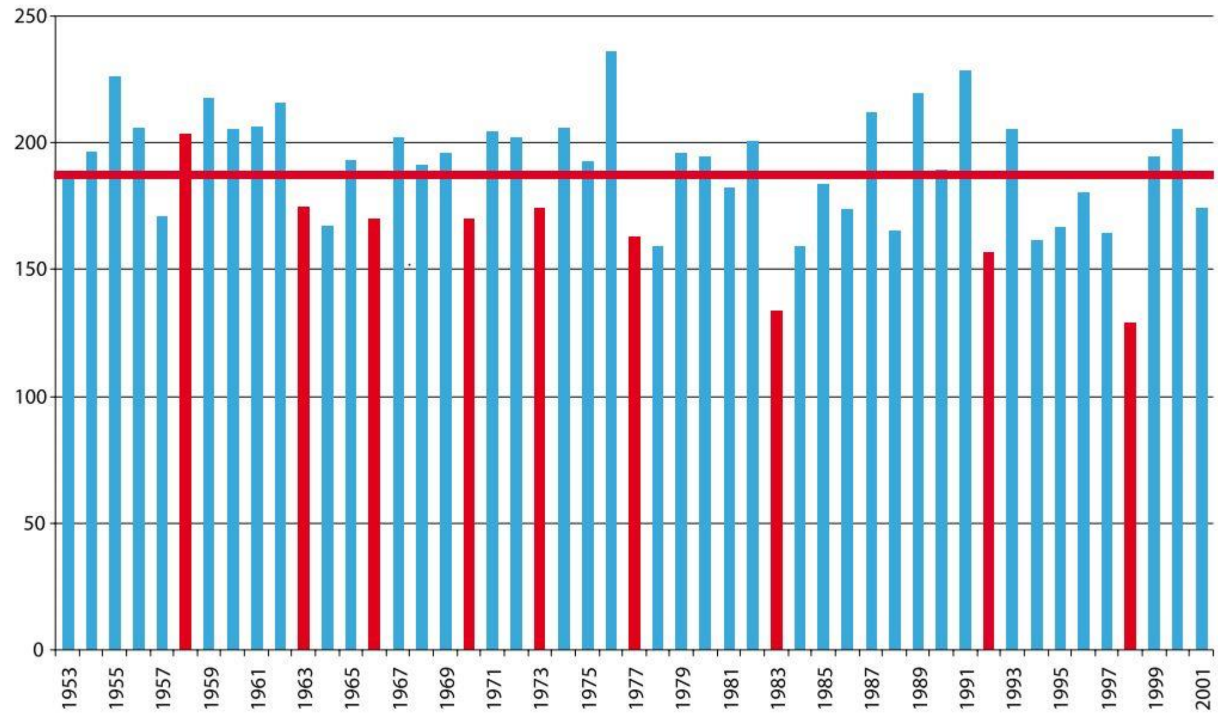
A number of studies suggest that global warming could accentuate the current climate regimes and the changes that come with ENSO events (e.g. Hay and Pratt, 2013). This will mean that the inherited and natural coping strategies that the inhabitants of the atoll islands and the atoll environment of FSM will not be enough to respond to these new climate regimes. It will be an ongoing challenge and burden to maintain and sustain the sensitive balance between ecosystem dynamics, the health of the marine environment, human settlement patterns and coastal resource use.

FSM's climate and sea level are both strongly modulated by the ENSO. Following El Niño conditions the country typically experiences drought. Severe drought events have resulted in water and food shortages as well as the occurrence of fires. Effects of El Niño on the FSM involve the persistence of a high-pressure weather zone over the Western Tropical Pacific for many months, blocking low-pressure, rain-bearing air masses. Nearly all extremely dry years in the FSM occur during the year following an El Niño event (Figure 3). In some years, drought conditions have continued through the wet season.

The driest year on record in Pohnpei and throughout most of Micronesia occurred in 1998, following the major El Niño of 1997. Some El Niño years are very wet depending upon the behaviour of typhoons and the monsoon trough. Most La Niña and neutral years have precipitation that is near normal to slightly above normal, unless it is a year following an El Niño, when rainfall is below normal. Deleterious effects include desiccation of grasslands and forests, draw-down of streamflow and well-heads, and wildfires[12].

[12] FSM Second National Communication Report to the UNFCCC, 2015.

Figure 3 Time series of annual rainfall at the Pohnpei Weather Service Observatory (WSO). Most post-El Nino years (red bars) are dry. (Source: Lander and Khosrowpanah, 2004)

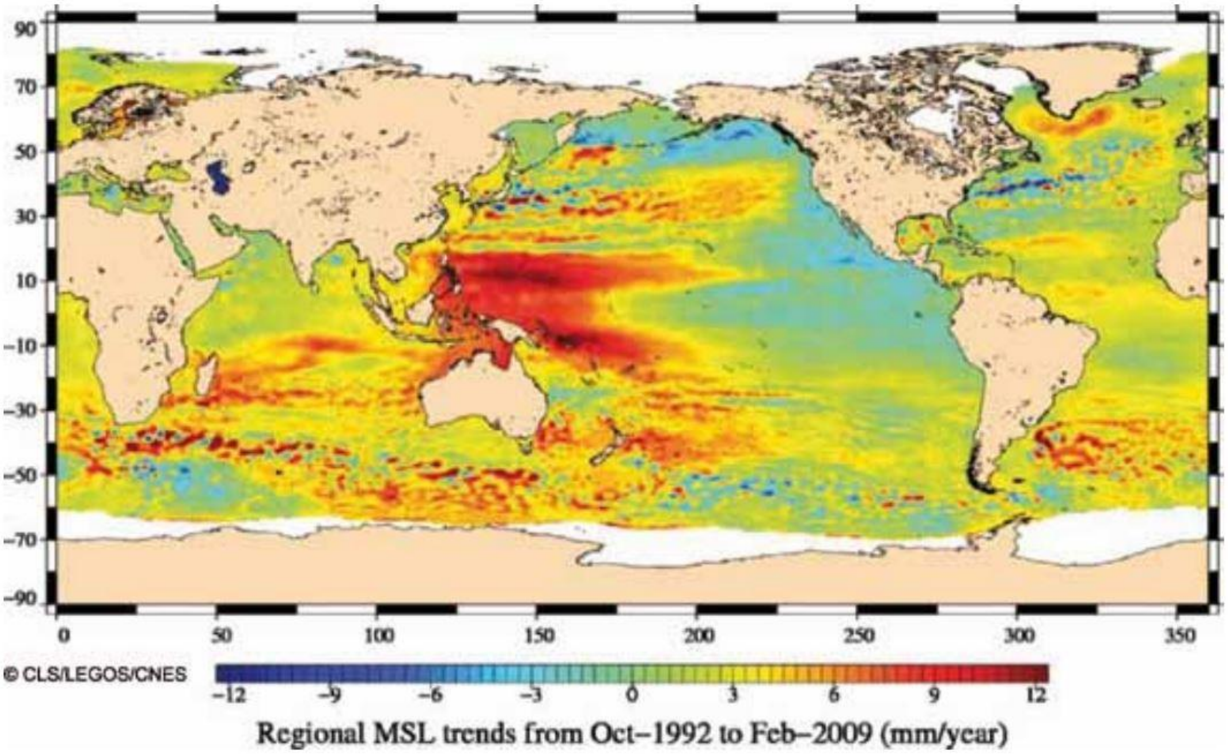


The droughts of 1982-1983 and 1997-1998 were especially severe on terrestrial habitats, increasing localized threats to biodiversity. Groundwater sources were taxed, agricultural systems damaged and problems associated with wildfires and invasive species were greatly aggravated. Insufficient rainfall caused water and food shortages, including staples such as taro, coconut, breadfruit, banana, yam, sweet potato, citrus, and sugar cane. Communities in the atolls survived because bottled water, food supplies, and reverse osmosis pumps were imported. Water rationing for only two hours a day in Pohnpei was necessary. High near-surface lagoon and ocean water temperatures, especially associated with low water spring tides, caused coral bleaching and damage to inshore marine ecosystems (Falanruw, 2001). Poor potable water quality resulted in cases of typhoid and cholera. There was also a decrease in fish catch, possibly due to the variations in water temperature that occur during El Nino events.

2.1 Sea Level and Extreme High Tides

FSM is located in part of the global ocean that has experienced some of the highest rates of sea-level rise (Figure 4) over the period of available satellite and tide gauge monitoring. Data from the Topex/Poseidon and Jason-1 satellites makes it possible to determine rates of sea-level change between 1992 and 2016.

Figure 4 Rate of Sea Level Change, 1992 - 2009



Monthly averages of the historical tide gauge, satellite (since 1993) and gridded sea-level (since 1950) data agree well after 1993. These data indicate an interannual variability in sea level around FSM of about 10 in (26 cm) (estimated 5–95% range), after removal of the seasonal cycle.

The average of the observed in situ relative sea-level records is indicated in red, with the satellite record (since 1993) in light blue. The gridded sea level data at FSM since 1950, from Church and White (in press), is shown in orange. The projections for the A1B (medium) emissions scenario (5–95% uncertainty range) are shown by the green shaded region from 1990–2100. The range of projections for the B1 (low), A1B (medium) and A2 (high) emissions scenarios by 2100 are also shown by the bars on the right. The dashed lines are an estimate of interannual variability in sea level (5–95% range about the long-term trends). These indicate that individual monthly averages of sea level can be above or below longer-term averages[13]. FSM's climate and sea level are both strongly modulated by the ENSO. These variations are important as drought, floods and marine inundation due to high sea levels may damage soil and degrade food resources and drinking water. During an El Niño year, the mean sea level drops across most of Micronesia. During La Niña, the sea level is elevated above its normal value. These changes in sea level are highly coherent across the region from Yap to Guam, Chuuk, Pohnpei, and Kosrae.

[13] Australian Bureau of Meteorology and CSIRO, 2011

2.2 Rainfall

For FSM, wet season (May-October), dry season (November-April) and annual average rainfall amounts are projected to increase over the course of the 21st century. There is high confidence in this direction of change. The majority of models used in the study indicate little change (-5% to 5%) in rainfall by 2030. However, by 2090 the majority simulate an increase (>5%) in wet season, dry season and annual rainfall, with up to a third simulating a large increase (>15%) for eastern FSM under the A2 (high) emissions scenario. There is moderate confidence in this range and distribution of possible futures.

There is an inconsistency between the projected increases in rainfall described above and the recent declining (Pohnpei) or relatively steady (Yap) trends observed at individual meteorological stations. This may be related to local factors not captured by the models (e.g. topography), or the fact that the above projections represent an average over a relatively large geographic region. Models do not agree on future ENSO conditions and therefore on the effect of ENSO on future rainfall patterns. However, models do agree that as a global average, tropical settings are likely to see increased rainfall and rainstorm intensity

3. Vulnerability Assessment

Like many Pacific islands countries, the FSM's low-lying atolls and coral islands are very vulnerable to natural hazards and disasters such as cyclones, sea surges, and droughts. On average, annual economic losses due to natural disasters amount up to three per cent of GDP.

Top five disasters in the FSM by total number of people affected

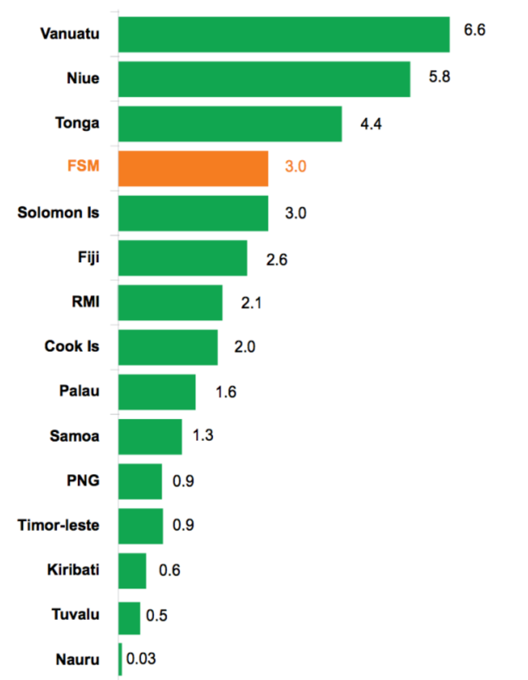
Number of people affected by disaster, 1987-2008

	People Affected
Drought (Marr. 1998)	28,800
Cyclone (Apr. 2004)	6,008
Cholera epidemic (Apr. 2000)	3,431
Cyclone (Jul. 2002)	1,448
Cyclone (Nov. 2003)	1,000

Source: EM-DAT: The OFDA/CRED International Disaster Database, www.emdat.be - Université catholique de Louvain - Brussels – Belgium

FSM's annual economic losses due to natural disasters are significant

Annual average economic losses due to tropical cyclone, earthquake, and tsunami as a percentage of GDP by Pacific island country



The islands of FSM Islands are categorized locally into three groups: 1) Volcanic 'High islands' which can be highly rugged in their basalt interiors; 2) 'Low' coral-based 'reef islands;' and 3)

'Low' coral-based 'outer islands' that are especially isolated and require significant effort to reach from the main islands by boat or small plane. Of great biological significance are the coral fringing reefs attached to land and extending watersheds into the marine environment in lagoons and open ocean[14].

The distinction between "high" islands and "low" atoll islands is essential to explain the different climates on islands, their many specialized terrestrial and marine ecosystems, and the forms of human communities they currently support. The terrain of high islands is characterized by abrupt elevation changes (mountains, sheer cliffs, steep ridges and valleys), with the altitude and size of these features varying according to the age of the island. On high islands, orographic rainfall (rain associated with or induced by the presence of mountains) can cause the island to receive much higher rainfall than the surrounding ocean, and is responsible for large differences between leeward and windward rainfall. The landscape on high islands is conducive to the formation and persistence of freshwater streams and the development of soils that can support large and diverse plant and animal populations.

In contrast, the low atoll islands are small and flat. They are not tall enough to generate orographic rain, and thus the amount of rainfall on low islands is close to that for the surrounding ocean. The atolls generally lack the freshwater and fertile soils that are characteristic of volcanic islands and have limited terrestrial resources. Low islands are especially prone to drought, but their varied coral reef, mangrove, and lagoon environments support rich marine ecosystems. Because high islands have more land and freshwater resources than low islands do, they have more long-term options for responding to changes in sea level, rainfall, and other climate variables. The amount of land on volcanic islands that is flat enough for large-scale settlement, development, and agriculture is limited, however, resulting in high concentrations of population, infrastructure, and commercial development in low-lying coastal areas. Thus, while communities on high islands and low islands have somewhat similar short-term challenges associated with climate change, they have different degrees of flexibility in how they can adapt.[15]

Most of the 32 atolls within the FSM are permanently inhabited, but their residents have always been continually at risk of water shortages. Groundwater resources are particularly important reserves, since the small exposed area of the island land surface and the high permeability of the carbonate sediments preclude the development of natural surface-water bodies or reservoirs.

Atoll aquifers consist of a layer or "lens" of freshwater floating on saltwater. Recharge from rainfall typically forms a thin lens of freshwater that is buoyantly supported by denser, underlying saltwater, and mixing forms a zone of transitional salinity. The thickness of this mixing zone is determined by the rate of recharge, tidal dynamics, and hydraulic properties of the aquifer.

Water use within atoll island communities is derived from either captured rain water (typically through a roof-gutter system that feeds a large storage tank) or groundwater. Rain catchment water is preferred for most domestic purposes such as drinking and cooking, whereas groundwater, typically accessed through hand-dug wells lined with concrete or rocks, is used for

[14] Ibid

[15] Keener, V. W., Marra, J. J., Finucane, M. L., Spooner, D., & Smith, M. H. (Eds.). (2012). Climate Change and Pacific Islands: Indicators and Impacts. Report for The 2012 Pacific Islands Regional Climate Assessment. Washington, DC: Island Press.

bathing and washing clothes. Communities may also use coconut juice to supplement drinking water. The tanks used to collect and store rainwater can become depleted quickly during droughts. At such times, island residents rely on groundwater to fulfill their domestic water needs. However, this groundwater, residing in the freshwater lens, is itself subject to stress and threat of depletion, particularly during El Niño-droughts. Atoll island groundwater is thus an inherently precarious resource.

In general, only large Leeward Islands appear to be able to maintain a substantial freshwater lens during both average and drought conditions. The majority of FSM atoll islands is windward and hence contains only a thin lens, irrespective of the rate of rainfall.[16]

The FSM government seeks to make each atoll island community sustainable in regards to water resources. Success depends on maintaining sufficient potable water on each atoll island during even the most severe droughts as well as other extreme weather events such as tropical cyclones; however results from a recent study by a team of researchers from FSM, Guam and the USA, indicate that out of 105 major islands on FSM atolls, only six would likely retain sufficient groundwater to sustain the local community during an intense drought.[17,18]

Box 3 The Special Challenges of FSM's Atolls[19]

Low-lying atoll islets pose special management challenges in FSM. Dozens of remote atoll islets are occupied by human communities of a few hundred people each.

These islets are composed of sedimentary accumulations of calcium carbonate sands and cobbles derived from the skeletal fragments of reef-dwelling organisms including coral and various carbonate-secreting algae. Some sediments are loose, and others are lithified by natural cements. Loose sedimentary deposits may be transported in various directions (seaward, lagoon ward, or along the shore) and redeposited on the island surface by storm overwash and winds.

Some researchers hypothesize that the tendency for high water events to carry sediment from the reef margin into island interiors may allow these islands to accrete upward with rising sea level. The islet landform might thus persist under a regime of accelerated sea-level rise associated with global warming. Other researchers speculate that atoll islets are pinned on the reef by rock ramparts and when rising waters breach these cemented deposits on oceanic shores, the islet will become unstable and rapidly erode out of existence.

The debate among geologists regarding the fate of atoll islets neglects a key point that is critical to the communities living on these islands: marine inundation, the same process that carries sediment to the island interior, is extremely damaging to atoll freshwater supplies, the soil, the forests that supply food, and the wetlands in which island residents

[16] Bailey, R.T, J. W. Jenson & D. Taboroši. 2013. Estimating the freshwater-lens thickness of atoll islands in the Federated States of Micronesia. Hydrogeology Journal (2013) 21: 441–457.

[17] For example, the severe El Niño-induced drought conditions of 1997-1999 in FSM caused water and food shortages including staples such as taro, coconut, breadfruit, banana, yam, sweet potato, citrus, sugar cane, and others. Communities among the atolls survived because bottled water, food supplies, and reverse osmosis pumps were imported. This was an extreme event, and provides a worst-case scenario for use in planning for future droughts.

[18] Ibid.

[19] Fletcher C.H. and B.M Richmond. 2010. Climate Change in the Federated States of Micronesia: Food and Water Security, Climate Risk Management, and Adaptive Strategies. Center for Island Climate Adaptation and Policy.

grow taro as a consumable staple. Long before the question of atoll landforms surviving sea-level rise is settled, human communities could be forced to abandon these environments unless a climate adaptation strategy is developed and implemented that provides them with potable water and sufficient food.

The following strategies for adapting to drought and improving sustainability under restricted water conditions have been recommended, with all but strategy 2 directly relevant to FSM's atoll communities[20]:

1. Implement a water resources research program that improves understanding of groundwater, surface water, and their sustainable use.
2. Improve high island water accessibility and retrofit and replace infrastructure in the context of climate risk management.
3. Predict drought events and plan for increased frequency and duration of drought including improvements to emergency services.
4. Plan for more intense rains and the impacts that accompany them: flash flooding, mass wasting, inundation, drainage problems, cut-off communities, and others.
5. Improve low island water planning, usage, and conservation.
6. Identify data gaps in water resources and steps to fill these.
7. Support hydrologic modeling of island aquifer systems.
8. Support down-scaled climate modeling that emphasizes water resources.
9. Expand network of water monitoring instrumentation.
10. Develop a water management plan for each island including each inhabited atoll islet and neighboring resource islets.

3.1 National level response to vulnerability

The FSM Strategic Development Plan addresses climate change by raising awareness of climate change among the general population; developing coastal management plans in all four states; and developing ways to 'climate proof' facilities and structure that support social and other services. In 2012, the Presidential Task Force for Disaster Management decided that a Disaster Risk Management (DRM) and Climate Change Policy should be developed for the FSM, building on the Climate Change Policy 2009, and the Disaster Relief Act 1989 to provide overarching policy guidance for joint DRM and Climate Change Action Plans at state level.

The Strategic Development Plan (SDP) for FSM provides a road map for social and economic development for the 20 years 2004−2023[i]. The SDP and the Infrastructure Development Plan 2016-2025 (IDP) both recognise the need for mitigation and adaptation measures to limit the impacts of climate change. FSM developed a Multi-State Hazard Mitigation Plan in 2005, and in 2009 a national Climate Change Policy was adopted. The country developed a combined Policy for Climate Change Adaptation and Disaster Risk Management in 2013. This is being implemented through State Joint Action Plans for Climate Change and Disaster Risk Management. The Office of Environment and Emergency Management (OEEM) is the focal point for all government climate change activities.

While each state has its own strategic development plan, Kosrae is the only State with a climate-responsive Strategic Development Plan (2013−2024). The SDP recognises that "the

[20] Fletcher C.H. and B.M Richmond. 2010. Climate Change in the Federated States of Micronesia: Food and Water Security, Climate Risk Management, and Adaptive Strategies. Center for Island Climate Adaptation and Policy.

most prudent approach to addressing effects of naturally occurring events (climate change or disaster risks) long term would be to divert development and settlement along the coast to inland and higher grounds" (SDP 2013−2024, p. 29). The Environmental Results and Targets No. 6 states that by 2023 capacity is strengthened at all levels to climate change adaptation, and management and mitigation of risks of disasters enhanced so that communities are resilient to impacts of climate change and disaster risks. Resilience to climate change is also included within strategies for agriculture.

FSM currently has no national strategy for coastal zone management. The State of Kosrae, however, is the first state to develop a strategic plan that addresses coastal zone management in view of the adverse impacts of climate change. Kosrae has a Shoreline Management Plan (SMP), first developed in 2000 and revised and updated in 2014 (Ramsay et al., 2014). The SMP sets out the principles for coastal development in Kosrae over the coming decades, and details *eight key strategies* for increasing the resilience of Kosrae's coastal communities. Taking on board lessons and practices from the Pacific Adaptation to Climate Change programme (PACC) and other coastal projects, this proposal aims to upscale and replicate lessons learned and best practices through guidance of these eight strategies of the SMP for Kosrae. The eight key strategies are:

(i) Continued development and strengthening of community awareness including outreach activities with a focus on effective natural coastal defence and Kosrae-relevant climate change impacts and adaptation options.
(ii) Amendment of the Kosrae Island Resource Management Authority (KIRMA) Regulations for Development Projects to incorporate climate change considerations and strengthening of regulation implementation to support successful long-term risk reduction and adaptation.
(iii) Over the next one to two generations the primary coastal road network and associated infrastructure currently located on the beach/storm berm is developed inland away from long-term erosion and coastal inundation risk.
(iv) Ensure new development (property, infrastructure) is located away from areas at risk from present and future coastal hazards or is designed with coastal hazards in mind.
(v) Implement a program to encourage existing residential property owners to reposition homes away from areas of high risk from present and future hazards. This may be a staged approach over time as homes are routinely replaced or renovated. Objective prioritization of properties most at risk should also be explored.
(vi) Incorporate a grant component in to the housing loan program to help encourage new property to be constructed in areas not exposed to coastal, river floor or landslide hazards.
(vii) Commence community and state discussions to develop a relocation strategy and identify potential approaches to support relocation from areas exposed to coastal hazards where no alternative land is available.
(viii) A strategic approach is adopted for the ongoing provision of coastal defences. These should be considered only where it is sustainable long-term option, or where it is accepted as a transitional approach to protecting areas over the short to medium term to enable relocation strategies to be implemented.

4. Water and Sanitation

There are significant differences in water and sanitation coverage between and within the four States of the FSM. Chuuk and the outer islands of Yap are especially lagging behind. Access also varies according to socio-economic status; poorer households are less likely to use improved sanitation facilities than wealthier households.

Water quality and resultant health concerns remain a major challenge in the FSM. Only five out of the approximately 70 public or community water systems serving the main islands feature any type of treatment and even here, water is not consistently “safe” due to inadequate system maintenance and irregular supplies (FSM 2010 MDG Report, p. 80). Moreover, two of the five public sewerage systems available in the FSM pump raw sewage directly into the lagoons without treatment.

The FSM’s Strategic Development Plan 2004-2023 gives high priority to water and sanitation issues with significant infrastructure development funding earmarked to the sector. However, FSM did not meet its own national targets, set for 2010, to provide universal access to safe drinking water and reach 50 per cent of rural and 100 per cent of urban households with sanitary latrines (urban 100%, rural 50%).

4.1 The Significance of Local Decision-Making to Water Security Adaptation in FSM

Throughout FSM but especially on the small, low islands, land is scarce. Decision-making has traditionally rested with landowners. Land equals power and land possession and occupancy influence political relationships and decision-making. Complex, diverse, and often competing tenure systems governing ownership and access rights to land have developed throughout the islands. Traditionally, inheritance of land rights depended on membership in a lineage or clan and often subject to chief-centered authority and control, but in most cases, the oldest male member of the lineage managed the estate. However, after a century of colonial rule, systems of land tenure followed a path away from descendant group ownership toward a western model of individualized tenure. Greater individual self-interest accompanying westernization is weakening traditional systems of land tenure based on lineage. However, authority regarding land use lies also with the local community. Hence, the implementation of any adaptation strategies requires that landowners, local communities, and decision-making bodies are all in agreement with regard to the problem, the need for a solution and the design of adaptation steps. Envisioning changes within the familiar framework of the existing system is more likely to engender greater trust, willingness, and acceptance compared to an approach that does not incorporate familiar elements.[21]

5. Discussions with Communities

OEEM carried out five sets of consultative meetings with all stakeholders including community, government and NGOs. This was during June to July 2015, January –February, and May-June 2016. The objectives of the consultations were to systemically identify and subsequently confirm the priorities that project will take up that will improve and enhance the resilience of the coastal village and island communities and their environment. The consultations involved prioritization and ranking of community and island needs to adapt to climate extremes from each of the four states.

[21] Ibid.

This approach ensures that local communities, including men, women, youth, persons with disabilities, are supportive of these identified priorities. The discussions focused on community beneficiaries to identify alternatives or priorities and whether or not these alternatives or priorities take precedence over the initial priorities of the project (prioritization and ranking). Consultations were carried out in all four states. The Kosrae consultations required community views and responses to their vulnerabilities on island, including experiences on hazards, risks, coping strategies and their needs today. These were over and above the prioritization and ranking, output and activity-based discussions.

The stakeholders of the project include local community (farmers, housewives, youth representatives, senior citizens, village food inspectors, landowners, teachers, etc.), municipal government representatives (council members, council chairman) and government agencies (department of agriculture, fisheries, environment, island resources management authority, resources and economic affairs, land court, health services, state legislature, transport and infrastructure) and the business community. The summary of the meetings is provided in Section II.H.

6. Existing resilient practices in water security

The following Table (Table 3) shows a summary of country experiences and practices that have improved resilience and reduce vulnerability to threats in the water and food security and food productions sector from the Pacific. These are accepted or prescribed as being correct or most effective (i.e., best practices)[22]. This project would refer to and consider these interventions to improve the selection and implementation of activities that will provide the most effective, efficient, sustainable and more relevant approach to improve resilience of communities to climate change.

Table 3 Relevant adaptation measures for water security in the Pacific

COUNTRIES IMPLEMENTED	DEMONSTRATED ADAPTATION MEASURES FOR WATER SECURITY
Nauru	By improving resilience to drought by improving management of the island's water supply, Nauru introduced solar water purifier purifiers. The units which have solar panels linked to a water distillation circuit, produce clean drinking water from non-potable sources such as seawater or contaminated groundwater. Nineteen households had solar purifier units fitted, providing 80 L of additional potable water per day per household. During a drought, this can be used for drinking, cooking and if in sufficient quantity, personal bathing. Even when not under drought conditions this is a useful and safe potable water supply. The system is operated by the household and does not require any major maintenance. The lifespan of the solar purifier is 15 years and no replacement of material is expected during this time.

[22] The PACC publication series have been reviewed to ensure all information about on-the-ground demonstration activities of the project are best practices (http://www.sprep.org/pacc/publicatoins/technical-reports). Lessons learned have been captured in the Experience series of the project and is available online in the same address as well.

Niue	A process of research, consultation and analysis led to the decision to build a tank moulding facility and begin manufacturing water tanks in Niue. Tanks could be made at half the price of importing them, and this would further increase resilience by reducing dependence on imports. The PACC team joined forces with the Global Climate Change Alliance: Pacific Small Island States project, which is funded by the European Union and implemented by the Secretariat of the Pacific Community (GCCA PSIS – SPC), to implement the project. The facility is capable of producing up to eight 5,000 litre tanks each day. The tanks are made of a robust plastic called high-density polyethylene (HDPE), which is imported in powder form before it is processed and moulded into tanks. The tanks are lightweight, there are no joints that can split, and the plastic material complies with New Zealand and Australian safety standards. Properly maintained, the tanks will last for many decades.
Tokelau	Tokelau's three atolls total about 12 km2 of land, rise to no more than 5 m above sea level, and are home to about 1,400 people. With drought a major threat, the PACC project improved water security in terms of both quantity and quality, and at both the household and community levels. Activities on all three atolls have included renovating or replacing water infrastructure such as pipes, guttering, and water tanks; and installing 'first flush diverters' which ensure that contaminants from the roofs do not enter the drinking water tanks.
Tonga	The objective of the Tonga project was to improve the water supply system to provide Hihifo residents of the main island of Tongatapu with better access to water in terms of reliability and pressure, and better water quality; and to enhance the capacity of the residents to sustainably manage their water resources and to effectively operate and maintain the improved water supply system. From a survey of all 354 households and a focus group discussion with key members of the communities, the SEA found that the problems were due to a combination of natural, governance and technical factors: the fragile and thin water lens which is increasingly vulnerable; a lack of community participation in the management of the precious water resources; and technical issues, such as breakdown of pumps and leakages. Solutions proposed included: ■ Putting a water meter in every household; ■ Installing solar water pumps in villages; ■ More water tanks; ■ Strengthening governance capacities of water committees; and ■ Better transparency and communication between water consumers and water committees.

Tuvalu	Tuvalu built a water harvesting system using church building roof as water catchment, with guttering and downpipes. Capacity: 700,000 L ground cistern compartmentalized. Community ownership 100%. Management plan between government and community to alleviate drought risks. Replication on another community - Tekavatoetoe community and church with a capacity of 288,000L storage system succeeded. Launched July 2014. The project targeted Funafuti atoll, Lofeagai community, Target population, 637 (97 households, female 323, male 314). The pojrect impacted on 90% of the village population with indirect benefits to the rest of Funafuti atoll. Individuals of the village now meet the minimum water supply of 40 L per household per day during dry periods and droughts

7. Existing resilient practices in coastal management

Kosrae, PACC Project - The PACC project in Kosrae identified a 7 km section of the road in the Tafunsak municipality which was being progressively damaged by flooding from heavy rains and high tides. The original road had been designed to withstand a maximum hourly rainfall of 178 mm. Analysis of climate and sea level data, and projections to 2050, concluded that the road should be redesigned to withstand maximum hourly rainfall of 254 mm. Following a socio-economic assessment, community consultations, and input from expert coastal engineers, the road was redesigned and rebuilt to withstand the anticipated heavier rainfall and higher sea levels. Adaptations included raising parts of the road by up to one and a half metres, fitting larger culverts, and improving drainage. The improved road was officially opened in May 2014. The PACC developed guidelines to share experiences with climate proofing the road, which will help others to replicate this success.

The project also installed tide gauge and rainfall gauges in 2011 to improve availability and quality of local climate and sea level data. These now feed into climate-sensitive decision making and development for the state. The project team based in KIRMA also promoted the mainstreaming of climate risk into all development in the state and the country. The team supported development of the Kosrae State Climate Change Act, which was endorsed in 2011; and amendments to Kosrae's Regulations for Development, which now require all development projects to consider the potential impacts of climate change. The team also contributed to the revision of the 2014 Kosrae Shoreline Management Plan that provides comprehensive strategies for building resilience of Kosrae's coastal communities and infrastructure and now will guide this project.

The PACC project trialled the implementation of its relocated roads, using this manual as a guide and the purpose is to develop and promote appropriate methods of road engineering that gives the best possible access to communities at minimum cost.

In the absence of a "Kosrae Standards" for its roads, lessons from the development of the Vanuatu manual, along with ADB climate-proof roading manual that guided the PACC project; will enhance the resiliency of the roading infrastructure program of Kosrae now and into the future

The nature and success of coastal interventions to enhance resilience to impacts of climate change are, as shown by examples from Cook Islands, Samoa and Vanuatu; very site-specific. The activities of this project that address coastal resilience would base it's design and implementation against this backdrop of experiences given the similar circumstances, vulnerability, capacity, state of the natural environment, economy and certain social aspects of FSM.

The beneficiary populations of this project will be the entire Kosrae population. The specific and immediate and daily beneficiaries, however, will be the Malem and Utwe municipal village communities. According to the 2000 census, the Malem population was 1300 with males 663 and females 637 and the number of households at 238. The Utwe population stands at 983 on the 2000 census and was composed of 458 males and 525 females. Twenty three percent (23%) of the Utwe population is high school age. These potential beneficiaries, coupled with about 90 employed by National Government require daily access to go to the only high school located in Tofol and to the government administration district in Tofol.

There are other potential beneficiaries, approximately less than 100 people who reside in Walung municipal. Walung village community does not have access to the main roads of the island. Everyone at present uses boats to travel to Tafunsak. The only road from Walung to the rest of Kosrae is via Utwe and ultimately this will be the only road to Walung as the road south from Tafunsak is now suspended due to the Yela area being protected. In essence there are two out of five villages reliant on the road access as the only connection to the rest of Kosrae including the health services, ports, etc.

8. Project / Programme Objectives:

List the main objectives of the project/programme.

Project goal: The overall goal of the project is to build social, ecological and economic resilience of the target island communities of FSM and reduce their vulnerabilities to extreme drought, sea level rise and other climate risks through water resource management, coastal resource and development planning, and by promoting gender perspectives and ecologically sound climate resilient livelihoods.

Project objective:

The overall objective of the project is to reduce the vulnerability of the selected communities to risks of water shortage and increase adaptive capacity of communities living in Woleai, Eauripik, Satawan, Lukunor, Kapingamarangi, Nukuoro, Utwe, Malem to drought and flood-related climate and disaster risks.

The proposed project will contribute to relevant outcomes and outputs of the Adaptation Fund Strategic Results Framework (AFB/EFC.2/3 from 31 August 2010), and corresponds particularly to the following higher order fund-level objectives as follows:

Project Objective 1: Prepare the necessary institutional and regulatory frameworks, policies, guidance and tools to help deliver a climate resilient FSM

Project Objective 2: Strengthen water and livelihood security measures to help 6 outer atoll islands adapt to impacts of climate change related to water, health and sanitation

Project Objective 3: Provide communities with climate resilient infrastructure to help relocate from high risk coastal inundation sites.

Project Objective 4: Capture and share the local knowledge produced on climate change adaptation and accelerate the understanding about the kinds of interventions that work in island environments in FSM

Project strategy: The project strategy is to provide all four (4) State Governments in FSM with development planning tools and institutional frameworks to help coastal communities prepare and adapt for higher sea levels and adverse and frequent changes in extreme weather and climate events. The project strategy is to also provide communities with the resources and technical support needed to adopt and manage concrete climate change initiatives and actions.

Project / Programme Components and Financing:

Fill in the table presenting the relationships among project components, activities, expected concrete outputs, and the corresponding budgets. If necessary, please refer to the attached instructions for a detailed description of each term.

For the case of a programme, individual components are likely to refer to specific sub-sets of stakeholders, regions and/or sectors that can be addressed through a set of well defined interventions / projects.

PROJECT COMPONENTS	EXPECTED OUTCOMES		EXPECTED OUTPUTS	AMOUNT (US$)
1. Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels	Strengthened policy and institutional capacity of government to integrate climate risk and resilience into its water and coastal management legislative, regulatory and policy frameworks	1.1	Legislation and policy paper to guide regulation of climate resilient coastal and marine management at national level	150,000
		1.2	State regulations for development projects amended to consider climate change risks and resilience measures	175,000
		1.3	National Water and Sanitation Policy endorsed with climate and disaster risks and resilience, and gender mainstreamed	128,000
		1.4	National Water Outlook and Water Sector Investment Plan developed and implemented	234,025
2. Demonstration of water security measures in outer islands of Yap, Chuuk and Pohnpei	(A) Water conservation and management technology & practices adopted, responding to drought, sea level rise and early recovery from cyclones	2.1	Outer island communities oriented to CC, SLR, and adaptive capacity measures involving water, health, sanitation and environment	257,750
		2.2	Water Harvesting and Storage System (WHSS) repaired and installed in 6 atoll islands	1,044,646
		2.3	Self-Composting Waterless Toilets constructed to conserve water, improve soil environment, and reduce marine eutrophication on the lagoon side	732,982

PROJECT COMPONENTS	EXPECTED OUTCOMES		EXPECTED OUTPUTS	AMOUNT (US$)
		2.4	3,253 people trained on water conservation and management including coastal protection and livelihoods in 6 outer islands	245,502
	(B) Increased awareness of climate change through formal climate education	2.5	Teacher's Guide on Climate Change developed to improve climate change learning in FSM schools and training institutions	156,313
3. Demonstration of Kosrae Inland Road Relocation Initiative	Increased resilience of coastal communities and environment to adapt to coastal hazards and risks induced by climate change	3.1	3.6miles (5.8km) of Malem-Utwe inland road and access road routes constructed to sub-base roading standard for future relocation	3,005,474
		3.2	Transitional coastal protection at Mosral and Pal upgraded for immediate coastal protection	315,000
		3.3	State support program to access land in upland areas established	55,000
		3.4	Community-Based Ecosystem Management strengthened	105,000
		3.5	State support program to assist access to finance for vulnerable households established	40,000
4. Knowledge management for improved water and coastal protection	Capacity and knowledge enhanced and developed to improve management of water and coastal sectors to adapt to climate change	4.1	Climate resilient Municipality Development Plans developed and communicated	125,128
		4.2	Resource materials developed, tailored to local context, translated, published and shared amongst various stakeholders	185,338
		4.3	Stakeholders brought together to share, learn and exchange knowledge and skills on climate change, adaptation planning, monitoring, vulnerability assessments and climate change	555,755

PROJECT COMPONENTS	EXPECTED OUTCOMES		EXPECTED OUTPUTS	AMOUNT (US$)
4 Total Project Activity Cost (A)				7,506,913
5. Project Execution Cost (B)				788,018
6. Total Project Cost (A+B)				8,294,931
7. Project Management Fee charged by the Implementing Entity				705,069
Amount of Financing Requested				9,000,000

Projected Calendar:

Indicate the dates of the following milestones for the proposed project/programme

Milestones	Expected Dates
Start of Project/Programme Implementation	April 2017
Mid-term Review (if planned)	November 2020
Project/Programme Closing	March 2022
Terminal Evaluation	June 2022

PART II: PROJECT /PROGRAMME JUSTIFICATION

A Project Activities of the Project

Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience. For the case of a programme, show how the combination of individual projects will contribute to the overall increase in resilience.

Component 1. Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels

Outcome 1: Strengthened policy and institutional capacity of government to integrate climate risk and resilience into its water and coastal management legislative, regulatory and policy frameworks

Output 1.1 Legislation and policy paper to guide regulation of climate resilient coastal and marine management at national level

Activity 1.1.1 Review of legislation and policies for infrastructure to identify climate change requirements

Current environmental legislation does not necessarily require environmental impact assessments on all projects[23]. All infrastructure development projects are left to their own willingness to comply with relevant environmental planning provisions. A thorough legal and regulatory policy assessment shall be undertaken to assess the status of legislation and regulations established at the national and state level on development projects and its impacts on the environment including coastal and marine. It will also assess to what extent it will protect developments from impacts of climate change.

Activity 1.1.2 Regulatory and policy framework for climate change at national level

Kosrae state was the first state to amend its Regulations for Development Projects (No. 67-05) in 2014 to incorporate climate change impacts and adaptation measures. The regulations set specific requirements and establish standard procedures for the formal review of development projects relative to climate risks and adaptation measures. The Okat Bridge in Kosrae ($12.7 million in FY2014) was the first development project that this was regulation was applied to. Lessons from Kosrae will therefore be applied where possible[24], and will be used to identify legal, regulatory and policy opportunities and approaches that will be applicable at National, State, Municipal and Outer island levels. This activity will aim to optimally produce a legsilative framework for coastal and marine resource management at the national level that will introduce a Bill that aim at protecting and securing the coastal and marine resources of FSM from the impacts of climate change.

[23] IDP 2016-2025, Government of FSM

[24] PACC experiences are documented in the Technical Report and Experience Series found online at http://www.sprep.org/pacc/publications

A review of defined regulatory inspection procedures and protocols will be undertaken. This will work to improve clarity on the regulatory responsibilities within the government structures, and to identify ways to improve enforcement performance. A detailed consultation and participatory stakeholder engagement exercise, along with a desk review of existing information will be conducted to produce a detailed report / road map and action plan for the national government. This will accentuate climate resilient mainstreaming within government processes.

Activity 1.1.3 Develop policy and guidance documents for national and states; and

Activity 1.1.4 Endorse and adopt regulations, policy and guidance documents established for national and state levels

Following the outcomes of the review and framework development in activities 1.1.1 and 1.1.2, the project will seek to have policy and guidance documents developed at the National and State level, where required under the developed legilsative framework. The project will proceed through the legal programmatic procedures of adopting all legal requirements produced by the project. In doing so, the project will aim to institutionalize certain government agencies - including Environment Protection Agency (EPA), Department of Resources & Development (R&D) to be responsible and carry out these works.

Activity 1.1.5 Lobby and advocate regulation and policy changes in media campaign and public awareness activities; and

Activity 1.1.6 Monitor and report feedback and progress

The project will build the resilience of coastal and marine management at all levels by supporting compliance of development projects to FSM's Climate Change Law (2013). These activities will lobby and and educate relevant stakeholders on the changes made at the legislative and regulatory levels of decision making. It will ensure all development proponents participating in any development along the coastline and on marine environment are aware of and enforce these regulations. In doing so, the project will gather feedback and report to relevant national and state government departments.

Output 1.2 State regulations for development projects amended to consider climate change risks and resilience measures

Activity 1.2.1 Consultations and regulations at state level – Yap, Chuuk and Pohnpei

Currently, only Kosrea has egulatoins for development projects. The other three States of Yap, Chuuk and Pohnpei do not. In 2014 the Kosrae Pacific Adaptation to Climate Change (PACC) Project developed the Kosrae Regulations for Development Project (No. 67-05). These regulations which incorporate climate change impacts and adaptation measures will be considered and used as guidance in this project. One of the key lessons of the Kosrae PACC project was the revision of existing EIA Guidelines and its review processes to incorporate climate change considerations into the process.

This activity involves a series of consultations workshops with all key relevant stakeholders in each of the three states Yap, Chuuk and Pohnpei. The consultations will discuss and develop the required regulations, policy and guidance documents as well as a regulatory framework to effectively take these changes on board at the state congress level. These consultations will follow on from a completed review of the existing regulations on the environment protection in each of the three states. The review will seek to what extent climate risks are addressed and if any resilient measures can be identified and or strengthened. The consultations will provide recommendations as to the development of a regulatory framework that will aim to incorporate climate risks and resilience measures and provide a roadmap on the development of state regulation for development projects.

Activity 1.2.2 Develop, endorse and adopt regulatory framework on development projects at state level; and

Activity 1.2.3 Initiate development of regulations, policy and guidance documents identified and adopt institutional changes to existing arranagements; and

Activity 1.2.4 Endorse and adopt regulations, policy and guidance documents established for national and state

During the priority consultations in July 2015 and January 2016, Yap, Chuuk and Pohnpei stakeholders re-emphasised the need for regulation, policy and guidance documents to address climate change impacts, similar to those developed by Kosrae. Activities 1.2.2 – 1.2.4 will produce Regulations for Development Projects for Yap, Chuuk, and Pohnpei , to be approved by State cabinet. The project will ensure that institutional arrangements are developed, enacted and supported. Capacity building for these changes at the individual, systemic and institutional levels will be addressed under Component 4 of the project through the provision of training, workshops and other activities.

Activity 1.2.5 Lobby and advocate regulation and policy changes through media campaigns and public awareness activities

Activity 1.2.6 Monitor and report feedback and progress

Similar to activity 1.2.7, this activity will lobby and advocate for the changes made at the legislative and regulatory levels of decision makers, the general public and through relevant stakeholders. This will address stakeholders at both the state and natoinal levels. It will ensure all development proponents participating in any development along the coastline and on marine environment of all islands belonging to the states are aware of and enforce the regulations established. In doing so, the project will gather feedback and report to the project and to relevant state government departments and other relevant national departments.

Output 1.3 National Water And Sanitation Policy endorsed with climate and disaster risks and resilience, and gender mainstreamed

Activity 1.3.1 Review the water policy framework to incorporate gender and climate change

Experiences gathered from climate change adaptation projects from the Pacific show that mainstreaming of gender considerations is required at the outset of climate change adaptation planning. It has also shown that the benefits of such maintreaming at the policy level will trickle down to the most vulnerable at the community levels. Taking on this lesson, this activity will carry out a gender review. The findings from this review will incorporated into an action plan to strengthen the water and sanitation policy by integrating gender-sensitive approaches. This plan will ensure that activities are better targeted to those vulnerable women, men and youth in communities.

This activity will use tools for integrating gender perspectives into climate change policies taken from the Pacific Gender & Climate Change Toolkit, developed by Pacific regional organizations[25] - to gather targeted policy-relevant information relating to gender and climate change in FSM. The outline of a gender and climate change assessment for the policy is provided in table 4 below.

Table 4: The outline of the Gender Assessment work activity follows:

GENDER ASSESSMENT AND ACTION PLAN OUTLINE
Introduction, Background
Gender and climate change in FSM: the social dimensions of resilience and adaptive capacity
Why integrate gender? (policy and planning)
Methodology
Limitations
Findings of the Assessment
Policy design and planning
Policy implementation
Key recommendations
GENDER ACTION PLAN
Purpose
Gender sensitive policy outcomes
Objectives of the Gender Action Plan
Actions and implementation
Technical support and financial reosurces
Roles and responsibilities
Communicating lessons learned
Monitoring and evalatuion
Risks and assumptions
Policy Gender Logical Framework and Action Plan

This acitivity will strengthen the existing National Water Task Force (NWTF) to develop, complete and launch the policy through a gender-sensitised approach. It will also be applied to

[25] GIZ, SPC, SPREP, UNDP, GIZ, PACC Project (2015)

implementation of other activities of the project at the outer island / municpality level, for example under activity 2.1.1.

Activity 1.3.2 Preparation of the National Water and Sanitation Policy (NWSP)

This activity will be the top-down implementation of water and sanitation measures designed to improve capacity of the government, state, municipality and outer islands to respond to impacts of climate change under the water sector. A Framework for National Water and Sanitation Policy was established in 2011. It institutionalised a National Water Task Force (NWTF) chaired by the Department of Resources & Development. Measures to finalise a comprehensive policy. The outline of the existing framework follows:

FRAMEWORK FOR WATER POLICY	STRATEGY
1. Rationale for a National Water Policy	
2. Overview of Freshwater Resources and their their management in the Federated States Of Micronesia	
3. Developing a strategic approach for the management of the FSM's freshwater resources	Policy Statement, Vision Goals Guiding Principles Priority Areas for Action, Priority Tasks for the National Water Policy Officer and National Water Task Force
4. Strengthening national coordination of water and sanitation service delivery	4.1 Proposed Features of a Coordinating Body for Water and Sanitation 4.2 Proposed Membership of a Federated States of Micronesia National Water Task Force
5. Proposed components of a national water and sanitation policy	4.3 Joint Communiqué/Resolution on National Water and Sanitation Policy Development and Implementation 4.4 Overarching Strategic Water and Sanitation Policy Statement 4.5 Federated States of Micronesia National Water Outlook 4.6 Federated States of Micronesia Water Sector Investment Plan 4.7 Water Utility and Environmental Protection Agency Codes of Conduct (as required)
6. Monitoring, evaluation and dissemination	

The activity will engage the NTWF to facilitate a group of consultants or aTechnical Team to solicit views, put together the information and write the policy using the framework as the guide. Informaton will also be solicited from national and state level stakeholders. The national level consultations will identify national water resource management targets and performance indicators of the policy reaffirming the outline developed under the Framework.

This activity will develop a Joint Communiqué / Resolution on ‘National Water and Sanitation Policy Development and Implementation’[26] . This will serve as the political instrument for the implementation of National Water and Sanitation Policy. The resolution will be developed as a result of consultations on the policy at the state and national level, facilitated by the Technical Team. It will also develop an ‘Overarching Strategic Water and Sanitation Policy Statement’[27]. This statement will provide the agreed strategic approach for the management of water and sanitation in FSM. Information gathered from national and state consultations facilited by the Technical Team will help develop this statement.

Thirdly, this activity will intiate work on ‘Water Utility and Environmental Protection Agency Codes of Conduct’. Based on consultation results, water utilities environment agencies may be instructed to develop these codes as part of implementing the national water policy.

The activity will aim to get the policy endorsed by the President and Congress of FSM, publish and disseminate the policy through public awareness and media campaign activities.

Output 1.4 National Water Outlook and Water Sector Investment Plan developed and implemented

Activity 1.4.1 Implementation of the National Water Outlook Program

The activity will engage the NWTF in implementing the policy elements 4.5 - National Water Outlook, and 4.6 – Water Sector Investment Plan. The Water Outlook Program will be an annual program where as the Investment Plan will be comprised of prioritised costed actions for water and sanitation in each state[28]. The NWTF will finalize action plans of these components of the Water and Sanitation Policy and implement the activities.

The Water Outlook Program is an analysis of current trends and future projections of the state of water resources, demand, management issues in view of climate change risks and climate planning. The Program aims to strengthen the monitoring role of government and state owned enterprises in service delivery for water and sanitation throughout FSM. The activity will develop tailored information on water outlook, integrated with climate science and meteorology, providing monthly advisory support across FSM to be updated quarterly. The project will implement and monitor the Program and report results on a quarterly basis.

Activity 1.4.2 Implementation of the WSIP Program

The Investment Plan activity will procure a technical team to develop and finalise the Water Sector Investment Plan (WSIP) as per the Policy and policy guidelines / implementation plan. The project will ensure that the WSIP emphasises equal consideration of support for the Outer Islands. As a component of the Water and Sanitation Policy, the the activity will also be monitored and results shared. Monitoring and evaluation planning process and reports on progress of the activities will be carried out under the activity.

[26] This is currently stated as Component 4.3 of the policy per the Framework of the NWSP 2011.
[27] This is currently stated as Component 4.4 of the policy per the Framework of the NWSP 2011.
[28] Framework of the National Water and Sanitation Policy, 2011

Component 2. Demonstration of water security measures in outer islands of Yap, Chuuk and Pohnpei

Outcome 2a Water conservation and management technology & practices adopted, responding to drought, sea level rise and early recovery from cyclones

Output 2.1 Outer island communities oriented to CC, SLR, and adaptive capacity measures involving water, health, sanitation and environment

Activity 2.1.1 Arrangements for demonstrations of water and sanitation technologies

The activity will organise inception and orientation meetings at the outer island level led by the island governing council and facilitated by the State project management unit. Tools to ensure the consultations are gender-sensitised will be applied by the project. The objective of the training will clarify the overall project strategy, its objectives, outcomes, outputs, inputs, activities and roles and responsibilities of all stakeholders nivolved incluing transporation and logistics.

The communities will be actively involved in the orientation on climate change, sea level rise, vulnerability and adaptive capacity measures involving water, health, sanitation and environment on the island. Sex-disaggregated and age-disaggregated group sessions will be carried out in learning, training and awareness workshops within the communities. The approach will include everyone, through their traditional community-based organizations to actively participate and have their say in activities and strategies of the plan. This will include women, men, youth and elderly and those persons living with disabilities. The meetings may use a vareity of tools, including participatory rapid appraisals (PRAs), socio-economic assessment surveys, and gender-sensitisation tools.

Through these consultations, other community needs may be identified and addressed to support the activities of the project. These may include basic skills training on managing and implementing project activities on a day to day basis. The results from all activities here will be collated to inform a much larger whole-of-island workshop on the development of a potential whole-of-island development plan for the atoll islands (see activities under Output 4.1). This whole-of-island approach has been trialled and found to be highly successful in outer island of Abaiang atoll of Kiribati and Choiseul island of the Solomon Islands.

With the knowledge and skills developed from the orientation workshops and having clarified and contextualised the social, cultural and environmental aspects of the islands and communities during the inception workshop, the communities will lead in the identification of community, schools, household infrastructures for demonstration of activities of the project. This activity may be repeated under activity 2.1.2 depending on the particular island(s) of the atoll identified for the project.

Activity 2.1.2 Carry out ground-truthing assessments

In order to reaffirm data and recommendations gathered from the consultations carried out during planning stages (July, November 2015; January, February 2016), and from recent rapid assessments carried out by the Department of Resources & Development, and International Organisation for Migration (IOM) in March 2016, **a ground-truthing assessment** will be carried out. This will include carrying out technical surveys on water, water use in the community villages on island, sanitation and health incidences related to water. These surveys will also collect information on social aspects such as traditional knowledge, cultural and politcal governance and how these may influence the implementation and management of the project.

This activity will carry out a two-step ground-truthing assessment of data collected from a rapid assessment carried out in March 2016 in the atoll islands of Eauripik, Ifalik and Woleai. The **ground truthing** assessment will identify household and community infrastructures for demonstration. It will be undertaken in two parts, firstly to conduct hydrological assessments for each island that include interviews and site surveys. The **interviews** will be carried out with key personnel that hold responsibilities for water, health and sanitation on each island. It will also interview women, men and youth in sample households. The survey will ground truth data on:

Water storage capacity (wells, tanks, etc)
Available rainwater catchment area
Water seal toilets (contirbuting to output 2.3 activities)
Sewage disposal systems

The **site surveys** will be carried by a technical team made up of a team of one local and one international expert. They will be accompanied by the committee on island community selected by the island municipal council with equal representation of women, men and youth. The main responsibilities that will be undertaken include:

- Global Position Survey
- Elevation survey
- Flora and fauna survey
- Well survey (depth, conductivity)
- Groundwater survey quality testing
- Water quality testing (chloride testing)
- Rain catchment inventory
- Household interview
- Photo documentation
- Drone survey (village setting, entire atoll, for video, 3D modelling)
- Project logistics: solar power setup, food and camp

There will be at least two people for each task (one main person, one backup) but the actual task may be carried out by more people. The information from this work will also inform activities of Output 2.3 for building and constructing self-composting toilets on the island.

The second step will be active consultations with the community for finalisation of the site selection for the installations of the water tanks at the household and community levels. Lessons from PACC Nauru have shown that once sites have been established and agreed to, signed agreements between households / community organizations and the island government council should be put in place to ensure the sustainability of the activities throughout and beyond the life of the project. The basic conditions of the agreements are as follows:

Community / private owners agree to:

- undergo training on water conservation practices and maintenance
- carry out maintenance of the installed systems over time per maintenance schedules
- agree to lead in collection of data and participate in monitoring and evaluation of data.

- provide feedback on benefits and challenges of the systems.

Project agrees to:

- provide training on water conservation practices and maintenance
- provision of resources (materials, services)
- provision of spare parts / materials

The results of the community consultations will also produce short (maximum 3 years) or long-term action plans (5 years or more) for managing of water resources on the island. These plans will include three key components – 1 water infrastructure and maintenance (including maintenance schedules), 2 – water and health and 3 awareness and education. The plans will be linked to the community development climate change adaptation plan to be developed under output 4.1. The activities outlined under the signed agreements between households and community and the project will also form a part of these implementation of the plans.

Output 2.2 Water Harvesting and Storage System (WHSS) repaired and installed in 6 atoll islands

The water harvesting and storage systems will address the climate stresses, namely the prolonged periods of drought such as those experienced in the 1997-1999, 2003-2005, 2015-16 El Nino events, and the extreme weather events leading to high intensity rainfall, and lengthening of the dry season months. These climatic stresses necessitated review of atoll water resources that include design and status of wells, sanitation and rainwater tanks and their water holding and storage capacities.

At present, various types of water harvesting systems exist in poor conditions on the islands and people resort to coconut juices to meet their water demands[29]. The rainwater harvesting and ground water wells that exist are largely privately owned. The current rainwater harvesting systems and storage elements include roofing, guttering, downpiping, water tanks and concrete tanks. All systems are in poor, basic or unusable conditions as a result of damage from cyclones, extreme high tide events damaging infrastructure coupled with no maintenance due to lack of equipment and spare parts[30]. In Yap for example, 40% of water tanks on all nine outer islands including Woleai and Eauripik do not have proper rain harvesting systems (tin roofs for collecting rainwater and gutters including down spout, fasteners and clips). Nearly 90% of water wells had very low water levela; all are brackish and nearly all were uncovered.

[29] Rapid Assessment Report, March 2016, FSM
[30] ibid

Figure 5 Sample of water tanks and wells from outer islands – Eauripik, Woleai atoll, Ifalik, and Feraulap atoll (Source: Rapid Needs Assessment, March 2016, Yap, FSM)

Activity 2.2.1 Repairing household rainwater harvesting and storage system

The constituents of the water harvesting and storage systems include roofing, guttering, downpipes, first flush diverters, cisterns or tank and tank base. The systems are linked to and part of housing infrastructure.

Figure 6 Installing a rainwater harvesting system at the household level (source, PACC Niue,2014)

This activity will rehabilitate and repair existing materials of the households selected from activity 2.2.1, to close leaks and improve efficiency of existing rainwater harvesting systems. It will extend the gutters to the full dimensions of the catchment to capture more water; increase the catchment area to improve long-term water security and storage tank size if overflow is frequent.

The repair of household level rainwater harvesting systems and construction of community tank activities will be undertaken under the following minimum requirements:

HOUSEHOLD LEVEL	SUB-ACTIVITIES
Rainwater catchment systems	
Key activities	Repair household rainwater catchment systems
Minimum requirements	• _Repair existing systems to ensure that there is: • _2 HDPE[31] tanks per household criteria for maintenance without • _Extend gutters to full dimension • _Increase catchment area by using reliability curves[32] • _Increasing storage tank volume using reliability curves • _Clean up awareness campaign • _Clean up and maintenance training • _Maintenance schedules established • _Project and Household agreement for monitoring and maintenance through duration of project
Wells	
Minimum requirements	• _Construct rim walls extending up off the ground for wells without walls • _Build covers for wells without and repair damaged covers

The repair and installation of rainwater harvesting systems has worked successfuly in many low-lying atoll islands around the Pacific such as the Marshall Isalnds, Tuvalu, Niue, Nauru and Tokelau - in the face of drought. A full rainwater harvesting system successfully demonstrated in Niue under the PACC / EU-GCCA PSIS projects is shown in the picture below will be similar to what will be carried out in the six islands at the household level.

[31] HDPE – high density polyethylene tanks known for stiffness, strength, toughness, resistance to chemicals and moisture, permeability to gas, ease of processing, and ease of forming.
[32] Beikmann, A., Bailey, R., (2015) Freshwater Resources for Selected Atolls - Recommendations based on Modeling Study. In: Beikmann, A., Bailey, R., Jenson, J., Kottermair, M., Taboroši, D., Bendixson, V., Flowers, M., Jalandoni, A., Miklavič, B., and Whitman, W. (2015). Enough Water for Everyone? A Modeling Study of Freshwater Resources for Selected Atolls of Yap State, FSM. WERI Technical Report 157. Water and Environmental Research Institute of the Western Pacific, University of Guam, Mangilao,Guam.

Figure 7. A fully installed rainwater harvesting & storage system (source: PACC Niue, 2014)

Activity 2.2.2 Constructing community rainwater harvesting and storage systems

Community tanks are recommended to assist the larger community in times of drought to relieve pressure on individual household water tanks, and to meet basic water requirements for medium-term survival needs (activity 2.2.3). These include meeting not only the short-term survival requirements of drinking and cooking, but personal washing, washing clothes, cleaning home, growing food, and sanitation and waste disposal[33].

The construction of community tank activities will be undertaken under the following minimum requirements:

	COMMUNITY LEVEL
Rainwater catchment systems	
Key activities	Install community tanks

[33] Based on Maslow's hierarchy of water requirement needs, WHO 2013.

	COMMUNITY LEVEL
Minimum requirements	• Minimum 2 x 5,000 L / 2,000 Gallon HDPE tanks per atoll island > 100 population • <100 population requires re-assessment • > 400 population = 4 tanks • HDPE tanks preferred over concrete tanks • Extend gutters to full dimension • Catchment area sized appropriately to tank volume using reliability curves. • Encourage standalone catchment areas to shelter tanks and fence for protection • Access and maintenance rules established and to include cleaning each tank on a rotation basis, cleaning to be 3 times per year • Rules for access to include access by neigboring villages in times of drought • Maintenance schedules established •
Wells	
Minimum requirements	• Municipal council review, assessment and executive orders on environmental advice on burials to encourage use of existing cemeteries and reconsider burials in private residences and plots • Exceptions to consider sites down hydrological gradient from wells.

Activity 2.2.3 Monitoring and maintenance

The project management unit on island will collect information on a monthly basis on the repair and construction work and prepare monitoring progress reports on a quarterly basis. A monitoring and maintenance plan will be developed followng completion of repair and construction. Data on water saved, quality, use and distribution, will be collected against the baseline from the surveys. Throughout the duration of the project, the maintenance schedules will be used to monitor the quality and use of assets, and provide solutions to maintain the assets using spare parts collected by the project. Climate related extremes and environmental conditions will be recorded as well. The climate extreme events that may occur during the life of the project will be reported against the project and communicated. This will be used to develop lessons and practices of the project and provide any corrective actions.

Output 2.3 Self Composting Waterless Toilets constructed to conserve water, improve soil environment, and reduce marine eutrophication on the lagoon side

The cultural diversity amongst the six outer islands of the three states suggests there may be diverse preferences for the types of sanitation technologies used on the islands. The absence of pit toilets on some of the islands on the atoll in Woleai and Eauripik in Yap and Satawan in Chuuk are a blessing for the local groundwater and its quality. These practices should not change if the groundwater is to be retained as a clean and viable source for showering, washing, and cooking, as well as an emergency source for drinking water. The concern, however, is that beaches and shallow seawater are used instead. There is possible evidence of eutrophication during low tide on the lagoon side. At such time when circulation with the ocean is reduced, solar heating of the water is increased, and water can hold less dissolved oxygen. When algal metabolism removes oxygen at night it can cause fish to suffocate. Algal growth in the lagoon is boosted by excessive nutrient input from human waste. Local people have reported that dead fish wash up on the beach following very low tide events on the lagoon side of the island[34].The onset of climate stresses that include increase in sea surface temperatures will exacerbate this problem contributing to food security issues as well as water, sanitation and health issues.

Note: The ground-truthing assessments in activity 2.1.2 may yield some results on disagreement to proceeding with output 2.3 and its activities. The result may come from any of the six island communities as a result of cultural and social barriers. In the event that this output is not entertained, the project team will refer the community / island to the other community priorites they identified, and the activities therein. The community will consult in agreement based on these priorities and within the scope of the project.

Activity 2.3.1 Developing plans/ guidelines for self-composting water less toilets (SCT) awareness, installation and maintenance

The community consultations carried out under the ground truthing assessments of output 2.1.1 will include identification of school, community or household sites for installation of self-composting toilets supported by this activity. Special sessions for developing and agreeing to plans and guidelines for SCTs will be developed for the outer island targeting women, men and youth of the communities. An awareness, installation and maintenance component will be part of these guidelines and manuals. A demonstration unit will be carried out on the main island of the atoll. Training workshops on construction will be carried out as required. These training events will be coupled with Basic Water, Sanitation and Health (WASH) practices and water conservation awareness sessions outlined under Activity 2.3.4. The plans and guidelines review and site –specific context will be developed by the team, but based on the established *'Sustainable sanitation manual and construction guidelines for a waterless composting toilet'* (SPREP, 2007). Lessons from Nauru and Tuvalu under the Integrated Waters Resource Project ECOSAN component and PACC projects will be applied to improve on the construction designs of the project as well.

Activity 2.3.2 Constructing self composting toilets – using plans (1 unit each per gender)

The construction of the units will act as a demonstration measures. There will be separate unit for females and a separate unit for males. Each unit is a superstructure for a freestanding toilet building. The toilet house is built on top of the composting chambers that includes a ventilation and drainage system.

[34] ibid

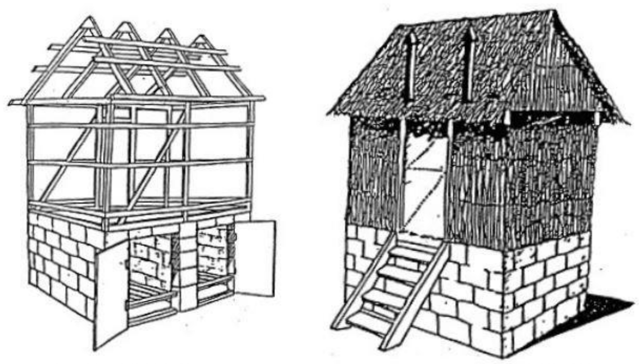


Figure 8 Basic and completed structure of self-composting toilets (source: SPREP, 2007)

The frame of the unit or superstructure will be built to storm resistant standard and suitable for covering with natural materials such as pandanus thatch or permanent materials such as fibro, plywood, or corrugated iron. The toilet rooms will provide a cool setting that allows cool air to settle and push down the hot air in the chambers up the tall ventilation pipes and out. The toilet rooms will be spacious, ventilated and allow for natural light. The roof will either be in zincalume, corrugated iron, or thatched with local materials. The materials and design of the superstructure toilet room can be varied to suit local building regulations and the practicalities and aesthetics of the site, as long as it does not compromise the function of the composting chamber and the drainage system.

A lead builder / carpenter on each main island will be identified with a team of men, women and youth to undertake the construction of the self composting toilets. The 'Sustainable sanitation manual and construction guidelines for a waterless composting toilet'[35] will be used to guide the construction.

[35] International Waters Project – Pacific Technical Report no.52, http://www.sprep.org/att/publication/000560_IWP_PTR52.pdf

Figure 9 Images of self-composting systems in the Pacific. L-R, a SCT using the roof as a catchment area for rainwater harvesting in Tuvalu (source: IWRM, Nauru). The toilet room, completed SCT in Tuvalu (IWRM, Nauru); construction of chambers, IWP Samoa and Vanuatu

The by-products of the SCTs will be managed through a soil improvement program led by communities.

Activity 2.3.3 Training on WASH and water conservation practices in school and communities

The training for Water, Sanitation and Health is particularly essential in the outer islands because of existing water storage infrastructures that are not maintained and are in very poor condition. A WASH survey tool will be used to collect information over the duration of the project and measure WASH baseline and changes as a result of the project intervention. Results of the WASH survey will contribute to evaluation results of the project overall. The tool will look at the following four indicators:

- Water & sanitation access.
- Water quality.
- Behaviour change.
- Health outcomes.

It will carry out the survey activities that include:

- Sanitary survey / Rainwater tanks survey
- H_2S tests for water quality

- Diarrheal/skin sore information
- Direct observation of sanitation facilities/ hygiene & household water storage & treatment practices

The WASH survey will be undertaken by a survey team lead by the Health department of each state, and those responsible for health on the outer islands. Teams will be assembled on each outer island and trainings carried out. Key experts will be sought from the Pacific WASH Coalition[36] program to assist. The project will work in partnership with IGOs such as the Red Cross Society and the State Health Services of each state. Women, men and youth members will be encouraged to form the teams and carry out the work. Following training, there will be at least four (4) rounds of surveys where round 1 will establish the baseline information. Monitoring behavioural change will need strong emphasis and how this will be catalogued will form an important part of the training programmes. This activity will need to be carried out subsequently, however, and not concurrently due to an unavailability of WASH experts in FSM and the region. As such, this activity may have to be carried out by one state or two outer islands each time.

Activity 2.3.4 Monitoring and after care

Data and information will be collected on a monthly basis and provided to the Outer Island Coordinator (OIC). The OIC will compile the quarterly progress report and update the Team Leader on the main island. The Team Leader will compile his/her quarterly report and submit to the Project Manager based in Pohnpei.

The after care activities will include maintenance checks and runs to the water harvesting systems installed, as well as the self composting toilets constructed. Caring for the assets developed by the project will be undertaken by the beneficiary themselves with assistance from the project, through provision of resources and materials agreed to during consultations. Any issues, risks and problems will be reported and corrective actions taken.

Output 2.4 3, 253 people trained on water conservation and management including coastal protection and livelihoods in 6 outer islands

The activities of this output are training workshops on skills and knowledge required to improve the ability of women, men and youth to carry out the work required for all activities under outputs 2.1, 2.3 and 2.4. The men, women and youth of the communities will be trained on skills and knowledge required for demonstration of water harvesting and storage systems, water data collection, quality testing and survey developments. This training will also include comonents on monitoring and maintenance and the after care of systems.

The trainings will be undertaken concurrently under each of the three areas of training needs as follows:

Activity 2.4.1 Water data collection and quality testing and survey developments	Activity 2.4.2 Construction, operations and maintenance of systems	Activity 2.4.3 Monitoring and maintenance / after care of systems
• **Well survey (depth, conductivity)**	• Operation and maintenance of rainwater harvesting	• Gender and climate change tools training

[36] Pacific WASH Coalition is a partner platform of various agencies formed in 2007 which supports/collaborates, coordinated regional initiatives for WASH

• **Groundwater survey quality testing** • **Water quality testing (chloride testing)** • **Rain catchment inventory training** • **Flora and fauna survey training** • **WASH survey techniques and tools**	systems • Construction guidelines for building self-composting toilets (SCTs) • Operation and maintenance of SCTs	• Climate change impacts on low-lying atoll island environments • Project management basics course training – importance of roles and responsibilities • Coastal geospatial assessment survey • Data collection, reporting and non-reporting.

Outcome 2b. Increased awareness of climate change through formal climate education

Output 2.5 Teacher's Guide on Climate Change developed to improve climate change learning in FSM schools and training institutions

The activity will produce a guide that will advance climate education at the state and outer island level and enhance the capacity of teachers to be able to teach climate and incorporate them into current curriculum on the environment.

Activity 2.5.1 Organizing climate change education planning workshops; and
Activity 2.5.2 Teacher's Guide on Climate Change translated in six outer island languages

The project management unit at state level of the project will be responsible for organising a series of state wide climate change education planning workshops. The objective of the workshops will be to develop a specific teacher's guide on climate change for each state. The guide will be translated to the local language in each of the outer islands. The aim of this guide is to deliver nationally prioritised key messages relevant to climate change science, the effects of climate change on FSM and the outer islands, and options to adapt to expected changes and awarenes on optinos mitigate its causes. It targets teachers, trainers or lecturers, and will be made easy for anyone to teach their students about climate change and increase their resilience to the effects of global warming.

The activity will undertake a collective review by participants of the workshops of the existing Pacific Guide developed by Regional SPC/GIZ/SPREP Programme called, Coping with Climate Change in the Pacific Island Region (CCCPIR)' . The *'Learning about climate change the Pacific way: A guide for Pacific teachers*'. The Pacific resource consists of a set of 16 colourful pictures with a description each. It descibes each picture with suggested learning outcomes, suggestions for teaching and learning activities; definitions and background information presented in colorful boxes. A glossary of key terminology is provided at the end of the guide. The FSM resource will consider these features and suplement and complement them with FSM-specific information.

Activity 2.5.3 Training of Trainers / Teachers on Teacher's Guide on Climate Change.

Following the review and finalisation of a FSM-specific resource, the activity will undertake at least a 3-day certified “train the trainer” workshop at each state. The objective of the training will be to train pre-service and in-service trainers in the teaching of climate change using the new FSM-tailored education resource: *Learning about climate change the FSM way*. Where appropriate the workshop will incorporate associated climate change education tools and topics.

Activity 2.5.4 Implement Teacher's Guide in Schools; and
Activity 2.5.5. Monitoring effectiveness of Teacher's Guide development system, and Guide itself

Following certified teachers and trainers, the activity will support schools on island proper and outer island in implementing the guide. A monitoring activity will be undertaken by providing evaluation forms for feedback by both teachers –on the use of the guide, and students – on the knowledge and lessons they learned on climate change from the new and added curriculum activity.

Component 3. Demonstration of Kosrae Inland Road Relocation Initiative

Over 6,680 inhabitants of Kosrae are likely to benefit from the intervention measures proposed (direct or indirect benefits) under Component 3.

Outcome 3. Increased resilience of coastal communities and environment to adapt to coastal hazards and risks induced by climate change

The Kosrae Shoreline Management Plan developed a prioritised list of inland road and essential infrastructure development to be implemented over the next one to two generations. Developing and upgrading the inland road between Malem and Utwe was considered the highest priority due to the risks posed to the vulnerable population and other infrastructure due to wave overwashing and potential breaching of existing sections at Paal and Mosral. There is a very real present day risk that road access to Utwe could be cut off. The natural storm berm to the south of Malem also tends to be lower in elevation resulting in the road being more prone to wave over washing during high tides.

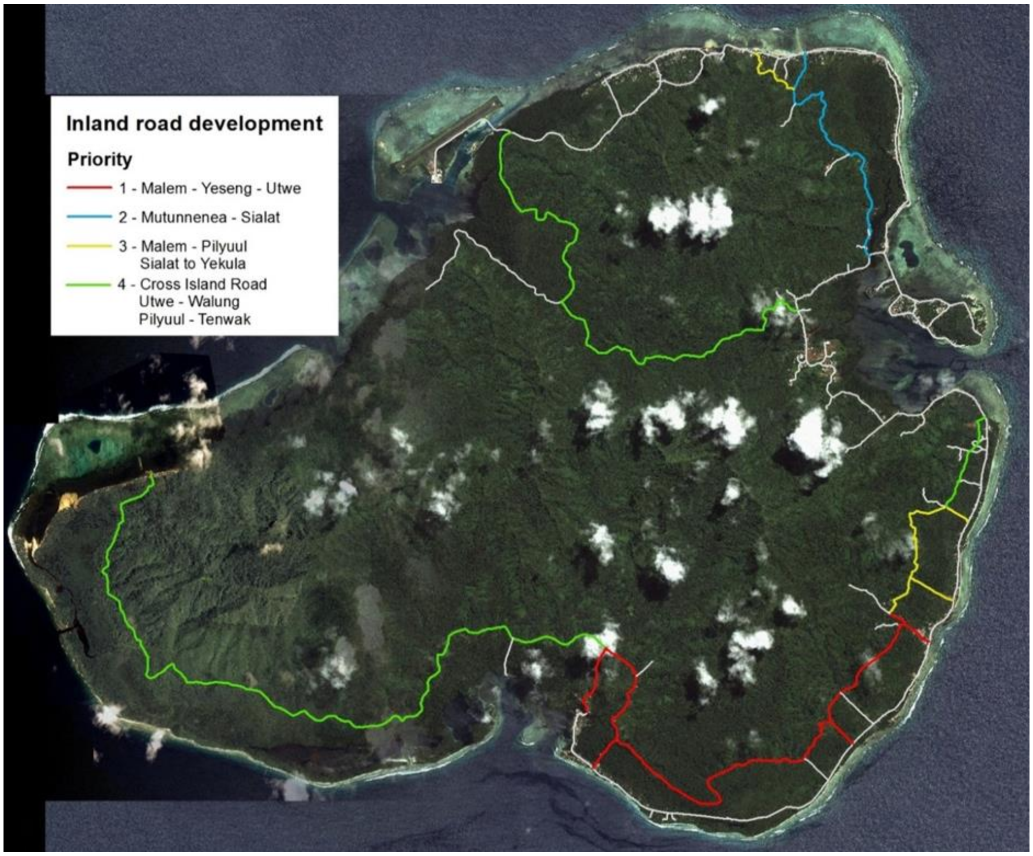


Figure 10: **Priority sections of the development of the inland road on Kosrae.**

Figure 11: Paved inland road between the airport and Tafunsak village (left) and on the narrow storm berm at Mosral, Malem (right).

Given the investment required, a staged approach is being adopted to the development of the relocated road, associated infrastructure and ultimately village infrastructure and residential development. Ultimately the intention is to develop the road to the same standard as the existing two lane paved road based on the design standards developed for the Kosrae Circumferential Road Extension Project (Barret Consulting Group Inc, 1987), as shown in Figure 11. Over the next one to two generations the inland road will become the primary road access from Utwe and Malem to Tofol.

The road design assumes:

- A 60 feet standard easement width.
- A 12 foot standard lane width.
- A 2% cross-section drainage gradient for hot mix asphalt pavement and 3% gradient for a sub-base surface.
- Existing sections of inland farm roads will be widened to obtain a roadway width of 30 ft., and include construction of roadway drainage structures (bridges and culverts) and resurfacing to sub-base course level.
- Upgrade to Hot Mix Asphalt (HMA) pavement includes base course preparation on top of the sub-base and 2" thick asphalt pavement. It is assumed that all aggregates included sand are imported.
- Where required an integrated infrastructure approach is adopted which includes relocation of power distribution, and any water or telecom service infrastructure.

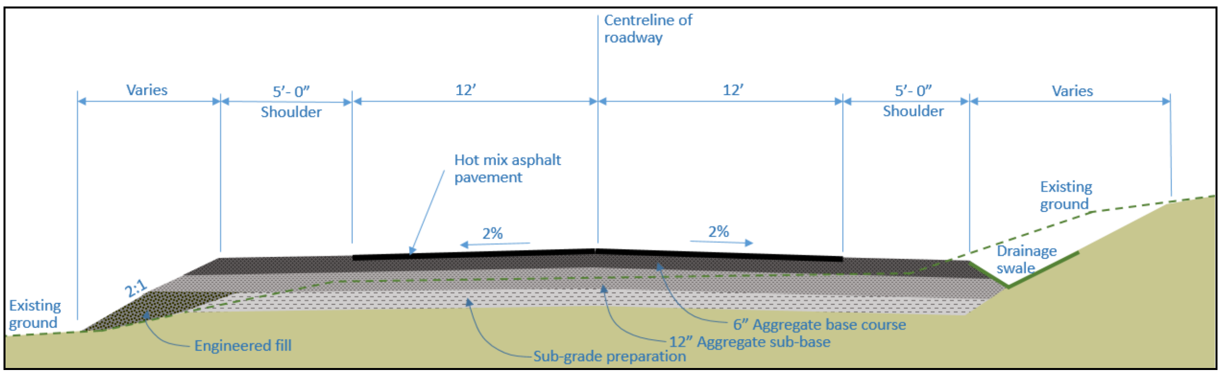


Figure 12: Typical road cross-section. Based on the design standard developed for Kosrae circumferential road extension project (Barret Consulting Group Inc., 1987).

The inland road would be developed around the perimeter of the lower slopes of the volcanic part of the island. At this present stage the alignment of the road is indicative and has not been yet surveyed and defined. However, it will be located well above the inland boundary of freshwater swamp or mangrove areas along approximately the 10 m contour. This will also be well above areas likely to be directly impacted by sea-level rise over the next century and beyond (Ramsay et al, 2014). Following the natural contour of the topography minimizes any significant road slopes, need for substantial cut and fill, and reduces erosion potential and land slipping hazard. The intention is that the road, when complete, will be similar to the present inland sections of road for example between the airport and Tafunsak village (see figure 11).
The proposed indicative alignment of the road along approximately the 10 m contour is shown in figure 12. Further alignment options are described under the Preliminary Environment Impact Assessment Report annexed under Annex1 – Environment Social Management Plan. Under the AF proposal the road will be constructed up to a sub-base standard (Figure 14). Upgrading the road to a hot-mix asphalt surface is expected to be subsequently completed with development funding assistance.

Figure 13: Initial indicative alignment of inland road sections between Utwe, Malem and Pilyuul. Dashed lines indicate further alternative road alignments / options considered.

Figure 14: PACC road in Tafunsak completed to sub-base surface standard.

Output 3.1 ***3.6miles (5.8km) of Malem-Utwe inland road and access road routes constructed to sub-base roading standard for future relocation***

Activity 3.1.1 Survey, design, reconstruction and maintenance of road and related infrastructure to ensure climate change resilience

A number of activities will be undertaken to construct the total distance of Malem-Utwe inland road and access routes as follows. Firstly, the project will finalise proposed inland route, vegetation clearing and topographical survey, and road easements with landowners. The Department of Transport & Infrastructure (DTI) will then move to design each section of the inland road and access routes from Malem to Utwe via Kuplu Wan to sub-base. Procurement of companies to provide the goods and services required to carry out the work will follow. The design, procurement and construction will include minor upgrade to access road from from Utwe to Finsrem and theYeseng access road. The Malem Municipal Council will be providing co-financing support by upgrading the access road at Malem which stems from the coastal road inland towards the starting point of the inland road from Malem.

New and relay works of water mains along the Malem - Yeseng - Mosral - Kuplu section will be carried out under DTI. The new mains will be connected to existing water supply at Malem and Finfokoa. The Kosrae Utilities Authority (KUA) will then install new electricity lines along entire length of inland road from Malem to Utwe via Kuplu Wan. The power lines will be installed together with new telecommunciation lines where required once the roads have completed construction.

Once construction is completed, the project will carry out monitoring and provision of support for road maintenance within the project life. This will assist the government under its Infrastructure Maintenance Fund budget to maintain the road until the end of the project in approximately June 2022. Thereafter the Government will maintain the road to the appropriate standard through its own resources.

Output 3.2 ***Transitional coastal protection at Mosral and Pal upgraded for immediate coastal protection***

Activity 3.2.1 Coastal protection works

The KSMP 2014 clearly states that the highest priority for “transitional defences” to upgrade of the defences at Malem village, and extension of coastal protection to the south along the critically exposed section of road at Pal and at Mosral. The communities of Malem and Utwe discussed this at length during consultations and concluded to agreement on this particular priority (Section II.H). The project activities summarized below will focus on constructing the protection walls and monitoring against climate and weather extremes (such as king tides and storm surges) during the implementation of the project.

Paal section of malem road. mass concrete bags, loose boulders and broken concrete, placed randomly to reduce surge impact and prevent wave overtopping and erosion of road (photo credit: Simpson Abraham, 2015)

Mosrael section of the coastal road. Existing dumped concrete rubble. A low reef flat breakwater to 'stabliize' shoreline will also be required further south to prevent outflanking and downdrift erosion. (photo credit: Simpson Abraham, 2015)

Transitional Location	Length of Defence	Proposed inputs in the project
Pal, near Utwe	160 m 175 yards	The revetment will be an upgraded section with a 1:3 slope, double layer of rock armour, average rock size of 0.66 m (2 feet), and a crest that is 3 rocks wide. Given the proximity of the road a mass concrete wave upstand wall at the landward edge of revetment crest will be required ensure wave overtopping is minimised. Revetment extension behind existing shoreline at the southern end to prevent outflanking and further downdrift erosion. Noting possible retreat of the shoreline at the southern end, an additional low reef flat breakwater will be be required to 'stabilise' the shoreline to prevent further exposure of the road.
Mosral, near Malem	110 m 120 yards	Existing mass concrete bags can be retained with the revetment constructed seaward of them. The revetment will be at a 1:2 to 1:3 slope, double layer of rock armour, average rock size of 0.66 m (2 feet), and a crest 3 rocks wide. Given the relatively low- level of the road a mass concrete wave upstand wall at the landward edge of revetment crest will be required to ensure wave overtopping is minimised. Outflanking and further downdrift erosion will occur at the southern end of the revetment and some form of additional low reef flat breakwater may also be required to 'stabilise' the shoreline at the southern end of the revetment to prevent further exposure of the road.

Output 3.3 State support program to access land in upland areas established

Activity 3.3.1 Land consultations, surveys, mapping and regulatory framework for future inland movement of vulnerable coastal people and infrastructure

It is normal practice for the people of Kosrae to swap land. They do this regularly between landowners, and between landowners and the Kosrae State Government. The practice to relocate land between the government of Kosrae and a private land owner to faciliate a municipal waste dump for the capital is a recent and succesful example. The Kosrae State Government has therefore been able to successfully negotiate with private land owners for appropriate sites and appropriate prices for their land.

At present, there is no program to facilitate land access anywhere except the socially agreed method of 'land swap'. The consultations from all stakeholders during the planning stages of Inland Road Relocation Inititiative (IRRI) identified the need for a State program to systematically support access to land in upland areas for inland road access.

A group of experts will facilitate the development of a land registry, including procedures and policy and guidance documents that may be required. The project will ensure that consultations with be an active participation involving all community stakeholders, including landowners, women, men and youth.

A mapping exercise of all households in vulnerable areas that are without land in inland areas will be undertaken as a first step. This will be followed by a community infrastructure relocation planning exercise with both Malem and Utwe municipalities. The options for a land provision for households who are without upland land will be highly considered. A land purchase and swap registry to be used by Malem and Utwe households who own no land inland in inland areas for homes and public infrastructure (schools, municipal govt buildings) will need to be established to support the implementation of the community infrastructure relocation plans.

A legislative amendment(s) to enable access to and use of land above Japanese line will also be considered under the activity. This will be required to assist with the voluntary movement by the communities. The land above the Japanese line is currently owned by the State and under the current consitution, can not be used. There is a currently a legislative request to amend the constitution to facilitate access to land above the Japanese line. This will be considered by the project and the State Government.

Output 3.4 Community-Based Ecosystem Management strengthened

Activity 3.4.1 Palusrik / Kuplu Wan watershed protection strategy, native vegatation buffer zones and stream health monitoring program to strengthen sustainable use of uplanad areas

The community of Utwe raised concerns as to the potential impacts of the construction of the road and the location of the road on Utwe village's water supply. As a result, the alignment of the road through the southern part of the Kuplu Wan plateau (Palusrik catchment) has been re-aligned (DTI, 2016). According to the preliminary environment impact assessment carried out for the inland road, the realignment results in a minimum buffer of 150 m at the watershed between the two catchments and over 350 m for the majority of the section of inland road within the Palusrik catchment (see Kuplu Wan Option 2 road in figure 15). Given the distance to the Palusrik River, the only perennial stream in the catchment, and the characteristics of the likely catchment drainage pathways, there is *unlikely* to be any impact from the construction or operation of the road itself on Utwe's water supply.

The community of Utwe agreed that this activity will develop a Watershed Protection (Management) Strategy for the Palusrik and Kuplu Wan area as a proactive adaptation measure to protect its water supply now and into the future. The strategy will take into consideration immediate, long-term and future developments around the area. It will promote ecosystem based adaptation services, practices and activities that aim to maintain the ecosystem services that the area provides.

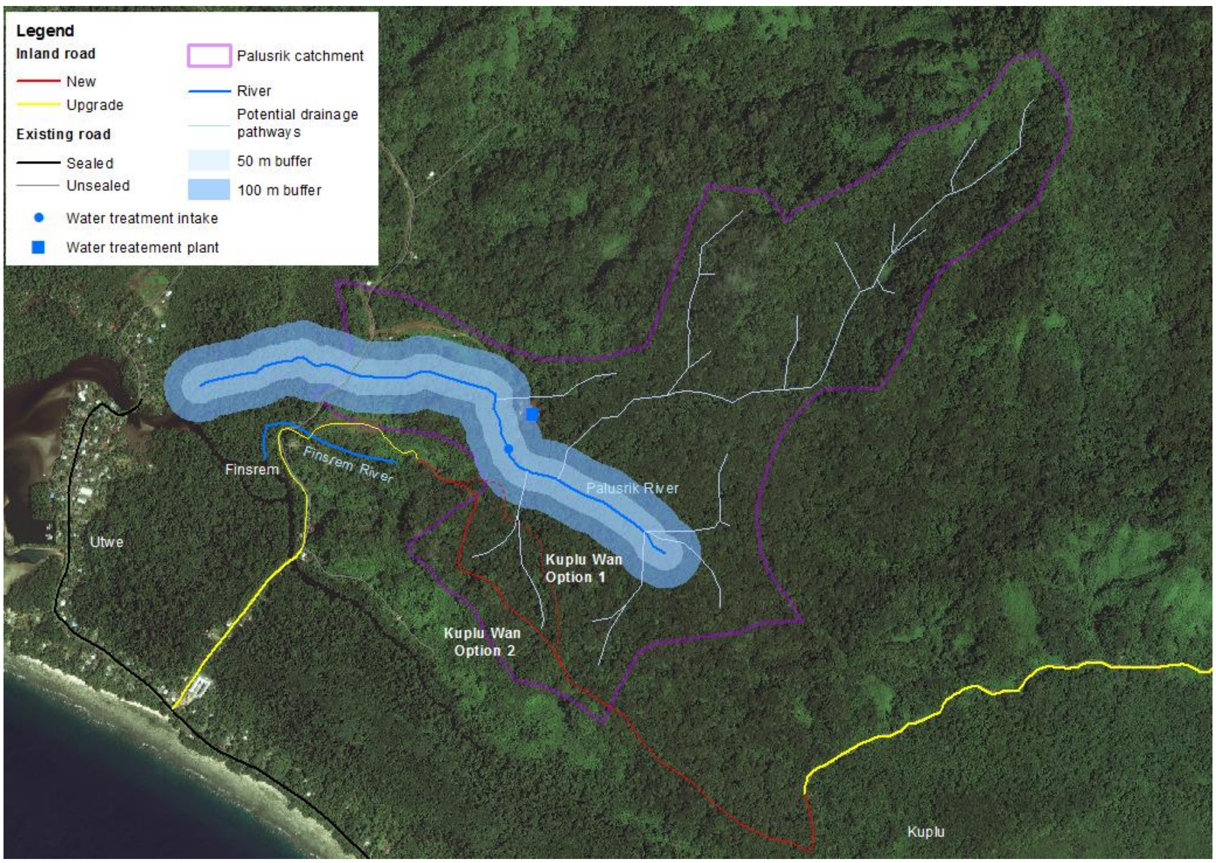


Figure 15 Kuplu Wan road alignment options and buffer zones from the Palusrik River. The re-alignment responding to issues raised by communities is shown in red (Kuplu Wan option 2). (source, PEIA Report 2016, Department of Transport and Infrastructure)

The communities with technical assistance provided by the Kosrae Conservation Society Organization (KCSO) will lead in developing, implementing and monitoring native vegetation buffer zones along sensitive areas where roads and rivers meet. The community will:

1) re-plant endemic vegetation around river and stream areas at road crossings; and
2) develop community gardens along road easement strip to stabilise cleared land; and
3) raise awareness about climate-resilient food crops and nutrition.

A community-led stream health monitoring program will engage schools, women and youth organization of the communities to be able to monitor the surrounding environment effectively, particularly where the new inland road is constructed. The program will educate, train and provide hands-on collection of data along the rivers and streams to gauge the level of water quality. The program will implement bio-assessment techniques such as sampling a body of water to find the biodiversity of macroinvertebrates in the water, providing strong indication of the water quality.

Awareness campaigns implemented throughout the project to support continued sustainable use of upland areas, catchments, waterways, swamp and mangrove ecosystems will be carried out by KCSO and community based organization working under the guidance of the municpality governments and project.

Output 3.5 State support program to assist accessing finance for vulnerable households established

Activity 3.5.1 Preparation of support program for accessing finance

The Kosrae Housing Authority (KHA) and the FSM Development Bank (FSMDB) currently have existing loan mechanisms that can be accessed by those that are eligible to apply. Currently most applicants are not eligible for loans under the FSMDB because they do not meet income criteria of USD 10-30,000 per adult. The Consumer loans are for up to USD 30,000; 5 yr term, 15% flat rate. If declined, one can apply under personal/consumer loan category or go to KHA.The KHA loan sizes are small relative to home construction costs.

The Banks do have support programs but are limited such as translating legal documents to Kosraen to help clients understand the terms and conditions. The following table (table 5) summarizes current mechanisms that are available from the only two funding institutions operating in Kosrae:

Table 5 Current Finance Mechanism available

<table>
<tr><th></th><th>CURRENT FINANCE PROGRAMS</th><th>BASIC CRITERIA</th><th>ELIGIBILTIY</th></tr>
<tr><td rowspan="3">FSM Development Bank</td><td>1) Housing Loan Program 100k/yr</td><td>USD $30,001+
Term: 20 years
Interest Rate (IR): 9% (fixed)</td><td rowspan="2">Income fo USD10-30,000 per adult
Currently most applicants are not eligible – do not meet the income criteria; move to – Personal / Consumer Loan</td></tr>
<tr><td></td><td>USD $20-30,000
Term: 5 years
IR:15% (fixed)</td></tr>
<tr><td>2) Personal / Consumer loan</td><td>USD 5-19,999
Term: 5 years
IR: 15% (fixed)</td><td>If ineligibile, refer to Kosrae Housing Authority loan programs</td></tr>
</table>

	CURRENT FINANCE PROGRAMS	BASIC CRITERIA	ELIGIBILTIY
Kosrae Housing Authority	1) Housing Loan Program Disbursment of $200-300K per year.	USD $7-10,000. Term: 15-20 years IR: 7% (fixed) # of disbursed loans / yr: 15-20	Eligible applicants are provided a promissory note and deed of trust and explained. Most loan takers are aged 25-40 yrs.
	2) USDA-funded Rural Development Program	These are "rural development" loans that can be used to improve home sites. IR: 4%	For senior citizens (over 62) with funding from the USDA.
	3) (new loan program) USDA-funded 50-80,000/yr program in development	Not yet qualified by USDA	Unknown

FSMDB's national lending target has a USD 9 million per year. In Kosrae lending target is 1.5 million per year; Housing Loans make up 20% of the National portfolio but only 1% of the Kosrae portfolio.

This activity will impact 1,476 people in Malem and Utwe communities. It will contribute to the high level target of the project of gradual inland relocation over the next 10-20 years of the 236 households in Malem and 161 households in Utwe, starting with the 93 households - 83 in Malem and 10 in Utwe, currently in the coastal hazard zone. The objective of the activity is to help vulnerable and poor households to be able to afford finance for inland relocation by establishing an enabling program from the state government.

The activity will carry out a short review of existing finance mechanism and identify options including financial incentives to support upland residential development. The activity will complement existing programs and schemes in Kosrae providing access to finance. The results and recommendations will assist and inform the state government and banking institutions in how to better assist the communities in meeting financial needs for relocation. The activity will also improve on existing activities such as translating terms and conditions and other legal documents in Kosraen as well.

The activity will ensure climate risks in coastal areas are considered in existing local schemes, ensuring they cater for vulnerable households in coastal hazard zones. The activity will support the capacity of the DREA and relevant stakeholders to be able to develop applications to GEF6 via grant and non-grant instruments.

Component 4 Knowledge management for improved water and coastal protection

Outcome 4. Capacity and knowledge enhanced and developed to improve management of water and coastal sectors to adapt to climate change

Output 4.1 Community resilient (Municipality) Development Plans developed and communicated

Activity 4.1.1 Organizing development of Island / Municipal Government Development Plan

The eight Development Plans developed by and for the eight communities of the project (Woleai, Eauripik, Satawan, Lukunor, Nukuoro, Kapingmarangi, Malem and Utwe) will serve as the overall strategic plans of the communities. These will be climate and disaster resilient plans that link all sectors plans that exist currently for the islands integrating approaches with the view to reduce vulnerability and promote risk reduction measures to island water and municipality coastal resources. Each Plan will encompass not just the priority sectors identified during the planning stage, but other sectors that the communities have identified as required climate resiliency measures to be incorporated. The new Plans will update the old and existing plans. These plans will be explicitly linked to state and national sector plans, policies, regulations and relevant legislations. An Action Plan outlining clear actions, timeframe and responsible community and partners, as well as a Communication strategy will be key components of each Plan.

An organizing community planning workshop will be used to form a Working Committee to develop, or review existing Island / Municipal Government Development Plans. A terms of reference for the Working Committee will be agreed upon at this Inception workshop and submitted to the Chief Magistrate seeking an Executive Order for the establishment of the Working Committee. A consultative planning processes by the Working Committee on island involving all stakeholders will be established under this working committee. This will ensure ownership of the process and document to be developed. The activity will promote partnership with Non Government Organizations and Community Based Organziations to work together to develop the Plans.

Activity 4.1.2 Implement institutional changes to existing arrangements and establish effective communications based on new/ revised Plan and communications strategy

At the finalisation of the Plan, the working committee will recommend to the Municipal Council is adoption. The activity will implement the adoption by establishing new institutional arrangements on island. It will require the improvement of existing municipal government council offices, roles and responsibilities will be revised, and personnel set up. It will install key relevant basic communication equipment required to communicate effectively to stakeholders on the main island, including to other islands of the atoll.

Activity 4.1.3 Share and disseminate Plan to partners and stakeholders

The activity will implement the communication strategy of the Plan, by launching, and implemeting outreach programs firstly within the atoll island, amongst the population. It will then disseminate this Plan and any progress reports and success stories, outwards to supporting partners, through government and NGO networks.

The Plans will complement activities that will be carried out by the outer island as outlined under Components 2 for all six outer islands and Component 3 where applicable for Malem and Utwe communities in Kosrae. The plans will also complement and link to relevant plans, policies and guidance notes developed under component 1.

Output 4.2 Resource materials developed, tailored to local context, translated, published and shared amongst various stakeholders

The activities under this output are expected to produce two kinds of resource materials: visibility and knowledge-based. Resource materials that promote visibility of the project, its lessons and best practices include project briefs, brochures, booklets for leaders, pamphlets in english and local languages targeting the communities, and success stories that are shared through national and regional newsletters (e.g., SPREP Climate Change Matters) on a frequent basis (monthly, quarterly). It may also include prints on pens, drives that include information about the project, calendars, shirts, hats, and other items that may increase awareness and support media campaigns about the project.

Knowledge-based products capture the adaptation knowledge generated by the project and from project processes and results. These include documentaries about the project and the results it has achieved. It includes peer-reviewed technical reports, manuals, guides, training modules, etc developed as a result of the interventions of the project.

The key areas of learning and knowedge generation, its documentation and sharing, would be as follows:

1. Legislation and regulation assessment on coastal and marine resource management at national and state levels in FSM.
2. Water harvesting and storage infrastructures and capacity in outer islands, FSM.
3. Water quality maintenance relative to water resources in outer islands – focusing on wells and tanks.
4. Water quantity relative to water harvesting systems in outer islands.
5. Success of reducing vector and water-borne diseases from changes in water and sanitation practices in outer islands, FSM.
6. Willingness to reloctate, and linkages to access to land and finance, and provision of utility services (inland roads, water mains, telecommunications and power)

At least 20 knowledge products will be produced by this activity, including an Operations and Maintenance Guide for rainwater harvesting and storage systems, and climate resilient design guidelines for inland road access routes.

Activity 4.2.1 Capture and document data and information generated by the project

The project will, through this activity, develop a project communication and knowledge management strategy that will guide and ensure the project is visible to partners and stakeholders and the work that they do. It will also guide the capturing, development, production and disemmination of knowledge products of the project.

The data and information generated, lessons learned and best practices of the project will be captured and developed into products that will be peer-reviewed, scientifically edited and published in journals or online and through existing government and regional publication series. The project will learn from the knowledge management process of the PACC project where a

Technical Series and Experience Series[37] was established, published, and shared online and in hard copies where possible.

The activity will engage a local expert on knowledge management and communications to be based within OEEM project management unit of the project, to capture, store and collate data and information incoming from state project management units. This will be through monthly and quartlery progress reporting. Data and information including metadata, pictures, sound recordings, maps, vidoes from ground truthing assessments, technical surveys, consultation workshops, reports carried out will be captured and stored. This will be useful for measuring against the baseline of the project and annually for changes, to measure results of the project against its strategic results framework. Communication equpiment required to effectively carry out the required work will be addressed under this activity.

Activity 4.2.2 Organizing consutlancy support to edit scientific and peer reviewed knowledge products from the project

Previous projects such as the PACC and GCCA:PSIS learned that engaging a knowledge management expert early in the process once results are generated, is more effective, especially for when production of knowledge management products and technical climate change adaptation information is required by decision and policy makers. Preivous and current project experiences show that the project manager, and finance officers are always tied up in the day to day management of the project, that often times, the results of the project is never catpured effectively, nor is it shared to those concerned and would benefit from it. This project will learn from that lesson by engaging an expert early in the process to edit and peer review information

The activity will enage a knowledge and communications officer after the first year of the project, prior to the mid term evaluation, and when results are generated from the commuity level. The knowledge management expert will write technical reports based on data and information collected from activity 4.2.1 and carry out interviews, visits, triangulating and revalidating data. The officer may propose specific technical experts to carry out technical review on processes and designs of adaptation interventions proposed by stakeholders. The aim is also to generate targeted lesson reports, practical guides, and manuals that help reduce risks and improve resliency to climate change within the sectors. These will become knowledge products that will be captured and produced and shared locally, nationally, regionally and internationally.

The activity will also engage local experts including NGOs and community-based organizations (CBOs) that include women, men, and youth as partners to catpure and produce knowledge products from the project, at the state and community level. The products will focus on documenting results of the project with the aim to target the local community population, the younger age groups, and/or specifically to women, elderly, men, youth, and people living with disabilities.

Activity 4.2.3 Print, publish, produce and share materials through public awareness and media campaigns

[37] The PACC Technical Report Series and the Experience Series can be found online at https://www.sprep.org/pacc/publications. The products can also be found by searching within the regional climate change portal, https://www.pacificclimatechange.net; and the SPREP Information Resource Center and Pacific Environment Information network https://www.sprep.org/pacific-environment-information-network/pein

OEEM will carry out a peer-reviewed process for the knowledge products to ensure the information and package is of high quality, before it can be printed for public consumption. OEEM will reach out to regional partners such as SPREP and SPC for their technical review of these products. The activity will launch the products at various events locally, regionally and abroad. It will invite key stakeholders and hold public awareness activities and media campaigns to ensure wide range of audience is captured. Once printed in hard copies and in soft copies, the materials will be distributed widely to stakeholders including communities involved. Each product will be assigned ISSN and ISBN numbers with the aim to distribute widely amongst key library and academic institutions within FSM and the Pacific.

The project will utilize existing distribution networks such as through the SPREP's award winning network - Pacific Environment and Informations Network (PEIN); the Informations Resouce Center, the Pacific Climate Change Portal (www.pacificclimatechange.net); and the Pacific Disaster Net (www.pacificdisaster.net).

Output 4.3 Stakeholders brought together to share, learn and exchange knowledge and skills on climate change, adaptation planning, monitoring, vulnerability assessments and climate change

Activity 4.3.1 Organizing inception workshop and project trainings for all key stakeholders of the project

The recommendations from some of the terminal evaluation reports and lessons learned reports of projects from around the Pacific such as the PACC have pointed to the need for stakeholders to be trained at the outset of any project, specifically during the inception phase, on the project framework or understanding of the logical flow of the project and how to participate effectively in it. Gender and climate change traning was also identified as another training required at the outset. Hence it has been incorporated under Component 1 for national and state level stakeholders specific to the water policy. The capacitiy needs assessment is required at the outset so that stakeholders, especially the communities provide what training needs are required to effectively undertake the project.

This activity will be implemented over a period of three months during the inception phase. An inception workshops inviting all key stakeholders from all four states will be carried out. A capacity needs assessment and basic project management and financial reporting trainings will be also carried out by stakeholders. The gender and climate change training of trainers workshop is to build the capacity of national and state level experts to be able to apply and use gender perspective tools in managing and implementing activities of the project. Refresher trainings will be be undertaken throughout the project period under other component activities outlined above. SPREP and OEEM will cofacilitate the trainings for project execution and project management.

Activity 4.3.2 Organizing Bi-Annual Meeting of the Project Board and presentation of impact assessment studies by key stakeholders of the project

As the entity responsible for approving key management decisions of the project, the Project Board (PAC) must meet face-to-face to discuss the progress of the project against its objectives. The PAC composition includes SPREP as the RIE and SPC, UNDP or another regional organziation as an observer within the PAC. There will be impact assessment studies that will require technical experts to attend and present at the meetings. The PAC therefore plays a critical role in assuring the technical quality, financial transparency and overall development impact of the project. The key management issues of the project overall will be discussed.

It will be costly for the project to host annual face-to-face meetings of the Project Board (PAC). There will be annual PAC meetings but these will be conducted through teleconference means over LAN lines or Skype. With the exception of Pohnpei (the capital), the internet in Kosrae, Chuuk and Yap do not have bandwidth for clear skype conversations. As such, the PAC will have to meet face to face.

This activity will hold two bi-annual meetings of the PAC during the implementation period. This is planned for May 2019 and May 2021. A third face-to-face meeting may be carried out for February 2022 towards the end of the project during its closing phase to discuss results including terminal evaluation results and closing strategy of theproject. Where feasible the PAC will carry out site visits to assess the progress of the project. This will only be likely with the Kosrae component.

Activity 4.3.3 Trainings on climate change, sea level rise and adaptive capacity measures on water and coastal sectors

The activity will carry out training workshops at the state level on climate change impacts, both global and localised changes on water resources for the water sector based states and coastal sectors for Kosrae. The workshops will be carried out in Kosrae with technical assistance from key partners such as SPREP and SPC North Pacific Regional Office, the Micronesian Trust and Micronesian Challenge program. These will be sector and state specific workshops that will address impacts of climate change and sea level rise on the proposed sectors. It will provide experiences from elsewhere in the Pacific.

The activity will carry out a number of varied and applicable refresher trainings during the course of the project for water priority states. The trainings will include the use of gender and climate change tools, improving communications between main and outer island, application of regulations and policis and basic financial management for state and community based organizations. There will also be opportunities to provide hands on basic plumbing, water tank cleaning and maintenance schedule trainings for water priority states. This will be a proactive adaptive capacity building measure that will be learned from other islands and applied to others. The project will partner with women’s council groups on main island as well as other non governmental organizations to carry out these trainings.

There will also be an opportunity to carry out a participatory 3-dimension modelling approach during consultations. This will be completed as one of the first activities of the project during inception phase. The activity will aim to map the bathymetry of the atoll islands as well as the surrounding islands of the atoll. This will assist in decision and policy making by members of the community.

Activity 4.3.4 Mid-term evaluation carried out to evaluate the extent the project is meeting its objectives and share lessons; *and*

Activity 4.3.5 Final evaluation carried out to evaluate the extent the project has met its objectives and share lessons

The activities will facilitate the conducting of reviews and evaluations as per the agreed monitoring and evaluation plan of the project. The Mid-term and Terminal Evaluation will be carried out by external person(s). The conduct of evaluation will follow the provisions of the Guidelines for Project/Programme Evaluation of the Adaptation Fund. The scope of the evaluation, inter alia, will include assessment of achievements, progress towards impacts; and evaluation of risks to sustainability, processes influencing achievements and M&E systems. The evaluation will specifically focus on achievement of adaptation measures and contribution of the project towards achievement of AFB targets, objectives, impacts and goal.

B Benefits

Describe how the project / programme provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project / programme will avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The project is expected to deliver a set of targeted and interlinked economic, social and environmental benefits, as well as serve as a model for future replication throughout the four states of the country in other sectors (food security, marine resource management). The project will promote a set of innovations, together with partner institutions / organisations that will help create better living conditions for the outer island and coastal communities of FSM.

The project will be implemented in the six outer islands namely Woleai and Eauripik in Yap State, Satawan and Lukunor in Chuuk State, and Nukuoro and Kapingamarangi in Pohnpei State. The project will also be implemented in Malem and Utwe communities of Kosrae island. The relevant demographic details of the villages collected throughout the planning stages are given in the tables below. The key indicators for improved water and toilet access are given below in percentage per households. The figures include the average percentage of households in outer islands.

Table 6 Relevant demographics of the two outer islands of Yap State, Eauripik and Woleai

NAME OF ISLAND >	EAURIPIK	WOLEAI	TOTAL
Population	110	800	910
Male	54	425	479
Female	56	375	431
Households	18	85	103
Source of drinking water, % per household	Improved[38]		99.5
	Not Improved[54]		0.5
Toilet facility - % per household	Improved[39]		24.7
	Not Improved[55]		75.3

[38] '*Improved*' includes sources from public water supply, community water supply, household tank, protected well, bottled water, and household water tank. *'Not improved'* is water truck, rivers, lakes, springs and other sources of drinking water. (source: Divisions of Statistics, SBOC, FSM, 2014)

[39] *Improved* includes flush toilet, water sealed and ventilate improved pit. *'Not improved'* are not-ventilated-improved pit, any 'other' form of toilet and not having a toilet (source: Divisions of Statistics, SBOC, FSM, 2014)

NAME OF ISLAND >	EAURIPIK	WOLEAI	TOTAL
No. of Rubber / Plastic Water Tanks	13	67	80
No. of Concrete tanks	0	8	8
No. of Concrete wells	6	55	61

Table 7 Relevant demographics of the two outer islands of Chuuk State, Satawan and Lukunor

NAME OF VILLAGE >	SATAWAN	LUKUNOR	TOTAL
Population	692	848	1540
Male	353	432	785
Female	339	416	755
Households	97	119	169
Sources of drinking water, % per household	Improved[54]		94.7
	Not Improved[54]		5.3
Toilet facility - % per household	Improved[55]		34.2
	Not Improved[55]		65.8
Rubber / Plastic Water Tanks	Incomplete information. Will be assessed in ground-truthing assessment activities		
Concrete tanks			
Concrete wells			

Table 8 Relevant demographics of the two outer islands of Pohnpei State, Kapingamarangi and Nukuoro

NAME OF VILLAGE >	KAPINGAMARANGI	NUKUORO	TOTAL
Population	350	210	560
Male	179	107	286
Female	171	103	274
Households	60	36	95
Sources of drinking water, % per household	Improved[54]		98.4
	Not Improved[54]		1.6
Toilet facility - % per household	Improved[55]		55.2
	Not Improved[55]		44.8
Rubber / Plastic Water Tanks	Approximately 60 units of various water holding mechanisms on island	-	-
Concrete tanks		-	-
Concrete wells		-	-

Table 9 Relevant demographics of the two outer islands of Kosrae State, Malem and Utwe

NAME OF VILLAGE >	MALEM	UTWE	TOTAL
Population	493	983	1476
Male	257	458	715

NAME OF VILLAGE >	MALEM	UTWE	TOTAL
Female	236	525	761
Households	85	169	254
Sources of drinking water, % per household	Improved[54]		92.4
	Not Improved[54]		7.6
Toilet facility - % per household	Improved[55]		98.3
	Not Improved[55]		1.7

The vulnerable groups expected to benefit from this project include:

Women, Men and Youth - The 2010 census finds that the domestic chores and responsibilities at the domestic level in households in FSM are largely owned and carried out by women and youth. It is in the range of 85-90% of the population reside in low-lying coastal areas in volcanic islands such as Kosrae, and 100% in the low-lying targeted atoll islands of Yap, Chuuk and Pohnpei which are highly exposed to climate extreme events. Women and children are therefore highly vulnerable to climate hazards and their impact. The proposed interventions in Yap, Chuuk and Pohnpei, that address water with indirect benefits to food security will be targeting and supporting the young and elderly women and youth to adapt. Over 6,680 inhabitants of Kosrae are likely to benefit from the intervention measures proposed (direct or indirect benefits) in Component 3.

Business owners and general local consumers:

> **Kosrae:** It is anticipated that the livelihood benefits shall include the creation of over 450 employment opportunities across these communities on mangrove planting schemes, coastal protection engineering support and monitoring, community engagement / business diversity opportunities. Micro finance renovation loan schemes such as Palau's successful Renewable Energy Subsidy Loan program would be one of the options that the project will learn from and how it may assist homeowners and land owners in relocating into the new inner roads development. Water lines will be installed at the same time it is constructed and to be followed by electricity and telecommunication lines. This will attract business and general local consumers to naturally and autonomously migrate inland and away from the coastal hazard zones.
>
> **Yap, Chuuk, and Pohnpei:** Stabilization of water and food production before, during and after extreme events will make available more nutritional and balanced food at affordable rates. This will allow the more vulnerable and poor populations of the outer islands to better sustain the supply of food, water and rich-protein food more consistently over time.

Schools in Outer Islands - The communication and awareness raising activities will engage local and national media, and will also target the primary and secondary schools in the island communities, reaching out to different generations of the country. For the purpose of the project the term "gender" will focus on men, women and children, including the elderly and people living with disabilities that are living in and deriving an income from the strip of land along the coastal zone. The project would emphasize women and children.

In summary, the main social, economic and environmental benefits from the project are given below, compared to the baseline scenario:

Table 10 Social, Economic and Environmental Benefits for the outer islands of Yap, Chuuk and Pohnpei

Type of Benefits	Baseline Scenario	Key Benefits
Social	Lack of outer island development plan addressing climate change impacts	Community mobilized, organized and trained for improved management of water resources, sanitation and health practices
	Lack of island water resource management plan incorporating climate and disaster risks	Capacity is built to work collectively for water security, water management, climate change risks and vulnerabilities
	Lack of leadership quality to address issues relating to natural resource management and climate change related issues	Specific training will be offered related to water rainwater harvesting systems repair, maintenance and cleaning of water assets (tanks, gutters, downpipes, first flush diverters)
	No trained personnel on water conservation and management practices, health and sanitation including water harvesting systems maintenance and care	Specific training on construction of self-composting toilets to it can be replicated in other islands and communities
	‘Dependency’ approach to development with high reliance on a diminishing US Compact funds for development (ending 2023).	Specific training on water, sanitation and health practices and monitoring and survey skills targeting women and youth

Type of Benefits	Baseline Scenario	Key Benefits
Economic	Costs of health treatment and services high for treatment of water and vector borne diseases (hepatitis, polio yellow skin, can't eat, crippled, bacteria salmonella, E-coli boils, sores, infections in ears and eyes, protozoa giardia vomiting, runny stomach, no energy, round worms, whip worms) Low income from crops and capture fishery due to depletion of fishery resources from algal bloom as a result of use of lagoon and seas as toilets. Loss of income and livelihood assets from food drought (loss of crops, agriculture fields) as a result of water drought from prolonged days of no rain	Reduced health problems as a result of improved access to clean water and sanitation. Reduced heath cost as a result of availability of safe potable water Employment in rainwater harvesting repairs and maintenance, community water tank maintenance Employment in construction of self-composting toilets during and after the life of the project Sustained income for maintenance of water and SCT systems in schools and community governing council properties. Reduced the loss of livelihood assets like farms and agriculture fields from drought, cyclones and high waves Reduced loss of health services to the communities Reduced health costs as a result of availability of safe potable water

Type of Benefits	Baseline Scenario	Key Benefits
Environmental	Eutrophication of lagoon side during low tide – as a result of use of lagoon as toilets Less dissolved oxygen available in lagoon and mangrove areas leading to incidences of suffocated fish and other marine life Algal growth boosted around lagoon and mangrove areas as a result of excessive nutrients from human waste Dead fish wash up on shore during very low tide events on lagoon side	Restored areas of lagoon side, increasing aesthetic and ecosystem services No pollution of groundwater and underground to the reef from wastewater from pit toilets on island No pollution of surface water and lagoon from human waste No excessive drawing of water from groundwater and wells allowing water in ground for plants and animals, improving the ecosystems during drought and post cyclones.

Table 11 Social, Economic and Environmental Benefits for beneficiaries of Kosrae State.

Type of Benefits	Baseline Scenario	Key Benefits
Social	High risk of communities being cut off from access to capital and utilities (power, water, electricity, hospital, main high school, port, airports) Malem and Utwe communities inaccessible to inland farm and land Landless unable to access land and finance to purchase and build on land 'Dependency' approach to development with high reliance on a diminishing US Compact funds for development (ending 2023).	Increase coastal resilience to inundation and erosion and guaranteed improved access to services benefiting 2,283 inhabitants of Malem and Utwe Landless, women, men and youth will have representation at municipality institutions Landless, women, men and youth will have access to landupland Landless, women, men and youth will have access to finance to support relocation Participation of women, men and youth in decision making processes ensured
Economic	Economically poor, low to non-existent level of agricultural labour, highly reliant on imported foods labour also only on a season basis Low-cost but high risk random bouldering seawall construction along high risk coastal road areas High risk to assets, safety, and livelihoods from unprotected exposure to risk of natural disasters High risk to infrastructures during cyclones and other natural disasters Eroding/disappearing beaches negatively affects tourism potential	Employment in road construction and community based ecosystem management activities for poor families in the project villages Sustained income from potential tourism and agriculture in upland areas Reduced loss to income, time and stress as a result of continued access to key utility services on island (water, electricity, telecommunications, hospital, ports, schools, safety (police)) Lower risk as a result of coastal zone protection measures. Ability to access land and increase income by investing in agriculture or tourism in upland areas Ability to access finance to build inland voluntarily as a result of state support program on access to finance. Coastal zone protection and potential finance for tourism in alternative areas.

Type of Benefits	Baseline Scenario	Key Benefits
Environmental	Frequent sea water inundation of coastal environment as a result of breaches of coastline from king tide, high tide events as well as storm surges Saltwater inundation on coastal environment and plantations and residential areas Lack of community-based ecosystems management practices at community level to manage ecosystems in lowland and upland areas Existing farm tracks in upland and access roads does not consider excessive water runoff and blocks catchment drainage pathways	Coastal road strengthened to withstand waver over topping, overwash, inundation and severe erosion. Protection of coastal areas from cyclones, erosion Limited inundation and overwash as a result of the transitional coastal defences Road relocated and constructed inland withstanding and safe from accelerated sea level rise impact on roads at sea level areas. Road designs improved, draining improved preventing water logging and flash flooding downstream.

A number of indirect environmental benefits are also expected to accrue from the project, especially under components 2 and 3. Firstly, the project will utilise the available rain water to the best possible extent for plants (crops, trees) and animals (livestock, local species). Secondly improving water quality maintenance, tank water protection for utilisation in dry condition and potentially act as carbon sinks. Thirdly, preventing of water run off by improving (repairing, installing new) catchment areas, as well as wastewater control would be helpful to minimise soil erosion, better soil water holding capacity, excessive nutrient runoff, minimise top soil erosion and overall maintaining soil quality and fertility. Fourthly, as further outlined in the preliminary environmental impact assessment report (Annex 1) and cost benefit analysis summary report (Annex 2) developing a watershed management strategy for the upland areas in Kosrae, will help maintain the diversity in the upland ecosystem by prohibiting agricultural activities and other development activities that will harm the environment.

Table 12 Key Social, Economic, Environmental Benefits from the project, at the output level

OUTPUT	KEY BENEFITS (DIRECT)		
	Social	Economic	Environmental
Component 1 Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels			
Legislation and policy paper to guide regulation of climate resilient coastal and marine management	Adaptation legislation, policies, and plans recognize the social imperatives of the communities in outer islands and municipalities		National legal standards for application country wide.

OUTPUT	KEY BENEFITS (DIRECT)		
State regulations for development projects amended to consider CC risks and resilience			Better management of the local coastal and marine environment by developers
National Water & Sanitation Policy developed	Policy recognizes the susceptibility of outer island communities to drought, El Nino, and typhoons and cyclones		National guidance on the principles to be followed for sustainable water access and sanitation practices
National Water Outlook and Water Sector Investment Plan	Proactive and systematic planning at the municipality levels for farmers, fisher folks, women, youth based on sound climate and water information	Concerted and targeted investment for cost-effective and efficient responses from partners and stakeholders to water related crisis	
Component 2. Demonstration of water security measures in outer islands of Yap, Chuuk and Pohnpei			
Climate Change adaptation plans	Women, men and youth involved in decision making on managing their own island resources	Targeted and directed support by partners	
Water harvesting and storage systems installed in 6 islands	Plenty of good quality water, sanitation and health benefits for women and men of the islands in atoll during climate extreme events (drought, post cyclones, etc).	Reduced cost of shipping in water during long dry spells	Pressure on underground water is reduced and is replenished for benefit of the natural ecosystems
Self-composting toilet programs established	Improved health and sanitation	Cost-saving on water purchases	Good soils with no pathogens, excellent for soil replenishment, gardening and plantation
Trained stakeholders on water conservation and management	Skilled and resourceful community to respond and address their water needs	Cost-saving on water purchases	
Teacher's Guide on Climate Change	Skilled and resourceful community to respond and address climate change for at least the next two generations		

OUTPUT	KEY BENEFITS (DIRECT)		
Component 3 Demonstration of Kosrae Inland Road Relocation Initiative			
Design and construction of of 3.6 miles (5.8km) of inland and access road routes	All residents of Malem and Utwe are able to commute to and from capital and where services are provided (government, business district, hospital, port, airport, schools, etc).		Design considers mitigation of impact of road on catchment drainage pathways, avoiding inundation and flash floods impact on the environment and residential areas
Transitional coast protection at Mosral and Pal upgraded	Allows for immediate to future commute by all Kosrae commuters, in particular access by Utwe to and from central business district	Reduce cost and pressure on project to hasten construction and	Protection of coastal areas from inundation and severe coastal erosion.
State support program to access land in upland areas established	Landless people from affected coastal zone are able to access safe land in in upland areas		
Community-based ecosystem management strengthened	Knowledge and skills at the municipality level to be able to manage changes of the natural environment, ecosystems from development in the short to long term		Protected watershed areas and managed development of upland areas to minimize environmental impacts and maintain ecosystem services of the natural forests and mangrove areas
State program to assist access to finance for vulnerable households established	State government recognizes and assists the needs of the poor and vulnerable households	Reduced costs for state government, private sector and households in relocating in upland areas	
Component 4 Knowledge management for improved water and coastal protection			

OUTPUT	KEY BENEFITS (DIRECT)		
Community Plans developed	Adaptation plans at the community level recognize climate change impacts and the need for proper adaptation planning under development for the islands and communities. Finance and supporting resources to implement the plans are provided by the project		
Resource materials developed	Knowledge and information captured and shared for replication and upscaling to other island communities and secure future support for adaptation. Dissemination of information country wide.		
Stakeholders brought together to share, learn and exchange	Knowledge, awareness and skills developed for communities to be able to undertake implementation, monitoring and future planning of concrete adaptation activities for their islands, homes and environment		

As may be seen from above, implementation of the project will not cause any negative social and environmental impacts. Outer Island communities and municipalities have been consulted in the design of the project components and are in line with the prevalent regulations, policies and standards of National and State Governments. Components proposed under the project have been designed with consideration towards the Social and Environmental Policy of Adaptation Fund.

C Cost-effectiveness

Describe or provide an analysis of the cost-effectiveness of the proposed project.

Component 1 focuses on mainstreaming of climate change at the national and state levels, through operationalizing the policy and planning processes for infrastructure, water and sanitation services. **Component 2** focuses on two main activities of increasing access to (and storage of) good quality water and reducing water wastage through installation of self-composting toilets. The benefits of the activities are expected to reach over 3,253 individuals across the 6 selected atolls during the course of the project. The impact of both components is expected to reach the 103,000 population of FSM beyond the life of the project.

The per capita cost of the water security activities (component 2) will be high given the inherent demographic (low population density) and geographical (distance to outer islands is only accessible by boat) nature of FSM, as is in other Pacific island countries. The costs are justified given the interventions of the project are of immediate to long-term need and are sustainable. The activities under **Component 4** will invest in knowledge management that will ensure sustainability, replication and up scaling of programs and activities.

The 'cost effectiveness' of the project based on the component outputs of the project for components 1 and 2 only is given in the following table (table 13). The cost effectiveness of **component 3** activities is outlined separately below.

Table 13 Cost Effectiveness of the project for Components 1 and 2 only.

CURRENT ADDRESSING MECHANISM	HOW IS IT ADDRESSED BY THE PROJECT	COST EFFECTIVENESS
Component 1, Output 1.1 Legislation and policy paper to guide regulation of climate resilient coastal and marine management at national level		

CURRENT ADDRESSING MECHANISM	HOW IS IT ADDRESSED BY THE PROJECT	COST EFFECTIVENESS
FSM has a national climate change and disaster risk management policy. The Strategic Development Plan provides for the macro-economic framework and the policies for each sector; the sector planning matrices; and the Infrastructure Development Plan. Of the four states, only Kosrae and Pohnpei have SDPs. FSM does not have a legislation either at the national or state level to enact climate resilient management of its coastal and marine resources. With the exception of Kosrae state, there are no laws and regulations at the national level to protect and conserve FSM's coastal and marine resources from business as usual development. Kosrae only has a climate change law, climate change policy, climate mainstreamed Regulation for Development Projects 2014 and EIA Guidelines	Development of a national and or state legislative framework, legislative draft that identifies and recognizes the social, economic and environmental imperatives to FSM's future development. The project may not be able to achieve the endorsement of a law on management of its natural resources, as there is likelihood it will be beyond the scope (time) of the project. The project, however, will develop a legislative framework / draft that will direct the national and state governments to initiative legislative and regulatory work to guide and govern its resources. The national government will continue the development of this framework beyond the lifetime of the project	The legislative framework/draft will introduce climate resilient factors into its environmental governance and development frameworks. In particular it will assist its SDP and IDP 2016-2025 in its governance aspects. Greater efficiency of expenditure will be achieved through the clarity and standards provided by a nation-wide approach. The legislative framework/draft developed by the project will trigger and push for state governments to develop their regulations for development projects – similar to Kosrae's RDP 2014 and EIA Guidelines. It will initiate actions to review, improve, and strengthen the SDP and IDP to ensure developments, especially infrastructure developments along the coastal and marine areas – are climate resilient.
Component 1, Output 1.2 State regulations for development projects amended to consider climate change risks and resilience measures		

CURRENT ADDRESSING MECHANISM	HOW IS IT ADDRESSED BY THE PROJECT	COST EFFECTIVENESS
With the exception of Kosrae State, existing EIA regulations of Yap, Chuuk and Pohnpei have not yet incorporated climate change and disaster. None of three states have a climate resilient Regulations for Development Projects. There is no mechanism to keep development in check with climate resiliency, environment impact assessment at a minimum. The current practice is largely voluntary	The project will consult, review, develop, endorse and promulgate regulations for development projects in each of the three states. It will take on board lessons from Kosrae State under the PACC project the developed, and revised the RDP 2014 for Kosrae. The project will look at existing regulations including the EIA regulations and update those regulations to incorporate climate risks and resilience factors to strengthen them. The project will see to it that the regulations are adopted, institutionalized and applied to any development in the each of the state	Long term contribution of the project in the on-going development of climate change environmental monitoring and governance at national and state level Opportunity of government stakeholders to review their existing regulations, policies and practices in light of climate change factors
Component 1, Output 1.3 National Water and Sanitation Policy endorsed with climate and disaster risks and resilience, and gender mainstreamed		
FSM has a framework for a policy but does not have a policy on water and sanitation. It has institutionalized the framework but has made no progress on developing and finalizing a policy. There is no mention in the framework of mainstreaming of climate change into the policy. The components of the policy proposed for under the framework does not incorporate climate risks and resilience, governance and support programs for water and sanitation issues across FSM, including the highly vulnerable outer islands	The project will incorporate climate risks and resilience factors into the national water and sanitation policy. It will do so by reactivating the national water task force. The project will aim to finalize the policy, and submit to congress for endorsement and launch nation-widely. The project will attempt to link its work under other outputs to the policy. Activities under output 1.3, component 2 and 4 will be part and parcel of the implementation plans of the policy.	The policy will enable the water plans at the national, state and municipality level to be better streamlined into development work. The policy will enable climate change adaptation programs for water, food, health and sanitation to be formally considered and addressed not only by government but by its partners.

<table>
<tr><th>CURRENT ADDRESSING MECHANISM</th><th>HOW IS IT ADDRESSED BY THE PROJECT</th><th>COST EFFECTIVENESS</th></tr>
<tr><td colspan="3">Component 1, Output 1.4. National Water Outlook Program (and Water Sector Investment Plan developed and implemented)</td></tr>
<tr><td>There is no outlook program in FSM to inform and assure stakeholders of the availability and distribution of water. This will have a major impact on both the main island and outer island population.

There is no mechanism that will inform farmers, businesses, village communities of what El Nino and La Nina will mean for different parts of FSM, and therefore its attribution on water resources.

Current practice rely on weather information and climate information provided by NASA, NOAA and SPREP. The scale by which information is provided and the time lapse is not enough to prepare and take decisions. This continues to have a detrimental effect on society, the economy (agriculture, tourism) and environment.</td><td>The project will work in partnership with NOAA, NASA, SPREP Climate Change Center through its Pacific Meteorology Desk to develop climate and weather based products that inform scenarios of water availability on account of rainfall, temperature, wind, and ENSO. It will also work to develop the capacity of local stakeholders.</td><td>The project will contribute to developing products tailored to sectors (tourism, agriculture, transportation, etc.) that will inform choices for the different development sectors.

The project will create a shift in paradigm by building individual and systematic capacities of the local institutions, to develop the products. This will increase the sustainability beyond the life of the project.

The information provided will contribute to facilitate improved protection against loss of income on account of anticipated climate change based impacts.</td></tr>
<tr><td colspan="3">Component 1, Output 1.4 : (National Water Outlook Program) and Water Sector Investment Plan developed and implemented</td></tr>
</table>

CURRENT ADDRESSING MECHANISM	HOW IS IT ADDRESSED BY THE PROJECT	COST EFFECTIVENESS
There is poor consideration of investment planning required to ensure sustainability of services of the water sector throughout FSM and across its islands. FSM lacks human capacity development that is needed for integrated water resource management and sustainable water supply solutions. The states are unable to systematically upgrade and utilize their existing assets for the supply of water in a sustainable manner across all islands (main, lagoon and outer islands) FSM lacks an investment plan at state level to be able to manage internal finances and acquire external financial assistance to meet safe water and sanitation goals.	The project will develop a water sector investment plan that FSM can prioritise costed actions for water and sanitation in each state and at all island levels – main, lagoon and outer islands. The project will improve institutional capacity for monitoring and support for action on findings from the water investment planning workshops The project will consider in the plans the need to acquire external financial assistance to meet its safe water and sanitation goals to build resilience of the water sector to climate change impacts	The plan will produce prioritised and costed actions for water and sanitation in each state and at the island level including all islands – main, lagoon and outer islands. The plan will minimise costs for future water supply upgrades by maximising the use of existing assets as far as possible, and respond to its human capacity development needs The plan will build on lessons and best practices gathered from the water demonstration activities in the six outer islands of the project. It will help inform and develop the investment plan, particularly in strengthening the outer island components of the plans. The plans will also ensure the effective use of resources based on informed and evidence based decision making.
Component 2. Output 2.2 Water harvesting and storage systems (WHSS) installed in 6 atoll islands		

CURRENT ADDRESSING MECHANISM	HOW IS IT ADDRESSED BY THE PROJECT	COST EFFECTIVENESS
Almost all households in the outer islands have water tanks that are either in very poor conditions or are not used at all. There are water tanks but very poor or no rainwater harvesting systems. Nearly 40% of the tanks in the outer islands of Woleai and Eauripik do not have proper rainwater harvesting systems Nearly 90% of water wells had very low water level, all brackish and all uncovered	Repairing of existing rainwater harvesting systems Training of women, men and youth on maintenance and cleaning of existing systems Establishing maintenance schedules with families / households Building community tanks to alleviate pressure on individual household water tanks during drought Ensure minimum 2 tanks per household / 2 community tanks per island to serve maximum 100 population	Repairing the existing rainwater harvesting systems will be cost-effective as it will utilize existing resources that are currently underutilized. Applying the optimal 2 water tanks per household rule will assist with cleaning of one tank interchangeably while the other is being utilized. The same rule is applied at the community level but for 10,000L capacity, plastic tanks, 2 minimum per maximum population of 100 persons. Communities will be involved in the development of tank maintenance protocols to ensure full community ownership.
Component 2, Output 2.3 Self-Composting Waterless Toilets constructed to conserve water, improve soil environment, and reduce marine eutrophication on the lagoon side		
There are no self-composting toilets installed on the islands, ie where no use of water is required. There are three common types of toilets that exist in the outer islands - flush toilet, water sealed and ventilate improved pit. These toilets use a lot of water that could have been conserved for other use (washing, bathing, watering, etc). It is also not healthy and sanitary, and the wastewater contribute to pollution and contamination of the underground water, reef and lagoons	Install waterless self-composting toilets at the school level. These will act as demonstration structures. There will be one unit for girls / women and one for boys / men. The project will also install these toilets at community and household level	Saves a lot of water from ever being used in a toilet It provides pathogen-free rich compost that can be added to plantation and agriculture fields or enrich the thin atoll island soil environment. It reduces environmental costs by containing waste in a closed system (chambers) It reduces health costs by containing and killing pathogens within its closed system and avoids a visit to the medical clinic for diarrhoea, yellow eyes, etc.

The elements of cost-effectiveness and efficiency of the activities under the particular outputs 2.2 and 2.3 are further outlined in the following table (table 14).

Table 14 Specific elements of cost effectiveness and efficiency for key activities under outputs 2.2 and 2.3

OUTPUT / ACTIVITY	ELEMENTS OF COST-EFFECTIVENESS	EFFICIENCY
For: Water Harvesting and Storage system		
Household rainwater harvesting system	Increasing catchment area Keeping all elements of the catchment systems clean Choosing right tank size relative to catchment area	Improving guttering of existing rainwater collection systems
Community water tanks	Increasing catchment area Plastic tanks (HDPE) with man-hole covers are easy to clean, maintain and moved allowing for use of land for other livelihood activities Choosing the right tank size relative to catchment area	Increased number of the same size of tank Easier to clean versus concrete tank.
For: Self-composting toilets		
Household, Community / school / church / health dispensary unit	SCTs are cheaper to build and maintain than a septic system Water savings — CTs don't need water for flushing, which means precious water can be saved for essential needs. Built above ground — the SCT chambers must be constructed above ground, so stairs or a ramp are needed to access the toilet room.	SCTs don't smell when properly used and maintained. Safe —SCTs can destroy all pathogens, including worm eggs and viruses.

The project interventions under component 2 would result in the following positive externalities:

- The impact of drought and aftermath of typhoons on water resources, have caused out migration from outer island to the main islands. Social impacts of the residue population include family and community disintegration, health issues for women and school dropouts. Improved water security and sanitation and health will assist to relieve these conditions over time, during drought and immediately in early recovery following cyclones and typhoons. Water will be essential to support all livelihood activities including food security, sanitation and health.

- Improved village and school level organization and training will assist communities to gain confidence and find solutions. It will improve the willingness to work collectively to address emerging socio-economic and environmental threats

- Water and land resources remain degraded and unproductive. Project investments will directly help to rehabilitate some unproductive areas.

- Current concrete tanks that have leaked cannot be repaired including those that have been repaired previously but leak again. The community concrete tanks are too large to maintain and have incapacitated land that could have been put to better use. Investing in HDPE plastic tanks versus concrete tanks at community level will improve the ability to clean and carry out maintenance. They can also be moved from one location to another, allowing land to be used for alternative purposes.

- Natural and social systems remain exposed to vulnerabilities. Project investments will improve the community's capacity to improve and manage the local natural resources on a sustainable basis.

- Alternatives for achieving long-term water storage and efficiency savings where considered. For example through the consultations communities considered the following:

Table 15 Alternative Options

ACTIVITY PROPOSED	ALTERNATIVES	BENEFITS
Water Harvesting & Storage Systems		
Repairing existing rainwater harvesting systems at household / private level, minimal purchase of just one other PVC to allow cleaning interchangeably *Cost per household including maintenance cost for at least a year comes to $560 USD*[40].	Construction of new systems per household with two HDPE tanks to allow cleaning interchangeably The cost per household will come to $1,120 USD plus added logistical coverage of about $5,000 minimum to import all new equipment required to install and monitor, comes to $6,000-$7,000 USD per household Install Reverse Osmosis Units. The installation of RO Units has been considered in other Pacific island contexts. While the effectiveness of RO units has been proven in some instances, they are accompanied by prohibitively high purchase installation, and maintenance costs and ownership issues. Spare parts are expensive and difficult to replace in outer islands. Filters have short-life span (6 to 12 months).	Repairing existing systems is less expensive Requires less maintenance Spare parts are easily attainable and shipped within FSM
Constructing community tanks to serve and alleviate pressure on private systems *Cost comes to $750 USD per 2,000 gallon, minimum 2 required to serve a minimum population of 100. Total with guttering and down pipes comes to $3,000 USD per tank*	Construct new systems for all households on all islands of the atoll without need for any community tanks Provision of systems for all will exceed the budget of the project per state.	Community tanks system is less expensive to import, construct, maintain, clean and own 2 community tanks / 100 population easier to manage, clean and maintain compared to many household systems without spare parts

[40] Capital cost of water tanks in FSM ranges from $350 to $750. The project takes the lowest cost, typical cost if a new water tank size is required of $350 for 1,000 gallon capacity. $210 for repairs and maintenance. The $560 is total activity budget for repair activities of Eauripik outer island divided by the number of households. This is used as the baseline by the project. Transportation costs of the equipment is born by the project.

ACTIVITY PROPOSED	ALTERNATIVES	BENEFITS
Construction of 2 SCT units each at a school, community building and 1 unit at a household select *$4000 USD[41] per unit x 5 total per outer island, total range in costs $25,000 - $50,000 based on outer island distance of shipment of materials*	Build either the following: Bush toilet — this is a hole in the ground with a simple cover around the hole. Pit toilet — pit toilets are usually covered with a concrete slab and have a “house” on the slab. The house needs to moved when the pit fills up. VIP toilet — VIP stands for ventilated improved pit toilet. These are really the same as pit toilets, but have a PVC pipe added to improve airflow and reduce flies and smells. Water seal — A pit covered with a concrete slab and a concrete toilet seat. A bucket of water is used to flush the waste into the pit. Flush/Septic toilet — A porcelain toilet with a water cistern. These require piped water to flush the waste into a concrete septic tank, where solids settle in the tank. The water collects in the tank and then passes out into a “soak”, or straight into the soil and groundwater. The discharged water should be treated in a properly constructed trench to destroy the pathogens.	• Self-compost toilet (SCT) — The waterless compost toilet (SCT) works just like a compost heap for your garden. In the garden compost heap you mix pig manure with dead leaves and chopped up branches, and leave if for a few months until it decomposes and makes a good fertiliser. In the SCT it is human manure instead of pig manure, mixed with leaves and left for at least six months so that all the pathogens are killed by the composting process.

The PACC programme delivered a similar set of activities to the ones proposed for this project. The terminal evaluation found that that the community driven and managed interventions “successfully….reduced water insecurity through better catchment regularity and retention; rainwater tanks and roof catchment systems”. Results were more mixed with solar purifiers,

[41] Based on cost of 1 whole unit built in Nauru $4,500-$5000 AUD. Not including transportation and shipping costs to be borne by the project through execution costs and other activity costs

especially those targeting individual households. The evaluation also acknowledges the relatively high cost of increased water availability achieved by the project, though does not provide a reference baseline. Given the geographic location, de-centralized and often non-existent water supply systems a relatively high cost for provision of water in such environments is to be expected.

Alternative options are either very expensive or socially unacceptable to the outer island communities and against local and World Health Organization health and sanitation standards. The major advantage of the proposed project as against alternative options is in its ability to provide sustainable livelihoods through increased provision of enough safe drinking water to not only for human consumption but to plants and animals. The project, therefore, is environmentally sound and socially acceptable. It addresses the immediate threats faced as a result of drought, sea level rise, typhoons and cyclones.

In summary, the following key characteristics of the project, particular to components 1 and 2, that would considerably enhance its cost effectiveness:

1. The major component 2 activities of water harvesting and storage systems and installation of self-composting toilet programs are highly replicable under similar outer island environments and conditions
2. The implementation mechanism by involving experienced NGOs, intergovernmental organizations such as IOM, and linking with the Micronesian Challenge (MC) to strengthen the state and community ownership and achieve high level of local ownership is highly cost-effective. These organizations have been very active during the planning stages of this proposal and very involved with work in the outer islands.
3. Being cost-effective, government departments would convince interest in up-scaling of the project through various programmes such as those under IOM and MC.

Under **component 3**, a detailed cost-benefit analysis study[42] has been completed for the proposal to construct and operate an inland road from Malem to Yeseng to Utwe. A copy of the cost-benefit analysis study is provided at Annex 2. The main purposes of the study were to:

- 'ground-truth' whether the inland road development is a priority investment (strategic rating of 8.9/10) as stated in the State's Infrastructure Development Plan (IDP), Volume 4 of the FSM IDP (DTCI 2015);
- inform how the design of the inland road development can be refined and improved; and
- further develop the evidence-base needed to support funding applications for this infrastructure investment.

[42] The cost-benefit analysis study was supported through the Pilot Program for Climate Resilience: Pacific Regional Track (PPCR-PR) - a regional program which aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' planning and related budgetary and decision-making processes (i.e. 'climate change and disaster risk mainstreaming'). The PPCR-PR is being implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and the Asian Development Bank (ADB), and is funded through the Climate Investment Fund (CIF). More information on this program can be found at https://www.climateinvestmentfunds.org/cif/node/7295

The cost-benefit analysis examined the proposal to construct and operate an inland road from Malem to Yeseng to Utwe. This option includes 20 years maintenance and revetment of the existing coastal road in order to provide time for households to relocate to safer areas, as is the intention of the proposed IRRI program.

The analysis also examined an alternative option to upgrade the existing coastal road, including elevating it and ramparting segments that are particularly exposed to erosion and over-wash.

A wide range of cost and benefit categories for each option were considered, reflecting the many dimensions of coastal hazard risks faced by Malem and Utwe coastal communities and of relocating communities and infrastructure inland. A summary of these costs and benefits for each infrastructure option is provided in Table 16 below.

Table 16 Summary of cost-benefit analysis results (PV$ @ 4% discount rate)

	INLAND ROAD DEVELOPMENT - PHASE 1 MALEM TO YESENG TO UTWE	**UPGRADE EXISTING COASTAL ROAD - MALEM TO YESENG TO UTWE**
(1) Costs		
establishment and operational costs, including awareness programs	5,846,667	5,307,444
impacts on inland environment from inroad development	Not valued	0
impacts on coastal environment from upgrading existing coastal road	0	Not valued
	5,846,667	5,307,444
(2) Benefits		
avoided clean-up costs from coastal flooding events	15,576	12,192
avoided damages to cars	Not valued	Not valued, but lower than inland road option
avoided damages to home gardens	Not valued	Not valued, but lower than inland road option
avoided damages to housing infrastructure	177,472	91,742
avoided damages to road infrastructure	278,375	1,517,936
avoided trauma and loss of life from major typhoon event	Not valued	Not valued, but lower than inland road option
avoided income losses associated with road damages (preventing access to workplaces)	1,452	1,185
avoided disruptions to schooling	Not valued	Not valued, but lower than inland road option

	INLAND ROAD DEVELOPMENT - PHASE 1 MALEM TO YESENG TO UTWE	UPGRADE EXISTING COASTAL ROAD - MALEM TO YESENG TO UTWE
avoided disruptions to accessing hospitals	Not valued	Not valued, but lower than inland road option
increased food production achieved through improved access to inland areas	2,446,134	0
other benefits (e.g. tourism and cultural) achieved through improved access to inland areas	Not valued	0
migration out of Kosrae and associated economic implications	Not valued, but lower than upgrading coastal road option	Not valued
Avoided replacement of coastal road at existing design standard	3,194,855	3,194,855
Avoided maintenance of existing coastal road	22,580	22,580
	6,136,444	4,840,490
(3) NPV = (2)-(1)	289,777	(466,954)
(4) BCR = (2)/(1)	1.05	0.91

As can be seen from Table 16 above, the quantitative results show that only the inland road option is expected to generate net benefits for the Malem and Utwe communities - relative to the status quo scenario - whereby the existing coastal road is retained at its current design specifications and a protective rampart (revetment) constructed to protect sections of the road most exposed to over-wash.

The CBA report also emphasizes that a number of important costs and benefit categories were not valued due to a lack of data, and hence are not reflected in the quantitative results. These costs and benefit categories include:

- benefits of the inland road relating to (i) avoided damages to cars and home gardens; (ii) avoided trauma and loss of life from major typhoon events; (iii) avoided disruptions to schooling; (iv) avoided disruptions to accessing hospitals; and (v) a range of other benefits expected to be generated from improving access to inland areas (e.g. tourism and culture);
- environmental costs of upgrading the existing coastal road, especially in terms of downstream coastal erosion; and

- broader economic implications relating to outmigration from Kosrae if the existing coastal road is maintained or upgraded.[43]

When these categories are taken into account, the inland road option would be expected to show a much stronger return on investment and represents a worthwhile use of resources. The social and environmental impacts will also be avoided, minimized, reduced through the proper application of the mitigation factors outlined in the Environmental Social and Management Plan (Annex 3).

The CBA report further stresses that a number of other (non-public-infrastructure related) barriers are constraining households capacity to relocate to inland areas - and that these barriers will need to be addressed if the infrastructure investment is to fully realize its intended objectives.

Key barriers identified as part of community consultations were a lack of access to finance (e.g. to construct a new house) and a lack of access to land located upland. Moreover, if households are slow to relocate inland, then the Government will likely be required to re-establish the coastal road - when it meets the end of its economic life in approximately 20 years' time. This would represent a substantial additional cost for the Government - in the order of US$3.4 million. This reinforces the need for complementary measures to address non-infrastructure-related barriers to relocation.

The project will address these by developing state support programs to access land and finance under outputs 3.3 and 3.5., to enable and facilitate the re-location preferences of the communities. These activities are considered essential in order to be able to realise the cost-effectiveness of the project

The key findings and conclusions outlined in the CBA report are consistent with the recommendations made in the Kosrae Shoreline Management Plan (2014). The key findings have also been peer-reviewed by a number of different stakeholders, including technical officials from SPREP, the Pacific Community (SPC), German International Co-operation Agency (GIZ), and the National Institute of Water and Atmospheric Research (NIWA).

Based on the CBA results, the Inland Road Development - Phase 1 Malem to Yeseng to Utwe is confirmed as a high priority investment for Kosrae. Moreover, the CBA results suggest that this project should be pursued ahead of some other infrastructure projects ranked higher than in the Infrastructure Development Plan 2016-2025. One example is the Lelu water systems improvement project for which a CBA study was also completed and shown to be economically unviable.

The project will not be able to fully fund Phase 1 of the inland road development which is the establishment and operational costs, including awareness programs with a total cost of $5,846,667 USD. The remaining allocation of $9 million USD under the AF for FSM will not suffice the concerted implementation of all components of the project. Component 3 along constitutes 49% of the total budget of AF. As such, the Kosrae State Government, with

[43] households located seaward of the coastal road have advised they will leave Kosrae if their safety remains compromised.

assistance of the national government will continue to pursue discussion with development partners to partnership and implement Phase II of the inland road development (Annex 4).

D Consistency with Development Strategies

Describe how the project is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

Key Policies of Central and State Government, on which this project is based, are as follows

NO.	NATIONAL / STATE GOVERNMENT POLICY, *RESPONSIBLE AGENCY*	PROJECT ELEMENTS CONSISTENT WITH THE POLICY
1	Nationwide Climate Change Policy, *Office of Environment and Emergency Management (OEEM)*	1. Developing legislation and regulation frameworks for climate resilient development in coastal and marine areas 2. Developing climate resilient water and sanitation policies 3. Implementing water outlook program to prepare and manage water resources in advance of climate variability and changes
2	National Strategic Development Plan,	1. Protection, conservation of freshwater, marine and terrestrial ecosystems, inland road relocation, coastal protection from erosion, training and awareness of CC, SLR, vulnerability, issues and causes of increasing hazards 2. Developing climate resilient regulations for development projects – to ensure developments at the coastal areas are climate-proofed
3	Nation Wide Integrated Disaster Risk Management and Climate Change Policy, *OEEM*	1. Cross-sectoral climate change coordination mechanisms within office of environment and emergency management at national level, state environment protection agencies 2. Preparation of outer islands against onset of El Nino periods that bring long dry spells. 3. Training of outer island communities on water and sanitary monitoring and other disaster preparedness and response measures
4	Kosrae Climate Change Act, *Kosrae State Government*	1. Cross-sectoral climate change coordination mechanisms amongst Kosrae State Government departments and utilities 2. Abide with regulations for development projects requirements to meet EIA guidelines and standards 3. Apply climate change hazard mitigation actions to protect society and the environment
5	Kosrae Shoreline Management Plan, *Kosrae Island Resource & Management Authority (KIRMA)*	1. Implementing the first priority of the shoreline management plan under the Inland Road Relocation Initiative (IRRI) program

NO.	NATIONAL / STATE GOVERNMENT POLICY, *RESPONSIBLE AGENCY*	PROJECT ELEMENTS CONSISTENT WITH THE POLICY
6	KSG Regulations for Development Project, *KIRMA*	1. Abide by regulation rules and requirements under the project
7	Kosrae Strategic Development Plan, *Office of Development Assistance*	1. Mainstreaming climate change into development through design and construction of roading infrastructure 2. Revetment of existing coastal roads to prolong the shelf life of the roads from sea level rise and resultant tidal surges, king tides and extreme high tide events.
8	Pohnpei State Strategic Development Plan , *Pohnpei State Government*	1. Integrated water resource management in the outer islands helping to conserve safe drinking water. 2. Implementing simple and effective wastewater treatment technologies such as self-composting toilets. It does not use water but it effectively decomposes off of wastewater in environmentally-friendly set up. 3. constructing potable water source facilities in outer islands that will provide significant support to environmental improvement and economic growth on main island.
9	National Infrastructure Development Plan , *Ministry of Transport, Infrastructure and Communication*	1. Implementing cost-effective, safe, reliable and sustainable infrastructure (environmentally sound and climate proof) 2. Implementing high priority infrastructure needs of the states that is submitted to national government under guidance of the NIDP
10	National Climate Change and Health Action Plan, *Department of Health*	1. Reducing incidences of water and vector-borne diseases in outer islands / hard to reach places 2. Building capacity of women, men and youth to better water, sanitation and health conditions and assets on island through trainings, survey assistance, construction and carrying out monitoring roles
11	Kosrae Shoreline Management Plan, *KIRMA*	1. Implementing the priority strategy identified by the KSMP
12	Yap Joint State Action Plan, *Department of Resources & Development*	1. Implementing the water goals for the outer islands
13	National Framework on Water and Sanitation Policy	1. Integrated water resource management helping to conserve water 2. Optimise water use by increasing water use efficiency by at least 20% 3. Enhancing storage, both above and below ground, special effort to increase water storage capacity

NO.	NATIONAL / STATE GOVERNMENT POLICY, *RESPONSIBLE AGENCY*	PROJECT ELEMENTS CONSISTENT WITH THE POLICY
14	"Endorsing Access and Right to Safe Drinking Water and Sanitation in the Micronesia Region" - Micronesian Traditional Leaders Conference	1. Providing access to safe drinking water and sanitation in the outer island regions of Micronesia 2. Providing training and awareness amongst the women, men and youth of the outer islands 3. Building capacity of the traditional leaders, island governing councils to manage climate change adaptation projects relating to water, sanitation and health
15	Second National Communication Report to the UNFCCC	1. Providing water and water tanks to outer islands immediately including improving food security by provisions of water to plants and crops
16	National Biodiversity Strategy and Action Plan	1. carry out a community-based ecosystem management program with municipal communities 2. work with leading NGOs to carry out monitoring and surveying of ecosystems
17	National Action Plan to Combat Land Degradation	1. Develop and implement water shed protection strategies 2. build capacity of communities to lead and manage community-based ecosystem management programs
18	Joint National Action Plan for climate change adaptation (CCA) and disaster risk management (DRM) (developing)	1. carry out coordination mechanisms at national and state levels involving the national office of environment and emergency management, state EPAs and departments of resources and development and department of transport, infrastructure and communications
19	National Environmental Policy Act of 1969	1. Protection, conservation of freshwater, marine and terrestrial ecosystems, inland road relocation, coastal protection from erosion, training and awareness of CC, SLR, vulnerability, issues and causes of increasing hazards 2. Developing climate resilient regulations for development projects – to ensure developments at the coastal areas are climate-proofed

E Consistency with Technical Standards

Describe how the project / programme meet relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and comply with the Environmental and Social Policy of the Adaptation Fund.

The overall objective of the project is in line with the Climate Change Policy of the FSM Government 2009, the Framework for National Water and Sanitation Policy 2011, and the Infrastructure Development Plan 2016-2025. At the state level, the Climate Change Act 2011 and the Regulations for Development Project 2014 and EIA Guidelines 2014 of the State of Kosrae as well as adhering to the recommendations of the Joint Strategic Action Plan on Climate Change and Disaster Risk Management of each state. Secondly, the project will be governed as per the policy and preference of the Government of FSM in adherence to all the specific local criteria. Apart from that, the project would also adhere to the recommendations communicated by FSM's Second National Communication report 2015 to the UNFCCC with regard to climate change adaptation benefits.

The National Government provides guidance and technical assistance to the States when needed and requested on matters related to planning, economic development, natural resources, fisheries, and the environment."[44] The National Climate Change Policy of 2009 for instance provides guidance related to infrastructure:

Adaptation
a. All development activities in FSM to take into account projected climatic changes in the design and implementation as stipulated in the FSM Strategic Development Plan/Infrastructure Development Plan (SDP/IDP); and
b. To use eco-system based approaches where applicable.

Technology Transfer
a. To optimize the use of local technologies where available.
b. To identify technology that is locally appropriate.
c. To enhance easy access to, and sustainable use of new technologies

Finance
a. To maximize the use of local resources through establishment of sustainable financing mechanism to support adaptation, mitigation and resource management initiatives.

The involvement of the key stakeholders in the technical teams, working committee and project steering committee will ensure compliance with policies, guidance and law. The monitoring of compliance to technical standards where applicable would be done at field level units by the Outer Island Project Working Committees for Yap, Chuuk and Pohnpei, and by the Kosrae Island Resource Management Authority (KIRMA). SPREP as RIE and OEEM as EE would monitor the adherence to the technical standards during its period field visits.

The following table (table 17) provides a summary of the key activities and the applicable standards that are applied by the relevant government department supporting the project.

Table 17 Key Activities

NO.	ACTIVITY	APPLICABLE STANDARDS	APPLICATION TO PROJECT BY
	Component 1		
1	Legislative framework and draft	Apply normal procedural standards in draft legislation and replicate lessons from Kosrae State Climate Change Act (refer to further description below)	Division of Litigation, Department of Justice

[44] Federated States of Micronesia State-Wide Assessment and Resource Strategy 2010-2015+. Undated. p. 10. http://www.wflccenter.org/islandforestry/fsm.pdf

NO.	ACTIVITY	APPLICABLE STANDARDS	APPLICATION TO PROJECT BY
2	State regulations for development projects	Apply normal procedural standards in draft legislation and replicate lessons from Kosrae State Regulations for Development Projects. (Refer to further description below)	Offices of the Attorney General Yap State, Chuuk State, Pohnpei State
	Component 2		
3	Rainwater harvesting systems	Minimum standards of the Rainwater Catchment Design And Installation Standards (ARCSA, 2009) State EPA Regulations Climate Adaptation Guide for Infrastructure 2014	Environment Protection Agency – Yap, Chuuk and Pohnpei States
4	Self-composting toilet programs constructed	Sustainable sanitation manual and guidelines for a waterless composting toilet (SPREP, 2007) State EPA Regulations Climate Adaptation Guide for Infrastructure 2014	Environment Protection Agency – Yap, Chuuk and Pohnpei States
	Component 3		
5	Construction of 3.6 miles of road to sub-standard level and transitional coastal protection	Climate Adaptation Guide for Infrastructure 2014	Department of Transport, Communications & Infrastructure
	Component 4		
	Key stakeholder participation	IDP strategic consideration of 'Involvement of States'	OEEM, State EPA and R&D offices, KIRMA
	Generation of evidence based learning	SNC Report adaptation recommendations, National Climate Change Policy suggested benefits	RIE, OEEM
	Sharing of learning	Government protocols for participation in learning sharing events	OEEM, State EPA offices, R&D office, KIRMA
	Development of knowledge products	Knowledge standards established by SPREP and other agencies	SPREP and OEEM

FSM does not have a formal building code. At present projects are generally designed in accordance with international codes, standards and guidelines, but with only limited account taken of the specific circumstances of FSM. Some guidelines have been developed for specific aspects including seismic and wind loading and are summarized in Climate Adaptation Guide for Infrastructure. FSM through the Department of Transport and Infrastructure, under the guidance of the IDP 2016-2025, plans to develop a National Building Code with State specific requirements where appropriate. The Code will be based on the International Building Code and other US based codes and standards, but will also take account of the requirements of FSM and incorporate existing state and national guidelines.

Without any national or state level rainwater catchment design and installation standards, the project will attempt to apply and meet minimum standards of the American Rainwater Catchment Systems Association (ARCSA) and the American Society of Plumbing Engineers (ASPE) based on its Rainwater Catchment Design and Installation Standards manual (ARCSA, 2009). The standard will be applied to new rainwater catchment installations, alterations, additions, maintenance and repairs to existing installations. The standards are designed to assist engineers, designers, plumbers, builders, developers, local government and users in safely implementing a rainwater catchment system. The environmental norms (water quality) notified with regards to rainwater harvesting systems, will be in conformity with the pollution norms outlined under each state of the State Environmental Protection Agency regulations.

F Duplication of project

Describe if there is duplication of project / programme with other funding sources, if any.

The project target areas are not the focus of any other climate change adaptation initiatives. In fact, this is the first, focused effort to implement a climate change adaptation project based on identified priorities on the ground in these remote and vulnerable islands of Yap, Chuuk and Pohnpei. In Kosrae state, this will be the second time a project will be focused on climate-proofing roading infrastructure, but a first time on the southern and most vulnerable coastlines of Malem and Utwe. The first project was a pilot project, that was successfully demonstrated under the PACC project in the northern coastline of Tafunsak from 2009 – 2015[45].

This project would be the first one to explicitly focus on improving water security as an adaptation strategy in the outer islands of FSM. The protection and preservation of ecosystems (lagoon and mangrove areas) and reduction of incidences of water and vector-borne diseases are complementary adaptation measures of the project. It will complement on-going government programs that are being implemented to improve outer island water resource management, agricultural productivity and conservation of biodiversity. The project will take required measures to avoid potential fund duplication with other funding sources for similar activities. Some of the potential schemes/programmes of Government that have complimentary components are as follows:

PROJECT	OBJECTIVES	COMPLEMENTARITY	GEOGRAPHICAL

[45] See Technical Report No.18 https://www.sprep.org/pacc/publications/technical-reports

			COVERAGE / AGENCY
Micronesia Challenge (MC)	Sub-regional conservation initiative which enhances community resiliency by using traditional knowledge and ecosystem strategies to conserve vulnerable coastal land resources by 2020; goals are to effectively conserve at least 30% of near-shore resources and 20% of terrestrial resources.	Construction of inland road with a community-based ecosystem management focus to reduce climate change impacts on road and community infrastructure and contribute to conserving terrestrial resources (mangrove forests and swamps) from future flooding events as a results of climate-proofing designs of the inland roads. Reducing impact of wastewater runoff into mangrove and lagoon effectively conserving vulnerable outer island environments	FSM, Palau, CNMI, Marshall Islands / KIRMA, KCSO – Kosrae State
Micronesia Conservation Trust (MCT)	a charitable and irrevocable corporation organized to manage and provide funds for the accomplishment of the following mission: "to support biodiversity conservation and related sustainable development for the people of Micronesia by providing long term sustained funding."	Promoting community-based ecosystem management practices complementing coastal infrastructure development Promoting conservation of biodiversity in outer islands by changing common practices that pollute the surrounding environment and ground water resources	All States / KIRMA – Kosrae State EPA – Chuuk, Pohnpei States EPA, R&D – Yap State
Pacific Adaptation to Climate Change Project (PACC)	To enhance the capacity of the FSM to adapt to climate change and climate variability in coastal management Kosrae was chosen as pilot State focusing on coastal infrastructure	Replication of the PACC activity in Tafunsak – climate proofing coastal road by relocating and constructing inland road. Building capacity of communities and coastline to climate variability.	Kosrae State / KIRMA
International Climate Change Adaptation Initiative-Pacific Adaptation Strategy Assistance Program (ICCAI PASAP)	To enhance the capacity of partner country to assess key vulnerabilities and risks, formulate adaptation strategies and plans and mainstream adaptation into decision making. For FSM: adaptive strategies informed by best practice methods and improved knowledge: community participatory surveys conducted in Yap which included Ulithi and Fais Atolls; evidence-based	Water harvesting and storage systems informed by best practices, methods and surveys. Ground truthing assessments based on rapid assessments of water resources in response to drought	All States / EPA in Yap, Chuuk and Pohnpei States

	field research conducted on drought and salt tolerant varieties of sweet potatoes and sweet taro in Dinay and Wugeem, Yap		
Geospatial Analysis for Food Security Adaptation	Trying to find suitable places to relocate the agricultural areas (particularly taro) with the help of geospatial analysis (GPS, remote sensing) and geographic information systems.	Repairing rainwater harvesting systems and installing community tanks for outer island communities. Watershed protection strategy to identify areas out of bounds for agriculture, residential and other developments	All States / EPA – Yap, Chuuk, Pohnpei KIRMA, KCSO – Kosrae
Pacific - Australia Climate Change Science and Adaptation Planning Program	Supporting the government of FSM develop improved climate change projections and adaptation planning activities. FSM and 14 other Pacific countries are part of this AUD$32 million project which builds on the foundation of the Pacific Climate Change Science Programme and the Pacific Adaptation Strategy Assistance Programme.	Establishing National Water Outlook Program	All States / OEEM
Implementing Sustainable Water Resources and Wastewater Management in Pacific Island Countries	The FSM's GEF Pacific IWRM Demonstration Project entitled "Ridge to Reef: Protecting Water Quality from Source to Sea" has strengthened national coordination in the water and sanitation sector and has enhanced community collaboration to improve water resource management. It has three main foci—(i) protected areas (improving existing ones and creating new ones), (ii) managing ecosystems outside protected areas, and (iii) improving agro ecosystems.	Develop and endorse National Water and Sanitation Policy Develop and implement national water outlook program Develop and implement national water sector investment plan Repair and construct water harvesting and storage systems at the outer island level Train and build capacity of national water task force and relevant stakeholders at the state level	Outer islands of Yap, Chuuk, Pohnpei States / R&D and EPA of each of the 3 states
Water and Environmental Research Institute of the Western Pacific	Mission is to seek solutions through research, teaching and outreach programs, to issues and problems associated with the location,	Ground truthing assessments on water harvesting and storage systems	Outer islands of Yap, Chuuk, Pohnpei States / R&D and EPA of each of the 3 states

(WERI)	production, distribution and management of freshwater resources in Micronesia. Current projects and programs include watershed management program, rooftop rain catchment sizing, groundwater and aquifer research, atoll hydrologic modelling, water quality production and distribution, water resources management and GIS		
Global Climate Change Alliance: Pacific Small Island States	To support the governments of nine Pacific smaller island states, including FSM, in their efforts to tackle the adverse effects of climate change.	Develop and implement national water outlook program Develop and implement national water sector investment plan Repair and construct water harvesting and storage systems at the outer island level Train and build capacity of national water task force and relevant stakeholders at the state level	Outer islands of Yap, Chuuk, Pohnpei States / R&D and EPA of each of the 3 states
University of the South Pacific European Union Global Climate Change Alliance Project	To develop and strengthen the Pacific ACP countries' capacity to adapt to the impacts of climate change.	Ground truthing assessments on water harvesting and storage systems	Outer islands of Yap, Chuuk, Pohnpei States / R&D and EPA of each of the 3 states
Coping with Climate Change in the Pacific Island Region (CCCPIR)	Undertaking mainstreaming climate change, and integrated land and marine resource management at the national and local level. Addressed six components ranging from regional and national mainstreaming of climate change, implementation of adaptation activities on the ground, and climate change related to tourism, energy and education	Develop and endorse National Water and Sanitation Policy Train and build capacity of national water task force and relevant stakeholders at the state level Developing a Teacher's Guide on Climate Change at the state level	All States/ OEEM
Technical Assistance (TA) to FSM for Strengthening	support state utilities within the FSM) in executing infrastructure projects more effectively by having an	Design and construct the Malem-Utwe inland road Build capacity of DTI in implementing CCA projects	Kosrae State / OEEM, KIRMA, DTI

Infrastructure Planning and Implementation	agreed upon approach to systems and procedures for project planning, design, and management across the country; and build capacity in the Department of Transportation, Communications and Infrastructure (DTCI) to plan, design, and oversee project execution.		
Second National Communications to the UNFCCC	National obligation under the UNFCCC to produce status report on national climate change measures and priorities. FSM is using a consultative approach involving a range of stakeholders to produce this report.	Implement water, sanitation and health adaptation activities in outer islands Develop climate resilient infrastructure	All States / OEEM
MAPCO2 Project	A MAPCO2 was deployed within the Chuuk Lagoon in November 2011. The goal of this joint effort is to establish a long term monitoring station in Micronesia as part of global ocean monitoring network system for coral reef areas.	Developing legislative framework to oversee enforcement of coastal and marine resource management, including protection of environment from development projects National Water Outlook Program	All States / OEEM
Pacific Islands Climate Education Partnership (PCEP)	Educates students and citizens across the Pacific about the urgency of climate change impacts in ways that exemplify modern science and honour indigenous cultures and environmental knowledge, so that students and citizens within the region will have the knowledge and skills to improve understandings of climate change and adapt to its impacts	Developing a Teacher's Guide on Climate Change at the state level	All States / OEEM, Department of Education
Unite for Climate Pacific Regional Integrated Sciences and Assessments (Pacific RISA)	To enhance Pacific Island communities' abilities to understand, plan for, and respond to a changing climate. Emphasizing the engagement of	Ground truthing assessments carried out for water resources in the outer islands will contribute to water sector education and will be excellent for outreach activities in FSM	All states / OEEM

	communities, governments, businesses, and scientists by translating scientific research into information and materials that are valuable for stakeholders in key sectors such as water resources. Climate focused water sector education and outreach is part of Pacific RISA's core mission	Technical reports and other knowledge products developed from results of the project will contribute to information and materials valuable for future adaptation planning under water, health, sanitation and coastal zone management.	
Schools of the Pacific Rainfall Climate Experiment (SPaRCE)	To increase awareness of the younger generations about global environmental issues, such as climate change, with hands-on experience by involving them in the collection of rainfall data.	Developing a Teacher's Guide on Climate Change at the state level	All States / OEEM, Department of Education
Climate Adaptation, Disaster Risk Reduction and Education (CADRE)	Aims to build resilience of vulnerable communities to natural hazards particularly those that are climate induced.	Developing a Teacher's Guide on Climate Change at the state level Ground truthing assessments carried out for water resources in the outer islands will contribute to water sector education and will be excellent for outreach activities in FSM Technical reports and other knowledge products developed from results of the project will contribute to information and materials valuable for future adaptation planning under water, health, sanitation and coastal zone management.	All States / OEEM, Department of Education
U.S. Peace Corps Small Project Assistance (SPA) for Adaptation	Reaching out to remote communities by supporting the following efforts of Peace Corps volunteers: (1) development of youth camps that promote environmental awareness, knowledge and skills among the youth to become responsible natural resource stewards; (2) trainings that support community adaptation to climate change and build capacity for disaster risk reduction (DRR); and (3) small-scale community projects that can	Implementing water harvesting and storage systems program in the outer islands Installing / constructing self-composting toilets in outer / remote island environments, applying climate change and DRR principles	All States / EPA, R&D, KIRMA

	demonstrate application of climate change and DRR principles		
Coastal Community Adaptation Project (C-CAP), 2013-2017	To build the resiliency of vulnerable coastal communities in the Pacific region to withstand more intense and frequent weather events and ecosystem degradation in the short-term, and sea level rise in the long-term.	Inland Road Relocation Initiative program Building capacity of landless to access land upland , and access to finance to assist with relocation Constructing inland road away from low and exposed coastal roads degraded from impacts of sea level rise	Kosrae State / KIRMA
Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)	To provide the Pacific Island Countries (PICs) with disaster risk modeling and assessment tools to help them better understand, model, and assess their exposure to natural disasters, and to engage in a dialogue on integrated financial solutions for the reduction of PICs financial vulnerability to natural disasters and to climate change.	Developing the Water Outlook Program. Application of adaptation planning models and tools that include EIA, CBA, MEF, V&A assessment tool, mainstreaming, gender and climate change tools GIS spatial mapping exercise Implementing Participatory 3 Dimension mapping exercise as a consultation tool	All States / OEEM

Box 4 Climate proofing Kosrae's coastal road

Kosrae, one of the four States comprising the Federated States of Micronesia (FSM), was selected to host the country's PACC project. Kosrae has a population of 6,616 (2010 census), and more than 75% of the island's people and infrastructure are located in the coastal zone. The demonstration project focused on improving a section of Kosrae's coastal road, which is the main transport route on the island.

The project identified a 7 km section of the road in the Tafunsak municipality which was being progressively damaged by flooding from heavy rains and high tides. The original road had been designed to withstand a maximum hourly rainfall of 178 mm. Analysis of climate and sea level data, and projections to 2050, concluded that the road should be redesigned to withstand maximum hourly rainfall of 254 mm.

Following a socio-economic assessment, community consultations, and input from expert coastal engineers, the road was redesigned and rebuilt to withstand the anticipated heavier rainfall and higher sea levels. Adaptations included raising parts of the road by up to one and a half metres, fitting larger culverts, and improving drainage. The improved road was officially opened in May 2014. The PACC team is now developing guidelines to share their experiences with climate proofing the road, which will help others to replicate this success.

Also under the PACC project, a tide gauge and rainfall gauges were installed on Kosrae in 2011 to improve availability and quality of local climate and sea level data. These will also feed into climate-sensitive decision making and development for the state.

The project team has also been promoting the mainstreaming of climate risk into all development in the state and the country. The team supported development of the Kosrae State Climate Change Act, which was endorsed in 2011; and amendments to Kosrae's Regulations for Development, which now require all development projects to consider the potential impacts of climate change. The team also contributed to the recently revised Kosrae Shoreline Management Plan, which provides a comprehensive strategy for building resilience of Kosrae's coastal communities and infrastructure into the future.

The project is to field test the above lessons of the PACC to create models which could be replicated and up-scaled through a similar program such as the Inland Road Relocation Initiative of Kosrae.

For more information on the FSM PACC project, please visit the project webpage: https://www.sprep.org/pacc/fsm

G Learning & KM

If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

The project proposes a dedicated component aimed at improving knowledge management and develop capacity at all levels of development intervention (individual, island, municipal, state and national). Component 4 will provide a systematic approach at the country level, to improving understanding on climate change impacts on water and coastal zones. In doing so, the goal here is to enhance and activate participation of key stakeholders to address the risks and challenges of climate change in the coastal sector in a holistic manner.

The project, through its management units at the national and state levels will each develop a project-based Knowledge Management and Communication Strategy that will guide the implementation of its work in capturing and disseminating lessons learned of the project. It will act as a media outreach strategy. It will be the overall guide to facilitating, monitoring and evaluating all knowledge, communication and learning works of the project. Each state will develop an action plan matrix that help guide and report against the work of the strategy. Each municipal and outer island community will also develop a similar action plan matrix, and will form part of the Community Plans under a knowledge and communications strategy component.

An action plan matrix will outline clear learning objectives, the desired learning, knowledge and communication outcomes, target audience, key messages for each communication outcome, knowledge product and knowledge sharing tools, and indicators. The strategy and action plan matrix will mirror the Communication Plan developed under the PACC project for FSM.

The key areas of learning and knowledge generation, its documentation and sharing would be as follows:

1. Legislation and regulations assessment on coastal and marine resources management at national and state levels in FSM
2. Water harvesting and storage infrastructures and capacity in outer islands, FSM
3. Water quality maintenance relative to water resources in outer islands – wells and tanks
4. Water quantity relative to water harvesting systems in outer islands
5. Success of reducing vector and water-borne diseases from changes in water and sanitation practices in outer islands, FSM
6. Willingness to relocate and its linkages to access to land and finance and provision of utility services (inland road, water mains, telecommunications, power)

The knowledge products that will be developed by the project include:

1. Legislation paper to guide regulation of marine and resource management
2. Policy and guidance documents on regulations for development projects
3. National Water and Sanitation Policy
4. National Water Outlook Program
5. Water Sector Investment Plan
6. Community Development (Climate Change Adaptation) Plan for Eauripik Atoll
6. Community Development (Climate Change Adaptation) Plan for Woleai Atoll
7. Community Development (Climate Change Adaptation) Plan for Satawan Atoll
8. Community Development (Climate Change Adaptation) Plan for Nukuoro Atoll
9. Community Development (Climate Change Adaptation) Plan for Kapingamarangi Atoll
10. Operations and maintenance guide for rainwater harvesting and storage systems in the outer islands, FSM
11. Sustainable sanitation manual and construction guidelines for self-composting toilets in the outer islands, FSM
12. Operations and maintenance guide for self-composting toilets in outer islands, FSM
13. Climate resilient water conservation and management practices in low-lying atoll island environments, FSM
14. Teacher's Guide on Climate Change, FSM
15. Climate resilient design guidelines for inland road and access routes on a volcanic island, Kosrae FSM Case study
16. Community-based ecosystems management guidelines for upland forested areas, Kosrae, FSM
17. Land registry, Kosrae, FSM
18. State support program on access to finance for vulnerable households
19. Training Manual for Carpenters and Plumbers on Installing, Repairing, Cleaning and Maintenance of Community Water Tanks, and Household Water Tanks and Wells
20. Training Manual on Construction, Operations and Maintenance of self-composting toilets in outer islands, FMS
21. Awareness materials on climate change and water
22. Awareness materials on climate change and coastal management
23. Awareness materials on climate change, legislation and regulations

The project's knowledge management systems will adapt what previous projects have carried out under the PACC project and else where. It will utilize technology-based systems through setting up of blog spots (popular in FSM projects and programmes) on internet, website, and library linkages through EE and RIE (SPREP) networks. It will also use Facebook, Twitter and other forms of social media to link and share its success stories and knowledge products. The few knowledge products outlined in the list above will be peer-reviewed and published and assigned ISSN and ISBN codes so that it can be shared globally. Throughout the project, the learning and knowledge sharing will be through interactive seminars, workshops, conferences in many climate change programs internally in FSM, in the region through SPREP and other regional agencies, as well as internationally through FSM's reporting obligations (National Communications to the UNFCCC).

This project would focus on developing materials and information that requires capturing, review and share lessons learned and best practices applies – output 4.2. The products that are translated into both English and the local dialect and native language which consider the cultural diversity of the target islands of the project will include science, traditional knowledge and educational materials such as brochures, booklets, technical reports that capture data and information that inform policy and management plans at the island and community levels. The lessons from the development of knowledge management products of other projects will be considered. For example the PACC Technical and Experience Series developed to capture the adaptation demonstration process of various adaptation projects, in the very key areas that this project is focusing on least of which is coastal zone management.

The trainings of stakeholders will include module-based trainings on important social capacity building skills such as gender and climate change tools. The department of social affairs will be working closely with EPA / KIRMA to carry out refresher trainings on gender perspective in coastal management and coastal monitoring. This comes as a result of existing technical training guides and modules that the project will utilise, for example the Pacific Gender and Climate Change Toolkit, developed by regional agencies and with assistance of the PACC project and is now available online through the climate change portal (www.pacificclimatechange.net).

Complementary products will be developed to capture processes of implementation of the projects. Documentaries, radio and TV programmes, leaflets and posters will target the public with special attention to audio-visual presentations in DVDs using English and local languages. The project will strengthen existing agency website already established with links targeting development professionals, teachers and schools at state level and including outer island communities. Peer-to-peer exchange of knowledge through web-based platforms such as Pacific Environment Information Network, the Micronesian Challenge Trust, the Pacific Climate Change Portal; the Adaptation Learning Mechanism will be encouraged to be used to share information and also promote project findings within the country.

An exchange visit amongst islanders within the island communities will be part of the learning program of the project. It will encourage members of other outer island communities amongst the three states under the water component for example to (where travel arrangement permit) visit the programmes work sites and observe the technologies used. For example, this will be part of the extension services work in the country and will stimulate learning and sharing of practices.

H. Consultation Process

Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

The stakeholders of the project include local community, traditional community leaders, municipal government council, NGOs; research institutions such as the College of Extension Services of Micronesia; women's council; sub-regional organizations such as the Micronesian Challenge and International Organization for Migration, and government agencies such as the departments of Environment (EPA), Office for Internal Affairs, Planning & Budget, Resources & Development, Youth and Social Affairs, Transport & Infrastructure and Communications.

The stakeholders identified and consulted include the following:

Table 18 Stakeholders consulted

STATE	COMMUNITY	GOVERNMENT	NGOS, IGOS

Yap State	- Village community – Woleai, Eauripik - Council of Pilung (Yap Proper) chief leaders - Council of Tamol (Outer islands) chief leaders	-__ Office of Internal Affairs (OIA) -__ Fishing Authority (FA) -__ Office of Planning & Budget (OPB) -__ Environment Protection Agency (EPA) -__ Department of Agriculture & Forestry (DAF) -__ Resources & Development (R&D)	-__ International Organization for Migration (IOM) -__
Chuuk State	- Satawan community (Women, men) - Lukunor community (Women, men)	- DAF - EPA - ODA - R&D - College of Micronesia (COM) - College Extension Services (CES-COM) - College Research Extension (CRE-COM)	- Chuuk Women's Council - IOM
Pohnpei State	- Traditional leaders Nukuoro - Women leaders Kapingamarangi - Chief leader Pingelap atoll - Church minister	- CES-COM - CRE-COM - Department of Lands and Natural Resources (LNR) - Department of Transport and Infrastructure (DTI) - FSM Youth and Social Affairs - DAF - Conservation Society of Pohnpei (CSP) - Office of Emergency and Environment Management (OEEM) - Pingelap atoll conservation	- IOM - Micronesian Challenge (MC) - Red Cross Society
Kosrae State	- Malem Community (Elderly, Women, Men, Youth) - Utwe Community - Farmers - Landowners - Fisherman - Council Chairman - Bankers - Food Inspectors	- KIRMA - DREA - Kosrae Land Court - Kosrae Governor's Office - Senator - DTI - DAF - Dept. Health Services - Dept. Environment - Kosrae Utilities Authority - ODA	- Micronesian Challenge Trust – Kosrae Office - Kosrae Conservation Society Organization - COM - IMO - MCT
National government and high level officials	- Vice President of the Federated States of Micronesia - Secretary (Minister) of the Department of Foreign Affairs, serving as NDA of AF - Secretary of Finance - Secretary of Resources and Development - Secretary of Overseas Development Assistance		

	- Governor and Lieutenant Governors of Yap, Chuuk, Pohnpei and Kosrae - Traditional Leaders and Mayors of Malem, Utwe, Woleai, Eauripik, Satawan, Lukunor, Kapingamarangi and Nukuoro - United States Embassy of FSM

The details of the consultations with stakeholders are described below. There were five sets of consultative meetings with all stakeholders including community, government and NGOs. As shown in table 19 below, the first set of consultative meetings (July 2015) was to re affirm the adaptation priorities of the project from the communities and government against their development plans and priorities to address climate change in the specific sites. These priorities were identified by the state governments during the concept planning stage in 2013 and 2014. The second consultative meeting (November 2015) was to work with the national and Kosrae state government in securing a development partner to assist in the construction of the Malem-Utwe inland road and access roads.

The third consultative meeting (November 2015) was with the Kosrae state government and community in establishing an Inland Road Relocation Initiative (IRRI) adaptation strategy. The objectives of this meeting were twofold: firstly, examining the methodology, results and findings of the draft cost-benefit analysis (CBA) study for the Malem to Utwe inland road component (Annex 2), and secondly developing a Monitoring and Evaluation Framework (MEF) for the project to reduce climate risks faced by the Malem and Utwe communities (Annex 5). The results of the consultation contributed to the strategic results framework elements of component 1, 3 and 4.

The fourth set of consultative meetings (January – February 2016) was a repeat of the MEF objective of the meeting in Kosrae, but for Yap, Chuuk and Pohnpei states addressing water resource management, food security and marine resource management as priorities for adaptation in the outer islands of the states. As a result, three more MEFs were developed which contributed to strategic results framework for component 2. All the findings of the consultative and follow up meetings contributed to framing the strategic results for components 1, 3 and 4.

The fifth consultative meeting (May 2016) was part of the preliminary environment impact assessment for Kosrae given the potential for risks proposed for the construction of the inland road. The consultations were carried out for both Malem and Utwe communities.

Two sets of follow-up visits and one partnership and due diligence meeting was carried out from November-December 2015, January-February 2106 and June 2016 respectively. These visits included high level government officials such as the Vice President of FSM, Secretary (Minister) and officials of the Office of Overseas Development Assistance, Resources & Development, Finance and Department of Foreign Affairs serving as the National Designated Authority of the Adaptation Fund for FSM,. Special attention was paid to Kosrae given the potential risks of the activities under Component 3. As such, follow up meetings with Kosrae included high level state government representatives that included the Governor, Lieutenant Governor, Cabinet members, Speaker and Legislature, Attorney General, the Infrastructure Planning and Implementation Committee (IPIC); and mayors and traditional leaders of Malem and Utwe communities. The follow up visits in Pohnpei also included the United States Embassy to FSM and the College of Micronesia.

Table 19 Key Meetings and Findings

MEETING	DATES	CONSULTED	KEY FINDINGS
Consultative Meeting 1.1	22 June 2015	Pohnpei stakeholders	- Re-affirming community support of project priorities - Ranking of priorities of the project - Role of community, island governing council and representatives on island proper (main island) - Coordination mechanism of the department with other government departments and NGOS/IGOs
Consultative Meeting 1.2	24 June 2015	Chuuk stakeholders	- Community confirmation of project priorities - Ranking of priorities of the project by the community - Role of community, island governing council and representatives on island proper (main island) - Coordination mechanism of the department with other government departments and NGOS/IGOs
Consultative Meeting 1.3	25 Jun 2015	Yap stakeholders	- Community confirmation of project priorities - Ranking of priorities of the project by the community - Role of community, island governing council and representatives on island proper (main island) - Coordination mechanism of the department with other government departments and NGOS/IGOs
Consultative Meeting 1.4	6 July 2015	Kosrae stakeholders	- Community confirmation of project priorities - Ranking of priorities of the project by the community - Role of community, island governing council and representatives on island proper (main island)

			- Coordination mechanism of the department with other government departments and NGOS/IGOs
Consultative Meeting 2	16-19 November 2015, Palikir, Pohnpei, Colonia, Pohnpei	Vice President, Secretary Department of Foreign Affairs, Secretary Overseas Development Assistance, Secretary Ministry of Finance Governor Pohnpei Lieutenant Governor Pohnpei Director, EPA Pohnpei	- Update Infrastructure Development Plan for Kosrae State and FSM - Plan for FSM Development Partner's Forum meeting in March 2016 to secure donor support to co-finance and construct the Malem-Utwe road\ - Coordination and collaboration mechanisms between national and state levels
Follow up Meeting 1.1	23 November 2015 Kosrae State	Governor, Lt. Governor Kosrae Infrastructure Planning and Implementation Committee, Speaker of the Legislature Mayor of Malem Municipal Government Director DTI, Engineers DTI Director KIRMA and KIRMA Permitting Unit	- Updated Infrastructure Development Plan for Kosrae State - Reviewed Malem-Utwe inland road within the priority listing of the IPIC list as one of two high infrastructure priorities of the state requiring immediate implementation - Review of CBA results, costings and benefits of the Malem - Utwe inland - Identified potential risks of the Malem-Utwe inland road and agreed to carry out a Preliminary Environmental Impact Assessment (PEIA)
Consultative Meeting 3	24-26 November 2015, Kosrae State	Kosrae State Government, NGO, IGO stakeholders	- Improved the accuracy and usefulness of the cost benefit analysis - Developed the IRRI program - Formulated 'logic model' and developed monitoring and evaluation framework of the IRRI program

Follow-up Meeting 1.2	27 November 2015, Kosrae State	Mayor of Malem Municipal Government Director DTI, Engineers DTI Director KIRMA and KIRMA Permitting Unit	- Legislature approval of Malem-Utwe inland road as one of two high infrastructure priorities of the state - Review of CBA results, costings following consultation meeting with Kosrae stakeholders (consultative meeting 3) - Developed Terms of Reference for PEIA
Follow Up Meeting 1.3	30 November – 3 December 2015, Pohnpei State	Vice President, Ministry of Finance, Department of Foreign Affairs, ODA, OEEM, Secretary Resources & Development, United States Embassy Secretariat of the Pacific Community (SPC) Deputy Director General	- Considered the Government of China as a potential donor to co-finance and construct the Malem-Utwe road - Coordination and collaboration mechanisms between national and state levels - Coordination between national, state and US Compact activities related to infrastructure priorities of states - Briefed potential collaboration with SPC sector related projects on food security, water resource management in outer islands, marine resource management (Marine Protected Areas, Fish Aggregating Devices)
Follow Up Meeting 1.3	30 November – 3 December 2015, Pohnpei State	Vice President, Ministry of Finance, Department of Foreign Affairs, ODA, OEEM, Secretary Resources & Development, United States Embassy	- Considered the Government of China as a potential donor to co-finance and construct the Malem-Utwe road - Coordination and collaboration mechanisms between national and state levels - Coordination between national, state and US Compact activities related to infrastructure priorities of states

		Secretariat of the Pacific Community (SPC) Deputy Director General	- Briefed potential collaboration with SPC sector related projects on food security, water resource management in outer islands, marine resource management (Marine Protected Areas, Fish Aggregating Devices)
Follow Up Meeting 1.4	3 December 2015, Pohnpei State	College of Micronesia (COM) College Extension Services (CES-COM) College Research Extension (CRE-COM)	- Training of Agriculture Extension Officers for outer islands - Potential outer island activities on Food Security activities - Raised taro patches technology for outer islands - Coordination and collaboration with Food Security related projects
Consultative Meeting 4.1	20-22 January 2016	Yap stakeholders	- Trained government and community stakeholders on logic model and development of the Monitoring & Evaluation Framework - Re-confirmed community priorities for the outer islands - Formulated 'logic model' and developed the MEF for water security, marine resource management and food security priorities - Identified no potential social, economic and environmental risks to any of the activities of the project
Consultative Meeting 4.2	26-28 January 2016	Chuuk stakeholders	- Trained government and community stakeholders on logic model and development of the Monitoring & Evaluation Framework - Re-confirmed community priorities for the outer islands - Formulated 'logic model' and developed the MEF for water security, marine resource

			management and food security priorities - Identified no potential social, economic and environmental risks to any of the activities of the project
Consultative Meeting 4.3	1-3 February 2016	Pohnpei stakeholders	- Trained government and community stakeholders on logic model and development of the Monitoring & Evaluation Framework - Re-confirmed community priorities for the outer islands - Formulated 'logic model' and developed the MEF for water security, marine resource management and food security priorities - Identified no potential social, economic and environmental risks to any of the activities of the project
Follow Up Meeting 2.1	3 February 2016	Vice President FSM, ODA, R&D, MOF, OEEM, DFA	- Brief update of the proposal - Further discussions with Government of China' support for co-finance and construction of the road to the tune of $5m USD in technical assistance - Confirmed support for a preliminary environmental impact assessment required for the project.
Consultative Meeting 5	23-27 May 2016	Malem and Utwe communities of Kosrae – via the PEIA process	- Concerns were raised by the Utwe community over alternative road alignments through the Kuplu Wan plateau resulting in potential contamination of their water supply which is sourced from the Palusrik catchment due to: - 1. The location of the road and construction resulting in increased sediments or other contaminants entering the

			Palusrik River and the Utwe water supply. - 2. The improved access to the Kuplu Wan area created by the road subsequently leading to increased development in the Kuplu Wan area, including land clearing, septic tanks, pig pens etc., resulting in increased potential for contamination of the Utwe water supply. - The alignment of the road through the southern part of the Kuplu Wan plateau (Palusrik catchment) has been re-aligned to ease community concerns on potential impacts on Utwe village's water supply. This results in a minimum buffer of 150 m at the watershed between the two catchments and over 350 m for the majority of the section of inland road within the Palusrik catchment. Given the distance to the Palusrik River, the only perennial stream in the catchment and the characteristics of the likely catchment drainage pathways, there is unlikely to be any impact from the construction or operation of the road itself on Utwe's water supply.
Follow Up Meeting 3.1	20 June 2016	Vice President FSM, DFA, ODA, OEEM; US Embassy	- Brief update of the proposal – appraisal stage - Letter confirming co-financing support pursued by national government at the November 2016 FSM Development Patner's Forum Meeting
Follow Up Meeting 3.2 – SPREP Appraisal phase	21 June 2016	Lieutenant Governor	- Brief update of the proposal - Support to development of the proposal to SPREP

		Cabinet members IPIC Mayors of Malem and Utwe and Municipal Government representatives Malem Community, landowners	provided by the USAID USADAPT Asia-Pacific Project - National government acknowledgement of endorsement by Kosrae State of the Malem-Utwe road under the AF proposal as one of the top two priorities of infrastructure requiring immediate support for implementation - Re-affirmation of the priorities of the project by the Utwe Municipal government, women, men, elders and youth of the community of Malem
Follow Up Meeting 3.3	22 June 2016	Director and staff, KIRMA Director and staff, DTI IPIC and ODA Utwe Community and landowners	- Brief update of the proposal - Support to development of the proposal to SPREP provided by the USAID USADAPT Asia-Pacific Project - IPIC, ODA acknowledgement of endorsement by Kosrae State of the Malem-Utwe road under the AF proposal as one of the top two priorities of infrastructure requiring immediate support for implementation - Re-affirmation of the priorities of the project by the Utwe Municipal government, women, men, elders, youth, landowners of the community of Utwe
Site Visit	23 June 2016	Malem-Yeseng-Utwe inland road, access routes, ADB Utwe Water Reservoir, Kuplu Wan plateau where road will access, coastal points Pal and Mosral,	- Visited Palusrik catchment in Utwe municipality - Visited inland roads that are accessible of the Malem-Utwe inland road stretch, including Kuplu Wan plateau - Visited all access routes coastal-inland - Visited PACC Tafunsak

		settlement areas, upland areas	climate-proof road

I Justification for funding

Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

The design of the four components is largely influenced by results of the consultative and follow-up visits as outlined in Section II.H of the proposal.

Component 1. Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels

Baseline Scenario

The 2009 national climate change policy exists at the national level and only one state – Kosrae - has strengthened its state legal and regulatory policies. This was possible under the PACC project and it became successful as it is now guiding and regulating development projects of the State. The Okat Bridge in Kosrae ($12.7 million in FY2014) was the first development project to have applied the regulation.

FSM has been carrying out coastal zone protection and enforcement of existing regulations largely through EPA (and KIRMA for Kosrae). The regulations are, however, based on scope and frameworks of EPA United States of America, many of which are not applicable or the resources required by the island to effect these regulations are not realistic.

There are initiatives that are carried out in isolation and 'in-silos' that require a concerted effort from a project of all of FSM. For example, the ecological surveys and monitoring activities in Yap State only will have benefited if there were enough resources to monitor and implement any actions identified, in particular, with coastal marine resource management program for the fishing population on the island.

Where initiatives exist to protect the island coasts including low-lying atoll islands, these are carried out relatively through an individual approach. There is less or no concerted effort to identify and demonstrate activities that are done in an integrated fashion.

Yap, Chuuk and Pohnpei currently do not have state-level policy frameworks, let alone legal and regulatory instruments that have climate risks incorporated, enforced or monitored. As a result, development in these three states, in particular construction and infrastructure related, 95% of which are along the coastal and urban areas are carried out through a business-as-usual approach development.

The current generation's experiences with their water, coastal and marine resources have been voiced at community consultations of the project. There are no management plans at the island community levels to assist in managing these natural resources, against threats of climate change. There are community calls and recent scientific studies that have concluded the urgent need for water and coastal management plans if good quality drinking water, coral reefs, fishes are to provide any support for food security for the outer islands.

Review and assessments of legal and regulatory frameworks and instruments is needed by the government and states in order to position it strongly to implement mainstreaming of climate risks into its sector development programs. The lessons learned from the PACC project in Kosrae is that the BAU approach to coastal development will increasingly be a quick fix before the next typhoon hits, or a drought is worsened.

Adaptation Alternative

The project is planning to develop a national legislative draft, regulations for development projects for Yap, Chuuk and Pohnpei as a lesson learned from Kosrae under its PACC project. It will develop a legislation draft and policy paper to strengthen the concerted effort to manage coastal and water resources as a whole of country response to climate change.

The project will also develop a National Water and Sanitation Policy, and implement two components of the policy. These are the National Water Outlook and Water Sector Investment Plans. The development and implementation of these two components of the policy will be integrated with and inform the demonstration activities of the outer islands in Component 2 and is therefore budgeted at $600,000 USD. The lessons learned and best practices from activities in Component 2 will inform and improve the policy. All these activities will incur high costs because of the extensive consultation meetings and logistical and procurement costs involved due to the vast isolation of the four states, and the time required to carry out, development, consolidate, produce and implement the two components of the plans.

The total cost for delivering legislation and regulation changes, as well as providing the tools, scope and frameworks to deliver effective management of coastal, marine and water resources is budgeted at $1,075,000 USD.

Component 2 – Demonstration of water security measures in outer islands of Yap, Chuuk and Pohnpei

Baseline Scenario

Of the six outer islands, only Kapingamarangi atoll of Pohnpei attempts to address climate change adaptation in its community development plan. A portable water reservoir system is the number one climate change adaptation priority activity for Kapingamarangi according to its ‘Utamadua Development Plan’ 2015. This is followed by shoreline erosion prevention, food security and natural disaster preparation.

All of the six outer islands have rainwater harvesting systems but are either no longer in use, in poor condition, cannot be maintained or harbour harmful pathogens that carry vector and water-borne diseases. Within one month of drought, the communities resort to drinking coconut juices to quench their thirst. Stagnant water in water tanks and saline water from wells are used for washing and cooking. Women and youth are required to fetch for water from neighbours or travel long distances to fetch water for nearly dry and salinated wells. Rainwater harvesting systems often do not have spare parts available on island to assist with maintenance. Concrete tanks and cisterns are no longer supported by the communities as a feasible option to store water. It is difficult or useless to be maintained and takes up valuable space on island that becomes useless for any other development.

The six islands either have bush, pit, VIP, water seal, flush / septic or no toilets at all. The islands that do not have any toilet facilities use the lagoon or the ocean side beaches. The safety and health concerns on both the environment (lagoon side beaches, mangrove areas, terrestrial ecosystems) and people (hepatitis, polio, salmonella, e-coli, giardia, round worms, whip worms, etc) are therefore a high concern with the Ministry of Health for these outer islands. In times of drought and other climate change impacts, these negative health and sanitary effects have been exacerbated. Other toilets that require water puts pressure on individual family-owned water tanks and therefore compete with washing, cooking and other needs.

Adaptation alternative
Investing in repairing of existing household and private rainwater harvesting systems by providing equipment, training and establishing maintenance support plans and educating all members of the community will assist in expanding and maintaining good supply of drinking water that will prove useful during drought periods. This was the highest recommendation from the recent rapid assessment of water resources in the outer islands of Yap following the drought experienced as a result of the 2015/16 El Nino. The project will, at the same time, review and recommend installation of a minimum of 2 community tanks at 10,000L capacity to serve a minimum of 100 people population. This will provide enough potable water to also cater and meet not only the minimum threshold of water per capita for survival (30L/capita/day) but also able to water plants, crops and feed livestock (70L/capita/day). At the household level, the project will ensure through its ground-truthing assessment that repair and installation will allow for a minimum of two storage tanks. This will assist with interchangeable maintenance schedules. Where one tank is emptied and maintenance carried out, the other tank is being used. The same approach will be applied for community tanks.

Saving water and promoting health and sanitation habits is an adaptation strategy that the project will apply at the individual and household level that is very much required and will become useful when impacts of climate change are at its worse. The project will target the younger generation to build this habit and impact behavioural change. As such, the installation of self-composting toilets aims to promote water conservation, improve health and sanitation, as well as improve the island environment, through a significant reduction in pollution of the water ways and reefs. It will demonstrate the construction of self-composting toilets at schools and other community infrastructure such as community halls or church buildings.

The six target islands of the three states are distant from the main islands where the key government and central business district is located. Logistics and procurement activities will cost the project significantly, in areas such as transportation and communications and time. The consultations, and ground truthing social and environment assessments will take time and will require expert involvement to identify and demonstrate adaptive agriculture crops, water harvesting, and coastal marine resources management practices. Over time, it is expected incur costs totalling $2,455,013 USD.

Component 3 – Demonstration of Kosrae Inland Road Relocation Initiative

Baseline Scenario
A full review of the Kosrae coastline has been carried out. The review has led to the development of the Kosrae Shoreline Management Plan 2014 which has since been endorsed by the Governor of the State.

A number of priority interventions were identified and, in following up for upscaling of the PACC project results, all stakeholders (communities, government, NGOs, etc.) agreed to the priority intervention measures of the PACC project be implemented.

Adaptation Alternative

The people of Malem community have clearly outlined, reiterated and repeated themselves in saying for the need to implement what has been identified in the KSMP 2014. This is with regards to the priority intervention measures outlined and costed in the KSMP that includes the coastal and community inner roads. The total costs including economic evaluation, environment impact mitigation assessments, and contingency costs amounts to a budget of $2,896,900 USD.

Component 4 – Knowledge management for improved water and coastal protection

Baseline Scenario
All States of FSM have projects that provide lessons and information only for the project and is largely for visibility of the project during the time of the project. There is no programmatic approach and institutional and systemic capacity program that ensures climate change information continues to be made available and produced for the benefit of the communities and state in water and coastal zone management areas.

Yap, Chuuk and Pohnpei have programs and schemes that promote water conservation but are BAU and do not have climate change clearly incorporated. Some outer islands, for example, Kapingamarangi have their own community development plans. These address economic and social development, and political reform. Climate Change adaptation, however, is only addressed under the economic development section. Climate change is not seen in a holistic manner in these development plans.

Kosrae State have, during the conceptualising and planning stages of this project, decided on the importance of addressing climate risks in infrastructure plans and community development plans.

All islands have resources in English and less in the local context. Traditional knowledge is also not equally captured as the science and social science of the impacts of climate change.

The mainstreaming of climate change in national and state curricula is carried out voluntarily and there are no specific and targeted materials that will improve climate education amongst the young and future generations of FSM.

Capacity development in terms of training personnel in key sectors of society and the economy on climate change is addressed largely at the project level. There is not programmatic approach to building capacity within the water and coastal sector with the exception of Kosrae for the latter development sector.

There is technology framework that has already been developed and assisted to by regional partners of FSM. For example SPREP developed a knowledge management online database through the Pacific climate change portal (https://www.pacificclimatechange.net). These could be used to store and capture information developed and collected by the project.

Adaptation Alternative
The project will address the institutional, individual and systemic capacities of key stakeholders (governments, NGOs, communities) to be able to develop, capture and disseminate learning and knowledge from the project outputs.

Systemically, the project will invest in community development plans that will address sustainability of responding to climate change beyond the life of the project. It will build consult, solicit and collate views of all stakeholders under each plan. The plans will be linked to outer island plans and outer island development goals of sector plans owned by the state. The project will ensure linkages of these community development plans to state plans relative to water and or coastal and marine management. It will ensure that community development plans link its goals to those of the water and sanitation policy, regulations for development project and other relevant legislation and regulatory frameworks that address climate change. It will link the plans to the national climate change policy. It will set realistic goals that are achievable with support of development partners and secure political will and commitment of local municipality, state and national governments.

Institutional and individual capacity will be built from the resource materials and sharing and dissemination of the knowledge, tools, practices captured by these resource materials. A number of trainings, lessons and learning workshops would be carried out. The knowledge and skills built from these workshops will set up the national, state and local teams to be in a better position to deliver on the adaptation activities outlined in components 2 and 3. Exchange visits to sites will be a key part of building knowledge and sharing it as quick as possible. These will allow exposure to methods, tools, hands-on learning of the various coastal management techniques that are available and being trialled at the different island environments of the project. The project will focus on enhancing two-way communication between scientists and traditional knowledge holders, educating the modern scientists and appreciating knowledge of the indigenous beneficiaries in natural resource management in the outer islands. The sustainability, relevance, effectiveness and efficiency of the project will rely on a large part to this component that will complete the bottoms-up and top-down approach of the project.

J: Sustainability
Describe how the sustainability of the project outcomes has been taken into account when designing the project.

The project has, over the course of the concept and planning stages - December 2013 until June 2016, gathered strong community, government, political and partnership support to push for and put in place measures to sustain the investments of the project. Through a community consultation to reconfirm priorities, all stakeholders agreed to redesign the project to ensure elements of sustainability are incorporated. As such, the project has incorporated sustainability practices and activities that will ensure the investments it are sustained beyond the life of the project, and are resilient to future climate change.

Project Redesign
Stakeholder discussions that ranged from the individual women, men and youth of the municipalities, to community based organizations such as traditional leaders to the highest political support from the Vice President of FSM, His Excellency Yosiwo George resulted in changing the design of the project from three components to four. In order to capture the process and results of the project, a knowledge management component must be explicit in the design of the projects, managed from state to community level. The lessons and practices from the community level will be captured and used to inform the policies at the mainstreaming, state and national government levels.

Sustainability: Legislation, regulation and policies

Strengthening legislation, regulations and policies at the national level to address and respond to climate change impacts on coastal and water sectors will impart two sustainability benefits. Firstly, from a bottom-up approach, it will strengthen FSM's stance on responding to climate change threats as a nation, contributing to the region's solidarity efforts to mainstream climate change and disaster risks into its development. FSM's position and stance on enhancing resilience will attract development and bilateral partners to invest in a climate resilient development for FSM. As a result, it will help implement its goals under the Paris Agreement and set a process of mainstreaming climate into policy, to achieve its intended nationally determined contributions under the UNFCCC. It will, at the same time, sustain support of it's the top-down benefits as a result.

In spite of the autonomous governance at the state level, a national legislation will channel support of resources to protect and conserve its natural resources, and promote climate resilient development of its people, at the capital and outer island communities.

State regulations for development projects will support national legislation and implement best practices, replicated from the Kosrae example. Future development such as infrastructure projects, along the coastline of the main islands as well as the outer islands will need to comply with these regulations. Policy and guidance documents that will be identified and or those existing, are linked to these regulations will help development partners and those providing technical assistance to FSM, to comply.

The National Water and Sanitation Policy will strengthen the work of the National Water Task Force. This will now provide continuous basis of the Force to continue its work through proper training, institutionalisation of processes, and implements components of the policy. These include the Water Outlook Program and Water Sector Investment Plan. The latter plan is a sustainability plan in place for the water sector of FSM. It will be the platform that all stakeholders, including development partners will need to work from in providing technical and funding assistance, resource and services to the water sector. The project will work to mainstream climate change in to the investment plan to ensure future investments are climate resilient.

Sustainability: Climate Change adaptation plans in six island communities for optimal management of resources

The activity to develop climate change adaptation plans for the six outer islands of Yap, Chuuk and Pohnpei is a popular community suggestion that has been incorporated into the project design to address exactly the issue of sustainability. The community group themselves raised the issue of addressing their water priority and other important concerns such as health, nutrition, outer-island migration, transportation, communications, yet are outside of the scope of the project. Other communities wanted to review their existing community development plans, and incorporate climate change.

The climate change adaptation plans will be an overarching plan that allows other priorities of the islands to be captured and targeted to reduce its vulnerability from impacts of climate change. The plans will contain a strategic results framework and action plan matrix that will assist its development partners to fund and implement its work activities and at the same time, align the activities of its government sectors. The plan will therefore allow continued support of activities of the project once it has been closed.

The plans will be linked to state sector plans and will be aligned to the national climate change policy, and linked to legislation and regulations relating to water and coastal management. This will ensure that the state and development partners will recognize and continue to support the adaptation needs of the islands beyond the life of the project.

In the latter stages of the project – Years 3, 4 and 5, the project will undergo a review of the plan. This will allow a review of what has been achieved, lessons learned and how to secure support for implementing any urgent and future activities.

Sustainability: Water Harvesting and storage systems

Building the capacity of the community through training on how to repair, clean, care and maintain parts of their water harvesting systems will ensure long-term use of the 20 year shelf-life of the water tanks. Each island will have spare parts stored in a island governing council storage facility. A maintenance schedules will also be incorporated into the training, and the island's water committee that will be set up, will assign roles and responsibilities to members of the community in caring for their assets.

The water harvesting systems themselves will be made resilient to climate change by locating them in safe localities around the island for community tanks. The individual household water tanks will be assigned two HDPE tanks. This will serve two purposes, allow serviceability of one while the other is being used. This is useful when drought is expected and one other tank provides the sustenance. There is also the fifty percent chance of one of the tanks to survive a typhoon/hurricane. The minimum of two x 10,000L HDPE tanks per island population of 100 has been calculated to suffice the community with safe drinking water. Again, when one other tank is being emptied and cleaned, one other suffices the supply, easing the pressure on individual family water tanks. HDPE plastic themselves are kown for stiffness, strength, toughness, resistance to chemicals and moisture, permeability to gas, ease of processing, and ease of forming. It can therefore withstand high temperatures and salt spray conditions. The project will ensure these assets are sheltered, secured and protected.

In response to accelerated sea level rise within the next 10-20 years, the ground-truthing assessment that will be carried out will determine the location where the tanks will be safe from threats of erosion, king tide high wave impacts, wave over topping and over washing

Sustainability: Self-composting toilet programs

The protection, security, maintenance provided to the water harvesting and storage systems will also be applied to the self-composting toilets. Training and educational, awareness and media campaign programs on island will assist with awareness, acceptance, and proper treatment of the facilities. This will ensure sustainable use of the toilets.

These investment themselves will be made resilient from future climate change by constructing the infrastructures away from areas where they are exposed to high wave over topping, overwash, erosion of ground soil and protected from the sun as much as possible.

The installation at schools program has shown to be successful in Nauru and Tuvalu. Results show that the use of self-composting toilets is highly successful when installed at the community level relative to household level. It is more so in outer islands – atoll environments, than on main islands /volcanic settings. Monitoring and maintenance program will be developed to allow for results to be shared. This will encourage change of behaviour and promote good conservation habits, for water, soil and the environment.

Sustainability: Teacher's Guide on Climate Change

Developing a Teacher's guide on climate change, contextualised to outer islands and state level has shown from application in other Pacific island countries, to be successful in developing awareness and understanding of the issue of climate change.

The five year period of the project will not be enough to develop a fully-fledged curriculum on climate change to be applied at the primary and high school levels. This project therefore is to contribute to developing materials that will target this long-term goal by the Department of Education. The development of, and translation into the local languages ensures the results of the teaching and training will be more sustaining, than simply printing, publishing and disseminating the knowledge product.

Sustainability: 3.5 miles (5.8km) of Malem-Utwe inland road and access routes constructed to sub-base roading standard for future relocation

According to the cost benefit analysis report carried out under the PPCR project, the road could be expected to benefit communities beyond the 50 year period of the analysis, benefitting the community for generations to come. Repositioning the road to higher ground ensures a long-term sustainable all weather access for the whole community as well as removing a significant barrier to the long-term development and relocation of residential property to higher ground.

The investment itself will be made resilient to climate change by climate proofing the design and avoid risks and hazards as a result of impacts of climate change. The alignment of the road has been designed to be well above any potential impacts of sea-level rise and coastal hazards over at least the next century based on guidance in the Kosrae Shoreline Management Plan which has been incorporated in to January 2014 amendments to the *Regulations for Development Projects*. This requires new infrastructure on the volcanic parts of the island to be at an elevation of at least 4 m above mean sea level datum of Kosrae, which is approximately around 2 m above mean high spring tide level. The alignment of the road is typically at the 10 m contour and should minor realignment be required during the detailed survey it should not extend below the 4 m contour or require fill of land areas below the 4 m contour[46].

Further, to improving the resiliency of the road to impacts of climate change, the next phase of construction will be to upgrade the Malem to Utwe inland road to hot-mix asphalt. The Kosrae State Government will be securing its development partner, through assistance of the national government, at FSM's Development Partner's Forum in November 2016; to carry out this second phase of the road (Annex 4).

Sustainability: Transitional coast protection at Mosral and Pal upgraded

Upgrading of the coastal protection at Mosral and Pal will buy time' not only for the project to carry out the first phase of the inland road construction, the second phase in tar sealing the road, but also to allow people to voluntarily resettle inland and discourage further development

[46] Preliminary Environment Impact Assessment Report, Department of Transport and Infrastructure, Kosrae State Government, 2016

along this coastline. At present, around 120 metres of road at Mosral and 200 metres of road at Paal are critically exposed and at risk of being breached at any time. Such a breach cuts off the village of Utwe (population approximately 983) and removes road access to Walung (population approximately 268), as well as potentially disrupting utilities (power and telecommunications) which run parallel to the road. It is assumed for illustrative purposes that, because of the perilous state of the road around Paal and Mosral and towards Utwe, the revetment is be implemented immediately and the road is replaced now over a two year period, subsequently being replaced again in re-replaced 35 years' time (the average of 30 and 40 years)[47].

Sustainability: State support programs to access land and finance

The state support programs are themselves sustainability measures to facilitate the government support for voluntary resettlement from the community. The project will develop the content of the support programs for the state. It will not be a means to an end, rather it is to initiate an obligatory role of the State government for the welfare of its communities and protect them from impacts of climate change.

The project will review the support programs towards the latter half of the project; to ensure the institutional set up and relevant capacity and consultations developed and carried out within government and with private and business community stakeholders. This will facilitate opportunities for people to be able to relocate voluntarily overtime.

Based on consultations with the communities concerned (Annex 2) community members are completely in favour of relocating because the threat of coastal inundation and harm to person security, health and well-being is high. Discussions were held with government representatives – some of whom are based in the affected communities – to consider potential scenarios for relocation, should an inland road be established. Based on these discussions together with discussions with the State Government of Kosrae (Lipar George, personal communication, October 2015), a *conservative* base case relocation rate was estimated in which two householders relocate every five years *following the completion* of the road. This would result in an average relocation over fifty years of 18 households (18 per cent)[48].

Sustainability: Community-based Ecosystem Management

The project will facilitate a community-based ecosystem management program at the outset of the project with communities. The activities will be a replication of activities already carried out under similar ongoing programs facilitated by the Kosrae Conservation Safety Organization (KCSO). In fact, KCSO will be the lead responsible agency for implementing the program for Malem and Utwe. It will build on lessons and practices from other programs that have been completed and ongoing. The women, youth and schools will be lead community beneficiaries of the activities.

Community ecosystem based adaptation activities that will help manage road construction impacts on the environment will include fringing mangrove restoration / protection / and permitting. Also spatial planning for expanding / creating new upland/mangrove/nearshore

[47] Cost-Benefit Analysis In Coastal Zone Management In Kosrae (FSM): Economic Assessment Of Coastal Road Relocation In The Face Of Climate Change, SPREP 2016

[48] ibid

coastal protected areas. To address sustainability of the activities, the project will aim to reduce vulnerability of food security and avoid unintended impacts of relocation by creating and improving community gardens, nurseries and raise awareness about climate-resilient food crops and nutrition. Project financial management skills for women, men and youth will be encouraged. This will ensure sustainability of activities beyond the life of the project, as management skills in food and nutrition, and improved knowledge on the linkages of food security and ecosystem services provided by the upland forested areas will ensure a well-managed resource.

The management activities themselves will be made resilient to future climate change impacts by implementing community-based risks management responses to risks such as landslides, flooding, and agricultural development. For example, invasive species management, regulation of timber harvesting, water catchment activities, requirements for agriculture buffer zones, control of pesticides / herbicide use, and more. The skills and knowledge in reduction of these risks will be institutionalised by the project through integrating these into roles and responsibilities of the various community based organizations of the project.

Replication and Scaling up

The institutional arrangement for implementation of the project is based on the institutional capacity and its operational mandate given by State and National Government. This will help to synergise the outcome in future plan and policy of Government. Based on the data and analysis that will be undertaken during implementation, the viability, sustainability and replicability of the model will be tested.

The capacity of the executing entities at national, state and municipality / outer island level, particularly the institutional capacity has been designed to allow for future and similar programs to be operationalized. The institutions, that include Working Committees, department management units on water, roading construction will synergise these works in future plan and policy of Government. In Kosrae, the project is already replicating the climate-proofing of road infrastructure. It will continue to improve on the process building on the capacity of individuals that started with the PACC project. The situation is similar for water-related projects of Yap, Chuuk and Pohnpei. It is already learning lessons from GCCA:PSIS project and has incorporated this into its design. It has learned to plan around transportation and logistical schedules with the Department of Transportation when organizing for shipments of equipment and services to the outer islands.

The process documentation and evidence-based assessments and studies, gathered from monitoring activities as well, will provide the necessary information to develop peer-reviewed information and knowledge products that users, including academic institutions, policy and decision makes at all levels, will capitalise on and enable wider replication of success stories from the project.

K Environment and Social Impacts and Risks

Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.

Checklist of environmental and social principles	**No further assessment required for compliance**	**Potential impacts and risks – further assessment and management required for compliance**
1 Compliance with the Law	• The Project complies with the FSM Environmental Protection Act 1999 (FSMEPA 1999); Environmental Impact Assessment Regulations 1989; • Further the project complies with Yap State Environmental Quality Protection Act (Y.S.L. 3-73); Kosrae Regulations for Development Project (No. 67.05); Kosrae State Building Code (Section 11.2104); Chuuk EIA Regulations (CSL 2-94-0)	None
2 Access and Equity	• The project provides fair and equitable access to the project beneficiaries and will not impede access to any of the other requirements like health clean water, sanitation, energy, education, housing, safe and decent working conditions and land rights. • The project ensures that women, men and youth have equitable access to capacity building activities (training, meetings, surveys, monitoring) and project benefits • The design and construction of the physical infrastructures of water conservation and management technologies will ensure access for persons living with disabilities, women, youth and elderly to water and self-composting toilets • The project ensures long term access for the community of Utwe and parts of Malem Municipality to the Government Centre, high school, hospital, airport, port and other villages. Over time it will enable both Malem and Utwe become more resilient and to develop safe housing through improved access to land and infrastructure inland. • Due diligence will be given to safety of the travelling public to ensure minimal disruptions to the city during construction of the inland road.	None
3 Marginalized and Vulnerable Groups	• FSM does not have marginalized groups. There are, however, vulnerable groups and who are identified by the project as direct beneficiaries. These are women, girls, children, men, elderly,	None

	and people living with disabilities living in atoll island environments and those that do not own land in upland areas. • The project views vulnerable groups as direct beneficiaries. • The design and construction of the physical infrastructures of water conservation and management technologies will allow prioritization of needs of the vulnerable groups to easily access water and use of self-composting toilets without hindrance. • The project will prioritize the orientation of vulnerable groups to climate change, sea level rise, and adaptive capacity. The access of vulnerable groups to information and their ability to participate actively in consultations and all activities of the project will be of paramount importance. • The project will ensure that the direct beneficiaries of Malem and Utwe communities are provided the support to access land and finance to aide their relocation to safe location. The project will therefore target those without land in upland areas, assisting them to afford safe housing at a safer elevation from sea level rise	
4 Human Rights	• The Project is in compliance with all applicable FSM and international laws relating to human rights. • The proposed interventions respect and where applicable, promote international human rights. It does not foresee any violation of human rights	None
5 Gender Equity and Women's Empowerment	• The project will be taking a proactive measure to incorporate gender into the national water and sanitation policy. This would ensure participation by women fully and equitably to receiving comparable socio-economic benefits resulting from management of water resources, at any level of society. This will also ensure they do not suffer adverse effects. • Gender-perspective trainings are one of the key activities of the project that will be undertaken for all proponents of the project so as to ensure a gender-sensitized management and execution of the project. • The beneficiary related activities, e.g. training, exposure visits, will include women so as to enable them to develop their capacities and strengthen their skill base. In each community, will have a representative from women and youth on their Working Committee, who will represent	None

	their views and participate in the project related decision making process • Women will also benefit in terms of increased access to water and upland areas for farming and gardening when they are part of the project management and monitoring committee at the community level.	
6 Core Labor Rights	The Project is in compliance with all applicable FSM and international labor laws. All labour payments including ad hoc labour payments will adhere to State laws as promulgated by labour regulations defining the relevant wage rate, workers benefits and other relevant working conditions.	None
7 Indigenous Peoples	All applicable international instruments relating to indigenous peoples would be adhered to by the project with regard to any activities conducted, including coast line developments. The project identifies indigenous population as those that are native and live and own land and have ancestral ties to the island environments. It is common today for landowners to own land in upland areas, but to reside on the coastlines. The project pursues to seek consent from indigenous landowners who will benefit from the project. The project is consistent with the United Nations Declarations on the Rights of Indigenous Peoples requirements and has already sought consent of the landowners and community. Detailed outcomes of the consultations with the indigenous communities, of their priorities to be addressed under the project in relation to enhancing the capacity of the coastal zone to adapt, are outlined in Section II.H of the proposal.	None
8 Involuntary Resettlement	On the atoll communities of Yap, Chuuk and Pohnpei, the repairing of household rainwater harvesting systems will not displace any households or communities. The installation of community water tanks will also not displace any communities. The community water tanks will be stationed next to selected community buildings. The construction of self-compositing toilets are designed to be built on existing infrastructures and/or can be standalone infrastructures. These will not displace any individuals, households or communities. The	None

	possibility of involuntary resettlement or relocation, therefore, is unlikely. The criteria for selecting the site to install the community water tanks and or self-composting toilets will ensure that there is no involuntary resettlement, displacement of any property, household or community. The ESI screening safeguards process will note this as an option. The inland road between Malem and Utwe is adjacent to seven properties and the indicative line and easement of the inland road has sufficient space to align the road and avoid any relocation or removal of property or displace any individual, household or community. The criteria for re-alignment (or re-designing) of a section of the inland road or access route will work to avoid any involuntary resettlement, displacement of any property, household or community. If necessary, the inland road or access route will be re-aligned.	
9 Protection of Natural Habitats	The environment impacts from the proposed inland road are *low to moderate* according to the Preliminary Environment Impact Assessment Report for the inland road (Annex 1). The project will adequately control this low to moderate environment impacts by: • Maintaining the alignment of the road between Malem and Kuplu (and Malem to Pilyuul) close to the proposed design following approximately the 10 m contour; • Realignment of the road between Kuplu and Finsrem via Kuplu Wan to avoid both difficult construction (land slipping, inadequate space to create the road), and important ecosystem (Mosral to Utwe Mangrove system); and • Adhering to the mitigating recommendations made in the PEIA report, particularly around sediment control and storm water runoff, and any others subsequently specified in the Environment Social Management Plan (ESMP) (Annex 3) As a result, the initial road alignment between Kuplu and Finsrem has been re-routed via Kuplu Wan to avoid any impacts on the Mosral-Utwe Mangrove area which is an area of biological significance (see Kuplu Wan Option 2 road in figure 15). The mangrove area is a defined medium priority area of	Low to Moderate

	biological significance and to accommodate the road via its original alignment would result in direct impact from sediment run-off and potential mangrove removal. As such, finalizing of the proposed inland routes that includes vegetation clearing and topographical survey, requires walking through the road, seeking and identifying at the same time, any record of any natural habitat for animals or birds. In cases where there are such habitats, the road design and realignment will consider that these habitats are not affected. The final road alignment will avoid upland forest areas designated as an area of biological significance, despite having undergone past disturbance primarily during the Japanese occupation during the Second World War. It will also avoid the need for the removal of any large tree species particularly endemic species such as Nunu (*Horsfieldia*). • The communities and NGO will also develop, implement and monitor native vegetation buffer zones along sensitive areas where roads and rivers meet to stabilise cleared land. • A community-led stream health monitoring program will engage schools, women and youth organization of the communities to be able to monitor the surrounding environment effectively, particularly where the new inland road is constructed. The Preliminary EIA report concludes that no potential significant issues have been identified that would require further assessment to understand or address potential impacts. The project will continue, however, to manage the risks and take preventive and corrective actions during design and construction of the road (ESMP, Annex 1) Component 2: The project does not affect any of the natural habitats of the atoll island environments. Some repairs of household rainwater harvesting systems, as well as installation of community tanks may require clearing of environment to allow for installation of water tanks and or expand the area for roofing structure to act as a water catchment area. Where clearing of the land or environment is significant and that land or environment is a natural	

	habitat, the repairs and installation work will not be covered by the project. The same approach will be applied by the project for self-composting toilets.	
10 Conservation of Biological Diversity	The project would not cause any impact on bio-diversity values The project on the atoll island environments will be addressing water and sanitation and water conservation and management technology. There is no use of any fauna or flora species to promote water conservation. The inland road construction will not utilize or promote any invasive species nor aim to remove any particular species during the construction of the road	None
11 Climate Change	The project is not expected to contribute to GHG emissions. In dealing with transportation to the outer islands, the project would take lessons learned from other programs in promoting 'ferry pooling' for government projects and programs to the outer islands. Project management, monitoring and evaluation activities to the outer islands for example will be planned around government ferry schedules or private and partner programs (United States Navy Pacific Fleet Program, US Coast Guard island visit programs - the project will take advantage of such partnerships for reducing its carbon footprint). The project will promote the use of traditional canoes and or diesel-hybrid versions where conditions are extreme to carry out transfer of goods and cargo from ferry over the lagoon into the islands.	None
12 Pollution Prevention and Resource Efficiency	Project is not expected to use any method that pollutes existing natural resources. Component 2 activities use repair and installation materials that have insignificant impact on the environment and people. The project will ensure any hazardous materials that will be used during construction are properly stored and if used by communities, are well aware of the safety and storage procedures. Component 3, the project will, however, undertake an assessment of the impact of the use of machinery and heavy vehicles during the construction of the inland road and access routes. The assessment will form	None to Low

	part of the monitoring process and the project will ensure that the quality of machines and vehicles used does not lead to spread of oil or other such pollutants to the near rivers, creeks and streams. The project will make arrangements to transport workers and not allow the establishment of camp sites on the construction sites.	
13 Public Health	No adverse impact on public health related issues is envisaged. The project will aim to minimize waste as much as possible through recycling and storing materials. To keep any unforeseeable public health related concerns at bay, the project will the following controls will be undertaken: 1. All non-hazardous, non-recyclable waste will be placed in containers and regularly emptied and disposed of to a permitted landfill site. 2. Lubricants and used oil will be stored in approved containers and promptly removed from site and disposed of as directed by EPA and KIRMA. 3. Care will be taken to prevent any releases or spills of fuel and lubricants during fueling and maintenance of construction equipment and will be prevented from entering the ground, drainage areas or water courses by using appropriate containers and bunds. 4. Any oily debris and contaminated soils will be recovered and disposed of as directed by EPA and KIRMA. 5. Adequate sanitary convenience that meets public health and environmental requirements will be provided for construction staff on site. The project will remove and recycle or dispose of any materials in an appropriate manner. For the outer islands, this may include shipping back to the main island any waste that does not cannot be disposed of in atoll island environments. Any remaining exposed earth surfaces shall be reinstated to match the surrounding topography and revegetated.	None
14 Physical and Cultural Heritage	FSM does not have any World Heritage properties[49]. It is also one of two State Parties in the Pacific that have no process in place for preparing national level	None

[49] 10A: Final report on the results of the second cycle of the Periodic Reporting exercise for Asia and the Pacific, UNESCO, Periodic reports, whc.unesco.org/archive accessed on 30 July 2015

	inventories for both Cultural and Natural Heritage properties. The project, however, would still endeavor to be in compliance to the EIA process outlined under the ESMP (Annex 3) and ensure there is no alteration, damage, or removal of any physical cultural resources, cultural sites, and sites with unique natural values recognized as such at the community, national, or sub-regional (Micronesian) levels. In doing so, the project will include the aspect in its monitoring works. The project will not be excavating for self-composting toilets as these will be on the ground technology. In cases where there is likelihood of encroaching on physical and cultural heritage sites and structures, the project will not consider construction or installation. The project therefore does not foresee any adverse impact on cultural heritage on any of its activities.	
15. Lands and Soil Conservation	Component 2: The project will carry out the ground-truthing assessments to ensure that the type of water tanks will not be concrete and the location of the tanks allow for maintenance, cleaning and ability to be moved from current location. The self-composting toilets intervention will be built close to existing infrastructure. The facilities are entirely on ground. There will be no excavation that will be required except for the unit foundation and evapo-transpiration unit. The foundation will be excavated to the right depth per climate proof building code standards. The evapo-transpiration unit only requires less than half a meter depth. The design of the self-compositing toilets will therefore promote conservation of soil. Component 3: The EIA (Annex 1) conducted as part of the Development Permit process has identified a range of mitigation measures within the design, alignment of the inland road, construction process and road operation to minimize soil degradation and erosion. This includes a full erosion and sediment control plan. Community monitoring of stream turbidity and stream biota health before, during and after construction has been built in to the project along with community led riparian planting of buffer zones	Low to Moderate

	at streams and re-establishment of food trees along the edge of the roadway shoulder to stabilize cleared areas, and to increase public awareness of the importance of riparian and buffer zones. The Development Permit process for the re-construction of the defenses at Paal and Mosral has also developed a sediment control plan and identified necessary design options to prevent further exacerbated shoreline erosion at the southern end of each defense.	

As discussed above, few environmental and social risks have been identified during the preliminary screening in the project and its activities at the community level. This is true for all the activities proposed for the six outer islands of Yap, Chuuk and Pohnpei focusing on enhancing the resilience of the water security to impacts of climate change. The preliminary Environment Impact Assessment report resulting from the assessment carried out for the construction of the inland road for Kosrae, however, concluded that the environment impacts are 'low to moderate'.

In view of this, the project is categorized as **"Category B".** To ensure that the project conforms to the AFP's Environmental and Social Policy (approved in November 2013) an Environment Social Management Plan (ESMP) has been developed (Annex 3).

The AFP's Environmental and Social Policy (approved in November 2013) will be made available to project stakeholders and promoted through training and dialogue with implementing agencies to build a common understanding of the principles and practices that have been adopted to enhance development benefits and avoid unnecessary harm to the environment and affected communities. Any potential impacts on vulnerable groups will be properly screened and considered by the project management team.

Kosrae under its EIA process has a grievance mechanism addressed under its existing EIA Guidelines. The three water security focus states do not have EIA Guidelines and therefore do not have grievance mechanisms currently in place. The project will apply the model of the Kosrae Grievance Mechanism under the project.

Grievance Mechanism for Kosrae: Kosrae's EIA process enables members of the public to make submissions and to raise issues that will be considered by the KIRMA Board prior to any decision on a Development Project application. In addition, any one affected by the decision of KIRMA also has the right to request review of the decision under the Administrative Procedures Act (Title 2 Chapter 4), which includes agency review and further rights of appeal to the Kosrae State Court and Supreme Court of the FSM.

Grievance Mechanism for Yap, Chuuk and Pohnpei states and outer island communities: In the absence of EIA Guidelines for Yap, Chuuk and Pohnpei, the project will replicate the grievance mechanism model of the state of Kosrae.

PART III: IMPLEMENTATION ARRANGEMENTS

A Institutional arrangements

A. Describe the arrangements for project / programme implementation.

The project will implement its activities through the four levels of governance of FSM – National, State, municipal, and traditional. The municipal and traditional levels are really one and the same. This project will refer to the municipal communities of Malem and Utwe of Kosrae state as municipals. It will refer to the six outer islands of Woleai and Eauripik (in Yap), Satawan and Lukunor (in Chuuk), and Nukuoro and Kapingmarangi (in Pohnpei) as traditional or the outer island level.

The institutional arrangements will have clear lines of authority from the RIE to the communities who are the key beneficiaries of the project. The arrangements will also ensure that the objectives of the project contribute directly to FSM's climate change objectives.

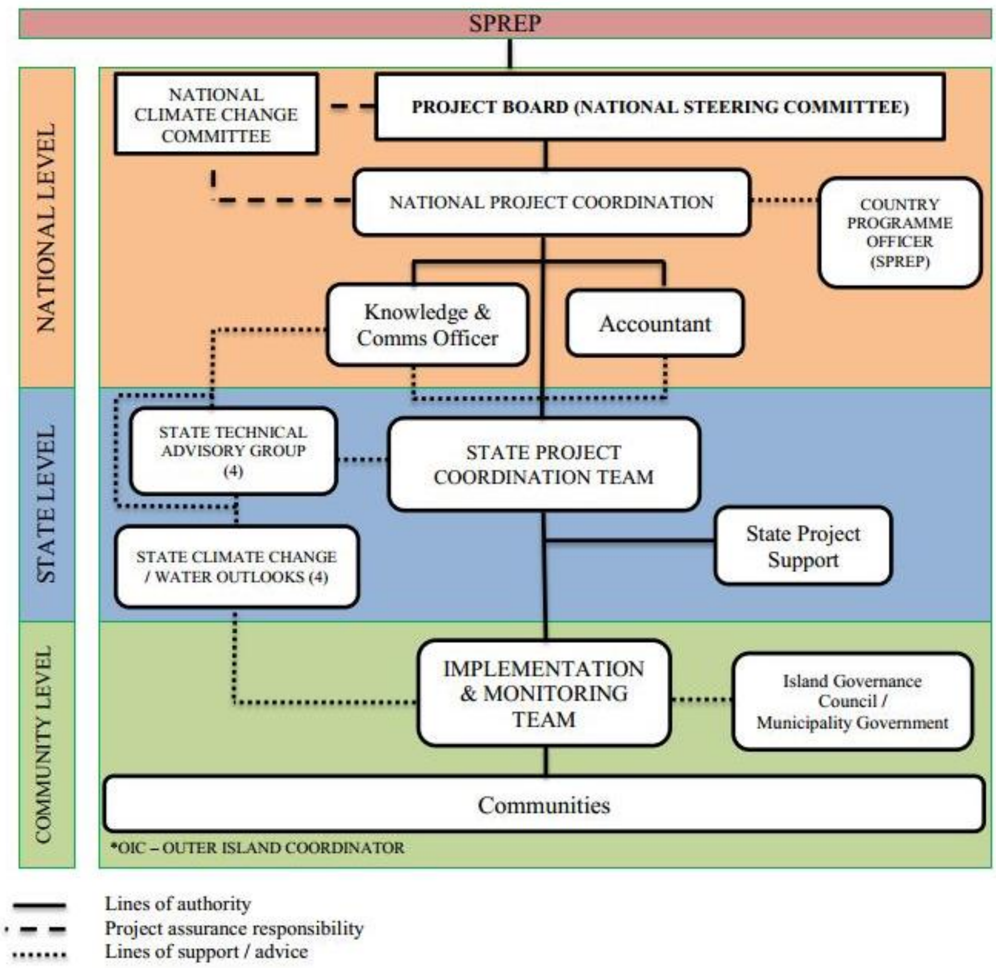


Figure 16. Institutional arrangement for the project

The Executing Entities of the project are:

- Office of Environment and Emergency Management (OEEM) at the national level
- Kosrae State Government in Kosrae

- Pohnpei State Govt in Pohnpei;
- Yap State Government, Yap; and
- Chuuk State Govt, Chuuk

In summary, the institutional arrangements and their roles and responsibilities under the project are as follows:

Table 20. Roles and responsibilities of the project management

INSTITUTIONAL STRUCTURE	COMPOSITION/MEMBERSHIP	ROLE AND RESPONSIBILITY
Project Board (PB)	Senior officials from OEEM; Department of Resources and Development Yap; Environment Protection Agency Chuuk; Environment Protection Agency Chuuk; Environment Protection Agency Pohnpei; Kosrae Island Resource Management Authority (KIRMA) Kosrae; Department of Transport & Infrastructure Kosrae; Office of Development Assistance (ODA) Kosrae; Office of Attorney General, National Government; SPREP as RIE Observers: Micronesian Challenge, IOM, MCT, COMS FSM SPC NPRO, UNDP, GIZ Substitutes: National government representatives of R&D, EPA, DTI, KIRMA, ODA	• Being accountable for the success or failure of the project in terms of the objectives of the project • Providing unified direction to the project. • Approving the resources and authorizing the funds necessary for the successful completion of the project • Ensure effective decision making • Providing visible and sustained support for the National Project Manager • Ensure effective communication both within the project team and with external stakeholders • Provide assurance that all activities have been delivered satisfactorily • Approve the Terminal Report and ensure that any issues, lesson and risks are documented and passed on to the appropriate body • Support approval of project closure and send project closure notification to SPREP as RIE.

INSTITUTIONAL STRUCTURE	COMPOSITION/MEMBERSHIP	ROLE AND RESPONSIBILITY
State Technical Advisory Groups (STAGs)	Experts with qualification and experience in: Legislation & Regulations • Institution Development Specialist • Environment Legislative and Regulation drafters • Climate Change Scientist • Climate & Environmental Law • Water Sector • Water Engineering • Rainwater harvesting systems • Outer island development • Civil Engineering • Atoll Island Soil Scientists • Gender and Education • Climate Education Specialist • Curricula Development specialist • Gender & CC Trainers • Coastal Infrastructure • Civil Engineering • Agricultural Engineer • Geo Hydrology • GIS Specialist	• Provide technical inputs to the team members • Assess relevance and impact of the climate adaptive strategies and advice the NPD, NCCC and NPM • Make recommendation to the Project Team on technical matters to incorporate into activities and implementation plan Each STAG will be constituted for the purpose of the project and will be convened by the Project Manager to draw upon the expertise from this group
Climate Change / Water Outlook Advisory Group (WOG)	Experts with qualification and experience in: • Water Engineering / Specialist • Climate Forecaster / Seasonal Climate Forecasting • Geo / Hydrologist • Climate Modeler • Programmer	• Provide technical and advisory information to inform decisions of the STAG • Provide timely information and advice to the KCO to the project team • Provide three monthly advance advice on climate and water outlooks for project sites / islands The WOG will be constituted for the purpose of the project and for implementing the National Water Outlook Program of the Water Policy. It will be convened by the Project Manager to draw upon the expertise from this group to provide advice to the water priority state activities.

INSTITUTIONAL STRUCTURE	COMPOSITION/MEMBERSHIP	ROLE AND RESPONSIBILITY
Country Programme Officer (CPO)	The CPO will be based at SPREP.	• Advise on selection of project team members • Advise on stakeholders engagement • Ensure that the Communication Management Strategy is appropriate and that planned communication activities actually take place
Country Project Team	The Country Project Team will exist at three governance levels: (i) at the national level comprising the National Project Coordination Team is the National Project Manager, Knowledge & Communications Officer and the Accountant; (ii) at the state level, each of the four states with a State Project Coordination Team comprising of the Team Manager acting as the Field Manager, the Operations and Finance Officer and Junior Communications Officer. The latter two officers make up the State Project Support team; and (iii) at the community level, each of the eight communities will have an Implementation and Monitoring Team (IMT)	• Overall responsibility for the implementation of the project • Engage with external stakeholders to achieve project objectives • Responsible to the NIE for fulfilling monitoring and evaluation activities under the project.

INSTITUTIONAL STRUCTURE	COMPOSITION/MEMBERSHIP	ROLE AND RESPONSIBILITY
Implementation and Monitoring Team (IMT)	The composition of the IMT for the Outer Islands - comprising of the Outer Island Coordinator, the Women's group representative, Men's group representative, Youth group representative, Persons living with disabilities group representative, and traditional leader / elderly representative. For Malem and Utwe communities, a community working committee will be under the coordination of the Team Manager in KIRMA.	• Carry out the technical surveys and assessments of the project based on consultations and direction from the communities and island governing council in relation to project outputs. • Assess relevance and impact of the climate adaptive strategies • Make recommendation to the Project Team on technical matters to incorporate the same in the implementation plan • Improve the design of the activities • Develop climate change adaptation plans specific for the island and sector • Train and lead in implementing adaptation activities • Report to the OIC progress, risks and issues of the activities
National Climate Change Committee	All relevant stakeholders of government, NGO, Inter government organizations, and Community Based Organizations and private sector	• Advise on other climate change projects and programs ongoing with the view to integrate, synergize and not duplicate efforts • Assure liaison with stakeholders of the project is maintained • Ensure Applicable standards are being used • The needs of specialist interests (for example, vulnerable groups) are being observed. •

The organizational structure for the implementation of the project requires staffing at three levels: national level will provide direction of the project through the project board. The National Project Manager and the project support team will manage the project from the national level with assistance of the coutnry programme officer (CPO) based at SPREP. The delivery of the project will be at the state and community levels. There will be four Team Managers posted at state level with a coordination team comprising of an Operations and Finance Officer and a Junior Communciations Officer. The Outer Island Coordinator will provide oversight of the implementation of the project at the community level, as well as carrying out monitoring and reporting. The organization structure of the staff is presented in the diagram below:

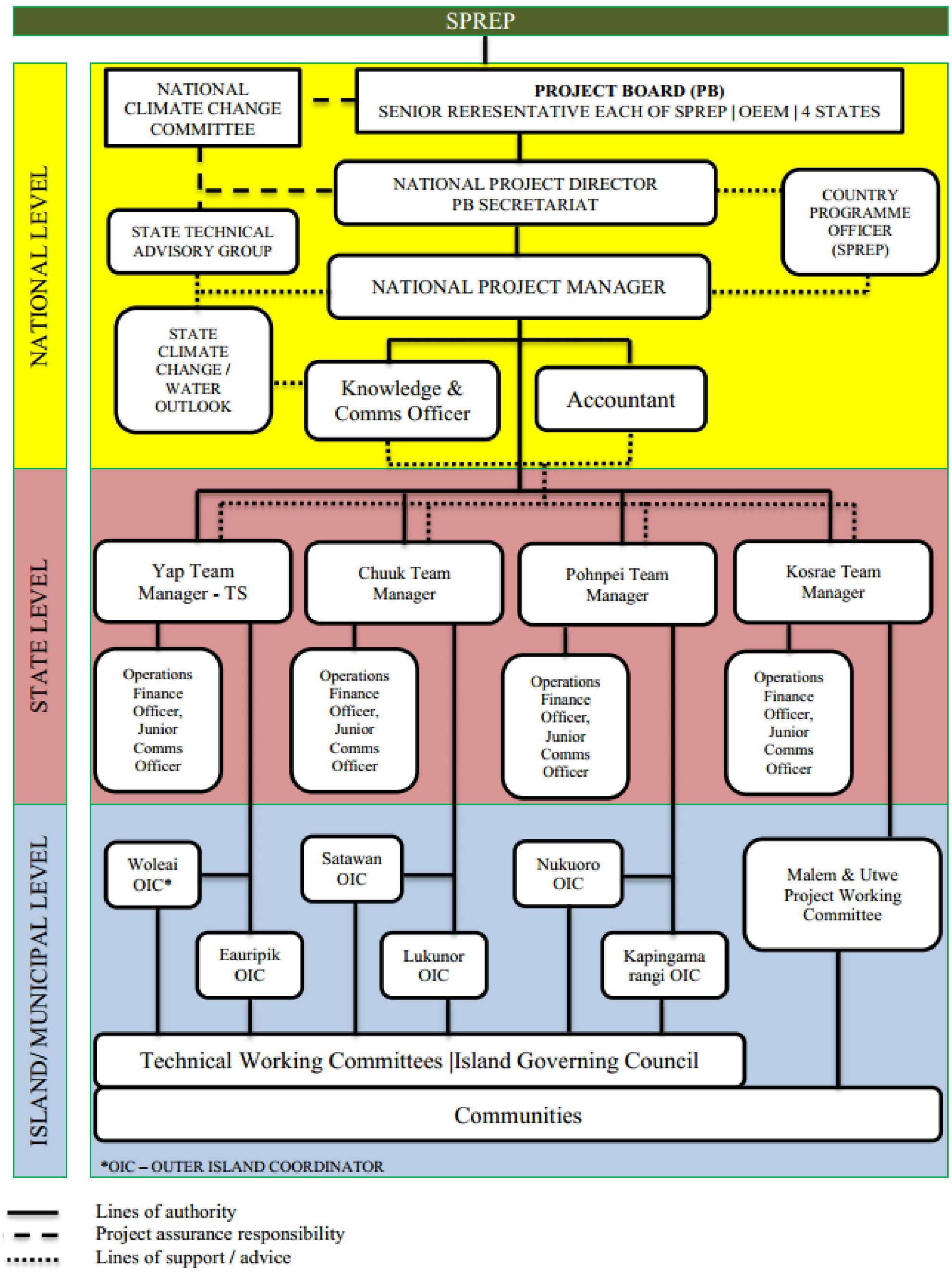


Figure 17. **Staffing structure of the project**

The key roles and responsibilities of the key staff are summarised in Table 21 below

Table 21. Key roles and responsibilities of Project Staff

POSITION	KEY ROLES & RESPONSIBILITY
National Project Director	- Organize and co-chair the Project Board reviews - Provides high-level advice to the Board on progress, risks and issues against the objectives of the project. - Monitor and control the progress of the project at a strategic level, in particular reviewing the objectives of the project regularly - Appoint the project management team - Ensure overall objective and goals of the project remains on target, is achievable and will be completed within the agreed scope of the project
National Project Manager	- Secretary to the Project Board - Overall responsibility for the implementation of the project - Engage with external stakeholders to achieve project objectives - Responsible to the NIE for fulfilling monitoring and evaluation activities under the project. - Liaise with SPREP Country Programme Manager and account managers - Lead and motivate the project management team - Manage the information flows between the directing and delivering levels of the project - Provide oversight to the project activities of each component, taking responsibility for overall progress and use of resources and initiating correction action where necessary - Advise the Project Board through the National Project Director of any deviations of the project. - Unless appointed to another person(s), perform the Team Manager role - Unless appointed to another person(s), perform the Project Support roles - Prepare and maintain quarterly, semi-annual, annual and bi-annual reports of the project - Schedule and respond to annual financial audits
Team Managers (TMs) (technical specialists)	- Responsible for delivering the activities of the project to an appropriate quality and completion within a planned and agreed timescale and cost. - Authorize and responsible for planning project activities and managing a team of specialists / experts - Unless appointed to another person(s), perform the Project Support roles - Assist in schedule and responding to annual financial audits - Report to the NPM, KCO and Accountant - Carry out technical reviews where required - Prepare and maintain quarterly, semi-annual, annual and bi-annual reports of the project

POSITION	KEY ROLES & RESPONSIBILITY
Knowledge & Communications Officer (KCO)	- Collect, collate and document data and information from management team at national and state levels - Assist in managing development of knowledge products and visibility materials - Provide administrative support for the project management team at national level - Provide advice to Team Managers at state level
Accountant	- Manage and advice the financial situation of the project - Develop and communicate (forecast) financial situations and reports to relevant stakeholders on a timely basis - Provide financial advice to NPD via the NPM and TMs - Provide administrative support for the project management team at national level
Communications Officer (CO)	- Based at state level, the CO is to - Capture, collect and document data and information from management team at state and community levels and share with national office - Update database of the project and ensure activities of the communication strategies take place. - Assist in development of knowledge products and visibility materials Provide administrative support for the project management team at national and state level - Report risks, issues and progress of the project against the communication plan and strategy
Operations & Finance Officer (State level)	- Provide administrative support for the project management team
Outer Island Coordinator (OIC)	- Coordinate execution of activities and services on island with the island / municipal governing council - Report progress, risks and issues of the project to the Team Manager - Communicate project data and information to the TM

B Risk Management

B. Describe the measures for financial and project / programme risk management.

Table 22. Project Risk Management Measures

Expected Risk	Rating of Risk	Risk Management Strategy
Institutional		
Limited or no buy-in from national and state government stakeholders	Low	- The inception workshop will invite high level key stakeholders from national and state. - A capacity needs assessment will identify those that are relevant to the project and those with limited input

Expected Risk	Rating of Risk	Risk Management Strategy
Lack of capacity within executing agencies cause delay or insufficient level of implementation	Med – Low	- Contracts will be for three years and notice for leaving will be for longer duration; recruitment of local persons at the State and community level so that they do not have motivation to leave and build ownership; - Regular project team meetings and capacity building to ensure that all staff understand their role in the project
Environmental		
Extreme natural disasters affect the implementation of the project	Medium	- The current practice in responding during and post-disaster phases is that all of the government functions will be diverted to emergency response measures. - The project will communicate in advance expected delays and actions required to minimise the risk and impact on the project activities, assets and personnel. - The national project manager will inform all key stakeholders in advance.
Climate hazards are more severe than anticipated leading to higher climate-proofing related costs for building the inland road	Medium	- The project will address the climate hazards in advance under this project. It will minimize the risk to people and infrastructure by revetment of the coastal road as planned under activity 3.2.1 of the project
Social		
Logistical/transport problems and/or prohibitive costs leading to delays in arrival of people and/or materials	Med-High	- Identify annual travel plans of the community around community occasions, events and celebrations. Incorporate into project plans - Work with the transportation shipping companies on the schedules in advance to avoid planning around delayed or no sailing days
Traditional values and governing structures restrict the participation of women	Low	- Break up into gender-based working groups will be applied to community consultations. - There will be an elderlies / traditional leaders only group, women's only group, youth only group discussions. Where youth are required to break further into girls and boys, that will also be carried out

Expected Risk	Rating of Risk	Risk Management Strategy
Limited or no buy-in from communities or island council	Low	- The inception workshop will clarify the project goals, strategies, objectives, activities, roles and responsibilities of all stakeholders involved. - Annual meetings and refresher meetings will be called by the Outer Island Coordinator for the project to update progress and report on risks, issues and assistance required by the project from the community and vice versa
Theft of assets from the water systems	Low	- Build fencing around assets where required - Awareness and education of the importance of the assets - Enforce community by-laws
Financial		
Delays in expediting funds to state and community project units to execute project activities	Low-Med	- Carry out refresher training on financial reporting - SPREP to assist in direct modality in advance and in support of the Finance departments of national and state
Delays in acquitting funds	Low-Med	- SPREP and OEEM to convene meetings to address the issue and aim to 1) utilize funds for other planned activities, 2) divert funds to other community, state or national activities that have been completed and ready to implement other planned activities
Operational		
State run ships to outer islands are unreliable and very slow to get to many outer islands, and only stay on island for half a day (on average).	Med – High	- The project will explore options of collaborating with the shipping companies with assistance of key government stakeholders. These may include chartering of ships and agreement to a working schedule such as frequencies, length of stops, and unloading processes
Team/ island communication difficulties (e.g., only have shortwave radio)	Medium	- Project will improve communication equipment of existing government office which is required by the project to effect timely reporting of project aspects including progress, risks and issues monthly and quarterly

Expected Risk	Rating of Risk	Risk Management Strategy
Difficult to reach out and train teachers in Outer Island schools	Low-Med	- A progressive plan of developing the Teacher's Guide will be carried out at state level and training carried out at state level. - The project will trial out training of teacher's in only 2 of the six islands. Identify issues and lessons to improve the conducting of training in other islands. - One other strategy is to bring volunteer and or selected teachers from both islands from each state to the main island for training. Upon return with materials and competency-based training have been undertaken
Land issues (disagreement/conflicts over access of land for installation tanks/reserves)	Low-Med	- Consultation and awareness prior to agreement - Letter of agreement between landowner and island governing council acting as the Principal of the agreement on behalf of the project, at the outset of the project.
Unsuitable infrastructure (e.g., house roofs can't support catchment systems)	Low	- Ground truthing assessments will include baseline and technical surveys to identify suitable housing infrastructure and modify design of installation of water harvesting systems
Agreement cannot be reached with all landowners on easements required for building the inland road	Low	- The June 2016 consultations with Malem and Utwe communities addressed this risk. The municipal governments have initiated development of agreements with all the relevant landowners. All landowners have already signed agreements to building the road during consultations in the planning stage of the proposal.
Implementing partner has adequate capacity	Low	- The capacity of NGOs delivering the activities will be developed through training and or recruitment of a local consultant to carry out the activities required - Training with CBOs will address the capacity issues. Emphasis will be placed on women councils and women's organization that will be requesting to assist.
Locally available printing, video and audio production capacity	Low	- The project will seek printing companies from within FSM to assist. The project will also seek services from nearby neighbouring countries to assist, in particular Guam where such services have the capacity
Political		

Expected Risk	Rating of Risk	Risk Management Strategy
There is no capacity on island to carry out needed trainings	Medium	- The project units at state level will work with NGOs and consultants to develop a team of trainers to go into the islands and carry out 'Train the Trainers', module and competent-based trainings. This will build capacity of the island teams to be able train and build capacity of the local population.
There is no political will and commitment from island leaders, and municipal government	Low	- The proposal has been on the agenda of the Vice President for 12 months since July 2015. The communications from the Vice President to the high level officials of government has been supportive to move with the project. - Mayors, traditional leaders have issued high political support of their local governments to the project. Their support letters are provided in Annex 6

The project has noted the key social risk with regards to the installation of self-composting toilets as an alternative adaptation option to conserve water, improve the thin soil environment and reduce marine eutrophication on the lagoon side of the atolls.

The project's risk response strategy will be to further identify, assess and control the risk during inception and adaptation planning meetings. The project will ensure that there is a common understanding of the risks to the project and community, carry out a survey and put control measures in place and communicate widely before further work is carried out. The control measures may include the enhancing the understanding of community members on the benefits and costs between the current practices and the new alternative technology introduced as part of adapting to impacts of climate change. Another control measure is to fallback to food security and marine resource management priorities identified by the communities in the planning stages.

C Environmental and Social Risk

C. Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.

The project is categorized as **"Category B"** with low to moderate adverse Environmental or Social Impacts and hence no additional measures for risk management are envisaged.

A Preliminary EIA has been undertaken of the proposed road investment in component 3 (see Annex 1). Its findings support the "C" classification of the project overall. The road design and construction will be based on the requirements of the preliminary impact assessment report so as to ensure enhancement of natural resources. All measures will be taken to avoid degradation of natural resources, as well as physical and cultural heritage. These are further outlined in the ESMP in Annex 3.

Specific measures to address major ESP risks are detailed below:

Table 23. Environment and Social Policy Principles addressed within the project

ESP Principles	Addressed within the Project
Access and Equity	There is equitable access to the project benefits by all, and it does not exacerbate any existing inequalities. The project does not impede access to any other basic infrastructure including sanitation and energy nor impact on land rights. Specifically for component 3 (Kosrae), the project ensures long-term access for the community of Utwe and parts of Malem Municipality to the Government Centre, high school, hospital, airport, port and other villages. Over time it will enable both Malem and Utwe develop safe housing and more resilient communities through improved access to land and infrastructure inland.
Marginalized and Vulnerable Groups	FSM including all eight communities do not have any marginalised groups. The vulnerable groups, however, are women, girls, children, men, elderly, and people living with disabilities living in atoll island environments who do not own land in upland areas. The project does not adversely impact any vulnerable groups of the six atoll communities and two municipality communities (women, men, youth and people living with disabilities or living with HIV/AIDS).
Human Rights	The project does not foresee any violation of human rights
Gender Equity and Women's Empowerment	The project will enable women and men to participate equally, social and economic benefits will be shared equally, and no gender group will be disadvantaged or suffer disproportionate adverse effects.
Core Labour rights	All labour payments including ad hoc labour payments will adhere to State laws as promulgated by labour regulations defining the relevant wage rate to the relevant work. The principle of equal wages for equal work for men and women will be strictly adhered to in the project. The project will not promote employment of child labour on any of its sites. The adults will be sensitized to provide protective measure for small children in and around constructions sites for water security and inland road construction. Forced labour or any form of bonded labour will be prohibited on the construction sites covered under the project. In case of private lands, agreements to conditions will be established and form part of a written agreement or memorandum of understanding, at the outset of the project. This will be drawn up between the landowner and the island governing council, acting on behalf of the project for the six outer island sites of Yap, Chuuk and Pohnpei.

Involuntary Resettlement	The project does not require any involuntary resettlement. Component 3: The inland road between Malem and Utwe is adjacent to 7 properties and the indicative line and easement of the inland road has sufficient space to align the road and avoid any relocation or removal of property. The criteria for re-alignment (or re-designing) of a section of the inland road will ensure that if there is any possibility or likelihood of involuntary resettlement, displacement of any property, household or community due to project activities, that section of the road will be re-aligned. A similar criterion was applied by the project for potential impacts of the project on the environment and was raised by the community of Utwe. The community was concerned over alternative road alignments through the Kuplu Wan plateau resulting in potential contamination of their water supply which is sources from the Palusrik catchment due to: (1). The location of the road and construction resulting in increased sediments or other contaminants entering the Palusrik River and the Utwe water supply; and (2) The improved access to the Kuplu Wan area created by the road subsequently leading to increased development in the Kuplu Wan area, including land clearing, septic tanks, pig pens etc., resulting in increased potential for contamination of the Utwe water supply. The project addressed this concern through ESI screening process. As a result, the alignment of the road through the southern part of the Kuplu Wan plateau (Palusrik catchment) has been re-aligned (DTI, 2016) (refer to Figure 15).
Protection Natural Habitats	Component 2: The project will consult with the communities through planned island community consultations on selection of sites for the project. The repairing of household rainwater harvesting systems will be on existing household sites. There will be no impact on any natural habitats as it will use existing housing infrastructures. The community tanks will be constructed within the building environment and will be situated close to any community infrastructure to leverage the roofs as water catchment area (for example church, schools, health dispensary units, terminals). The self-compositing toilet uses zero water and produces zero waste to the environment. The technology has a closed evapo-transpiration trench system that dissipates water waste preventing any contamination back or leakage to the soil. The technology prevents any waste pollution from seeping into the thin soil and contaminates the ground water. The technology, therefore, promotes the protection of the natural habitats as opposed to destroying the habitats. Component 3: Initial road alignment between Kuplu and Finsrem has been re-routed via Kuplu Wan to avoid any impacts on the Mosral-Utwe Mangrove area which is an area of biological significance (see Kuplu Wan Option 2 road in figure 15). The mangrove area is a defined medium priority area of biological significance and to accommodate the road via its original

	alignment would result in direct impact from sediment run-off and potential mangrove removal. Concern was also raised by the KIRMA Forestry staff over increased access leading to accelerated mangrove harvesting (and dumping) in an area that is presently only accessible by canoe. Given present pressure on mangrove harvesting in Kosrae this would be a likely consequence. The road passes through upland forest area in the Kuplu Wan area. However, this has been disqualified as an option in the design with the upland forest area designated as an area of biological significance although it has undergone past disturbance primarily during the Japanese occupation during the Second World War. The final road alignment will avoid the need for the removal of any large tree species particularly endemic species such as Nunu (*Horsfieldia*).
Conservation of Biological Diversity	Component 2: The project will not impact on any ecosystems of the atoll island environment. The project will have a positive impact on conservation of biological diversity by protecting the soil environment from untreated waste and reduce eutrophication of the lagoon sides by preventing any rich nutrients from human waste as runoff into the lagoons. As such, improving the marine environment and ecosystems that act as natural buffers to tidal surges and king tides. Component 3: The project will not impact on the Kosrae flying fox, Kosrae's only indigenous mammal and protected under the Convention against International Trade in Endangered Species (CITES). The current large colony in the upper part of the Yeseng catchment is well away from any proposed construction activities and will not be disturbed. Similarly there is no suggestion that habitat important for, of the current range of, the endangered Micronesia Imperial Pigeon will be disturbed. Most of the forest bird species are found throughout the Malem and Kuplu Wan regions and elsewhere in Kosrae. Whilst larger populations are found in areas of less disturbed mature forest, most are generally found through a variety of habitats including agro-forested areas.
Climate Change	Component 2: Repairing of rainwater harvesting systems at the household level will ensure there are at least two x 1,000L storage tanks per household. In view of prolonged drought and one tank is being emptied and cleaned, the other tank will provide enough water to last the drought. The project will also reduce the pressure to rely on household tanks during drought by installing 10,000L community tanks to buffer the water needs. A minimum of two tanks for every 100 people on an island will be installed. The site and situation of the water tanks relative to housing infrastructure, as well as the locations of self-composting toilets, relative to the shoreline from the ocean side, and considering other physical and safety parameters will be considered during the ground-truthing assessments stages of the project. This will be a response to the impacts of wave over-topping and overwash

	from high tides, king tides, surges, and typhoons. The cyclone-proof building code standards adopted from other Pacific Island Countries such as Samoa will be applied. FSM is currently developing its building codes. This will help reduce the impact from frequent or intense cyclones projected for FSM as a result climate change. Component 3: Kosrae's road design standards include appropriate bridge/culvert design and methodologies to calculate extreme flow rates for the design of drainage structures based on extreme rainfall amounts (1 in 10 year return period event) and the area of the relevant catchment. However, rainfall intensity amounts contained in the standards are out of date and do not include allowance for increased intensity rainfall for climate change. To mitigate potential design impacts on drainage flows: 1. Bridge and culvert design should be based on the most recent extreme rainfall intensity amounts available for Kosrae (the ADB Climate Proofing. A risk based approach to adaptation guidance). Given the "present day" in this guidance is considered to be the 1980-1999 period it is suggested that the 2025 projections are now considered "present day", and the design accommodate rainfall intensities to the 2050 projections. 2. Bridges and culverts are designed to accommodate a 25 year return period flow. This is higher than the 10 year return period specified in the design guidance. However, the intensities presented in the ADB guidance are based on a mid-range climate change scenario and there are also typically considerable uncertainty levels associated with extreme rainfall projections, hence the additional allowance would be pragmatic. This would increase the design hourly rainfall intensity used from 150 mm to 256 mm. 3. The road design standards include specifications for bridge and culvert wing walls to avoid bank erosion immediately upstream/downstream of each structure. Where necessary rock mattresses or equivalent should be installed to prevent any erosion of either the upstream or downstream water course. If exit velocities from the any of the culverts of bridges are likely to be significantly increased above normal, energy dissipation measures should also be included to minimise downstream erosion.
Pollution Prevention and Resource Efficiency	The current practice of not using the toilets in outer islands, due to limited water and infrastructure resources is promoting pollution of the local marine environment. This is common in low-energy environment of the islands – the lagoon side. This is, however, impacting on food security – in terms of fish suffocating from excess nutrients, and algal bloom marine environments that impacts on marine life. It is already polluting the groundwater and impact on the health of the reefs.

	The project will not use any method that pollutes existing natural resources. Component 2: The repairs and installation of water tanks and self-composting toilets will use repair materials that have no impact on environment and people. For example, the project will use no lead paints for water tanks and self-composting toilet infrastructures where required. Component 3: The employment of heavy vehicles or equipment during the construction phase will ensure no emissions of pollutants from these vehicles to rivers, streams, creeks, mangrove lakes or the catchment area. Community-based ecosystem management activities alongside of the road, particularly near areas where bridges and or culverts are established, will lead to construction of soil and moisture conservation structures and increase the vegetative cover. This will be done through re-planting of endemic vegetation around river and stream areas at road crossings; developing community gardens along road easement strip to stabilise cleared land. This will contribute towards increase in soil fertility, strengthening and holding river banks, reducing severe riverside erosion. These measures will decrease the need for and demand for fertilizers in the catchment area and promote organic gardening techniques. Water quality monitoring of all rivers, streams and within proposed area will be carried out by the project. The monitoring will indicate whether there has been excessive flow of pollutants in the pond. This will be possible through a community-led stream health monitoring program . The program will educate, train and provide hands-on collection of data along the rivers and streams to gauge the level of water quality. The program will implement bio-assessment techniques such as sampling a body of water to find the biodiversity of macroinvertebrates in the water, providing strong indication of the water quality. These water management measures will be implemented with the help of schools, women, and youth organizations. This will build the capacity of the young and old locals to be able to monitor their own environment using local and natural resources. Training on best practice will lead to better understanding on the conservation and use of resources and the importance of it to help communities adapt to climate change and sea level rise. .
Public Health	Construction design and planning will aim to ensure waste is minimized as much as possible. Where possible the opportunity will be taken to use other recycled materials such as wood cuts, cement bases, gutters as spare parts for future maintenance, security fencing; or crushed glass crushed concrete in the road sub-bases. The following controls will be undertaken: 6. All non-hazardous, non-recyclable waste will be placed in containers and regularly emptied and disposed of to a permitted landfill site. 7. Lubricants and used oil will be stored in approved containers and promptly removed from site and disposed of as directed by EPA and

	KIRMA. 8. Care will be taken to prevent any releases or spills of fuel and lubricants during fuelling and maintenance of construction equipment and will be prevented from entering the ground, drainage areas or water courses by using appropriate containers and bunds. 9. Any oily debris and contaminated soils will be recovered and disposed of as directed by EPA and KIRMA. 10. Adequate sanitary convenience that meets public health and environmental requirements will be provided for construction staff on site. On completion of the works all surplus materials and construction debris shall be removed and recycled or disposed of in an appropriate manner. Any remaining exposed earth surfaces shall be reinstated to match the surrounding topography and revegetated.
Physical and Cultural Heritage	Component 2: During the ground-truthing assessments activity for the repairing and construction of water harvesting and storage systems, and of self-composting toilets, the project will identify any significant and existing cultural sites as well as potential new cultural heritage sites. Re-consideration by the community on the location of community water tanks and self-composting toilets will be carried out and re-location of the interventions will be carried out. Component 3: During initial clearing and engineering survey of the road alignment, the Historic Preservation Office of KIRMA will survey any potential new cultural heritage sites identified. Re-alignment of the road will occur to avoid any identified sites.
Lands and Soil Conservation	Component 2: The rapid assessments of water resources on the outer island sites of the project has shown the need to improve conservation of soil as well as avoid or reject any project development that proposes installation of concrete water tanks on the outer islands. The project will carry out the ground-truthing assessments to ensure that the type of water tanks will not be concrete and the location of the tanks allow for maintenance, cleaning and ability to be moved from current location. The self-composting toilets intervention will be built close to existing infrastructure. The facilities are entirely on ground. No digging will be required except for the evapo-transpiration unit that requires only half a meter depth. The design of the self-compositing toilets will therefore promote conservation of soil. Component 3: The EIA (Annex 1) conducted as part of the Development Permit process has identified a range of mitigation measures within the design, alignment of the inland road, construction process and road operation to minimise soil degradation and erosion. This includes a full erosion and sediment control plan.

	Community monitoring of stream turbidity and stream biota health before, during and after construction has been built in to the project along with community led riparian planting of buffer zones at streams and re-establishment of food trees along the edge of the roadway shoulder to stabilize cleared areas, and to increase public awareness of the importance of riparian and buffer zones. The Development Permit process for the re-construction of the defenses at Paal and Mosral has also developed a sediment control plan and identified necessary design options to prevent further exacerbated shoreline erosion at the southern end of each defense.

D Monitoring & Evaluation
Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

The monitoring and evaluation (M&E) scheme will be applied in accordance with the established SPREP procedures throughout the project lifetime. This shall ensure the timeliness and quality of the project implementation. The M&E plan will be implemented as proposed in Table 24 below.

The following sections outline the principle components of the Monitoring and Evaluation scheme and indicative cost estimates related to M&E activities.

Project Inception Phase

Inception Workshops (IW): A national and all state Inception Workshop will be carried out by the project within three months of project start and the first tranche of funds have been received. A full project team with assigned roles in OEEM, KIRMA, EPA Pohnpei, Chuuk and Yap, and where appropriate and feasible, collaborating partners of the project and technical advisors will lead the workshop. The IW is crucial to building ownership for the project results and to plan the first year annual work plan.

The overall objective of the inception phase is for key stakeholders to take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's strategic results framework (Table 25). The key objectives of the workshop are:

- To review stakeholder analysis for each project;
- To review and check through the logic of the Project Framework;
- To draft a stakeholder capacity needs assessment in management of the project;
- To clarify the monitoring protocol for indicators; and
- Clarify clear project boundaries (both technical and geographical).

The activities of the workshop include:

- Reviewing the strategic results framework (indicators, means of verification, assumptions), imparting additional detail as needed;
- Agree upon the first Annual Work Plan (AWP) with measurable performance indicators;
- Introduce support processes and technical backstopping mechanisms available;
- Agree on elements of the project's communication strategy, including requirements of the communication infrastructure for project implementation;

- Agree on the monitoring and evaluation process including provisions of training on project management skills and execution;

The inception workshop would be the opportunity to understand the project roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff and decision-making structures will be discussed and clarified, as needed, in order to clarify for all, each party's responsibilities during the project's implementation phase

The national inception workshop will also provide the first annual meeting of the Project Board (PB) with responsibilities over management decisions including approving implementation work plans and budget revisions, identifying problems, suggesting actions to improve project performance (see **Project Board and Project Board meetings**)

Inception Report. A Project Inception Report (IR) will be prepared immediately following the series of Inception Workshops. It will include a detailed first year/AWP divided in quarterly time-frames detailing the activities and progress indicators that will guide implementation during the first year of the project The Report will also include Appendixes of detailed project budget for the first full year of implementation, prepared on the basis of the AWP, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months' time-frame.

The Inception Report will include the agreed detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners that were discussed in the workshops.

Annual Progress Report (APR): The APR shall be prepared by the National Project Manager and is to be presented at the Annual Review Meeting for endorsement. The APR will be prepared with progresses against set goals, objectives and targets, lessons learned, risk management and detailed financial disbursements.

Project Annual Review (PAR) Meeting: An Annual Review Meeting shall be conducted annually, with the first meeting a year after the National inception workshop. The meeting will be a high-level review meeting where key representatives of major stakeholders of the project are represented. The objective of the meeting is to review progress, discuss results, challenges and opportunities. Recommendations of the progress review meeting will be the key outcome of the meeting. The recommendations and report of the annual review meeting is submitted to the Project Board for endorsement for action.

Project Board and Project Board meetings: The Board is represented by high-level representatives of the implementing entity SPREP and the executing entities (OEEM, KIRMA Kosrae, R&D Yap, EPA Chuuk, EPA Pohnpei). It is chaired by the Director General of SPREP or a senior adviser directed by the Director General. It is co-chaired by the Director of OEEM acting as the Director of the Project. The National Project Manager acts as the secretariat to the Board. The Board will agree and adopt a coordinated implementation strategy of the project and its partners, as well as endorse the project's first year's annual work plan.

The Board will also include high level representatives of the communities in the project proposed areas. The Board will meet annually at the auspices of the PAR. The Board will call meetings immediately following the PAR meetings. The objective of the board meetings is to discuss recommendations of the project progress and way forward as agreed to and presented by the PAR meeting outcomes. Agreement and approval of the direction and way forward from the Board in view of the recommendations of the PAR will be key outcomes. The outcomes of the Project Board, including approved APR of the project is shared and submitted to the Donor via SPREP as the RIE.

Independent Evaluation

The project would carry out at least two independent external evaluations as follows:

Mid-term Evaluation: The project will undergo an independent Mid-Term Evaluation (MTE) at the mid-point of project implementation. The MTE will determine progress being made toward the achievement of outcomes and will identify course correction if needed. The evaluation will address effectiveness, efficiency and timeliness of project implementation. It will check the relevancy of the project activities so far carried out by the project. It will outline risks and issues that relate to the management and implementation of the project. The list of recommendations will highlight decisions and actions that require responses and execution. The evaluation will review and suggest lessons in relation to the design, implementation and management of the project. The findings of the evaluation will inform the final half of the project period.

Final Evaluation: The project will undergo a final evaluation that will be carried out within three months following implementation closure of the project. The evaluation will be carried out by an independent evaluation time. A final project annual review (PAR) meeting will be conducted following the completion of the final evaluation report. All stakeholders will review the report and the final PAR meeting will be to present, discuss, finalize and endorse the final evaluation report of the project.

The content of the evaluation report will include progress towards the outcome of the project. It will review any immediate impact and sustainability of results of the project. It will outlines results against the strategic results framework and provide a conclusion, of whether or not the project has achieved its goal, objectives, outcomes and outputs it set out to implement. A review on the contribution to capacity development and knowledge management in FSM would be presented in the report. The report will outline key management and capacity recommendations highlight results, lessons learned, best practices. It must amalgamate these results into a section of the report, designed to be useful for future projects and or programs of FSM.

As the regional implementing entity, SPREP will be in charge of organizing the management of both the mid-term and final evaluation activities. This will include drafting of the terms of reference, procure the evaluation team, manage the logistics maintain the time period of the review, and ensure reports are submitted on time.

TABLE 24. Budget for Monitoring and Evaluation Plan

BUDGET FOR M&E PLAN:								
Monitoring and evaluation plan Activity	**Responsible person**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total $**	**Timeframe**
Inception workshops (activity 4.3.1)	Project Manager	30,000					30,000	Within 6 months of project starting
Inception report	Project Manager						part of execution cost	Within 3 months after inception stage
Participatory Monitoring & Evaluation by beneficiaries	Project Manager and Team Leaders						part of execution cost	Quarterly
Quarterly Progress Reports	Project Manager and Team Leaders						part of execution cost	Quarterly
Six monthly Progress Reports	Director OEEM						part of execution cost	6 monthly
Audits	External auditor						part of execution cost	Every year - starting 2018
Annual Project Advisory Committee Meetings	Project Manager						part of execution cost	Annual
Bi-Annual field visits by representatives of Project Advisory Committee (under activity 4.3.7)	Project Manager	-	-	18,000		18,000	36,000	Bi-annual - starting 2019
Minutes of Advisory Committee Meeting	Project Manager						part of execution cost	annually, twice starting 2019

BUDGET FOR M&E PLAN:								
Impact assessment** (under activity 4.3.7)	Director OEEM			4,500		4,500	9,000	Bi-annual - starting Oct 2018
Mid-term Evaluation	External Consultant			106,938			106,938	Mid term
Final evaluation	External Consultant					107,488	107,488	3 months before end of project
	TOTAL	**30,000**	**-**	**129,438**	**-**	**129,988**	**289,426**	

E. Results Framework

Include a results framework for the project proposal, including milestones, targets and indicators.

A fully endorsed stakeholder results framework for the project proposal, including milestones, targets and indicators is presented in the following table.

Table 25. Projects Strategic Results Framework

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Component 1: Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels					
Outcome 1: Strengthened policy and institutional capacity of government to integrate climate risk and resilience into its water and coastal management policy and regulatory frameworks	Number of national and state level stakeholders participating in EPA, R&D, NWTF meetings, planning and implementation of activities. Number of relevant sector and community based consultations carried out to identify institutional capacity gaps and capacity needs Number of staff across sectors trained and build their awareness on the new regulations enforcement Number of regulatory framework drafts developed for development projects regulations at state level	FSM regulations for development projects does not consider climate risks and resilience, with the exception of the Kosrae State Regulations for Development Projects 2014 Existing policy lacks consideration of existing climate change risk and disaster risk and projected risks A framework for developing a water and sanitation policy, water outlook, and water sector investment plan exists but no plans that integrate climate risks and consider gender-sensitive approaches	At least two relevant regulatory frameworks endorsed and adapted to guide and support development of regulations on development projects at national and state level. Climate change is mainstreamed into the FSM National Water & Sanitation Policy, Water Outlook Program, Water Sector Investment Plan, national and state development projects.	Legal and regulatory policy assessment report President and Government Resolution on National Water & Sanitation Policy, National Water Outlook Program, National Water Sector Investment Plan Stakeholder consultation reports Annual reports of ministries and other government agencies.	**Assumptions:** Political will and commitment that encourage full participatory participation of key government stakeholders at national and state level **Risks:** Limited or no buy-in from national and state government stakeholders

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 1.1 Legislation and policy paper to guide regulation of climate resilient coastal and marine management at national level	Number of stakeholder organizations participating in legal and regulatory assessment meetings Number of regulation, policy and guidance documents drafted at national level	No current and future climate risks mainstreamed into current legislation, regulation, policy and guidance documents for development projects in FSM	A legislative framework to guide national level regulation of climate resilient coastal and marine resource management at national level A national level regulation for development projects with climate risks and resilience incorporated developed, endorsed and adopted	Legal and regulatory policy assessment report President and Government Resolution on legislative and regulatory frameworks on development projects Stakeholder consultation reports Annual reports of ministries and other government agencies.	**Assumptions:** Political will and commitment to ensure plans and planning "tools" are prepared in a fully participatory manner. Strong national and state leadership and support for, and engagement in project activities in all 4 States. **Risks:** Limited or no buy-in from national and state government stakeholders
Output 1.2 State regulations for development projects amended to consider climate change risks and resilience measures	Number of stakeholder organizations participating regulatory framework workshops at state level Number of regulation, policy and guidance documents drafted at state level	No current and future climate risks mainstreamed into current legislation, regulation, policy and guidance documents for development projects in Yap, Chuuk and Pohnpei States	At least one state has endorsed and adopted changes to its state regulation for development project that consider climate risks and resilience	Stakeholder Consultation Reports State Level resolutions on regulatory frameworks, policy and guidance documents Annual reports of ministries and other government agencies.	**Assumptions:** Political will and commitment to ensure plans and planning "tools" are prepared in a fully participatory manner. Strong national and state leadership and support for, and engagement in project activities in all 4 States. **Risks:** Limited or no buy-in from state government stakeholders

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 1.3 National Water and Sanitation Policy endorsed with climate and disaster risks and resilience, and gender mainstreamed	Number of stakeholders participating in NWTF meetings, planning and implementation of activities Number of women, men, and youth participating in gender and climate change trainings, meetings and public awareness activities Number of stakeholders (organizations) participating in NWSP awareness activities	No national climate resilient water and sanitation policy No gender-focused policy on water and sanitation	NWSP with climate risks and resilience, and gender incorporated, is endorsed and adopted by a resolution of the President and Government of FSM (Four state endorsement)	Stakeholder Consultation Reports President and Government Resolution on National Water & Sanitation Policy Official National Water & Sanitation Policy document NWSP Gender Assessment and Action Plan report	**Assumptions:** Political will and commitment Strong national and state leadership and support for development of the NWSP and its elements **Risks:** Limited or no buy-in from state government stakeholders in finalising the NWSP Traditional values and governing structures restrict the participation of women
Output 1.4 National Water Outlook and Water Sector Investment Plan developed and implemented	Number of women, men and youth and stakeholder organizations participating in NWTF meetings, planning and implementation of activities Number of stakeholder organizations participating and implementing water outlook programs Number of partnerships strengthened under the water sector investment plan	No water and sanitation policy Limited emphasis on the importance of social roles and responsibilities of women, men and youth in water, sanitation and climate change policies	NWSP with climate risks and resilience, and gender incorporated, is endorsed and adopted by a resolution of the President and Government of FSM (Four state endorsement) National Water Outlook Program endorsed adopted and implemented National Water Sector Investment Plan endorsed, adopted and implemented	Stakeholder Consultation Reports Annual reports of ministries and other government agencies. President and Government Resolution on National Water & Sanitation Policy Official National Water & Sanitation Policy document NWSP Gender Assessment and Action Plan report	**Assumptions:** Political will and commitment Strong national and state leadership and support for development of the NWSP and its elements **Risks:** Limited or no buy-in from state government stakeholders in finalising the NWSP Traditional values and governing structures restrict the participation of women
Component 2: Demonstration of water security measures in outer islands of Yap, Chuuk and Pohnpei					

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Outcome 2a: **Water conservation and management technology & practices adopted, responding to drought, sea level rise and early recovery from cyclones**	Available capacity (volume in cubic litres) of water per person per day Storage capacity for potable and grey water at household and community level Rainfall data collected on a monthly basis used to provide advice on water conservation practices and advice on other development sectors (farming, fishing, etc).	Poorly maintained traditional water harvesting and conservation infrastructure and technology available. It cannot cope with the dry seasons. No monitoring stations on island to collect and monitor rainfall data to advice on water conservation practices including advice on other sectors	By end of project, at least 80% of households have collected enough water to respond to drought events By end of project, at least five project islands and its communities have increased storage capacity to store potable and grey water. By end of project, women, men, and youth know how to use and read rain gauges	Participatory evaluation report, survey report progress report developed by Municipal Government quarterly reporting Data collected by the Island municipal government office through rain gauges (on water resources, quality, use and maintenance of water conservation and management technologies)	**Risks:** Theft of water resources Logistical/transport problems and/or prohibitive costs leading to delays in arrival of people and/or materials (R2) **Assumptions:** Household / Individuals accept the need to limit water usage Maintenance plans can be implemented
Output 2.1 Outer Island communities orientated to CC, SLR and adaptive capacity measures involving water, health, sanitation and environment	Number of men and women in six outer islands trained in CC, SLR and adaptive capacity measures for water, health, sanitation and environment	The six island sites have limited understanding of the impacts of climate change and sea level rise on the water, health, sanitation and environment sectors Limited knowledge and experience in the application of climate change information to adaptation planning in outer islands	At least 60% of the community population in the six outer islands (of which close to 50% are women) are educated on the impacts of CC and SLR on water, health, sanitation and the environment, and have their capacity enhanced to develop adaptation measures to address these impacts At least 80% of those that participate in the above capacity building activities have acquired knowledge and skills to develop and implement adaptation plans and actions	Training and awareness materials. Workshop reports, including participants lists and evaluation results Community adaptation plans developed and endorsed Progress reports on implementation of adaptation actions	**Risks:** Community engagement is low **Assumptions:** Community are receptive to training and are able to engage

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 2.2 Water Harvesting and Storage System (WHSS) installed in 6 atoll islands	Number of WHSS installed in 6 islands Capacity of storage water (in m3 and ft3) constructed / maintained, per household and per community Number of women, men and youth with access to water from WHSS systems installed at household and community level (church, school, community halls) Agreed maintenance schedules for installed WHSS	Water cisterns and tanks exist on the islands in poor conditions (leakages, contaminated), including poor guttering and down piping There is no culture of maintenance of water harvesting systems at community level due to lack of specialised equipment and maintenance planning. Very limited awareness of WASH techniques useful for application during drought periods and post-typhoon situations	100% of target population have access to enough potable water from the WHSS At least 20% members of the island council and women, men, and youth community groups trained in maintenance of community water harvesting and storage systems	Training documents including visuals and reports Surveys and interviews Progress reports Monitoring reports Visibility materials – awareness programs Picture of WHSS installation Maintenance schedules and guidelines	**Risks:** Logistical / transport problems and /or prohibitive costs leading to delays in arrival of people and /or materials Team/ island communication difficulties (e.g., only have shortwave radio) Unsuitable infrastructure (e.g., house roofs can't support catchment systems) **Assumptions**: Availability of skilled facilitators Community involvement including participation of women and elders Most HH benefit
Output 2.3 Self-composting waterless toilets constructed to conserve water, improve soil environment, and reduce marine eutrophication on the lagoon side	Number of SCT units constructed and in working condition Changes in level of nutrients in soil and groundwater Percentage of change in dissolved oxygen in the lagoon levels	Currently, the majority of people use the lagoon for toileting. The existing water-flushed toilets or pit-latrine toilets are in poor condition, with leakage into soil and lagoon. Contamination / eutrophication of lagoon from excessive nutrient input from human waste	By the end of the soil quality and lagoon water quality have improved as a result of reduced leakage from toilets.	Soil management reports Lagoon water quality reports Surveys and interviews Progress reports Monitoring reports	**Risks:** Logistical / transport problems and /or prohibitive costs leading to delays in arrival of people and /or materials Accessibility to labs to validate soil and lagoon monitoring tests Team/ island communication difficulties (e.g., only have shortwave radio) **Assumptions:** Availability of skilled facilitators Community involvement including participation of women and elders

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 2.4 3, 253 people trained on water conservation and management including coastal protection and livelihoods in 6 outer islands	Number of women , men, youth trained in demonstration of water harvesting and storage systems Number of women, men, youth trained in water data collection and quality testing Number of women, men and youth carrying out survey of potable and non-potable water needs, water use (quality & quantity), storage capacity, sanitation, conservation methods, practices Most significant understandings50 gained by youth, women and men through climate change adaptation training	Business as usual knowledge exists on water conservation and management methods and practices Limited awareness about climate change impacts on water use and water resources on low-lying island environments and communities	By the end of the project, at least 80% of targeted women men and youth trained in water conservation and management methods and technology	Training documents including visuals and reports Survey reports Training evaluation reports (interviews, feedbacks) Progress reports Monitoring reports	**Risks:** Logistical/transport problems and or/prohibitive costs Team/Island communication difficulties **Assumptions:** Availability of skilled staff to carry out, analyse & present survey results Community involvement, including participation of women and elders Availability of skilled staff to develop & deliver training a/o resources

[50] What did each group learn during the training that has made the most practical difference to their lives?

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Outcome 2b: Increased awareness of climate change through formal climate education	Number of schools with climate education curriculum introduced Level of awareness of climate education in schools at different elementary and all grades Number of teachers trained in climate education at elementary and all grade schools	Climate education materials are available Lack of systematic training on climate education for teachers	By end of project, at least two schools participated in the development of the curriculum plan At least 60% of teachers trained on climate education under the new climate education curriculum. At least 80% of students enrolled and taken climate education have a pass rate of 65%	School reports Department of Education report Teacher's training report	**Assumptions:** Teachers have sufficient knowledge & resources to teach the CCA curriculum The Department of Education communication system to outer island teachers are reliable and efficient **Risks:** Difficult to reach out and train teachers in Outer Island schools
Output 2.5: Teacher's Guide on Climate Change developed to improve climate change learning in FSM schools and training institutions	Number of climate change education planning workshops carried out to identify tailored education resources to enhance learning about climate change in schools and training institutions Number of State-specific versions that is culturally relevant to teachers and students distributed to schools, providers of technical and vocational education and training (TVET) and libraries in FSM.	There are very few educational resources that address adaptation measures that are specific to FSM. *Learning about climate change the Pacific way:* A guide for Pacific teachers exists and has been applied in Fiji, Kiribati, Samoa, Tonga and Vanuatu.	By the end of the project, at least 80% of teachers employed in all schools of the targeted six islands have access to the correct specific version of the Guide. By the end of the project, at least 25% of schools in the six targeted islands and 50% of targeted training institutions have used and applied the guide to enhance climate change learning	Workshop reports Training workshops Reports Electronic version of the Teacher's Guide available online on Department of Education websites Distribution report of the Guides Survey on use of the Guide by teachers in schools of the targeted islands.	**Risks:** Limited or no buy-in from communities or island council Logistical/transport problems a/o prohibitive costs leading to delays in arrival of people a/o materials Team/Island communication difficulties **Assumptions**: Islands & communities have existing social & institutional structures to assist with project implementation Community involvement including participation of women and elders The model Teacher's Guide developed for other PICs is appropriate for FSM
Component 3: Demonstration of Kosrae Inland Road Relocation Initiative					

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Outcome 3: Increased resilience of coastal communities and environment to adapt to coastal hazards and risks induced by climate change	Number of women, men and youth benefitting from the access provided by inland road Quality condition of road after extreme rainfall event	Malem-Utwe coastal road highly exposed to severe coastal erosion and is in high risk of being washed away within the next 10 - 30 years Unsealed inner road limits access of communities inland	At least 1,476 inhabitants of Malem and Utwe have increased coastal resilience to inundation and erosion. At least one landslide, flooding or agriculture-related risk management response has been implemented by Malem and/or Utwe By the end of the project replication and up-scaling activities are explicitly informed by lessons learned and good practices relating to gender in Kosrae Targeted beneficiaries are the 2,283 people resident in the Malem51 and Utwe52 municipalities. Indirect beneficiaries include 4,333 residents of other Kosrae Municipalities	Documents on lessons learned, best practices and case studies Records and reports of government executing partners in Kosrae Project monitoring and evaluation reports documenting lessons learned and good practices in climate change mainstreaming that comprehensively addresses gender Independent evaluation reports Training evaluation reports Reports of State Governors. Community , public, stakeholder perception surveys that are sex-disaggregated	Island stakeholders and key players (e.g.: Kosrae State Government) have a high interest in, support for, and engagement in capacity building activities in Kosrae. Political will and commitment from the community and government Continuous support provided by the government and development partners.

[51] Gender and age breakdown for Malem: Adult men 286; Adult women 284; Youth 252; Children 478

[52] Gender and age breakdown for Utwe: Adult men 196; Adult women 241; Youth 180; Children 366

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 3.1: 3.6 miles (5.8km) of Malem-Utwe inland road and access road routes constructed to sub-base standard for future relocation	Number of road easements obtained against number of road easements required Number of kilometers of inland road constructed to sub-base standard Length of new and re-lay water mains along Malem - Yeseng - Mosral - Kuplu section installed and connected to existing water supply at Malem and Finfokoa. Length of new power line along entire length of inland road from Malem to Utwe via Kuplu Wan installed Length of new tele-communication lines along entire length of inland road from Malem to Utwe via Kuplu Wan installed	Current inland road (1.5 km) is gravel only, in poor condition, and does not meet climate resilience standards No water mains are connected from Malem and Utwe except old water mains. No power lines and telecommunication lines from Malem to Utwe via Kuplu Wan	Approximately 8.5 km of i\nland road of the Malem-Utwe road constructed to climate resilient sub-base standard with access routes to the two villages Water running through connected and completed mains for the Malem – Yeseng – Mosral – Kuplu section New power and telecommunication lines installed along the entire length of the inland from Malem to Utwe via Kuplu Wan	DREA and DT&I reports Progress reports Records of landowner agreements on easements Road, water, power and telecommunication progress reports Pictures of construction and installation Climate resilient engineering design and reports	**Risks:** Agreement cannot be reached with all landowners on easements required for building the inland road Climate hazards are more severe than anticipated leading to higher climate-proofing related costs for building the inland road **Assumptions:** DT&I has adequate capacity DT&I can secure quality contractors to design and build the road KSG is able to fund maintenance of the new road
Output 3.2: Transitional coast protection at Mosral and Pal upgraded for immediate coastal protection	Length (in metres/miles) of coastline revetted	Ineffective loose boulder defences at Mosral and Pal patched only after extreme events	Mosral and Paal coastline revetted in the order of 2.5 km or 1.6 miles	DT&I reports	**Assumptions:** KSG is able to fund maintenance of the transitional defences

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 3.3: State support program to access land in upland areas established	Percentage of household without land inland who accessed land inland Area (m^2) of safe land inland identified for access	No state government program to assist access land in upland for those without land	At least 30% of the household in the coastal hazard zone with no land inland access land (18 HH in Malem; 9 in Utwe)	DREA records and reports	**Assumptions:** Land swaps occur (between private owners and between private owners and KSG) KSG is able to successfully negotiate with private land owners for appropriate sites and appropriate prices
Output 3.4: Community-Based Ecosystem Management strengthened	Number of women, men and youth trained on community-based ecosystem management tools Number of women, men and youth participating in planning and consultation meetings on rehabilitation of streams through community and school-led stream health monitoring programs Number of women, men and youth participating in planning meetings, implementation and monitoring of Malem and Utwe watershed management strategies	No watershed managements strategies and municipal government policies to guide community-based and community-led ecosystem management programs	At least 90% of the 1,476 inhabitants (50%) are women) of Malem and Utwe community participated in community-based ecosystem management planning meetings, implementation and monitoring activities At least one landslide, flooding or agriculture-related risk management response has been implemented by Malem and/or Utwe By the end of the project replication and up-scaling activities are explicitly informed by lessons learned and good practices relating to gender in Kosrae Malem and Utwe Watershed Management strategies developed, endorsed by Municipal Government Council and adopted for implementation and monitored	CBO work plans KSCO progress reports Progress reports Awareness activity reports Success stories on media School newsletters	**Risks**: Implementing partner has adequate capacity **Assumptions**: Communities and CBOs participate in initiatives for community-based ecosystem management

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 3.5 State support program to assist access to finance for vulnerable households established	Number of stakeholder organizations (including development banking institutions) participating in planning meetings of the adapted finance mechanisms, implementation and monitoring Number of women, men and youth participating in community consultations on the state program No. of people who have used the adapted finance mechanism Existing housing finance mechanisms adapted Recommendations are produced by a review of programs and practices in Kosrae and other Pacific Island Countries	Existing loan mechanisms are offered by Kosrae Housing Authority[53] and FSM Development Bank[54] Most applicants for the FSM Development Bank loans do not meet eligibility criteria; Kosrae Housing Authority loan sizes ae small relative to home construction costs	At least 20% of people enrolled and participated in consultations (50% are women) have used the adapted finance mechanism At least 1 existing program is adapted to improve affordability of finance for house construction inland Recommendations address affordability of finance Recommendations identify ways to serve needs of vulnerable household in coastal risk zones	DAF study and reports KHA reports, newsletters FSM Development Bank reports and newsletters	**Assumptions:** Schemes prioritise vulnerable household in coastal hazard zones
Component 4: Knowledge management for improved water and coastal protection					

53 Kosrae Housing Authority (HA) currently offers loans through two mechanisms: 1) Housing Loan Program; 2) USDA-funded Rural Development Program. The HA house loan lending target is 200-300K/yr; Disburse 15-20 loans/yr between USD 7-10,000. Loan terms are 15-20 yrs with a fixed rate (7%). Most loan takers are aged 25-40 yrs. Staff explain the T&C, particularly related to the promissory note and deed of trust. A second type of loan is for senior citizens (over 62) with funding from the USDA. These are "rural development" loans that can also be used to improve home sites. Interest rate is 4%. HA would like to add new program, with USDA funding of USD 50-80,000/yr; does not currently qualify. Main requirement: USD 500,000 escrow; Have only USD 300,000

54 FSM Development Bank has capitalization from the FSM National Govt plus USD 2M and 5M loans (5 yr term) from China EXIM and the European Investment Bank. FSMDB's national lending target is USD 9 M/yr. In Kosrae lending target is 1.5 M/yr; Housing Loans make up 20% of the National portfolio but only 1% of the Kosrae portfolio; Housing Loans: up to USD 100,000; terms of up to 20 yrs; Interest rate: 9% flat. Currently most applicants are not not eligible (do not meet income criteria of USD 10-30,000 per adult). If declined, can apply under personal/consumer loan category or go to Housing Authority. Consumer loans are for up to USD 30,000; 5 yr term, 15% flat rate; Have translated legal docs to Kosraen to help clients understand T&C; Options for FSM Dev Bank to increase affordability are 1) seeking additional sources of funding; 2) advocate for govt social housing scheme (standard housing).

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Outcome 4: Capacity and knowledge enhanced and developed to improve management of water and coastal sectors to adapt to climate change	Awareness materials on CC, SLR, Vulnerability and Adaptive capacity, and about the project is prepared in local language and distributed to community and other stakeholders Number of success stories developed and shared on briefs, brochures, pamphlets, posters prepared and distributed Number of men, women and youth participating in trainings and planning meetings	Programs carried out by various stakeholders (government, private sectors, and academic institutions) in the Outer Islands are not consolidated and implemented under island development plans that exist. No systematic approach to awareness of opportunities and issues around climate change in outer islands and community / municipal government levels There is lack of gender-sensitized management and execution of climate-related projects and programs. The approaches with existing projects are only in pilot and in silo approaches without integration across program planning	At least eight (50%) success stories, or knowledge products generated on lessons learned and best practices have been produced, published and shared with targeted stakeholders each project year At least 50% of perception responses (at least 50% are from women) to significant level of awareness and acknowledgement of gender and climate change benefits – compliance with natural resource management and gender dimensions of climate change	Site/field visits and surveys. Project reports Project monitoring and evaluation reports. Project monitoring and evaluation reports documenting lessons learned and good practices in climate change mainstreaming that comprehensively addresses gender Independent evaluation reports Training evaluation reports	**Assumptions:** Local capacity exists to produce training materials that are of a high standard. Strong island and community interest in, support for, and engagement in capacity building activities in the Outer Islands of each State. **Risks:** Locally available printing, video and audio production capacity

OUTCOME / OUTPUT	INDICATOR	BASELINE	TARGET	SOURCE OF VERIFICATION	RISKS AND ASSUMPTIONS
Output 4.1: climate resilient municipality development plans developed and communicated	Number of women, men and youth participating in development and review of existing island / municipal government development plans Number of meetings and workshops held Number of brochures and pamphlets prepared and distributed	Existing island and municipal government development plans have not mainstreamed climate risks and resilience	Climate change (including risks and resilience factors) are mainstreamed into Island and Municipal Government Development Plans Development plans are printed and disseminated to various stakeholders	Brochures, pamphlets Workshop reports Island / Municipal Development Plans Progress reports	**Risks:** There is no political will and commitment from island leaders, and municipal government **Assumptions:** All community groups are supportive of the plans Government departments assist in review of community / municipality development plans
Output 4.2 Resource materials developed, tailored to local context, translated, published and shared amongst various stakeholders	Number of knowledge products (training materials, etc.) generated on lessons learned and best practices published and shared Percentage of women and men staff trained on the various technical and skill-building trainings	0 awareness materials available and no resources to distribute	By the end of the project, at least 60 awareness materials and knowledge management products on the project results, on CC, V&A results, gender-based results are produced and disseminated to all relevant key stakeholders.	Printed awareness materials Workshop proceedings and reports Visuals Training evaluation reports	**Risks:** There is no capacity on island to carry out needed trainings **Assumptions:** The trainees are willing to learn and absorb the skills based trainings. English is the common language used in trainings
Output 4.3: Stakeholders brought together to share, learn and exchange knowledge and skills on climate change, adaptation planning, monitoring, vulnerability assessments and climate change	Number of trainings, workshops and learning programs developed and carried out on CC, V&A, gender, coastal, water, project management, and climate education Number of women, men, youth trained at national, state and community level	0 workshops organized on CC, SLR, vulnerability to CC and CC adaptive capacity 0 trained or aware of gender and CC, CC adaptation techniques on the environment, water resources and coastal rehabilitation	13 training and learning workshops, 8 at community level (municipality, outer island), one each at state and one national At least 1 inter-state experience exchange on lessons learned and best practices on practical and concrete island intervention At least 2 learning course programs targeting environment champions /ambassadors on CC, water resource management, or integrated coastal management course At least 1 Participatory 3D Mapping & Community Workshop	Workshop proceedings and reports Visuals 3D Map of Island	**Risks:** Logistical / transport problems and /or prohibitive costs leading to delays in arrival of people and /or materials Team/ island communication difficulties (e.g., only have shortwave radio) **Assumptions**: Community involvement including participation of women and elders

F. Alignment with AF RF

Demonstrate how the project aligns with the Results Framework of the Adaptation Fund

Table 26. Program alignment with AF Result Framework

PROJECT OBJECTIVE(S)[55]	PROJECT OBJECTIVE INDICATOR(S)	FUND OUTCOME	FUND OUTCOME INDICATOR	GRANT AMOUNT (USD)
Project Objective 1: Prepare the necessary institutional and regulatory frameworks, policies, guidance and tools to help deliver a climate resilient FSM	Number of institutional, regulatory and planning policies, frameworks and tools introduced to implement climate resiliency for all FSM States	Outcome 2 Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses Outcome 7. Improved policies and regulations that promote and enforce resilience measures	2.1 No. and type of targeted institutions with increased capacity to minimize exposure to climate variability risks 7.2. No. or targeted development strategies with incorporated climate change priorities enforced	687,025
Project Objective 2: Strengthen water and livelihood security measures to help 6 outer atoll islands adapt to impacts of climate change related to water, health and sanitation	Number of risk-exposed communities in Yap, Pohnpei and Chuuk protected through adaptation measures	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level Outcome 4: Increased adaptive capacity within relevant development and natural resource sectors	3.2. Modification in behavior of targeted population 4.1. Development sectors' services responsive to evolving needs from changing and variable climate	2,437,193
Project Objective 3: Provide communities with climate resilient infrastructure to help relocate from high risk coastal inundation sites.	Length of climate-resilient infrastructure (road, power lines, water mains, telecommunication lines) constructed	Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses Outcome 4: Increased adaptive capacity within relevant development and natural resource sectors	2.2. Number of people with reduced risk to extreme weather events 4.2. Physical infrastructure improved to withstand climate change and variability-induced stress	3,520,474

[55] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

PROJECT OBJECTIVE(S)[55]	PROJECT OBJECTIVE INDICATOR(S)	FUND OUTCOME	FUND OUTCOME INDICATOR	GRANT AMOUNT (USD)
Project Objective 4: Capture and share the local knowledge produced on climate change adaptation and accelerate the understanding about the kinds of interventions that work in island environments in FSM	Number of knowledge products developed and men, women and youth trained on CC, SLR, vulnerability and adaptive capacity	Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses	862,221

Table 27. Project Outcome and indicators in relation to the AF RF Fund Output and Output Indicators

PROJECT OUTCOME[56]	PROJECT OUTCOME INDICATOR(S)	FUND OUTPUT	FUND OUTPUT INDICATOR	GRANT AMOUNT (USD)
Outcome 1: Strengthened policy and institutional capacity of government to integrate climate risk and resilience into its water and coastal management policy and regulatory frameworks	Number of national and state level stakeholders participating in EPA, R&D, NWTF meetings, planning and implementation of activities. Number of regulatory framework drafts developed for development projects regulations at state level	**Output 2.1:** Strengthened capacity of national and regional centres and networks to respond rapidly to extreme weather events **Output 7:** Improved integration of climate-resilience strategies into country development plans	**2.1.1.** No. of staff trained to respond to, and mitigate impacts of, climate-related events **7.1.** No., type, and sector of policies introduced or adjusted to address climate change risks **7.2.** No. or targeted development strategies with incorporated climate change priorities enforced	687,025
Outcome 2a: **Water conservation and management technology & practices adopted, responding to drought, sea level rise and early recovery from cyclones**	Available capacity (volume in cubic litres) of water per person per day Storage capacity for potable and grey water at household and community level Rainfall data collected on a monthly basis used to provide advice on water conservation practices and advice on other development sectors (farming, fishing, etc).	**Output 4:** Vulnerable physical, natural, and social assets strengthened in response to climate change impacts, including variability	**4.1.1**. No. and type of health or social infrastructure developed or modified to respond to new conditions resulting from climate variability and change (by type)	2,280,880

[56] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

PROJECT OUTCOME[56]	PROJECT OUTCOME INDICATOR(S)	FUND OUTPUT	FUND OUTPUT INDICATOR	GRANT AMOUNT (USD)
Outcome 2b: Increased awareness of climate change through formal climate education	Number of schools with climate education curriculum introduced Level of awareness of climate education in schools at different elementary and all grades Number of teachers trained in climate education at elementary and all grade schools	**Output 3:** Targeted population groups participating in adaptation and risk reduction awareness activities	**3.1.1** No. and type of risk reduction actions or strategies introduced at local level	156,313
Outcome 3: Increased resilience of coastal communities and environment to adapt to coastal hazards and risks induced by climate change	No. of people benefitting from the road Quality condition of road after extreme rainfall event	**Output 2.2:** Targeted population groups covered by adequate risk reduction systems **Output 4:** Vulnerable physical, natural, and social assets strengthened in response to climate change impacts, including variability	**2.2.1.** Percentage of population covered by adequate risk-reduction systems **2.2.2.** No. of people affected by climate variability **4.1.2**. No. of physical assets strengthened or constructed to withstand conditions resulting from climate variability and change (by asset types)	3,520,474
Outcome 4: Capacity and knowledge enhanced and developed to improve management of water and coastal sectors to adapt to climate change	Awareness materials on CC, SLR, Vulnerability and Adaptive capacity, and about the project is prepared in local language and distributed to community and other stakeholders Number of success stories developed and shared on briefs, brochures, pamphlets, posters prepared and distributed Number of men, women and youth participating in trainings and planning meetings	**Output 3:** Targeted population groups participating in adaptation and risk reduction awareness activities **Output 2.2:** Targeted population groups covered by adequate risk reduction systems	**3.1.1** No. and type of risk reduction actions or strategies introduced at local level	862,221

Table 28. Project Impact

IMPACT	INDICATOR
	Number of beneficiaries (direct and indirect)
AF Impact: Increased resiliency at the community, national, and regional levels to climate variability and change.	**Direct Beneficiaries:** • At least 2,365 women and 2,365 men oriented to CC, SLR and adaptive capacity concepts and measures – in relation to water resource management, coastal and ecosystem sectors • At least 14 communities participating in adaptation planning, project management meetings, implementation and monitoring activities have the tools, knowledge and skills to respond to new conditions results from climate variability and change
Project Impact: The atoll communities of Woleai & Eauripik, Yap; Kapingamarangi & Nukuoro, Pohnpei; and Satawan and Lukunor, Chuuk have sufficient safe, clean water to ensure resilience to natural disasters	• At least 1,627 women and 1,627 men participated in planning, implementation and monitoring of activities of the project in the six outer islands of Yap, Chuuk and Pohnpei • At least six water harvesting and storage systems infrastructure developed or modified on six outer islands to respond to new conditions resulting from climate variability and change
Project Impact: The Kosrae communities most vulnerable to coastal climate change-related hazards (Malem and Utwe) are relocating inland to safer village areas	• By end of project, at least 5% of the populations of Utwe and Malem have considered measures for relocating inland to safe village areas. • At least 185 women and 185 men (25% of total population) are aware of the risk reduction systems in place to respond to impacts of climate change • 5.8km of inland road constructed and strengthened to withstand conditions resulting from climate variability and change

G. Detailed Budget

Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

Table 29. Budget

Component		Activity	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL ($, USD)
1. Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels	**Output 1.1: Legislation and policy paper to guide regulation of climate resilient coastal and marine management at national level**							
	1.1.1	Review of regulatory inspection procedures, protocols and enforcement	15000	22500	22500	7500	7500	75,000
	1.1.2	Regulatory and policy framework for climate change at national level	6,000	9,000	9,000	3,000	3,000	30,000
	1.1.3	Develop policy guidance documents for national and states	1,000	1,500	1,500	500	500	5,000
	1.1.4	Endorse and adopt regulations, policy and guidance documents established for national and state levels	5,000	7,500	7,500	2,500	2,500	25,000
	1.1.5	Lobby and advocate regulation and policy changes in media campaign and public awareness activities	1,000	1,500	1,500	500	500	5,000
	1.1.6	Monitor and report feedback and progress	2,000	3,000	3,000	1,000	1,000	10,000
	Output 1.2: State regulations for development projects amended to consider climate change risks and resilience measures							
	1.2.1	Consultations and regulations at state level - Yap, Chuuk and Pohnpei	5,000	7,500	7,500	2,500	2,500	25,000
	1.2.2	Develop, endorse and adopt regulatory framework on development projects at state level	10,000	15,000	15,000	5,000	5,000	50,000
	1.2.3	Initiate development of regulations, policy and guidance documents identified and adopt institutional changes to existing arrangements.	4,000	6,000	6,000	2,000	2,000	20,000
	1.2.4	Endorse and adopt regulations, policy and guidance documents established for national and state	12,000	18,000	18,000	6,000	6,000	60,000
	1.2.5	Lobby and advocate regulation and policy changes in media campaign and public awareness activities	2,000	3,000	3,000	1,000	1,000	10,000
	1.2.6	Monitor and report feedback and progress	2,000	3,000	3,000	1,000	1,000	10,000
	Output 1.3: National Water and Sanitation Policy endorsed with climate and disaster risks and resilience, and gender mainstreamed							
	1.3.1	Review the water policy framework to incorporate gender and climate change	12,400	18,600	18,600	6,200	6,200	62,000

	1.3.2	Preparation of the National Water and Sanitation Policy	13,200	19,800	19,800	6,600	6,600	66,000
	Output 1.4: National Water Outlook and Water Sector Investment Plan developed and implemented							
	1.4.1	Implementation of the NOW Programme	23,403	35,104	35,104	11,701	11,701	117,013
	1.4.2	Implementation of the Water Sector Investment Plan (WSIP) Programme	23,403	35,104	35,104	11,701	11,701	117,013
		Total: Component 1						**687,025**
2. Demonstration of water security measures in outer islands of Yap, Chuuk and Pohnpei	**Output 2.1: Outer island communities orientated to CC, SLR, and adaptive capacity measures involving water, health, sanitation and the environment**							
	2.1.1	Arrangements for demonstrations of water and sanitation technologies	20,620	10,310	30,930	30,930	10,310	103,100
	2.1.2	Carry out ground-truthing assessments	30,930	15,465	46,395	46,395	15,465	154,650
	Output 2.2: Water Harvesting and Storage System (WHSS) installed in 6 islands							
	2.2.1	Repairing household rainwater harvesting and storage system	53,342	26,671	80,013	80,013	26,671	266,709
	2.2.2	Constructing community rainwater harvesting and storage system	117,227	58,613	175,840	175,840	58,613	586,135
	2.2.3	Monitoring and maintenance	38,360	19,180	57,541	57,541	19,180	191,802
	Output 2.3: Self-composting waterless toilets constructed to conserve water, improve soil environment, and reduce marine eutrophication on the lagoon side							
	2.3.1	Developing plan/ guideline for self-composting toilets (SCT) awareness, installation and maintenance	27,180	13,590	40,770	40,770	13,590	135,901
	2.3.2	Constructing self-composting toilets - using plans (1 unit each per gender)	86,458	43,229	129,688	129,688	43,229	432,292
	2.3.3	Training on WASH and water conservation practices in school and communities	18,413	9,207	27,620	27,620	9,207	92,066
	2.3.4	Monitoring and care after	14,544	7,272	21,817	21,817	7,272	72,722
	Output 2.4: 3, 253 people trained on water conservation and management including coastal protection and livelihoods in 6 outer islands							
	2.4.1	Selecting stakeholders (men, women, youth) for training	17,646	8,823	26,469	26,469	8,823	88,230
	2.4.2	0rganizing training in water data collection and quality testing and survey developments	19,946	9,973	29,919	29,919	9,973	99,731
	2.4.3	Organizing training in construction, operations and maintenance of systems	11,508	5,754	17,262	17,262	5,754	57,541

	Output 2.5: Teacher's Guide on Climate Change developed to enhance climate change learning in FSM schools and training institutions							
	2.5.1	Organizing climate change education planning workshops	3,836	1,918	5,754	5,754	1,918	19,181
	2.5.2	Develop Teacher's Guide on Climate Change in English and translation in six main island languages	14,000	7,000	21,000	21,000	7,000	70,000
	2.5.3	Training of Trainer's / Teachers on Teacher's Guide on Climate Change.	5,754	2,877	8,631	8,631	2,877	28,771
	2.5.4	Implement Teacher's Guide in Schools	3,836	1,918	5,754	5,754	1,918	19,181
	2.5.5	Monitoring effectiveness of Teacher's Guide development system, and Guide itself	3,836	1,918	5,754	5,754	1,918	19,181
		Total: Component 2						**2,437,193**
3. Demonstration of Kosrae Inland Road Relocation Initiative	**Output 3.1: 3.6 miles (5.8km) of Malem-Utwe inland road and access road routes constructed to sub-base standard for future relocation**							
	3.1.1	Survey, design, reconstruction and maintenance of road and related infrastructure to ensure climate change resilience	300,547	901,642	901,642	751,369	150,274	3,005,474
	Output 3.2: Transitional coast protection at Mosral and Pal upgraded for immediate coastal protection							
	3.2.1	Coastal protection works	31,500	94,500	94,500	78,750	15,750	315,000
	Output 3.3: State support program to access land in upland areas established							
	3.3.1	Land consultations, surveys, mapping and regulatory framework for future inland movement of vulnerable coastal people and infrastructure	5,500	16,500	16,500	13,750	2,750	55,000
	Output 3.4: Community-Based Ecosystem Management strengthened							
	3.4.1	Plusrik / Kuplu Wan water shed protection strategy, native vegetation buffer zones and stream health monitoring programme to strengthen sustainable use of upland areas	10,500	31,500	31,500	26,250	5,250	105,000
	Output 3.5: Develop state program to assist access to finance for vulnerable households established							

	3.5.1	Preparation of support programme for accessing finance, Identify options and Kosrae workshops for developing financial incentive mechanisms to support upland residential development to complement existing programmes/schemes in Kosrae providing access to finance	4,000	12,000	12,000	10,000	2,000	40,000
		Total: Component 3						**3,520,474**
4. Knowledge management for improved water and coastal protection	**Output 4.1: Community Resilient (Municipality) Development Plans developed and communicated**							
	4.1.1	Organizing development of Island/Municipal Government Development Plan	6,632	13,264	19,895	13,264	13,264	66,318
	4.1.2	Implement institutional changes to existing arrangements and establish effective communications based on new/revised Plan and communications strategy	2,503	5,005	7,508	5,005	5,005	25,026
	4.1.3	Share and disseminate Pla to partners and stakeholders	3,378	6,757	10,135	6,757	6,757	33,785
	4.2 Resource materials developed, tailored to local context, translated, published and shared amongst various stakeholder							
	4.2.1	Capture and document information generated by the project	7,448	14,897	22,345	14,897	14,897	74,483
	4.2.2	Organizing consultancy support to edit scientific and peer reviewed knowledge products from the project	6,252	12,504	18,755	12,504	12,504	62,518
	4.2.3	Print, publish, produce and share materials through public awareness and media campaigns	4,834	9,667	14,501	9,667	9,667	48,337
	4.3 Stakeholders brought together to share, learn and exchange knowledge and skills on climate change, adaptation planning, monitoring, vulnerability assessments and climate change							
	4.3.1	Organize inception workshop and project trainings for all key stakeholders of this project	2,748.3	5,497	8,245	5,497	5,497	27,483
	4.3.2	Organizing Bi-Annual field visits by representatives of Project Advisory Committee and impact assessment studies by key stakeholders of the project	1,455.0	2,910	4,365	2,910	2,910	14,550
	4.3.3	Trainings on climate change, sea level rise and adaptive capacity measures on water and coastal sectors	29,529.6	59,059	88,589	59,059	59,059	295,296

	4.3.4	Mid-term evaluation carried out to evaluate the extent to which the project is meeting its objectives and share lessons	10,693.8	21,388	32,081	21,388	21,388	106,938
	4.3.5	Final evaluation carried out to evaluate the extent the project has met its objectives and share lessons	10,748.8	21,498	32,246	21,498	21,498	107,488
		Total: Component 4						**862,221**
		Total Components (1- 4)	**1,063,113.1**	**1,678,413.2**	**2,252,073.9**	**1,852,423.0**	**660,889.7**	**7,506,913.0**
5. Project Execution Cost (B)	5.1	Salary of Project Staff	50,000	147,764	147,768	147,768	147,768	641,068
	5.2	Financial Audit	-	14,000	14,000	14,000	14,000	56,000
	5.3	Operating Costs	37,500	2,750	2,750	2,600	3,650	49,250
	5.4	Travel Costs	-	-	18,000	-	18,000	36,000
	5.5	Training, Learning, Workshops	1,300	900	1,300	900	1,300	5,700
		Total Project Execution Cost (5)	**88,800.0**	**165,414.0**	**183,818.0**	**165,268.0**	**184,718.0**	**788,018.0**
6. Total Project Cost			**1,163,292.7**	**2,322,426.0**	**2,431,427.9**	**1,471,930.3**	**905,854.3**	**8,294,931**
7. Regional Implementing Entity Fee (RIE Fee)			**98,879.9**	**197,406.2**	**206,671.3**	**125,114.0**	**76,997.6**	**705,069**
8. Amount of Financing Requested from AFB			**1,262,172.5**	**2,519,832.1**	**2,638,099.3**	**1,597,044.3**	**982,851.9**	**9,000,000**

Table 30. Project Execution Costs breakdown

Project Execution Activities	USD	Budget note table
Salary of Project Staff	641,068.00	Table 31
Financial Audit	56,000.00	Table 32
Operating Costs	49,250.00	Table 33
Travel Costs	36,000.00	Table 34
Training, Learning, Workshops	5,700.00	Table 35
TOTAL*	**$ 788,018.00**	

Table 31. Salary of Project Staff

	Location	START	Year 1	Year 2	Year 3	Year 4	TOTAL (US$)
		2017	**2018**	**2019**	**2020**	**2021**	
Project Manager	P-OEEM	24,214	24,214	24,214	24,214	24,214	121,068
Accountant	P-OEEM	12,000	12,000	12,000	12,000	12,000	60,000
Knowledge & Comms Officer	P-OEEM	12,000	12,000	12,000	12,000	12,000	60,000
Operations & Finance Officer	Kosrae	-	10,000	10,000	10,000	10,000	40,000
Operations & Finance Officer	Yap	-	10,000	10,000	10,000	10,000	40,000
Operations & Finance Officer	Chuuk	-	10,000	10,000	10,000	10,000	40,000
Operations & Finance Officer	Pohnpei	-	10,000	10,000	10,000	10,000	40,000
Outer Island Coordinator 1	Y-Woleai		10,000	10,000	10,000	10,000	40,000
Outer Island Coordinator 2	Y-Eauripik		10,000	10,000	10,000	10,000	40,000
Outer Island Coordinator 3	C-Satawan		10,000	10,000	10,000	10,000	40,000
Outer Island Coordinator 4	C-Lukunor		10,000	10,000	10,000	10,000	40,000

Outer Island Coordinator 5	P-Nukuoro		10,000	10,000	10,000	10,000	40,000
Outer Island Coordinator 6	P-Kapinga		10,000	10,000	10,000	10,000	40,000
TOTAL		**50,000**	**147,764**	**147,768**	**147,768**	**147,768**	**641,068**

Table 32. Financial Audit

Description	Location	START	Year 1	Year 2	Year 3	Year 4	TOTAL (US$)
		2017	2018	2019	2020	2021	
Financial Audit - Kosrae	**Kosrae**	NA	8,000.0	8,000.0	8,000.0	8,000.0	32,000
Financial Audit - Yap, Chuuk, Pohnpei	**Yap, Chuuk, Pohnpei,**	NA	6,000.0	6,000.0	6,000.0	6,000.0	24,000
TOTAL		**-**	**14,000**	**14,000**	**14,000**	**14,000**	**56,000**

Table 33. Operating Costs

Description	START	Year 1	Year 2	Year 3	Year 4	TOTAL (US$)
Stationery and other Office Supplies	500	500	500	450	500	2,450
Audio & Visual Equipment, Productions	18,000	-	-	-	500	18,500
Acquisition of Communication Equipment	5,000	500	-	-	500	6,000
Printing and Publication	2,000	500	500	500	500	4,000
Translation Costs	1,500	-	500	500	500	3,000
Storage	1,000	-	-	-	-	1,000
Sundry	500	200	200	200	200	1,300

Courier charges	1,500	-	-	-	-	1,500
Land Telephone Charges	1,500	200	200	200	200	2,300
Mobile Telephone Charges	2,000	250	250	250	250	3,000
Common services - Communications	2,000	300	300	300	300	3,200
Connectivity Charges	2,000	300	300	200	200	3,000
TOTAL	**37,500**	**2,750**	**2,750**	**2,600**	**3,650**	**49,250**

Table 34. Travel Costs

Description	Location	START	Year 1	Year 2	Year 3	Year 4	TOTAL (US$)
		2017	**2018**	**2019**	**2020**	**2021**	
6 members Travel	**All**	NA		15,000		15,000	30,000
Travel miscellaneous costs (venues, catering)				3,000		3,000	6,000
TOTAL		**-**	**-**	**18,000**	**-**	**18,000**	**36,000**

Table 35. Training, Learning & Workshops

	Location	START	Year 1	Year 2	Year 3	Year 4	TOTAL (US$)
		2017	**2018**	**2019**	**2020**	**2021**	
Stationery, Venue, Catering and sundries	**P-OEEM**	400	300	400	300	400	1,800
Stationery, Venue, Catering and sundries	**Kosrae**	300	150	300	150	300	1,200
Stationery, Venue, Catering and sundries	**Yap**	200	150	200	150	200	900

Stationery, Venue, Catering and sundries	**Chuuk**	200	150	200	150	200	900
Stationery, Venue, Catering and sundries	**Pohnpei**	200	150	200	150	200	900
TOTAL		**1,300**	**900**	**1,300**	**900**	**1,300**	**5,700**

Project Management fee

The project management fee (8.5% of the total budget) will be utilized by SPREP, the Regional Implementing Entity, to cover the costs associated with the provision of general management support. Table 36 below provides a breakdown of the estimated costs of providing these services.

Table 36. RIE Fee

Project Cycle Management Fee	Amount (US$)	Distribution
(a) Project Identification	35,253	5%
(b) Preparation of Project Concept	49,355	7%
(c) Preparation of the detailed Project Document	56,406	8%
(d) Project Approval and Start Up	70,507	10%
(e) Project Implementation and supervision	423,041	60%
(f) Evaluation	70,507	10%
TOTAL	**705,069.00**	**100%**

a) Project identification

(i) Consult with appropriate stakeholder's in-country, including the AF operational focal point, Director of the Office of Environment & Emergency Management (OEEM), identify opportunities for AF financing, using country dialogue and other country planning/sector strategy documents as a basis.
(ii) Review options for co-financing and partnerships.
(iii) Incorporate AF opportunities in appropriate planning/country assistance strategy documents of the AF Agency.

b) Preparation of project concept

(i) Discuss AF eligibility criteria with FSM project operational focal point (OEEM) and other stakeholders.
(ii) Undertake brief in-country consultation mission if necessary.
(iii) Consult within the AF Agency.
(iv) Assist OEEM to prepare project concept, in consultation with appropriate stakeholders, including the AF operational focal point and the AF Secretariat.
(v) Assist with the preparation of the project concept.
(vi) Obtain endorsement letter(s) from the operational focal point (OEEM).
(vii) Discuss with the AF Secretariat on clearance and approval.

c) Preparation of the detailed Project Document

(i) Prepare and execute legal agreements for project concept activities. Keep OEEM informed.
(ii) Help OEEM write Terms of Reference for consultant(s), if required, to undertake project concept activities.
(iii) Assist the project proponent (OEEM) to identify and recruit consultants to assist with project preparation, if necessary.
(iv) Supervise project preparation, in consultation with all appropriate stakeholders, including missions to the field, with particular focus on risk assessment, governance issues, execution arrangements, co-financing, capacity development, partnership building and outreach.
(v) Negotiate and reach agreement on incremental cost with government and other relevant stakeholders.
(vi) Submit Project Document with Request for CEO endorsement template to the AF Secretariat.
vii) Coordinate with relevant stakeholders in formulating a programmatic approach (PA); prepare a Program Framework Document (PFD) for submission to the AF Secretariat for work program entry and Council approval; implement the PA; monitor and report on progress of the PA, prepare and submit for approval; complete implementation of all projects under the PA.

d) Project Approval and Start-up

(i) Appraise the project and finalize project implementation arrangements, including mission travel.
(ii) Prepare legal and other documentation for approval by the AF Agency approval authority.
(iii) Advise the project proponent on the establishment of a project management structure in the recipient country.
(iv) Assist project management to draft TORs and advise on the selection of experts for implementation.
(v) Advise on and participate in project start-up workshop.

e) Project implementation and supervision

(i) Mount at least one supervision mission per year, including briefing operational focal points on project progress.

(ii) Provide technical guidance, as necessary, for project implementation.
(iii) As necessary, include technical consultants during supervision missions to advise government officials on technical matters and provide technical assistance for the project as needed.
(iv) Pay advances to the executing entity and review financial reports.
(v) Oversee the preparation of annual project implementation reports (APIR) for submission to the AF Secretariat.
(vi) Monitor and review project expenditure reports.
(vii) Prepare periodic revisions to reflect changes in annual expense category budgets.
(viii) Undertake the mid-term review, including possible project restructuring. Send a copy to the AF Secretariat.

f) Project completion and evaluation

(i) Oversee the preparation of the Project Completion Report/Independent Terminal Evaluation, submit the report to AF Secretariat.
(ii) Prepare project closing documents.
(iii) Prepare the financial closure of the project.

H. Include a disbursement schedule with time-bound milestones

Table 37 below presents the proposed disbursement matrix for the project. The funds disbursements schedules closely follow the initiation of activities as per the Gantt chart provided in Appendix H. The funds required upon agreement for example will initiate the inception workshops of the project, initiate assessments, develop the knowledge management and capacity development strategy and plan of the project and carry out required trainings. For example, monitoring and evaluation trainings on the strategic results framework (log frame) that would be refined following inception workshops. Technical meetings and terms of references for all activities will be developed earlier before actual procurement can commence in into the first 12 months after the project initiation. Implementation on the ground is expected to start in the second year of the project and would be well underway by the third year. Monitoring and evaluation and capturing of lessons and practices with setting up of the project for closure and terminal evaluation would be the focus of the last eighteen months of the project.

The matrix and clear time-bound milestones will be refined during the inception phase of the project.

Table 37. Project Disbursement Matrix

S. NO	MAJOR ACTIVITY	TIME LINE
1	Inception Phase: Inception Workshops at national, state, municipality	0-12 month
2	Hiring staff, project management unit set up	0-12 month
3	National Water & Sanitation Policy - development, implementation & monitoring	7-24 month
4	Developing legislation, regulations, policy and guidance documents	7-24 month
5	Identification of sites for WHSS and SCTs - for Yap, Chuuk and Pohnpei islands	9-15 month
6	Climate proof designing of WHSS, SCTs	15-20 month
7	Procurement of Materials for WHSS, SCTs	15-29 month
8	Construction of WHSS, SCTs , maintenance and monitoring	23-30 month
9	Finalisation of road easements, survey clearing & topographical surveys - Kosrae	7-12 month
10	Climate proof design inland road section / transitional defences - Kosrae	7-18 month
11	Procurement of Construction Company, Equipment & Materials	13-36 month
12	Construct to design - inland road section / transitional defences - Kosrae	19-47 month
13	State Support Program on Access to Land - Kosrae	14-51 month
14	Community-Based Ecosystem Management program - Kosrae	14-51 month
15	State Support Program on Access to Finance - Kosrae	14-51 month
16	Capacity building and training programmes	3-51 month
17	Programme Management activities including reporting	3-64 month
18	Mid-term monitoring by stakeholder	28-39 month
19	Final evaluation	52-60 month

Table 38. Disbursement Schedule

DISBURSEMENT SCHEDULE						
	Upon Agreement Signature	One Year after Project Start	Year 2	Year 3	Year 4	Total (USD)
Scheduled Date	**April 2017**					
Project Funds	1,163,292.7	2,322,426.0	2,431,427.9	1,471,930.3	905,854.3	**8,294,931**
Implementing Entity Fee	98,879.9	197,406.2	206,671.3	125,114.0	76,997.6	**705,069**
Total	1,262,172.5	2,519,832.1	2,638,099.3	1,597,044.3	982,851.9	**9,000,000**

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[24] *Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an Appendix to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:*

Lorin. S. Robert Secretary Department of Foreign Affairs, Federated States of Micronesia	Date: 1 August 2016

B. Implementing Entity certification *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans, the 2004 National Strategic Development Plan, 2013 National Policy on Disaster Risk Management Plan and Climate Change Adaptation, 2011 Kosrae State Climate Change Act, 2014 Kosrae Shoreline Management Plan and other relevant regulations, and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Kosi Latu, Director General SPREP Implementing Entity Coordinator	
Date: *August 1, 2016*	Tel. and email:+685 21929; kosil@sprep.org
Project Contact Person: Peniamina Leavai	
Tel. And Email: +685 21929 peniaminal@sprep.org	

[24] Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

ACRONYMS

List of Acronyms used in the project proposal

- ADB Asian Development Bank
- AF Adaptation Fund
- AFB Adaptation Fund Board
- AF RF Adaptation Fund Results Framework
- APR Annual Progress Report
- AWP Annual Work Plan
- BOM Bureau of Meteorology
- CBO Community Based Organisation
- CC Climate Change
- CCCPIR Coping with Climate Change in the Pacific Region
- CDM Country Development Manager
- CEO Chief Executive Officer
- CLIMAP Climate Adaptation in the Pacific project
- CROP Council of the Regional Organisations of the Pacific
- CSIRO Commonwealth Scientific and Industrial Research Organisation
- CSO Civil society organisations
- DAC Development Cooperation Directorate
- DAF Department of Administration & Finance
- DREA Department of Resources and Economic Authority
- DRM Disaster Risk Management
- DTI Department of Transport and Infrastructure
- ECOSAN Ecological sanitation
- EE Executing Entity
- EEZ Exclusive Economic Zone
- EIA Environmental Impact Assessment
- ENSO El Nino Southern Oscillation
- EPA Environment Protection Agency
- EU European Union
- FSM Federated States of Micronesia
- FSMDB Federated States of Micronesia Development Bank
- GCCA Global Climate Change Alliance
- GDP Gross Domestic Product
- GEF Global Environment Facility
- GIZ Deutsche Gessellschaft fur International Zusammernarbiet
- SPC Secretariat of the Pacific Community
- HDPE High Density Poly Ethlyene
- HH Households
- HMA Hot Mix Asphalt

- IDP Infrastructure Development Plan
- IGO Inter-Governmental Organisation
- IOM International Organisation for Migration
- IR Interest Rate
- IR Inception Report
- IRRI Inland Road Relocation Initiative
- ISBN International Standard Book Number
- ISSN International Standard Serial Number
- IW Inception Workshop
- IWRM Integrated Water Resources Management
- KCSO Kosrae Conservation Society Organisation
- KIRMA Kosrae Island Resource Management Authority
- KHA Kosrae Housing Authority
- KSG Kosrae State Government
- KSMP Kosrae Shoreline Management Plan
- KUA Kosrae Utilities Authority
- LAN Local Area Network
- MDG Millennium Development Goals
- M&E Monitoring and Evaluation
- MTE Mid Term Evaluation
- NWOP National Water Outlook Programme
- NCCC National Climate Change Committee
- NECC National Environmental Coordinating Committee
- NGO Non-Governmental Organisation
- NIW National Inception Workshop
- NPM National Project Manager
- NWTF National Water Task Force
- OECD Organisation for Economic Cooperation and Development
- OEEM Office of Environment and Emergency Management
- OIC Outer Island Coordinator
- PAC Project Advisory Committee
- PACC Pacific Adaptation to Climate Change Project
- PACCSAP Pacific Climate Change Science and Adaptation Programme
- PAR Project Annual Review
- PB Project Board
- PCCSP Pacific Climate Change Science Project
- PEIN Pacific Environment and Information Network
- PIC Pacific Island Country
- PIU Project Implementation Unit
- PMU Project Management Unit
- PNG Papua New Guinea
- PRA Participatory Rapid Response

- R&D		Resources and Development
- RTSM		Regional Technical Support Mechanism
- RIE		Regional Implementing Entity
- SCT		Self Composting waterless Toilets
- SDP		Strategic Development Plan
- SIS		Small Island State
- SLR		Sea Level Rise
- SMP		Shoreline Management Plan
- SPREP		Secretariat of the Pacific Regional Environment Programme
- TWG		Technical Working Group
- UNDP		United Nations Development Programme
- UNFCCC	United Nations Framework Convention on Climate Change
- UNFPA		United Nations Population Fund
- US		United States
- USD		United States Dollars
- WASH		Water Sanitation and Health
- WHSS		Water Harvesting and Storage System
- WSIP		Water Sector Investment Plan
- V&A		Vulnerability and Adaptation
- 3D		Three dimensional

ANNEXES

Annexes referred to in the proposal:

Annex 1	Malem to Utwe Inland Road Initiative. Preliminary Environment Impact Assessment for the inland road. Prepared for the Kosrae State Government and the Secretariat of the Pacific Regional Environment Programme, May 2016, NIWA
Annex 2	Cost-Benefit Analysis in Coastal Zone Management in Kosrae (FSM): Economic Assessment of Coastal Road Relocation in the Face of Climate Change
Annex 3	Environment and Social Management Plan, July 2016
Annex 4	Official correspondence from Federated States of Micronesia Department of Foreign Affairs, to Mr Naresh Sharma (Chair), Adaptation Fund Board Secretariat, endorsing the priorities identified in the AF Project Proposal (8 July, 2016)
Annex 5	Malem-Utwe Inland Road Relocation Initiative, Kosrae, Monitoring and Evaluation Framework, SPREP, 2016
Annex 6a	Official correspondence from Utwe Municipal Government endorsing the project, April 13, 2016
Annex 6b	Official correspondence from Malem Municipal Government endorsing the project, July 6, 2015

ADDITIONAL DOCUMENTS ATTACHED, FOR THE INFORMATION OF THE ADAPTATION FUND

1. Kosrae Shoreline Management Plan, 2014
2. Federated States of Micronesia Infrastructure Development Plan 2016 – 2025
3. Kosrae Island Resource Management Authority (KIRMA) Regulations for Development Projects.
4. Kosrae State Climate Change Act, 2011
5. Development Review Permit Application
6. Official correspondence from Government of Kosrae (Office of the Governor) to President of FSM, with regards to Prioritisation of Inner Roads within the Infrastructure Development Plan Framework for Kosrae State (November 6, 2015)
7. Legislative Resolution No.11-106, Endorsing the inner road construction projects as one of the highest infrastructure priority projects for the State of Kosrae and for other purposes (November 24, 2015).
8. Workshop Report, Developing a Monitoring and Evaluation Framework for a Project to Reduce Climate Risks Faced by Malem and Utwe Communities, 2015.
9. Summary findings from consultations, held with Yap, Chuuk, Pohnei and Kosrae communities (June, 2015)

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Department of Foreign Affairs
Federated States of Micronesia

Letter of Endorsement by Government

August 2, 2016

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for "Enhancing the climate change resilience of vulnerable island communities in Federated States of Micronesia".

In my capacity as designated authority for the Adaptation Fund in the Federated States of Micronesia, I confirm that the above national project/programme proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in the Federated States of Micronesia.

Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/programme will be implemented by the Secretariat of the Regional Environment Programme (SPREP) and executed by the Office of Environment and Emergency Management (OEEM) on behalf of Kosrae State Government, Pohnpei State Government, Yap State Government, and Chuuk State Government.

Sincerely,

Lorin S. Robert
Secretary (Minister) of Foreign Affairs

NIWA
Taihoro Nukurangi

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Malem to Utwe inland road initiative

Preliminary Environmental Impact Assessment for the inland road

Prepared for Kosrae State Government and Secretariat of the Pacific Regional Environment Programme

May 2016

Prepared by:
Doug Ramsay

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NIWA CLIENT REPORT No:
Report date: May 2016
NIWA Project:

Quality Assurance Statement		
	Reviewed by:	
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Executive summary

The Federated States of Micronesia (FSM), with support from the Secretariat of the Pacific Regional Environment Programme (SPREP) is developing a project proposal for submission to the Adaptation Fund (AF) to assist coastal communities in all four states in the FSM prepare and adapt for higher sea levels and adverse and frequent changes in extreme weather and climate events.

A significant component of the Kosrae part of the AF proposal will focus on implementing activities in Malem Municipality around supporting the commencement of a long-term and staged strategy of relocating essential infrastructure back from the coastline. Specifically this will look to construct the first phase of inland road development between Malem and Utwe up to a two-laned sub-base standard.

This report presents a preliminary environmental impact assessment (EIA) of the proposed inland road between Malem and Utwe and also includes the section between Malem and Pilyuul. The purpose of the report is to provide a premliminary Environmental Impact Assessment to support the Development Consent process for the inland road development, and the development of the Environmental and Social Management Plan required for AF proposal submission.

This preliminary Environmental Impact Assessment builds on existing studies and identified State, Municipal and community concerns. The overall conclusion is that environmental impacts from the proposed inland road are low to moderate and can be adequately controlled through:

- Maintaining the alignment of the road between Malem and Kuplu (and Malem to Pilyuul) close to that proposed following approximately the 10 m contour.
- Realignment the road between Kuplu and Finsrem via Kuplu Wan to avoid both difficult construction (land slipping, inadequate space to creat the road), and important ecosystem (Mosral to Utwe Mangrove system)
- Adhering to the mitigating recommendations made in this EIA, particularly around sediment control and stormwater runoff, and any others subsequently specified in the Development Permit conditions.

At this stage no potential significant issues have been identified that would require further assessment to understand or address potential impacts.

1 Introduction

1.1 Project background

The Federated States of Micronesia (FSM), with support from the Secretariat of the Pacific Regional Environment Programme (SPREP) is developing a project proposal for submission to the Adaptation Fund (AF) to assist coastal communities in all four states in the FSM prepare and adapt for higher sea levels and adverse and frequent changes in extreme weather and climate events.

The Kosrae component of the proposal has an indicative budget of $2.9 m to begin the process of implementing necessary adaptation activities identified in the Kosrae Shoreline Management Plan (Ramsay et al, 2013). This will specifically focus on implementing activities in Malem Municipality (Figure 1) around supporting the commencement of a long-term and staged strategy of relocating essential infrastructure back from the coastline. The specifics of the Kosrae component of the AF proposal are still being finalised but is expected to include some or all of the following aspects:

- Construction of the first phase of inland road development between Malem and Utwe up to a two-laned sub-base standard.
- Upgrading of existing coastal defences at Paal and Mosral
- Inland Municipal Development planning and identification of land availability
- Awareness and strengthening of complimentary ecosystem based adaptation activities
- Identifying incentive options to assist households relocate inland.

At present implementation of the inland road and associated infrastructure may also be supported by a Chinese grant for up to $5 m for each State for infrastructure development currently being negotiated by the FSM. Whilst verbal commitments prioritising up to $4 m of this funding to support inland road development (completing the Malem to Utwe road to hot-mix asphalt pavement) have been made, no firm commitments are at this point in time in place. Hence the assumption through the development of the AF proposal has been to develop a standalone project, but one where further implementation could be achieved if the Chinese funding (or other donor support) is secured.

As part of the Adaptation Fund Proposal a number of supporting activities are required, including a cost-benefit analysis (Holland et al, 2015), a monitoring and evaluation framework (Braun, 2015) and an environmental and social management plan (ESMP). This EIA will contribute to the development of the ESMP.

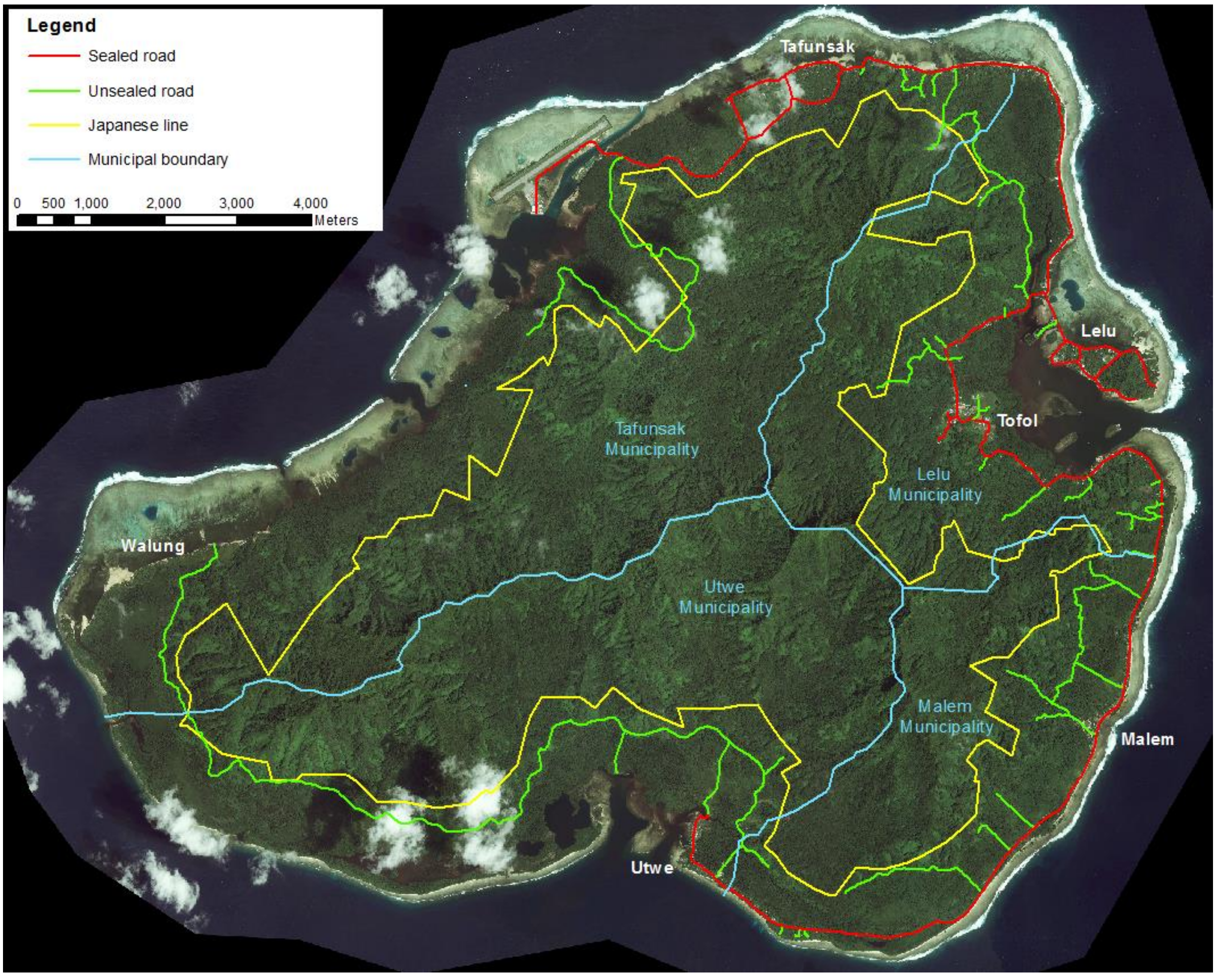

Figure 1: Kosrae location map.

1.2 Legislative framework in Kosrae

Kosrae has enacted legislation and prepared a range of resource and management plans to give effect to its responsibilities in relation to the management, protection and conservation of the environment and natural resources (KIRMA, 2014). These responsibilities are principally implemented by the Kosrae Island Resource Management Authority (KIRMA), a semi-autonomous government agency, which is mandated to:

> *"protect the environment, human health, welfare and safety and to abate, control and prevent pollution or contamination of air, land and water by balancing the needs of economic and social development with those of environmental quality and adopting regulations and pursuing policies which, to the maximum extent possible, ensure that economic and social development is environmentally sustainable"* (Kosrae State Code, Section 19.101).

Under Title 19 of the Kosrae State Code and the *Regulations for Development Projects* KIRMA has responsibilities and powers to administer a development permit system. Where a potential project may have significant impact on the environment, these regulations require an Environmental Impact Assessment (EIA). This assesses the physical, ecological, aesthetic, cultural, economic, social, or health effects or impacts of a proposed activity on the environment, whether direct, indirect or cumulative. The EIS describes the potential effects or impacts on the environment in sufficient detail so as to allow the assessors (KIRMA, the Board of Commissioners, and stakeholders) to make a comparison of the alternatives that can be taken to avoid, minimize, rectify, reduce or eliminate, or compensate for the impact of the proposed activity. This assessment process concludes with a decision by the Board of Commissioners to issue a development review permit, subject to conditions that will avoid, minimize or eliminate the effects or impacts of the proposed activity on the environment. The process is detailed in full in KIRMA's guidance document*: Environmental impact assessment in the State of Kosrae*, FSM (KIRMA, 2014).

Determining whether an impact is significant includes consideration of the following:

- The number of people affected;
- The duration of an effect (short and long-term);
- The proportion of a natural resource that is damaged or consumed;
- The location of a project in a sensitive area (historic site, coastal area, marine conservation area);
- The relationship to other components of the project or other projects in the region; and
- The intensity of severity of an impact (irreversible and cumulative).

1.3 Scope of the present report

This report presents a preliminary environmental impact assessment of the proposed inland road between Malem and Utwe and also includes the section between Malem and Pilyuul.

The purpose of the report is to:

1. If no significant environmental[1] issues are identified, provide sufficient assessment to support the development consent for the alignment of the proposed inland road, and the construction activities associated with the Adaptation Fund proposal.
2. If any potential significant issues are identified, outline further assessment that will be required to understand or address these impacts.

The report does not cover the assessment related to construction activities associated with upgrading the inland road from a sub-base standard to hot-mix asphalt pavement (as is proposed if the Chinese funding is secured). This will require a further Development Permit and development of an Environmental Management Plan to address and mitigate potential construction and associated impacts during the planning phase. However, many of the mitigation requirements outlined in this report will be relevant.

[1] Taken here to include physical, ecological, aesthetic, cultural, economic, social, or health impacts

2 Description of the proposed inland road

2.1 Introduction

The road network on Kosrae is a mix of two-laned paved road linking the villages of Utwe, Malem, Tofol, Lelu and Tafunsak to the port and airport at Okat, and generally single lane unsealed access roads and farm tracks (Figure 1).

The paved road network is located either around the base of the volcanic part of the island, (Figure 2) such as the road from the port/airport behind Tafunsak village, or on the narrow storm berm located on the reef flat along much of the eastern coastline of Lelu and Malem Municipalities (Figure 2).

Much of this latter section of road is at risk from shoreline change and wave overwash. To date the response to the most critically sections has been to build seawalls, typically rock revetments which provide varying degrees of protection. At present further sections at Paal and Mosral are critically threatened with concrete rubble dumped along the most critical section to provide temporary protection. In the forseeable future, both ongoing coastal change and the exacerbating effects of sea-level rise and climate change, will result in further sections of road becoming increasingly exposed to damage and flooding, for example at Pilyuul. Given the elevation of much of the existing coastal road relative to future sea levels, and its location on the narrow beach/storm berm, continued reliance on seawall protection of all sections of the present paved coastal road and communities located there, will become progressively less effective, more expensive and will not be a sustainable.

Figure 2: Paved inland road between the airport and Tafunsak village (left) and on the narrow storm berm at Mosral, Malem (right).

The road network plays a fundamental role in directing where other infrastructure (water, electricity and telecommunications) and residential and commercial development both historically and in the future occurs. Over the last two to three generations the majority of residential property is located alongside or close to the main paved sections of road. This has resulted in residential development, particularly in Malem Municipality, occurring in areas exposed to high risk of coastal change and flooding, a risk which will become increasingly significant and frequent with ongoing climate change and sea-level rise.

Due to these interdependencies, continuing to maintain the single main road in its present location on the narrow beach/storm berm will leave the whole community vulnerable to being isolated and unable to move between locations / villages, and make responding to emergencies and continued development very difficult if not impossible. Repositioning the road to higher ground ensures a long-term sustainable all weather access for the whole community as well as removing a significant barrier to the long-term development and relocation of residential property to higher ground.

The Kosrae Shoreline Management Plan developed a prioritised list of inland road and essential infrastructure development to be implemented over the next one to two generations (Figure 3). Developing and upgrading the inland road between Malem and Utwe was considered the highest priority due to the risks posed due to wave overwashing and potential breaching of existing sections at Paal and Mosral. There is a very real present day risk that road access to Utwe could be cut off. The natural storm berm to the south of Malem also tends to be lower in elevation resulting in the road being more prone to wave overwashing during high tides (Figure 2).

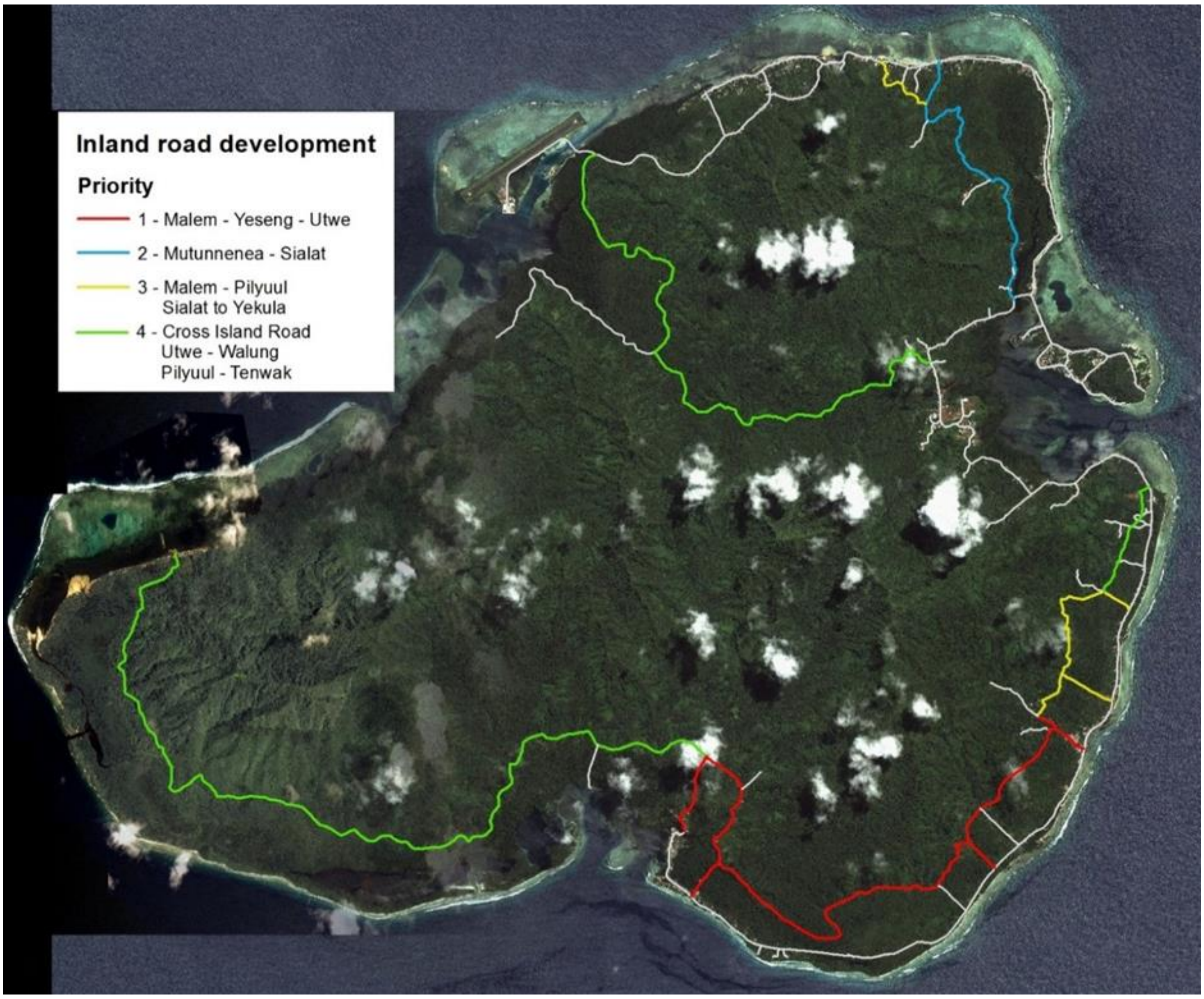

Figure 3: Priority sections of the development of the inland road on Kosrae.

2.2 Proposed inland road design and alignment

Given the investment required, a staged approach is being adopted to the development of a relocated road, associated infrastructure and ultimately village infrastructure and residential development. Ultimately the intention is to develop the road to the same standard as the existing two lane paved road based on the design standards developed for the Kosrae Circumferential Road Extension Project (Barret Consulting Group Inc, 1987), as shown in Figure 4. Over the next one to two generations the inland road will become the primary road access from Utwe and Malem to Tofol.

The road design assumes:

- A 60 feet standard easement width.
- A 12 foot standard lane width.
- A 2% cross-section drainage gradient for hot mix asphalt pavement and 3% gradient for a sub-base surface.
- Existing sections of inland farm roads will be widened to obtain a roadway width of 30 ft., and include construction of roadway drainage structures (bridges and culverts) and resurfacing to sub-base course level.
- Upgrade to Hot Mix Asphalt (HMA) pavement includes base course preparation on top of the sub-base and 2" thick asphalt pavement. It is assumed that all aggregates included sand are imported.
- Where required an integrated infrastructure approach is adopted which includes relocation of power distribution, and any water or telecom service infrastructure.

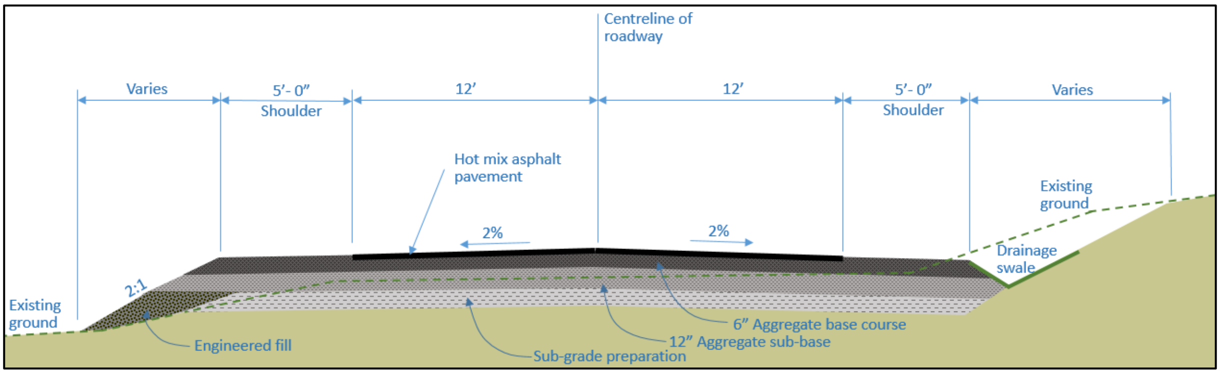

Figure 4: Typical road cross-section. Based on the design standard developed for Kosrae circumferential road extension project (Barret Consulting Group Inc., 1987).

The inland road would be developed around the perimeter of the lower slopes of the volcanic part of the island. At this present stage the alignment of the road is indicative and has not been yet surveyed and defined. However, it will be located well above the inland boundary of freshwater swamp or mangrove areas along approximately the 10 m contour. This will also be well above areas likely to be well above areas directly impacted by sea-level rise over the next century and beyond (Ramsay et al, 2014). Following the natural contour of the topography minimizes any significant road slopes, need for substantial cut and fill, and reduces erosion potential and landslipping hazard. The intention is that the road, when complete, will be similar to the present inland sections of road for example between the airport and Tafunsak village (see Figure 2).

The proposed indicative alignment of the road along approximately the 10 m contour is shown in Figure 5. Further alignment options considered within this report are also shown and discussed in the following sections. Under the AF proposal the road will be constructed up to a sub-base standard (Figure 6). Upgrading the road to a hot-mix asphalt surface is expected to be subsequently completed with Chinese funding assistance.

Figure 5: Initial indicative alignment of inland road sections between Utwe, Malem and Pilyuul. Dashed lines indicate further alternative road alignments / options considered.

Figure 6: PACC road in Tafunsak completed to sub-base surface standard.

The Department of Transport and Infrastructure have the expertise and equipment to design and construct the road up to sub-base level (external construction support will be required to upgrade the road to hot-mix asphalt. Fill and aggregate material is available from existing permitted quarries adjacent to the proposed inland road, for example at Yeseng, with aggregates available from the PUK quarry in Tenwak.

3 Description of the Environment

3.1 Introduction

Kosrae is a high volcanic island with a land mass totalling approximately 109 km^2. The highest point is Mount Finkol at 633 m with steep mountain ridges and deep valleys covering approximately 70% of the land surface. Foot slopes, alluvial fans, freshwater swamp and bottom land around the base of the high volcanic land areas make up a further 15% of land area with the remainder mangrove areas and coastal strands (US Department of Agriculture, 1983).

The island is surrounded by a fringing coral reef with the distance between the reef flat and shoreline strand varying in width depending on exposure to the incident wave climate. The fringing reef is dissected by four natural breaks (harbours) that occur at the mouths of the four main catchment systems (Okat, Yela, Finkol and Innem Rivers). A narrow modern, and in places remnant, coastal strand separates the reef system from the lagoon mangrove and swamp infill areas that fringe the volcanic parts of the island. Much of the development of Kosrae has occurred on this narrow coastal strand.

Average daily temperature is around 27°C and generally varies less than 1-2°C from month to month. Humidity is also high, with relative humidity typically above 80% throughout the year. Trade winds from the north-east blow throughout the year and are strongest during the December to February period. An increase in westerly winds and reduction in trade winds tends to occur during periods of El Nino with stronger trade winds experienced during La Nina periods.

Average annual rainfall is in excess of 5000 mm and is likely to be higher in the interior with their being slightly less rain experienced on the leeward southern side of the island. Rainfall is generally well distributed throughout the year with April tending to be the wettest month (Figure 7). During periods of El Nino, Kosrae can experience drought conditions, with the typical pattern being reduced rainfall between October and December of the El Nino year and significantly reduced rainfall between January and March in the year following continuing with lower than normal rainfall to the middle of the year.

Heaviest rainfall tends to occur between July and October, particularly when the West Pacific Monsoon extends eastwards towards Kosrae, as can occur when El Nino conditions are developing. Short period extremely high intensity convective rainfall is common, for example an hourly rainfall of 100 mm has an estimated return period of 6 years (or approximately a 16% chance of occurring in any one year), Figure 8. Typhoons, tropical depressions and storms that track close to Kosrae can also cause heavily rainfall. The last typhoon to directly strike Kosrae occurred in 1905 but with a number of severe typhoons have affecting Kosrae prior to 1905[2]. Many of the typhoons that affect the western parts of Micronesia often originate around Kosrae as tropical depressions or storms developing in to full typhoons to the west and north. These events typically occur between June and November and are more likely to form or track closer to Kosrae during El Nino phases.

[2] http://kosraecoast.com/damaging-events/

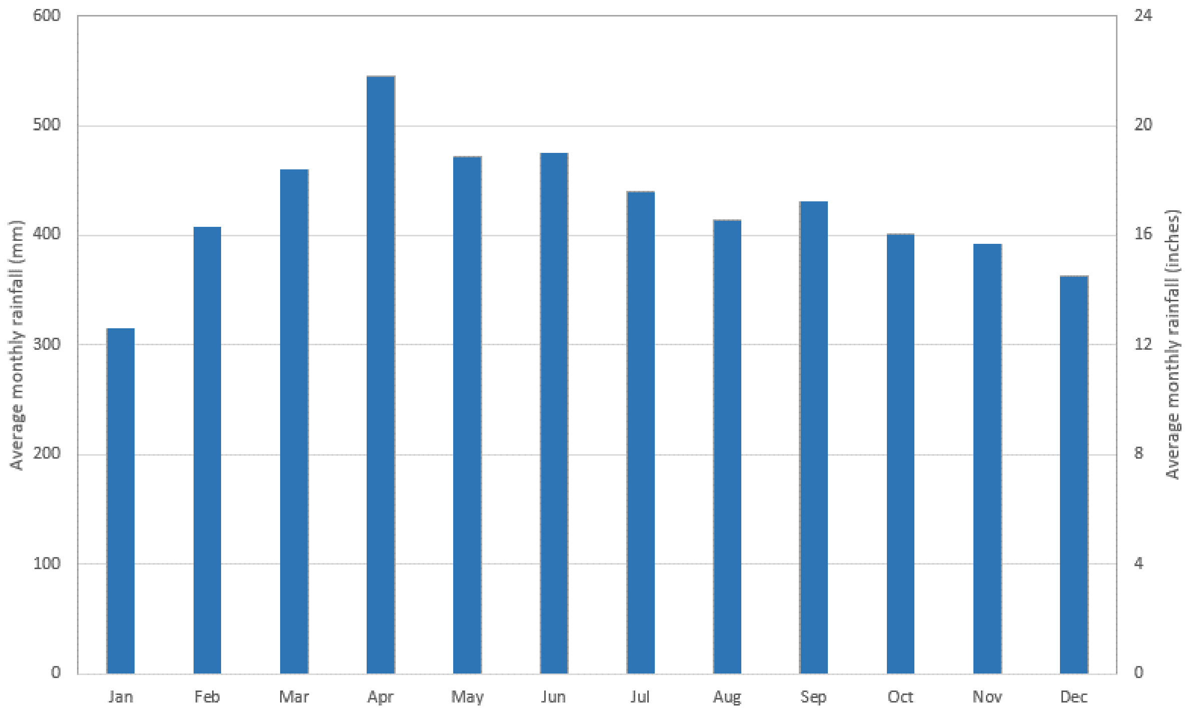

Figure 7: **Average monthly rainfall for Kosrae.** Based on monthly long-term average rainfall amounts provided by the Pacific ENSO Application Centre (http://www.weather.gov/peac/) from observations at Kosrae Airport supplemented by observations at Lelu between 1933 and 1977 and Japanese observations between 1933 to 1937.

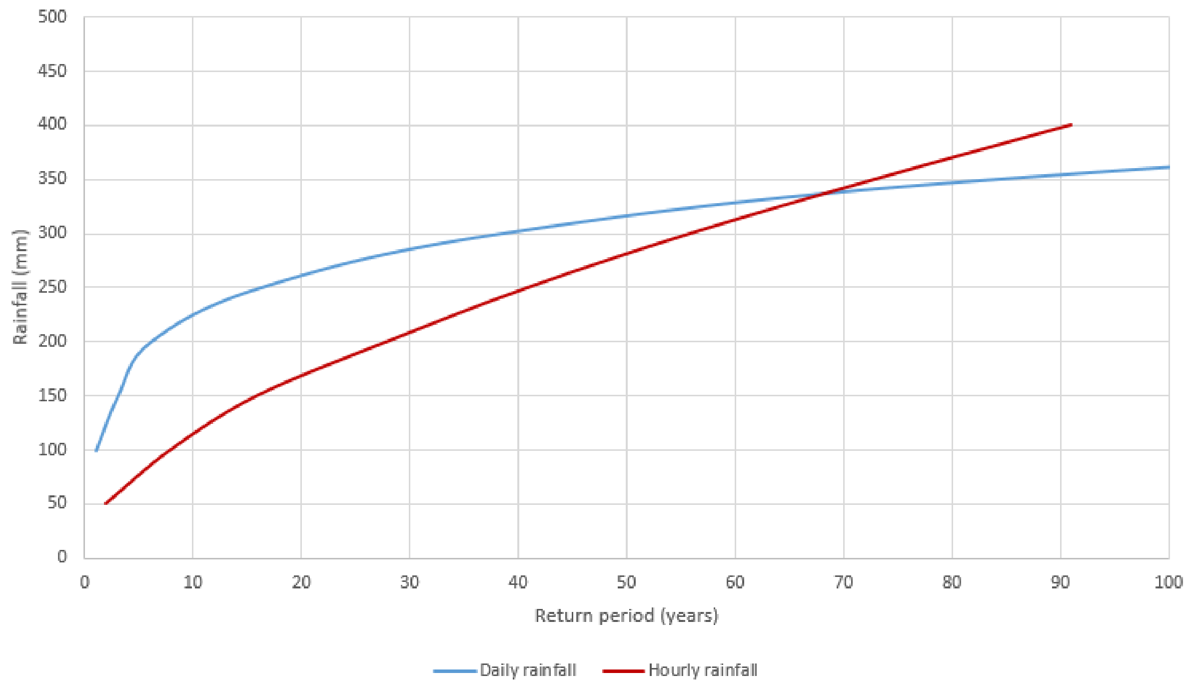

Figure 8: **High intensity extreme daily and hourly rainfall amounts for Kosrae.** Source: Asian Development Bank (2005).

3.2 Overview of Malem and Utwe municipalities

Malem and Utwe Municipalities are located on the south-east and southern areas of Kosrae respectively (Figure 1) with the majority of the proposed inland road project located in Malem Municipality. At the last census (2010), Malem Municipality had a population of 1300 with 983 people recorded in Utwe.

The majority of this population, coastal road and other infrastructure is located on land less than 5 m above mean sea level on a narrow storm berm (Figure 9) that was likely formed within the last 1-3000 years due to storm/typhoon events depositing coral rubble and sediment on the reef flat which has then been reworked to build up the storm berm. The development of the storm berm has enabled the infill swamp and mangrove areas to develop between the storm berm and the base of the mountainous part of the island. The berm, and hence degree of infilling and associated ecosystem behind it varies in age being older around Malem and much younger to the south. Radiocarbon dating of the peat swamp deposits suggests that the areas around Malem did not become swamp until between the 5th and 9th century AD, and between the 7th to 12th century AD further south (Athens, 1995). This is reflected in the level of infill with well-developed but younger lagoon mangroves in the south from Utwe, through Kuplu to Mosral, and a brackish and freshwater swamp, which has had a longer period to develop from a mangrove to a swamp system, from Mosral northwards (Figure 10).

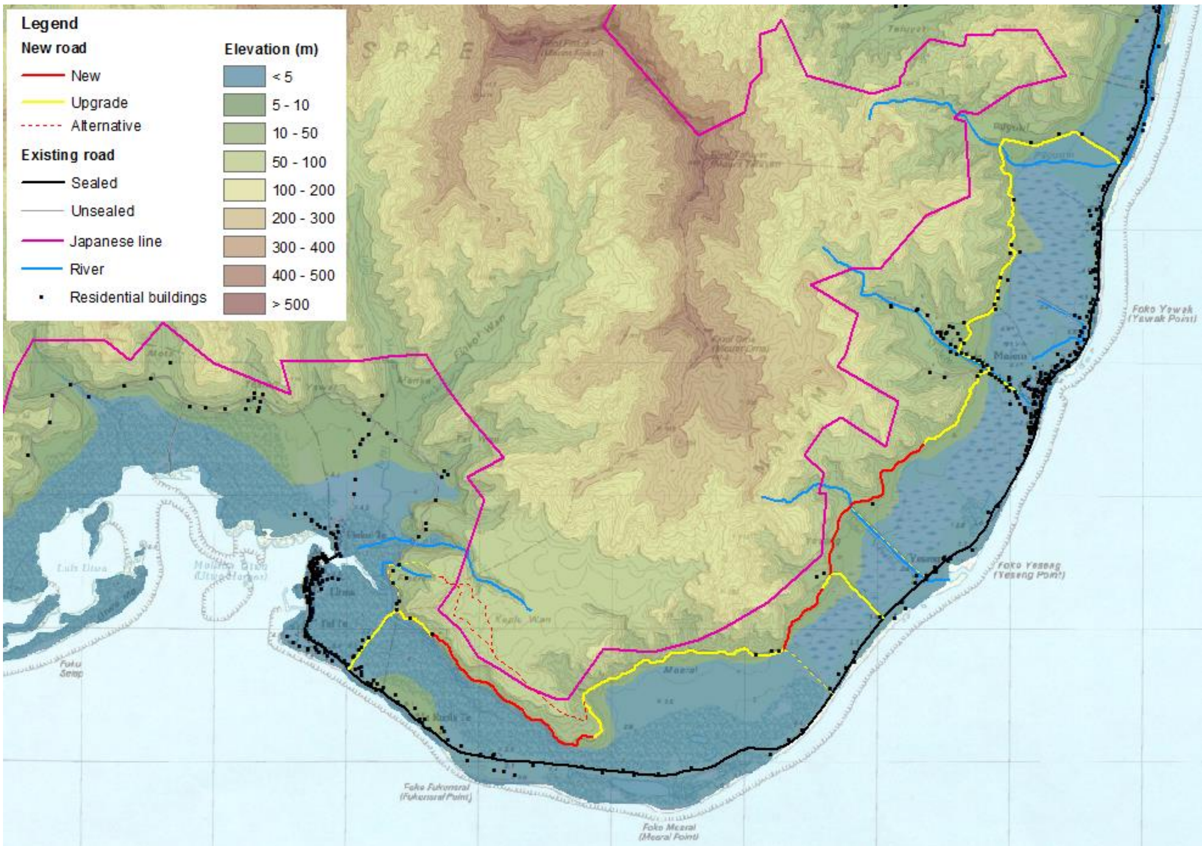

Figure 9: Topography map and distribution of residential properties in Malem and eastern part of Utwe Municipalities. Residential property locations taken from the 2010 census.

A narrow colluvial/alluvial plain provides the transition between the swamp and mangrove areas and the steep, mountainous part of the island and the peaks of Mount Oma (448 m) and Mount Tafuyat (500 m), Figure 9.

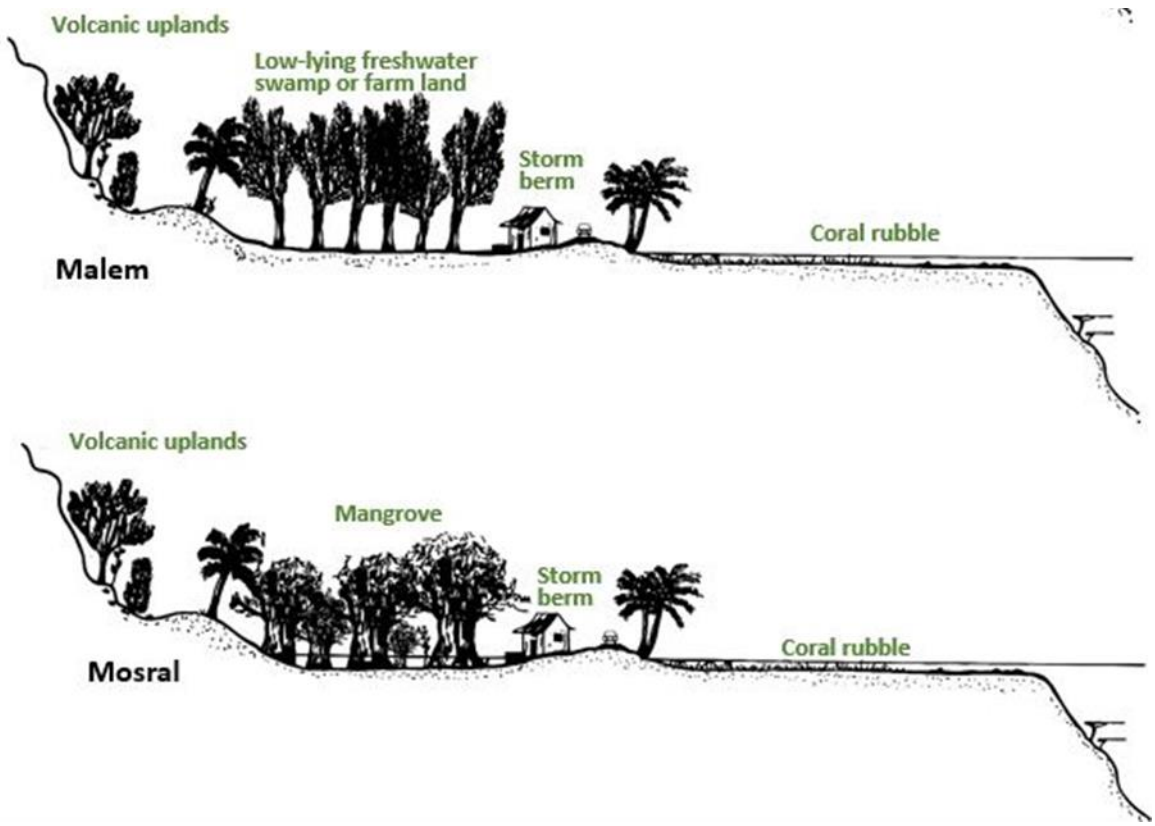

Figure 10: Typical cross-section of the low-lying coastal areas at Malem and Mosral.

3.3 Watersheds

The main watersheds along the area of the proposed inland road are shown in Figure 11 and summarised in Table 1 along with noted drainage infrastructure along sections of existing farm road in each of the catchments.

The majority of each of the catchments are above the Japanese Line. During the period of Japanese occupation (1930 to 1945), public lands were expanded to include all upland forest areas above an arbitrary line, the “Japanese Line” (Figure 11) and the shoreline below mean high water. This was to restrict access to upland areas and manage the development of upland forest areas, with all land above the Japanese line removed from traditional ownership and declared state land.

This land above the Japanese line is still under control of the Kosrae State Government with minimal development having occurred above it. As a result large parts of the catchments have essentially been protected from development and other land-use activities, and are in a relatively natural state providing significant watershed protection. Amendment 19 of the 1995 Kosrae State Constitutional Convention now allows reclamation of land above the Japanese line by the descendants of the original landowner. However, the processes for reclamation has not been established yet by law and is not yet underway.

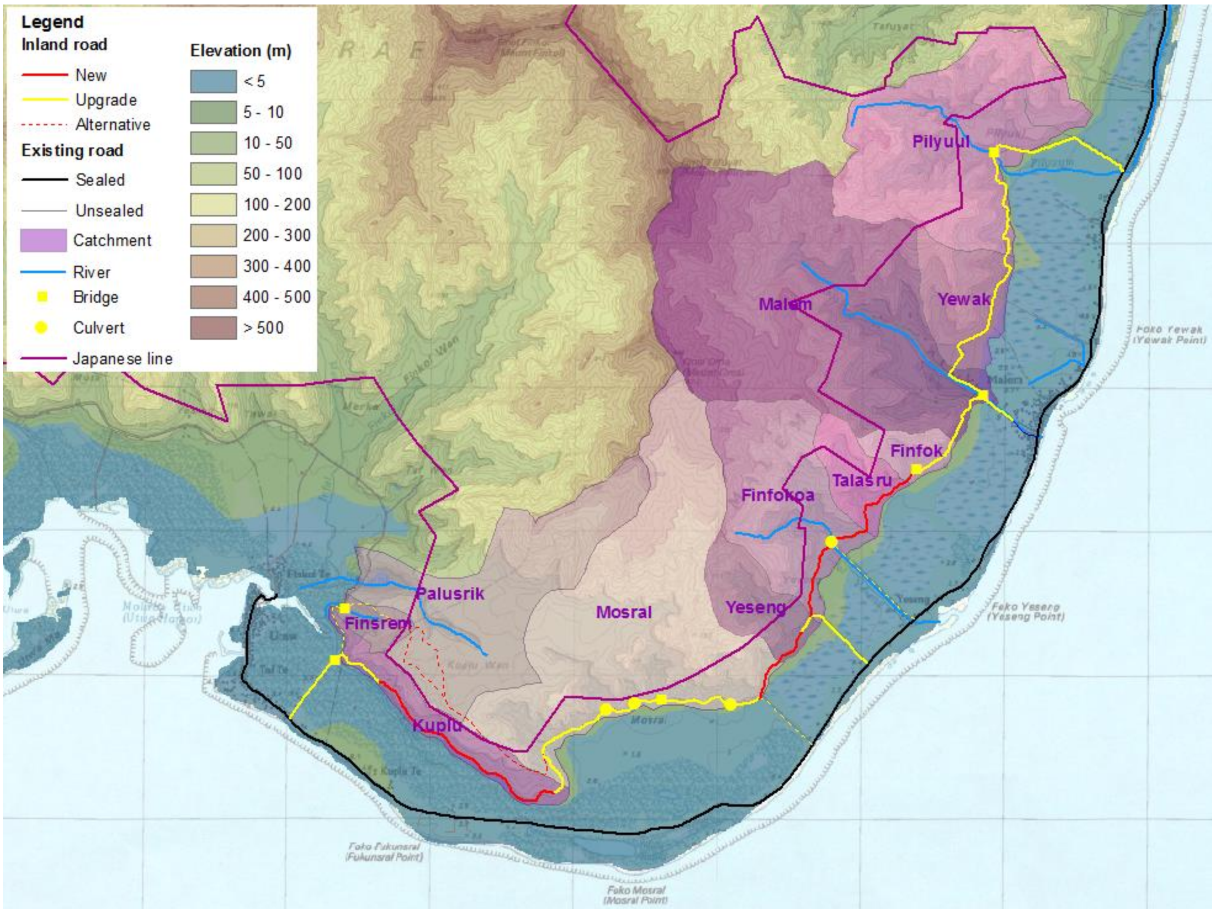

Figure 11: **Main watersheds within the proposed inland road area.**

Table 1: **Catchment characteristics and existing drainage infrastructure.**

Catchment	Area (km^2)	Water supply	Drainage infrastructure
Pilyuul	1.65		Single lane bridge over Pilyuul river
Yewak	0.46		
Malem	3.02	Malem village & Pilyuul	Double lane bridge over Malem river
Finfok	0.17		
Talasru	0.27		
Finfokoa	0.99	Yeseng	Culvert over Yeseng River
Mosral	2.43		3 culverts and one single-lane bridge
Kuplu	0.36	Private water supplies from inland springs feeding properties at Kuplu and Finsrem	Double lane bridge over the Kuplu mangrove channel.
Palusrik	1.41	Utwe village	
Finsrem	0.12		Single lane bridge over Finsrem River

Much of the upland areas in the Malem catchments, with the exception of the Kuplu Wan area, are too steep for any form of development or intensive agriculture (Figure 12). Where slopes are greater than 30% no clearing of land is permitted and row cropping avoided and between 15-30% land management practices, such as minimum tillage, use of terraces and diversions, contouring and cropping systems that can control erosion, are required (USDoA, 1983).

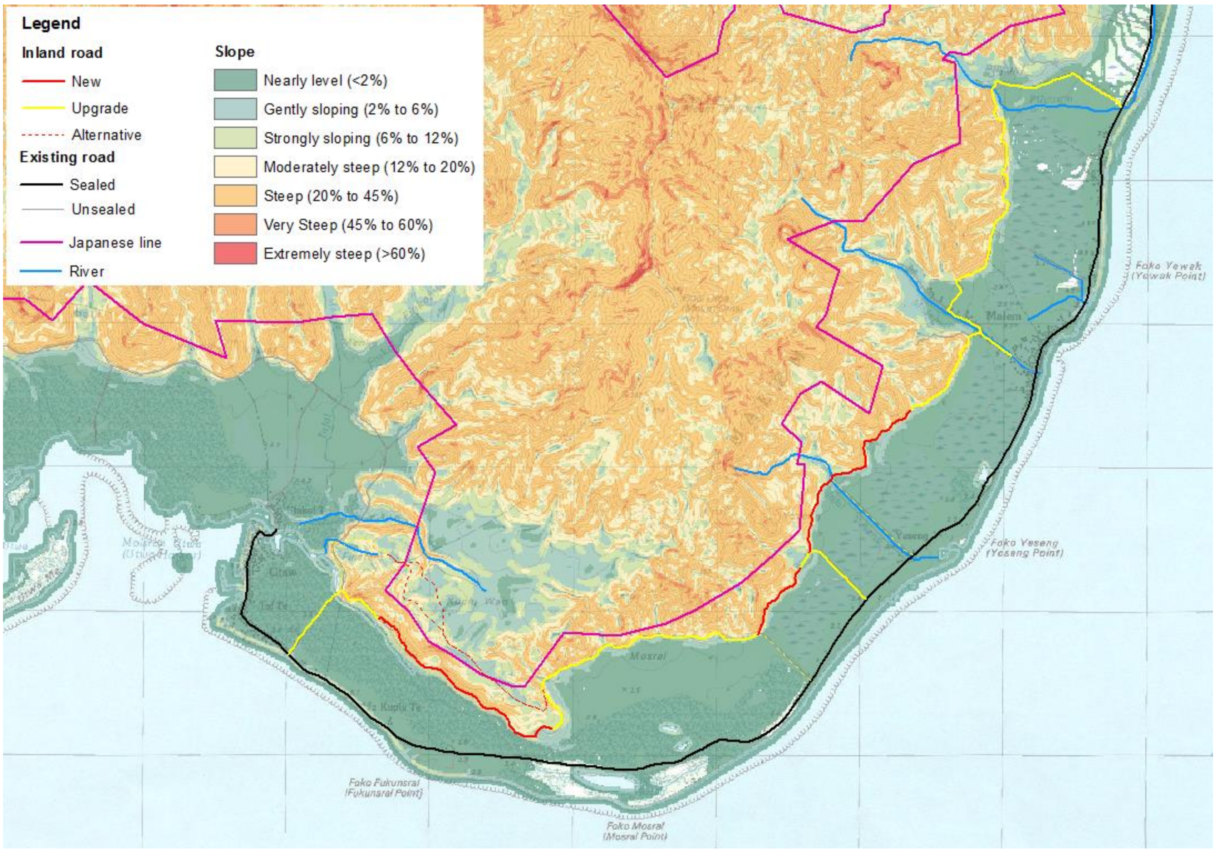

Figure 12: **Slope classification.** Classification based on US Department of Agriculture (1983).

The high central relief of Kosrae results in a radial drainage pattern with small catchments, with the Malem catchment the largest at around 3 km^2. The main rivers (Pilyul, Malem, Yeseng and Palusrik) are perennial owing to the year round prevailing high rainfall, dense vegetative cover and steep uplands leading to high level of drainage in the uplands. A number of other smaller perennial and intermittent streams and springs occur around the base of the volcanic part of the islands (Figure 13). Variations in discharge of the rivers and streams can be significant and rapid due to the high rainfall intensities, small catchment sizes and steep slopes.

Streams and rivers discharging from the catchments are filtered through the various areas of freshwater, brackish and mangrove swamp. The hydrology of these low-lying swamp and mangrove areas is complex but essentially the area from Mosral to Utwe drains westwards through the main mangrove channel *Inya Kuplu* and into Utwe Harbour. However, during the Japanese era, many of the main rivers and streams, such as Pilyuul, Masis, Malem and Yeseng Rivers were straightened to aid drainage to support intensive agriculture and the development of a runway within the freshwater swamp between Yeseng and Mosral (Figure 14). This results in the main rivers since this time discharging straight to the reef flat which, despite the healthy vegetative cover in the catchment, can result in high suspended sediment loads during periods of heavy rain.

Figure 13: Typical examples of rivers, streams, springs and water supplies. Top left: Malem River at Malem Village; Top right: Typical perennial stream in Yeseng catchment; Bottom right: Spring providing water supply to residents in Finsrem; Bottom right: Recently upgraded Utwe water supply inlet on the Palusrik River.

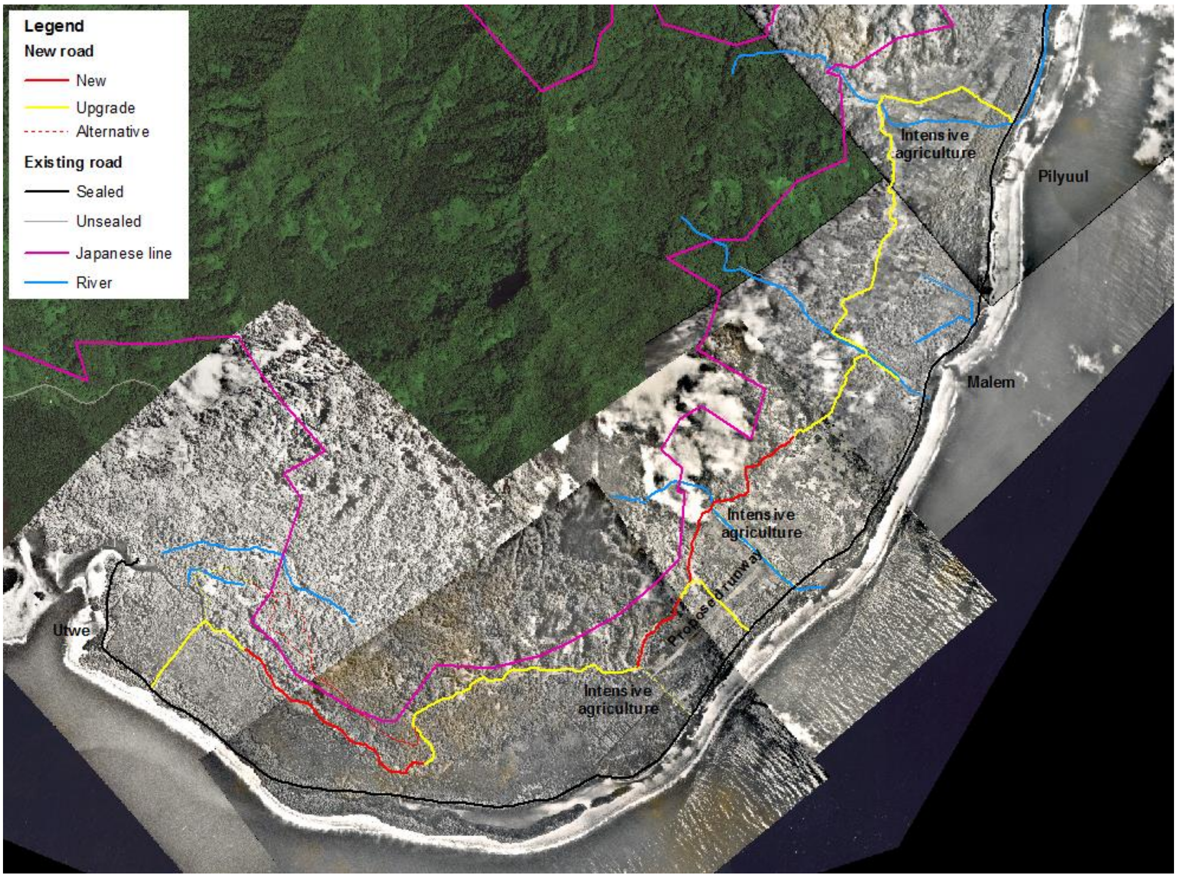

Figure 14: Agriculture and airstrip development in the freshwater swamp areas in 1944.

Most houses in Kosrae have access to both water from the municipal systems as well as from roof catchment water tanks, with a small number of people having private, gravity-fed piped sources where they have springs on their land (Figure 13). Municipal supplies are sourced primarily from Malem and Finfokoa catchments (Malem) and Palusrik (Utwe). The former are simple small dam systems in the upper reaches of the river and a gravity-fed pipe system. No treatment is conducted of the water resulting in unacceptable water quality for consumption in terms of frequent high levels of suspended sediments. The majority of residents tend to use roof-catchment tank water for consumption and the municipal water supply for other activities such as bathing, laundry and toilet flushing. The Utwe supply is currently being upgraded under an ADB loan project with a new intake and sand-filtration system being presently constructed (Figure 13).

3.4 Soils

Soil types based on the US Department of Agriculture (1983) soil survey are shown in Figure 15 with corresponding soil erosion potential and drainage classification show in Figure 16 and Figure 17 respectively. Soil erosion potential and drainage are strongly related to slope. The proposed initial alignment of the inland road contours around the base of the volcanic part of the island at approximately the 10 m MSL contour. This is typically on alluvial or colluvial soils at the intersection between the upland, more erodible but better drained Fomseng and Tolonier soil types and the less well drained but less erodible Nansepsep-inkosr soil types, and between Kuplu and Utwe the Naniak soils associated with mangrove areas. With the alternative road option through the Kuplu Wan plateau between Kuplu and Finsrem the road alignment is located further inland, climbing up to the Kuplu Wan plateau at an elevation of up to 80 m MSL.

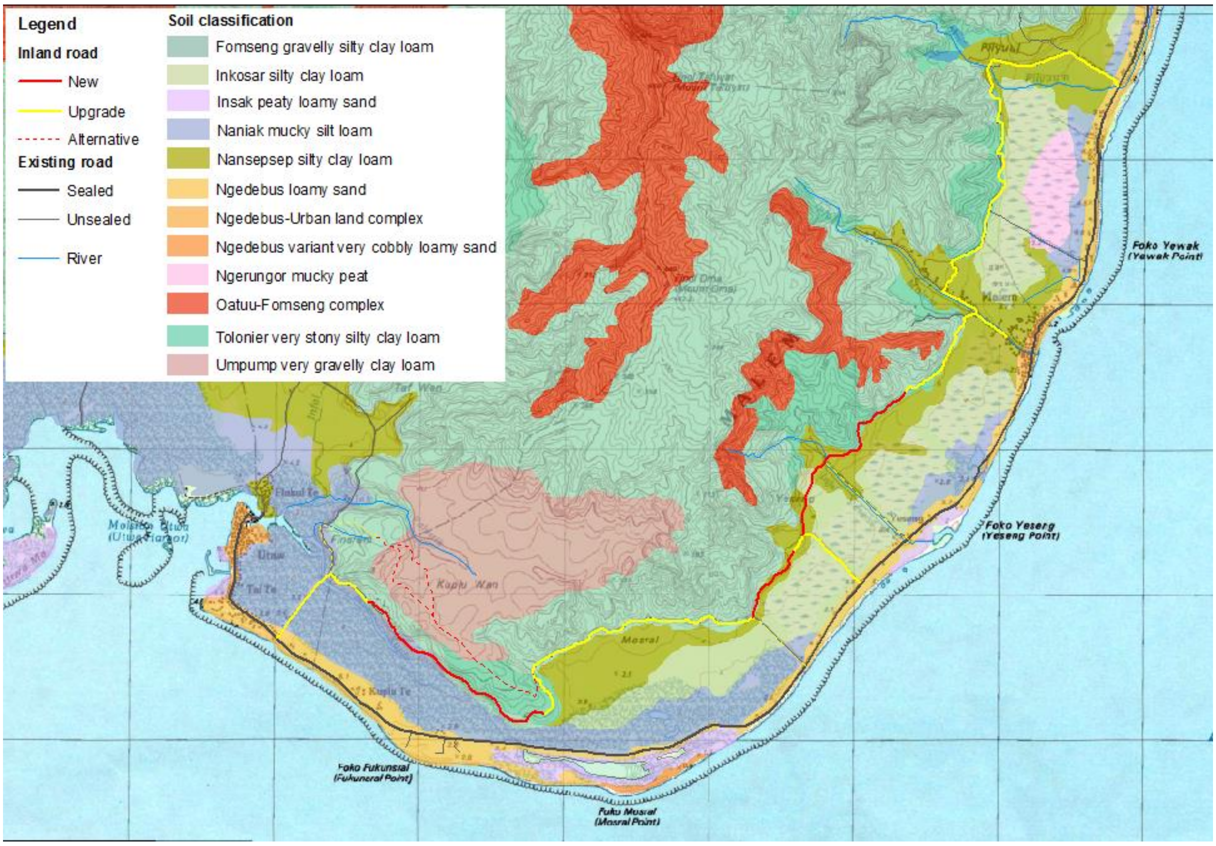

Figure 15: Soil classification. Source: US Department of Agriculture (1983).

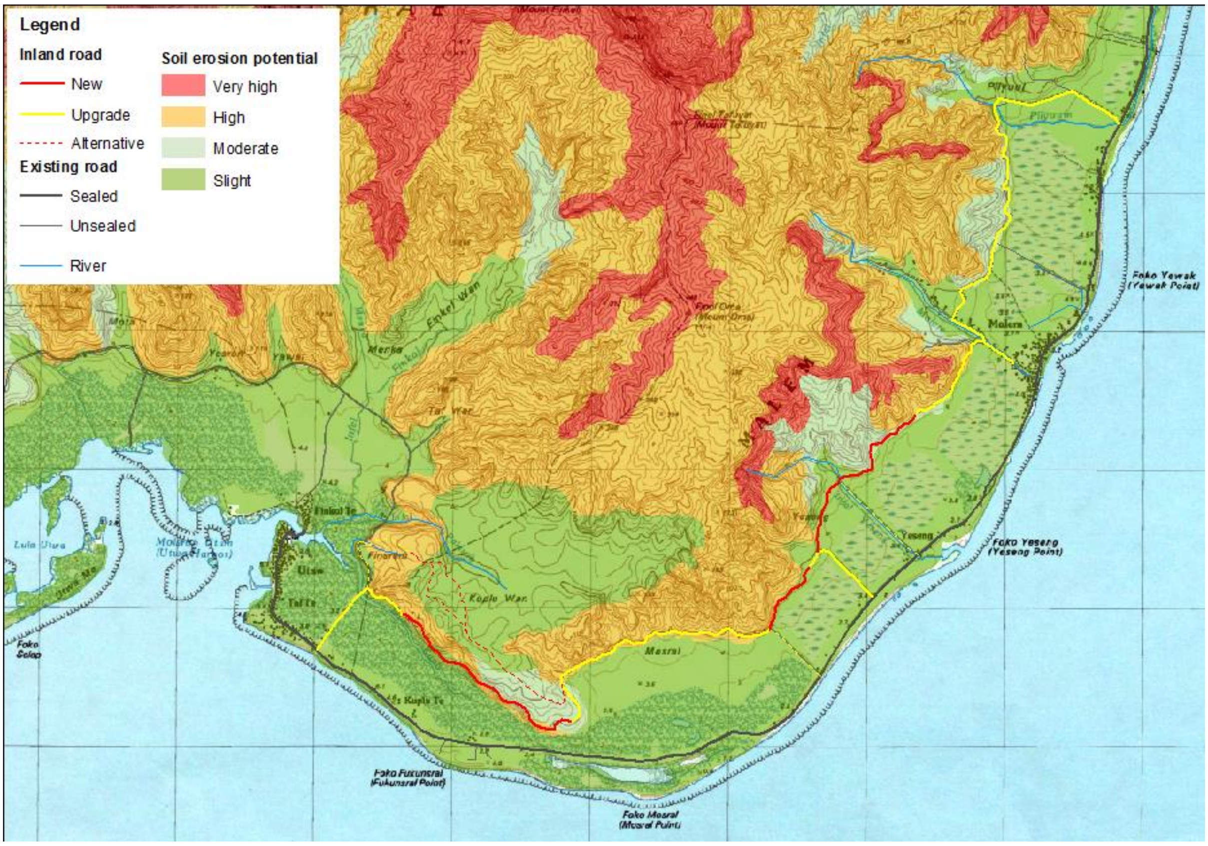

Figure 16: **Potential soil erosion categorisation.** Source: US Department of Agriculture (1983).

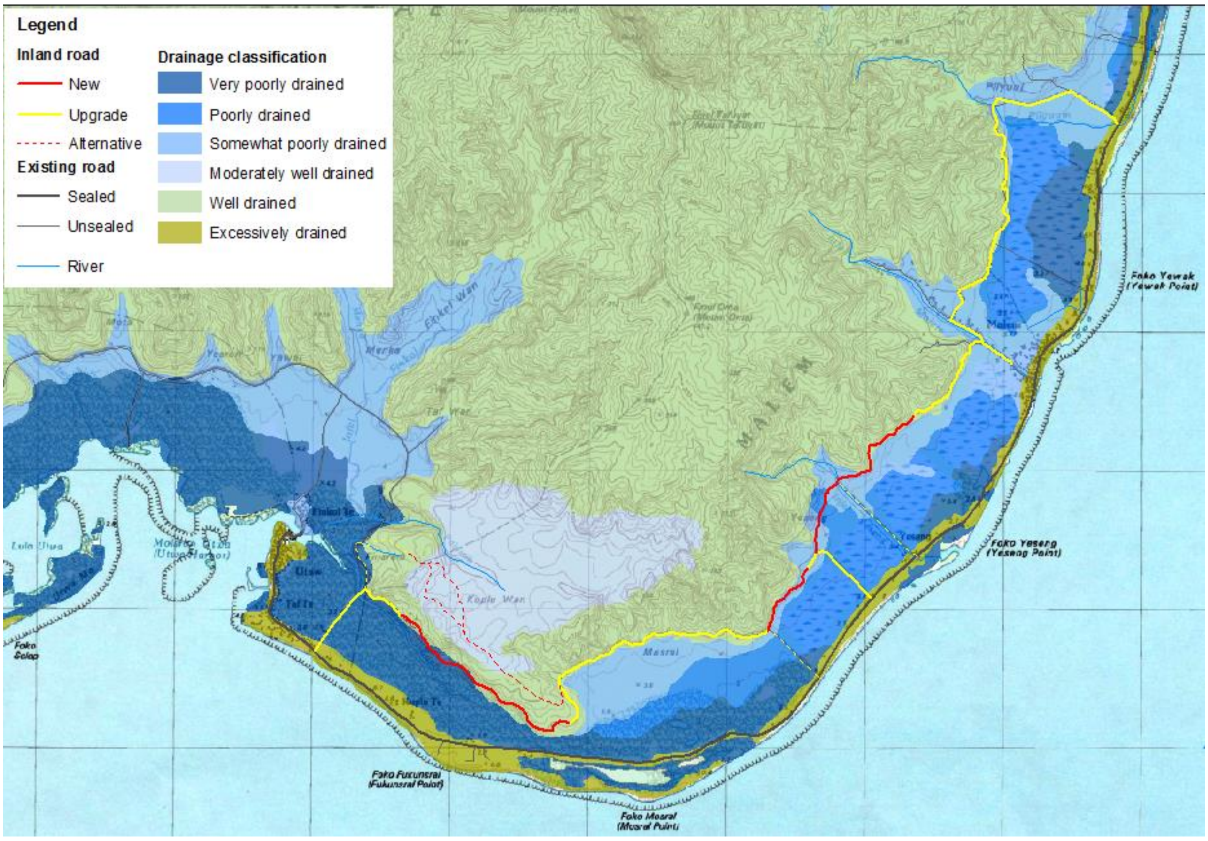

Figure 17: **Soil drainage classification.** Source: US Department of Agriculture (1983).

Specific soil characteristics for each of the relevant classifications from the US Department of Agriculture (1983) soil survey are summarised in Table 2.

Table 2: Proposed inland road route soil classification descriptions. Source: US Department of Agriculture (1983).

Name	Description
102-Fomseng gravelly silty clay loam, 30 to 60 percent slopes.	Shallow, well-drained soil on mountainsides. Formed in residuum derived dominantly from basic igneous rock. Slopes generally are concave. Areas are irregular in shape and are 2 to 1O hectares in size. The native vegetation is mainly mixed forest. Elevation is 10 to 300 meters. Typically, the upper 5 cm of the surface layer is dark brown gravelly silty clay loam and the lower 7 cm is brown silty clay loam. The subsoil is dark yellowish brown silty clay loam 33 cm thick. Highly weathered basalt is at a depth of 45 cm. Depth to basalt ranges from 25 to 50 cm. Included in this unit are small areas of Oatuu soils and soils that are similar to this Fomseng soil but are deeper. Also included are small areas of Fomseng soils that have stones or cobbles on the surface. Included areas make up about 25% of the total hectarage. The percentage varies from one area to another. Permeability of this Fomseng soil is moderately rapid. Available water capacity is low. Effective rooting depth is 25 to 50 cm. Runoff is rapid, and the hazard of water erosion is high. This unit is used for subsistence farming and as woodland and watershed.
114-Tolonier very stony silty clay loam, 6 to 30 percent slopes.	Very deep, well-drained soil on toe slopes and foot slopes. Formed in residuum and colluvium derived dominantly from basic igneous rock. Slopes are concave. The vegetation in areas not cultivated is mainly mixed forest. Elevation is 6 to 50 m. Typically, the surface layer is very dark brown very stony silty clay loam 12 cm thick. The upper 8 cm of the subsoil is dark brown cobbly silty clay loam, and the lower 67 cm is dark yellowish brown very cobbly silty clay loam. The substratum to a depth of 150 cm or more is strong brown very cobbly silty clay loam. Included in this unit are small areas of Dolen soils. Also included are small areas of Fomseng and Final soils that have slopes of more than 30 percent. Included areas make up about 20% of the total hectarage. Permeability of the Tolonier soil is moderately rapid. Available water capacity is moderate to high. Effective rooting depth is 150 cm or more. Runoff is medium, and the hazard of water erosion is moderate. This unit is used for subsistence farming.
115-Umpump very gravelly clay loam, 2 to 8 percent slopes	Moderately deep, moderately well drained soil on plateaus. It formed in residuum derived dominantly from basic igneous rock. Areas are irregular in shape and are 5 to 20 hectares in size. The native vegetation is mainly mixed forest. Elevation is 50 to 100 meters. Typically, the surface layer is dark brown very gravelly clay loam 13 cm thick. The upper 25 cm of the subsoil is strong brown gravelly silty clay loam, and the lower 32 cm is mottled, red silty clay loam. Highly weathered basalt is at a depth of 70 cm. Depth to basalt ranges from 50 to 100 cm. Included in this unit are small areas of Umpump soils that have stones or cobbles on the surface. Also included are small areas of Umpump and Tolonier soils that have slopes of more than 8 percent. Included areas make up about 20 percent of the total hectarage. Permeability of this Umpump soil is moderate. Available water capacity is moderate. Effective rooting depth is 50 to 100 cm. Runoff is slow, and the hazard of water

Name	Description
	erosion is slight. The water table fluctuates between depths of 60 and 100 cm throughout the year. This unit is used as woodland and watershed.
107-Nansepsep silty clay loam, 0 to 2 percent slopes.	Very deep, somewhat poorly drained soil on bottom lands. Formed in alluvium derived dominantly from basic igneous rock. Areas generally are long and narrow in shape and are 5 to 20 hectares in size. The vegetation in areas not cultivated is mainly mixed forest. Elevation is 2 to 10 meters. Typically, the surface layer is dark brown silty clay loam 17 cm thick. The subsoil is mottled, dark grayish brown and strong brown silty clay loam 43 cm thick. The substratum to a depth of 150 cm or more is dark greenish gray silty clay loam. Included in this unit are small areas of lnkosr and Sonahnpil soils. Also included are small areas of soils that are similar to this Nansepsep soil but have stones and cobbles on the surface. Included areas make up about 20% of the total hectarage. The percentage varies from one area to another. Permeability of this Nansepsep soil is moderate. Available water capacity is high. Effective rooting depth is limited by a high water table that is at a depth of 50 to 75 cm. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to occasional, very brief periods of flooding throughout the year. This unit is used mainly for subsistence farming. It is also used as watershed and for wildlife habitat.
104-lnkosr silty clay loam, 0 to 2 percent slopes.	Very deep, poorly drained soil is on bottom lands. Formed in alluvium derived dominantly from basic igneous rock. Areas are irregular in shape and are 2 to 10 hectares in size. The native vegetation is mainly swamp forest. Elevation is 1 to 10 meters. Typically, the surface layer is dark yellowish brown silty clay loam 17 cm thick. The subsoil is mottled, dark brown and dark gray silty clay loam 28 cm thick. The substratum to a depth of 150 cm or more is dark greenish gray silty clay loam. Included in this unit are small areas of Ngerungor and Nansepsep soils. Also included are small areas of soils that are similar to this lnkosr soil but have stones and cobbles on the surface. Included areas make up about 20% of the total hectarage. Permeability of this lnkosr soil is moderate. Available water capacity is high. Effective rooting depth is 150 cm or more for water tolerant plants. Runoff is slow, and the hazard of water erosion is slight. The water table is at a depth of 15 to 60 cm throughout the year. This soil is subject to occasional, brief periods of flooding throughout the year. Most areas of this unit are idle, but some areas are used for wetland taro and as woodland. The unit can be used for coconuts and bananas if artificial drainage is provided to lower the water table.
106-Nanlak mucky silt loam, 0 to 2 percent slopes	Very deep, very poorly drained soil is in coastal tidal marshes. It formed in alluvium derived dominantly from basic igneous rock. Areas are irregular or oval in shape and are 1 to 100 hectares in size. The native vegetation is mainly mangrove forest. Elevation is sea level. Typically, the soil is black mucky silt loam that ex1ends to a depth of 150 cm or more. It is underlain by basalt or coral rock at a depth of 100 to 150 cm or more. Included in this unit are small areas of lnsak soils and Chia soils that formed in moderately deep organic deposits overlying coral sand and gravel. Also included are small areas of soils that are similar to this Naniak soil but are shallower over bedrock. Included areas

Name	Description
	make up about 20 % of the total hectarage. The percentage varies from one area to another. Permeability of this Naniak soil is moderate. Available water capacity is high. Effective rooting depth is 100 to 150 cm or more. Runoff is slow, and the hazard of water erosion is slight. The water table is 30 cm above the surface to 30 cm below the surface. This soil is flooded daily with ocean saltwater during periods of high tide. It has a high content of sulfidic material, which makes it extremely acidic if drained. This unit is used for mangrove wood production and wildlife habitat.

3.5 Terrestrial flora and fauna

The Malem area is characterised by a number of landforms and associated ecosystems. From the ocean, these include the fringing coral reef, an intertidal reef flat which is generally between 100 m to 150 m wide, a narrow coastal berm upon which most human development is located, well developed lagoon mangrove strands between Mosral and Utwe in the south and brackish and freshwater swamp areas north of Mosral, a narrow colluvial/alluvial plain, narrow valleys along the main rivers, steep mountainous areas, and at Kuplu Wan a relatively flat upland plateau.

The terrestrial environment is comprised mostly of upland forest (Figure 18), which along with areas of agroforestry account for close to 70% of Kosrae's vegetation (Kosrae State Government, 2003). Kosrae has at least 511 vascular plant species, of which 261 are indigenous, with 31 endemic species (FSM DR&D, undated), including Nunu (*Horsfieldia Nunu*), Nahnek (*Elaeocarpus carolinensis*) and in the Yela watershed the only remaining stand of Ka trees (*Terminalia carolinensis*).

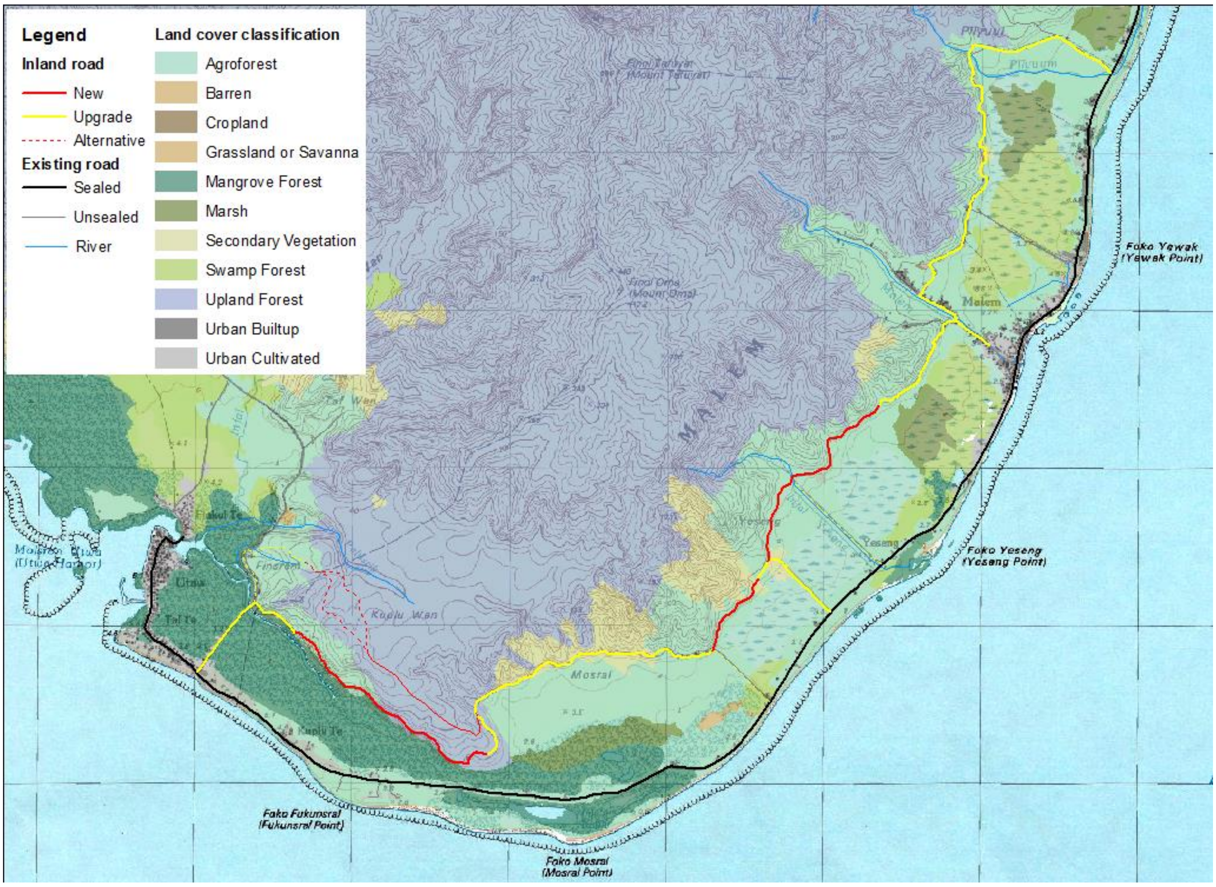

Figure 18: Land cover classification. Source: Kosrae Island Resource Management Authority.

Table 3: Summary of vegetation type characteristics. Source: Merlin et al, 1993; FSM DR&D, undated; Falanruw, 2002).

Vegetation type	Description
Native upland forests and dwarf forests	The undisturbed upland native forest on Kosrae provides a good example of tropical oceanic island rain forest. The principal forest genera here include *Horsfieldia*, *Neubergia*, *Psychotria*, *Syzgium*, *Campnosperma*, *Macaranga*, *Cyathea*, *Dendrocnide*, *Boehmeria*, and *Ficus*, and the only indigenous palm, *Ptychosperma ledermanniana*. Species diversity is high and many different species of ferns, both terrestrial and epiphytic, are present Dense vegetation covers much of the uplands, with plant types and species changing with elevation Species diversity is high and many different species of ferns, both terrestrial and epiphytic, are present. Above approximately 480 m elevation, dwarf or moss forests occur. Much of the upland forest up to about 100 m elevation has been altered through centuries of agroforestry and other human activities. This is particularly the case along much of the immediate upland areas in Malem. In Kuplu Wan the forest is dominated by tall Horsfieldia (*Nunu*), False Sandalwood (*Mwetkwem*), Elaeocarpus carolinensis (*Nahnek*), Banyan tree (*Kohnyah*), Strangler Fig (*Shrah*), Neubergia (*Tohoh*) and thickets of Hibiscus (*Lo*) and Parinari laurina (*Ahset*), (Bell, 1992). Tree ferns, lianas, vines and terrestrial ferns characterise the mid and ground levels. Minimal agroforestry occurs currently within the interior of Kuplu Wan but there has been greater use historically, including during the Japanese period.
Secondary vegetation	Generally occurring on the lower slopes of the volcanic part of the island where previously disturbed or cultivated areas have been abandoned. Vegetation consists of fast-growing small trees, shrubs and vines, such as hibiscus and bamboo.
Agroforestry	Agroforests occur primarily on the fertile lower slopes, characterized by a spatial and temporal mix of introduced and native trees and cultivated areas (fields, plantations, gardens, groves of trees or farms). Cultivated areas and tree crops (typically breadfruit, coconut palms and other fruit trees, banana, papaya, cassava, sugar cane, taro and yam), are typically interspersed with older, structurally complex forests of mixed species.
Grassland or Savana	Generally occurring on the lower slopes of the volcanic part of the island where vegetation is characterised by scattered shrubs, few trees, many ferns and various species of grasses and other small plants. The soils are often infertile and poorly drained with the areas likely to have been the result of repeated human cutting or burning resulting in erosion and loss of the humus layer.
Swamp and swamp forests	Swamp forests occur where soils are inundated with fresh or slightly saline water. They are most commonly found just inland of mangroves, above tidal influence but lower in elevation than the surrounding terrain. Forest plants are dominated by Terminalia (*Ka*), Horsfieldia (*Nunu*) and Barringtonia (*Kenguhl*). Kosrae has some of the most well developed and important swamp forests in the Pacific, for example in the Yela watershed on the north-west coast. Forest areas occur to the north and south of Malem. However, much of the freshwater swamp areas in Malem are covered in secondary vegetation having been heavily disturbed by intensive agriculture and associated drainage activities during the Japanese era (Figure 14) and their proximity to inhabited areas. Aquatic and marsh vegetation also includes grasses, sedges and reed grasses. Freshwater wetland areas are also an important area for cultivation where traditional root crops such as sweet and swamp taro are grown and replace the native vegetation.

Vegetation type	Description
Mangrove	Nine species of Mangrove occur on Kosrae with some of the largest and oldest mangrove trees in the Pacific found. Between Mosral and Utwe, back lagoon mangroves have developed in the lee of the coastal berm, . The unique Suhkasrihk (Rhizophora) mangrove trees include three species and one hybrid: Suhkasrik fwel (Rhizophora apiculata), Suhkasrik loes (Rhizophora mucronata), Suhkasrik fototo (Rhizophora stylosa), and Suhkasrik lolacp (Rhizophora x lamarckii). Also present are the Sroal (Bruguiera gymnorhiza), Fulofohl (Sonneratia alba), Tuhi (Xylocarpus granatum), and the increasingly rare Oi (Lumnitzera littoralis). Fahsuc (Nypa fruiticane) is also common, and Kwacngi (Pemphis acidula) is found mostly along the western side of the island.

The only indigenous mammal is the Kosrae flying fox (*Pteropus mariannus ualanus*) which is endemic. The species is protected under the Convention against International Trade in Endangered Species (CITES), and listed under Appendix I and II of the Convention. It is found in both swamp and mangrove forest areas, such as within Lelu Harbour, and in higher elevation forests including the Kuplu Wan area. At present a large colony has recently established in the mountainous areas above the Yeseng catchment, with numbers reduced in other commonly observed areas. Whether this is related to the severe drought conditions that have been experienced over the end of 2015 / beginning of 2016 due to El Niño is uncertain.

Kosrae has approximately 56 recorded bird species, with one endemic species, the Dusky White Eye. Within historic times the Kosrae Rail and Kosrae Mountain Starling have both become extinct with a number of other species declining in number. Of particular concern is the Micronesia Imperial Pigeon which was extensively hunted for food during the Japanese era, is now protected but still poached, and is generally now found only in the more remote upland areas. Most of the forest bird species are found throughout the Malem and Kuplu Wan regions and elsewhere in Kosrae. Whilst larger populations are found in areas of less disturbed mature forest, most are generally found through a variety of habitats including agro-forested areas.

Kosrae's benthic stream communities are species poor likely due to the comparative isolation of the island. Nine species of fish, two shrimp and one snail species have been recorded in a study of the Inem River in Lelu. The benthic insect community was also particularly low in taxonomic richness (March et al., 2003). This is likely to be representative of the stream and rivers in the Malem and Kuplu Wan regions also.

Other species have all been introduced either as invasive species (African snail, cane toads, frogs, rats, mice and monitor lizards) or common domestic animals (pigs, dogs, goats, cats, fowl) with feral pigs, cats and fowl common.

3.6 Conservation and culturally important areas

The Kosrae State Land Use Plan (Kosrae State Government) has identified and delineated 'Areas of Particular Concern' (Figure 19) and 'Special Consideration Districts' (Figure 20) to help guide the development of management and conservation strategies covering the following areas: Forests, Shoreline and Reef, Waste Management, Utwe-Walung Marine Park, and Historical Site Preservation.

Areas of Particular Concern include Mangrove Reserves, Shoreline Erosion Hazard Areas, Rivers and Water Resources (water supply catchments), mouths of Rivers, the Trochus Sanctuary, the Green Snail Sanctuary, Cultural & Historical Sites. These areas are identified as Areas of Particular Concern because of their sensitive ecological, cultural, and social requirements. It also includes areas identified in the FSM Conservation Blueprint as Areas of Biological Significance, (TNC, 2003). This was produced to identify species, natural communities, and ecological systems that represent the biodiversity of FSM; to record the best remaining examples of where these species, natural communities, and ecological systems occur; and to define, delineate, and prioritize "Areas of Biological Significance" (ABS) or clusters of high quality examples of species, natural communities, and ecological systems. Among the 130 Areas of Biological Significance (ABS) identified in the FSM, 12 are located in Kosrae (Figure 21 and Table 4).

Figure 19: Areas of particular concern. Source: Kosrae Land Use Plan.

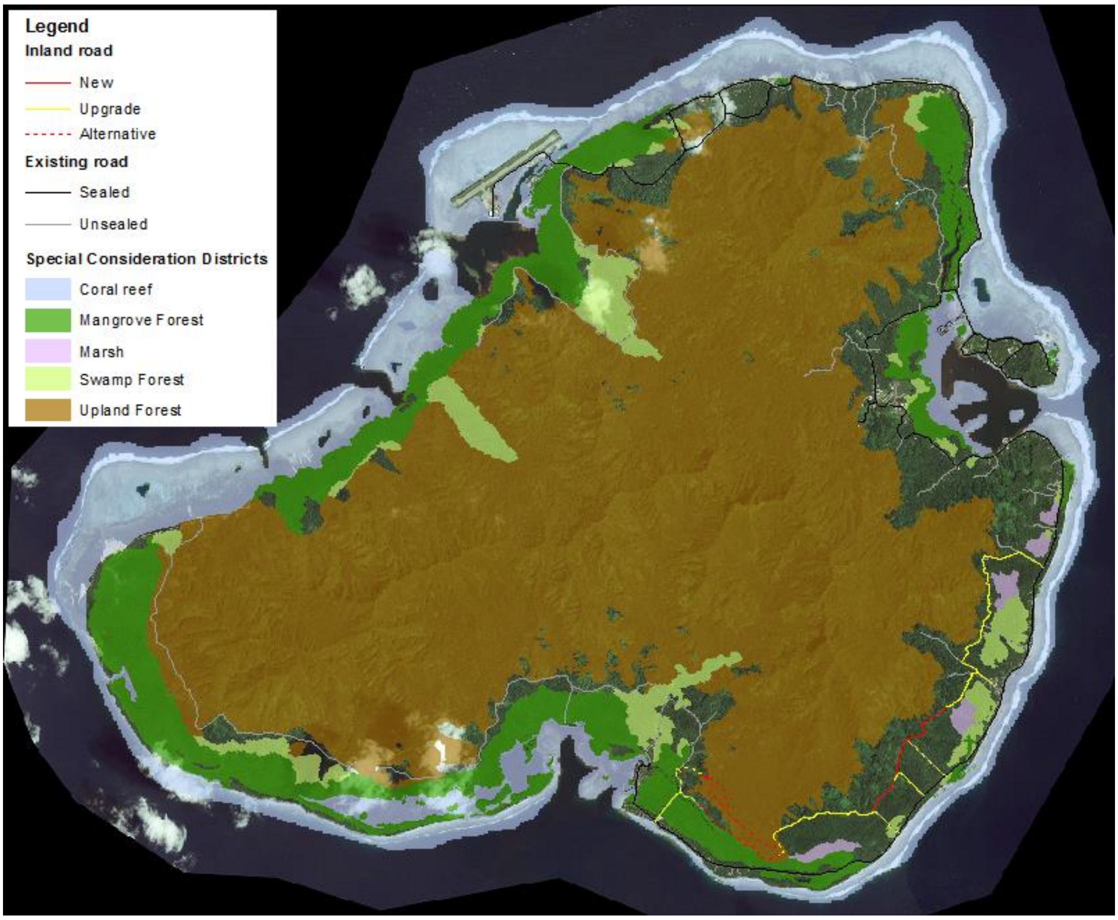

Figure 20: Special consideration districts. Source: Kosrae Land Use Plan.

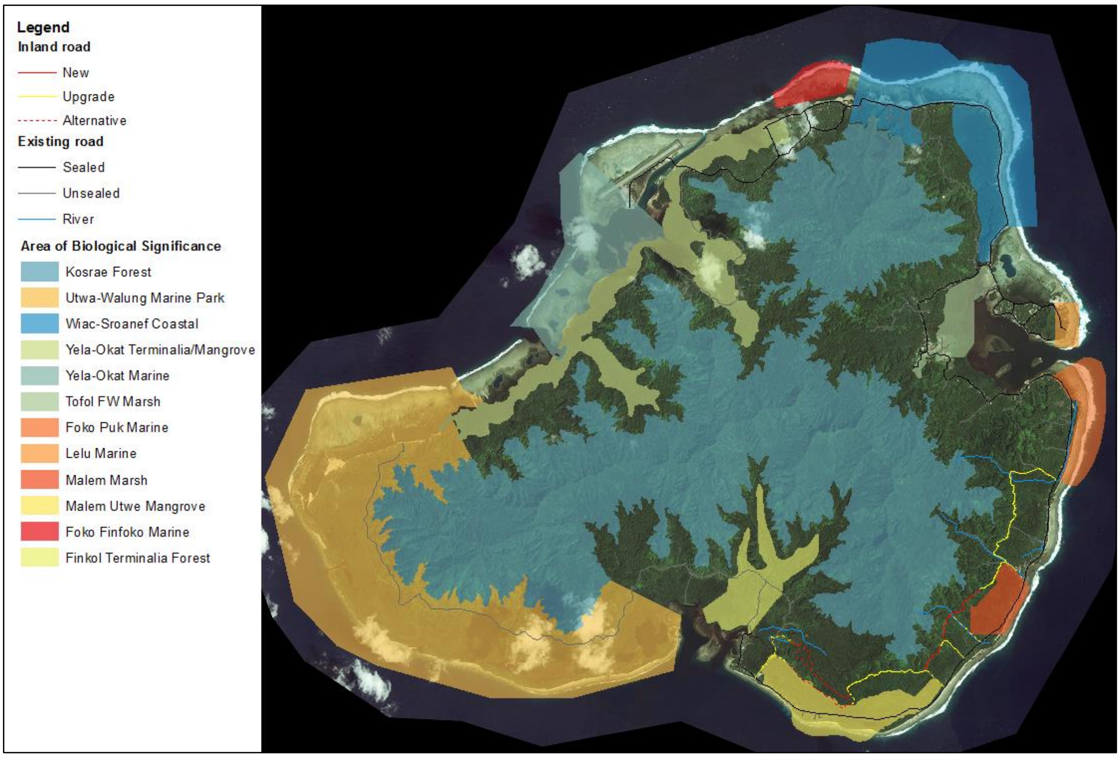

Figure 21: Areas of biological significance. Source: TNC (2003).

Table 4: **Summary of areas of biological significance.** Source: TNC, 2003. Relevant ABS within or adjacent to the inland road are highlighted.

Area	Description	Targets	Ranking
Kosrae Forest	All central forest above 100 m	Upland broadleaf forest, Montane cloud forest Micronesian Imperial Pigeon	
Utwe-Walung Marine Park	Existing boundaries of Utwe-Walung Marine Park boundaries	Turtle nesting beach. High-island nearshore marine, Kosrae flying fox, Micronesian Imperial pigeon	
Wiac-Shroanef Coastal	From shore to 100m out past reef	High-island nearshore marine	
Yela-Okat Terminalia / Mangrove	Yela and Okat Terminalia, Okat to Walung Mangroves	Terminalia swamp forests, mangrove forests	
Yela-Okat Marine	Shore to reef from Yela passage to airport	High-island nearshore marine	
Tofol Freshwater Marsh	Entire marsh below College of Micronesia / High School	Coastal freshwater marsh	
Foko Puk Marine	Shore to 100 m off reef	High island nearshore marine	
Lelu Marine	Coast and lagoon out to outer reef	Coconut crabs, Napoleon Wrasse	
Malem Marsh	Freshwater marshes and beach in Central Malem	Turtle nesting beach, Coastal freshwater marsh	
Malem-Utwe Mangrove	Mangroves and lagoon to outer reef	Mangrove forest, Kosrae flying fox, Humphead Parrot fish	
Foko Finfoko Marine	Finfoko coast to outer reef	Grouper Spawning	
Finkol Terminalia Forest	Terminalia forest at mouth of Finkol River	Terminalia swamp forests, mangrove forests	

Table 4 also shows a ranking for priority action based on a The Nature Conservancy marxxan analysis of the ABS (Kosrae DR&D, undated). This is being used to prioritise initial support under the US Forestry Service Forest Legacy Program with a proposal for the Yela Terminalia forest prepared and underway. Underpinning these initiatives is the Micronesia Challenge, the goal of which is to effectively conserve at least 30% of the near-shore marine resources and 20% of the terrestrial resources across Micronesia by 2020[3].

[3] http://themicronesiachallenge.blogspot.co.nz/

3.6.1 Historical and cultural sites

The location of known historical and culturally important sites are shown in Figure 22. The majority are military installations from the Japanese era with prehistoric sites at Lela and Kuplu/Mosral.

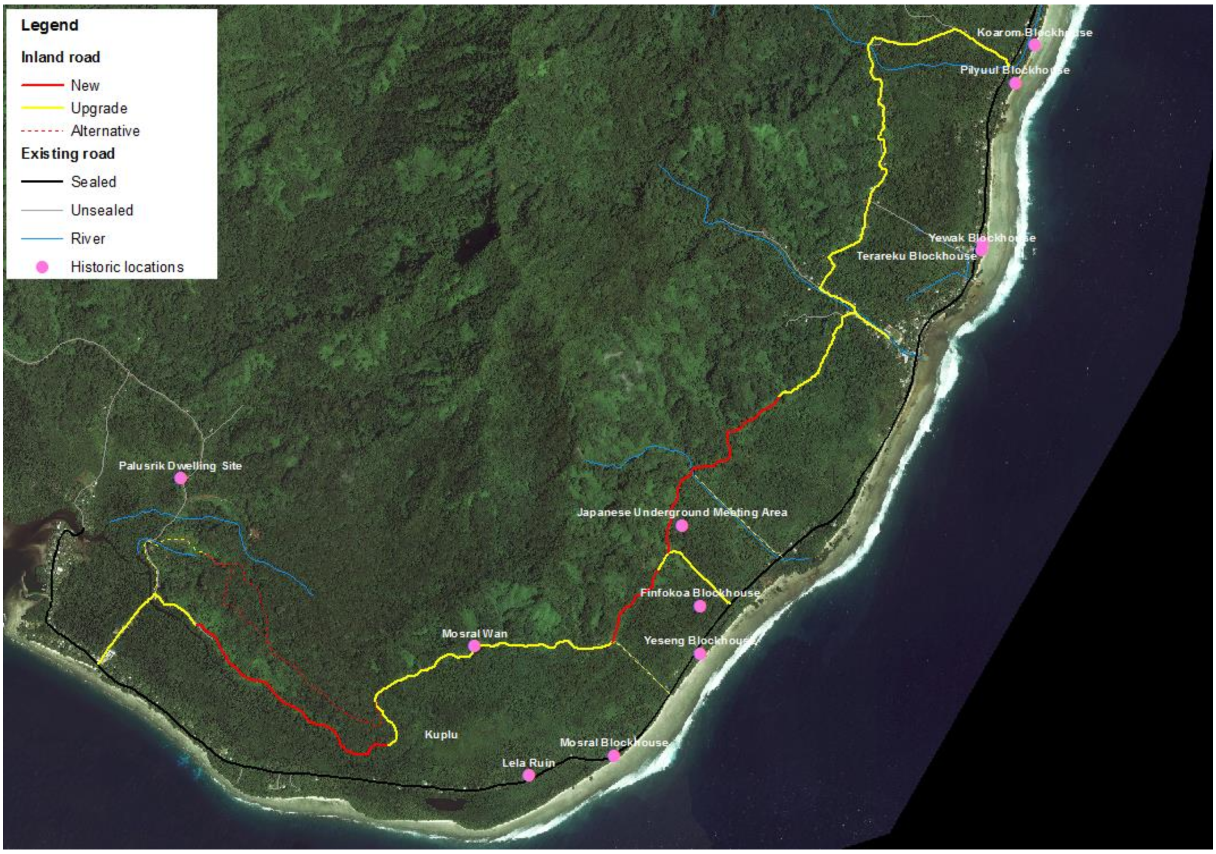

Figure 22: Location of known historical sites. Source: KIRMA.

The Kuplu and Lela areas (facl) was a previous settlement before people moved to the present Malem village location. The Lela area is thought to have been first occupied from the Kuplu and Kuplu Wan regions between A.D. 1282 to 1440, becoming the residence of the four low chiefs. The Lelu ruin contains five walled enclosures and fifteen internal features, including canoe landings, cooking areas, dwellings, graves and breadfruit preservation (Swift et al., 1997). Much of the coral rock used in the construction was removed during the Japanese era for construction projects. The commoners lived inland at Kuplu and Kuplu Wan practicing upland subsistence farming. Evidence of inhabitation in the form of stone house foundations, walls and cooking areas are evident. Generally these tend to be close to water sources, occur within the narrow valleys and around the base of the volcanic part of the island, for example at Mosral Wan where the foundations of a residential dwelling have been surveyed (Swift et al., 1997). Use of the Mosral uplands dates between A.D. 1432-1687 (Swift et al., 1997). Bell (1992) notes an initial cultural resource survey of the Kuplu Wan area in 1980 which identified 18 similar sites with a further 6 located during a survey in 1991, the majority of which are close to the Pukusrik River.

The occupation of Lela continued through the late 1700s to early 1800s with it thought that a severe cyclone that occurred during the late 1700s may have led to the abandonment of the settlement. There are also historical records that indicate that the majority of people moved from the Lela and Kuplu areas to Malem in 1852 at the request of the King.

4 Screening of potential environmental and social impacts and mitigation measures

4.1 Introduction

The preliminary EIA was conducted between Monday 16 May to Friday 27 May 2016. Details of the activities conducted during the week and consultations held are contained in Appendix A. During the visit GIS and other relevant information was collected and consultations held with key State, Municipal and community representatives. Field visits were undertaken with KIRMA (Permitting, Forest & Wildlife, and Historic & Preservation) and Department of Transport and Infrastructure staff along the proposed alignment of the inland road. This included all sections of existing farm road and along parts of the proposed new sections, specifically between Kuplu and Finsrem and through the Kuplu Wan plateau.

During the visits general observations were made of biophysical characteristics at each site, identification of potential issues and potential impacts that could occur from the development of the inland road.

Initial screening of potential environmental impacts was conducted using the KIRMA Regulations for Development Projects – Initial Environmental Impact Assessment Checklist, with potential impacts and mitigation measures discussed in more detail in the following sections.

Environmental Impacts – will the proposed project result in…		*Yes*	*No*	*May be*
Earth	a. Destruction, covering or modifications of any unique geological or biophysical features?		X	
	b. Contamination of soils or disturbance of previously or potentially contaminated soils?		X	
	c. Creation of steep slopes or other unstable land conditions?			X
	d. Any potential for increased wind or water erosion (including in coastal areas) or soils, either on or off the site?			X
	e. Changes in the channel of a stream, or the bed of the ocean or lagoon?			X
Air	a. Substantial air emissions, including greenhouse gas emissions, or deterioration of existing air quality?		X	
	b. Creation of objectionable odors?		X	
Water	a. Changes in currents, or the course or direction of water movements in either the marine or fresh waters?		X	
	b. Changes in absorption rates, drainage patterns, or the amount of surface runoff?	X		
	c. Cause or exacerbate coastal, stream or river flooding or land drainage impacts?			X
	d. Alterations to the course of flow of flood waters?			X
	e. Discharge into surface waters or any alteration of surface water, water quality, including, but not limited to, temperature, dissolved oxygen, bacteria or turbidity?		X	
	f. Change in the quality or contamination of ground waters or wells, either through direct additions, withdrawal, seepage, or through interception of an aquifer by cuts or excavations?			X
Plant life	a. Destruction of any upland or mangrove forest communities?			X
	b. Destruction of other important plant communities, such as sea grasses, or plants having potential commercial or medicinal value?		X	
	c. Destruction of or reduction in the numbers of any unique, rare or endangered plant species?		X	
	d. Introduction of a new plant species into an area?		X	
	e. Result in a barrier to the normal replenishment or movement of existing plant species?		X	
	f. Increase in acreage of any agricultural crop?		X	

Animal life	a. Destruction of any coral reef areas?		X	
	b. Destruction of or reduction in the numbers of unique, rare or endangered animal species?		X	
	c. Introduction of new animal species into an area?		X	
	d. Result in a barrier to the migration or movement of animals through the environment?		X	
	d. Substantial deterioration in the quality of fish or wildlife habitat?		X	
Alien invasive species	a. The potential introduction of an alien invasive species?		X	
	b. The risk of spread or movement of an alien invasive species from an infested site to an un-infested site?		X	
Risk of upset	a. A risk of an explosion or the release of hazardous substances, including, but not limited to, oil, pesticides, chemicals or radiation, in the event of an accident or perturbed conditions?			X
Climate change – will the proposed project be affected by…				
	a. Loss of land associated with ongoing, or storm or typhoon-related, shoreline change or coastal erosion?		X	
	b. Coastal flooding from high tides, large swells, storm or typhoon-related events?		X	
	h. Exposure of people or property to water related hazards such as flooding or tidal waves?		X	
	c. Extreme rainfall and associated flooding, including from rivers and streams, or waterlogging and drainage of low-lying land?	X		
	d. The effects of sea-level rise or other climate change influences of the hazards in (a) to (c)?		X	
Social impacts – will the proposed project result in…				
Earth	a. Exposure of people and property to geological hazards such as landslides, ground failure or similar hazards?		X	
Water	a. Substantial reduction in the amount or quality of water otherwise available for public water supplies?		X	
Noise	a. Increase in existing noise levels or exposure of people to severe noise levels?		X	
Land use	a. Substantial alteration of the present or planned land use of an area?			X
	b. Incompatibility or conflict with adjacent land use(s)?		X	
Population	a. Relocation or altered distribution, density or growth rate of the human population of the area?	X		
Housing	a. Changes in existing housing or create a demand for additional housing?	X		
Transportation	a. Generation of substantial additional vehicular movement?		X	
	b. Substantial impact on roads and existing transportation system?	X		
	c. Alteration to present patterns or movement of people and/or goods?	X		
Human health	a. Creation of any health hazard or potential health hazards?		X	
	b. Improvement in human health?		X	
Aesthetics	a. Obstruction of or deterioration of any scenic vista?		X	
Recreation	a. Changes in the quality or amount of existing recreational opportunities, including those recommended sites for nature-based tourism?		X	
Cultural resources	a. Alteration or destruction of archaeological sites?			X
	b. Adverse physical or aesthetic effects to a historic resource?			X
	c. Potential to cause a physical change that would affect unique cultural values?		X	
	d. Restriction of existing religious or sacred uses within the affected area?		X	
Economic impacts – will the proposed project result in…				
Natural resources	a. A noticeable increase in the rate of use of any natural resource?			X
	b. Substantial depletion of any non-renewable natural resource?		X	
Public services – will the proposed project affect or result in the need for new or altered services in the following areas?				
	a. Police or Fire Protection?		X	
	b. Schools?		X	
	c. Parks or other recreational facilities?		X	
	d. Hospital?		X	

	e. Other government services?		X	
Utilities – will the proposed project result in the need for new systems or substantial changes in the following?				
	a. Power?	X		
	b. Communications?	X		
	c. Water?	X		
	d. Sewage disposal?	X		
	e. Solid waste disposal?		X	

4.2 Environmental impacts and mitigation due to the road alignment

4.2.1 Initial road alignment

The indicative alignment of the inland road was initially defined in the KSMP along the base of the volcanic part of the island at approximately the 10 m contour in a similar manner to other existing sections of inland road on Kosrae (Figure 5). This is generally located on the narrow strip of land between:

- the landward boundary of freshwater swamp / mangrove areas and on land above areas potentially affected by sea-level rise over the next century and beyond.
- Below the steep uplands and areas exposed to slope instability and landslipping

Following the natural topographic contour also helps minimise the potential erosional impact of the road.

Between Malem and the end of the inland farm road at Kuplu, and between Malem and Pilyuul, the alignment follows existing farm roads with connecting new sections. No significant environmental effects are anticipated due to the alignment. Maintaining a relatively consistent road level avoids any significant cut and fill and increased maintenance issues associated with steeper road grades. It also limits any significant slope stability issues and as a result soils with significant erosion potential, is through an area of secondary or agroforestry vegetation with no direct impact on wetland or mangrove areas, and does not directly impact on known environmentally or culturally important areas.

During the field visit for the new section of road between Kuplu and Finsrem it was apparent that for much of this section there was insufficient width to accommodate the road without either:

3. Cutting in to the steep ridge that borders the southern boundary of the Kuplu Wan plateau. There was existing evidence of landslipping on land cleared for agroforestry at the Finsrem end and such activity would likely lead to further instability, as well as substantially increasing the cost of road construction, or
4. Creating additional width through filling the landward edge of the Mosral-Utwe mangrove area. This would require a substantial amount of fill to be sourced and transported to site, significantly increasing costs. The mangrove area is a defined medium priority area of biological significance and would be directly impacted, requiring mangrove removal, with further impacts likely due to associated sediment run-off during construction, even with controls in place. Concern was also raised by the KIRMA Forestry staff over increased access leading to accelerated mangrove harvesting (and dumping) in an area that is presently only accessible by canoe. Given

present pressure on mangrove harvesting in Kosrae this would be a likely consequence.

There was also of evidence of groundwater springs discharging at the base of the slope along this section (Figure 13) which are used for private water supply in Finsrem and are important sources of water for Utwe residents during drought conditions when the water supply from the Palusrik River can dry up.

4.2.2 Kuplu Wan road alignment

To mitigate these concerns other potential road alignment options were explored via the Kuplu Wan plateau. This would elevate the road to around 80 m above mean sea level on the plateau and be located on State land above the Japanese line. An initial route was proposed (Kuplu Wan Option 1 in Figure 23) which aimed to minimise road grade on both flanks leading up to the Kuplu Wan plateau, and build on an existing farm track extending up the small Finsrem River catchment.

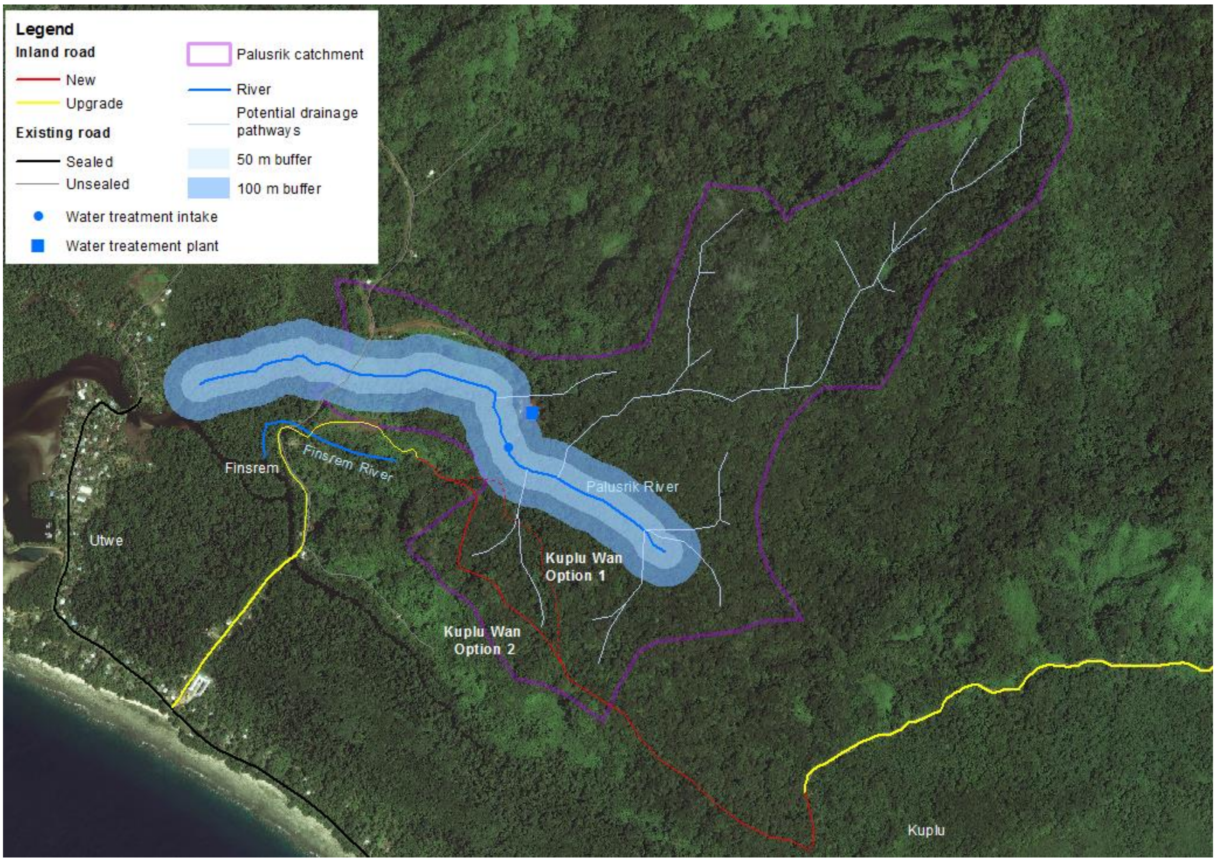

Figure 23: Kuplu Wan road alignment options and buffer zones from the Palusrik River.

During all discussions with the State, Malem and Utwe communities, an option through Kuplu Wan was also identified as the preferred option. However, significant concerns were raised by the Utwe community concerning potential contamination on their water supply which is sourced from the Palusrik catchment from:

1. The location of the road and construction resulting in increased sediments or other contaminants entering the Palushrik River and the Utwe water supply.

2. The improved access to the Kuplu Wan area created by the road subsequently leading to increased development in the Kuplu Wan area, including land clearing, septic tanks, pig pens etc, resulting in increased potential for contamination of the Utwe water supply.

4.2.3 Impact on Utwe's water supply

Road alignment

The Kosrae Land Use Plan recommends a development buffer of 15 m for rivers in watersheds above municipal dams. However, a minimum of 50 m would be more typical for perenial flow waterways used as a drinking water source where there is minimal risk of highly contaminant or hazardous pollutant sources. The closest point of the proposed road alignment (Option 1) to the Palusrik River upstream of the Utwe water treatment plant intake is where the road alignment crosses the watershed boundary between the Finsrem and Palusrik catchments. There the road is located approximately 75 m from the river just above the intake.

About one third of the Palusrik catchment is within the Kuplu Wan plateau. Also shown in Figure 23 are the potential main drainage flow pathways within the catchment based on a basic analysis of available digital elevation data from the 1:50,000 Kosrae topographic map. Overland flow to the Palusrik River via these pathways will be intermittant with groundwater flow likely to dominate. It is known that the Kuplu Wan area acts as a recharge for the seepage springs around the southern and western base of the slope leading off of the plateau. However, there is little information of the aquifer and groundwater flows within plateau area.

Bell (1992) noted that the Umpump soil defined in the soil classification (see Figure 17 and Table 2) is generally found on the ridge tops and shoulder slopes of Kuplu Wan and is moderately well drained and moderately permeable. However, 75% of the Kuplu Wan area is an Umpump Variant soil which is found on the side and toe slopes. This soil is deeper than normal soils found on Kosrae, excellent for agriculture, well drained and moderately pemeable but with a fair amount of clay.

Discussions with the Utwe community identified that they would prefer as much a buffer zone as possible between the road and the main Palusrik river course above the water intake, with the Option 2 alignment (Figure 23) subsequently developed. This results in a minimum buffer of 150 m at the watershed between the two catchments and over 350 m for the majority of the section of inland road within the Palusrik catchment. Given the distance to the Palusrik River, the only perennial stream in the catchment, and the characteristics of the likely catchment drainage parthways, there is unlikely to be any impact from the construction or operation of the road itself on Utwe's water supply.

Future development of the Kuplu Wan area

Providing road access through Kuplu Wan will increase development pressures on the area. The road alignment through the Kuplu Wan area is above the Japanese line with land currently under state control and no private development presently permitted to occur. However, the side and toe slopes of the Kuplu Wan plateau provide some of the best agricultural soils available of Kosrae and with improved access to the land by the Malem community (who traditionally owned the land) it is likely small-scale agroforestry activities will increase within the Kuplu Wan area. As long as such activity is small-scale and does not involve clearing of vegetation (which is prohibited above the Japanese line), pesticides and fertilisers are not used, and at least a 15 m buffer from the Palusrik River and any intermittant tributaries is maintained, impacts on water quality should be insignificant.

However, in the longer term if legal processes are established to enable recamation of title above the Japanese line, the Kuplu Wan area is likely to be one of the few significant areas where development could be considered in the uplands. Increased intensive agriculture practices, development of residential properties and associated septic tanks and pig rearing will potentially impact on the quality of Utwe's water supply.

Within KIRMA the process is underway to develop watershed management plans with a focus on the water-supply catchments, including the Palusrik catchment. This provides an opportunitiy to identify and agree the necessary protections (and conduct further technical studies if required) for the Palusrik water catchment and to get these incorporated in to the *Regulations for Development Projects* legislation prior to land being returned to private ownership.

4.2.4 Implications for existing landowners and residents

Land below the Japanese line is typically privately owned with landowners holding legal title. For approximately 1.4 km of the exisiting farm road from Mosral to Kuplu, an easement for the farm road is in place and surveyed, with similar easements in place along the existing access roads at Utwe and Malem. In Malem Municipality the 60 ft wide easement for the proposed inland road alignment, and access road at Yeseng crosses approximately 70 land parcels, with a further 4 at Finsrem in Utwe. This represents a small proportion of each parcel with landowners not considered vulnerable by economic, minority or gender status. The State and Municipal Governments have legal procedures in place to negotiate and establish easements with landowners. Previous consultations, both in the development of the AF proposal, and prior to that during the developnment of the KSMP, with affected landowners have been fully supportive of the road development as it will provide much improved access to their land. Malem Municipal Council have begun easement discussions with the landowners.

Between Malem and Kuplu, there are a total of 7 properties adjacent to the indicative line and easement with of the inland road. However, there is sufficient space to align the road to avoid any relocation or removal of property. Between Malem and Pilyuul there are approximately 20 properties adjacent to the existing farm road, again none of which will be required to be relocated or removed.

4.2.5 Additional mitigation requirements for road alignment

The alignment of the road indicated in the above figures is still indicative and will require a full survey to determine the final alignment. This is not expected to deviate to any great extent from the alignment shown. The final alignment of the road should:

- Avoid the need for the removal of any large tree species particularly endemic species such as Nunu (*Horsfieldia*)
- Not be located any lower than the 4 m contour.
- Not result in clearing of slopes greater than 30% and to minimse sustained road grading below 12% as defined in Kosrae's road design standards.
- At the time of clearing for the survey, the Historic and Preservation Office of KIRMA will be required to carry out a survey along the proposed route to identify any further cultural and historic sites. The road alignment should be re-routed sufficently around any identified sites to enable them to be properly investigated.

4.3 Environmental impacts & mitigation related to road design

Kosrae has a standard for road design developed when the circumferential road from Okat to Walung to Utwe was proposed (Barrett Consulting Group, 1987). The design standards are still applicable but with some updating required. Key design issues relate to impacts on catchment drainage pathways and the management of rainwater runoff from the road:

4.3.1 Mitigating impacts on catchment drainage pathways

The inland road will cross a number of perennial and intermittent streams that drain the upper catchments in to freshwater swamp / mangrove areas. Appropriate drainage structures will be required to ensure no changes on stream channel location, impacts on upstream (or downstream) drainage characteristics, and downstream ecological function.

Where there are farm tracks at present, single lane bridges or box culverts are typically in place to cross the main streams. It is anticipated approximately 9 new/replacement bridges or culverts will be required between Malem and Kuplu, one bridge to replace the existing single lane bridge across the Finsrem River at Utwe, and for the Pilyuul section four bridges/culverts.

The road design standards include appropriate bridge/culvert design and methodologies to calculate extreme flow rates for the design of drainage structures based on extreme rainfall amounts (1 in 10 year return period event) and the area of the relevant catchment. However, rainfall intensity amounts contained in the standards are out of date and do not include allowance for increased intensity rainfall for climate change. To mitigate potential design impacts on drainage flows:

- Bridge and culvert design should be based on the most recent extreme rainfall intensity amounts available for Kosrae (ADB, 2005) and shown in Figure 24. Given the "present day" is considered to be the 1980-1999 period it is suggest that the 2025 projections are now considered "present day", and the design accommodate rainfall intensities to the 2050 projections.

- Bridges and culverts are designed to accommodate a 25 year return period flow. This is higher than the 10 year return period specified in the design guidance. However, the intensities in Figure 24 are based on a mid-range climate change scenario and there are also typically considerable uncertainty levels associated with extreme rainfall projections, hence the additional allowance would be pragmatic. Based on Figure 24 this would increase the design hourly rainfall intensity used from 150 mm to 256 mm.

- The road design standards include specifications for bridge and culvert wing walls to avoid bank erosion immediately upstream/downstream of each structure.

- Where necessary rock mattresses or equivalent should be installed to prevent any erosion of either the upstream or downstream water course. If exit velocities from the any of the culverts of bridges are likely to be significantly increased above normal, energy dissipation measures should also be included to minimise downstream erosion.

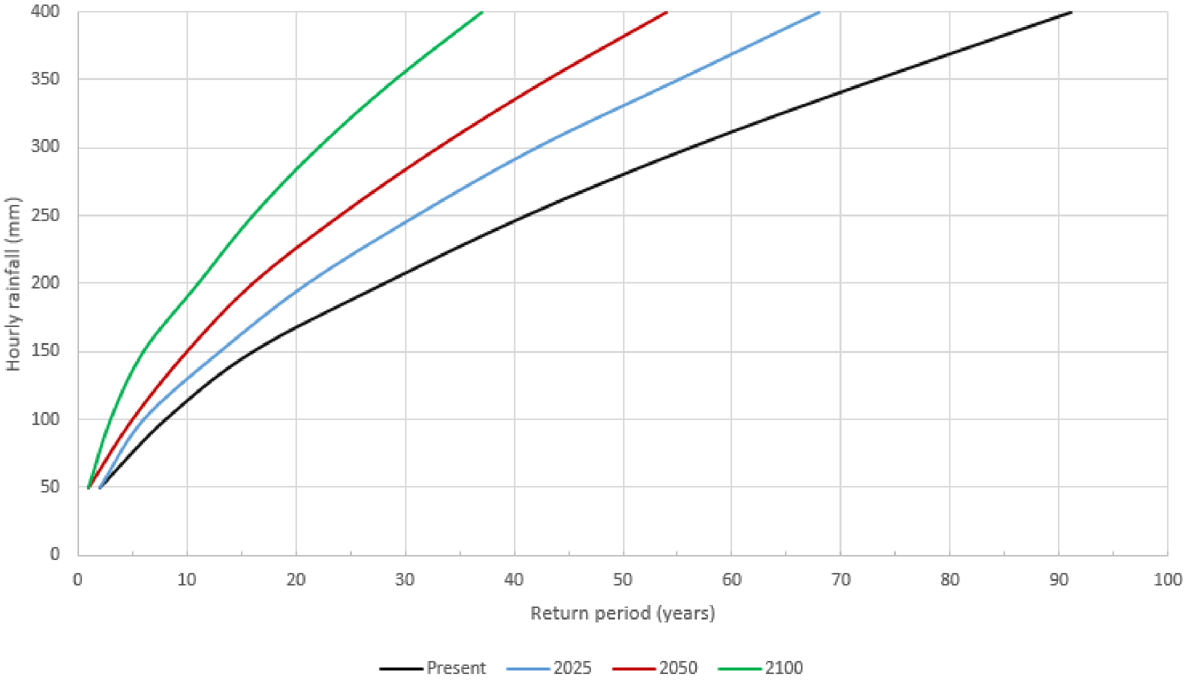

Figure 24: Hourly extreme rainfall amounts for the present day and years 2025, 2050 and 2100. Projections based on the IPCC AR4 SRES A1B Scenario. Source: ADB (2005).

4.3.2 Mitigating stormwater runoff and surface erosion

Construction of the proposed inland roads increases the amount of impermeable surface areas, which increases the amount of superficial water runoff. Increased stormwater run-off can lead to increased stream erosion and flooding and may also be contaminated by oil and grease, metals (e.g. lead, zinc, copper, cadmium, chromium, and nickel), particulate substances and other pollutants released by vehicles on the roadway.

The standard cross-section design allows for a 3% crossfall for a sub-base road surface and should be no less than this to enable sufficient drainage from the carriageway. The design also allows for vegetated swales on one or both sides of the road. These vegetated swales need to be sized to accommodate design rainfall (see above), enable collected stormwater to drain away within a few hours to a day, and facilitate water quality improvement through infiltration, filtration and sedimentation.

The design guidelines also suggest that any sustained longitudinal gradient of the road should be no greater than 12%. The road alignment through Kuplu Wan raises the road elevation from around 10 m relative to mean sea level at Finsrem and Kuplu to around 80 m on top of the plateau. Average sustained gradient at the Kuplu side is between 11-12% and around 8% at the Finsrem side.

Preventing longitudinal water movement is critical on sloping sections of road, particularly on unpaved roads, where ruts will typically develop leading to increased sediment run-off. Designing the road and associated drainage to minimise water running along the road will be critical on all the sloping sections and will need to include some or all of the following:

- Aligning the road to minimise long sloping sections, where necessary having shorter steep sections interspersed with flatter sections that follow the topographical contours.

- Having in- or out-sloping road surfaces to encourage greater lateral flow
- Intercepting longitudinal water movements with dips or cross drains.
- Slowing drainage flows in the swales or drains at the side of the road to prevent erosion of the drainage channel, through for example construction of regular check dams along sloping sections of road. These are typically made out of graded rock, with other material such as sandbags able to be used as a temporary measure until the rock check dams are installed.

4.3.3 Mitigating impacts of sea-level rise and future coastal hazards

The alignment of the road has been designed to be well above any potential impacts of sea-level rise and coastal hazards over at least the next century based on guidance in the Kosrae Shoreline Management Plan which has been incorporated in to January 2014 amendments to the *Regulations for Development Projects*. This requires new infrastructure on the volcanic parts of the island to be at an elevation of at least 4 m above mean sea level datum of Kosrae, which is approximately around 2 m above mean high spring tide level. The alignment of the road is typically at the 10 m contour and should minor realignment be required during the detailed survey it should not extend below the 4 m contour or require fill of land areas below the 4 m contour.

4.4 Environmental impacts and mitigation associated with construction

4.4.1 Erosion and sediment control

The most significant impacts related to construction activities relate to potential excessive runoff of soil and silt and soil erosion of cleared or exposed soils during construction. The alignment of the road (discussed above) was, as far as possible, located on soils with lower erosion potential and to follow the natural topographic contour which helps reduce potential erosion.

The downstream environments are adapted to a certain amount of soil and silt runoff. Despite the relatively natural state of the catchments, stream turbidity can increase substantially during periods of intense rain. Measurements in streams leading to the Lelu water supply in Tofol indicated variations in turbidity from < 10 NTU[4] to > 250 NTU over short periods of time. These storm events are generally short duration with streams reverting to typical flows and low turbidity and do not appear to have significant impact on stream biota or downstream ecosystems. However, increased sediment run-off will need to be controlled during all phases of construction to ensure no increase in the potential length of time of elevated stream turbidity levels

Within the KIRMA EIA process all projects with earthmoving must have an erosion and sediment control plan. This is outlined below.

- No burning of ground cover for clearing shall be practiced.
- Stockpiles of sand, soil or other aggregates/materials will not be located where material can be washed in to a drain, stream or wetland area, including on a road pavement, on an overland flow path or within 15 m of a stream bank, wetland or mangrove.

[4] Nephelometric Turbidity Units. Drinking water is generally less than 5 NTU and highly murky water > 200 NTU

- Geotextile sediment fencing will be erected around all areas where vegetation has been cleared and soil exposed. The fence should be installed prior to clearing, as close to the contour of the site as possible, with the bottom edge of the fence buried to at least 150 mm, and the fence posts installed on the down-side of the fabric. The fences will be checked regularly and where sediment has built up, this will be removed.
- If required, for example for larger exposed areas, sediment fencing will be complimented by some or all of the following: temporary drains or bunds around areas to prevent discharge of storm water, sediment traps to slow run-off containing sediment and allow settlement of coarse sediment, erosion control matting or mulch on any exposed batter slopes prior to revegetation.
- As soon as possible after works are completed, rehabilitation of exposed areas on the shoulder and adjacent areas will be undertaken. Excavated topsoil will be stockpiled and re-used and revegetation completed of bare areas. Revegetating buffer areas around streams and other catchment drainage pathways will be prioritised. The discussions with KIRMA and Kosrae Conservation and Safety Organisation suggest that as part of the AF project, community engagement and involvement to assist with revegetation activities including the planting of native species around streams and potential food trees along the edge of the road shoulder would be undertaken.

4.4.2 Control and disposal of wastes and hazardous materials

Construction design and planning should aim to ensure waste is minimised as much as possible. Also where possible the opportunity should be taken to use other recycled materials on Kosrae, such as crushed glass and crushed concrete in the road sub-bases.

The following controls will be undertaken:

- All non-hazardous, non-recycleable waste will be placed in containers are regularly emptied and disposed of to a permitted landfill site.
- Lubricants and used oil will be stored in approved containers and promptly removed from site and disposed of as directed by KIRMA.
- Care will be taken to prevent any releases or spills of fuel and lubricants during fuelling and maintenance of construction equipment and will be prevented from entering the ground, drainage areas or water courses by using appropriate containers and bunds.
- Any oily debris and contaminated soils will be recovered and disposed of as directed by KIRMA.
- Adequate sanitary convenience that meets public health and environmental requirements will be provided for construction staff on site.

On completion of the works all surplus materials and construction debris shall be removed and recycled or disposed of in an appropriate manner. Any remaining exposed earth surfaces shall be reinstated to match the surrounding topography and revegetated.

4.4.3 Dust control

For dust emissions, prevention and control techniques will include:

- Land clearing, removal of topsoil and excess materials and construction activities will be planned with due consideration to meteorological factors (e.g. rainfall, temperature, wind conditions) and location of residential property or other sensitive receptors.
- During periods of dry conditions water spraying of roadways, other exposed areas and any stockpiles will be implemented. Exposed surfaces of stockpiled material will be covered during prolonged periods of dry conditions.
- During construction, roads will be adequately compacted and periodically graded and maintained with speed limits for trucks and other vehicles applied if necessary.

4.4.4 Haulage and construction vehicle movements

The impacts of construction traffic on Malem and Utwe villages and other residential areas will be minimised as much as possible:

- Equipment and trucks passing through Malem village and other residential areas will slow to an appropriate speed to avoid noise and vibration disturbance as far as possible.
- Construction vehicles using public and private roads will be clean with loads secured to prevent accidental spillage. Any accidental spillage of material or soil transported on to roads beyond the immediate construction area will be promptly cleaned up.
- Establishment of machinery storage and washdown areas will be kept to a minimum and will be removed and the area reinstated and vegetated after construction. Any washdown areas shall be a minimum of 15 m from any natural water course and washdown runoff will not be discharged in to natural waterways.

4.4.5 Noise control

Construction activities will be conducted by DT&I and will take all reasonable steps to ensure minimum nuisance to adjacent land users and property owners during construction.

Construction activities will be limited to daytime working hours during standard working days, with no work on weekends or public holidays except for necessary emergency work.

4.4.6 Access by residents

DT&I will ensure that reasonable access is maintained to land and property affected by construction activities and that health and safety is not compromised at any time.

4.5 Environmental impacts associated with operation

The road will become the responsibility of the DT&I who are responsible for maintenance of the primary road network in Kosrae.

Under the first phase of the inland road to a sub-base surface, regular maintenance of the road and road drainage structures is essential to minimise erosion and damage to the road surface and sediment runoff. Regular inspections, particularly after periods of heavy rain, need to be conducted of the road, drainage and drainage infrastructure. For as long as the road surface remains to a sub-base standard, remedial maintenance involving regrading and compacting will be required to ensure the main road carriageway is kept free of vegetation, the slope of the road crossfall is maintained to ensure adequate drainage and rills or scouring of the road surface are promptly addressed. Ensuring sediment has not built up in drainage swales and that no road-related sediments are entering waterways will also be required. Equipment is available within DT&I to adequately carry out all maintenance activities.

4.6 Environmental monitoring

KIRMA Permitting staff conduct routine monitoring of development activities to ensure that development permitting conditions are being adhered to. KIRMA also conducts various environmental monitoring activities including related to forestry inventory, invasive species, shoreline change. They also conduct water turbidity testing, using a turbidity tube, of the various water supplies including the upgraded water treatment plant at Utwe.

In additional to KIRMA's regulatory monitoring, discussions with KIRMA and KCSO have identified a number of direct monitoring opportunities to aid community engagement, particularly around stream and watershed protection. This is likely to include:

- Extending routine turbidity monitoring and visual inspections off all downstream perennial streams and rivers along the length of the proposed inland road to ensure no increase in the amount or frequency of sediment runoff.
- Development of a community-based stream health toolkit based on visual and biota indicators to assess long-term changes in stream health and support the necessary ecosystem approaches, such as riparian buffers, to protecting stream, wetland and other downstream ecosystems from increased inland development

5 Conclusion

This preliminary Environmental Impact Assessment builds on existing studies and identified State, Municipal and community concerns. The overall conclusion is that environmental impacts from the proposed inland road are low to moderate and can be adequately controlled through:

- Maintaining the alignment of the road between Malem and Kuplu (and Malem to Pilyuul) close to that proposed following approximately the 10 m contour.
- Realignment the road between Kuplu and Finsrem via Kuplu Wan to avoid both difficult construction (land slipping, inadequate space to creat the road), and important ecosystem (Mosral to Utwe Mangrove system)
- Adhering to the mitigating recommendations made in the previous sections, particularly around sediment control and stormwater runoff, and any others subsequently specified in the Development Permit conditions.

At this stage no potential significant issues have been identified that would require further assessment to understand or address potential impacts.

A further environmental management plan will be required to address the specific issues if the Chinese funding is secured for the next phase of construction to upgrade the Malem to Utwe inland road to hot-mix asphalt.

6 Acknowledgements

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7 References

Appendix A   Summary of activities and consultations.

Date	Meeting	Purpose
Monday 16 May	Arrive Kosrae at 3 pm	
Tuesday 17 May	Meeting with, Governor Lyndon Jackson, Acting Attorney General Carson Sigrah & KIRMA Director, Robert Jackson	Courtesy meeting and discussion around the AF Proposal, linkages to potential Chinese funding and other proposed activities including Compact Funding.
	KIRMA staff & DT&I Director Robert Jackson Blair Charley, GIS	Review purpose of the visit, finalise and plan schedule for the week
Wednesday 18 May	Malam Inland Road initiative workshop, Kosrae State Government	1 day workshop to discuss and refine AF proposal and EIA requirements
Thursday 19 May	Field visit to inland road alignment with KIRMA, DTI & Survey & Mapping staff	Assess alignment of road and potential environmental impacts
Friday 20 May	Working in DT&I	Working on road alignment and AF costings with DT&I
	Meeting with Housing & Renovation Division, Department of Resources & Development	
Saturday 21 May	Field visit to update coastal change assessment including Paal and Mosral sites	
Monday 23 May	Meeting with KIRMA Permitting staff Meeting with KIRMA Historic & Preservation staff Meeting with Malem Municipal Council Malem Community Meeting	AF project update identification and discussion around potential environmental impacts.
Tuesday 24 May	Field visit to Kuplu Wan area with KIRMA and DTI staff	Assess alignment of road and potential environmental impacts
Wednesday 25 May	Working in KIRMA office	
Thursday 26 May	Meeting with Utwe Municipal Council Utwe Community Meeting	AF project update identification and discussion around potential environmental impacts.
Friday 27 May	Malam Inland Road initiative workshop, Kosrae State Government	¾ day workshop to revise and finalise AF proposal.

Date	Meeting	Purpose
Saturday 28 May	Depart Kosrae to Guam	

COST-BENEFIT ANALYSIS IN COASTAL ZONE MANAGEMENT IN KOSRAE (FSM):

ECONOMIC ASSESSMENT OF COASTAL ROAD RELOCATION IN THE FACE OF CLIMATE CHANGE

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ACRONYMS

CBA	Cost-benefit analysis
FSM	Federated States of Micronesia
KIRMA	Kosrae Island Resource Management Authority
NIWA	National Institute of Water and Atmospheric Research
PPCR	Pilot Program for Climate Resilience: Pacific Regional Track
SPC	Pacific Community
DREA	Department of Resources and Economic Affairs

GLOSSARY

Storm berm	nearly horizontal or landward-sloping portion of a beach formed by the deposition of sediment by storm waves
Revetment	retaining wall, barricade or facing of masonry, earth, sandbags or other material, to support or protect

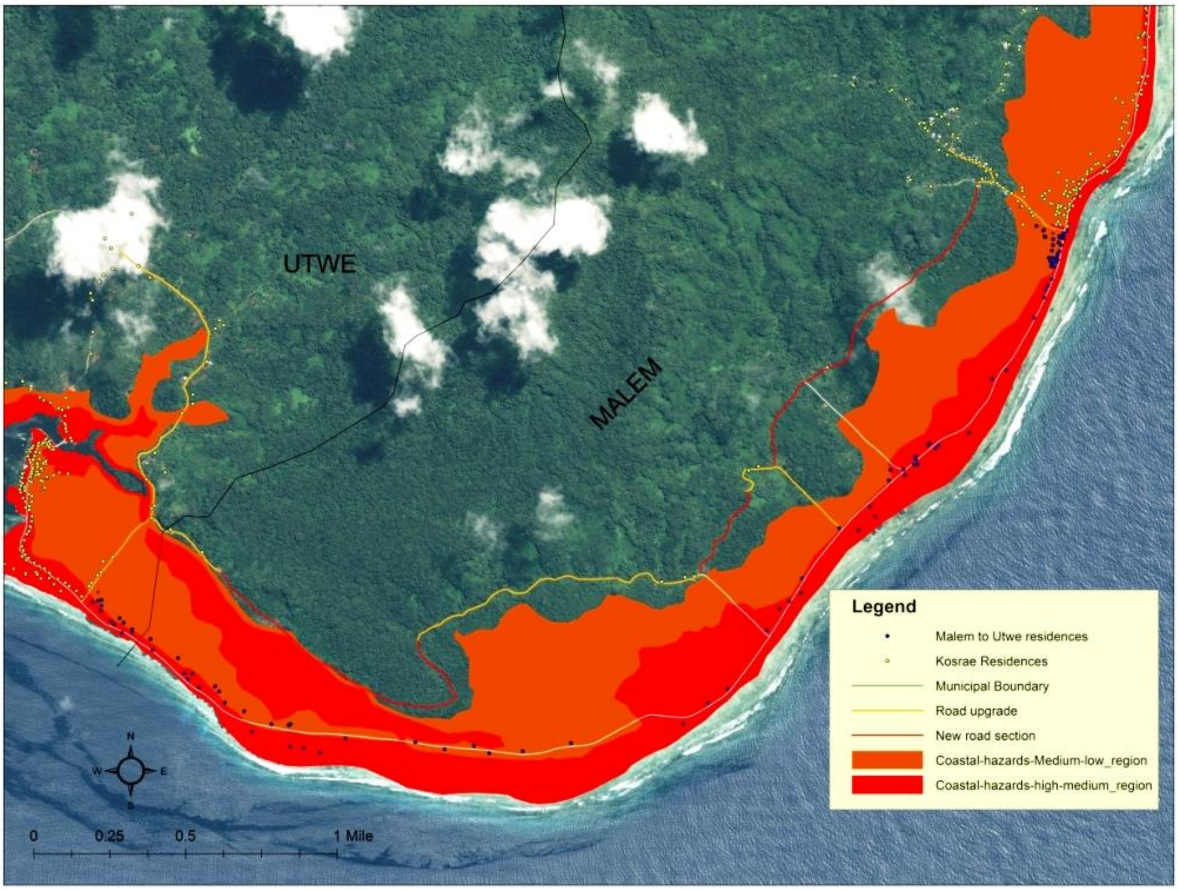
EXECUTIVE SUMMARY

Background

Much community and infrastructure development in Kosrae over the last few decades has occurred within the coastal margins. However, much of the area in which this coastal development has occurred is susceptible to coastal hazards, such as long term coastal change and episodic coastal inundation. The effects of climate change and, in particular, sea level rise, are likely to exacerbate the threat of inundation to coastal developments and loss of infrastructure such as sections of the road network.

The areas most vulnerable to coastal inundation include the coastal area between Malem and Utwe (Image). The community, road and infrastructure in the area face numerous inundation events, with coastal homes in Malem and Utwe (98 houses plus businesses and amenities) exposed to regular over wash. The effects of this include flooding of homes, damage to vehicles and blockages/ breaching of the road, cutting off villagers from homes, work and access to amenities.

Image Areas at risk of inundation



The SPREP-executed Strategic Program for Climate Resilience: Pacific Regional Track (SPCR-PR) aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes. In light of the coastal threats being faced along the Malem to Utwe coastal corridor, the State Government of Kosrae – in tandem with SPREP and the Programme – is developing a proposal to establish an interior road that links Malem to Utwe, by passing the need for citizens to rely on the existing 4.5 kilometre coastal road for access, while ensuring the safety of people in the coastal area. A secondary but important objective in the road project is to protect the long term wellbeing of the Kosrae community by facilitating the relocation of families by opening up the interior.

Cost benefit analysis

In support of proposal development, an economic assessment of the benefits and costs of the road project has been undertaken. The relocation option has been compared against a series of alternative adaptation options including coastal protection with revetment and upgrading the coastal road. In reality, the form of that these options and an inland road could take can vary. For example, revetment could cover the entire coastline or just parts; new coastal roads could be built to existing design standards or to new design standards. This analysis assesses selected forms of the adaptation options to consider a way forward for Kosrae:

- Establishing a protective rampart (revetment) to protect the affected coastline, in accompaniment of a new coastal road built to existing specifications;
- Upgrading the coastal road (including elevating it) while revetting segments of the existing road that are particularly vulnerable to erosion;
- Establishing an inland road while maintaining the existing coastal road for various lengths of time and revetting segments of it that are particularly vulnerable to erosion;
- Establishing an inland road at various points in the future instead of today;
- Establishing just part of an inland road.

Data for this exercise was sourced principally from direct consultations with government departments, and supplemented by expert opinion from National Institute of Water and Atmospheric Research (NIWA) and the Pacific Community (SPC). Estimates of the value of the different adaptation options in Kosrae were based on expert opinion on the effect that the options would have on costs faced by the Kosrean community from present over wash trends (impacts of road, houses, earnings and so on). The fact that data was not generated for all impacts means that the quantified benefits of adaptation options were underestimated.

Results

The analysis provides conservative estimates of the potential payoffs from the adaptation options. This is because:

- The analysis is based on the quantified benefits from the different adaptation options arising from only three types of events – 1:5 year events, 1:40 year events and 1:100 year over wash events. However, the adaptation options could also generate benefits when other events occur;
- Some benefits of adaptation – avoided injuries/ fatalities arising from severe events, damage to cars and crops or ongoing access to schooling – have not been quantified. Significantly, the calculations are based on the assumption that only families located around the coastal road from Malem to Utwe relocate over time with improved access to the interior via a new inland road. In practice, relocation might not be restricted to these communities. Families from other parts of Kosrae might also benefit from improved access to the interior through relocating or using their own inland sites for agriculture production;
- By opening up access to the interior of Kosrae – facilitating enhanced agricultural production while changing the dynamic of development away from the hazardous coastline and into the safer and more sustainable interior – the road could be expected to benefit communities beyond the 50 year period of this analysis, benefitting the community for generations to come.

As a result of these three issues, the potential benefits from developing an inland road now or in the future are quite certain to be higher than quantified.

Based only on those benefits quantified over a 50 year period and applying a 4 per cent discount rate, establishing an inland road now offers a modest payoff (NPV) of USD$0.37 million. When non-quantified benefits are taken into account, this payoff is expected to substantially higher.

The option to establish the inland road now is shown to be preferable to establishing the inland road 10 years in the future (NPV=-USD$0.56 million) and 20 years in the future (NPV=-USD$0.23 million) - reflecting, in part, the increasing risks presented by sea-level rise and (potentially also) cyclones.

- The option to establish the inland road now is also shown to be superior to the alternative course of action - to protect or upgrade the existing coastal road. These options were shown to generate a negative payoff (NPV = -USD$2.16 million and -USD$0.85 million respectively). Moreover, there are a number of important limitations associated with these responses that are not fully captured in the aggregate results. Most importantly: the benefits of an upgraded coastal road specifically would only accrue to those families located *landward* of the road who would benefit from reduced inundation. By comparison, families located *seaward* of the upgraded road would remain in the direct line of the waves and continue to be affected by over wash, with potential harm to family members or properties worsening over time as the sea level rises. As a result, these families would eventually still have to find an alternative means to adapt to the coastal threats. In community consultations, families in Malem and Utwe stated firmly that – if the coastal threats are not addressed – the area will cease to be a safe and unsustainable place for them to inhabit. They viewed that migration out of Kosrae or FSM is the only option remaining (Annex 2). Considering that Kosrae already represents the smallest state in FSM and that the island is presently experiencing a net loss of population due to outward migration (Division of Statistics undated), increased migration as a result of coastal threats may not be desirable both in terms of economic potential, but also in terms of retaining Kosrean culture.

- protecting or upgrading the coastal road can risk generating a false sense of security in the community, allowing families to believe that the area is now safe from inundation and *implicitly encouraging* further coastal development. Such an option is therefore counter to the State development plan intent of encouraging inland development as it can hamper relocation in the medium term. By comparison, establishing an inland road network facilitates relocation and opening up on the interior; and

- there are likely to be additional environmental costs from establishing construction work such as protecting or upgrading of the road along the coast (such as downstream erosion). In the face of ongoing sea level rise, this would appear to be unwise.

Furthermore, the analysis shows that the inland road should only be pursued if funding can be secured for the full section of the road from Malem to Yeseng to Utwe. The calculated NPVof establishing a shortened road (from Malem, to Yeseng) only is shown to be negative and is substantially lower than those that could be achieved by establishing a complete road. This reflects the fact that a smaller proportion of the community will benefit while ongoing treatment of the existing coastal road remains. Equally importantly, establishing a portion of the inland road from Malem to Yeseng will leave the community of Utwe cut off from the rest of the community if the road becomes unpassable in future over wash events. This is important for two reasons.

- First, ongoing threats will continue to undermine quality of life in the village, risking health and damaging possessions. In particular, damage to the road takes time to repair. While 'minor' over wash events may cut off families for one or two days, extreme events (such as a near cyclone) could cause extensive damage which could take from days to weeks to repair. Ongoing interruption to family life, earnings and education – especially in a community less advantaged than the rest of the Kosrae community – is important.

- And secondly–as already indicated – the poor condition of the existing inland access roads brings into question the safety of the community in using these roads as escape routes. As a result, establishing a partial inland road does not address the quality of all the inland access and the immediate safety of the community. An advantage of establishing an entire inland road is rather that – should a sudden storm surge or over wash event occur – families will all have immediate access to safe inland roads as an escape route – while also having long term access to the interior of the island for development or establishing new homes.

Distributional considerations

Based on the quantitative analysis conducted, by far the greatest beneficiaries from the establishment on an inland road established today are families (compared to government), principally in the form of access to the interior of Kosrae to extend agricultural production. This is important because the communities of Utwe and Malem who stand to benefit first from the new road project already have the lowest average earnings in Kosrae, compared with communities in Lelu and Tafunsak. The opportunity to increase income and or food security through increased agricultural would directly improve the wellbeing of these families.

Moreover, these families already presently suffer a variety of harmful effects from over wash, including reduced earnings (when access to work by hampered by road blocks), reduced educational opportunities (when access to school by hampered by road blocks) and reduced access to food (through the destruction of home gardens). The harmful impacts from these effects have a disproportional impact upon these communities as they already have the lowest average earnings in Kosrae, compared with communities in Lelu and Tafunsak. Ongoing over wash can therefore suppress the economic vulnerability of the community. By comparison, a continually accessible road will minimise this harm and facilitate change, increasing the economic resilience of the community. While items values were not valued in the analysis in theory at least, an inland road project would contribute positively to both the food security and economic security of the community.

Relocation considerations

Consultations held with stakeholders from Malem and Utwe revealed in resounding support for an inland road and for relocation to the interior for safety and security. This support has also been affirmed in the present draft of the proposal for the road project (SPREP 2015b).

However, the rate at which families can move in practice will not be known with any certainty until the community can work through issues in collaboration with government and policy makers. Key issues here are:

- Relocation is likely to take time. The analysis presumes that relocation will be gradual. During this time, families who have not yet moved will continue to need access to the wider Kosrae community through a functioning road. Data analysis suggests that the cost of maintaining the existing coastal road for a few years will have a negligible impact upon the payoffs of a road. On the other hand, retaining a functional coastal road could act as a deterrent to relocation to safer ground and can implicitly discourage relocation. After 20 years, retention of the existing coastal road would require a new coastal road to be established which is expensive. There would therefore be logic in establishing a new inland road network while (i) advising the community of the cessation of existing road maintenance at a specific point in time (eg., 20 years or less) (ii) delivering a strategic campaign on relocation and agricultural development inland and (ii) providing the community with reasonable lead time for their relocation while minimising costs.

- An average house in Kosrae has a replacement value of around USD$43 000 (Section 4.7). Few family members have access to such money to establish a new house once an inland road is established. However, with financial assistance, relocation could be rapid as the community are keen to relocate for safety's sake. As indicated in Section 5, the faster the relocation, the higher the net benefits from relocation. There is therefore logic in the Kosrae State government reviewing access to housing loans or resources for relocation.
- Relocation from the hazardous coast is unlikely to happen while development continues unconstrained along the coast. In the face of sea level rise and climate change, it is unsustainable and unsafe for any new developments to be allowed to continue in hazardous areas such as the Malem to Utwe coastline. In the interest of public safety, no new developments should be permitted here. This constraint would then create a higher drive for developments in safer areas.
- Interim development in hazardous areas such as the Malem to Utwe coastline should be subject to appropriate building standards. In the face of sea level rise, ground level developments would appear to be unsound. Engineers in the State and or national government should be able to recommend clear standards which State government should actively enforce for the safety of the community.
- To support a new inland road and address the points raised above, a strategic communications campaign is required. This should include messages such as why the old road will eventually not be maintained, why new developments along the coastline are not supported, how government can support families in relocation and so on.
- Ultimately – and as indicated in SPREP (2015b), a relocation committee is needed to clarify relocation issues.

Food security considerations

The largest component of quantified potential benefits from establishing an inland road from today is increased agricultural activity from opening up the interior of the island. At the same time, the impact most commonly reported from over wash was loss of subsistence crops in existing home plots. The cost of lost crops was not quantified in this analysis. However, considering that home gardens provide a common source of food in Kosrae, and in view of the likelihood that a representative home includes at least three young dependents, the negative impact of coastal inundation on food security is likely to be increasingly significant over time.

Ongoing damage to food gardens harms food security for the affected communities and this is likely to worsen with time. Efforts to open up the interior for safe agricultural development would assist in this. There is therefore likely to be value in accompanying the establishment of an inland road with a campaign to encourage the adoption of sustainable inland agriculture.

Other issues

A number of issues concerning the road relocation are uncertain. First, the impacts of climate change adaptation projects are unclear. What is the potential environmental impact of major construction work along the coast or inland? While the potential exists that major projects have bring potential risks, they might also bring opportunities. Would opening up the interior of Kosrae provide access to cultural sites hitherto denied to the community because they could not access the area? Would this bring harm? What are the potential environmental impacts of different adaptation options? These matters would presumably need to be considered in an EIA should the road project proceed. Any identified risks would need to be built into a monitoring plan for the project to optimise benefits for the State.

Similarly, the rate of relocation promised by the road project is still unclear. While community enthusiasm for the project is high, relocation depends on access to resources. It is therefore logical that the means and speed of relocation of the community should be monitored as part of the project, should it proceed.

Government presently routinely collects little documentation of the actual effects of over wash on the government, private sector or community. This analysis relied heavily on a key 2008 assessment of the effects over wash. Documentation of disaster events provides the foundation and business case for future remedial action. Government should consider documenting the impact of future events including noting impacts such as impacts of housing and estimated cost of repairs or other remedial action. This data should be stored for future reference.

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INTRODUCTION

This report documents a cost benefit analysis (CBA) of coastal road relocation in Kosrae. The report builds on and extends preliminary economic analysis conducted with the Kosrae State Government in early 2015, conducted as part of a capacity building exercise (SPREP 2015a).

The objective in the CBA presented here is to identify economic issues around a project to relocate a coastal road in the face of climate change and sea level rise, identifying:

- The value for money of alternative coastal infrastructure options in the face of sea level rise and climate change;
- The degree to which any coastal infrastructure option might be pursued as a high priority infrastructure investment;
- The extent to which key risks and uncertainties might potentially affect the realisation of potential benefits and value for money.

1 BACKGROUND – MALEM COASTAL ZONE MANAGEMENT PROJECT PROPOSAL

1.1 Coastal development threats around Kosrae

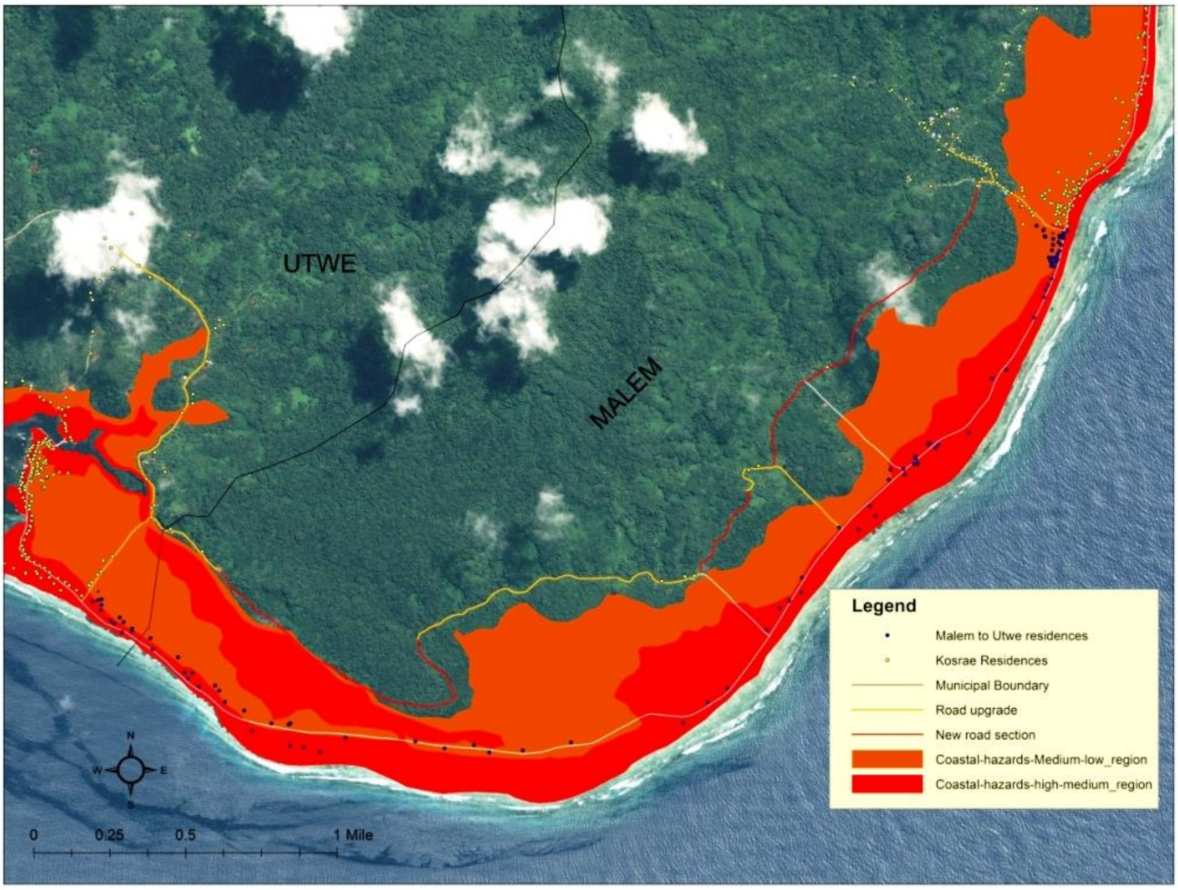
According to the Kosrae Shoreline Management plan (KIRMA 2014), much community and infrastructure development in Kosrae over the last few decades has occurred within the coastal margins. However, much of the area in which this coastal development has occurred is susceptible to coastal hazards, such as long term coastal change and episodic coastal inundation (especially during spring high tides) (KIRMA 2014, p. 11). For the foreseeable future, the effects of climate change, particularly sea level rise, are likely to exacerbate the threat of inundation to coastal developments and loss of infrastructure such as sections of the road network.

Based on the Kosrae Shoreline Management Plan, the areas most vulnerable to coastal inundation include the coastal area between Malem and Utwe (Image 1). The road connecting these two communities runs parallel to the coast, on a narrow storm berm (raised bank), and is precariously close to the sea, at risk of over wash and increasingly at risk of being breached (Image 2). The community, road and infrastructure in the area have faced numerous inundation events, with coastal homes in Malem and Utwe exposed to regular (annual) over wash, particularly during spring high tides when larger waves can reach the shoreline. Severe damage due to tropical cyclones is a rare occurrence on Kosrae, with the last notable event occurring in 1905. However, cyclones often form close to Kosrae or track close to the island as they develop with increased risk during El Nino conditions, the last being Tropical Storm Dolphin in May 2015. Whilst wind damage from these events is relatively minor, large swell waves can cause damage along the Utwe and Malem coasts.

Work conducted by KIRMA has identified that – in a potential inundation event – around 104 buildings are potentially exposed to over wash/ inundation on the stretch from Malem to Utwe. These include: 98 houses, one church, three businesses, one playground and one school (Image 1). 25 homes are located seaward of the road and 73 are located behind (landward of) the road.

The effects of wave over wash and inundation events include flooding of homes, damage to vehicles and blockages/ breaching of the road. At present, around 120 metres of road at Mosral and 200 metres of road at Paal are critically exposed and at risk of being breached at any time. Such a breach cuts off the village of Utwe (population approximately 983) and removes road access to Walung (population approximately 268), as well as potentially disrupting utilities (power and telecommunications) which run parallel to the road (often precariously close to the shoreline – Images 3 and 4).

Image 1 Areas at risk of inundation



Source: KIRMA (unpublished).

Ongoing shoreline change is also expected to result in an ever increasing length of road becoming critical exposed to wave damage within the next decade and beyond, including a further 450 metres section south of Mosral to Kuplu, 500 metres from Pal to Malem river mouth, and approximately 1 kilometre from Kuplu to Utwe (Doug Ramsay, Manager Pacific Rim, NIWA personal communication personal communication, June 2015).

The infrastructure exposed to shoreline change and wave over wash damage in Malem encompasses road, power, water and telecommunication lines which run parallel to the road. The power lines at certain sections like Paal and Mosral are fully exposed to wave damage and corrosive salt spray. (Image 3). Inundation and over wash from large waves and spring tides, particularly in the November to February period, are normal occurrences given the increasingly receding coastline and low elevation of the road in this area. Some households are inundated during such events, and exposure of vehicles, running over sea water inundation and over wash happens yearly.

Image 2 Road exposed to over wash

Image 3 Exposed power lines alone coastal road

Image 4 Power utilities propped up on nearby shoreline

Image 5 Barely discernible access road (Finsrem inland access road)

Images © Paula Holland.

1.2 Causes of the problem

The problem of coastal inundation is founded in a number of contributory causes. First, the southern coastline is naturally exposed to active wave action and ongoing erosion. The establishment of the coastal road in late 1940s and early 1950s and other development on Kosrae involved the removal of large amounts of coastal rubble from the beach and reef flat, resulting in the loss of natural protection along much of the eastern-facing coastline (KIRMA 2014, pp. 65-66).

Second, the road and much development are located on a narrow (10-50 m wide) storm built berm, with inter-tidal wetland or mangrove between the berm and the volcanic part of the island. This land area is highly dynamic and highly exposed to coastal change and coastal inundation. With sea-level rise, present-day very high tide levels that cause inundation problems at present will become ever more frequent (KIRMA 2014, p. 93).

Third, the establishment of the road and associated infrastructure has focussed development along this exposed coastline. Unfortunately, over the period of significant development since the Second World War, limited information and understanding existed at the time of settlement about the scale of hazard risks in this area. Not only are houses now exposed to the coastal hazards, but infrastructure critical to the livelihoods and well-being of coastal villagers is also now at increasing risk from inundation and coastal change.

Fourth, much of the land in Kosrae is privately owned. This means that some families occupying the coastline cannot automatically relocate inland where they do not themselves own the land. In truth, even if families had access to land inland, the fact that the public road infrastructure focuses on coastal access constrains householders from independently adapting to climate risks by moving inland away from the coast.

1.3 Climate change

According to Government of Australia (2011; 2014), temperature rise has been recorded as increasing generally for FSM in recent years, while a clear decreasing trend in annual and wet season rainfall has been observed.

For the future, the Government of Australia (2011; 2014) predicts that:

- Air temperature and sea-surface temperature will increase.
- The number of hot days and warm nights will increase.
- There will be an increase in average annual and seasonal rainfall.
- Droughts will become less frequent.
- Extreme rainfall days are likely to occur more often.

Sea-levels are also rising around Kosrae and can be expected to continue to do so for the next few decades (See for example, Government of Australia 2014). In light of this, the probability of over wash events and inundation of low-lying coastal land will likely increase with climate change, especially given sea level rise.

1.4 Objective of the project

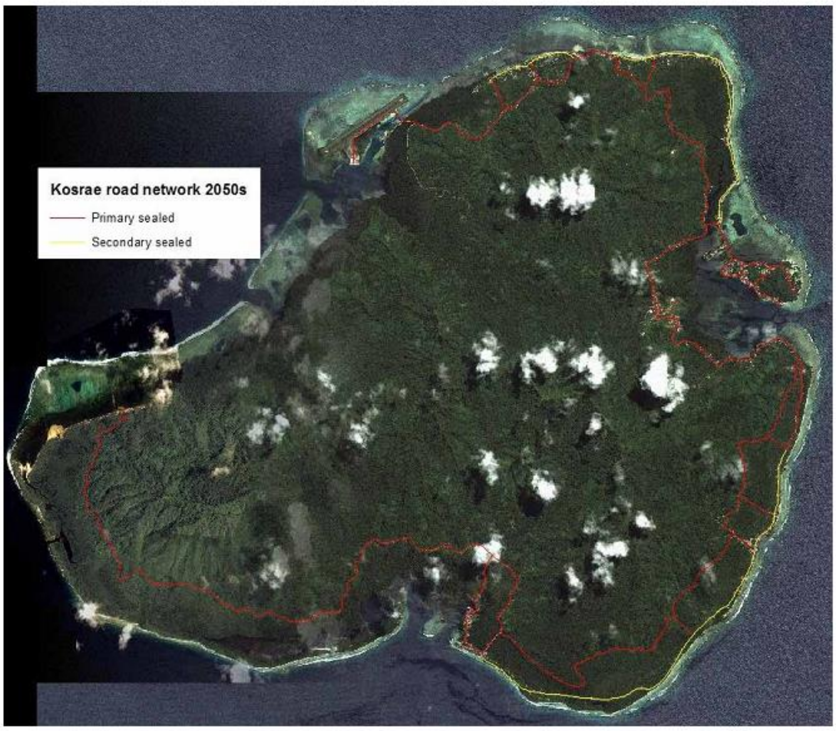
The Strategic Program for Climate Resilience: Pacific Regional Track (SPCR-PR) is a regional program that aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes. The SPCR-PR is being implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank (ADB,) and is funded through funded through the Climate Investment Funds (CIF). In light of the coastal threats being faced along the Malem to Utwe coastal corridor, the State Government of Kosrae – in tandem with SPREP and the SPCR-PR – is developing a proposal to establish an interior road that links Malem to Utwe, by passing the need for citizens to rely on the 4.5 kilometre coastal road for access, while ensuring the safety of people in the coastal area.

A secondary but important objective in the road project is to protect the long term wellbeing of the Kosrae community by facilitating the relocation of families by opening up the interior. While relocation inland is presently difficult due to limited access, the opening up of the interior through an inland road would enable families to plan to relocate community infrastructure and properties, as new buildings are constructed or as existing buildings are upgraded, enabling new settlements to develop in areas not exposed to coastal hazards and the ongoing effects of sea-level rise. The importance of developing the interior of Kosrae island is presently in the Kosrae Strategic Development Plan which stipulates that it is a national priority to 'divert development and settlement along the coast to inland and higher grounds … diverting development and settlement inland: improving inner roads and encouraging the citizenry to settle inlands" (Division of Economic Planning 2013, p. 29).

1.5 Options

In view of ongoing natural coastal erosion processes, existing sea level rise trends and the present precarious location of the road, the establishment of an inland road has been identified as an option for adaptation in Kosrae that is sustainable in both reducing the impacts of coastal hazards for Malem and Utwe while ensuring access to the removing essential infrastructure from being impacted by coastal hazards in Malem and Utwe while ensuring access to the community of Utwe (Image 6). The establishment of an inland road is also a recognised national priority. The need for a new road inland to replace the present coastal road has been stipulated as the priority of the Kosrae Shoreline Management Plan (KIRMA 2014, p. 32), and reinforced in the Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change (Government of Kosrae, in press).

Image 6 Proposed inland road



Source: KIRMA (2014).

To consider the economic implications of the new road project, and reflecting the terms of reference for this economic assessment (CBA) of it, several climate change adaptation scenarios are compared against a series of alternative adaptation options including coastal protection with revetment and upgrading the coastal road. In reality, the form of that these options and an inland road could take can vary. For example, revetment could cover the entire coastline or just parts; new coastal roads could be built to existing design standards or to new design standards. This analysis assesses selected forms of the adaptation options to consider a way forward for Kosrae:

- The value of *business as usual* – ongoing retention of the coastal road in the face of climate change and natural hazards. This scenario would result in ongoing (and potentially increasing) costs from coastal over wash and breaching of the road. These impacts are described more in Section 2;
- The value of mitigating coastal threats through the establishment of a new inland road or coastal defences. These scenarios would potentially reduce risks to the community (see Section 2). Considerable interest surrounds the inland road option which has already been the focus of preliminary costings (KIRMA 2014, pp. 32). In detail, the options compared are as follows.

1. Establishing a protective rampart (rock armoured **revetment**) to protect the coastline between Malem and Utwe. Revetment is a common form of coastal protection in the Pacific generally as well as specifically on Kosrae. (This adaptation option would accompany replacing the existing coastal road to its existing specifications – see Section 2.1 – *Revetment of the coastal road* below);
2. Construction of **inland road starting now** and ending in 2017[1] (thus allowing two years for construction from the present day) **and abandoning the existing coastal road**;
3. Construction of **inland road starting now** and ending in 2017[1] (thus allowing two years for construction from the present day) and **maintaining the existing coastal road for a period of 10 years** (after completion, to 2027);
4. Construction of **inland road starting now** and ending in 2017[1] (thus allowing two years for construction from the present day) and **maintaining the existing coastal** road for a period of 20 years (after completion, to 2037);
5. Construction of **inland road starting now** and ending in 2017[1] (thus allowing two years for construction from the present day) **and maintaining the existing coastal road for a period of 50 years**;
6. Construction of the **inland road in 10 years' time** (commencing construction 2026; completed 2028);
7. Construction of an **inland road in 20 years' time** (commencing construction 2036; completed 2038);
8. Additionally, a new option is being included in this analysis – that of **upgrading the existing coastal road to** accommodate sea level rise and storm surge. This would involve elevation and strengthening of the road based as well as the use of Asphalt. An upgrade of this form was recently delivered by the Kosrae State Government in 2015 at the airport, although this did not include the asphalt layer.

Details are summarised in Annex 1.

[1] SPREP terms of reference requested assessment of an inland road established from 2016. However, as it takes two years to construct the road, assessment of a functioning road would actually not be possible until from 2017.

2 METHODOLOGY

CBA is a systematic process for identifying, valuing, and comparing costs and benefits of a project. Multiple references exist on the methodology and principles of CBA (see for example, European Commission, 1997; HM Treasury, 2003; Tietenberg, 2006; OECD, 2006; Australian Government Department of Finance, 2006; UNECE, 2007; USEPA, 2010). However, broadly speaking, the key features of a CBA are:

- All related costs (losses) and benefits (gains) of an project are considered, including potential impacts on human lives and the environment;
- Costs and benefits are assessed from a whole-of-society perspective[1], rather than from one particular individual or interest group (that is, a public and not a private perspective is taken);
- Costs and benefits are expressed as far as possible in monetary terms[2] as the basis for comparison; and
- Costs and benefits that are realised in different time periods in the future are aggregated to a single time dimension (discounting) (Buncle et al. 2013).

The first issue of considering all costs and benefits from a project is fundamental to effectively interpreting any CBA. In theory, all the potential benefits and costs of a project are supposed to be assigned dollar figures when doing a CBA. However, it is common for cost benefit analyes to be completed in practice without all the benefits or costs of a project being values due to lack of data. This is because, in such cases, it is frequently impractical to assign values to certain benefits or costs because:

- the physical or monetary values can simply not be reliably measured or established;
- the cost or benefit items are not significant to the analysis;
- it is judged that the cost of attempting to value the cost or benefit outweighs the benefit of including them in the analysis (Buncle et al 2013).

Where values cannot be quantified in practice for this analysis, they will be listed and analysed qualitatively. Their impact in relation to the value of climate change adaptation will be considered in more detail in the Implications Section.

2.1 Costs and benefits

Without change

Considering the precarious state of the road in places already, it seems unrealistic to assume that the State Government of Kosrae could continue to merely maintain the existing coastal road into the long term without investing in some major form of remedial work. It is more realistic to recognise that the government would ultimately need to at least replace the road in its current form. If this was done, ongoing impacts from over wash would be expected to continue over time but at least the road would not be crumbling into the sea as it is presently in some places.

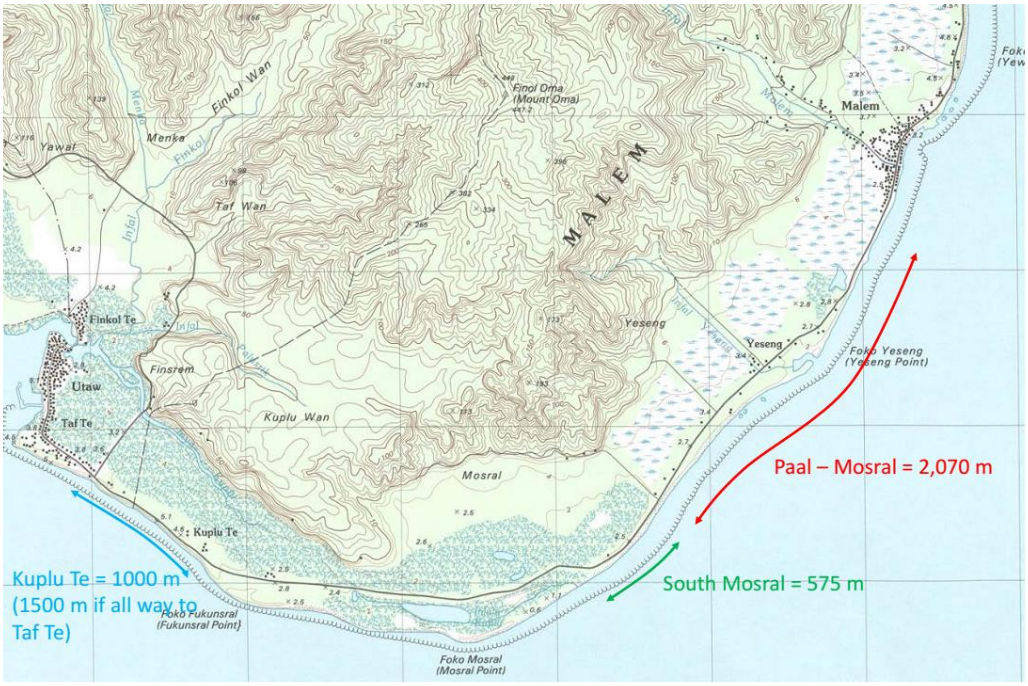
Kosrae State Government advised that replacing the road in its present form would require substantial investment by the government, involving upgrading the road sub-base wearing course to a hot mix asphalt pavement (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). Additionally, NIWA (Doug Ramsay, Manager Pacific Rim, NIWA personal communication, January 2016)

[1] For this reason, some people refer to CBA as *social* CBA.

[2] Note that costs and benefits that cannot be quantified in monetary terms are still considered during decision making.

advises that revetment along the most exposed parts of the coast (between Paal and Mosral, plus an additional stretch around the corner towards Utwe (Image 7) is unavoidable in order to prevent ongoing damage. This is a length of coastline in the order of 2.5 km or 1.6 miles.

Image 7 Revetment targets



Source: Doug Ramsay, Manager Pacific Rim, NIWA personal communication, personal communication, January 2016.

Ongoing sea level rise and climate related hazards would continue to threaten the condition and operation of the present coastal road, resulting in an increased frequency and magnitude of over wash and leading to road breaches and possible harm to both the community and their possessions (Table 1).

At present the negative impacts from coastal over wash include inundation and the risk of loss of sections of the road (Table 1). Over wash leads to damage to property, households, crops and vehicles. The frequency and severity of over wash and resulting damage will increase with sea level rise. Maintenance of the existing road will likely to become more costly.

Additionally, exposed sections of the road at Paal and Mosral are presently susceptible to being breached during and over washing event. The likelihood of this happening and the length of road section over which it could occur will continue to increase. Residents in Utwe and affected areas around Malem then lack access to commercial, health and education facilities, as well as the seaports and airports since these facilities are predominantly located in northern part of the island. Furthermore, power and telecommunication lines built parallel to the existing road will also be affected, threatening services to the residents in Utwe and Malem. Ultimately, this infrastructure could be permanently unusable with road failure. Finally, access by people to the hinterland for farming is presently limited without a decent road. The existing inland roads are predominantly farm tracks poor quality (Image 5).

Table 1 Broad potential benefits and costs with and without the new road project

Without scenario/ existing road replacement	**General with scenarios**		
	Revetment with coastal road replaced to existing specifications	*Coastal road upgrade (elevated)*	*Inland road*
Debris blocking the road and cost to remove	Reduction in over washing and associated debris for lower return period events	No or reduction in over washing and debris for lower-moderate return period events	No coastal-related debris to remove
Inundation of coastal houses	Limited expected change	Reduced risk of over washing for landward homes No reduction in high tide flooding which will increase in frequency with sea level rise	Reduced risk of over washing for landward side homes No reduction in high tide flooding which will increase in frequency with sea level rise
Damage to cars, garden crops	Some minor reduction in car damage. Reduced risk of over washing affecting garden crops under lower return period events	Some minor reduction in car damage. Reduced risk of over washing affecting garden crops under lower return period events	No car damage, no crop damage
Inability to get to work (Utwe and Malem) resulting in lost income	Continued access under lower/moderate return period events. Loss of access under more extreme events	Continued access under lower/moderate return period events. Loss of access under more extreme events	Continued access, no lost earnings
Inability to reach schools and hospitals	Continued access under lower/moderate return period events. Loss of access under more extreme events	Continued access under lower/moderate return period events. Loss of access under more extreme events	Continued access
Interruption of power, telecommunications – inconvenience for households, loss of earnings to utilities	No expected change under lower return period events. Interruptions and loss likely under moderate-high return period events	No expected change under lower return period events. Interruptions and loss likely under moderate-high return period events	No interruption for families No lost earnings for utilities
Damage to road and need for repairs	Reduced damage under lower return period events. Damage to roads will still occur under moderate-high return period events	Reduced damage under lower return period events. Damage to roads will still occur under moderate-high return period events	No repairs needed
Trauma and inconvenience	Reduced trauma / inconvenience under lower return period events No expected change under higher return periods	Reduced trauma / inconvenience under lower return period events No expected change under higher return periods	No trauma or inconvenience
Limited access to interior	No expected change	No expected change	Land access for increased farming
Road maintenance	Limited expected change	Costs to upgrade road	Costs to establish road
			Land Acquisition
	Require ever increasing maintenance	Require ever increasing maintenance to	Maintenance

	to provide serviceable road as sea level rise increases	provide serviceable road as sea level rise increases	
	Possibility for increased erosion at the southern end of the wall	Possibility for increased erosion at the southern end of the wall	Environmental impacts?
			Awareness cost
			Cultural site impacts?
Land loss due to natural processes	Land retained	No expected change	No expected change

Sources: Blair Charley, KIRMA; Lipar George, ODA; Nena M. William, Office of the Governor, Kosrae State; and Doug Ramsay, NIWA, personal communication, October 2015.

Much property and community development landward of the road is located on low-lying land or has been reclaimed from inter-tidal mangrove or wetland areas and is barely above present-day high tide levels. High tide inundation will become an ever-more frequent and significant occurrence as sea-levels increase, irrespective of continued protection of the current road.

Upgrade of the coastal road

An alternative to replacing the road in its current form would be to replace the road but seek to protect it from sea level rise by elevating the road (around 6 inches to 1 foot) (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). Establishing an upgraded costal road would be expected to reduce the damaging effect of minor inundation events on the road (reducing road repair and clearance costs) and reducing the frequency at which the coastal road is blocked. The effect on housing would vary, with homes seaward of the road receiving no benefit, but those behind it potentially benefitting from some reduction in over wash.

Establishing an upgraded coastal road could potentially encourage further development of the coastal strip between Malem and Utwe. This is because of the perception that coastal over wash and inundation will no longer be a threat so families can safely invest further. In such a case, household numbers along the coastal fringe could be expected to increase. Discussions between State Government of Kosrae representatives and SPREP (Buncle 2015) confirm that government believe this would happen if any major construction – such as an upgraded coastal road and revetment – is established.

Establishing an upgraded coastal road would involve costs, including upgrading the sub-wearing course to Hot mix asphalt pavement as well as elevating the road. Theoretically, such an elevated road would limit the scope for over wash and damage from severe events. Additionally, NIWA advise that revetting of the critical 1.6 miles of highly vulnerable coast between Paal and Mosral and around the corner towards Utwe would still be required.

Additionally NIWA states that any major construction work along the Malem coastline would likely result in down drift erosion impacts. The extension of the existing rock wall along the southern part of Malem village has been a significant factor in the accelerated erosion problems at Paal. Likewise the engineering structures at the outlet of the Mosral stream have increased the erosion immediately to the south (Doug Ramsay Manager Pacific Rim, NIWA personal communication, personal communication, January 2016). Consequently there are likely to be some environmental costs from coastal road works.

Revetment of the coastal road

A cheaper alternative might be to revet the coastal area to limit the potential for breaching of the road and provide increased protection from over washing. This would provide short-medium term protection of coastline and road.

The level of protection provided to over washing will depend on the design of the revetment, but it would be expected that overtopping could be significantly reduced for low to moderate severity events. On the other hand, revetment alone would be unlikely to reduce overtopping volumes sufficiently to prevent damage from large swell caused by cyclones forming or tracking close to Kosrae or due to cyclone passing directly over Kosrae (Doug Ramsay Manager Pacific Rim, NIWA personal communication, personal communication, January 2016).

Moreover, the level of protection would ultimately decrease as sea levels rise and, given the low-lying nature of the land levels behind the revetment, this option would not stop the increased frequency and severity of high-tide inundation that will occur with sea-level rise. As a result, NIWA (Doug Ramsay Manager Pacific Rim, NIWA personal communication, personal communication, January 2016) recommend that revetting the coastline should only be considered as an adaptation option that *accompanies* other solutions – not considered on its own as its effectiveness relies on accompanying measures. To this end, revetment of the entire coastline is only considered in this analysis as an accompaniment to the replacement of the coastal road in its present state.

As suggested for the upgraded coastal road option, establishing revetment could potentially encourage further development of the coastal strip between Malem and Utwe because of the perception that coastal over wash and inundation are no longer threats. In such a case, revetment works could reduce the likelihood of households relocating voluntarily (potentially increasing them over time, in fact), and increase the difficulty and timeframes available for relocation to occur in the future. Discussions between State Government of Kosrae representatives and SPREP (Buncle 2015) confirm that government believe this would happen if any major defensive coastal infrastructure – such as an upgraded coastal road and revetment – is established.

Establishing revetment would involve construction costs and might have some impact upon the coastal environment. Additionally – and as indicated for coastal road upgrades – NIWA linear construction along the Malem coastline would risk down drift erosion impacts (Doug Ramsay, Manager Pacific Rim, NIWA personal communication, personal communication, January 2016). Consequently there are likely to be some additional environmental costs from coastal road works.

Inland road network

Compared to protecting the existing road, re-establishing the road inland would remove essential infrastructure from being impacted by coastal hazards or the impacts of sea-level rise for this century and beyond (Table 1). It would ensure permanent access to Utwe and the Malem community south of Malem village

In the medium term, opening the interior through a new road network could facilitate community and relocation away from the hazardous coast. It is impractical for families to relocate presently since no access road or other essential infrastructure exists for the hinterland and families need to be located near to public infrastructure. With a new road, power and telecommunications lines would be expected to be permanently relocated with the new road, thereby ensuring continued long run utility access to residents in the affected areas. It would also mean that inundation of homes and crops would cease as people would move away from the coast.

Establishing an inland road would involve construction costs and require the purchase of the land. KIRMA (2014) propose that an inland road project be accompanied by an awareness campaign to maintain support from stakeholders to share land for road construction as well as to allow the opening up of the interior for relocation.

If an inland road network were established today, a replacement coastal road would not need to be established. However, given the state of the existing coastal road, delays in the establishment of a coastal road network or long term of the existing road while migration occur would mean a replacement coastal road would be needed as the road is presently is poor condition in places.

Potentially, environment and cultural impacts could arise from the construction of a road inland. According to the Kosrae State Government (Andrew Standon, Heritage Protection Office, personal communication, October 2015), the interior of Kosrae has not be surveyed for cultural amenities although it is known that many of the pre-missionary villages were located around the base of the volcanic part of the island (Rainbird 2004; Swift et al. 1997). It is presently unclear if the proposed route for the inland road would threaten any culturally valuable sites. For the same reason, it is also unclear the extent to which access to the interior by a new road would increase access by the local community and or tourists to cultural sites for social benefit. These matters would presumably need to be considered in an EIA should the road project proceed.

3 DATA

3.1 Baseline data

Costs assosicated with the existing road

According to DT&I, the engineering standard of the present coastal road should allow for a life span of around 30-40 years, provided it is adequately maintained (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). However, the road is already long established and parts of the road around Paal and Mosral and around the corner towards Utwe are already perilously close to the sea and crumbling. Consequently, the existing coastal road would ultimately need to be replaced. DT&I consider that the existing road would barely last another five years if these areas are not revetted. However, with revetment of the more vulnerable parts of the road and sufficient maintenance, the existing coastal road could perhaps last up to another 20 years (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). After this, the entire road would need to be replaced anyway.

In practice, it is unclear when the revetment of the areas around Paal and Mosral would be conducted and when the road would be replaced to its present technical specifications. Upon agreement with stakeholders (Buncle 2015), it is assumed for illustrative purposes that, because of the perilous state of the road around Paal and Mosral and towards Utwe, the revetment occurs immediately and the road is replaced now over a two year period, subsequently being replaced again in re-replaced 35 years' time (the average of 30 and 40 years).

Replacing the road in its current form would involve upgrading the road sub-base wearing course to Hot mix asphalt pavement at a standard cost if around USD$ 520 000 per mile (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). It is assumed that upgrading the coastal road between Malem and Utwe would take two years.

The coastal road would need to be maintained over time. The existing road is presently maintained using a share of Government's annual provision for road up keep. However, no record is kept of the amount spent to maintain that portion of the state's road network. KIRMA (2014) indicate that upkeep of an inland road would be in the vicinity of two to five per cent of the total road construction costs, over the life of the road (50 years). A similar approach was taken by Rios Wilks (2013). Using this approach, the upkeep of the road between Malem and Utwe is estimated as two per cent of the construction cost of a replacement road, spread over the life of the road (50 years).

3.2 Coastal protection construction

Revetment

Data on construction costs was sourced from the Kosrae State Government (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). According to DT&I, the normal expected lifespan of revetment along the coast of Kosrae is in the order of 50 years. Costs to establish it are summarised in Table 2. Costs for revetment are based on a standard cost formula of US$ 600 000 per mile used by the state government. Revetment of the coastline from Malem to Utwe is assumed to take two years whereas revetment of the small portion of land around Paal and Mosral is expected to occur within a year. Maintenance for revetment is assumed at two per cent per cent of total construction costs, spread over 50 years. This is consistent with the principle by KIRMA (2014) of assigning two per cent maintenance costs towards effective maintenance of a new inland road.

Where revetment is delivered in support of other options, revetment of the entire coast would not be necessary – only specific parts of the road most at risk. As indicated in Section 2.1, these are the coastal area between Paal and Mosral, plus an additional stretch around the corner towards Utwe (Image 7). This generates a length of coastline to be revetted in the order of 2.5 km or 1.6 miles

Coastal road upgrade

According to DT&I, the normal expected lifespan of an upgraded coastal road is in the order of 50 years (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). Estimated costs to upgrade the coastal road are based on state government estimates to upgrade the sub-wearing course and upgrade the sub-wearing course to Hot mix asphalt pavement (see Table 2). This represents a cost of around USD$ 820 000 per mile – USD$ 300 000 per mile to elevate (around 6 inches to 1 foot) the road, plus $520,000 per mile to upgrade the sub-wearing course to hot mix asphalt pavement (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). Additionally, based on discussions with NIWA (Doug Ramsay, Manager Pacific Rim, NIWA personal communication, personal communication, January 2016), establishment of an upgraded road would require revetment around the 1.6 miles of critically exposed areas of the coastal road around Paal and Mosral and the stretch around the corner towards Utwe.
As with revetment:

- It is assumed that upgrading the coastal road between Malem and Utwe would occur over two years;
- Maintenance for upgrading the road is assumed at two per cent of total construction costs, spread over 50 years which is consistent with the principle by KIRMA (2014) of assigning two per cent maintenance costs towards effective maintenance of a new inland road.

Table 2 Alternative coastal protection costs

Form of protection	US$
Costs to revet coastal road Utwe to Malem	960 000
Costs to upgrade coastal road Utwe to Malem	5 338 200

Source: Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015.

3.3 Inland road

Establishment costs

According to DT&I, and based on the engineering data provided in KIRMA (2014), a new inland road network should have a life span of around 50 years, provided it is properly maintained. Depending on speed at which communities relocate from the hazardous coastal area, DT&I consider that an inland road would need to be accompanied by revetment of the most vulnerable coastal areas (eg., the area between Paal and Mosral – see Section 3.1). This is because neglect of this portion of the road will ultimately result is road failure. This move would ‘buy time’ for the community to relocate (SPREP personal communication with Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, November 2015). Based on consultations held with multiple stakeholders in 2015 (Buncle 2015), the State Governance of Kosrae believe that the existing coastal road would need to be maintained generally and revetted specifically at specific locations if relocation of the community away from the hazardous coastal area is not sufficiently fast.

The Kosrae State Government initially estimated the costs to establish an inland road network in 2014 (KIRMA 2014), but updated these costs in 2015 (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). Revised cost estimates include road and utility construction, water, power and telecommunications facilities (Table 3). Lifetime maintenance costs for the new road are assumed at two per cent of total construction costs, spread over the life of the road (KIRMA 2014).

Table 3 Estimated inland road network construction costs
(Includes water, power and telecommunications)

	Total US$
Malem to Yeseng	1 467 039.54
Access Road Malem	475,986.29
Access Road Yeseng	273 555.35
Inland Yeseng to Finsrem	3 183 177.56
Access road Utwe to Finsrem	328 266.40
Total construction cost	5 728 025.14

According to DT&I, it would take approximately two years to construct the inland road and utilities. As a result, construction costs were annualised over these years.

The costs to revet the area between Mosral and Paal were taken from DT&I. Additionally, values were estimated for land purchase (see Land Values) and an awareness raising campaign. According to DT&I, an awareness campaign costs an average of US$5,000 given that the target group is all 4 villages of Kosrae. It would usually be delivered in two rounds – one before implementation and one after implementation. As a result, costs were divided into two blocks of US$2500 – one prior to construction (year 0) and the second at the completion of the road (year 2). Total estimated costs are summarised in Table 4.

No estimates were made of environmental or cultural impacts associated with any of the construction options.

Table 4 Road and utility establishment costs (2015 prices)

Item	US$
Road construction	5 728 025
Land purchase	342 571
Awareness campaign	5 000
Environmental impacts	Not costed
Maintenance costs	2% construction costs over time

3.4 Population growth

Population along the coastal fringe between Malem and Utwe is assumed to remain stable, except when extensive defensive coastal developments – such as upgrading the coastal road or revetment – occur. In this case, it is assumed that household numbers for the coastal fringe between Malem and Utwe increase gradually over time as families perceive that the threat of over wash or inundation no longer exists. Such a population increase implies that – while the damage or losses (eg., lost earnings) to households from over wash would be expected to fall with enhanced coastal roads or revetment – these lower costs would nevertheless grow slightly over time as the number of households in the hazard areas swells.

Government representatives (Buncle 2015), recommend using an annual population rate of increase along the coastline of three per cent per annum. This is also the target indicator for GDP growth (Division of Economic Planning 2013). In practice, it is unlikely that the population of families along the coastline would continue without end. There is limited space for families to settle. For the purpose of illustration, it is assumed that additional growth along the coastline would remain stable once total household numbers swell to from the present level by 150 per cent (from the present 98 households to 147 by 2031).

3.5 Land values

The price to secure land for a new road was based on a 2006 assessment of land valuation conducted by ADB (ADB 2006). Costs were indexed to 2015 using CPI data from the Department of Statistics and presuming an average ongoing CPI of 4 per cent per year.

3.6 Cost of damage from coastal over wash

Frequency of over wash events

Estimates of the likely costs of inundation that would be faced without adaptation to climate change were founded on estimates of the regularity (return frequency) of over wash events. Return frequencies were estimated on the basis of observed inundation events reported in KIRMA (2014), as well as expert opinion from:

- The Kosrae State Government (Blair Charley, KIRMA; Lipar George, ODA; Nena M. William, Office of the Governor, Kosrae State); and
- NIWA (Doug Ramsay, Manager Pacific Rim, NIWA personal communication, personal communication).

The events used to underpin estimates of impacts costs are noted in Table 5, with the assumptions used noted in the final column.

Table 5 Expert opinion-based assumed return frequencies for inundation events

Event	Impact	Return period	Return period assumed	Values quantified?
General over wash	▪ Minor – road temporarily blocked with sea water – vehicles able to wade through, but can sustain damage, minor debris	Several times per year when larger than normal waves coincide with high tides	Nov to April (high tide season) with vulnerable areas like Pal and Mosral affected daily	No
Extreme high tides (high king tides) eg., 2008 event	▪ minor-moderate damage to the road damaging part of the carriageway eg., at Mosral and at Pal ▪ vehicle passage still possible in some areas but road breaches around Mosral given receding shoreline in that area ▪ Some over washing damage, flooding: - 2 home destroyed, 4 with major damage,5 with minor damage, 7 affected*	5-7 yearly	5 yearly	Yes, based on Government of Kosrae (2008)*
Cyclone tracing close to Kosrae causing large swell waves	▪ breaching of the road around Mosral and Pal – vehicle passage not possible ▪ minor-moderate road damage, over wash damage to road ▪ moderate damage to property located landward of the road between Malem and Utwe (toppings/roofing damage but walls potentially still standing; associated flooding impacting homes) and some minor damage to properties located behind the road: - 25 homes are located seaward of the road** sustaining major damage - 73 located behind the road** sustaining minor impact.	1:30-40 yearly	40 yearly	Yes
Cyclone with a direct hit on Kosrae	▪ Has not happened since 1905 ▪ Multiple breaching of the road around Mosral, Pal, Malem ▪ Vehicle passage not possible ▪ Extensive damage expected for home seaward of the road (toppings/roofing ripped off but walls potentially still standing. Associated flooding impacts.) Lesser damage for homes landward of the road: - 25 homes are located seaward of the road** completely destroyed - 73 located behind the road** sustaining major impact.	75-100 yearly	100 yearly	Yes

Sources: Blair Charley, KIRMA; Lipar George, ODA; Nena M. William, Office of the Governor, Kosrae State; and Doug Ramsay, NIWA, personal communication, October 2015; * Government of Kosrae (2008); ** KIRMA database.

In practice, more over wash events than these three types would occur over the life of a road and in the future. Smaller annual events, biannual events and other events would also be mitigated by adaptation options. These three events will be used as the basis of the minimum costs of over wash but logically, it means that any quantified payoffs for adaptation options are likely to be substantially underestimated.

Climate change effects on the frequency of over wash events

Reviews of climate change assessments (Government of Australia 2011, 2014) indicate that there is very high confidence that mean sea-level rise around FSM will continue as a result of climate change. More recently, KIRMA (2014, p. 93) estimate that, by the:

- 2030s, the high tide level of 2 metres will be exceeded by 12 per cent of all high tides;
- 2050s, the high tide level of 2 metres will be exceeded by 27 per cent of all high tides; and
- 2070s, the high tide level of 2 metres will be exceeded by 69 per cent of all high tides.

It is assumed that a 1:5 year event is represented by such an extreme high tide. As a result, these increases in frequency are used to illustrate future increases of 1:5 year over wash events (Table 6).

Table 6 Future % increases in 1:5 year-type over wash events

	2030	2040	2050	2060	2070
% increase	12	19.5	27	48	69
Data source	KIRMA (2014)	Average of increases between 2030 and 2050	KIRMA (2014)	Average of increases between 2050 and 2070	KIRMA (2014)

Compared with an expected increase in high tides, Government of Australia (2014) states that tropical cyclone numbers can be expected to decline in the future. However, such a projection is only made with low to moderate confidence as individual assessments vary in the extent to which they project cyclones staying the same or decreasing. Based on the qualitative assessment provided in 2014 and consultations with staff familiar with the field (Gillian Cambers, Project Manager, Global Climate Change Alliance: Pacific Small Island States Project, SPC, personal communication, October 2015) a conservative rate of change in the frequency of tropical cyclones is provided for illustrative purposes:

- No change in the frequency of tropical cyclones is assumed before 2050;
- A five per cent reduction in the incidence of tropical cyclones is assumed to occur between 2050 and 2100. This is assumed to be a steady reduction over the 50 year period to 2100 (Tables 7 and 8).

The change in impacts resulting from ongoing climate change is assigned each decade for indicative purposes.

Table 7 Future % decreases in 1:40 year-type over wash events

2030	2040	2050	2060	2070
0	0	0	-1	-3

Source: SPC interpretations of Government of Australia (2014)

Table 8 Future % decreases in 1:100 year-type over wash events

2030	2040	2050	2060	2070
0	0	0	-1	-3

Source: SPC interpretations of Government of Australia (2014)

Impact of over wash events on clean up costs

Kosrae State Government estimate clean-up costs for a large swell event (1:25-1:30 year recurrence) event in the vicinity of USD$ 10 000 (Norinston Joe ODA, personal communication with Abraham M. Bahillo, Department of Transport and Infrastructure, March 2015). These costs would likely underestimate the cost of cleaning up debris after a 1:40 year event but are used as a conservative estimate.

Estimates for the cost of cleaning up after a 1:100 year event were not available but are logically to be higher than those of a 1:25-30 year event. An illustrative clean-up cost of USD$20 000 is imputed for cleaning up after a 1:100 year event.

Estimates for a 1:5 year event were not available. An illustrative cost of USD$ 2 000 has been imputed for clean-up costs following a 1:5 year event in the absence of any other data.

Value of homes at risk

According to the Pacific Risk Information System (PacRIS – see http://pcrafi.sopac.org/about/), around 348 dwellings are assigned to Utwe municipality with an estimated total replacement value of US$11,815,521 in 2009 terms (Litea Biukoto, Hazard Specialist, SPC, personal communication, March 2015). This means the average cost of a dwelling is around US$33,953 – or US$43119 each in 2015 values.

Impact of over wash events on housing

State of Kosrae (2008) indicates the scale of impact from an extreme high tide event that hit Kosrae in 2008. As indicated in Table 5, the 2008 event was estimated to be expected to recur on average every five to seven years (Doug Ramsay, Manager Pacific Rim, NIWA personal communication). The damage information documented in the 2008 report was used as the basis of estimates of the expected costs of future five yearly (1:5 year) over wash events, if no adaptation occurred. State of Kosrae (2008) documents considerable damage from over wash to housing around the southern coast between Malem and Utwe (Table 5), resulting in two houses totally destroyed, four houses sustaining major impact, five sustaining minor impact and seven houses affected.

In practice, the meaning of houses sustaining ‘major damage’, ‘minor damage’ or ‘affected’ by the 2008 event was unclear, making it difficult to estimate the actual cost of housing damage. As a result, discussions were held with representatives of the Kosrae State Government (KIRMA, ODA, Office of the Governor) to generate ‘representative’ estimates of the extent of damage implied by major damage, minor damage or affected. The resulting indicative rates of damage for the terms are presented in Table 9, with assumptions noted in the final column.

Table 9 Levels of harm to housing (2008)

Impact term	Type of damage	Illustrative extent of housing damage %	Assumption used %
Destroyed	Amount of damage requires new construction or complete renovation	80-100%	90
Major Damage	Unsafe to live in until repairs are made	40-80%	60
Minor damage	Inhabitable but need repairs, cleaning and clearing	20-40%	30
Affected	Need cleaning and clearing	5-20%	12.5

Source: Blair Charley, KIRMA; Lipar George, ODA; Nena M. William, Office of the Governor, Kosrae State, personal communication, October 2015.

For less common, more extreme events (1:40 year event, 1:100 year event), no documentation exists on the observed impact on housing. As a result, discussions were held with officials of the Kosrae State Government to consider the likely effects of over wash/ from storms. Staff drew on accounts of previous events including the 1905 typhoon that hit Kosrae. Drawing on data from KIRMA of the number of houses seaward of the road and landward of the road, illustrative estimates of possible damage were generated (Table 6).

Impacts of over wash events on road repair costs

Over wash over time can result in damage to the coastal road. Based on discussions (Doug Ramsay, Manager Pacific Rim, NIWA personal communication, October 2015):

- A 1:5 year event could result in minor to moderate damage of the road requiring reinstatement of the shoulder or damage to part of the carriageway;
- A 1:40 year event could result in moderate damage along seaward edge of road along exposed sections (1.6 miles – see Section 3.2), affecting the shoulder as well as undermining the carriageway (loss of parts of the tar surface);
- A 1:100 year event could cause significant damage along the 1.6 miles seaward edge of road along exposed sections.

State Government of Kosrae advised that over wash events leading to potholes etc. along the main paved road of Kosrae would incur road repair costs in the order of USD$5,500 per mile (Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015). These figures were used to calculate road repair costs for a 1:5 year event. By comparison, damage from a 1:40 and 1:100 year event would likely require major structural repairs including replacement of the sub-wearing course (Doug Ramsay NIWA personal communication January 2016). The costs for replacement of these items were based on the full costs of road repaid power mile affected (USD$ 520 000 per mile – see Section 3.1) and expert opinions of the extent (length) of road damage (Doug Ramsay personal communication, January 2016) (Table 10).

Impact of over wash events on the community

Recorded data on the impact of inundation events on families does not appear to exist. In its absence, consultations were conducted with the communities most impacted by inundation on the affected coastline – Malem and Utwe (Annex 2). Community representatives were invited to complete a questionnaire on the effect of coastal inundation and over wash, as well as share views on how the issue should be tackled. Based on the data provided, it would appear that a representative household in Malem or Utwe:

- Contains 7 family members of whom at least 3 are under the age of 18;
- Has been affected by inundation of the coastline, with their home garden being harmed or totally destroyed, affecting their access to food;
- Has experienced negative impacts on utilities from over wash – most likely power outages – but otherwise affecting their access to shops, work or other facilities.

According to the consultations, 63 per cent of respondents had had experience the effects of over wash, with the 2014 over wash event being the most commonly recalled event (affecting a third of affected respondents). The 2014 event was a high (King) tide, similar to the 2008 over wash event which has with an expected return frequency of around 1:5 years.

Table 10 Road damage and other costs without adaptation

Minor events	5 yearly events	40 yearly events	100 yearly events
▪ Road passable ▪ No inundation (but high-tide flooding of property will increase with frequency and potential magnitude with sea level rise ▪ Ongoing coastal retreat resulting in increasing length of road being exposed and ongoing permanent damage to the road	▪ Road mostly passable (although may affect cars) ▪ Debris to be removed ▪ 2 homes destroyed, 4 with major damage,5 with minor damage, 7 affected (2008 report) ▪ Minor road repair costs along seaward edge of road / road pavement along exposed sections ▪ Ongoing coastal retreat ▪ Some loss of earnings	▪ Significant damage (assume 25%) along seaward edge of road along exposed sections, damage to pavement and potential breaching of the road ▪ Potential for Utwe to be cut off for a short period of time until road is made passable (or is passable only on lower parts of the tide until road is fully repaired). ▪ Debris to be removed ▪ 25 homes located seaward of the road expected to sustain major damage ▪ 73 located behind the road expected to sustain minor impact ▪ Road repair costs ▪ Ongoing coastal retreat / breaching of berm ▪ Increased loss of earnings	▪ Significant damage (assume 60%) along seaward edge of road along exposed sections, damage to pavement and complete loss of road sections due to multiple road breaches ▪ Potential for road access and power to Utwe to be cut off for a substantial length of time ▪ Debris to be removed ▪ 25 homes located seaward of the road expected to be completely destroyed ▪ 73 located behind the road expected to sustain major impact ▪ Road repair costs ▪ Ongoing coastal retreat / breaching of berm ▪ Increased loss of earnings

70 householder representatives provided data at the community consultations. Those who completed the questionnaires provided basic data on negative impacts from over wash such as impacts on power, access to work and schools as well as impacts on home gardens. As an example:

- 10 per cent of all household respondents having to spend time to clear yards and or homes of debris. On average, respondents reported spending six days on clean-up;
- 23 per cent of all household respondents stated that power was interrupted as a result of inundation. On average, the outage lasted for three days;
- 10 per cent of respondents reported losing income due to road blockages, power outages, clean-up or other inconveniences from the over wash. The average days' earnings lost was three days.

Considering that the minimum hourly wage for employment with the national government in Kosrae is USD$1.42 per hour – or approximately USD$ 10 for a seven hour day (Bureau of Democracy, Human Rights, and Labour 2010), the diversion of time to clean up and or loss of income is noteworthy.

Extrapolating the survey data to estimate community costs from such effects presumes that the sample of community representatives completing the questionnaire are statistically representative of the entire community affected. This is not certain at this point. Nevertheless, at the explicit request of SPREP, cost estimates for power loss and interrupted earnings are estimated in this analysis using this approach. While they will certainly go some way to indicate the social harm from over wash increasingly faced by the coastal community, the numbers – while modest – must nevertheless be treated with caution.

Lost earnings were estimated by multiplying the average days lost of work in the community by the minimum wage rate. As some of these individuals lost earnings due to time spent cleaning-up after an event, the cost of remaining clean-up activities was calculated separately (Table 11).

Table 11 Lost earnings

Reason for loss	Total days lost	Households affected	Average lost	% survey affected	# households represented between Malem and Utwe
Clean up	8.0	4.0	2.0	5.7	5.6
Other	9.0	3.0	3.0	4.3	4.2
Total	17.0	7.0	2.4	10.0	9.8

For 1:40 and 1:100 year events, there was little frame of reference to estimate probable higher impacts upon earnings. As a result, an illustrative increase of costs of 100 per cent was applied for a 1:40 year event and an increase of 400 per cent for a 1:100 year event for indicative purposes.

Summary findings from the community consultations and questionnaire are provided in Annex 1.

3.7 Existing coastal ersion rates

The coastal area between Malem and Utwe is subject to coastal erosion and the retreat of land. According to KIRMA, aerial imagery analysis by SOPAC and KIRMA reveals that land loss between Utwe and Malem has varied over time with:

- Around 45 to 50 metres lost to erosion between 1944-1976;
- Around 15-19 metres from 1976 to 1997; and
- Around 5-17 metres from 2000 to 2014.

If nothing changes, the coast line would continue to retreat over time because of erosion. Some adaptation options would be expected to affect this change (for instance, revetment would stop coastal retreat), while others would not (such as an inland road).

Based on the figures presented, KIRMA estimates that average historic land loss is around 0.8 m^2 per year (Blair Charley, KIRMA, personal communication, October 2015). This figure was used to quantify the value of different adaptation options in reducing coastal retreat (if any). Bearing in mind that the average value provided by KIRMA reflects historic coastal change over a long period of time, this average is assumed to reflect the impact on coastal retreat of a variety of over wash events, including those with damaging waves (such as a cyclone).

3.8 Impacts of adapation options on over wash/ inundation impacts

The absence of baseline recorded data on over wash events and the fact that the detailed designs of adaptation options will only be finalised during project implementation means that it cannot be known with certainty the effect of the options on present trends in over wash costs. Nevertheless, based on the information presented so far and discussion, some logical deductions can be made about the form of change on the community – principally, that damages to homes will be reduced from destruction to major damage, or major damage to minor damage, or minor damage to affected and so on.

Road repairs using an upgraded road are assumed to be avoided for smaller over wash events of 1:5 and 1:40 year recurrences. For larger 1:100 year events, the effectiveness of adaptation options in mitigating damage varies according to the technology. Road repairs for an upgraded road are assumed to fall for 1:40 and 1:100 year events. In the absence of reports or experience by government officials, indicative savings in road repairs for 1:40 and 1:100 year events are assumed at 50 per cent.

Based on consultations with Kosrae State Government officials and NIWA, the assumed impacts of alternative adaptation options used in there analysis are presented in Table 12.

Possible rates of relocation

A key objective in the road relocation project is to facilitate the relocation of the communities at risk in Malem to Utwe of coastal over wash and inundation, especially in the face of ongoing sea level rise and climate change. Theoretically, establishment of an inland road would facilitate relocation from the threatened coastline and reduce the number of families and homes at risk of over wash, reducing the costs of over wash events. At present, the rate of relocation from the villages or coast to the interior is entirely hypothetical – no relocation strategy has been devised. Relocation would be affected by a variety of factors, not least of which is ownership of or access to, land in the interior for building, as well as access to finance to support the establishment of new housing.

Based on consultations with the communities concerned (Annex 2) community members are completely in favour of relocating because the threat of coastal inundation and harm to person security, health and well-being is high. On the other hand, until it is clear what kind of assistance would be available to assist relocation, the ability of families to relocate is uncertain. Discussions were held with government representatives – some of whom are based in the affected communities – to consider potential scenarios for relocation, should an inland road be established. Based on these discussions together with discussions with the

State Government of Kosrae (Lipar George, personal communication, October 2015), a *conservative* base case relocation rate was estimated in which two householders relocate every five years *following the completion* of the road. This would result in an average relocation over fifty years of 18 households (18 per cent).

DT&I add that – if relocation of the community away from the hazardous area is slow (less than five households every five years, starting five years after completion of the road) – the present access roads would not likely be adequate to provide transport connections for all families still in the process of relocating away from the coastal hazard zone after 20 years (Buncle 2015). As a result, the existing coastal road would have to be replaced after 20 years. This analysis then includes replacement of the entire existing coastal road after 20 years so slow migration levels.

Agricultural impacts of opening up the interior

The State Government of Kosrae observes that agriculture production was undertaken by the Japanese in the Malem and Utwe areas during World War II. Aerial imagery indicates that around 160 acres was farmed at the time (Blair KIRMA communication with SPREP – Image 7). However, agricultural activity in the area ceased following the removal of the Japanese from the island. Drawing on the experience provided, the State Government of Kosrae consider that – once access to the interior is facilitated and agriculture is able to develop – this same scale of agricultural could be targeted again in the future, for subsistence or commercial harvesting purposes (Buncle 2015).

Department of Agriculture officials suggest that tangerine would be a representative/ typical crop type for future inland production. Department of Agriculture representatives proposed average expected annual yields in the area of 2 400 pounds of fruit per acre (Remos Livaie, Agriculture Division, Department of Resources and Economic Affairs – DREA – personal communication via SPREP, November 2015).

Table 12 Impacts on over wash assumed for options

	Minor events	5 yearly events	40 yearly events	100 yearly events
Status quo (no change)	▪ Road passable ▪ No inundation ▪ Ongoing coastal retreat	▪ Road mostly passable (although may affect cars) ▪ Debris to be removed ▪ 2 homes destroyed, 4 with major damage,5 with minor damage, 7 affected (2008 report) ▪ Minor road repair costs ▪ Ongoing coastal retreat ▪ Some loss of earnings	▪ Some breaching of the road ▪ Debris to be removed ▪ 25 homes located seaward of the road expected to sustain major damage ▪ 73 located behind the road expected to sustain minor impact ▪ Road repair costs ▪ Ongoing coastal retreat ▪ Increased loss of earnings	▪ Multiple road breaches ▪ Debris to be removed ▪ 25 homes located seaward of the road expected to be completely destroyed ▪ 73 located behind the road expected to sustain major impact ▪ Road repair costs ▪ Ongoing coastal retreat ▪ Increased loss of earnings
Entire road revetment and new coastal road to existing specifications	▪ Road passable ▪ No inundation ▪ No coastal retreat	▪ Road passable (although may affect cars) ▪ Debris to be removed ▪ Ongoing harm to houses ▪ Ongoing minor road repair costs ▪ No coastal retreat ▪ Some loss of earnings	▪ Road breaches continue ▪ Debris to be removed ▪ 25 homes located seaward of the road continuing to sustain 'major damage' ▪ 73 located behind the road continuing to sustain 'minor impact' ▪ Ongoing road repair costs ▪ No coastal retreat ▪ Increased loss of earnings	▪ Road breaches ▪ Debris to be removed ▪ 25 homes located seaward of the road continuing to be completely destroyed ▪ 73 located behind the road continuing to sustain major impact ▪ Ongoing road repair costs ▪ No coastal retreat ▪ Increased loss of earnings
Road upgrade (elevated) with selective revetment	▪ Road passable ▪ No inundation ▪ No coastal retreat	▪ Road passable ▪ No debris removal costs ▪ Compared to 2008, no homes impacted ▪ No road repair costs ▪ No coastal retreat ▪ No loss of earnings	▪ No road breaches/ debris removal costs ▪ 25 homes located seaward of the road continuing to sustain 'major damage' ▪ 73 located landward of the road go from 'minor damage' to 'affected' ▪ Road repair costs reduced by 50 per cent ▪ No coastal retreat ▪ Loss of earnings reduced by 50 per cent	▪ Road breaches now avoided ▪ Debris on road reduced by 50 per cent ▪ 25 houses located seaside of the road contuse to be completely destroyed ▪ 73 houses located landward of the road go from major damage to 'minor' ▪ Road repair costs reduced by 50 per cent ▪ No coastal retreat ▪ Loss of earnings reduced by 50 per cent
Inland road with selective revetment	▪ Road passable ▪ No inundation ▪ Ongoing coastal retreat	▪ Road passable ▪ No debris removal costs ▪ No road repair costs* ▪ Gradual reductions in inundation with	▪ No road breaches/ debris removal ▪ No road repair costs* ▪ Gradual reductions in inundation with relocation ▪ (Ongoing coastal road damage)* ▪ No coastal retreat	▪ No road breaches/ debris removal ▪ No road repair costs* ▪ Gradual reductions in inundation with relocation ▪ (Ongoing coastal road damage)*

		relocation ▪ (Ongoing coastal road damage)* ▪ No coastal retreat ▪ No loss of earnings	▪ No loss of earnings	▪ No coastal retreat ▪ No loss of earnings

Sources: Blair Charley, KIRMA; Lipar George, ODA; Nena M. William, Office of the Governor, Kosrae State; and Leandro Olando, Civil Engineer, Department of Transport and Infrastructure, personal communication, October 2015

* Any retention of the coastal road while the inland road exists would require ongoing maintenance and repairs in the interim

Discussions with government representatives (Blair Charley, KIRMA; Nena M. William, Office of the Governor, Kosrae State, Remos Livaie, Agriculture Division, DREA) were used to identify a scenario where increasing areas of land (10 acres extra per year) gradually transfer over to tangerine agriculture until the area formerly used by the Japanese for agriculture is filled. Price information to determine the potential value of this new agricultural production was obtained from local market survey (US$0.55 per pound) and from export monitoring datasheets (US$0.50 per pound at quarantine in 2012).

Image 7 1944 cultivated areas from Malem to Utwe

Source: Blair Charley, SPREP personal communication, November 2015).

A summary of values estimated and their importance to the overall picture of adaptation are provided in Table 13.

Table 13 Values estimated

Impact	Valued?	Comment
Debris blocking the road and cost to remove	Yes	
Inundation of coastal houses	Yes	These values are indicative. Actual values are likely to be significant since repeated events would undermine the structural integrity of homes and also potentially result in damage to possessions
Damage to cars	No	
Damage to garden crops	No	
Inability to get to work (Utwe and Malem) resulting in lost income	Yes	Likely to be important to the community as the government is the key employer and average incomes are low
Inability to reach schools and hospitals	No	Important from the perspective of decreasing poverty
Interruption of power, telecommunications – inconvenience for households, loss of earnings to utilities	No	Important – power outages were the utility most commonly noted by community representatives power as a result of over wash (almost a quarter of all respondents reported interruptions to power as a result of inundation.)
Damage to road and need for repairs	Yes	
Trauma and inconvenience	No	
Limited access to interior	No	This is a significant benefit that would affect generations into the future
Road maintenance	Yes	KIRMA (2014)
Land Acquisition	Yes	
Road and utility construction	Yes	
Maintenance of new and existing	Yes	
Awareness cost	Yes	
Environmental impacts?	No	

4 PRELIMINARY RESULTS AND SENSITIVITY ANALYSIS

In the first instance, different adaptation options are assessed for their value:

- In comparison to a *status quo* situation in which the coastal road is replaced, with replacement of the road occurring in the first two years;
- Using a 4 per cent discount rate;
- Assuming that relocation of the coastal community as a result of opening up the interior of the island through a new inland road occurs at a conservative rate of two households moving every five years, starting five years *after* the road has been completed;
- Assuming that this conservative rate of relocation away from the coastal area would require replacement of the existing road after 20 years, if the option continues after 2035, in order to support families who remain in the area and who relocate slowly;
- Assuming that there is no increase in the number of developments of the coastal area unless otherwise stated;
- Assuming that revetment of critical parts of the coastline will proceed regardless of delays in adaptation.

As indicated in Sections 2 and Table 13, not all benefits or costs from an adataption option may be readily identified in practice. In such cases, these values are considered qualitatively and their significance is discussed in detail in the Implications Section. In this analysis, some critical values were not quantified. These include the benefit of adaptation to smaller over wash events (not just the 1:5 year, 1:40 year and 1:100 year events), and the benefits over the next 50 years – and future generations – of access to the interior of Kosrae for both safe harbour and also for economic development. Since omitting values from a CBA is not ideal, interpreting the findings of this CBA must be conducted responsibly. Accordingly, readers are reminded that CBA numbers only tell part of the story about the merits of adaptation; the other part of the story lies in the Implications Section where those items not valued are described and what this means for the overall merit of the activities and their design are considered.

Details findings of the quantified analysis can be found in Annex 5 with a summary of the key findings presented here and in section 6. Summarised values are presented in Table 14 which displays the estimated and payoffs of alternative adaptation options as far as they could be quantified in the form of:

- Net benefits of the adaptation option after costs over time have been accounted for. This is referred to as the bet present value of the option – or NPV;
- The payoff per dollar invested in each option. This is the value benefits of the option in terms of each dollar infested – benefit: cost ration or BCR.

Based on data available, establishing and inland road network now offers the highest quantified NPVs over a 50 year period (Table 14). This option offers an NPV of USD$ 0.37 million. This is equivalent to a payoff per dollar (BCR) of 1.05. In other words, for every dollar invested in an inland road, the people of Kosrae gain back USD$1.05 in savings[2].

Establishing the road in the future offers lower net payoffs than establishing it sooner as a result of the effect of delaying benefit flows. BCR for establishing the inland road in 10 years time and in 20 years time is 0.91 and 0.96 respectively.

[2] Quantified savings; some benefits were not quantified. See Table 13.

It is important to highlight here that – and as indicated in Table 13 – many of the critical benefits for the inland road options have not been quantified in this analysis. First, benefits from avoiding small scale over wash events, from opening up the interior and avoiding damage to possessions, amenities etc. are not included which means that the value of an inland road now (as well as in the future) is underestimated. Moreover, considering the ongoing nature of sea level rise, the long term benefits of opened access to the hinterland by an inland road is a benefit that would be experienced for generations to come. In addition – and as indicated in Section 2.6 – the benefits of an inland road today (as well as in the future) will likely be felt for many more smaller over wash events than just the three types used to quantify benefits. As a result, the true benefits of road relocation now and in the future are certainly much higher.

Based on data available, the option to upgrade the existing coastal road is not expected to generate a positive net benefit. This option offers a quantified NPV of -USD$0.85 million, or a BCR of 0.86 (that is, USD$0.86 in savings/ benefits per USD$1 invested).

Table 14 Quantified payoffs (4 per cent discount rates[3])
(Assumes relocation following completion on an inland road of two households every five years)
(Ranking: 1 is best)

		Revetment with coastal road replaced to existing specifications	Coastal road upgraded (elevated)	Inland road from 2017				Construction of inland road in 10 years' time (2026)	Construction of inland road in 20 years' time (2036)
				No maintenance of old road	10 years' maintenance of old road	20 years' maintenance of old road	50 years' maintenance of old road)		
NPV	Value	-2156561	-849020	387330	380785	371039	-1767740	-556570	-225349
	Rank	8	6	1	2	3	7	5	4
BCR	Value	0.58	0.86	1.06	1.06	1.05	0.94	0.91	0.96
	Rank	8	7	1	1	3	5	6	4

[3] The Kosrae State Government does not have an official discount rate. In the absence of such an official discount rate, a 4% rate is used. The rationale for selecting this rate is that it represents the average worldwide real interest rate over the last 150 years (Sources: N.G. Mankiw. Macroeconomics. 2007). Moreover, a 4% discount rate has been used in other CBA studies recently completed for Kosrae and so applying the same discount rate here will provide for easier comparison and prioritisation of investments within Kosrae.

Impact of maintaining the old road of the value of a new inland road

The payoffs of establishing a new inland road network were scrutinised if the old coastal road was maintained for various periods (not maintained, or maintained for 10, 20 or 50 years). In these cases, the benefits from establishing the road remain much the same while the costs slightly increase. Nevertheless, the costs of road maintenance are not high and these costs are diminished with time, with the effect that the impact on payoffs is negligible, provided that maintenance does not extend beyond 20 years. Maintaining the existing coastal road does, however, have an impact if the road is maintained for 50 years since, as indicated in Section 3.1 (Baseline data – Costs associated with the existing road), maintenance of the existing road after 20 years would require a major replacement of the existing road after 20 years (Table 14). This is discussed further in the Sensitivity Analysis under *Speed of relocation* below. At this point, the value of avoiding having to replace the existing road (say, by speeding up migration) or investing in other adaptations might be considered.

4.1 Sensitivity analysis

The biggest uncertainties in valuing the road project particularly are:

- Costs for the road;
- The discount rate;
- The frequency of severe weather events (direct hits by a tropical cyclone);
- The degree to which it facilities relocating of families away from the threatened coastline and into the interior (or elsewhere for that matter) of Kosrae;
- The availability of funding for the entire proposed road project. If funding is not accessed, this may affect implementation of the proposed road network.

These matters were subjected to a sensitivity analysis.

Costs for the road

The costs to establish an inland road network were first estimated by KIRMA (2014) and then updated by DT&I. These costs therefore represent the most up to date figures for the State Government of Kosrae. On the other hand, the island is reliant upon imports and – as a small island state – is subject to the fluctuations of the international market. To account for the possibility that imported materials might increase in price and consider their impacts upon the value of an inland road, a sensitivity analysis was conducted in which the cost of constructing the road increased by 10 per cent.

In this case, the quantified net costs of an inland road network established today are somewhat sensitive to costs. An increase of 10 per cent in construction costs results in a net cost of around –USD$0.16 million – or a payoff of 0.98 – that is, USD$0.98 worth of benefits per dollar invested (Table 15). This does not change the ranking of the inland road network relative to other adaptation options.

Table 15 Quantified payoffs with higher construction costs (4 per cent discount rates)
(Assumes relocation following completion on an inland road of two households every five years)

	Inland road from 2017 (maintenance of old road for 20 years)	Inland road from 2017 old road abandoned, costs 10% higher
NPV	371,039	-159,395
BCR	1.05	0.98

Discount rate

The State Government of Kosrae does not have a preferred discount rate for investment analysis. In the absence of this, the base case to appraise options involves a 4 per cent discount rate to consider the economic impact of time on impacts. The rationale for selecting this rate is that it represents the average worldwide real interest rate over the last 150 years (Sources: N.G. Mankiw. Macroeconomics. 2007). Moreover, a 4% discount rate has been used in other CBA studies recently completed for Kosrae and so applying the same discount rate here will provide for easier comparison and hence prioritisation of investments within Kosrae.

In practice, the results in this analysis are sensitive to the discount rate used. Lower discount rates generally improve the quantified payoffs for adaptation because they assign greater importance to future benefit flows (Table 16). As a result, with a discount rate of 0 per cent, an inland road established today is shown to generate a significantly higher pay off (NPV=8,842,563; BCR=2.23) provided that maintenance of the existing coastal road does not exceed 20 years (as this requires a new replacement of the existing coastal road).

By contrast, a higher discount rate reduces the quantified payoffs for adaptation because they assign less importance to future benefit flows (Table 16). As a result, with a discount rate of 10 per cent, an inland road established today is shown to generate a negative pay off (NPV=-US$2,086,839; BCR=0.67) and delaying the construction of the road becomes the highest ranked option. Again, it is emphasised that a number of important benefit categories are not reflected in the quantitative results due to a lack of data.

Table 16 Quantified payoffs with different discount rates
(Assumes relocation following completion on an inland road of two households every five years)
(Ranking: 1 is best)

Discount rate		Revetment with coastal road replaced to existing specifications	Coastal road upgraded (elevated)	Inland road established today: No maintenance of old road	Inland road established today: 10 years' maintenance of old road	Inland road established today: 20 years' maintenance of old road	Inland road established today: 50 years' maintenance of old road)	Construction of inland road in 10 years' time (2026)	Construction of inland road in 20 years' time (2036)
10	NPV	**-1325868**	**-2161309**	**-2074635**	**-2082481**	**-2086839**	**-5251561**	**200982**	**1259470**
	Rank	3	7	4	5	6	8	2	3
	BCR	**0.69**	**0.64**	**0.67**	**0.67**	**0.67**	**0.66**	**1.06**	**1.58**
	Rank	3	8	4	4	6	7	2	3
4	NPV	-2156561	-849020	387330	380785	371039	-1767740	-556570	-2156561
	Rank	8	6	1	2	3	7	5	8
	BCR	0.58	0.86	1.06	1.06	1.05	0.94	0.91	0.58
	Rank	8	7	1	1	3	5	6	8
0	NPV	-4371735	3522576	8858529	8859954	8842563	5407040	2724143	-158169
	Rank	8	6	1	2	3	7	5	4
	BCR	0.44	1.55	2.24	2.24	2.23	1.51	1.26	0.99
	Rank	8	7	1	1	3	5	6	4

Frequency of severe weather events

Consultations conducted between SPREP and the State Government of Kosrae reveal that there is some uncertainty around how often tropical cyclones will directly hit Kosrae in the future. The base case for this analysis assumes that a direct hit can be expected round every 100 years (Table 5) although this could be as regular as every 75 years (Buncle 2015).

Based on the data available, the findings are not sensitive to changes in assumptions about the return frequencies of direct tropical cyclone hits. If a direct hit was sustained every 75 years instead of just every 100 years, the payoffs and ranks for adaptation options remain virtually the same (Table 17).

Table 17 Quantified payoffs with more frequent direct cyclone hits (4 per cent discount rates)
(Assumes relocation following completion on an inland road of two households every five years)
(Ranking: 1 is best)

Discount rate		Revetment with coastal road replaced to existing specifications	Coastal road upgraded (elevated)	Inland road established today				Construction of inland road in 10 years' time (2026)	Construction of inland road in 20 years' time (2036)
				No maintenance of old road	10 years' maintenance of old road	20 years' maintenance of old road	50 years' maintenance of old road)		
NPV	Value	-2232538	-827679	432137	425591	415846	-1678126	-531542	-211737
	Rank	8	6	1	2	3	7	5	4
BCR	Value	0.56	0.87	1.06	1.06	1.06	0.95	0.92	0.96
	Rank	8	7	1	1	3	5	6	4

Speed of relocation

The base case to value the inland road was that – five years after the road is completed – two households would relocate every five years to the interior. This estimate is potentially conservative considering that:

- Some of the families along the threatened coastline already own land in the interior around the proposed road;
- The community have expressed absolute commitment to relocating inland;
- Consultations undertaken in the preparation of the proposal, in particular, with landowners, show full support for the development into their land (SPREP 2015b).

In light of this, a sensitivity analysis has been conducted to assess the potential quantified payoff from the road with a faster relocation. In this case, the payoff has been assessed assuming two alternative faster payoff scenarios:

- That five households move every five years, starting five years after road completion; and
- That one household moves every two years, starting two years after road completion.

On the other hand, community consultations (Annex 2) confirm that the ability of the community to relocate hinges upon a number of factors including:

- Access to land – not all families own land in the interior near the proposed inland road;
- Access to finances – as noted in Section 2.6, an average house in Kosrae has a replacement value of around USD$43 000. Few family members have access to such money to establish a new house once an inland road is established. Frankly, they would likely need some form of financial assistance in order to be able to take up the opportunity provided through an inland road to move.

As can be seen from Table 18, the quantified payoffs from an inland road are not very sensitive to relocation rates. This is likely because the assumed transition of families to the interior is so gradual that – once discounting is taken into effect – there is little impact on the present value of benefits. A more rapid rate of relocation improves the NPV of establishing a new inland road, but not by much.

Table 18 Inland road from 2017 with different relocation rates (4% discount rate)

	Most likely?	Faster relocation?
	2 hhs move every 5 years starting 5 years after establishment	5 hhs move every 5 years starting 5 years after establishment
NPV	371,039	645,958
BCR	1.05	1.10

* Established 2017, no maintenance of coastal road

A more important change arises under a scenario where the existing coastal road needs to be re-instated[4] because of slow migration. As can be seen from Table 19, the expenses

[4] i.e. replaced due to substantial degradation

associated with establishing an inland road climb substantially if the existing coastal road has to be retained for more than 20 years.

A clear lesson from this is that any inland road strategy should – if practical – seek to avoid having to maintain the existing coastal road for over 20 years. For example, government might want to develop a strategy to facilitate rapid migration over a 20 year period to avoid having to replace the old coastal road in the long term.

Table 19 Benefits from speedier relocation: the case of maintaining the coastal road for 50 years
4 per cent discount rate

	Inland road from 2017 (50 years' maintenance of old road; 2 households move every 5 years; coastal road replacement)	INLAND ROAD (old road maintained for 50 years; no road replacement (displays savings of faster migration)
NPV	**-1,767,740**	**360,170**
BCR	**0.94**	**1.05**

Targetting the Malem-Yeseng portion of the inland road only

At the request of SPREP, an estimate was made to assess the potential value of establishing the inland road network connecting only Malem to Yeseng. This option becomes important if only part of the funding for the road project becomes available in the first instance. This raises the question of the kind of benefits that staged road relocation might offer Kosrae state.

Targeting the Malem to Yeseng component of the proposed inland road network involves upgrading the two existing access roads as well as establishing a short portion of the inland road (around 39 per cent of the costs of the entire proposed road network from Malem to Utwe). In order to estimate the impact of inundation events occurring with a return frequency of every five, 40 and 100 years:

- It is assumed that construction of this partial road network takes one year, compared to two for the entire proposed Malem and Utwe inland road network.
- The portion of the coast not covered by an inland road – Yeseng to Utwe – would still require road replacement.
- The proportion of the Malem-Utwe coastline covered by Malem to Yeseng was used to attribute:
  - Its share of the road replacement costs.
  - Its share of estimated road clean-up and repair costs in the event of over wash.
  - Its share of old road maintenance applicable to that small road area.
- The proportion of Malem-Utwe households represented over Malem to Yeseng was used to attribute its share of agricultural production facilitated in the interior.
- The maintenance costs of the new shorter inland road are estimated at two per cent of total construction costs, annualised over 50 years;
- The distribution of damage to housing from 1:5, 1:40 and 1:100 year events along the Malem-Utwe coastline was applied to the Malem-Yeseng stretch of coastline, and then scaled down according to the proportion of houses represented in the Malem-Yeseng portion.
- It is assumed that coastal harm will continue unimpeded to be experienced along the Yeseng-Utwe stretch of the coast.

With a 4 per cent discount rate, a partial road from Malem to Yeseng is estimated to generate a net cost of around -USD$6.6 million, offering a lower per dollar invested payoff than a full inland road network established now and in the future. The limited payoff represents the fact that a smaller proportion of families would benefit from the road while the government would still have to replace the existing coastal road to support those families who do not benefit as well as to cope with slow migration.

5 EQUITY AND DISTRIBUTIONAL IMPLICATIONS

Stakeholders experiencing the benefits of a new road are divided between the private sector (principally residents of Utwe and Malem) and the public sector (government departments responsible for repairs to the existing coastal road and clean up following an over wash event) (Table 20).

Based on the 2010 census, which is the latest on hand, householders in Utwe and Malem who stand to benefit from the new road are at the lowest spectrum in terms of socioeconomic status, compared with the people of Lelu and Tafunsak. The 2010 census shows the average income for the people of Utwe at $7,833 and $11,745 for Malem, while Lelu and Tafunsak stand at $14,065 and $13,159, respectively. The costs of lost earnings from road blocks to these families is therefore likely to be more harshly felt than in more affluent communities. Lost education effects are also likely to be important in the longer term as education is essential for development opportunities. Additionally, community consultations revealed that over wash commonly harmed subsistence crops of families. In view of the limited income of the families concerned, ongoing or worsening loss of food crops as a result of over wash will logically be felt more keenly by this community.

Ongoing impacts of road cut offs, lost food and lost education opportunities associated with over wash will harm the economic resilience of an already disadvantaged community. The proposed new road would thus be expected to contribute positively to improved equity within the Kosraean community by minimising lost present and future earnings and improving long term food security.

The benefits of the new road are expected to be felt primarily by families, principally through access to increased agricultural production opportunities. This is significant as it implies both a potential increase in food security to an isolated but also the potential increase in income/ saving in food purchases for a less privileged community. Nevertheless, it is possible that other unanticipated impacts may also arise from the new road (such as environmental impacts), although this is not clear as no Environmental Impact Assessment has yet been undertaken. Certain impacts will be felt by more specific groups.

Table 20 Potential stakeholders in the road project

Cost/benefit	Stakeholder	Comments
Debris blocking the road and cost to remove	DT&I	
Inundation of coastal houses	Householders (Utwe, Malem)	
Damage to cars	Householders (Utwe, Malem) School buses General public	
Damage to garden crops	Householders (Utwe, Malem)	All household members take care of garden – there is no perceived burden on one particular group of society in this
Inability to get to work (Utwe and Malem) resulting in lost income	Householders (Utwe, Malem)	
Inability to reach schools and hospitals	Householders (Utwe, Malem)	Estimated at 300 plus students (School year 2014 Enrolment, Kosrae Statistics Office)
Interruption to power/ telecommunications – inconvenience for households	Householders (Utwe, Malem)	
Interruption to power, telecommunications – loss of revenue to utilities	Utilities (public sector)	
Standard maintenance of old road	DT&I	
Repairs to the road following over wash events	DT&I	
Trauma and inconvenience	Householders (Utwe, Malem)	
Limited access to interior	Land owners	
Land Acquisition	Government	
Road and utility construction	Government	
Maintenance of new road	Government	
Awareness campaign	Government	

Table 21 Population of Malem and Utwe

Village	Male	Female	Total
Malem	257	236	493
Utwe	458	525	983
TOTAL	715	761	1476
% of total	48	52	100

6 IMPLICATIONS

A number of options exist for the coastal communities of Malem and Utwe to adapt to climate change. The form of that these options could take can vary. For example, revetment could cover the entire coastline or just parts. New coastal roads could be built to existing design standards or to new design standards. This analysis considers selected adaptation options to consider a way forward for Kosrae. In so doing, the analysis provides conservative estimates of the potential payoffs from the adaptation options.

This is because:

- The analysis is based on the quantified benefits from the different adaptation options arising from only three types of events – 1:5 year events, 1:40 year events and 1:100 year over wash events. However, the adaptation options could also generate benefits when other events occur;
- Some benefits of adaptation – avoided injuries/ fatalities arising from severe events, damage to cars and crops or ongoing access to schooling – have not been quantified. Significantly, the calculations are based on the assumption that only families located around the coastal road from Malem to Utwe relocate over time with improved access to the interior via a new inland road. In practice, relocation might not be restricted to these communities. Families from other parts of Kosrae might also benefit from improved access to the interior through relocating or using their own inland sites for agriculture production;
- By opening up access to the interior of Kosrae – facilitating enhanced agricultural production while changing the dynamic of development away from the hazardous coastline and into the safer and more sustainable interior – the road could be expected to benefit communities beyond the 50 year period of this analysis, benefitting the community for generations to come.

As a result of these three issues, the potential benefits from developing an inland road now or in the future are quite certain to be higher than quantified.

Based only on those benefits quantified over a 50 year period and applying a 4 per cent discount rate, is shown to generate the highest payoff (NPV) of USD$0.37 million.

This is shown to be higher than establishing the inland road 10 years in the future (NPV=-USD$0.56 million) and 20 years in the future (NPV=-USD$0.23 million) - reflecting, in part, the increasing risks presented by sea-level rise and (potentially also) cyclones.

The option to establish the inland road now is also shown to be superior to the alternative course of action - to protect or upgrade the existing coastal road. These options were shown to generate a negative payoff (NPV = -USD$2.16 million and -USD$0.85 million respectively). Moreover, there are a number of important limitations associated with these responses that are not fully captured in the aggregate results. Most importantly:

- the benefits of an upgraded coastal road specifically would only accrue to those families located *landward* of the road who would benefit from reduced inundation. By comparison, families located *seaward* of the upgraded road would remain in the direct line of the waves and continue to be affected by over wash, with potential harm to family members or properties worsening over time as the sea level rises. As a result, these families would eventually still have to find an alternative means to adapt to the coastal threats. In community consultations, families in Malem and Utwe stated firmly that – if the coastal threats are not addressed – the area will cease to be a safe and unsustainable place for them to inhabit. They viewed that migration out of Kosrae or FSM is the only option remaining (Annex 2). Considering that Kosrae already represents the smallest state in FSM and that the island is presently experiencing a net loss of population due to outward migration (Division of Statistics undated), increased migration as a result of coastal threats may not be desirable both in terms of economic potential, but also in terms of retaining Kosrean culture.

- protecting or upgrading the coastal road can risk generating a false sense of security in the community, allowing families to believe that the area is now safe from inundation and *implicitly encouraging* further coastal development. Such an option is therefore counter to the State development plan intent of encouraging inland development as it can hamper relocation in the medium term. By comparison, establishing an inland road network facilitates relocation and opening up on the interior; and

- there are likely to be additional environmental costs from establishing construction work such as protecting or upgrading of the road along the coast (such as downstream erosion). In the face of ongoing sea level rise, this would appear to be unwise.

There are also other considerations. The payoffs for an inland road established today appear to be sensitive to assumptions about the discount rate. If the discount rate is 10 per cent, the quantified payoffs for an inland road established today become negative - but delaying construction for 10 or 20 years still remains positive.. The issue of discount rate is important since discussions with State Government of Kosrae officials (Buncle 2015) reveal that – while the government does not have a preferred discount rate – some departments consider that a discount rate of 4% is more appropriate than a higher rate of around 10%. Amongst other considerations, this is because inter-generational equity is a major consideration in Kosrae culture.

As some of the unquantified payoffs from an inland road network – particularly in terms of lives and safety ensured and food security increased – are likely to be significant (see Table 12), it is reasonable to expect that the NPV for establishing an inland road system is actually higher. Considering (i) that it will take time for the community to relocate away from the coast, and (ii) that an upgraded coastal road would likely *encourage* development in a hazardous area, risking lives and well-being, there would appear to be sense in targeting the establishment of an inland road now, rather than waiting for the future. This suggests the need for a long planning period for relocation (both in general, as well as with the road specifically). Consequently long term government commitment to this would be essential. Moreover, government might want to develop a strategy to facilitate rapid migration over a 20 year period to avoid having to replace the old coastal road in the long term as this generates considerable costs. In this respect, there would logically be value in conducting a strategic campaign to support community relocation to avoid existing coastal road replacement and get the most benefits from an inland road network.

The sensitivity analysis conducted in this study reveals that the quantified benefits of establishing a shortened road (from Malem, to Yeseng) are not positive and are lower than those that could be achieved by establishing a complete road. This likely reflects the fact that a smaller proportion of the community will benefit while ongoing treatment of the existing coastal road remains. Equally importantly, establishing a portion of the inland road from Malem to Yeseng will leave the community of Utwe cut off from the rest of the community if the road becomes unpassable in future over wash events. This is important for two reasons.

First, ongoing threats will continue to undermine quality of life in the village, risking health and damaging possessions. In particular, damage to the road takes time to repair. While 'minor' over wash events may cut off families for one or two days, extreme events (such as a near cyclone) could cause extensive damage which could take from days to weeks to repair. Ongoing interruption to family life, earnings and education – especially in a community less advantaged than the rest of the Kosrae community – is important. Second – and as already indicated – the poor condition of the existing inland access roads brings into question the safety of the community in using these roads as escape routes. As a result, establishing a partial inland road does not address the quality of all the inland access and the immediate safety of the community. An advantage of establishing an entire inland road is rather that – should a sudden storm surge or over wash event occur – families will all have immediate access to safe inland roads as an escape route – while also having long term access to the interior of the island for development or establishing new homes.

Distributional considerations

Based on the quantitative analysis conducted, by far the greatest beneficiaries from the establishment on an inland road established today are families (compared to government), principally in the form of access to the interior of Kosrae to extend agricultural production. This is important because the communities of Utwe and Malem who stand to benefit first from the new road project already have the lowest average earnings in Kosrae, compared with communities in Lelu and Tafunsak. The opportunity to increase income and or food security through increased agricultural would directly improve the wellbeing of these families.

Moreover, these families already presently suffer a variety of harmful effects from over wash, including reduced earnings (when access to work by hampered by road blocks), reduced educational opportunities (when access to school by hampered by road blocks) and reduced access to food (through the destruction of home gardens). The harmful impacts from these effects have a disproportional impact upon these communities as they already have the lowest average earnings in Kosrae, compared with communities in Lelu and Tafunsak. Ongoing over wash can therefore suppress the economic vulnerability of the community. By comparison, a continually accessible road will minimise this harm and facilitate change, increasing the economic resilience of the community. While items values were not valued in the analysis in theory at least, an inland road project would contribute positively to both the food security and economic security of the community.

Relocation considerations

Consultations held with stakeholders from Malem and Utwe revealed in resounding support for an inland road and for relocation to the interior for safety and security. This support has also been affirmed in the present draft of the proposal for the road project (SPREP 2015b).

However, the rate at which families can move in practice will not be known with any certainty until the community can work through issues in collaboration with government and policy makers. Key issues here are:

- Relocation is likely to take time. The analysis presumes that relocation will be gradual. During this time, families who have not yet moved will continue to need access to the wider Kosrae community through a functioning road. Data analysis suggests that the cost of maintaining the existing coastal road for a few years will have a negligible impact upon the payoffs of a road On the other hand, retaining a functional coastal road could act as a deterrent to relocation to safer ground and can implicitly discourage relocation. After 20 years, retention of the existing coastal road would require a new coastal road to be established which is expensive. There would therefore be logic in establishing a new inland road network while advising the community of the cessation of existing road maintenance at a specific point in time (eg., 20 years or less), providing them with reasonable lead time for their relocation while minimising costs.
- An average house in Kosrae has a replacement value of around USD$43 000 (Section 4.7). Few family members have access to such money to establish a new house once an inland road is established. However, with financial assistance, relocation could be rapid as the community are keen to relocate for safety's sake. As indicated in Section 5, the faster the relocation, the higher the net benefits from relocation. There is therefore logic in the Kosrae State government reviewing access to housing loans or resources for relocation.
- Relocation from the hazardous coast is unlikely to happen while development continues unconstrained along the coast. In the face of sea level rise and climate change, it is unsustainable and unsafe for any new developments to be allowed to continue in hazardous areas such as the Malem to Utwe coastline. In the interest of public safety, no new developments should be permitted here. This constraint would then create a higher drive for developments in safer areas.
- Interim development in hazardous areas such as the Malem to Utwe coastline should be subject to appropriate building standards. In the face of sea level rise, ground level developments would appear to be unsound. Engineers in the State and or national government should be able to recommend clear standards which State government should actively enforce for the safety of the community.
- To support a new inland road and address the points raised above, a strategic communications campaign is required. This should include messages such as why the old road will eventually not be maintained, why new developments along the coastline are not supported, how government can support families in relocation and so on.
- Ultimately – and as indicated in SPREP (2015b), a relocation committee is needed to clarify relocation issues.

Food security considerations

The largest component of quantified benefits from establishing an inland road from today is increased agricultural activity from opening up the interior of the island. At the same time, the impact most commonly reported from over wash was loss of subsistence crops in existing home plots. The cost of lost crops was not quantified in this analysis. However, considering that home gardens provide a common source of food in Kosrae, and in view of the likelihood that a representative home includes at least three young dependents, the negative impact of coastal inundation on food security is likely to be increasingly significant over time.

According to the Office of Statistics, Budget and Economic Management (2009a), Kosrae exported around USD$ 1.2 million worth of agricultural products in 2012 (Table 24). The value of food imports into Kosrae specifically is not presently clear on government web sites, although it is apparent that food imports into FSM in total were around USD$ 58 million in 2012 (Office of Statistics, Budget and Economic Management (2009b) (Table 25). If Kosrae's share of that total was estimated according to its share of national population, Kosrae would be a net importer of food. Ongoing damage to food gardens harms food security for the affected communities and this is likely to worsen with time. Efforts to open up the interior for safe agricultural development would assist in this. There is likely to be benefit in the state Government of Kosrae accompanying any inland road project with a strategic campaign to encourage sustainable agricultural development, as a result.

Table 24 Value of Exports (FOB), FSM: Value ($USD'000s)

Major commodity groups	2008	2009	2010	2011	2012
Agricultural Produce	21	38	27	46	59
Marine Products	-	1	1	464	1,175
Other Products	-	-	-	-	-
TOTAL	21	38	27	509	1,234

Source: Office of Statistics, Budget and Economic Management (2009a).

Table 25 Food imports to FSM ($USD'000s)

Description	2008	2009	2010	2011	2012
Animals and animal products	7,182	9,727	9,915	11,126	12,490
Vegetable products	10,524	12,278	9,592	11,760	13,877
Animal or vegetable fats	930	920	708	856	1,107
Prepared foodstuff, beverages and	27,924	29,594	26,234	29,925	30,593

Source: Office of Statistics, Budget and Economic Management (2009b).

Other issues

A number of issues concerning the road relocation are uncertain. First, the impacts of climate change adaptation projects are unclear. What is the potential environmental impact of major construction work along the coast or inland? While the potential exists that major projects have bring potential risks, they might also bring opportunities. Would opening up the interior of Kosrae provide access to cultural sites hitherto denied to the community because they could not access the area? Would this bring harm? What are the potential environmental impacts of different adaptation options? These matters would presumably need to be considered in an EIA should the road project proceed. Any identified risks would need to be built into a monitoring plan for the project to optimise benefits for the State.

Similarly, the rate of relocation promised by the road project is still unclear. While community enthusiasm for the project is high, relocation depends on access to resources. It is therefore logical that the means and speed of relocation of the community should be monitored as part of the project, should it proceed.

Government presently routinely collects little documentation of the actual effects of over wash on the government, private sector or community. This analysis relied heavily on a key 2008 assessment of the effects over wash. Documentation of disaster events provides the foundation and business case for future remedial action. Government should consider documenting the impact of future events including noting impacts such as impacts of housing and estimated cost of repairs or other remedial action. This data should be stored for future reference.

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ANNEX 1 SCENARIOS ASSESSED

Cases quantified using a 1:5 year event, 1:40 year event, and 1:100 year event

1	Entire existing coastal road revetted only – this was not realistic because revetment really requires a functional road of some form – so this was not reported on
2	**<u>ENTIRE COASTAL ROAD REVETMENT accompanied by a new coastal road built to existing specifications</u>** Construction over two years Replaced coastal road lasts for 35 years Coastal population increases so increasing damage
3	**<u>COASTAL ROAD UPGRADE (ELEVATED), accompanied by selected revetment</u>** Construction over two years Upgraded road lasts for 50 years Coastal population increases so increasing damage
4	**<u>INLAND ROAD ESTABLISHED NOW (old road abandoned – this is unrealistic)</u>** Construction over two years Immediate abandonment of the coastal road (so no revetment or its maintenance around the vulnerable Paal and Mosral and Utwe areas) Five years after road completion, two households move every five years
5	**<u>INLAND ROAD (old road maintained for 10 years)</u>** Construction over two years Existing road is not replaced as only maintaining the existing coastal road for 10 years (and yet it could last for up to 20 with adequate maintenance) Five years after road completion, two households move every five years

6	**INLAND ROAD (old road maintained for 20 years)** Existing road is not replaced as only maintaining the existing coastal road for 20 years at which point the old road expires Five years after road completion, two households move every five years
7	**INLAND ROAD (old road maintained for 50 years)** Construction over two years Old road re-established to existing specifications after 20 years because of slow migration (displays costs of slow migration) Five years after road completion, two households move every five years
9	**INLAND ROAD CONSTRUCTED IN 10 YEARS' TIME** Commence construction in 2026, complete in 2028 Old road re-established once only after 20 years because of slow migration; maintained thereafter for 20 years Revetment and its maintenance of vulnerable areas around Paal and Mosral and Utwe – allows 20 year maintenance Five years after road completion, two households move every five years
10	**INLAND ROAD CONSTRUCTED IN 20 YEARS' TIME** Commence construction in 2036, complete in 2038 Old road re-established after 20 years because of slow migration; maintained thereafter for 20 years Revetment and its maintenance of vulnerable areas around Paal and Mosral and Utwe – allows 20 year maintenance Five years after road completion, two households move every five years

Sensitivity analysis

8	**INLAND ROAD (old road maintained for 50 years with no existing road replacement** Construction over two years Old road not re-established to existing specifications after 20 years to display potential cost savings from faster migration Five years after road completion, two households move every five years

11	**<u>Scenario 4 with inland road construction costs 10 per cent higher</u>**
12	**<u>Scenario 4 with faster relocation</u>** Five years after road completion, five households move every five years
13	**<u>Scenario 4 with faster relocation</u>** Two years after road completion one household moves every two years Re-establishment of old road after 20 years because still has slow migration
14	**<u>Scenario 4 with slower relocation</u>** Five years after road completion, one household moves every five years
15	**<u>SHORTENED INLAND ROAD (FROM MALEM TO YESENG ONLY)</u>** One year to buy land; one year construction period Maintenance of old road between Malem and Yeseng as people still need to reach each other Five years after road completion, two households move every five years Re-establishment of old road after 20 years because of slow migration, maintained for 20 years
16	**<u>Scenario 15 with faster migration</u>** One year construction period Two years after road completion, one household moves every two years
17	**<u>Scenario 4 with slower agricultural production take up</u>**

ANNEX 2 IMPACTS OF INUNDATION ON COMMUNITIES

Recorded data on the impact of inundation events on families does not appear to exist. In its absence, consultations were conducted with the communities most impacted by inundation on the affected coastline – Malem and Utwe. The purposes in the consultations were to:

- Generate some statistics about how over wash events present affect the community (eg., cutting them off, affecting their property); and
- Get a feel for how the communities might be affected by a new inland road.

To achieve this, community representatives were invited to:

- Complete a questionnaire (Annex 3) on the effect of coastal inundation and over wash;
- Focus group discussions on how the issue should be tackled, with groups providing views and feedback on four key questions (Annex 4), followed by a general discussion.

Data cleaning

Responses in some questionnaires were internally inconsistent, with respondents stating that they had never experienced an inundation event but then explaining impacts they had experienced of inundation. These individuals were then recorded as having experienced inundation.

Where respondents described impacts of inundation in terms of weeks and months rather than days, a week was interpreted as 7 days and a month as 30 days unless otherwise obvious. Where respondents stated that they relocated because of inundation or spent time cleaning up after an event but did not specify the length of time, a minimum time of 1 day were assigned. Where respondents provided a range of time (eg., 1-2 weeks), a numeric average was assigned.

Results of the questionnaire

70 completed questionnaires were used: 36 from Malem and 34 from Utwe. Two thirds of respondents identified themselves as heads of household. These were virtually all male. Only two of the 19 women responding identified themselves as heads of households.

Table 1 General information on respondents

	Male	**Female**	**Head of household?**
Malem	67%	33%	64%
Utwe	79%	21%	74%
Total	73%	27%	69%

The households represented by respondents averaged six family members, although the size ranged from one in a household to 10, with seven members being the most common size. Not all questions on the other members of the household were completed, so it was not possible to determine the nature of dependents in each household. From what was provided, a representative household included at least three children under the age of 18.

Not surprisingly for such small communities, many of the families completing the questionnaire were related. Over 80 per cent of all respondents stated that they had always lived in their present village. Just over half stated that they had access to other land in Kosrae.

Impacts of inudation

Of all those responding, 63 per cent advised that they had directly experienced a coastal inundation event or had been affected by one (say, through an impact to services). The proportion of families affected was virtually identical in both villages, with 64 per cent of Malem respondents reporting effects and 62 per cent of Utwe respondents reporting effects. The most commonly recalled event was that of 2014 which a third of affected respondents named.

Of those affected by inundation, the most commonly reported impact on housing was debris in the yard and resulting damage to crops (breadfruit, fruit trees). Considering that home gardens provide a common source of food in Kosrae, and in view of the likelihood that a representative home includes at least three young dependents, the impact of coastal inundation on food security is likely to be increasingly significant over time. Not surprisingly, the impact of coastal inundation on food security was raised several times in group discussions as being a major concern (Table 3).

In addition to damage to food supplies, some affected respondents stated that some household possessions were harmed during inundation, with damage to vehicles and furnishings (including television sets) the most commonly reported. Occasionally, items that were damaged in the past by inundation were cited as irreplaceable. These were commonly photographs but also a passport (raised once).

Of those respondents who reported some experience of coastal inundation, the most commonly reported impact on families was clean up, with over 10 per cent of all respondents having to spend time to clear yards and or hoes of debris. On average, respondents reported spending 6 days on clean up, with Utwe villagers reporting a longer time spent cleaning on average (7 days in Utwe compared to 5 in Malem).

The impact of inundation on utilities was notable. On balance, power was the utility most commonly reported affected, with almost a quarter of all respondents stating that power was interrupted as a result of inundation. Power outages resulted in the spoiling of food as freezers thawed, the inability to prepare food and affected work. A smaller proportion of families lost water, due to broken pipes or power outages (pumping water).

Road breaches affected transport for families, affecting a fifth of all families surveyed. The effect was an inability to get some children to school or employees to work. A reported 10 per cent of respondents stated that they had to take time off work following the event, either because they could not access work due to road breaches or because they had to clean up their compounds. This resulted in a loss of earnings to families.

Nine per cent of all respondents stated that their children missed some schooling. This was either – again – because of road breaches or because uniforms and school items were harmed in the flooding. The average affected child missed two or three days of school. Considering that families usually pay school fees up front, this is a financial cost to families as well as a lost learning opportunity for children.

Table 2 Interruptions to utilities from inundation experienced

	Transport	Water	Electricity	Telephone
Malem	35	9	26	17
Utwe	18	26	29	24
Total	20	16	23	17

The damage to utilities, access or sheer flooding of homes meant that some families relocated temporarily for safety or convenience. Almost one fifth of all respondents surveyed (19 per cent) stated that they had to relocate, with families relocating on average for two days.

Health and safety

The impact of coastal inundation on health was not extensively reported in the questionnaires. On the other hand, this issue was actively discussed in break out groups. As well as concerns about food security and damage to homes, focus groups stressed the issue of family safety and how this could be harmed by ongoing inundation threats. A key issue here was pollution arising from the inundation of pig pens and septic tanks. On this issue, a couple of respondents had stated in their questionnaires that family members had in the past experienced skin rashes after the floods.

Relcoation and other solutions

Focus group discussions identified that families in the Malem/ Utwe area felt that – unimpeded – coastal inundation would likely worsen and continuity in the community would be untenable. All representatives suggested that homes would become unsafe, food security harmed, businesses damaged and – ultimately – families would not be able to stay in the area. Representatives suggested that families would either have to find a way to move inland or overseas.

Both in questionnaires and in focus groups, community representatives expressed complete support for the establishment of an inland road that would allow families to relocate. They also suggested other options to support ongoing coastal access such as the establishment of wave breakers. Relocation raised several issues:

- Access to land – not all representatives had access to land elsewhere. Only half (52 per cent) of respondents had access to other land outside their existing home, and – of those that had land elsewhere – this was not always in the vicinity of the proposed road. As a result, representatives queried who would access land for them.
- Relocation of the road would enable families to access the interior but the proposed road project did not include the establishment of new houses for the affected population. Representatives expressed a need for financial assistance to establish new homes in the interior once the road was established. Several groups raised the need for there to be a change to the criteria for government housing loans and or the need for financial assistance to build new homes.

Summary results of focus groups

1 What is your biggest concern/ fear about coastal over wash and coastal inundation?

Malem Men's group #1	**Malem Men's group #2**
▪ Damage to: - Food crops - Housing ▪ Inundation of pig pens leading to contamination of area from animal waste and the outbreak of disease ▪ Safety of human life (dead or alive)	▪ Damage to properties/ housing ▪ Risk of fatalities from storm surge (where people are right near the coastline and waves are strong, or where strong winds bring down trees onto houses)
Malem Women's group #1 ▪ Safety of the family ▪ Damage to properties/ housing/ food crops ▪ Damage to vehicles ▪ Damage to road	**Malem Women's group #2** ▪ Damage to: - Housing - Food and root crops ▪ Lives of families (safety)

Utwe Men's group #1	**Utwe Men's group #2**
▪ Damage to houses ▪ Food security	Coastal erosion: - Food security - Home safety Health issues Public infrastructure; - School - Utilities and water
Utwe Men's group #3 ▪ Impact on residences ▪ health issues ▪ infrastructure damage ▪ food security	**Utwe Women's group #1** ▪ damage to environment, crops, roads, homes ▪ impact on health

2 What do you think is the answer to over wash/ coastal inundation is? What should the government do? What should families and businesses do?

Malem Men's group #1 ▪ Government needs to: - relocate housing - improve the access road (main road) - immediately maintain power and water system (during a flood) - Establish a wave breaker - set policy direction ▪ There is a need for housing loans to promote movement inland ▪ Families need to promote a move inland by sharing access to interior land ▪ Relocation would be an opportunity for people to get into real estate and for people to lease out properties for business	**Malem Men's group #2** ▪ We need to relocate families, road and other utilities and infrastructure ▪ There is a need for technical assistance to facilitate relocation ▪ Government needs to access financial assistance to facilitate relocation ▪ We need to adjust the housing loan criteria to enable access to funds ▪ On the matter of relocation, we are concerned about the need for families on the coast to have access to land in the interior
Malem Women's group #1 ▪ We need experts to inform relocation etc. ▪ Government needs to fund: - relocation - the building of a sea wall ▪ We need to conserve natural resources to better protect the coast: - Sand and gravel - Mangrove trees - River (canals)	**Malem Women's group #2** ▪ Government needs to: - strengthen/ add a seawall - strengthen enforcement of laws governing coastal activities eg., preventing sand mining ▪ Businesses need to help victims of inundation ▪ Families and business need to work together to develop inundation preparation plans and bring to local government ▪ In the aftermath of an inundation event, businesses need to assist affected families of inundation

<table>
<tr><td>Utwe Men’s group #1

▪ Relocate homes,. Businesses and infrastructure
▪ Climate proof the road</td><td>Utwe Men’s group #2

▪ Relocate upland
▪ Build a wave breaker
▪ Enforce regulations</td></tr>
<tr><td>Utwe Men’s group #3

Relocate – design and implement programmes for relocation</td><td>Utwe Women’s group #1

▪ Relocate.
▪ Government should provide funding support (roads, power)
▪ Families should support relocation</td></tr>
</table>

3 If over wash and coastal inundation continue but nothing is fixed, what will happen to your family/ business? Would you stay?

<table>
<tr><td>Malem Men’s group #1

If nothing changes:
▪ Families would suffer hunger (because of the impact on crops)
▪ Properties would be damaged
▪ The schools would be closed (because of lack of access)
▪ There would be no access to the public services (eg., hospitals)
⇨ Ultimately, people would have to out migrate from Kosrae
▪ Businesses would be harmed as food and commodities are spoiled.
⇨ Ultimately, they would go bankrupt</td><td>Malem Men’s group #2

If nothing changes:
▪ We would need to out-migrate (abroad)</td></tr>
<tr><td>Malem Women’s group #1

▪ If nothing changes, we would continue to have disruptions to family because of fear, hunger and death
⇨ We would definitely not be able to stay
⇨ Housing policies are needed to discourage housing construction near coast</td><td>Malem Women’s group #2

▪ If nothing changes, family relationships disrupted or despair, which will lead to people to leave the island
⇨ We could not stay</td></tr>
</table>

<table>
<tr><td>Utwe Men’s group #1

▪ Continued damage to housing
▪ No more businesses
▪ A move to higher ground</td><td>Utwe Men’s group #2

[discussed in forum]</td></tr>
<tr><td>Utwe Men’s group #3

▪ Life is at risk.
▪ We could not stay</td><td>Utwe Women’s group #1

▪ Health issues
▪ Food problems
▪ Businesses affected</td></tr>
</table>

4 What do you think of the idea of establishing a new inland road? What would be the biggest change to you and your family/ or business?

Malem Men's group #1 ▪ We support the idea of an interior road However: - Families tied could be weakened if people are not located close together as before. This would harm social events and functions - Families would face higher fuel expenses as they now live further away from facilities	**Malem Men's group #2** ▪ We support the idea of an interior road. We see advantages and disadvantages: - Advantages include that we could increase farming with improved interior access, we would have access to a clean environment and we would be safe - However, moving would be costly and there is a risk that – with freer access to the interior, people from other communities might trash the interior or might steal from others' inland farms
Malem Women's group #1 ▪ We fully support the idea of an interior road because we know that we would be safe	**Malem Women's group #2** ▪ It is good to go ahead with an inland road because it will lessen their worries

Utwe Men's group #1 ▪ Healthier population ▪ Safety ▪ Cost savings (avoided damage) ▪ Lower transportation costs ▪ Incomes	**Utwe Men's group #2** 100 per cent agree that we should move upland. This would lead to: ▪ Improved health ▪ Better food production ▪ safety
Utwe Men's group #3 [discussed in forum]	**Utwe Women's group #1** ▪ 100 per cent support relocation ▪ Cost – we need financial support

ANNEX 3 KOSRAE HOUSEHOLDER QUESTIONNAIRE ON COASTAL INUNDATION

The questionnaire was broken into three parts. Section targeted information on stakeholder connections to the area and their experiences of coastal inundation. This section also sought information on access to interior land by stakeholders as a means to indicate whether communities would have the opportunity to relocate if they chose.

Section B collected information about how families suffer as a result of coastal inundation. This section collected information on possible impacts in the form of harm to personal effects (possessions, crops etc.), how or if possessions were fixed/ replaced, clean up and evacuation impacts, injuries, loss of earnings and access to services and interruption to utilities and schooling. Section C invited any general comments community representatives wanted to share.

Data entry only
(questionnaire #)

Data entry only
Consultation session (village name): _______________

KOSRAE HOUSEHOLDER CONSULTATION ON COASTAL INUNDATION

Date	

A PERSONAL BACKGROUND

The purpose in this section is to understand your connection to the area and your experiences of coastal inundation.

A1 Your name ____

A2 Your position in the household (circle)

head of household   student/ youth   Other (please state) ____________________

A3 Are you male or female? (circle)   Male   or   Female

A4 Your village (eg., Utwe, Malem) ____

A5 Including yourself, how many people normally live in your house?

	Age	Male/ female
Person 1		
Person 2		
Person 3		
Person 4		
Person 5		
Person 6		
Person 7		

(Continue on another sheet if necessary)

A6 When did you come to live in this house? (circle/complete)

(i) Always lived here

(ii) Moved here from (town, island) ______________________ in (year) ________________________

A7 If you came here to live from elsewhere, why did you move here to begin with?

____
____

A8 Please indicate if you or your family own land elsewhere in Kosrae. Please give us a general idea of the location of the area (eg., coastal area near other village, interior etc.)

____
____

A9 Who in your family owns this land? (circle)

Me My parents Other (please indicate) ________________________

A10 Have you experienced coastal inundation (coastal floods) in this area in the past? (Circle) (If NO, go to Section C).

Yes No

A11 In what year did you last suffer a coastal inundation event?

____

B PERSONAL IMPACTS FROM PREVIOUS INUNDATION EVENTS

The purpose in this section is to get an understanding of how families suffer as a result of coastal inundation. To answer these questions, it may help you if you think back to the last time a storm surge hit the area.

Personal effects

B1 In previous inundation events, did your house get harmed in anyway (flooded, damaged etc.)? If NO, go to question B2. If YES, please state how:

____
____
____

B2 Please indicate any types of item that were destroyed or damaged. Eg., TV, telephone, refrigerator, Furniture, livestock/animals, cash crops that you were producing, subsistence crops, vehicles etc.). If NONE of your items were destroyed or damaged, please go to question B6.

____
____
____
____
____

B3 How did you cover the cost of replacing or fixing the damaged items?

(i) Didn’t replace/ fix (ii) Insurance (iii) Private savings

(iv) Extended family (v) Charity donations (vi) Government assistance

(vii) Other (specify) ____
____
____

B4 If you spent money to fix or replace items, roughly how much did you spend? _______________

B5 Did you lose any items that are irreplaceable and difficult to value (photos, records, heirlooms etc.)? If YES, which items?

____
____
____

B6 How many days did it take to clean up your house and land after the inundation? _______days

B7 Did you have to live somewhere else at any point because of the inundation? Yes No

If NO, go to question B11.

B8 If YES, why did you have to stay elsewhere? And for how long did you stay there?

I stayed away because ____
____
____

I stayed away for__________ days

B9 Did staying elsewhere cost you anything? If NO, go to question B11. If YES, what did you have to pay for?

____
____
____

Physical impacts

B11 Did you or other members of your household suffer any sickness or injury because of the inundation? (circle) Yes No

If NO, go to question B14.

B12 If YES, what kind of the sicknesses/ injuries occurred (e.g., cuts, injuries and infections from slipping in the water, etc.)?

____
____
____

B13 Did you have to pay for medical treatment as a result?(circle) Yes No

Earnings

B14 Were any of your household unable to work because of the inundation? Yes No

If NO, go to question B16.

If YES, why were they unable to work? (eg., road block, staying home to clean up etc.)

____
____
____

B15 Roughly how many days did they miss? _____ days

Services and utilities

B16 Did you experience disruption in basic services? If YES, what services were disrupted? (Circle all that apply.)

Transport Water supply Electricity Telephone

B21 What problems did these outages cause you?

____

____

B22 On average, how long did you have to wait for the services to resume?

____

____

____

B23 Did you have any issues with blocked roads because of the inundation? If YES, what problems arose?

____

____

B24 Did any children in the household miss any days of school as a result of the inundation?

If NO, go to Section C.

If YES, why? ____

____

____

____

B25 How many children missed school? ___________ children

B26 How many days did they miss each? __________ days

C FINAL COMMENTS

C1 Would you like to add any comments about the inundation?

____

____

____

____

____

____

____

____

____

This is the end of questionnaire. The results of the survey will be made available to the government around October/ November 2015 and these will be released in a report that goes to the government later in the year.

If you would like to find out more about the survey, please contact in the first instance:

Mr Lipar George, Government of Kosrae

THANK YOU FOR HELPING US IN THIS WORK.

ANNEX 4 KEY QUESTIONS FOR FOCUS GROUPS

Consider the responses you have individually given in the questionnaire about coastal inundation in Kosrae. In your groups, please can you now discuss and consider the following questions. Please write your answers on the paper provided:

1 What is your biggest concern/ fear about coastal over wash and coastal inundation?

2 What do you think is the answer to over wash/ coastal inundation is?:

- What should the government do?
- What should families and businesses do?

3 If over wash and coastal inundation continue but nothing is fixed:

- What will happen to your family/ business?
- Would you stay?

4 What do you think of the idea of establishing a new inland road? What would be the biggest change to you and your family/ or business?

ANNEX 5 RESULTS TABLES

Base cases								
	Revetment with coastal road	Coastal road upgraded (elevated)	Inland road from 2017				Construction of inland road in 10 years' time (2026), 2 hhs move every 5 years	Construction of inland road in 20 years' time (2036), 2 hhs move every 5 years
			No maintenance of old road	10 years' maintenance of old road	20 years' maintenance of old road	50 years' maintenance of old road		
Total value impacts (discounted @10%)		1044630	728876	721995	719342	717876	1751859	3474953
Total value impacts (discounted @4%)		2091170	323598	313436	306571	297691	4473786	6249642
Total value impacts (undiscounted)		4631956	-1485983	-1499534	-1513085	-1548318	12472606	14305783
Total value benefits (discounted @10%)	-420837	3866497	4182251	4189132	4191785	4193251	3159268	1436174
Total value benefits (discounted @4%)	-1237609	5364262	7131833	7141995	7148860	7157740	2981646	1205790
Total value benefits (undiscounted)	-3462030	9907217	16025156	16023801	16023801	16087491	2066567	233390
Total value costs (discounted @10%)	919822	4165834	6256506	6256506	6256506	7803850	2476360	1855467
Total value costs (discounted @4%)	949418	4299875	6743591	6743591	6743591	9469265	4792047	3824014
Total value costs (undiscounted)	978816	4433016	7164390	7164390	7164390	11975235	7871462	7464550
NPV (discounted @10%)	-1340659	-299337	-2074256	-2067374	-2064721	-3610599	682908	-419294
NPV (discounted @4%)	-2187028	1064387	388242	398404	405270	-2311524	-1810401	-2618224
NPV (undiscounted)	-4440846	5474201	8860766	7529190	7534611	4112256	-5804895	-7231160
BCR (discounted @10%)	-0.46	0.93	0.67	0.67	0.67	0.54	1.28	0.77
BCR (discounted @4%)	-1.30	1.25	1.06	1.06	1.06	0.76	0.62	0.32
BCR (undiscounted)	-3.54	2.23	2.24	2.24	2.24	1.34	0.26	0.03

	Base case and sensitivity analysis						
	Inland road from 2017 old road abandoned, costs 10% higher	Inland road from 2017 with faster relocation (5 households every five years from five years after establishment)	Inland road from 2017 (no maintenance of old road; 1 hh moves every 2 years)	Inland road with slower relocation (no maintenance; 1 hh every 5 years after 5 years from establishment)	Partial inland road from Malem to Yeseng from 2017 (no maintenance of old road; 2 hhs move every 5 years)	Partial inland road from Malem to Yeseng from 2017 (no maintenance of old road; 1 hh moves every 2 years)	Inland road from 2017, (no maintenance of old road; 2 hhs move every 5 years) - slower agricultural production (4 acres per year)
Total value impacts (discounted @10%)	728876.23	671024.15	226237	725238	3175985	238397	1080810
Total value impacts (discounted @4%)	323598.44	64970.58	-1281213	289202	3287072	-221256	1365483
Total value impacts (undiscounted)	-1485982.84	-2433750.91	-5180973	-1641867	2996165	-1597236	969217
Total value benefits (discounted @10%)	4182251	4240103	4684890	4185888	1735141	1656578	3830317
Total value benefits (discounted @4%)	7131833	7390461	8736645	7166229	4168360	3783100	6089949
Total value benefits (undiscounted)	16025155.78	16972923.85	19720146	16181040	11543008	10132301	13569956
Total value costs (discounted @10%)	6753566	6256506	6256506	6256506	3745994	3745994	6256506
Total value costs (discounted @4%)	7283771	6743591	6743591	6743591	5026751	5026751	6743591
Total value costs (undiscounted)	7737193	7164390	7164390	7164390	7204799	7204799	7164390
NPV (discounted @10%)	-2571316	-2016403	-1571616	-2070618	-2010853	-2089416	-2426189
NPV (discounted @4%)	-151937	646870	1993054	422639	-858391	-1243652	-653642
NPV (undiscounted)	8287963	9808534	12555756	5530604	4338209	2927502	6405566
BCR (discounted @10%)	0.62	0.68	0.75	0.67	0.46	0.44	0.61
BCR (discounted @4%)	0.98	1.10	1.30	1.06	0.83	0.75	0.90
BCR (undiscounted)	2.07	2.37	2.75	2.26	1.60	1.41	1.89

ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

Siosinamele Lui, Peniamina Leavai, Doug Ramsay

SECRETARIAT OF THE PACIFIC ENVIRONMENT PROGRAM (SPREP) Apia, Samoa.

Contents

1 Introduction

Federated States of Micronesia (FSM), with support from the Secretariat of the Pacific Regional Environment Programme (SPREP) is developing a project proposal for submission to the Adaptation Fund (AF) to assist coastal communities in all four states in the FSM prepare and adapt for higher sea levels and adverse and frequent changes in extreme weather and climate events. Like many Pacific islands countries, the FSM's low-lying atolls and coral islands are very vulnerable to natural hazards and disasters such as cyclones, sea surges, and droughts.

The Environment and Social Management Plan (ESMP) provides details, principles, practices and procedures to be implemented by the project to ensure compliance with national and state legislation, regulations, policies and guidance documents. Details of the potential environment effects arising from construction activities of the project and how these will be mitigated are detailed in Sections 5, 6 and 7 of this Report.

This ESMP will require review and amendments once ground truthing is complete to reflect changes to activities, risks mitigation measures, responsibilities and management processes. The ability to make changes to the ESMP is an important aspect of continually improving its effectiveness. In preparing the ESMP the planning stages of the project carried out consultations and follow up meetings with communities and state government environment protection agencies, particularly for Yap, Chuuk and Pohnpei states. The project also carried out a preliminary Environment Impact Assessment (PEIA) for the Kosrae inland road activities. The results of the consultations and meeting identified mitigation measures for the project. These are outlined under this Plan and will be utilised to assist and minimise the low to moderate environment impacts identified for the project.

2 Project Description

This project seeks to enhance community resilience through working with communities focussing on improving water security measures in outer islands of Yap, Chuuk and Pohnpei, and increase resilience of coastal communities to adapt to coastal hazards and risks induced by climate change. The project is expected to deliver a set of targeted and interlinked economic, social and environmental benefits, as well as serve as a model for future replication throughout the four states of the country in other sectors (food security, marine resource management). The project will promote a set of innovations, together with partner institutions / organisations that will help create better living conditions for the outer island and coastal communities of FSM

The key aspects of the project are summarised as:

1. **Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels**
    - Strengthened policy and institutional capacity of government to integrate climate risk and resilience into its water and coastal management legislative, regulatory and policy frameworks through reviews of exisiting environmental legislations and policies.
2. **Demonstration of water security measures in outer islands of Yap, Chuuk and Pohnpei**
    - The activities will focus on water conservation and management technology and practices adopted, responding to drought, sea level rise and early recovery from cyclones and increased awareness of climate change through formal climate education

3. **Demonstration of Kosrae inland road relocation initiative**

- An activity prioritised by the Kosrae Shoreline Management Plan as an essential infrastructure development and considered the highest of priority due to risks to the vulnerable population and existing infrastructure due to wave over washing and potential breaching of existing parts of the road. There is an immediate risk of the road access to Utwe could be cut off.

4. **Knowledge management for improved water and coastal protection**

- The project will develop eight Development plans developed by and for the eight communities and will serve as the overall strategic plans of the communities. These will be climate and disaster and resilient plans that will link all existing sector plans integrating approaches with the view to reduce vulnerability and promote risk reduction measures to island and municipality coastal resources.

3 Project Components

The project presents four components, namely the strengthening policy and institutional capacity for integrated coastal and water management at national and state levels, demonstration of water security measures in outer island of Yap, Chuuk and Pohnpei, demonstration of Kosrae inland road relocation initiative and knowledge management for the improved water and coastal protection.

Component wise project activities and expected outcomes have been designed as follows:

Table 1: Project Components

PROJECT COMPONENTS	EXPECTED OUTCOMES		EXPECTED OUTPUTS
1. Strengthening policy and institutional capacity for integrated coastal and water management at national and state levels	Strengthened policy and institutional capacity of government to integrate climate risk and resilience into its water and coastal management legislative, regulatory and policy frameworks	1.1	Legislation and policy paper to guide regulation of climate resilient coastal and marine management at national level
		1.2	State regulations for development projects amended to consider climate change risks and resilience measures
		1.3	National Water and Sanitation Policy endorsed with climate and disaster risks and resilience, and gender mainstreamed
		1.4	National Water Outlook and Water Sector Investment Plan developed and implemented
2. Demonstration of water security measures in outer Islands of Yap, Chuuk and Pohnpei	(A) Water conservation and management technology & practices adopted, responding to drought, sea level rise and early recovery from cyclones	2.1	Outer island communities oriented to CC, SLR, and adaptive capacity measures involving water, health, sanitation and environment
		2.2	Water Harvesting and Storage System (WHSS) repaired and installed in 6 atoll islands

PROJECT COMPONENTS	EXPECTED OUTCOMES		EXPECTED OUTPUTS
		2.3	Self-Composting Waterless Toilets constructed to conserve water, improve soil environment, and reduce marine eutrophication on the lagoon side
		2.4	3,253 people trained on water conservation and management including coastal protection and livelihoods in 6 outer islands
	(B) Increased awareness of climate change through formal climate education	2.5	Teacher's Guide on Climate Change developed to improve climate change learning in FSM schools and training institutions
3. Demonstration of Kosrae Inland Road Relocation Initiative	Increased resilience of coastal communities and environment to adapt to coastal hazards and risks induced by climate change	3.1	3.6miles (5.8km) of Malem-Utwe inland road and access road routes constructed to sub-base roading standard for future relocation
		3.2	Transitional coastal protection at Mosral and Pal upgraded for immediate coastal protection
		3.3	State support program to access land in upland areas established
		3.4	Community-Based Ecosystem Management strengthened
		3.5	State support program to assist access to finance for vulnerable households established
4. Knowledge management for improved water and coastal protection	Capacity and knowledge enhanced and developed to improve management of water and coastal sectors to adapt to climate change	4.1	Climate resilient Municipality Development Plans developed and communicated
		4.2	Resource materials developed, tailored to local context, translated, published and shared amongst various stakeholders
		4.3	Stakeholders brought together to share, learn and exchange knowledge and skills on climate change, adaptation planning, monitoring, vulnerability assessments and climate change

3.1.1 Monitoring, Evaluation (M&E) and Reporting

The monitoring and evaluation component of the project will be applied in accordance with the established SPREP procedures throughout the project lifetime. This shall ensure the timeliness and quality of the project implementation. The M&E plan will be implemented as proposed in Table 25, Section D, Part III of the main proposal gives the outland and timeframe for each project activity and will keep track of all project activities. The following is the process and the form of reporting that the project will adhere to.

Annual Progress Report (APR)

The APR shall be prepared by the National Project Manager and is to be presented at the Annual Review Meeting for endorsement. The APR will be prepared with progresses against set goals, objectives and targets, lessons learned, risk management and detailed financial disbursements.

Project Annual Review (PAR) Meeting

An Annual Review Meeting shall be conducted annually, with the first meeting a year after the National inception workshop. The meeting will be a high-level review meeting where key representatives of major stakeholders of the project are represented. The objective of the meeting is to review progress, discuss results, challenges and opportunities. Recommendations of the progress review meeting will be the key outcome of the meeting. The recommendations and report of the annual review meeting is submitted to the Project Board for endorsement for action.

Project Board and Project Board meeting

The Board is represented by high-level representatives of the implementing entity SPREP and the executing entities (OEEM, KIRMA Kosrae, R&D Yap, EPA Chuuk, EPA Pohnpei). It is chaired by the Director General of SPREP or a senior adviser directed by the Director General. It is co-chaired by the Director of OEEM acting as the Director of the Project. The National Project Manager acts as the secretariat to the Board. The Board will agree and adopt a coordinated implementation strategy of the project and its partners, as well as endorse the project's first year's annual work plan.

Independent Evaluation

The project would carry out at least two independent external evaluations as follows:

Mid-term Evaluation

The project will undergo an independent Mid-Term Evaluation (MTE) at the mid-point of project implementation. The MTE will determine progress being made toward the achievement of outcomes and will identify course correction if needed. The evaluation will address effectiveness, efficiency and timeliness of project implementation. It will check the relevancy of the project activities so far carried out by the project. It will outline risks and issues that relate to the management and implementation of the project. The list of recommendations will highlight decisions and actions that require responses and execution. The evaluation will review and suggest lessons in relation to the design, implementation and management of the project. The findings of the evaluation will inform the final half of the project period.

Final Evaluation

The project will undergo a final evaluation that will be carried out within three months following implementation closure of the project. The evaluation will be carried out by an independent evaluation time. A final project annual review (PAR) meeting will be conducted following the completion of the final evaluation report. All stakeholders will review the report and the final PAR meeting will be to present, discuss, finalize and endorse the final evaluation report of the project.

4 Policy and Legislative framework

The legal instruments that are the foundation of FSM's environmental safeguards legal regime are ' Federated State of Micronesia Environmental Protection Act 1999' and the Environmental Impact Assessment Regulations 1989'. National policy documents which contains provisions related to the principles and elements of the environmental safeguards are the ‘Federated State of Micronesia's State-Wide Assessment and Resource Strategy 2010-2015+', ‘Federates States of Micronesia's Strategic Development Plan 2004-2023' and ‘Nation Wide Integrated Disaster Risk Management and Climate Change Policy 2013'.

The FSM Environmental Protection Act 1999 states that Preliminary Environmental Impact Assessments (PEIA) can only be carried out if a project is likely to have potential environmental risks and impacts. After wider community consultation, the general consensus was that Component 2 of the project does not require a PEIA because it has very low to no adverse impacts. Therefore the legislative framework presented below is for Component 3 which covers Kosrae Island only.

4.1.1 Legislative framework for Kosrae

Kosrae has enacted legislation and prepared a range of resource and management plans to give effect to its responsibilities in relation to the management, protection and conservation of the environment and natural resources (KIRMA, 2014). These responsibilities are principally implemented by the Kosrae Island Resource Management Authority (KIRMA), a semi-autonomous government agency, which is mandated to: *"protect the environment, human health, welfare and safety and to abate, control and prevent pollution or contamination of air, land and water by balancing the needs of economic and social development with those of environmental quality and adopting regulations and pursuing policies which, to the maximum extent possible, ensure that economic and social development is environmentally sustainable"* (Kosrae State Code, Section 19.101).

Under Title 19 of the Kosrae State Code and the *Regulations for Development Projects* KIRMA has responsibilities and powers to administer a development permit system. Where a potential project may have significant impact on the environment, these regulations require an Environmental Impact Assessment (EIA). This assesses the physical, ecological, aesthetic, cultural, economic, social, or health effects or impacts of a proposed activity on the environment, whether direct, indirect or cumulative. The Environment Impact Statement describes the potential effects or impacts on the environment in sufficient detail so as to allow the assessors (KIRMA, the Board of Commissioners, and stakeholders) to make a comparison of the alternatives that can be taken to avoid, minimize, rectify, reduce or eliminate, or compensate for the impact of the proposed activity. This assessment process concludes with a decision by the Board of Commissioners to issue a development review permit, subject to conditions that will avoid, minimize or eliminate the effects or impacts of the proposed activity on the environment. The process is detailed in full in KIRMA's guidance document*: Environmental impact assessment in the State of Kosrae*, FSM (KIRMA, 2014).

Figure 1: EIA Process (source: Kosrae EIA guidelines)

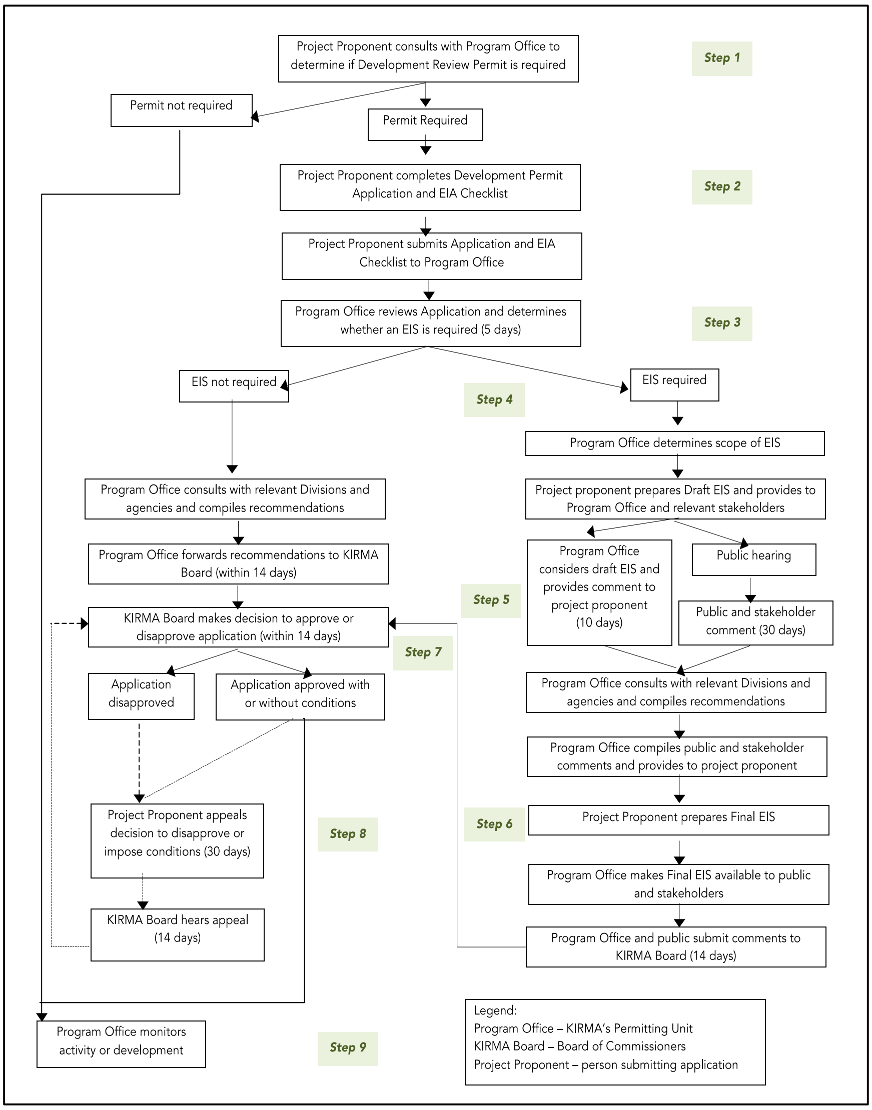

Figure 1 (above) outlines the process for carrying out an EIA in Kosrae. The project has completed the preliminary EIA steps outlined above, from steps 1 to 6. During community consultations held in Malem and Utwe communities (June 2016), the community endorsed the project EIA report. The EIA is currently being made available to the public and stakeholders. Should there be no objections from the public, the project will more forward from steps 7 to 9, going first to the KIRMA board.

5 Environmental Impacts

The objective of assessing potential environmental effects it to identify issues and plan actions and corrective measures to avoid adverse impacts and enhancing positive environmental benefits from the project. The direct positive environmental impacts are on soil and water resources while possible and low adverse environmental effects are on habitats and marine ecosystems. There is no disruption to human livelihood activities by the project nor will it affect natural ecological services.

The wastes (waste water and solid waste) generated from the project activities, especially the construction phase will be addressed by the project. In addition, possible impacts on public health from the proposed sewage disposal system will be addressed by the project to minimise potential health risks. The following are specific environmental effects from the project activities:

5.1.1 Habitats

The rainwater harvesting systems and self-composting toilet (SCT) activities in Component 2 will be located near community buildings (schools and community halls) and will not affect any existing habitat.

The potential road alignment (Component 3) is generally located through disrupted natural habitats of secondary vegetation or agroforestry areas on the lower slopes of Kosrae with no direct impact on wetland or mangrove areas, nor does it impact on known environmentally or culturally important areas.

The impact on habitats and species as a result of the project activities will be very low and localised and will not have an effect on the whole island.

5.1.2 Biodiversity

The oceanic islands of Yap, Chuuk, Kosrae and Pohnpei harbours some of the most biologically diverse forests and coral reefs in the world. There are over 1239 species of flowering plants and ferns with approximately 80% of it endemic to the FSM. The terrestrial ecosystem harbours unique avian, mammalian, reptilian and other species and is also home to a thriving marine ecosystem making these island regions unique and at the same time fragile.

Although the oceanic islands are biologically diverse, it is unlikely for the project to have any significant direct impact on biodiversity, nor will it affect it by introducing any exotic or invasive species. All the construction and building materials for the project will be sourced locally.

5.1.3 Soil Erosion

The water conservation and management (Component 2) of the project will not have a negative impact on soil erosion. However this component of the project will enhance soil enrichment through the use of toilet compost as fertiliser adding nutrients to the thin layer of soil.

There is a medium to significant impact on downstream environment due primarily to construction activities of the road on Kosrae. Construction activities may increase excessive runoff of soil and silt and soil erosion exposed soils during construction. There is also a potential risk of increase sedimentation of the freshwater ponds during the road construction as well as the risk for landslip hazard if road alignment is located on the steep section of the volcanic part of the island.

The alignment of the road selected as much as possible soils with lower erosion potential and to follow the natural topographic contour of the island which helps reduce potential erosion.

5.1.4 Water Resources

Water use within the atoll island communities is derived from captured rainwater captured through a roof-gutter system and stored in water tanks or groundwater. The large volcanic base islands in FSM appear to be able to maintain a substantial freshwater supply from its perennial rivers, freshwater ponds and other sources.

Constructing SCT's and Water tanks (Component 2) will not have a direct impact on the supply of freshwater, though indirectly, it enhances water conservation and management efforts.

The proposed road alignment (Component 3) in Kosrae is located is within the water catchment boundaries of the Palusrik river. Concerns was raised by the Utwe communities of the potential threat of contamination of their water supply as well as potential impacts on the natural flows and natural recharge services the catchment provides for seepage springs around the southern and western base of the plateau. The initial road alignment around the base of the volcanic part of the island between Kuplu and Finsrem has the potential to impact on groundwater springs which are used for private water supply in Finsrem and are important sources of water for Utwe residents during drought conditions. Concerns were raised by the Utwe community over alternative road alignments through the Kuplu Wan plateau resulting in potential contamination of their water supply due to:

- The location of the road and construction resulting in increased sediments or other contaminants entering the Palusrik River and the Utwe water supply

- The improved access to the Kuplu Wan area created by the road subsequently leading to increased development in the Kuplu Wan area, including land clearing, septic tanks, pig pens etc, resulting in increased potential for contamination of the Utwe water suppl.

Therefore, the project will undertake additional mitigation requirements and additional efforts to minimise any potential adverse impacts that may arise from the project activities. Such effort includes;

- avoiding the removal of large tees
- follow Kosrae's road design standards
- following the natural topography of the land to minimise erosion and run off
- Ensuring that key design issues relating to the impacts on catchment, drainage pathways and management of rainwater runoff from the road are properly addressed

5.1.5 Pollution and Waste

It is unlikely that the project activities will generate significant impacts from solid waste and pollution derived from project activities. There is no bulky waste generated from the construction of Component 2, however, there is a potential risk of eutrophication of groundwater resources or nearby marine resources if the SCT system fails.

The potential road alignment in Component 3 will generate a lot of waste materials and possible groundwater contamination from release or spills of fuel and lubricants during fuelling and maintenance of construction equipment.

However, measures to store, control and dispose of any oil or other materials associated with equipment operation, construction and all project activities will be undertaken.

5.1.6 Public Health

Positive impacts and benefits on public health from the construction of SCT's in Component 2 will minimize the risk of vector-borne diseases due to improvement in local sanitary conditions and increasing the overall effective use of water.

The road alignment and the activities in Component 3 opens up land access for more agro forestry activities, thus increasing forest cover and food security. No other development activities are allowed above the Japanese line except for agro-forestry activities in Kosrae.

5.1.7 Landscape

The project will have positive impacts on the aesthetic value and general landscape of the islands through improved sanitary conditions (from activities in Component 2) and the increase in vegetative cover of the catchment area (from activities in Component 3). Minimal adverse impact may arise during the construction phase of Component 3, however, mitigating measures to ensure minimum disturbance to the landscape is provided in details in Annex 1.

5.1.8 Physical and Social Infrastructure

The proposed project does not affect any sacred areas nor will it undermine any traditional beliefs. Continuous consultations and communication with the affected communities will be undertaken by the project to ensure that all project activities does infringe on any sacred areas or traditional places of worship.

5.1.9 Climate Change

The overall project will contribute to increasing community adaptation and resilience to climate change. Component 2 of the project will enhance and repair the rainwater harvesting systems at the household level ensuring at least two (2) 1000 Litre storage tanks per household. The project will also reduce the pressure to rely on household water tanks with the installation of new 10,000 Litre community tanks to buffer the water needs. SCT's will improve water conservation management efforts especially during droughts. Location of SCT's will take into account physical and safety parameters, taking into consideration long term effects from sea level rise and potential impacts from king tides, storm surges and typhoons.

Component 3 supports enhancing the resilience of critical infrastructure and the long-term adaptive capacity of Malem and Utwe communities in Kosrae against adverse impacts of climate change and is not expected to contribute to GHG Emissions. The project will contribute to updating the Kosrae's road design standards which is currently out of date and do not include allowance for increased intensity rainfall for climate change. The proposed road alignment has been designed to be well above any impacts of sea level rise and coastal hazards adhering to the new amendments to the Kosrae Regulations for Development Projects

6 Social Impacts

The social impact assessment objective is to ensure that there is equitable access to the project benefits by all, and it does not exacerbate any existing inequalities. The project does not restrict access to any basic infrastructure nor impact on land rights or causes displacement or involuntary resettlement. The project does not violate any human rights but it seeks to provide equal opportunities in access and benefits from the project for all members of the communities.

6.1.1 Access and Equity

The project will ensure that access is maintained to land property affected by the construction activities and that health and safety is not compromised at any time.

Component 2 of the project will ensure that safety, accessibility and cultural sensitivity will be included in all aspects of the final design and location of the SCT's and water tanks. The project will ensure access to safe sanitary conditions and safe drinking water by all.

Component 3 of the project ensures long-term access for the community of Utwe and parts of Malem Municipality to the Government Center, high school, hospital, airport, port and other villages. Over time it will enable both Malem and Utwe develop safe housing and more resilient communities through improved access to land and infrastructure inland.

6.1.2 Marginalized and Vulnerable Groups

The project does not adversely impact any vulnerable groups found on the four islands(children, women and girls, people living with disabilities or living with HIV/AIDS). The project will improve access to key agroforestry areas for subsistence farmers.

6.1.3 Human Rights

The project does not foresee any violation of human rights.

6.1.4 Gender Equity and Women's Empowerment

The project will enable women and men to participate equally, social and economic benefits will be shared equally, and no gender group will be disadvantaged or suffer disproportionate adverse effects. Women are not directly involved in the physical construction of Components 2 and 3, however, other project activities involving development of maintenance guides, maintenance of infrastructure will create equal opportunities for women and girls to gain skills, knowledge and experience in maintenance of water harvesting and storage systems and SCT's. The direct approach taken by the project to target women for Component 2 will empower women and ensure gender equity within the project activities.

6.1.5 Core Labour rights

The project will be primarily implemented by FSM State Government employees supported by a local NGO and members of the communities. Payments for any adhoc labour under the project will be made as per FSM defined wage rate and core labour regulations.

6.1.6 Indigenous People

The people living in Yap, Chuuk, Pohnpei and Kosrae are all indigenous to their islands with some shared similarities in language and customs. The project does not adversely impact any indigenous people.

6.1.7 Involuntary Resettlement

The project does not require any involuntary resettlement. The inland road between Malem and Utwe is adjacent to 7 properties and the indicative line and easement of the inland road has sufficient space to align the road and avoid any relocation or removal of property.

7 Environment and Social Risk Management Plan

7.1.1 Safeguard and Screening

All project components and activities will undergo a thorough environmental and social impact screening process and will adhere to the standards and safeguards set by the relevant Environment Protection Acts and Policies.

Table 2: Environmental and Social Principles addressed by the Project

Policy Issues/ESP Principles	**Mitigating Actions to address the Environment Risks**
Natural Habitats	Component 2: The project will consult with the communities through planned island community consultations on selection of sites for the project. The repairing of household rainwater harvesting systems will be on existing household sites. There will be no impact on any natural habitats as it will use existing housing infrastructures. The community tanks will be constructed within the building environment and will be situated close to any community infrastructure to leverage the roofs as water catchment area (for example church, schools, health dispensary units, terminals). The self-compositing toilet uses zero water and produces zero waste to the environment. The technology has a closed evapo-transpiration trench system that dissipates water waste preventing any contamination back or leakage to the soil. The technology prevents any waste pollution from seeping into the thin soil and contaminates the ground water. The technology, therefore, promotes the protection of the natural habitats as opposed to destroying the habitats. Component 3: Initial road alignment between Kuplu and Finsrem has been re-routed via Kuplu Wan to avoid any impacts on the Mosral-Utwe Mangrove area which is an area of biological significance. The mangrove area is a defined medium priority area of biological significance and to accommodate the road via its original alignment would result in direct impact from sediment run-off and potential mangrove removal. Concern was also raised by the KIRMA Forestry staff over increased access leading to accelerated mangrove harvesting (and dumping) in an area that is presently only accessible by canoe. Given present pressure on mangrove harvesting in Kosrae this would be a likely consequence. The road passes through upland forest area in the Kuplu Wan area. However, this is out with the upland forest area designated as an area of biological significance as it has undergone past disturbance primarily during the Japanese occupation during the Second World War. The final road alignment will avoid the need for the removal of any large tree species particularly endemic species such as Nunu (*Horsfieldia*).
Conservation of Biological	Component 2: The project will not impact on any ecosystems of the atoll island environment. The project will have a positive impact on conservation of

Diversity	biological diversity by protecting the soil environment from untreated waste and reduce eutrophication of the lagoon sides by preventing any rich nutrients from human waste as runoff into the lagoons. As such, improving the marine environment and ecosystems that act as natural buffers to tidal surges and king tides. Component 3: The project will not impact on the Kosrae flying fox, Kosrae's only indigenous mammal and protected under the Convention against International Trade in Endangered Species (CITES). The current large colony in the upper part of the Yeseng catchment is well away from any proposed construction activities and will not be disturbed. Similarly there is no suggestion that habitat important for, of the current range of, the endangered Micronesia Imperial Pigeon will be disturbed. Most of the forest bird species are found throughout the Malem and Kuplu Wan regions and elsewhere in Kosrae. Whilst larger populations are found in areas of less disturbed mature forest, most are generally found through a variety of habitats including agro-forested areas.
Climate Change	Component 2: Repairing of rainwater harvesting systems at the household level will ensure there are at least 2 1,000L storage tanks per household. In view of prolonged drought and one tank is being emptied and cleaned, the other tank will provide enough water to last the drought. The project will also reduce the pressure to rely on household tanks during drought by installing 10,000L community tanks to buffer the water needs. A minimum of 2 tanks for every 100 people on an island will be installed. The site and situation of the water tanks relative to housing infrastructure, as well as the locations of self-composting toilets, relative to the shoreline from the ocean side, and considering other physical and safety parameters will be considered during the ground-truthing assessments stages of the project. This will be a response to the impacts of wave over-topping and overwash from high tides, king tides, surges, and typhoons. The cyclone-proof building code standards adopted from other Pacific Island Countries such as Samoa will be applied. FSM is currently developing its building codes. This will help reduce the impact from frequent or intense cyclones projected for FSM as a result climate change. Component 3: Kosrae's road design standards include appropriate bridge/culvert design and methodologies to calculate extreme flow rates for the design of drainage structures based on extreme rainfall amounts (1 in 10 year return period event) and the area of the relevant catchment. However, rainfall intensity amounts contained in the standards are out of date and do not include allowance for increased intensity rainfall for climate change. To mitigate potential design impacts on drainage flows: 1. Bridge and culvert design should be based on the most recent extreme rainfall intensity amounts available for Kosrae (the ADB Climate Proofing. A risk based approach to adaptation guidance). Given the "present day" in this guidance is considered to be the 1980-1999 period it is suggested that the 2025 projections are now

	considered "present day", and the design accommodate rainfall intensities to the 2050 projections. 2. Bridges and culverts are designed to accommodate a 25 year return period flow. This is higher than the 10 year return period specified in the design guidance. However, the intensities presented in the ADB guidance are based on a mid-range climate change scenario and there are also typically considerable uncertainty levels associated with extreme rainfall projections, hence the additional allowance would be pragmatic. This would increase the design hourly rainfall intensity used from 150 mm to 256 mm. 3. The road design standards include specifications for bridge and culvert wing walls to avoid bank erosion immediately upstream/downstream of each structure. Where necessary rock mattresses or equivalent should be installed to prevent any erosion of either the upstream or downstream water course. If exit velocities from the any of the culverts of bridges are likely to be significantly increased above normal, energy dissipation measures should also be included to minimise downstream erosion.
Pollution Prevention and Resource Efficiency	The current practice of using the toilets in outer islands, due to limited water and infrastructure resources is promoting pollution of the local marine environment. This is common in low-energy environment of the islands – the lagoon side. This is, however, impacting on food security – in terms of fish suffocating from excess nutrients, and algal bloom marine environments that impacts on marine life. It is already polluting the groundwater and impact on the health of the reefs. The project will not use any method that pollutes existing natural resources. Component 2: The repairs and installation of water tanks and self-composting toilets will use repair materials that have no impact on environment and people. For example, the project will use no lead paints for water tanks and self-composting toilet infrastructures where required. Component 3: The employment of heavy vehicles or equipment during the construction phase will ensure no emissions of pollutants from these vehicles to rivers, streams, creeks, mangrove lakes or the catchment area. Community-based ecosystem management activities alongside of the road, particularly near areas where bridges and or culverts are established, will lead to construction of soil and moisture conservation structures and increase the vegetative cover. This will be done through re-planting of endemic vegetation around river and stream areas at road crossings; developing community gardens along road easement strip to stabilise cleared land. This will contribute towards increase in soil fertility, strengthening and holding river banks, reducing severe riverside erosion. These measures will decrease the need for and demand for fertilizers in the catchment area and promote organic gardening techniques.

	Water quality monitoring of all rivers, streams and within proposed area will be carried out by the project. The monitoring will indicate whether there has been excessive flow of pollutants in the pond. This will be possible through a community-led stream health monitoring program . The program will educate, train and provide hands-on collection of data along the rivers and streams to gauge the level of water quality. The program will implement bio-assessment techniques such as sampling a body of water to find the biodiversity of macroinvertebrates in the water, providing strong indication of the water quality. These water management measures will be implemented with the help of schools, women, and youth organizations. This will build the capacity of the young and old locals to be able to monitor their own environment using local and natural resources. Training on best practice will lead to better understanding on the conservation and use of resources and the importance of it to help communities adapt to climate change and sea level rise. .
Public Health	Construction design and planning will aim to ensure waste is minimized as much as possible. Where possible the opportunity will be taken to use other recycled materials such as wood cuts, cement bases, gutters as spare parts for future maintenance, security fencing; or crushed glass crushed concrete in the road sub-bases. The following controls will be undertaken: 1. All non-hazardous, non-recyclable waste will be placed in containers and regularly emptied and disposed of to a permitted landfill site. 2. Lubricants and used oil will be stored in approved containers and promptly removed from site and disposed of as directed by EPA and KIRMA. 3. Care will be taken to prevent any releases or spills of fuel and lubricants during fuelling and maintenance of construction equipment and will be prevented from entering the ground, drainage areas or water courses by using appropriate containers and bunds. 4. Any oily debris and contaminated soils will be recovered and disposed of as directed by EPA and KIRMA. 5. Adequate sanitary convenience that meets public health and environmental requirements will be provided for construction staff on site. On completion of the works all surplus materials and construction debris shall be removed and recycled or disposed of in an appropriate manner. Any remaining exposed earth surfaces shall be reinstated to match the surrounding topography and revegetated.
Physical and Cultural Heritage	Component 2: During the ground-truthing assessments activity for the repairing and construction of water harvesting and storage systems, and of self-composting toilets, the project will identify any significant and existing

	cultural sites as well as potential new cultural heritage sites. Re-consideration by the community on the location of community water tanks and self-composting toilets will be carried out and re-location of the interventions will be carried out. Component 3: During initial clearing and engineering survey of the road alignment, the Historic Preservation Office of KIRMA will survey any potential new cultural heritage sites identified. Re-alignment of the road will occur to avoid any identified sites.
Lands and Soil Conservation	Component 2: The rapid assessments of water resources on the outer island sites of the project has shown the need to improve conservation of soil as well as avoid or reject any project development that proposes installation of concrete water tanks on the outer islands. The project will carry out the ground-truthing assessments to ensure that the type of water tanks will not be concrete and the location of the tanks allow for maintenance, cleaning and ability to be moved from current location. The self-composting toilets intervention will be built close to existing infrastructure. The facilities are entirely on ground. No digging will be required except for the evapo-transpiration unit that requires only half a meter depth. The design of the self-compositing toilets will therefore promote conservation of soil. Component 3: The EIA (Annex 1) conducted as part of the Development Permit process has identified a range of mitigation measures within the design, alignment of the inland road, construction process and road operation to minimise soil degradation and erosion. This includes a full erosion and sediment control plan. Community monitoring of stream turbidity and stream biota health before, during and after construction has been built in to the project along with community led riparian planting of buffer zones at streams and re-establishment of food trees along the edge of the roadway shoulder to stabilize cleared areas, and to increase public awareness of the importance of riparian and buffer zones. The Development Permit process for the re-construction of the defences at Paal and Mosral has also developed a sediment control plan and identified necessary design options to prevent further exacerbated shoreline erosion at the southern end of each defence.

7.1.2 Social impacts

Table 3: Social Impacts

Policy Issues/ESP Principles	**Mitigating Actions to address the Social Risks**
Access and Equity	There is equitable access to the project benefits by all, and it does not exacerbate any existing inequalities. The project does not impede access to any other basic infrastructure including sanitation and energy nor impact on land rights. Specifically for component 3 (Kosrae), the project ensures long-term access for the community of Utwe and parts of Malem Municipality to the Government Centre, high school, hospital, airport, port and other villages. Over time it will enable both Malem and Utwe develop safe housing and more resilient communities through improved access to land and infrastructure inland.
Marginalized and Vulnerable Groups	FSM including all eight communities do not have any marginalised groups. The vulnerable groups, however, are women, girls, children, men, elderly, and people living with disabilities all that are living in atoll island environments and those that do not own land in upland areas. The project does not adversely impact any vulnerable groups of the six atoll communities and two municipality communities (women, men, youth and people living with disabilities or living with HIV/AIDS).
Human Rights	The project does not foresee any violation of human rights
Gender Equity and Women's Empowerment	The project will enable women and men to participate equally, social and economic benefits will be shared equally, and no gender group will be disadvantaged or suffer disproportionate adverse effects.
Core Labour rights	All labour payments including ad hoc labour payments will adhere to State laws as promulgated by labour regulations defining the relevant wage rate to the relevant work. The principle of equal wages for equal work for men and women will be strictly adhered to in the project. The project will not promote employment of child labour on any of its sites. The adults will be sensitized to provide protective measure for small children in and around constructions sites for water security and inland road construction. Forced labour or any form of bonded labour will be prohibited on the construction sites covered under the project. In case of private lands, agreements to conditions will be established and form part of a written agreement or MoU, at the outset of the project. This will be drawn up between the landowner and the island governing council, acting on

	behalf of the project for the six outer island sites of Yap, Chuuk and Pohnpei.
Involuntary Resettlement	The project does not require any involuntary resettlement. Component 3: The inland road between Malem and Utwe is adjacent to 7 properties and the indicative line and easement of the inland road has sufficient space to align the road and avoid any relocation or removal of property. The criteria for re-alignment (or re-designing) of a section of the inland road will include the fact that in case that there is any possibility or likelihood of involuntary resettlement, displacement of any property, household or community due to project activities, that particular road will be re-aligned. A similar criterion was applied by the project for potential impacts of the project on the environment and was raised by the community of Utwe. The community was concerned over alternative road alignments through the Kuplu Wan plateau resulting in potential contamination of their water supply which is sources from the Palusrik catchment due to: (1). The location of the road and construction resulting in increased sediments or other contaminants entering the Palusrik River and the Utwe water supply; and (2) The improved access to the Kuplu Wan area created by the road subsequently leading to increased development in the Kuplu Wan area, including land clearing, septic tanks, pig pens etc., resulting in increased potential for contamination of the Utwe water supply. The project addressed this concern through ESI screening process. As a result, the alignment of the road through the southern part of the Kuplu Wan plateau (Palusrik catchment) has been re-aligned (DTI, 2016) (refer to Figure 15).

7.1.3 Consultation and Public Disclosure

Consultations of key stakeholders at State, Municipal and Public levels and has been undertaken as part of the development of the Environmental Impact Assessment for the inland road and preparation of the Development Permit Application for the reconstruction of the coastal defences at Paal and Mosral. This builds on similar State, Municipal and public consultation conducted during the development of this proposal and during the updating of the Kosrae Shoreline Management Plan in 2013/14.

Village/Municipal Level Consultation

During the EIA process a presentation and discussion of the project was conducted with firstly the Mayor and Council Members of both Utwe and Malem Municipalities, and immediately following this, an open public meeting in each Municipality, again also attended by the Mayors and Council Members. Following the presentation, clarifications and discussions around issues were conducted around large scale maps of the project area showing the key project components (proposed road alignment/options etc). Discussions and issues identified, including changes to the project design were captured in the EIA (Annex 1).

State Consultation

A cross-Government and key NGO stakeholder group (including the Municipal Mayors) has assisted the development of the proposal were involved in two, one-day workshops at the start and end of the EIA process to finalise project components, identify and discuss issues. This same stakeholder group was also involved in the development of the Kosrae Shoreline Management Plan and will be involved through project implementation. Follow up and additional meetings and discussions were held with other State level stakeholders during the EIA process.

Public Disclosure

KIRMA determine whether a public hearing or consultation is required for any project application. As outlined in Kosrae's EIA process above, the completed draft EIA is generally circulated to all State Stakeholders and made available for public consultation. Stakeholders and the community have a minimum of 30 days to provide comments on the proposal.

7.1.4 Grievance Mechanism

Kosrae's EIA process enables members of the public to make submissions and to raise issues that will be considered by the KIRMA Board prior to any decision on a Development Project application. In addition, any one affected by the decision of KIRMA also has the right to request review of the decision under the Administrative Procedures Act (Title 2 Chapter 4), which includes agency review and further rights of appeal to the Kosrae State Court and Supreme Court of the FSM.

DEPARTMENT OF FOREIGN AFFAIRS

of the

FEDERATED STATES OF MICRONESIA

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8 July 2016

Mr. Naresh Sharma
Chair
Adaptation Fund Board Secretariat
C/O: Global Environment Facility Mail
N 7-700 1818 H Street NW Washington DC
20433 USA

Dear Adaptation Fund Secretariat Board,

The Government of the Federated States of Micronesia's (FSM) Infrastructure Development Plan (IDP) 2016-2025ranks as one of the most important and significant plans of the next 10 years for the FSM as a nation. It documents the priority projects in standalone State Plans providing a direct connection to communities and their needs. The Plan outlines a realistic level of funding representing 70 percent of FSM's infrastructure needs over a 10 years period. It is the first time a climate change adaptation project on infrastructure is included and is being implemented in the State of Yap. A second infrastructure climate change adaptation project is now planned for the State of Kosrae.

The State of Kosrae Legislature endorsed the construction of the Kosrae State inner roads as one of its top priority infrastructure projects and has declared its intention to mobilize all available resources, including development partners' support. The Legislative Resolution No. 11-106 adopted by the Eleventh Kosrae State Legislature, Fourth Special Session 2015 came as a result of a series of national, state and municipal level consultations on the impact of sea level rise on coastal roads, particularly at Malem and Utwe and the need for relocation of the roads. The State Government undertook a Cost Benefit Analysis, an Environmental Impact Assessment and a Monitoring and Evaluation Framework workshop and produced an Inland Road Relocation Initiative (IRRI) as a result of this priority. These are clearly linked to the IDP 2016-2025, Kosrae Shoreline Management Plan 2014 and the Kosrae Strategic Action Plan.

The FSM Government is committed to these State priorities and as a result will be holding a development partners forum this year which will present 2 priority projects from each of the four FSM States for support from partners. Cognizant of the Adaptation Fund to implement the strategies identified under IRRI, the government of Kosrae is including the IRRI as one of the two priority projects from Kosrae.

The Government of the Federated States of Micronesia wishes to take this opportunity to thank you Chair, and the Adaptation Fund Board Secretariat for assisting FSM in building our resilience and adapt to climate change.

Sincerely,

Lorin Robert
Secretary

Copy: Mr. KosimitiLatu
Director General
Secretariat of the Pacific Regional Environment Programme
Adaptation Fund Regional Implementing Entity
Vailima, Apia
Samoa

Malem-Utwe Inland Road and Relocation Initiative Kosrae Monitoring and Evaluation Framework

SECRETARIAT OF THE PACIFIC REGIONAL ENVIRONMENT PROGRAMME (SPREP)

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Acronyms and Abbreviations

AF	Adaptation Fund
CBEM	Community-Based Ecosystem Management
CCA	Climate Change Adaptation
DAF	Department of Administration and Finance
DREA	Department of Resources and Economic Affairs
DT&I	Department of Transport and Infrastructure
EOPO	End-of-project (or program) outcome
FE	Final Evaluation
FSM	Federated States of Micronesia
FSP	Financial Service Provider
FY	Financial Year
GDP	Gross Domestic Product
HH	Household(s)
HIES	Household Income and Expenditure Survey
IRR	Inland Road and Relocation
KCSO	Kosrae Conservation and Safety Organization
KIRMA	Kosrae Inland Resource Management Authority
KSDP	Kosrae Strategic Development Plan
KSG	Kosrae State Government
KSMP	Kosrae Shoreline Management Plan
M&E	Monitoring & Evaluation
MEF	Monitoring & Evaluation Framework
MTE	Midterm Evaluation
N/A	Not Applicable
OEEM	Office of Environment and Emergency Management (National)
PPCR	Pilot Program for Climate Resilience
SBOC	Office of Statistics, Budget and Economic Management
SPREP	Secretariat of the Pacific Regional Environment Programme
TBD	To be determined
VAW	Variation Against Workplan

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1. INTRODUCTION

This document is the Monitoring and Evaluation Framework (MEF) for the Malem-Utwe Inland Road and Relocation Initiative (IRRI) of the Kosrae State Government (KSG), Federated States of Micronesia (FSM). The Framework is aligned with the the FSM Action Plan for 2023[1], the climate-responsive Kosrae Strategic Development Plan (KSDP) for 2014-2023, and the Kosrae Shoreline Management Plan (KSMP) updated in 2014. The KSMP sets out the principles for coastal development in Kosrae over the coming decades, and details key strategies for increasing the resilience of Kosrae's coastal communities.

The preparation of the Malem-Utwe IRRI is supported by the Secretariat of the Pacific Regional Environment Programme (SPREP), an intergovernmental organisation charged with promoting cooperation among Pacific Island Countries and territories to protect and improve their environment and ensure sustainable development. In partnership with the Asian Development Bank, SPREP is implementing the ~~Pilot Program for Climate Resilience (PPCR): Pacific Regional Track~~ . The PPCR includes an initiative to build the capacity of an interdepartmental team in the use of monitoring and evaluation frameworks. The team is comprised of representatives from the the Governor's Office and from the Departments of Administration and Finance (DAF), Resources and Economic Affairs (DREA), Transport and Infrastructure (DT&I) and the Kosrae Island Resource Management Authority (KIRMA), to jointly implement Monitoring and Evaluation (M&E) in the infrastructure sub-sector. This MEF was developed to support this effort.

IRRI is largely a combination of strategies from the KSMP, which is specifically aimed at the Malem to Utwe area. The main strategies from the KSMP are:

- Inland repositioning of a priority section of the road (the Malem-Yeseng-Utwe section (KSMP section 4.2.4.)
- Transitional revetment defences, specifically the highest priority defences at Mosral and Paal (KSMP section 5.1.2)
- Develop a relocation strategy (KSMP section 4.3.2)
- Create incentives to relocate to safer areas (KSMP section 4.3.1).

[1] The 2023 Action Plan is a response to the economic challenge facing FSM to reverse the trend over the first 10 years of the Amended Compact where real gross domestic product growth (GDP) averaged -0.5 percent per annum. Implementing a long-term sustainable growth strategy is the Government's top priority. However, the challenge of growing the private sector at a rate sufficient to produce jobs and entrepreneurial opportunities and to close the fiscal gap in FY2024 is daunting. The Action Plan targets average real growth of 2 percent per annum over the remaining years of the Amended Compact. From 2024 onwards the FSM states will face serious fiscal deficits without any interventions or reforms. A key challenge in fiscal reform is that fiscal policy is formulated individually by the national and state governments, with separate expenditure and revenue policies. However, in order to meet the 2023 challenge, all five governments will need to undertake both revenue and expenditure reforms that reflect the nations long term goals and aspirations. Surpluses for the National Government prior to FY2024 will allow it to achieve two goals. Firstly, it will be able to set aside $15 million per annum into the 2023 Investment Development Fund which will be used to stimulate economic growth. A further $15 million will be invested into the FSM Trust Fund to assist with financing State deficits from FY2024 and beyond. The fiscal challenge in FY2024 occurs at the State level and in particular in Chuuk and Kosrae. The economies of Pohnpei and Yap are stronger and have the capability to partially absorb the fiscal gap of FY2024. The centerpiece of the national strategy for achieving private sector growth is to "ignite tourism" by upgrading over 100 tourism sites, and, obtaining World Heritage Site status for Nan Madol in Pohnpei (and the associated Lelu site in Kosrae). The intent is to link agriculture and fisheries production to tourism as part of FSM's unique destination, offering the supply of fresh fruits, vegetables and fisheries produce. This will require development of farmers' and shipping supply chains to boost supply of local food to hotels and restaurants. Source: FSM 2023 Action Plan; http://whc.unesco.org/en/tentativelists/5652/ (Accessed 9 Dec 2015)

Several Development Partners will contribute to the initiative. One of the Development Partners is the Adaptation Fund[2] (AF), and IRRI is part of a wider proposal for AF funding. The elements to be included in the AF proposal and in complementary proposals will be determined in early 2016. The AF aims to provide all four (4) State Governments in FSM with development planning tools and institutional frameworks to help coastal communities prepare and adapt for higher sea levels and adverse and frequent changes in extreme weather and climate events. These tools and frameworks may include national, state, island, municipal, community and sector plans, policies, regulations, guidelines, standards and protocols.

The MEF was prepared following a Guidance Note prepared by SPREP[3] (see Appendix section 0~~6.1~~ for a brief outline of the methodology).

1.1 Objective

The objective of this MEF is to guide a KSG Team and partners, to conduct M&E of the proposed inland road and relocation initiative (IRRI) for the municipalities of Malem and Utwe. The purpose of the MEF is fourfold, assisting management and adaptation, while supporting learning and accountability.

- **Management**: tracking progress of intervention implementation against plans and to be able to, in a timely manner, adjust program inputs, activities and outputs to successfully achieve expected outcomes where needed.
- **Adaptive Management**: improving the design and performance of an intervention during its implementation and making overall assessments as to its quality, value and effectiveness.
- **Accountability**: reporting on the use of allocated resources to Government, funders, members of the public and intervention beneficiaries.
- **Learning**: inform future planning and revisions of the KSG's IRRI by generating knowledge about good practice, learning from experience as to what works and what does not, and why the intervention has been successful or not, in its particular context.

A particular emphasis of the MEF is to support adaptive management and learning. This is because the IRRI is a new area of work for KSG and will serve as a pilot for future relocation initiatives involving other areas of Kosrae as identified in the KSMP.

1.2 MEF Audiences and Use

The primary audiences for this MEF and the resulting information and knowledge are the Kosrae State Government and its non-governmental partner in the Malem-Utwe IRRI, the Kosrae Conservation and Safety Organization (KCSO) and the Adaptation Fund-related Project Board, Director and Manager at the National Level and other Development Partners who may contribute to the initiative. A key use by the relevant state government departments and KSCO is for ongoing

[2] The Adaptation Fund was established under the Kyoto Protocol of the UN Framework Convention on Climate Change, and has committed US$ 331 million in 54 countries since 2010 to climate adaptation and resilience activities. The Fund is financed in part by government and private donors, and also from a two percent share of proceeds of Certified Emission Reductions issued under the Protocol's Clean Development Mechanism projects.

[3] SPREP. 2015. M&E Guidance Note Kosrae.

planning and adaptive adaptive management. Table 1 summarizes the main audiences, uses and main activities of the MEF[4].

Table 1. Audience, Use and Main Activities of the Monitoring and Evaluation Framework

Audience		M&E Framework Use	Main Activities
Primary	Directors and Heads of Divisions of DAF, DREA, DT&I, KIRMA; Director and staff of KCSO;	Build consensus on the purpose, outcomes and strategies of the, initiative; Planning and adaptive management; Assess progress against expected outcomes; evaluate risks and assumptions; identify lessons and recommendations	• Monitoring • Planning and review meetings • Quarterly Report • Annual Progress Report
	Development Partners including the AF National Project Board, Director, Manger and Technical working group; Governor's Office; Divisions of DAF, DREA, DT&I, KIRMA Director and staff of KCSO	Assess progress against expected outcomes; evaluate risks and assumptions; inform future climate change adaptation- related initiatives, revisions of the KSDP, and strategic planning for the next KSDP, and future investment	Monitoring Visits Annual Progress Report Project Annual Review Project Board Meetings[5] Independent Mid-term Evaluation[6] Independent Final Evaluation[7][8]
Secondary	FSM, Kosrae, Yap, Chuuk and Pohnpei state leaders	Lessons and recommendations to inform future climate change adaptation-related initiatives	Monitoring Visits Independent Mid-term Evaluation Independent Final Evaluation
	Regional organisations	Assess progress against outcomes; identify areas for support; identify effective practices for knowledge sharing	
	Donors/funding partners	Assess progress against outcomes; identify effective practices for knowledge sharing; inform future investment	

[4] The activities are based on the draft proposal to the Adaptation Fund (v.010915)
[5] Annually after PAR; also after MTE and FE
[6] After 2 years of implementation
[7] Within 3 months following implementation closure
[8] SPREP will manage implementation of the MTE and FE

2. INTERVENTION PROFILE AND LOGIC MODEL

2.1.1 Problem Statement[9]

The Malem to Utwe coastal zone area of Kosrae is an 'unstable' storm berm that was created in large part by a series of large typhoons in 1891 and 1905. This coastal margin area is dynamic and subject to continuous change. The rate of change and structure of this area is also affected by climate change-related sea-level rise and changing frequencies and intensities of typhoon events. Uncontrolled mining of beach aggregate and inappropriately designed coastal protection measures are also contributing to coastal erosion in these areas.

The coastal road and a significant number of homes and other infrastructure is located on this narrow (10-50 m wide) berm, with wetland or mangrove between the berm and the upland part of the island. The establishment of the coastal road encouraged settlement along the exposed coastline. Unfortunately, limited information and understanding about the magnitude of flooding hazards and related risks in this area existed at the time of urbanization. Consequently, homes and other infrastructure located in these coastal zone areas are increasingly vulnerable to erosion and associated overwash from king tide events and typhoons. According to a recent Cost-Benefit Analysis (CBA) of infrastructure options (Holland, 2015), potential overwash events are expected to result in the following consequences:

- impacts (damage) on housing, school and church infrastructure
- impacts (damage) on road, power and other essential public infrastructure
- impacts (damage) on safety of the community including potential loss of life
- indirect impacts (losses) associated with damage to road infrastructure. These include reduced earnings and educational opportunities and health effects, when access to work, school and the hospital are hampered by road breaches, and reduced food security, through the destruction of home gardens, which are an important element of food security on the island.

The magnitude of these expected impacts is significant. A conservative estimate of this impact for the next 50 years is around US$146,000 per annum - and this expected impact is increasing in line with increasing frequencies of overtopping and flooding events.

The impact of these effects is exacerbating the already lower economic status of the residents of Malem and Utwe, who have lower average earnings than the residents of the other Kosrae municipalities of Lelu and Tafunsak.

KIRMA estimates that approximately 98 households (HH) (25% of the total number of HH in Malem and Utwe based on the 2010 Kosrae Census) are potentially under threat of overwash/inundation on the stretch of coastal road from Malem to Utwe.

In community consultations, families in Malem and Utwe stated that if the coastal threats were not addressed the area would cease to be a safe and sustainable place to live, and that emigration from

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[9] Sources for this section: 1) Holland, P. 2015. Cost-Benefit Analysis in Coastal Zone Management in Kosrae (FSM): Economic Assessment of Coastal Road Relocation; 2) Ramsay et al. 2013. Kosrae Shoreline Management Plan; 3) KSG. 2013. Kosrae State Strategic Development Plan 2014-2023. 4) SBOC. 2014. Federated States of Micronesia Household Income and Expenditure Survey 2014/14. Main Analysis Report.

Kosrae and/or FSM would be the most feasible option remaining to them. Considering that Kosrae is FSM's smallest state, and that the island lost a quarter of its population between 2000 and 2014 due to economically motivated outward migration, further migration to avoid coastal hazards to could have serious consequences.

The capacity of the Malem and Utwe communities to adapt to/manage these risks through relocation to safer areas inland in particular, is considered low.

2.1.2 Barriers to Adaptation

The key barriers and constraints affecting the adaptive capacity of the Malem and Utwe communities include:

- Lack of an inland road to provide access to safer areas inland
- Lack of land in safer inland areas. Approximately 50% of households located in the vulnerable coastal area do not own land inland. This is complicated by legal restrictions affecting the use and sale of land inland[10].
- Lack of access to affordable finance.

2.1.3 Objective and Strategies of the Malem-Utwe Inland Road and Relocation Initiative

The primary objective of the IRRI is to increase the capacity of the Malem and Utwe communities to adapt and manage risks associated with coastal erosion and coastal flooding. More specifically, the IRRI aims to create conditions to enable the Malem and Utwe communities located in coastal hazard zones to gradually relocate to safer areas inland over the coming 50 years.

The IRRI consists of five key strategies for achieving this objective:

Strategy 1: Construction of an inland road and related public infrastructure
Strategy 2: Increase access to land
Strategy 3: Increase access to affordable finance
Strategy 4: Community-Based Ecosystem Management
Strategy 5: Limit Further Coastal Development

The first three address the three barriers constraining relocation. The fourth is aimed at ensuring that relocation is environmentally sustainable and building resilience to primary climate risks in the inland areas. These primary risks are extreme rainfall events and related flooding and landslide risks.

[10] Currently all land in Kosrae above the so-called *Japanese Line* is under government control. During the Japanese occupation of Kosrae, public lands were expanded to include the shoreline below the mean high water mark, the mangroves and the upland forests above the Japanese Line, which includes approx. 67% of the total land area of Kosrae. As much as 50% of this area is too steep for any development and should be maintained as forest for watershed protection. A Constitutional amendment (Amen 19, 1995) was passed which allows reclamation of land above the Japanese Line by the original landowners. Land will be awarded by issuing a Certificate of Title to an individual or to the Tenancy-in-Common, however, a procedure for reclamation must be established by law before any advancement can be made. (Sources: FSM 2023 Action Plan (pgs 47-48); Kosrae State Land Use Plan 2003)

The fifth strategy is limiting further development of public and private infrastructure in the Malem-Utwe coastal hazard zone.

2.2 Logic model

The Logic Model (Figure 1) provides a graphic illustration of the IRRI design. It was developed through a process summarized in Appendix 2. It shows how a five-year project focused on construction of an inland climate-proofed road with power and water lines supplying designated inland village areas, supported by efforts to 1) improve access to land and finance, (particularly for Malem and Utwe HH who have no land in safer inland areas), 2) protect ecosystems and 3) carefully manage land converted for agriculture are expected to enable the gradual inland relocation of Malem and Utwe HH over the subsequent 5-50 years. Revetment of the existing coastal road would permit continuity of access to services in the meantime. The main strategies for achieving inland relocation are supported by Public Information and Capacity Development. The model also identifies plausible linkages between a road and inland relocation initiative, intended to increase resilience to climate-change, and the KSG/FSM national priority of private sector development.

Before the end of the first five years, KSG will also need to develop plans and access finance for provision of the other critical public infrastructure required for inland village areas; and review this approach to identify gaps and opportunities.

The initiative is intended to generate learning to help provide a roadmap for the eventual relocation of other Kosrae communities to safer inland areas, and contribute to the 50-year vision of:

A sustainable population of Kosraens are living in inland village areas safe from coastal climate change hazards, protecting their ecosystems, participating in a growing private sector, including the development of inland agriculture, and experiencing rising social well-being and equity.

The expected outcomes for the initial five-year period fall in the time zone labeled inception to five years. The outcomes in the ten-year band represent the expected impact of the initiative.

Risks and assumptions relating to each strategy and outcome of the IRRI are also made explicit in the model. A key risk is the potential for environmental degradation associated with inland development. The magnitude of this risk in Kosrae is clear from several older proposals and studies.[11] The environmental risks together with social and cultural issues including land tenure and access are summed up by Monnereau and Abraham (2013)[12] and in the CBA of coastal infrastructure options.

The importance of finding culturally sound solutions to land access matters and the avoidance of degradation through effective community-based ecosystem management can not be overemphasized.

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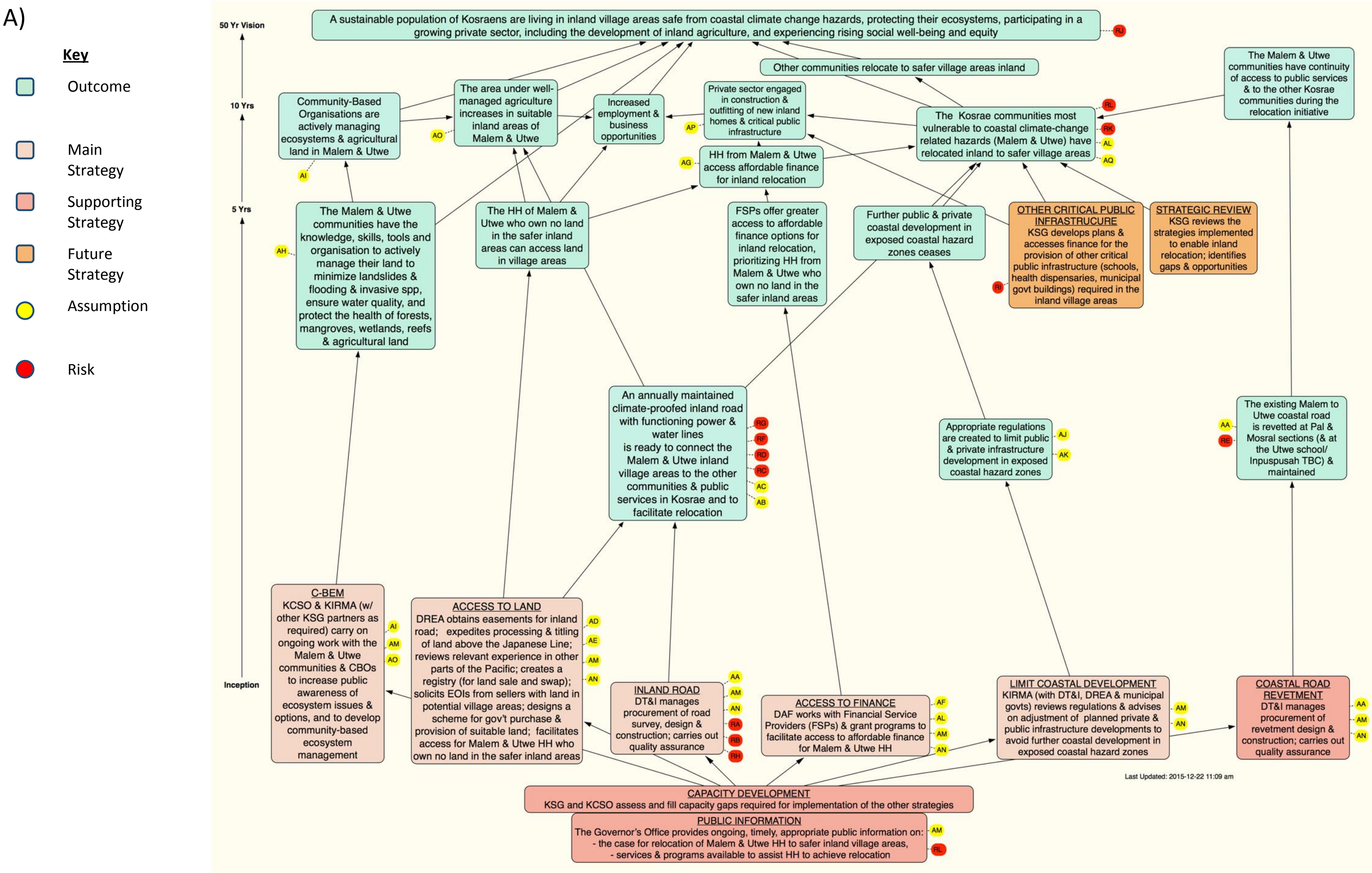
[11] 1) Bell F, 1992. Environmental Analysis for Kuplu Wan Golf Course Proposal Unpublished report USDA Forest Service); 2) Gorenflo LJ. 1993 Demographic Change in Kosrae State, federated states of Micronesia. Pacific Studies 16(2):67-118; 3) Naylor RL, KM Bonine, KC Ewel and E Waguk. 2002. Migration, Markets and Mangrove Resource Use o Kosrae, Federated States of Micronesia. Ambio 31(4):340-50.

[12] Monnereau I and S Abraham. 2013. Loss and damage from coastal erosion in Kosrae, Federated States of Micronesia. Loss and Damage in Vulnerable Countries Initiative. Case Study Report. Bonn: United Nations University Institute for Environment and Human Security.

Figure ~~12~~. A) Logic Model for Malem to Utwe Inland Road and Relocation Initiative; B) Assumptions and Risks

A)



B)

Assumptions:

Infrastructure:
AA: KSG can secure quality contractors to design & build the road/revet the existing road
AB: KSG is able to fund maintenance of the inland road
AC: KSG is able to fund maintenance of the other new power & water infrastructure in Malem & Utwe

Access to Land:
AD: Land swaps happen (between private owners & between private owners and KSG)
AE: KSG is able to successfully negotiate with private land owners for appropriate sites & appropriate prices

Access to Finance:
AF: KSG will be able to apply for GEF6 and other funding in relation to housing and broader development
AG: HH taking loans for relocations have adequate levels of financial literacy

Environmental Management:
AH: Communities & CBOs participate in initiatives for Community-Based Management of ecosystems
AI: Community-based Management of ecosystems is effective

Coastal Development:
AJ: HH will not invest money to build permanent homes in the coastal risk area
AK: Landowners, FSPs & Municipal Govts comply with regulations limiting infrastructure development in coastal hazard zones

Cross cutting:
AL: Malem & Utwe HH willing and able to relocate
AM: Implementing partners have adequate capacity
AN: TA required is available and of adequate quality
AO: Landowners in the inland area opened by the road engage in agriculture
AP: The private sector plays a role in increasing the affordability of house construction
AQ: Relocation occurs gradually with the HH in the most exposed coastal risk zones relocating first

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Risks:

RA: Agreement can not be reached with all landowners on easements required for building the inland road

RB: Climate hazards are more severe than anticipated leading to higher climate-proofing related costs for building the inland road

RC: Landslides damage new inland road

RD: Climate proof-design for the road is not effective

RE: Road revetment de-incentivises and delays inland movement by Malem and Utwe HH

RF: Utwe municipal government fails to permit use of water to supply Malem needs related to inland relocation

RG: Private HH are not willing to negotiate access for to enable power line installation passing through their land

RH: KSG is unable to access sufficient funding for the entire Malam to Utwe inland road

RI: KSG is unable to access sufficient funding for the other public infrastructure needed to facilitate inland relocation

RJ: The opening of the new road and inland area facilitates environmental problems such as incursion of invasive species, forest degradation or erosion

RK: Discord/conflicts between communities and or individuals emerge in relation to land, finance or other issues

RL: Adequate rate and/or density of relocation is not achieved

3. EVALUATION QUESTIONS

The logic model shows that achieving relocation to safer inland areas of two of Kosrae's four municipalities is a complex, long-term strategic initiative with several embedded projects, each corresponding to a component strategy, and requiring coordination at both the individual and overall levels. This complexity implies a considerable burden of data collection and analysis for M&E. To focus the effort, and reduce the risk of overwhelm, it is critical to develop an M&E framework that is flexible and addresses the most critical information and learning needs. The formulation of priority evaluation questions helps to focus the M&E effort and to ensure it addresses the most critical information and learning needs.

The priority evaluation questions identified by KSG and KSCO are shown in Table 2. The "How Addressed" column shows which questions require the collection of monitoring data that will be fed into evaluation (M→E), and which questions will be handled exclusively through evaluation (E).

Table 2. Priority Evaluation Questions

	Questions & Sub-questions	How Addressed
Efficiency	1) To what extent were the key actions associated with each strategy (access to land, access to finance, construction of inland climate proof road, revetment, control of further coastal development; community-based ecosystem management, public information, capacity development) achieved?	1: M→E
	a) Was the new road completed as designed and planned?	
Effectiveness	2) How effective were the strategies?	
	a) What community based ecosystem management projects/actions are being implemented, and what are they achieving?	2a: M→ E
	b) What depth and quality of community participation is being achieved in community-based ecosystem management work?	2b: M→E
	c) How suitable are the sites designated as village areas?	2c: E
	d) How well were the Malem and Utwe HH with no land in the inland area served by the actions to enable access to land?	2d: M→E
	e) How well were the Malem and Utwe HH served by actions to enable access to finance?	2e: M→E
	i) How well were the Malem and Utwe HH with no land in the inland area served?	
	f) How effective are the Public Information efforts at facilitating community participation and ownership?	2f: M→E
	g) How well did changes in new and existing policies and regulations function in limiting further coastal development?	2g: M→E
	3) What worked well and less with with each of the strategies and why?[13]	3: E

[13] Prioritise Inland Road Construction, Access to Land and CBEM strategies if not feasible to analyze all during the Mid-term and final evaluations

	Questions & Sub-questions	How Addressed
Impact	4) What proportion of Malem and Utwe HH are planning, preparing, ready to relocate, or have already done so? 5) What is enabling and constraining readiness for relocation by HH from Malem and Utwe? 6) How are agricultural issues influencing readiness for relocation by HH from Malem and Utwe? 7) How is the private sector influencing readiness for relocation by HH from Malem and Utwe? 8) Were there any unintended effects of the KSG inland road and relocation initiative (positive and negative)?	4: M→E 5: E 6: M→E 7: E 8: E
Sustainability	9) How resilient is the new road to the heavy/extreme rainfall events and associated climate-change related hazards? 10) What, if any, were the gaps in the overall approach? i) What if any are the gaps in the individual strategies? 11) What opportunities exist for addressing these gaps? 12) How sustainable are the strategies implemented by KSG to enable relocation?	9: M→E 10: E 11: E 12: E
Synthesis	13) What are the key lessons for Kosrae from the inland road and relocation initiative?	13: E

4. MONITORING PLAN

Good quality information and data is required to address the key evaluation questions outlined in Section 3 (i.e. questions 1; 2a,b,d,e,f,g; 4; 6; 9). This section outlines a plan for ensuring that **the basic data** needed to help answer these questions is collected. The basic data collected as part of monitoring are 'performance indicators' - quantitative or qualitative variables that measure progress in a specific area of intervention performance.

The 'Monitoring Plan' can also serve to collect information needed for regular progress reporting - for the purposes of informing routine management decision-making, as well as accountability.

To be consistent with the formats utilised by the Adaptation Fund, the Monitoring Plan is presented as a 'Project Results Framework'. The detailed Monitoring Plan or Results Framework is provided at Appendix 3.

5. EVALUATION PLAN

Monitoring information on its own is generally not sufficient to provide answers to all relevant evaluation questions. In particular, monitoring information is not able to explain the reasons why or why not objectives (or performance areas more generally) were achieved, or identify specific success factors or barriers. More in-depth information collected at discrete points in time is needed for this.

This section outlines a plan to ensure the in-depth information needed to fully answer the evaluation questions (and complement indicators collected as part of Monitoring) is collected, and that the methods for doing this are appropriate. For the purposes of this M&E Framework, this is called an 'Evaluation Plan'.

The Evaluation Plan is presented in Table 3 below. This format is different from, but also related to, that used in the Monitoring Plan. It specifies the evaluation questions (column 1); a summary of relevant indicator information collected as part of Monitoring (column 2); and the suggested data collection tool/method for collecting in-depth information needed to fully answer the evaluation question (column 3).

Table 3 Evaluation Plan

Questions & Sub-questions		Summary of Monitoring	Data collection tool/method
Efficiency	1) To what extent were the key actions associated with each strategy (access to land, access to finance, construction of inland climate proof road, revetment, control of further coastal development; community-based ecosystem management, public information, capacity development) achieved? b) Was the new road completed as designed and planned?	Performance indicators for *Outputs* 3.1.1, 3.2.1, 3.3.1, 3.4.1, 3.5.1, and 3.6.1	1: Analysis of Progress Reports - no additional data collection required
Effectiveness	2) How effective were the strategies? a) What community based ecosystem management projects/actions are being implemented, and what are they achieving? b) What depth and quality of community participation is being achieved in community-based ecosystem management work? c) How suitable are the sites designated as village areas? d) How well were the Malem and Utwe HH with no land in the inland area served by the actions to enable access to land? e) How well were the Malem and Utwe HH served by actions to enable access to finance? i) How well were the Malem and Utwe HH with no land in the inland area served? f) How effective are the Public Information efforts at facilitating community participation and ownership? g) How well did changes in new and existing policies and regulations function in limiting further coastal development?	Performance indicators for *Outcomes* 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6.	2.a: Analysis of Progress Reports; Key informant interviews to learn about achievements; and Most Significant Change (MSC) stories 2.b: Analysis of Progress Reports; case studies of CBO leaders and of a purposeful sample of CBO members; and possible use of MSC stories 2.c: Analysis of Progress Reports; Key informant interviews comparing views against Village Area Designation Criteria, Direct observation/Expert Opinion 2.d: Key informant interviews 2.e: Survey and/or key informant interviews with Malem and Utwe HH. Include sample of HH with no land inland (prioritized for relocation assistance); Case studies illustrating key learning 2.f: Analysis of Progress Reports; Key informant Interviews 2.g: Analysis of evidence complemented by Key Informant interviews if necessary
	3) What worked well and less with with each of the strategies and why?[14]	Builds on monitoring information collected for 1 and 2, mentioned above	3: Analysis of progress reports; and key Informant Interviews

[14] Prioritise Inland Road Construction, Access to Land and CBEM strategies if not feasible to analyze all during the Mid-term and final evaluations

Questions & Sub-questions		Summary of Monitoring	Data collection tool/method
Impact	4) What proportion of Malem and Utwe HH are planning, preparing, ready to relocate, or have already done so? 5) What is enabling and constraining readiness for relocation by HH from Malem and Utwe? 6) How are agricultural issues influencing readiness for relocation by HH from Malem and Utwe? 7) How is the private sector influencing readiness for relocation by HH from Malem and Utwe? 8) Were there any unintended effects of the KSG inland road and relocation initiative (positive and negative)?	4: Performance indicator for *Impact*	4: Analysis of Progress Reports; and Key informant interviews 5: Analysis of progress reports; and Key informant interviews 6: For change in areas: Rapid survey (Malem, Utwe); Aerial photographs For views: Key informant interviews 7: Key informant interviews and survey of private sector actors, Most Significant Change (MSC) stories 8: Analysis of progress reports; and Key Informant Interviews
Sustainability	9) How resilient is the new road to the heavy/extreme rainfall events and associated climate-change related hazards? 10) What, if any, were the gaps in the overall approach? i) What if any are the gaps in the individual strategies? 11) What opportunities exist for addressing these gaps? 12) How sustainable are the strategies implemented by KSG to enable relocation?	9: Performance indicator for Outcome 3.1	9: Analysis of progress reports; and Key Informant Interviews 10, 11: Stakeholder workshop; Analysis and synthesis of evidence 12: Analysis and synthesis of evidence
Synthesis	13) What are the key lessons for Kosrae from the inland road and relocation initiative?	All performance indicators	13: Analysis and synthesis of evidence

An independent evaluation specialist will be responsible for collecting the evaluation information. This will be undertaken as part of the mid-term evaluation and the final/terminal evaluation.

Indicative Terms of Reference for the independent MTE including a cost estimate are in Appendix 4. The team size, the process outline and the associated budget reflect a very comprehensive approach that can be scaled down. The Terms of Reference for the FE would be similar but subject to adjustment depending on the evolution of the initiative and learning from the commissioning of the MTE.

6. COMMUNICATION & KNOWLEDGE MANAGEMENT

Given the interdepartmental nature of the IRRI, the creation of a common repository for reports, resources and monitoring data is recommended. This could consist of an online password-protected folder accessible to all partners (e.g., via Google Docs or Dropbox) with a clear directory structure for key data, progress, evaluation and research reports. The system could be set up and overseen by the lead agency.[15] Each department would be responsible for managing relevant subfolders.

A plan for communication and knowledge management related to the MTE and FE reports is outlined below in Table 4~~Table 3~~. It recommends ways to pre-package and repackage information and knowledge from these evaluations to ensure effective communication and increase the probability of use.

[15] The lead agency remains to be determined.

Table 4~~5~~. Communication and Knowledge Management Plan

Report type	Audiences	Timeline	Pre-packaging & Repackaging	Dissemination	Cost (USD)	Knowledge Management
MTE & FE	KSG/KCSO and Development Partners (MTE/FE Steering Committee)	Inception Phase	Consultation on strategies to ensure achieve effective dissemination and use findings	N/A	See MTE TOR	N/A
	KSG /KSCO implementing team	Before MTE/FE report is finalised	Validation Workshop (see TOR, Appendix section 0~~6.4~~)	Workshop for feedback on findings & recommendations & to create ownership. Gather recommendations on dissemination approaches and modify this plan accordingly.	TBD	See recommendation above on creation of repository for IRRI related information
	KSG policy makers	After Validation Workshop	Briefing for Governor	Short presentation of key findings and recommendations accompanied by short written brief. Obtain recommendations for dissemination approaches to FSM national government audience.	See MTE TOR	Knowledge products become part of KSG/KCSO IRRI repository
	FSM policy makers	After finalization of MTE/FE report	Action approaches recommended by MTE Steering Committee, implementing team and Governor		TBD	
	Kosrae communities		Depending on recommendations develop press releases to disseminate via Kosrae radio, posters with infographics, and also possibly video, photo essay and web material as appropriate. Churches are powerful institutions in Kosrae and should be considered in the dissemination strategy.		TBD	
	Development Partners		Depending on recommendations develop website, infographics, video etc. material		TBD	

7. CONCLUDING REMARKS

This framework outlines the approach that the KSG will take - working with Development Partners - to monitor and evaluate the implementation of the Malem-Utwe Inland Road and Relocation Initiative (IRRI).

A key feature of the framework is to focus the M&E work on answering a number of key evaluation questions and sub-questions - which were discussed and agreed by stakeholders during a workshop in November 2015.

The intention for this M&E framework is to be a 'living document' that will be periodically updated and adjusted according to the priority learning needs of KSG.

Appendix 1 Methodology

This M&E Plan was prepared following the Guidance Note for Developing Monitoring and Evaluation Frameworks: Strengthening the effectiveness and Resilience of Development Efforts in Kosrae. (SPREP, 2015)

Step 1: Summarise the evidence and logic of intervention design

Step 2: Incorporate external factors and risk into the Logic Model

Step 3: Formulate key evaluation questions

Step 4: Prepare a Monitoring Plan

Step 5: Prepare an Evaluation Plan

Step 6: Prepare Terms of Reference for key evaluative analyses

Step 7: Prepare a Communication, and Knowledge Management Plan

Step 8: Putting it all together

Appendix 2 Development of the Logic Model

The logic model for the Malem-Utwe IRRI was developed through a two step process: 1) initial framing and, 2) refinement. The initial framing occurred at a workshop with key stakeholders attended by the key KSG Departments of Infrastructure and Transport (DT&I), Finance and Administration (DFA); Resources and Economic Affairs (DREA) and the Kosrae Inland Resources Management Authority (KIRMA), the Governor's Office and a representative from the NGO, Kosrae Conservation and Safety Organization (KCSO). The facilitation style involved the use of plain language and avoidance of M&E jargon. A report of the workshop was prepared by SPREP and is available upon request.

The initial facilitation questions were:

- **What changes do you intend to achieve by the end of the project.**
  These were referred to as EOPOs (End-of-Project Outcomes)
- **What needs to be in place to achieve the EOPOs: What barriers must be overcome?**

These questions led to the identification of a series of outcomes that were grouped into three time horizons: within five, ten and fifty years. The outcomes desired within 50 years were formulated into a broad, guiding statement of vision linked to the KSDP. Achievement of gradual relocation of Malem and Utwe HH inland was seen as being a 10-year process, and the five-year project lifecycle was seen as a first phase, and the time required to create conditions to enable relocation. The principal outcomes identified were construction of an inland climate-proofed road, and achievement by Malem and Utwe HH of access to land and finance for inland relocation. Once the desired outcomes were identified for these at 10 and 5-year time horizons, a new facilitation question was introduced.

- **What are the main strategies (related groups of activities required to bring about the EOPOs)**

The main strategies identified were: Inland Road (Malem to Utwe) Construction; Access to Land, Access to Finance, Limiting Further Coastal Development, and Community-Based Ecosystem Management (CBEM). Three supporting and cross-cutting strategies were added: Coastal Road

Revetment, Public Information and internal Capacity Development. Main activities together with institutional responsibilities were identified for the strategies of Inland Road Construction and Revetment, Access to Land, Access to Finance and Limiting Further Coastal Development. Further work will be required to identify the main activities to be carried out under the CBEM, Public Information and internal Capacity Development.

A visualization of the emerging logic model was prepared based on the discussions up to this point, shared, discussed and refined further.

Using the logic model visualization as the basis for discussion, assumptions and risks were identified in relation to the strategies and EOPOs. The facilitation questions were

- **What are our beliefs** (assumptions) **about how things will work in this project?**
- **What are the forseeable risks** (factors beyond our control that may be manageable) **associated with implementation of this project?**

Assumptions and risks were identified in relation to both strategies and outcomes.

The process of creating the logic model led to the identification of several outcomes, strategies and related stakeholders that had not been envisioned initially as being within the scope of project (Access to Land, Access to Finance and the supporting strategies of Public Information and Capacity Development). Financial Service Providers (FSPs) were identified as a key stakeholder group that needed to be brought into the process.

The refinement phase of the logic model involved meetings with each KSG department, KCSO, and with FSPs to revisit or present the logic model. The meetings were also used to collect information for constructing a baseline situation analysis. The discussions and information gathered at these meetings pointed to the need to align the model more closely with the KSDP, and also with the national level FSM 2023 Action Plan, which both emphasize the fiscal and economic development challenges facing Kosrae and FSM, and the need to reduce dependency on the public sector by developing the private sector.

The following facilitation question was used at the M&E workshop with KSG and KCSO to make a first cut at prioritizing information needs:

- **What are the questions you would like to be able answer at the 5-year mark to guide the next phase of the 10-year Malem & Utwe relocation initiative?**

The evaluation questions prioritised by two working groups at the M&E workshop and draft questions prepared by the M&E Specialist were compared and discussed until consensus was reached.

Appendix 3 Monitoring Plan/Project Results Framework

Notes:

- This PRF assumes that the cross cutting areas of public information and capacity development are covered under Component 4 of the overall project
- Total numbers of HH and residents in Malem, Utwe and other Kosrae municipalities are based on 2010 census and can be updated based on the HIES if we receive a information from SBOC in time. Alternatively, DREA might be able to supply the latest figures
- The numbers of HH in the coastal hazard zone, the number of road easements required were supplied by DREA and are current
- In a number of cases the activities corresponding to each output (listed at the end) have been broken down into more steps compared to the budget table set to KSG
- Yellow highlighting indicates one of the following: 1) missing information that needs to be supplied; 2) info that could be updated based on the HIES; 2) baselines or targets requiring checking or endorsement by KSG

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
Impact: The Kosrae communities most vulnerable to coastal climate change-related hazards (Malem and Utwe) are relocating inland to safer village areas	% of Malem and Utwe HH relocated inland	0	Gradual inland relocation over the next 10-20 years of the 236 HH in Malem and the 161 HH in Utwe, starting with the 93 HH (83 in Malem and 10 in Utwe) currently in the coastal hazard zone	DREA and Municipal Govt records	**Risks:** Discord/conflicts between communities and/or individuals emerge in relation to land, finance or other issues Adequate rate of relocation is not achieved **Assumptions:** Malem and Utwe HH are willing and able to relocate Relocation occurs gradually with HH in the most exposed coastal zones relocating first
Outcome 3.1. An annually maintained climate-proofed inland road with functioning power and water lines is servicing the municipalities of Malem and Utwe and enabling relocation to safer inland areas	No. of people benefitting from the road	0	Targeted beneficiaries are the 2,283 people resident in the Malem[16] and Utwe[17] municipalities. Indirect beneficiaries include 4,333 residents of the other Kosrae Municipalities	DREA and Municipal Govt records	**Risks:** The opening of the new road and inland area facilitates environmental problems such as incursion of invasive species, forest degradation, erosion. KSG is unable to access sufficient funding for other public infrastructure (in addition to road, power, water) needed to facilitate inland relocation

[16] Gender and age breakdown for Malem: Adult men 286; Adult women 284; Youth 252; Children 478
[17] Gender and age breakdown for Utwe: Adult men 196; Adult women 241; Youth 180; Children 366

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
	Condition of road after extreme rainfall event (xx mm)		A rubric[18] for assessing road conditions after rainfall events will be developed and the target set based on this	Expert opinion from DT&I assessment report	Landslides damage the new inland road The climate-proof design for the road is not effective
Output 3.1.1. Malem-Utwe road section plus access routes to the two villages produced	No. road easements obtained/No. road easements required Agreement with Utwe municipal govt for provision of water to supply Malem No. power line access agreements obtained/No. power line access agreements required No. of km of inland road produced to climate-resilience standards	0 Current inland road (xx km) is gravel only, in poor condition, and does not meet climate resilience standards No agreement currently exists 0 0	71 road easements (estimate of the number required[19]) are produced Utwe-Malem water supply agreement produced 100% of required powerline access agreements are produced X km of inland road produced to climate resilience standards	DREA and DT&I reports	**Risks:** Agreement can not be reached with all landowners on easements required for building the inland road Utwe municipal govt fails to permit use of water to supply Malem needs related to inland relocation Private HH are not willing to negotiate access to enable power line installation passing through their land Climate hazards are more severe than anticipated leading to higher climate-proofing related costs for building the inland road **Assumptions:** DT&I has adequate capacity DT&I can secure quality contractors to design and build the road KSG is able to fund maintenance of the new road KSG is able to fund maintenance of the new power and water infrastructure in Malem and Utwe
Outcome 3.2. The Malem and Utwe communities have continuity of access to public services and to the other Kosrae	Number of people benefitting from the transitional defences at Mosral and Pal	0	Targeted beneficiaries are the 2283 children resident in the Malem and Utwe municipalities who are affected	DREA and Municipal Govt records	**Risks:** Construction of transitional defences at Mosral and Pal de-incentivises and delays inland movement by Malem and Utwe

[18] For definition and examples of rubrics see: http://betterevaluation.org/evaluation-options/rubrics
[19] This estimate will need to be adjusted after the road route is finalised

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
communities while new inland road is being built and over the course of gradual inland relocation			by the vulnerable state of the coastal road at Mosral and Pal, particularly during extreme tidal surge events. Indirect, potential beneficiaries include the 4,333 resident in the other Kosrae Municipalities who may use the coastal road.		HH
Output 3.2.1 Transitional coast protection at Mosral and Pal produced	No. of m of transitional defences produced	0 Ineffective loose boulder defences at Mosral and Pal patched only after extreme events	X m of transitional defences produced	DT&I reports	**Assumptions:** KSG can secure quality contractors to design and build the transitional defences KSG is able to fund maintenance of the transitional defences
Outcome 3.3. The HH of Malem and Utwe who own no land in safer inland areas can access land to enable relocation	% of HH without land inland who accessed land inland Area (m^2) of safe land inland identified for access	0 0	100% of the HH in the coastal hazard zone with no land inland access land (18 HH in Malem; 9 in Utwe) TBD	DREA records and reports	**Assumptions:** Land swaps occur (between private owners and between private owners and KSG) KSG is able to successfully negotiate with private land owners for appropriate sites and appropriate prices
Output 3.3.1. A State program established to facilitate access to land in inland areas for homes and public infrastructure (schools, municipal govt buildings)	Land purchase/swap registry used by Malem and Utwe HH who own no land inland Legislative amendment(s) to enable access to and use of land above Japanese line are produced	No program currently exists to facilitate land access. Land above the Japanese line is currently owned by KSG and can not be used; however, there is a legislative request to amend the constitution to facilitate access to land	100% of the HH in the coastal hazard zone with no land inland use the land purchase/swap registry (18 in Malem; 9 in Utwe) All legislative amendment(s) required to enable access to and use of land above Japanese line are produced	DREA records and reports Legislative Amendment(s)	

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
		above the Japanese line			
Outcome 3.4. The Malem and Utwe communities have the tools, skills, and organisation to actively manage their land to minimize landslides and flooding, and manage environmental risks associated with conversion of land for agriculture	Participation by CBO members in management of environmental risks CBEM skills of CBO members improved CBOs established	No CBEM is occurring presently. Several existing plans & studies[20] provide a starting point for CBO establishment, tools & skills development	Assessments of CBO participation quality for a cross-section of members using 1-5 scale[21]; Target: moderate to high Self-assessments by a cross-section of members using 1-5 scale[22] on extent of improvement of key skills; Target: moderately to mostly improved Two CBOs established (in Malem and Utwe)	KSCO reports	**Assumptions:** Community-based ecosystem management skills development is effective
Output 3.4.1. CBO members trained	No. of CBO members trained (by type e.g., women's group, school group, elders etc.) in application of environmental risk management tools or methods	0	At least X% of Malem and Utwe adults and youth are trained in application of each environmental risk management tool or method	CBO workplans and KSCO newsletters and reports	**Risks:** Implementing partner has adequate capacity **Assumptions:** Communities and CBOs participate in initiatives for community-based ecosystem management

[20] Utwe biosphere Reserve Management Plan (2011); Draft Olum Watershed (in Malem) Management Plan (2013); Feasibility study for management of Invasive Species in Kosrae (2012)

[21] 1: No participation; 2: low participation; 3: Moderate participation; 4: high participation; 5: very high participation. Scale rubric TBD

[22] 1: Not improved; 2: Somewhat improved; 3: Moderately improved; 4: Mostly improved; 5: Fully improved. Scale rubric TBD

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
	CBO tools and/or methods produced No. CBO members by type: (women's group, school group, elders etc.)		At least 1 tool or method is produced for each key dimension of risk management (landslides, flooding, agricultural land); with 1-5 scale[23] used for reporting progress on tools development At least X% of Malem and Utwe adults and youth become members of the CBOs		
Outcome 3.5. HH from Malem and Utwe can access affordable finance for inland relocation	No. of people who have used the adapted finance mechanism Existing housing finance mechanisms adapted	Existing loan mechanisms are offered by Kosrae Housing Authority[24] and FSM Development Bank[25]	At least XX people have used the adapted finance mechanism At least 1 existing program is adapted to improve affordability of finance for house construction inland	DAF reports	**Assumptions:** Schemes prioritise vulnerable HH in coastal hazard zones
Output 3.5.1. Mechanisms for improving access to affordable finance for inland relocation identified and support	Recommendations are produced by a review of programs and practices in Kosrae and other Pacific	Most applicants for the FSM Development Bank loans do not	Recommendations address affordability of finance	DAF and study reports	

[23] 1: Not produced; 2: Somewhat produced; 3: Moderately produced; 4: Mostly produced; 5: Fully produced

[24] Kosrae Housing Authority (HA) currently offers loans through two mechanisms: 1) Housing Loan Program; 2) USDA-funded Rural Development Program. The HA house loan lending target is 200-300K/yr; Disburse 15-20 loans/yr between USD 7-10,000. Loan terms are 15-20 yrs with a fixed rate (7%). Most loan takers are aged 25-40 yrs. Staff explain the T&C, particularly related to the promissory note and deed of trust. A second type of loan is for senior citizens (over 62) with funding from the USDA. These are "rural development" loans that can also be used to improve home sites. Interest rate is 4%. HA would like to add new program, with USDA funding of USD 50-80,000/yr; does not currently qualify. Main requirement: USD 500,000 escrow; Have only USD 300,000

[25] FSM Development Bank has capitalization from the FSM National Govt plus USD 2M and 5M loans (5 yr term) from China EXIM and the European Investment Bank. FSMDB's national lending target is USD 9 M/yr. In Kosrae lending target is 1.5 M/yr; Housing Loans make up 20% of the National portfolio but only 1% of the Kosrae portfolio; Housing Loans: up to USD 100,000; terms of up to 20 yrs; Interest rate: 9% flat. Currently most applicants are not not eligible (do not meet income criteria of USD 10-30,000 per adult). If declined, can apply under personal/consumer loan category or go to Housing Authority. Consumer loans are for up to USD 30,000; 5 yr term, 15% flat rate; Have translated legal docs to Kosraen to help clients understand T&C; Options for FSM Dev Bank to increase affordability are 1) seeking additional sources of funding; 2) advocate for govt social housing scheme (standard housing).

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
provided to adapt these mechanisms	Island Countries	meet eligibility criteria; Kosrae Housing Authority loan sizes ae small relative to home construction costs	Recommendations identify ways to serve needs of vulnerable HH in coastal risk zones		
Outcome 3.6. Further public and private infrastructure development in coastal hazard zones in Malem and Utwe ceases	No. of new developments (public, private) in Malem and Utwe coastal zone	Planned developments will be identified as part of the review	Once regulations are in place no new developments are initiated in the Malem and Utwe coastal zones	KIRMA records	**Assumptions:** Landowners, Financial Service Providers and Municipal Governments comply with regulations limiting infrastructure development in coastal hazard zones
Output 3.6.1. Coastal development infrastructure regulation measures are produced and/or strengthened	Regulations are produced and/ or strengthened	Existing regulations will be identified as part of the review	At least 1 regulation limiting public and private coastal development is produced or strengthened	Text of official regulations	**Assumptions:** Draft regulations developed after the review are approved by the Kosrae State Government

Activities for Output 3.1.1.
1. Reconnaissance survey to determine road route
2. Finalise road easement terms and conditions (DREA)
3. Topographic Survey
4. Procure engineering design for road, water and powerlines (civil, geotechnical and environmental) including climate-proofing
5. Quality assurance for engineering design for road, water and powerlines
6. Procure construction of road, water and power lines
7. Construct road including water and power lines
8. Quality assurance for road, water and power line construction
9. Develop maintenance plan
10. Yearly maintenance of road

Activities for Output 3.2.1
1. Procure services for review to finalise design for transitional coastal protection at Mosral and Pal
2. Quality assurance for transitional coastal protection designs for Mosral and Pal
3. Procure construction of transitional coastal protection at Mosral and Pal
4. Quality assurance for construction of transitional coastal protection at Mosral and Pal
5. Develop maintenance plan
6. Yearly maintenance of transitional coastal protection at Mosral and Pal

Activities for Output 3.3.1
1. Obtain easements for the inland road
2. Identify private land owners in upland areas including those with traditional ownership claims above the Japanese Line
3. Identify vulnerable HH in coastal hazard areas that are without land inland
4. Set up a registry to facilitate land purchases and swaps
5. Expedite legislative amendments related to land above the Japanese line
6. Expedite processing, titling related to land above the Japanese line
7. Research and develop options for a land provision scheme that prioritises vulnerable HH from the coastal hazard zone who are without land inland
8. Swap/purchase land inland that can be used for schools and municipal government buildings
9. Swap/purchase land inland that can be accessed by vulnerable HH from the coastal hazard zone through the land provision program

Activities for Output 3.4.1
1. Review existing assessments related to landslide, flooding and agricultural development risks in upland areas and identify gaps; based on assessments determine community-based risk management responses
2. Undertake additional assessments (to fill gaps) related to management of risks associated with landslides, flooding and agricultural development in upland areas; based on assessments determine community-based risk management responses
3. Implementation of community-based landslide and flooding risk management responses (invasive species management, regulation of timber harvesting, water catchment activities etc.)
4. Implementation of community-based agricultural risk management responses (e.g. requirements for buffer zones, control of pesticide/herbicide use etc)

Activities for Output 3.5.1
1. Review existing access to finance (for home construction) programs/schemes in Kosrae
2. Review access to finance schemes (for home construction) programs/schemes in other Pacific Island Countries
3. Support adaptations to existing local schemes, ensuring they cater for vulnerable households in coastal hazard zones
4. Develop applications to the GEF6 via non-grant instrument

Activities for Output 3.6.1
1. Review regulations relevant to management of infrastructure development in coastal hazard zones
2. Strengthen and/or develop regulations for management of infrastructure development in coastal hazard zones
3. Review planned public infrastructure developments in the Malem and Utwe municipal areas (e.g. schools, municipal offices, health dispensaries)
4. Develop plan to site public infrastructure in upland areas
5. Proper application and enforcement of regulations aimed at managing infrastructure development in coastal hazard zones
6. Develop funding proposals for public infrastructure (e.g. schools, municipal offices, health dispensaries)

Appendix 4 Draft Terms of Reference for Mid-Term Evaluation

DRAFT

Background and Context

The island of Kosrae is the easternmost island in FSM. Kosrae is a 112 km^2 volcanic island surrounded by mangroves and coastal strand forests that have been historically used for lumber and fuel by residents. There is a shallow fringing reef spotted with boulders of limestone quarried from the fore-reef by high-energy wave events (storms, tsunamis, and other overwash processes). There are no outer islands. The island has steep, heavily vegetated watersheds with unstable slopes. Intense rainfall denudes exposed soil in areas of deforestation. Invasive vegetation is prolific and has taken a foothold in every watershed.

The Kosrae Inland Road and Relocation Initiative (IRRI) is a long-term undertaking by the Kosrae State Government (KSG) to increase the resilience of Kosrae to climate change. The Long term vision is:

A sustainable population of Kosraens are living in inland village areas safe from coastal climate change hazards, protecting their ecosystems, participating in a growing private sector, including the development of inland agriculture, and experiencing rising social well-being and equity.

Within 5 years the IRRI aims to create the conditions necessary to enable gradual inland relocation, starting with the most vulnerable households in the most vulnerable communities of Malem and Utwe.

The Program Logic is summarised in Table 1.

Table 1: [Insert Program Logic including diagram and assumptions & risks chart]

The initiative consists of five main and three supportive strategies. The main strategies are Construction of a Climate-Proofed Inland Road, Access to Land, Access to Finance, Community-Based Ecosystem Management and Limitation of further Coastal Development.

Land access issues are critical to the initiative. The construction of the inland road requires easements for approximately 71 privately owned parcels. Some of the households located in the coastal hazard zone have no land inland for the building of a new home. The relocation of the Malem-Utwe section of the circumferential road to the interior and the relocation of the Malem and Utwe households to the interior (with priority given to those currently living in the coastal hazard zone) both mean engagement with complex issues of land rights and titling. Land in Kosrae is managed under a complex mix of modern and traditional systems and intricately connected to people's perception of inheritance and community. This needs to be tackled with a long-term perspective and disputes also can take an inordinately long period of time to resolve.

Some of the land required for the IRRI is above the so called *Japanese Line*, which delineates an undeveloped zone consisting of 65% of the interior of the mountainous island. The Government owns all the land above the Japanese Line and the health of Kosrae' forests, mangroves, reefs and watersheds is due in large part to its existence.

A key risk for IRRI is the potential for environmental degradation associated with inland development. Other risks are that (i) the revetment of the coastal road, essential to keep it functioning while the inland road is built, de-incentivizes inland relocation, and (ii) the engineering design of the inland road is not 'proofed' from flooding and landslide hazards.

Access to finance for housing and other household relocation costs is also a challenge because the income levels of borrowers is often below the threshold needed to qualify for the loan products that are currently available.

In addition to Coastal Road Revetment, the other supportive strategies are Public Information and Capacity Development. The role of Public Information is to build a case for inland relocation to safer village areas, and to inform people of the services and programs available to assist households to achieve successful relocation. The role of Capacity Development is to ensure that KSG and partners have the capacity to able successfully implement the other strategies.

The first five year phase of IRRI began in [201X] with a total funding envelope of [USD] from [donor1, donor2] and [donorx].

A 'Framework' has been developed to assist monitor and evaluate the IRRI in a systematic and focussed manner. The development of this M&E framework was supported by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank through the Pilot Program for Climate Resilience (PPCR): Pacific Regional Track. A copy of this M&E framework document is provided at [Annex A].

Purpose and Use

The main purpose of this midterm evaluation is learning for adaptive management. The evaluation will identify practices, opportunities, lessons and corrective actions needed for the next phase of implementation and to ensure the realization of the expected outcomes.

The findings and recommendations will be used by KSG and IRRI Development Partners to identify key strategic adjustments to the overall approach and/or to the component strategies.

Scope

The Midterm Evaluation covers the entire time period since inception of IRRI, and will evaluate the efficiency, effectiveness, impact and sustainability of the five main strategies and the three supportive strategies. In line with the learning purpose of the evaluation, priority will be given to the evaluation criteria of effectiveness, impact and sustainability.

The Evaluation will aim to include all the relevant stakeholder groups including the implementing KSG departments (DT&I, DREA, KIRMA, DAF, Governor’s Office), contractors and consultants, and KCSO, Malem and Utwe municipal governments, households and Community-Based Organizations, Financial Service Providers, The Chamber of Commerce and other Private Sector actors.

Evaluation Questions

During the inception phase the KSG and its partner, the Kosrae Conservation and Safety Organisation (KSCO) identified the following key evaluation questions. It is intended that this will be the primary focus of the mid-term evaluation.

<table>
<tr><td>Efficiency</td><td>1) To what extent are the key actions associated with each strategy (access to land, access to finance, construction of inland climate proof road, revetment of the coastal road, control of further coastal development; community-based ecosystem management, public information, capacity development) being achieved?
a) Has the new road been completed as designed and planned?</td></tr>
<tr><td rowspan="2">Effectiveness</td><td>2) How effective are the strategies?
a) What community based ecosystem management projects/actions are being implemented, and what are they achieving?
b) What depth and quality of community participation is being achieved in community-based ecosystem management work?
c) How suitable are the sites designated as village areas?
d) How well are the Malem and Utwe HH with no land in the inland area being served by the actions to enable access to land?
e) How well are the Malem and Utwe HH being served by actions to enable access to finance?
i) How well are the Malem and Utwe HH with no land in the inland area being served?
f) How effective are the Public Information efforts at facilitating community participation and ownership?
g) How well are changes in new and existing policies and regulations functioning to limit further coastal development?</td></tr>
<tr><td>3) What is working well and less with with each of the strategies and why?[26]</td></tr>
<tr><td>Impact</td><td>4) What proportion of Malem and Utwe HH are planning, preparing, ready to relocate, or have already done so?
5) What is enabling and constraining readiness for relocation by HH from Malem and Utwe?
6) How are agricultural issues influencing readiness for relocation by HH from Malem and Utwe?
7) How is the private sector influencing readiness for relocation by HH from Malem and Utwe?
8) Were there any unintended effects of the KSG inland road and relocation initiative (positive and negative)?</td></tr>
<tr><td>Sustainability</td><td>9) How resilient is the new road to the heavy/extreme rainfall events and associated climate-change related hazards?
10) What, if any, are the gaps in the overall approach?
i) What if any are the gaps in the individual strategies?
11) What opportunities exist for addressing these gaps?
12) How sustainable are the strategies implemented by KSG to enable relocation?</td></tr>
<tr><td>Synthesis</td><td>13) What are the emerging lessons for Kosrae from the inland road and relocation initiative?</td></tr>
</table>

[26] Prioritise Inland Road Construction, Access to Land and CBEM strategies if not feasible to analyze all during the Mid-term and final evaluations

Timing

The evaluation will be carried out over a three-month period between [when] to [when] during the last quarter of the initiative.

Management and Governance

The evaluation will be managed by [insert]. [Insert relevant title or role] will be responsible for contracting the evaluation tea and monitoring the evaluation process against the TOR deliverables. An Advisory Committee comprised of a Senior KSG official from the implementing team, representatives of [Development Partner 1, Development Partner 2…] and [Development Partner X], and a Peer Evaluation Adviser designated by SPREP. The Advisory Committee will be responsible for reviewing and approving the MTE TOR, the Inception report and the draft Evaluation reports.

Methodology

Effective methodologies engender stakeholder ownership, build evaluation capacity, support accountability, foster independence, and ensure the transparency and reliability of findings. These are the principles that SPREP and KSG expect to be upheld over the course of this evaluation:

<u>Partnership</u>: Work in partnership with development partners and other stakeholders to design and implement the evaluation.

<u>Transparency</u> and <u>independence</u>: Ensure the evaluation process is transparent (open and understood by all partners), and independent (carried out in a way that avoids adverse effects of political or organisational influence).

<u>Participation</u>: Ensure that stakeholders are appropriately involved at all stages of the review or evaluation

<u>Capacity building</u>: Design the evaluation so that KSG capacity to participate in evaluations is enhanced through involvement in the process.

After identification of the team leader and member, the Midterm Evaluation will be conducted in three stages described below. Drawing on the Monitoring and Evaluation Framework, the Evaluation Questions, analysis of relevant document and inception meetings the team leader will prepare the evaluation design and schedule (Evaluation Plan).

The time requirements after the inception phase will be determined by the team leader as part of the evaluation plan.

Phase	Processes	Deliverables
Inception (Team Leader Only)	Contextual Analysis: Reading/analysis of relevant documents	
	Inception meetings in Kosrae with steering group and with key KSG, KCSO and SPREP staff including stakeholder analysis, identification of key informants potential case studies, use and dissemination of findings and recommendations	**Inception Report**
	Preparation of Inception Report and Evaluation Plan including interview guides, surveys, and participatory tools as required	
	Revision of Evaluation Plan based on feedback	**Evaluation Plan**

Phase	Processes	Deliverables
Field Work (Full evaluation team)	Orientation of team member	
	Engagement with implementers, contractors, consultants, municipal govts, communities, CBOs, FSPs and private sector actors: Carry out interviews, meetings, workshops, field trips, case studies, surveys etc. as per evaluation plan with emphasis on the evaluation questions related to effectiveness, impact and sustainability	
	Processing and preliminary analysis of data from field work and review of stakeholder surveys/feedback	
	Carry out remote interviews (skype/phone) as required. Further field work to fill information gaps, check hypotheses	
Briefing	Workshop with the KSG/KCSO implementing team and SPREP to review the program model in light of the findings and identify key strategic changes	
	Preparation of briefing to Steering Group	
	Briefing of Steering Group	**Briefing: Preliminary Findings**
Analysis and Writing (at SPREP for at least part of the time; to enable team to work together)	Processing and analysis of data	
	Draft Report preparation	**Draft Report**
	Preparation of Advanced Draft Report	**Advanced Draft Report**
Validation (Team leader only)	Preparation of validation workshop	
	Validation workshop in Kosrae Briefing for Governor	
	Preparation of Final Report	**Final Report**
Total Days		

Evaluation Team

The evaluation team will consist of two members with the following profiles:

<u>Team Leader</u> (TL): A senior evaluator with a minimum of 10-15 years of experience in designing and managing program theory-based evaluations, plus experience of conducting evaluations of Community based Ecosystem Management (or similar programs), and access to finance and/or land programs. Pacific experience is essential. Experience with designing evaluations for road infrastructure and/or climate change adaptation programs is highly desirable.

<u>Infrastructure Specialist</u> (IS): An road infrastructure specialist with a minimum of 10-15 years experience including experience with climate-proofing designs. Experience in evaluating infrastructure projects is highly desirable. Pacific experience is essential.

Deliverables

See above

Indicative Budget

Tasks	Days, TL	Days, IS	Total Days	Cost @ 550 USD/day
Planning and Preparation	6	1	7	
Field work	10	5	15	
Preliminary analysis & Briefing	2	2	4	
Analysis	5	4	9	
Reporting	5	4	9	
Validation	0	0	0	
SUBTOTAL	28	16	44	24,200
Travel	**TL**	**CCS**	**Total**	**Cost**
Kosrae @ USD 5000/trip	1	1	2	10,000
Samoa @ USD 3000/trip	0	0		
Rental car days @ USD 50/day	20	10	30	1,500
Per diem days @ USD 166/day	20	10	30	4,900
SUBTOTAL				16,400
TOTAL				**40,600**

Key Documents

- IRRI project design document
- FSM 2023 Action Plan
- Kosrae Strategic Development Plan
- Kosrae Shoreline Management Plan
- Infrastructure Cost Benefit Analysis
- IRRI Progress Reports
- [insert other relevant documents]

Appendix:

[insert MEF here]

MALEM MUNICIPAL GOVERNMENT
OFFICE OF THE MAYOR
P.O. BOX 339
TOFOL, KOSRAE FM 96944
FEDERATED STATES OF MICRONESIA

TELEPHONE 691 370 4501

July 06, 2015

General Endorsement from Mayor Jonas and Council Chairman Elesha.

It gives us great pleasure to communicate our full support and endorsement of the propose climate adaptation project now considered under the Climate Adaptation Fund.

We acknowledge and support the adaptation measure identified in the Kosrae State Shoreline Management Plan. We have lived in Malem our whole lives and have experienced the effects of rising sea level eroding our beach fronts, increased of rain fall with yearly inundation of our farm lands, inundation of certain road sections, especially at Paal and Mosral, and from damages these events brought to our homes and properties. Also a need to upgrade the existing road from Malem to Yeseng is a priority to relocate their settlements and infrastructure during the extreme climate events.

Responding to the unaddressed questions and issues arising out of the project proposal, representatives of the community have gathered tonight during our community consultation meeting to discuss these issues and provide their individual perspectives. This community consultation meeting witness the presents of the woman, person with disabilities, youth, senior citizens groups, community leaders , land owners and other stakeholders.

We recognize and take note of the full support and enthusiasm shown by the participants during the consultation. It is our objective that this message provide further evidence of our official support to the position taken by the community as represented by the parties mentioned above.

Grant Jonas
Mayor

Likiaksa Elesha
Council Chairman

Utwe Municipal Government
P.O. Box 447030
Utwe, Kosrae State
Federated States of Micronesia 96944
Phone: (691) 370-3207; Fax: (691) 370-3000
Office of the Mayor

April 13, 2016

General Endorsement from Mayor Benjamin and Council Acting Chairman Andrew

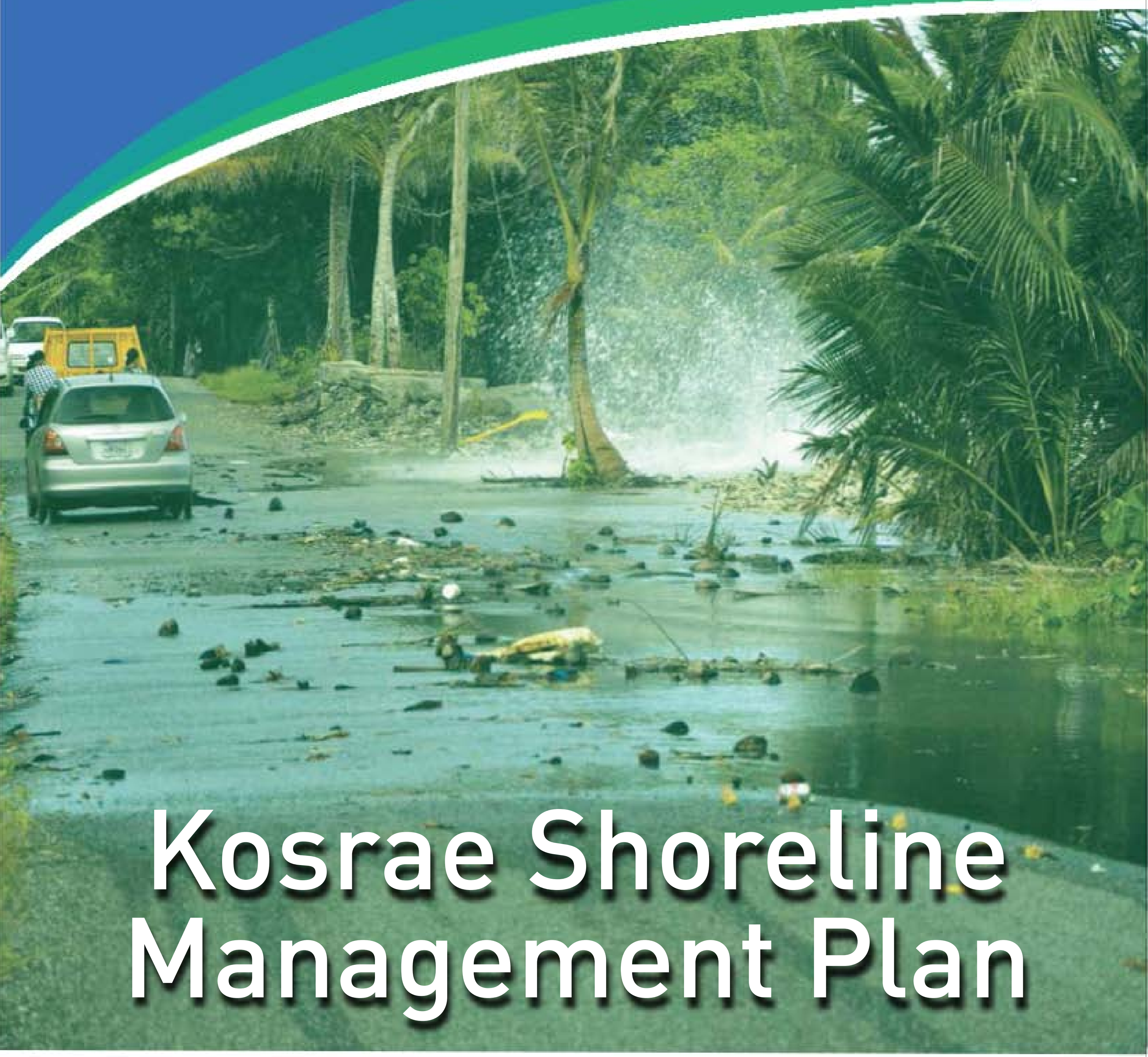
We, the undersigned, on behalf of the People and Municipal Government of Utwe Municipality, Hereby express our full support and endorsement of the proposed climate adaptation project, namely, the construction of an inland road connecting Utwe to Malem and the rest of Kosrae. This project proposal, we understand, is put together by SPREP on behalf of the Federated States of Micronesia.

We acknowledge and support the construction of this inland road as a long term adaptation measure to climate change and sea level rise on our coastal village of Utwe. We are fully aware of the continuing erosion of our beach fronts, yearly inundation of our properties and the likely breach of the main road connecting our Utwe community to the rest of the island.

The construction of the inland road will ensure our community continued access to health, educational, commercial services and other critical services located in the northern parts of Kosrae. The construction of the inland road will also provide our people ease of access to Inland land areas for farming and development, and especially the opportunity to relocate upland from the coastal areas.

In these respects, we put our hands hereunder to show our official endorsement of the Proposed inland road project.

Patterson Benjamin, Mayor	Bruce Andrew, Council Acting Chairman



Kosrae Shoreline Management Plan

Repositioning for resilience

Kosrae Shoreline Management Plan

Repositioning for resilience

Authors/Contributors:

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Report date: November 2013
NIWA Project: DGI13201

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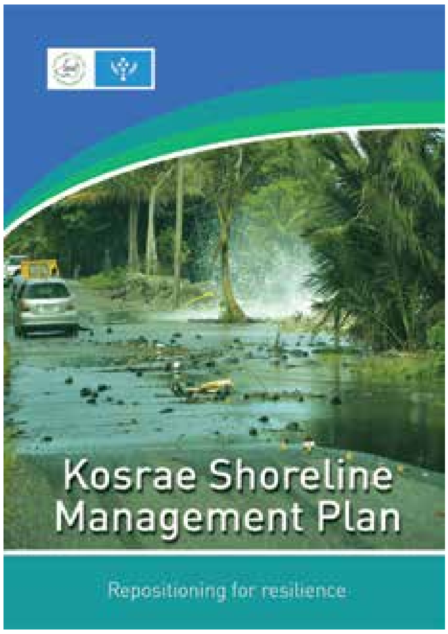

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is a federally-owned agency that implements technical cooperation programmes on behalf of the German Government and other donors. This Study was undertaken under the SPC/GIZ regional programme Coping with Climate Change in the Pacific Island Region (CCCPIR).

OUR ISLAND ~ OUR LIFE ~ OUR RESPONSIBILITY
KIRMA

german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz

NIWA
Taihoro Nukurangi

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GOVERNMENT OF KOSRAE
Office of the Governor
Post Office Box 158
Kosrae, Federated States of Micronesia 96944
Telephone: 691-370-3002/3003. Facsimile: 691-370-3162

Foreword

The high tides and flooding of land that we have experienced in January 2014 is another reminder of how exposed much of the development and communities on Kosrae are to the damaging effects of shoreline change, high tide and storm flooding. We now know that due to climate change and sea-level rise the impacts of such coastal hazards will become ever more frequent and damaging in the future.

Much development on Kosrae over the last two to three generations has occurred in low-lying coastal areas. We acknowledge that many of the approaches we presently use to manage the impacts of these hazards on development and our communities will be increasingly ineffective or unaffordable as sea-levels rise.

Going forward this provides some difficult challenges and changes facing our communities if we are to effectively reduce both present day and future coastal change impacts on what we value in Kosrae. It will involve thinking differently than we have done in the past, particularly concerning where we locate infrastructure, our communities and our homes. It will require our communities, municipalities and the state to all work together, to think long-term, to agree priority actions and to instigate timely and effective implementation.

This Shoreline Management Plan was an initiative in 2000 of the Development Review Commission (now Kosrae Island Resource Management Authority). Since the first Plan was produced, much more is now known of the potential changes that will be caused by climate change and sea level rise. This revision of the Shoreline Management Plan incorporates this information, what it means for coastal areas on Kosrae and the communities and development located there, and sets out a pathway over the next one to two generations to create a more resilient society and one that provides a secure foundation for our future generations to better manage the ever increasing impacts of climate change and sea-level rise on Kosrae.

Implementation of the Plan needs to start now. The threats to our environment, livelihoods and quality of life of our people have never been so great. We look forward to working with our development partners to assist Kosrae in successfully achieving the outcomes identified in the Plan, and to develop our local capacities so that Kosrae can take a greater responsibility in implementing the Plan.

Sincere thanks to the five village communities, Municipal staff, KIRMA, the FSM PACC Office, and the various Government offices on Kosrae who have helped shape the vision outlined in this plan. I would also like to thank the Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) regional programme Coping with Climate Change in the Pacific Island Region (CCCPIR) for their ongoing support, and the Secretariat of the Pacific Community Applied Science and Technology Division (SPC-SOPAC) and the National Institute of Water & Atmospheric Research Ltd (NIWA) for their contributions in the preparation of this Plan.

Lyndon H Jackson
Governor, Kosrae State

Executive Summary

Most of the coastline on Kosrae, where this development has occurred, is prone to coastal hazards such as long-term shoreline change and episodic coastal inundation (particularly during times of high (king) tides, large swell and very occasionally due to typhoon events).

The effects of ongoing and future climate change and sea-level rise will increasingly exacerbate the impact that these coastal hazards have on infrastructure, the five village communities and residential homes. Climate change stress will also potentially adversely impact on natural protective functions provided by reef systems, seagrass beds, mangrove strands, wetland areas and the coastal berm.

The consequences of climate change and sea-level rise will not create any new hazards on Kosrae. Rather they will enhance existing coastal hazard issues. Over the next one to two generations, and beyond, climate change will progressively increase the frequency and impacts of coastal hazards such as erosion, wave overwash and flooding damage to existing property, infrastructure and communities on Kosrae. Increasingly it will make the situation too difficult for those currently located in exposed areas.

Considering actions to reduce the present risks to communities and infrastructure on Kosrae is a vital first step. We already understand that existing natural weather events, climate and sea-level variability can cause change and damage in Kosrae's coastal zone. Addressing these known issues of exposure is an effective way to start to reduce the coastal hazard impacts posed by future climate change.

However, beyond the next one to two generations communities on Kosrae will need to adapt beyond the current range in variability and extremes. Adapting to these future impacts needs to start now and will require a different approach to development on Kosrae than has been practiced over the last 2 to 3 generations. Fundamentally this will mean a much greater emphasis on preventative measures that remove exposure to the hazard, rather than a primary focus on impact reduction (e.g., for example through continuing to build seawalls).

Furthermore, effective policy to reduce current coastal hazard-related risks to communities and infrastructure and achieve efficient and resilient development will need to promote well designed adaptation responses and build on existing approaches already underway in Kosrae.

The following principles are key for successful adaptation and reduction of present and future coastal hazard risks to Kosrae communities and infrastructure over the next few generations:

1. The continued careful management of Kosrae's natural environment and resources is fundamental for effective and sustained protection from coastal hazards and long term adaptation.
2. A primary focus on where to build.
3. A focus also on how to build.
4. A recognition that in most situations a reliance on impact reduction measures such as coastal defences are not a long-term option for achieving resilient infrastructure and communities on Kosrae.
5. Effective adaptation needs to start now.

Strategies

Based on these principals eight key strategies have been developed for Kosrae to implement as a means of increasing the resilience of Kosrae's communities and associated infrastructure to the impacts of coastal-related hazards and exacerbating effects of climate change:

Based on these principals eight key strategies have been developed for Kosrae to implement as a means of increasing the resilience of Kosrae's communities and associated infrastructure to the impacts of coastal-related hazards and exacerbating effects of climate change:

Strategy 1: Continued development and strengthening of community awareness including outreach activities with a focus on effective natural coastal defence and Kosrae-relevant climate change impacts and adaptation options.

Strategy 2: Amendment of the KIRMA Regulations for Development Projects to incorporate climate change considerations and strengthening of regulation implementation to support successful long-term risk reduction and adaptation.

Strategy 3: Over the next one to two generations the primary coastal road network and associated infrastructure currently located on the beach/storm berm is developed inland away from long-term erosion and coastal inundation risk.

Strategy 4: Ensure new development (property, infrastructure) is located away from areas at risk from present and future coastal hazards or is designed with coastal hazards in mind.

Strategy 5: Implement a program to encourage existing residential property owners to reposition homes away from areas of high risk from present and future hazards. This may be a staged approach over time as homes are routinely replaced or renovated. Objective prioritization of properties most at risk should also be explored.

Strategy 6: Incorporate a grant component in to the housing loan program to help encourage new property to be constructed in areas not exposed to coastal, river floor or landslide hazards.

Strategy 7: Commence community and state discussions to develop a relocation strategy and identify potential approaches to support relocation from areas exposed to coastal hazards where no alternative land is available.

Strategy 8: A strategic approach is adopted for the ongoing provision of coastal defences. These should be considered only where:

- it is a sustainable long-term option, or
- where it is accepted as a transitional approach to protecting areas over the short to medium term to enable relocation strategies to be implemented.

By the 2050s (2 generations time) Kosrae needs to have made significant progress in implementing an adaptation strategy that repositions the majority of existing critical infrastructure and property away from the beach/storm berm areas, reclaimed areas of mangrove and low-lying wetland swamp to slightly higher ground around the base of the volcanic part of the island.

Without such a change in development direction, Kosrae will find it ever more difficult and expensive to protect and maintain infrastructure and property in the present coastal zone. Given limited resources it is important to invest now to reduce vulnerability and avoid the far more significant impacts of climate change that will occur over the latter half of this century and beyond. If action is delayed it will become increasingly difficult or impossible for Kosrae authorities and community to respond appropriately.

1 Introduction

1.1 Background

Much community and infrastructure development on Kosrae over the last 60 years has occurred within the coastal margins. Most of the coastline on Kosrae, where this development has occurred, is prone to coastal hazards such as long-term shoreline change and episodic coastal inundation (particularly during times of high (king) tides, large swell and very occasionally due to typhoon events).

The effects of ongoing and future climate change and sea-level rise will increasingly exacerbate the impact that these coastal hazards have on infrastructure, the five village communities and residential homes. Climate change stress will also potentially adversely impact on natural protective functions provided by reef systems, seagrass beds, mangrove strands, wetland areas and the coastal berm.

In 2000, the Development Review Commission (now Kosrae Island Resource Management Authority) developed a Shoreline Management Plan (DRC, 2000) which set out to:

- Inform and aid planning for future development by identifying areas of present and future coastal erosion and inundation.
- Identify opportunities for maintaining and enhancing natural coastal protection and function.
- Assess a range of strategic coastal management options, in terms of limiting the future impacts of coastal erosion, flooding and storm damage to communities and infrastructure.
- Establish necessary monitoring and data collection systems to develop a better understanding of natural coastal processes on Kosrae, and thus better understand the potential impacts and future risks posed by climate change.

The strategy summarised a range of short and long-term recommendations to assist in reducing coastal hazard risks to the natural environment, communities and infrastructure. Many of the recommendations are still valid, and this revision of the Shoreline Management Plan builds on these recommendations and provides important additions and updates as follows:

- Account for more recent data, information and development/infrastructure changes.
- Increase focus on long-term adaptive management

Figure 1: Map showing locations of municipal boundaries, roads, villages and place names on Kosrae.

planning and prioritisation for critical infrastructure over the next one to two generations.
- Guide and support future municipal, community and individual development decision-making.
- Implementation of village/municipal-level integrated adaptation activities.

1.2 Building resilient coastal communities on Kosrae

1.2.1 Past development pathway

Infrastructure, land and property of Kosrae is currently impacted by coastal flooding and erosion largely due to development and planning choices that have occurred since the end of the Second World War. The pattern of development (Figure 2 and Figure 3) that has occurred over the past 2 to 3 generations has resulted in the majority of property and infrastructure been built on:

- Land that is low-lying and prone to coastal flooding.
- Reclaimed areas in mangrove or swamp areas, or over reef flat sand deposits (in the case of Utwe and Lelu villages).
- Land that that is too close to the shoreline to accommodate both natural and human-induced shoreline change. Much has occurred on the narrow storm or beach berm that separates the fringing reef from the low-lying mangrove or brackish swamp areas (Figure 3).

The combination of the natural susceptibility of Kosrae's coastline to coastal change and inundation, increasing post

Figure 2: Development between 1944 and 2012 in Malem. Much of the development has taken place on the narrow storm berm between the shoreline and the low-lying wetlands.

World war II population and movement of communities in to these coastal areas, and changing community aspirations (electricity supply, telephones, paved roads, permanent buildings) have all led to greatly increased vulnerability of the Kosrae community (Figure 4). Other associated impacts include:

- Removal of sand and coral rubble from the reef flat (particularly along the eastern coast between Finaunpes and Mosral).
- Beach mining (removal of sand, gravel and cobbles) from the beach primarily for construction aggregates.
- Dredging of the reef flat in front of Tafunsak village.
- Altering the position of stream outlets or changing swamp drainage patterns and flows.
- Building inappropriate seawalls and land reclamation that has exacerbated erosion elsewhere or resulted in further development in high risk areas.

1.2.2 A different pathway for the future

The consequences of climate change and sea-level rise will not create any new hazards on Kosrae. Rather they will enhance existing coastal hazard issues. Over the next one to two generations, and beyond, climate change will progressively increase the frequency and impacts of coastal hazards such as erosion, wave overwash and flooding damage to existing property, infrastructure and communities on Kosrae. Increasingly it will make the situation too difficult for those currently located in exposed areas.

Considering actions to reduce the present risks to communities and infrastructure on Kosrae is a vital first step. We already understand that existing natural weather events, climate and sea-level variability can cause change and damage in Kosrae's coastal zone. Addressing these known issues of exposure is an effective way to start to reduce the coastal hazard impacts posed by future climate change.

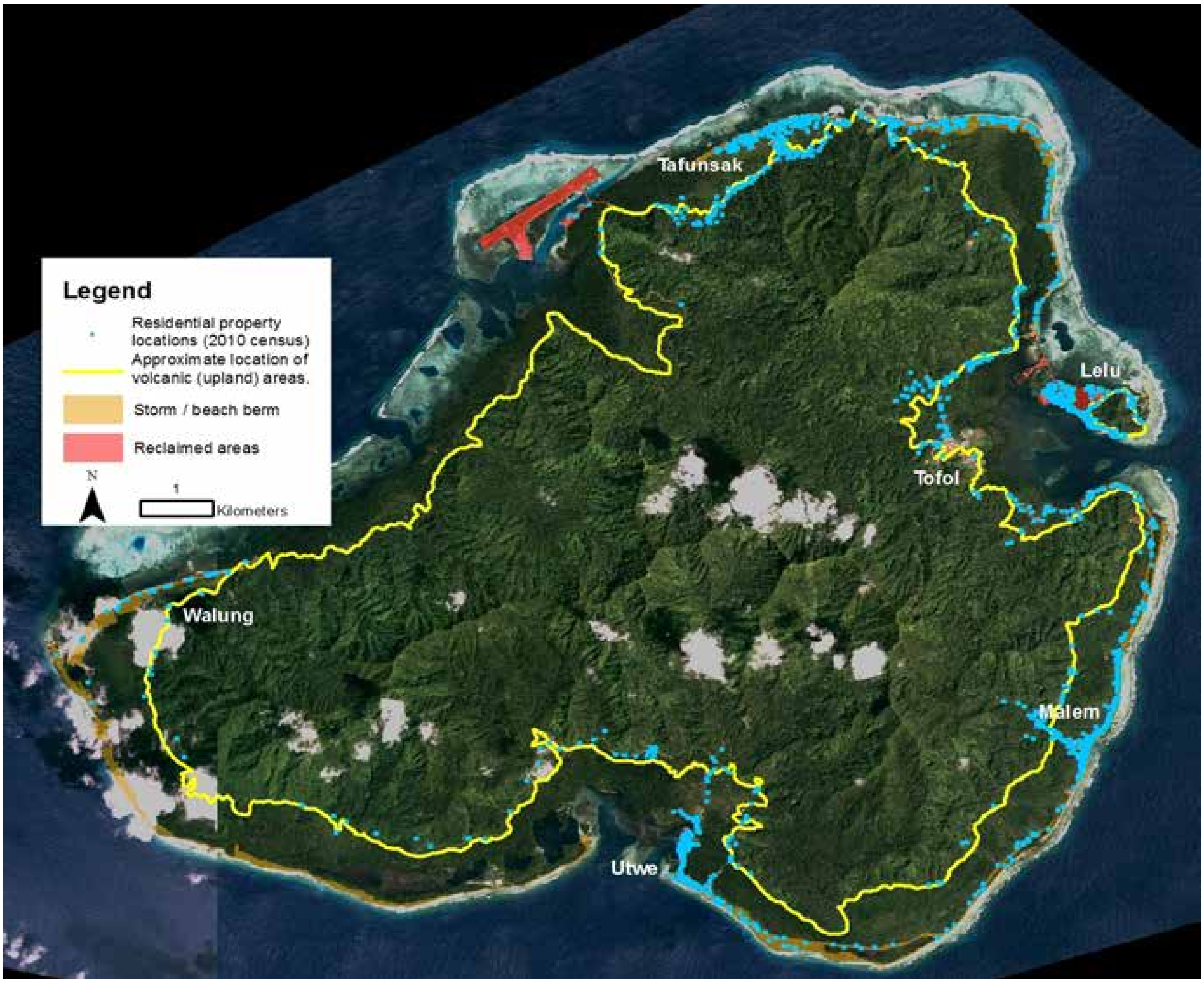


Figure 3: Location of residential development. Based on data from the 2010 census.

However, beyond the next one to two generations communities on Kosrae will need to adapt beyond the current range in variability and extremes. Adapting to these future impacts needs to start now and will require a different approach to development on Kosrae than has been practiced over the last 2 to 3 generations. Fundamental this will mean a much greater emphasis on preventative measures that remove exposure to the hazard, rather than a primary focus on impact reduction (e.g., through for example continuing to build seawalls).

The approaches to achieve effective adaptation will build on existing coastal management approaches in Kosrae and can be used in an effective policy for reducing current coastal hazard-related risks and achieving safe and resilient development.

There is no one "solution" to solving all the coastal hazard issues that Kosrae faces now and in to the future. Successful adaptation will involve a "mix" of inter-related activities, the composition of which will vary both from location to location on Kosrae and over time.

The following principles are key for successful adaptation and reduction of present and future coastal hazard risks to Kosrae communities and infrastructure over the next few generations.

Figure 4: Examples of human impacts that have caused or exacerbated the potential for coastal erosion and inundation impacts on Kosrae. Top left: removal of coral rubble from the reef flat; Top right: Sand mining; Middle left: Dredge pits on the inner reef flat at Tafunsak; Middle right: Erosion at Walung caused by the cutting of a drainage channel at Leap; Bottom left: Erosion at the Sandy Beach Hotel caused by the seawall; Bottom right: Erosion and coastal change at Finfokoa caused by the reclamation at the old Pheonix Resort and recent house construction.

1. **The continued careful management of Kosrae's natural environment and resources is fundamental for effective and sustained protection from coastal hazards and long term adaptation:**
   - Recognising that the coastal ecosystem on Kosrae is the most effective coastal defence protecting the island from the effects of coastal hazards.
   - Understanding that the enormous value of this natural protection is dependent on the health and the natural interactions between the various ecosystems including the watershed, wetlands and swamp forests, mangroves, coastal berm and beach, reef flat and seagrass, and surrounding fringing coral reef.
   - Limiting negative human impacts on natural protective features is essential to Kosrae's efforts to address both climate change and existing coastal hazards.

2. **A primary focus on where to build:**
   - Ensuring new development (property, infrastructure) is located away from areas at risk from present and future coastal hazards.
   - Over the next one to two generations a sustained programme of encouraging existing development and infrastructure to be relocated away from areas at risk from present and future hazards as it is replaced or renovated.
   - Strengthening investment criteria and the Development Review Permit process to limit new development in areas at risk from present and future coastal hazards.
   - Developing incentive mechanisms to encourage development/redevelopment away from areas at risk from present and future coastal hazards.

3. **A focus also on how to build:**
   - Ensuring that new infrastructure and buildings are designed to withstand weather and climate extremes including the future effects of climate change (climate proofing) over the proposed design life of the structure.
   - Incorporating appropriate climate-proofing guidance in to existing policy and legislation.

4. **Recognising that in most situations a reliance on impact reduction measures such as engineered coastal defences are not a long-term option for achieving resilient infrastructure and communities on Kosrae:**
   - Given the levels of sea-level rise likely to be experienced in the latter part of this century, seawalls will not be capable of dealing with the types of coastal change and flooding that will occur.
   - Over the foreseeable future, Kosrae will need to ensure that substantial financial commitment is made to ensure that existing coastal defences are maintained and upgraded to provide a sufficient standard of protection and to enable longer-term more sustainable risk-reduction initiatives to be implemented.
   - Coastal defences built to protect communities often result in an increased sense of security and ongoing intensification of development with the problem becoming ever more complex.

5. **Effective adaptation needs to start now:**
   - Starts with effectively addressing existing coastal hazard problems and issues to present communities, villages and infrastructure and builds on the many good examples of risk-reduction activities already occurring on Kosrae.
   - Proactively plan and implement change to reduce exposure and vulnerability rather than waiting for damaging events to happen and then reacting.
   - Adopts an adaptive management approach focusing on change on Kosrae over the next one and two generations to:
     - Address current and immediate future coastal hazard issues.
     - Position Kosrae to effectively cope with the much more significant coastal hazard impacts that will occur beyond this time over the latter part of this century and beyond.
   - Take advantage of international adaptation financial support available now and recognise that such opportunities may not be as accessible into the future as the effects of climate change increase for all nations.
   - Adopts whole of community approach where the population at large must assume responsibility for such change. Adapting to climate change requires changes in the way all sectors behave and for adaptation to be effective there needs to be functional partnership between all (community, Municipality, State and National Governments).

1.3 Shoreline management progress since 2000

Many of these principles lay behind the development of the first version of the Shoreline Management Plan in 2000. Since the plan was produced, a number of activities have progressed that are contributing to the reduction of the impacts of coastal hazards have on the community and infrastructure of Kosrae. These efforts have also improved understanding of coastal hazards and enabled better incorporation of practical risk management in decision-making and development-related legislation. A review of progress against the various recommendations made in 2000 is summarised in Appendix A with some key areas of progress outlined below:

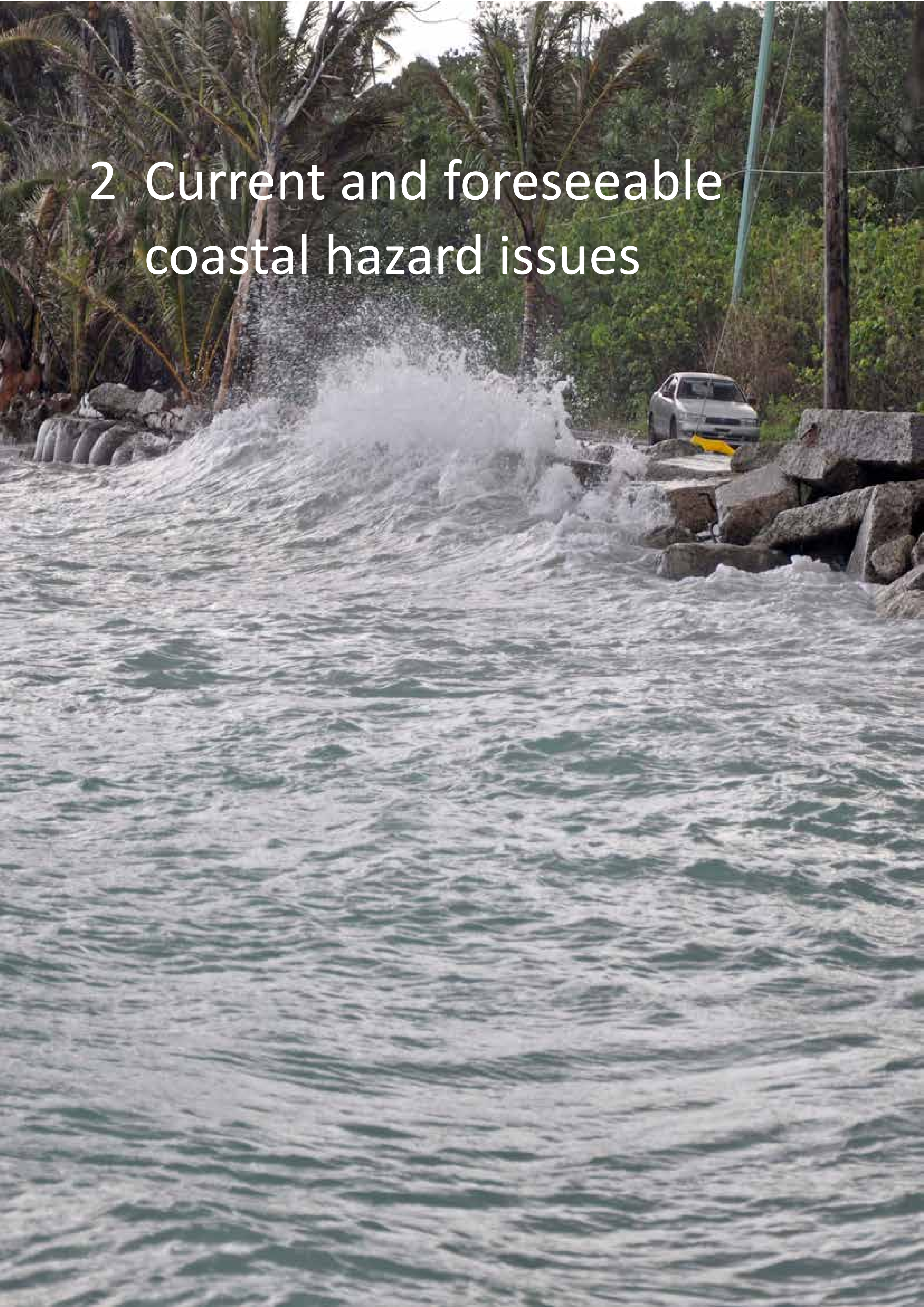
- The continued emphasis on educational activities within both the Kosrae Island Resource Management Authority (KIRMA) and Kosrae Conservation and Safety Organisation (KCOS) that is focussing on both catchment and coastal-related aspects.
- An increasing number of residential properties being built inland and increased awareness about the need to move back from the shoreline.
- Incidences of housing loan applications being refused where dwellings are proposed in areas at risk from shoreline change or inundation.
- Construction/upgrading of a number of seawalls identified as being required in the Shoreline Management Plan.
- Installation of an automatic sea-level gauge within Lelu Harbour (since November 2011) and a temporary gauge at Okat Dock (which will be left in place for one year and then moved to Walung and then to Utwe). This allows sea-levels to be accurately related to land levels.
- Greater consideration of climate change and climate change impacts and climate change adaptation strategies in to infrastructure projects within the Kosrae State Code and in Kosrae Island Resource Management Authority Regulations for Development Projects (currently under review).
- Continuation of beach profile recording since 1995 to accurately monitor ongoing shoreline change at key locations around the Kosrae coast.

Figure 5: Recent examples of poor development activities that will lead to further coastal hazard-related problems and are not sustainable or effective in the long-term. Top left: Low-lying reclamation for a new laundromat at Tafuyat, Lelu Harbour; Top right: Concrete bag seawall to protect the road at Mosral, Malem; Bottom left: Dumped concrete rubble to attempt to protect the road at Pal, Malem; Bottom right: Access road construction through the mangrove and along the foreshore at Leap, Walung.

However, there are also developments and activities which are of concern and not in keeping with sound coastal hazard risk management. In the longer term these may lead to mal-adaptation and greater risk to development on Kosrae. These include:

- Continued reclamation of mangrove and shoreline areas, for development. In many cases fill levels are too low and are already subject to flooding during normal high (king) tide sea levels.
- Recent, use of "low cost" coastal protection solutions in response to urgent need to protect sections of the paved road. This includes dumped concrete rubble at Finfoko in Tafunsak and Pal in Malem, large concrete filled bags at Mosral in Malem, and a previous proposal to use old bitumen drums, left from the re-sealing of the airport runway, filled with concrete for seawall construction.
- Proposed external support for shore protection activities without considering such activities within a wider strategic and sustainable approach to coastal hazard risk reduction.
- The extension of the road across the wetland/mangrove area and along the shoreline at Leap in Walung (with the intention to continue the reclamation and road development to the church at Insiaf), rather than continuing it around the edge of the volcanic part of the island.

2 Current and foreseeable coastal hazard issues



2.1 Shoreline change

Over the last century changes in the position of the shoreline around Kosrae shows considerable variability. Some sections such as along the eastern Malem coastline and at Finfokoa in Lelu has resulted in large shifts in the shoreline position, other sections have been relatively stable. A summary of the key processes driving coastal change and flooding on Kosrae are summarised in Appendix B and potential climate change and sea-level rise in Appendix D. Where changes have occurred these are due to both natural long-term processes and the effects of human activities on Kosrae's shoreline and reef flat (Section 1.2.1).

The most significant long-term coastal retreat over much of the last century has occurred along the eastern facing Lelu and Malem coastlines. To understand why these coastal changes are occurring, it is necessary to look back to the end of the 19th century. Kosrae is rarely affected by cyclone events, with the main tracks located to the north and west of the island. The last major cyclone was in 1905 but it was a cyclone in 1891 that resulted in a bank of coral rubble being deposited on to the reef flat along much of the eastern coastline. In places it was so high that the breaking waves could not be seen (Buck, 2005).

This bank of coral rubble (Figure 6) acted as a breakwater blocking a substantial amount of the incident wave energy that would have normally reached the shoreline. This sheltered environment in the lee of the rubble rampart enabled the shoreline to gradually build out and fringing reef mangrove strands to develop at the mouths of streams along the Malem coast over much of the early to mid-part of the last century.

Over the subsequent decades these rubble banks gradually broke down but continued to provide a substantial level of protection to the eastern shoreline. However, it was in the decades after World War II when considerable development commenced, including the circumferential road and the widening of a causeway to Lelu. These projects utilised large amounts of coral rubble sourced from these banks.

The removal of such a large amount of rubble from the banks both accelerated the breakdown and shoreward migration of the remaining coral rubble but also substantially reduced the protection provided to the shoreline. The increase in wave energy reaching the shoreline has subsequently resulted in a loss of the fringing mangroves and long-term and on-going readjustment of the shoreline along much of the eastern coastline with much higher rates of erosion than has been occurring on any of the other shorelines around Kosrae.

Many of these natural processes are to be expected and are ongoing and likewise the impacts of past human activities in the coastal zone still have an influence on patterns of shoreline change and adjustment. Such changes are indicative of the likely changes that will continue to occur over the foreseeable future (Figure 7).

The following areas are considered to be where coastal change-related impacts are likely to be most significant, either due to ongoing movement of the shoreline and/or the proximity of key infrastructure to the shoreline:

- **Lelu: Finfokoa and Pukushruk** – Large changes have occurred in the shoreline position at Finfokoa over the last half century and continued changes in shoreline position must be expected. However, it is expected the rate of change may be less in comparison with past change. Continued retreat of the coastline along the central section at Pukushruk will likely increase the exposure of the road to damage over time. Similarly the proximity of the road to the shoreline at Putukte suggests it will be susceptible to damage during large waves and high tides.

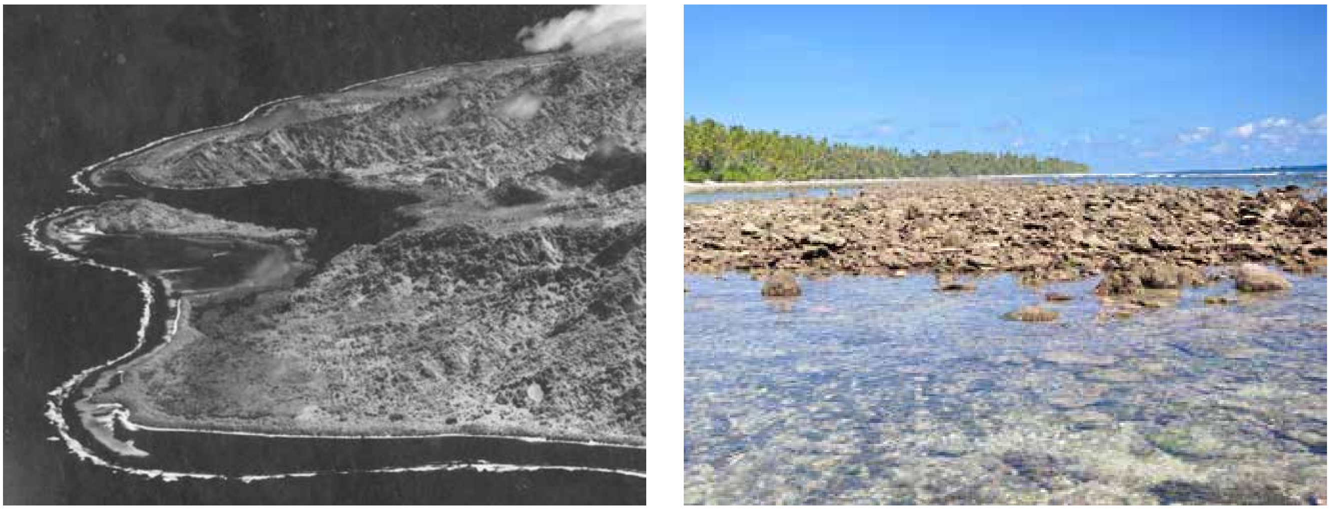


Figure 6: Aerial photograph of the north-east Kosrae coast in 1944 (left) and the remnants of the rubble ridge in 2013 at Putukte (right). The rubble ridge extending from Finaunpes all the way down the Pukusruk shoreline to Putukte can be clearly seen in 1944. The size of the ridge between Finaunpes and Finfokoa resulted in a build out of the shoreline in a bulge in the lee of the ridge. With the breakdown/removal of the rubble ridge, the sediment in this bulge in the shoreline has been redistributed along the adjacent coastline.

Current and foreseeable coastal hazard issues

- **Malem** – The length of road exposed at Pal and Mosral will continue to increase (to the south) with damage from erosion and wave overwashing.
  - At Mosral if the concrete (tideflex) outlet continues to deteriorate reducing its effectiveness as a "groyne", the coastline to the north of the Mosral River could retreat more rapidly.
  - A pattern of ongoing slow shoreline retreat is likely along much of the Malem coast, particularly at Yeseng, Kuplu and from Yewak to Tenwak.
  - At Yewak/Pilyuul, where the Pilyuul River would have originally discharged before being deflected north, there is a risk that ongoing retreat will increasingly expose the road to damage.
- **Utwe** – The Impuspusa coastline is relatively stable but does experience episodic storm damage which over time may increase the potential for damage to the road where it runs close to the current shoreline.
- **Tafunsak** – The position of the shoreline at Finfoko is relatively stable but the proximity of the road to the shoreline means it is susceptible to storm-related damage. At the western end of the seawall at Tafunsak, a slow rate of downdrift erosion has been occurring, and will continue, which is now beginning to undermine the road. At Wiya, the shoreline has moved little in the past but again the location of the road makes it susceptible to storm damage and erosion.
- **Walung** – Between Insiaf and Leap the shoreline has retreated primarily due to long-term sand mining activities and the cutting of a drainage channel through the beach berm in 1976 (and recently blocked up by the construction of the new seawall). A slow rate of retreat is likely to continue to both the east and west of the new seawall.

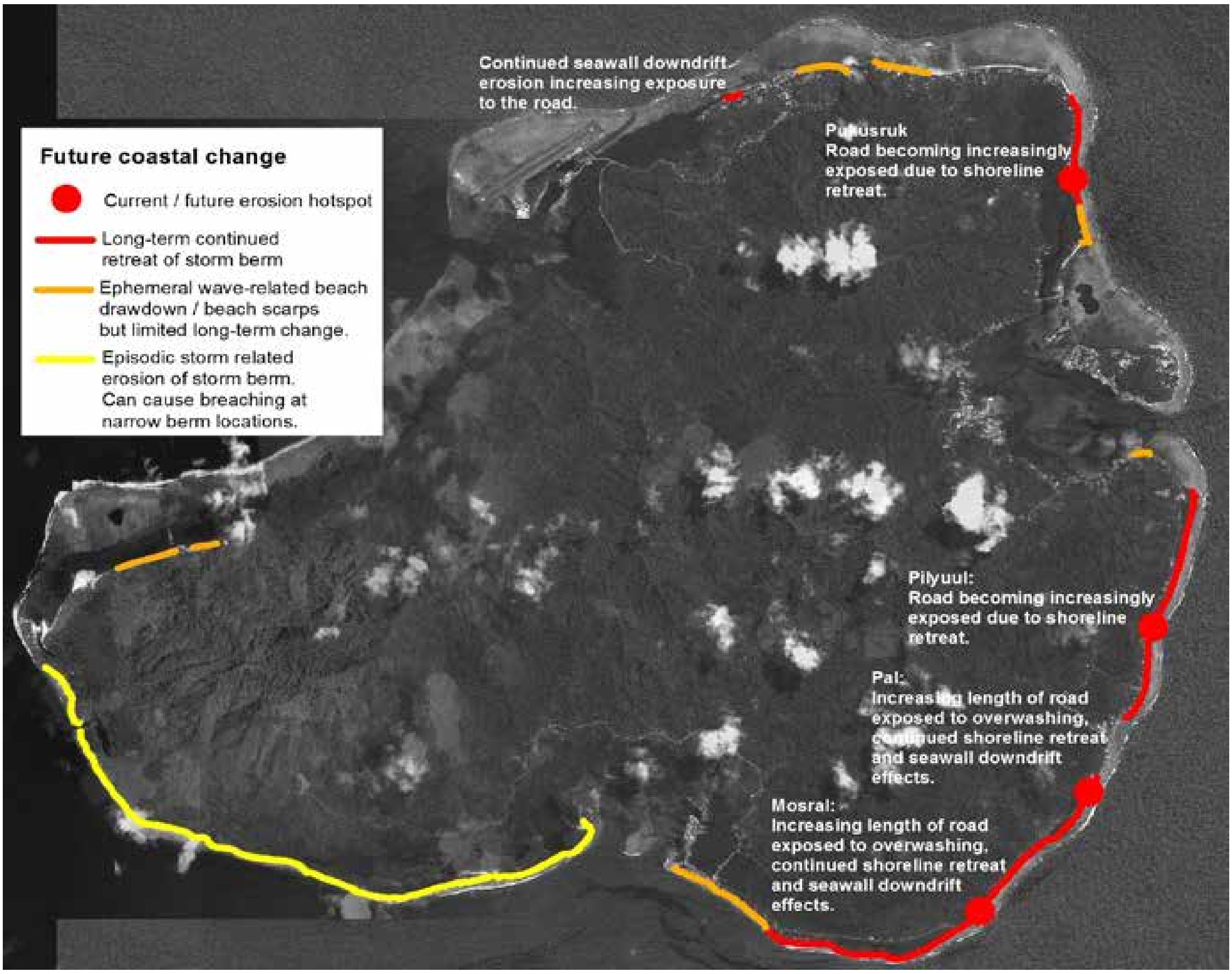


Figure 7: Summary of key locations and types of coastal change likely to be experienced on Kosrae over the next one to two generations.

2.2 Coastal inundation

Flooding of land from the sea tends to occur episodically due to three types of events: large swell events, typhoon events and high tide flooding.

Large swell events (such as affected the Tafunsak coastline in December 2008) and cyclone events (Figure 8)) are extremely destructive when they do occur, but are relatively infrequent events. There is always a chance that such events will occur but their frequency of occurrence is not likely to change noticeably due to climate change, at least over the next few generations.

Flooding caused by high tides, either due to high tides alone or when waves coincide with high tide conditions are most likely to cause significant impacts on Kosrae's communities (Figure 9). Where high tide flooding occurs at present, sea level rise will result in the frequency of such flooding events increasing. For example within one generation present-day high tide flooding will occur over four times more frequently than it does today, and within two generations about 10 times more frequently (see Appendix D).

Figure 8: Overwashing of the road in South Malem during Tropical Storm 31W in December 2001 (top) and at Tafunsak during the December 2008 large swell event (bottom).

Figure 9: Low-lying reclaimed areas on Lelu Island (top) and Utwe village (bottom). Both Lelu and Utwe villages have been built on reclaimed land that is close to present day high spring tide levels. The frequency and severity of high-tide flooding will be an ever-increasing issue as sea-level rise continues. Constructing further seawalls will not prevent more frequently and severe inundation occurring in the future.

The main locations (Figure 10) where high tide levels cause inundation problems to property or infrastructure tends to be where land has been reclaimed in the harbour or mangrove areas:

- **Lelu Island** – Much of the reclaimed areas on Lelu Island have land levels that are barely above present day high tide levels. Flooding of land during December and January commonly occurs adjacent to the canal sections in Lelu.
- **Pukusruk** – Landward of the road, many properties are built on reclaimed land in to the mangrove areas with levels barely above spring high tides.
- **Utwe village** – Much of Utwe village lies on reclaimed land on top of a sand spit. Again the level of the land is barely above present day spring high tide levels.
- **Walung** – The section of coast between Insiaf and Pilyuul (old elementary school) is largely sheltered from waves but the level of the coastal berm is barely above high tide levels.

Current and foreseeable coastal hazard issues

- **Tafunsak** – The communities at Malsu, Yekula, Finfukul and Sialat that are located on land that is lower than the crest of the beach berm / coastal road. Overwashing of the seawall at Finfukul on to the road also already occurs.

There can be no doubt that flooding will increase in these vulnerable locations. However, in the longer term, the potential rate of sea-level rise toward the second half of this century will result in increasingly more frequent damage to much of the infrastructure and property located along all parts of the coastal storm/beach berm and reclaimed areas (Figure 3). It will be increasingly difficult to maintain infrastructure and residential property located in these areas without substantial and continuous investment (for example raising reclaimed land levels in Lelu and Utwe villages).

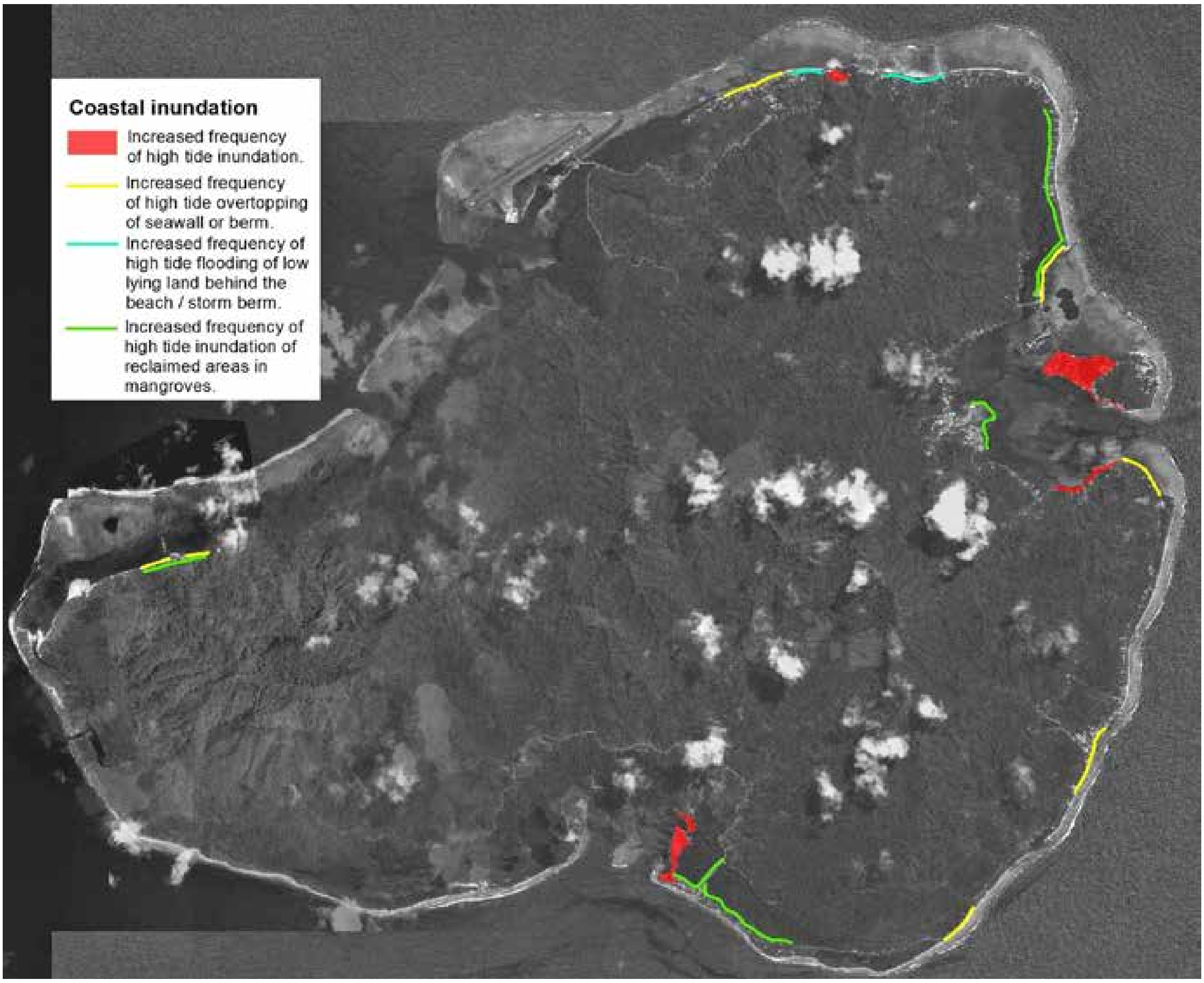


Figure 10: Summary of key locations where coastal inundation issues will increase on Kosrae over the next one to two generations.

3 Adaptation foundations

The careful management of the natural coastal environment

The foundations for effective adaptation is built on the careful management of the natural coastal environment, and the resources found there. This is the single most important coastal protection activity on Kosrae and one that is fundamental for minimising the potential impacts of present and future coastal hazard impacts.

A healthy coastal environment on Kosrae is the most effective coastal defence available. This natural coastal defence includes the watersheds, wetlands and swamp forests, mangroves, beaches, reef flat, and the coral reef (Figure 11 and Table 1). The effectiveness of this natural coastal defence, and its resilience to the effects of climate change and sea-level rise, is dependent upon the health of, and the natural interactions between, each of these environments.

Limiting detrimental human impacts on the functioning of this natural protection is essential to Kosrae's efforts to address both climate change and existing coastal hazards. The mechanisms for supporting this are well developed and mainstreamed in Kosrae through the community awareness activities of both KIRMA and Kosrae Conservation and Safety Organisation (KCOS) and the development review process.

Figure 11: The best coastal defence on Kosrae. Awareness poster developed in 1999 by the Development Review Commission (now KIRMA).

Table 1: Coast protection functions of Kosrae's natural environment and key impacts on this coast protection function.

Environmental feature	Key coastal protection functions	Key activities on Kosrae that impact on the coastal protection function of the natural environment
Coral reef, reef flat and seagrass	• Direct protection from waves. • Source of sediment, (coral rubble, skeletal remains of reef biota), that feeds Kosrae's beaches. • The primary factor controlling wave energy reaching the shoreline and influencing how beach and shoreline mangrove areas change.	• Detrimental fishing practices (chlorox, poison leaf). • Overfishing of herbaceous reef fish. • Excessive pollution from pig pens and septic tanks located too close to the coast or streams. • Pollution or excessive sedimentation from commercial activities or dredging. • Land practices increasing freshwater and sediment discharge. • Removal of reef flat sand and coral rubble.
Beach and backshore	• Natural adaptable buffer providing direct protection to land behind from waves and coastal flooding.	• Sand mining and removal or reef flat coral rubble. • Vegetation removal from behind the beach. • Development that is too close to the shoreline (encroachment within the backshore buffer zone). • Land reclamation or seawalls that impact on the natural beach processes.
Mangroves	• Direct protection from waves (reef flat and harbour areas). • Trapping sediments and nutrients washed off the land before it reaches seagrass and coral reef environments.	• Harvesting large areas of seaward fringe mangroves. • Land activities that result in pollution, increased river flows or sediment input. • Land filling, roads through, or reclaiming mangroves areas.
Wetland areas and rivers	• Controls flow of fresh water from land to reef environments during periods of heavy rain. • Trapping sediments and nutrients washed off the land before it reaches the seagrass and coral reef environments.	• Drainage of wetlands. • Alterations to natural drainage pathways through wetlands (e.g., due to farm roads, insufficient culverts). • Alterations to river or stream outlets at the coast. • Land filling or reclaiming large areas of wetland.
Catchment watersheds	• Regulates flow of rainfall and sediment run-off to wetland and coastal areas.	• Clearing of steep sloping land or land too close to rivers and streams. • Development of land above the Japanese line. • Construction of roads with steep slopes.

Strategy 1: Continued development and strengthening of the community awareness and outreach activities with a focus on an effective natural coastal defence and Kosrae-relevant climate change impacts and adaptation options.

Strategy 2: Amendment of the KIRMA Regulations for Development Projects to incorporate climate change considerations and strengthening of regulation implementation to support successful long-term risk reduction and adaptation.

Continuing the community awareness and outreach activities conducted by KIRMA and KCOS is critical if Kosrae's communities are to reduce the ongoing impacts of coastal hazards on their communities and respond effectively to the longer-term exacerbating impacts of climate change and sea-level rise. Many of the current coastal hazard-related issues are in a significant part due to past, and in some cases ongoing, human-related activities that have impacted on the effectiveness of the natural coastal protection provided by the coastal system on Kosrae.

Future awareness and outreach activities should continue to focus on reducing and minimising human impacts on the effectiveness and protection provided by the natural coastal defences:

- Impacts of sand mining and coral rubble removal.
- Importance of naturally vegetated buffer zones between the shoreline/edge of mangroves/rivers and streams and land development.
- Avoiding developing areas prone to current or future coastal hazards over the lifetime of the development. Key messages should incorporate recommendations to avoid any further development:
  - seaward of the paved section of road between Okat and Utwe
  - within 50 feet (15 m) of the shore or mangrove vegetation line or top of seawall structures (including no further land reclamation over mangrove or beach areas)
  - located on land less than 4 m (4 m contour) above land vertical datum on Kosrae (this is approximately 6 feet (2 m) above the present day high water mark) or in mangrove areas.
- Continued focus on protecting the natural functions of river and stream catchments and limiting development above the Japanese Line.
- Limitations of sea walls and other coastal defences as a long-term effective adaptation option.

An integral component of this awareness/outreach activity will be to continue to strengthen the relationship with the Housing and Renovation Division of the Department of Resources and Economic Development.

The KIRMA *Regulations for Development Projects* are currently being amended to require the design and implementation of public infrastructure such as road and building to incorporate climate change adaptation measures consistent with the FSM National Climate Change Policy of 2009.

Further changes have been suggested to strengthen the consideration of the effects of natural change, impacts of extreme weather and climate events, and climate change on a proposed development activity and to better incorporate risk-reduction and adaptation considerations in to the development permitting process.

In strengthening the implementation of the development permit process to contribute to sustained adaptation and reduction of present and future coastal hazard risks to Kosrae communities it is recommended that development projects in the following locations be prohibited and that any exceptions require full technical assessment of the risks in the following locations:

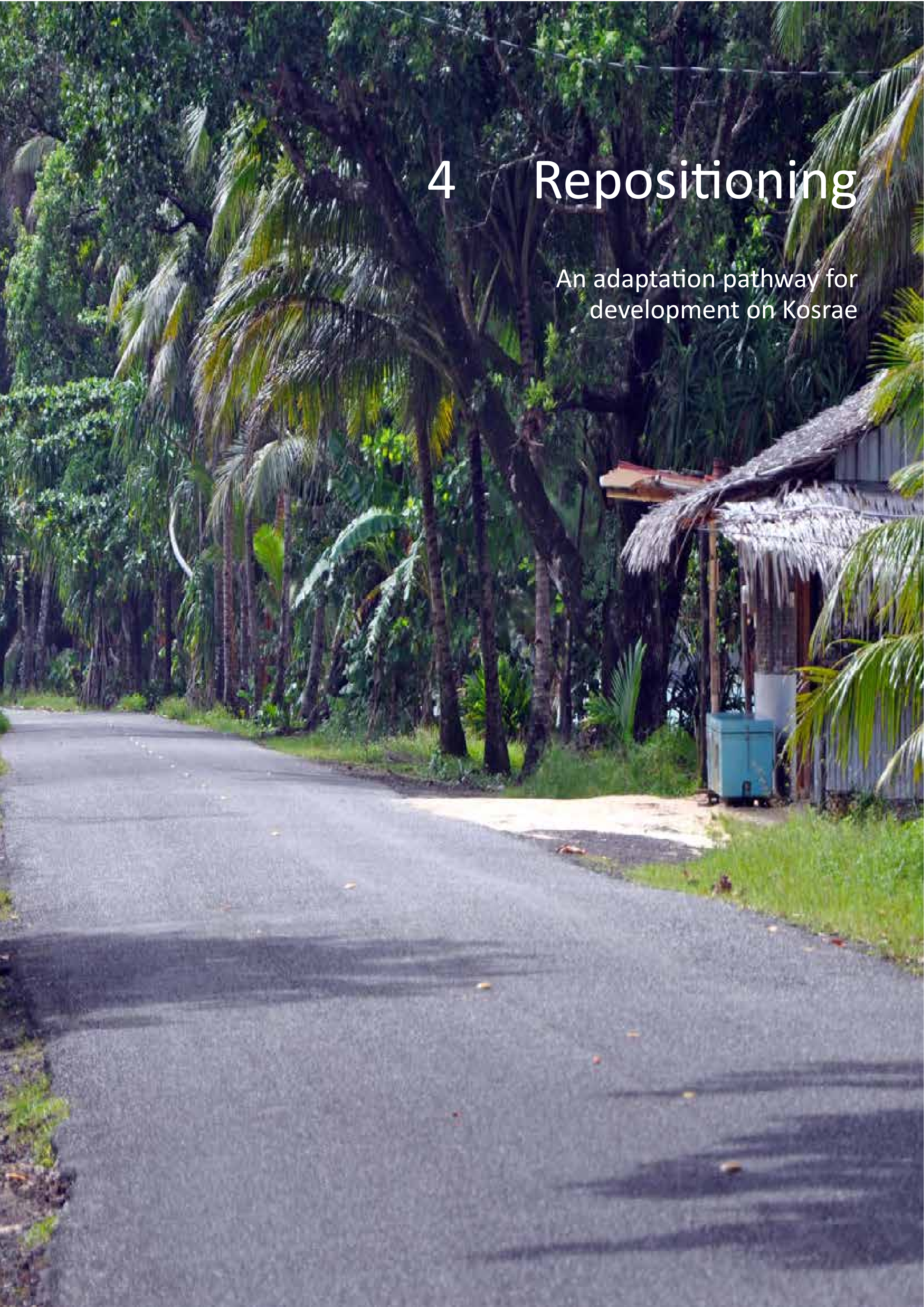
- seaward of the paved section of road between Okat and Utwe, or
- within 50 feet (15 m) of the shore or mangrove vegetation line or top of seawall structures (including no further land reclamation over mangrove or beach areas), or
- located on land less than 4 m (4 m contour) above land vertical datum on Kosrae (this is approximately 6 feet (2 m) above the present day high water mark) or in mangrove areas.

The area covered by the above development restrictions is shown in Figure 12.

Figure 12: Low-lying coastal areas where restrictions on further development are required. The areas shown in red are largely below the 4 m MSL contour which is approximately 2 m above present day high spring tide level.

4 Repositioning

An adaptation pathway for development on Kosrae



4.1 Introduction

If Kosrae is to build communities resilient to the future effects of climate change, over the next one to two generations all new development (property, infrastructure) must be located away from the narrow coastal berm and low-lying areas. These areas are already vulnerable to shoreline change and inundation, and climate change will cause the frequency and severity of such impacts to ever increase.

Also of great importance will be a sustained effort to encourage existing development and infrastructure to be repositioned away from areas at risk. Such repositioning does not need to happen immediately but rather it can be conducted in a structured way over time as buildings and infrastructure require replacement or significant upgraded or renovation.

By the 2050s (2 generations time) Kosrae needs to have made significant progress in implementing an adaptation strategy that repositions the majority of existing critical infrastructure and property away from the beach/storm berm areas, reclaimed areas of mangrove and low-lying wetland swamp to slightly higher ground around the base of the volcanic part of the island (Figure 13).

Figure 13: Potential primary and secondary sealed road network on Kosrae by the 2050s. Note: Parts of the secondary road network (current coastal road) may become impassable due to ongoing shoreline change and breaching.

4.2 Resilient infrastructure

4.2.1 Strategy overview

The coastal (paved) road network is a major piece of critical infrastructure on Kosrae providing the only connection between the main villages and to the airport and port.

Much of the coastal road is located on the narrow storm/beach berm between Tafunsak and Utwe. With the exception of the section around Tofol much of the roads is at risk from shoreline change and wave overwash. To date the response to the most critically at risk sections has been to build seawalls, typically rock revetments which provide varying degrees of protection. At present further sections at Pal and Mosral are critically threatened. In the forseeable future, both ongoing coastal change and the exacerbating effects of sea-level rise and climate change, will result in further sections of road becoming increasingly exposed to damage and flooding (for example, at Yewak/Pilyuul and Pukusruk). Given the elevation of much of the existing coastal road relative to future sea levels and its location on the narrow beach/storm berm continued reliance on seawall protection of all sections of the present paved coastal road will become progressively less effective, more expensive and will not be a sustainable.

The road network plays a fundamental role in directing where other infrastructure (Kosrae Utility Authority and FSM Telecom) and residential development both historically and in the future occurs. For example, the majority of residential property developed over the last two to three generations is located alongside the main paved sections of road. Likewise the power distribution network (power lines and poles) runs north from Tofol to the airport and port at Okat, and to the south to Utwe and is located next to the road upon the narrow beach/storm berm. Airport and port operations in particular are extremely vulnerable should damage occur to any part of the power distribution system between Tofol and Okat (the back-up route between Mutunnenea and Sialat for part of the route is largely in place but with a small gap due to a lack of access agreement with one landowner).

Due to these interdependencies continuing to maintain the single main road between Tafunsak and Okat in its present location on the narrow beach/storm berm will leave the whole community vulnerable to being isolated and unable to move between locations/villages and make responding to emergencies and continued development very difficult if not impossible. Repositioning the road to higher ground ensures lower cost, all weather access for the whole community into the future.

Strategy 3: Over the next one to two generations the primary coastal road network and associated infrastructure currently located on the beach/storm berm is developed inland away from long-term erosion and coastal inundation risk.

The priority focus of road development activities on Kosrae urgently needs to change from any further extension/completion of the circumferential road between Okat and Walung to addressing the current and potential vulnerabilities of the existing coastal road particularly between Utwe and Malem (where there is presently a real risk of a breach occurring of the road) and from Finpukal to Tafunsak.

Starting now, but implemented over the next 25 to 50 years, a phased approach to repositioning the main access road away from the shoreline to higher ground must be a priority. This is key to enhancing the resilience of the coast to the effects of future climate change, reducing and removing the risks to Kosrae's essential infrastructure, and to encouraging and enabling the relocation of residential properties and communities back from areas at risk from present and future coastal hazards.

The present-day practice (as seen in the development of the section between Utwe and Walung) of constructing the inland road around the perimeter of the lower slopes of the volcanic part of the island and above the freshwater swamp or mangrove areas provides a suitable long-term response as long as levels of new and upgraded inland roads are at least 6 feet (2 m) above present day high tide levels (above the 4 m contour). This would ensure:

- Road levels are above any future high tide levels for at least the next one hundred years.
- The majority of the road network is located well back from the shoreline and protected by the full extent of the natural coastal protection (reef, reef flat, beach and beach/storm berm, swamp and/or mangrove forest).

Furthermore with Kosrae's already high rainfall amounts and intensities, and with rainfall intensities likely to increase in the future due to climate change:

- Road slopes need to be minimised as far as possible.
- Minimize, construction activities that increase landslipping risk, e.g., cutting into the hillsides.
- Adequate culverts and bridges are installed, taking account of revised design rainfall amounts and drainage guidelines that have been developed to minimize changes to drainage patterns and to cope with periods of heavy rainfall.

In the development/upgrade of sections of inland road the following assumptions have been made:

- A 60 feet standard easement is assumed.
- An integrated infrastructure approach is adopted which includes relocation of power distribution, and any water or telecom service infrastructure. For this indicative costing it is assumed that new power lines will be installed along all new/upgraded sections of road.
- Existing sections of inland farm roads require widening to obtain a roadway width of 30 ft, require construction of roadway drainage structures and resurfacing to sub-base course level.
- Upgrade to Hot Mix Asphalt (HMA) pavement includes base course preparation on top of the sub-base and 2" thick asphalt pavement. It is assumed that all aggregates included sand are imported.
- Indicative costs from the Department of Transport and Infrastructure and Kosrae Utility Authority are as follows:
  - New road development to full width, all drainage infrastructure and to sub-base wearing course: US$600k per mile (approximately $373 per metre).
  - Sub-standard road upgrade to full width, all drainage infrastructure and to sub-base wearing course: at least $300k per mile (approximately $186 per metre).
  - Upgrade sub-base wearing course to Hot Mix Asphalt pavement: $520k per mile (approximately $323 per metre).
  - Power line network: $30k per mile ($19 per metre).

In addition roads will cost somewhere in the order of 2–5% of the construction cost on an annualized basis to maintain at their as-constructed standard over their design life (Katie Friday, US Forestry Service, Pers Comm).

The prioritized redevelopment of the coastal road is summarized in Figure 14 and outlined below:

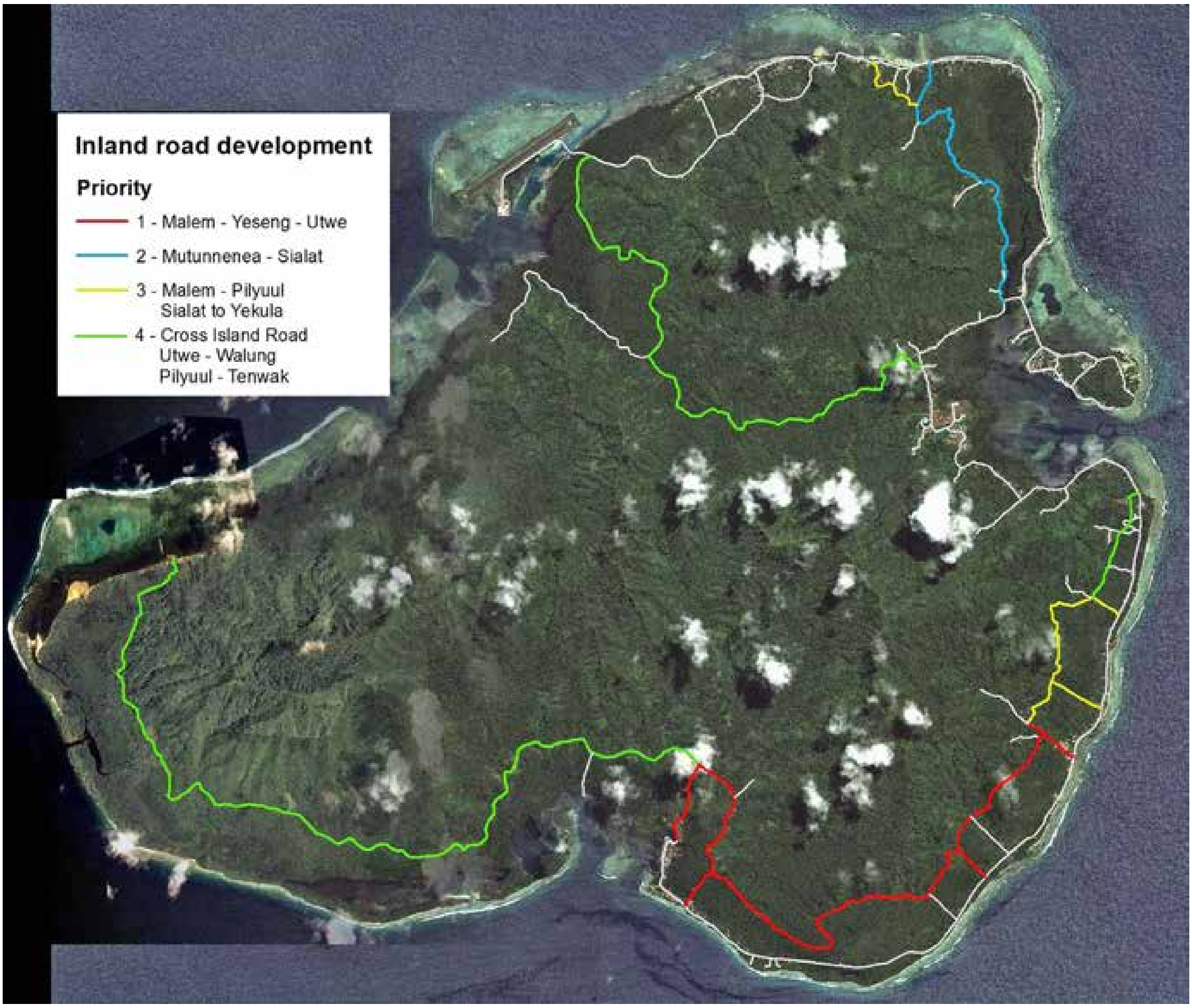


Figure 14: Priority section of the development of the inland road on Kosrae.

4.2.2 Priority section 1: Malem to Yeseng to Utwe

Upgrading the inland road between Malem and Utwe is considered the highest priority due to the risks posed due to wave overwashing and potential breaching of existing sections at Pal and Mosral. There is a very real present day risk that road access to Utwe could be cut off. The natural storm berm to the south of Malem also tends to be lower in elevation (than other areas such as north of Malem and the Pukusruk coast) resulting in the road being more prone to wave overwashing where it is exposed.

At Pal despite rock protection being extended south from Malem and further concrete rubble being dumped along the most exposed section. Adequate protection will require a significant investment to maintain this section or road in a serviceable condition in the short to medium term (see Section 3.2). At present there is a very real risk of the road being breached or damage to the power line, which is located to the seaward edge of the road. Over the next 25 years further sections of the road to the south of Pal will become progressively exposed as the shoreline continues to retreat back.

At Mosral the concrete bags that have been placed along the most exposed section to the south of the Mosral River outlet do not offer an adequate standard of protection and there remains a significant present-day risk of the road being damaged. There are already signs that this section of seawall is exacerbating the rate of retreat of the shoreline immediately to the south. Over the next 25 years further sections of road to the south of Mosral to where the road bends inland at Kuplu, will become progressively exposed as the shoreline continues to retreat back. The road may also become more exposed to the north as well if the tideflex outlet deteriorates further. At present the tideflex outlet acts as a groyne trapping gravel which is being moved southward along this section of coast.

Should a severe typhoon affect Kosrae during the next 25 years, it is likely that substantial sections of the road from Malem to the south of Pal, at Mosral, and from Hiroshi Point towards Utwe could experience substantial damage irrespective of whether coastal defences are in place or not, further highlighting the need to relocate the road inland to higher ground.

Indicative locations of new and upgraded inland road between Utwe and Malem are shown in Figure 15 with indicative costs in Table 2.

Table 2: Indicative costs in US$ for inland road and associated infrastructure development between Utwe and Malem. Costs are shown for upgrading/developing the inland road to both sub-base wearing course and to hot mix asphalt pavement.

Section	Upgrade existing road (m)	New road section (m)	Total to sub-base wearing course ($)	Total to Hot Mix Asphalt Pavement ($)	Power line upgrade/ installation ($)
Inland road: Malem to Yeseng		2000	$746,000	$1,392,000	$38,000
Access road: Malem	870		$163,000	$444,000	$16,300
Access road: Yeseng	500		$94,000	$255,000	$9,400
Inland road: Yeseng to Finsrem (Utwe)	2520	2460	$1,387,000	$2,997,000	$92,900
Access road: Utwe to Finsrem	600		$355,000	$969,000	$35,500
Inland road: Finsrem to Finkol	1900		$112,000	$306,000	$11,200
Access road: Utwe to Finkol	1140		$213,000	$581,000	$21,300
TOTAL	7530	4460	$3,070,000	$6,944,000	$224,600

Figure 15: Indicative inland road between Utwe and Malem showing the requirements of new and upgraded sections of road.

4.2.3 Priority section 2: Mutunnenea to Sialat

The section of coastal road between Mutunnenea and Wiya is a further major section of coastal road located on a narrow storm berm between Finpukal and Finaunpes, and on the northern coast a wider beach berm. Also located adjacent to the road is the only power and telephone line to Tafunsak and to the port and airport.

Currently the only section of road at critical risk to wave overwash and damage is at Finaunpes, which has been protected by a variety of seawalls culminating in the rock revetment installed in 1998. Between Finaunpes and Sialat the shoreline has generally been accreting over the last few decades. However, severe erosion was previously experienced from around 1998 at the Sandy Beach Hotel due to the seawall at Finaunpes. This has now been stabilised by a beach control breakwater and beach nourishment scheme undertaken in 2001). This section of coast has a wide natural buffer, although narrowing towards Sialat, with minimal development between the road and the shoreline. Unless there is a significant change in the sedimentary regime along this section of coast this natural buffer should continue to provide adequate protection to the road.

Between Finfokoa and Putukte the road is generally well back from the shoreline at the northern end with a narrower coastal buffer at the southern end. Whilst the shoreline appears to have moved little over the last few decades at Putukte, the proximity of the road to the shoreline does put it at significant risk. However, it is north of the Mormon Church where over the next 25 years coastal retreat will progressively increase exposure and risk of damage to the road. Any coastal defences, unless very carefully designed, on the Pukusruk coast will exacerbate erosion on adjacent unprotected sections.

From Putukte to Finpukal, the storm berm (and road) is lower and, despite being sheltered from the largest of waves, overwashing of the existing road at high tides will become an increasing issue as sea levels rise, irrespective of whether further coastal defences are built.

Landward of the road from Finpukal to Finaunpes most property is located on reclaimed land within the mangroves with little elevation above high spring tide levels. Between Finaunpes and Sialat, property located on the low-lying land behind the beach berm is prone to occasional inundation when large swell events from the north overwash the berm (such as occurred in December 2008), or due to heavy rainfall and flooding from the various streams that drain to the coast. These areas will increasingly experience drainage issues, waterlogging and ponding of water due to increasing rainfall and higher sea levels.

The inland road between Mutunnenea and Sialat has been in place for many years (Figure 16). It was originally built as a single track and when maintained was passable in most vehicles. However, over the last few years the central section has had little maintenance, is now largely overgrown

Table 3: Indicative costs in US$ for inland road and associated infrastructure development between Mutunnenea and Sialat. Costs are shown for upgrading/developing the inland road to both sub-base wearing course and to hot mix asphalt pavement.

Section	Upgrade existing road (m)	New road section (m)	Total to sub-base wearing course ($)	Total to Hot Mix Asphalt Pavement ($)	Total Power line upgrade/ installation ($)
Mutunnenea to Sialat	4500		$839,000	$2,293,000	$83,900

and only passable with a large four-wheel drive. However, progressively it has encouraged an increasing number of residential properties to be located along it, particularly at the southern end. Upgrading the inland road will encourage further development inland away from the exposed storm/beach berm and low-lying areas between Finaunpes and Finpukal.

The alternative to upgrading the inland road between Mutunnuenea and Sialat would be to develop the cross island road between Innem and Okat. This is the preferred option for Kosrae Utility Authority to provide a secondary power line to Okat harbor and airport. However, the Mutunnenea to Sialat option was generally favoured by all others consulted. Power lines do extend up the existing inland road from both the Mutunnenea and Sialat ends but do not yet join due to local land ownership issues.

Figure 16: Inland road section between Mutunnenea and Sialat.

4.2.4 Priority section 3a: Sialat to Yekula/ Wiya

Between Sialat to Wiya the road is located close to the shoreline. A number of streams discharge to the shoreline resulting in low-lying, inundation-prone land behind the beach berm. At present coastal inundation only tends to be an issue during episodic swell events (such as occurred in December 2008) or when high tides combine with northerly waves (the low lying areas behind the berm are also prone to flooding due to heavy rainfall events). From Yekula to Wiya the coastal margin is higher in elevation, less prone to overwashing, and relatively stable but it has only a narrow buffer between the shoreline and road.

The most exposed section between Sialat and Yekula, opposite the channel over the outer reef, was protected by a seawall in 1999. The wall was well constructed and succeeded in minimizing impacts on adjacent sections of the coast but had no crest protection resulting in the edge of the road remaining prone to damage due to wave overtopping. The potential for damage to the road along this protected section will increase over time unless some further crest protection is provided.

Table 4: Indicative costs in US$ for inland road and associated infrastructure development between Sialat and Yekula. Costs are shown for upgrading/developing the inland road to both sub-base wearing course and to hot mix asphalt pavement.

Section	Upgrade existing road (m)	New road section (m)	Total to sub-base wearing course ($)	Total to Hot Mix Asphalt Pavement ($)	Total Power line upgrade/ installation ($)
Sialat to Yekula	765	350	$274,000	$634,000	$21,000

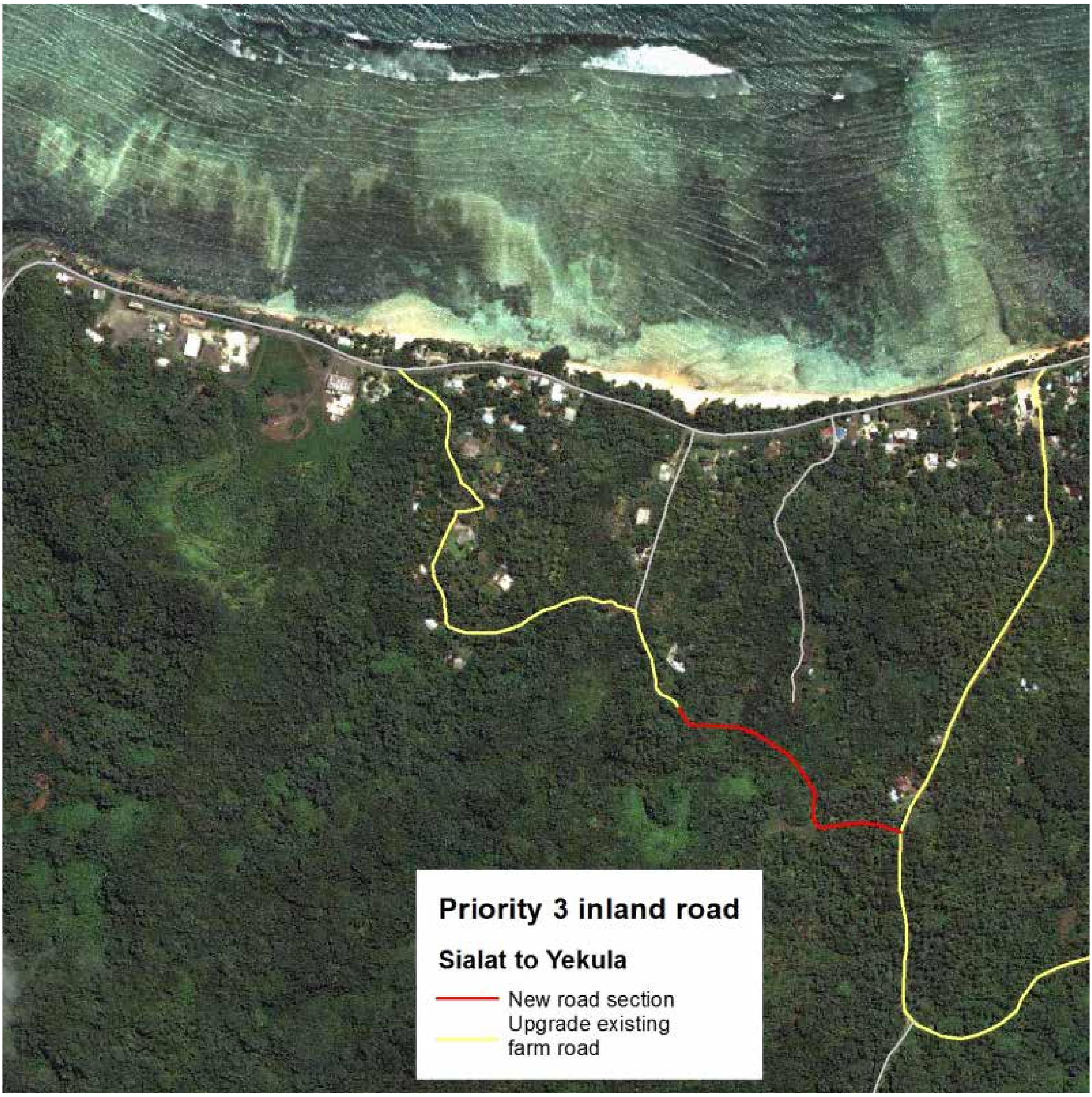


Figure 17: Inland road section between Sialat and Yekula.

4.2.5 Priority section 3b: Malem to Pilyuul

The coastal road through Malem village to the north of the Malem River outlet is protected by a rock revetment and buffer of reclaimed land. The revetment has been poorly constructed in places and is overwashed during high tides. However, with the exception of typhoon events, the road is not presently at significant risk. To the north of Malem, through Yewak to south Pilyuul, the shoreline position is relatively stable but over the next one to two generations is likely to see a continual slow retreat with the road becoming progressively more exposed to coastal hazards (particularly around the section of coast opposite the shallow reef channel between Yewak and Pilyuul).

Between Malem and Pilyuul there is a relatively high density of residential properties located along the coastal road and upon the storm berm, either:

- Seaward of the road and hence at greater and increasing risk from erosion and wave damage, over the next 25 to 50 years.
- Landward of the road on slightly less wave exposed but lower lying flood prone land backing on to the saline/ freshwater swamp areas behind the storm berm.

Around Pilyuul the buffer between the shoreline and road increases in width and despite a slow rate of ongoing shoreline retreat the road is less at risk over the foreseeable future.

As with developing the inland road between Mutunnenea and Sialat, upgrading the inland road between Malem and Pilyuul will encourage further development on higher ground away from the narrow storm berm. Whilst the storm berm upon which the road is located is not critically exposed at present, parts of the road will progressively become more exposed to damage over the next one to two generations. The timing for the upgrade of the inland road development will depend on the ongoing rate of retreat of the section of coast between Yewak and southern Pilyuul, particularly around the location of the historical outlet of the Pilyuul River. It is suggested that as soon as the buffer between the shoreline vegetation line reduces to less than 30 feet (10 m), planning and implementation for the upgrade of the inland road should be prioritized.

As on other sections of the exposed Malem and Lelu coastline, any coastal defences such as seawalls will tend to cause downdrift erosion on adjacent shoreline sections to the south and are not recommended.

Figure 18: Inland road section between Malem and Pilyuul.

Table 5: Indicative costs in US$ for inland road and associated infrastructure development between Malem and Pilyuul. Costs are shown for upgrading/ developing the inland road to both sub-base wearing course and to hot mix asphalt pavement.

Section	Upgrade existing road (m)	New road section (m)	Total to sub-base wearing course ($)	Total to Hot Mix Asphalt Pavement ($)	Total Power line upgrade/ installation ($)
Inland: Malem to Pilyyul	2500		$467,000	$1,274,000	$46,700
Access: Pilyuul	430		$81,000	$220,000	$8,100
Access: Yewak	760		$142,000	$388,000	$14,200
TOTAL	3690		$690,000	$1,882,000	$69,000

4.2.6 Priority section 4: Pilyuul to Tenwak

Between Pilyuul and Tenwak most of the coastal road is located on the storm berm. However, along this section there is a relatively wider buffer formed by a more recent storm ridge (likely created during the 1891 cyclone). This berm has not yet migrated back to join the more "permanent" storm berm. In between the Pilyuul River flows northwards to its outlet at Tenwak.

The need for upgrading this section of the road over the next one to two generations will depend on the pattern of shoreline retreat. If the storm ridge continues to retreat (and the Pilyuul River outlet breaches further south) then the need for repositioning of the road to the base of the volcanic part of the island may increase in priority. As with other road and coastal sections, ongoing monitoring is key to the continued fine tuning or priorities for road relocation.

Table 6: Indicative costs in US$ for inland road and associated infrastructure development between Pilyuul and Tenwak. Costs are shown for upgrading/developing the inland road to both sub-base wearing course and to hot mix asphalt pavement.

Section	Upgrade existing road (m)	New road section (m)	Total to sub-base wearing course ($)	Total to Hot Mix Asphalt Pavement ($)	Total Power line upgrade/ installation ($)
Inland: Pilyyul to Tenwak		1510	$563,000	$1,051,000	$28,200
Access: Tenwak	150		$28,000	$77,000	$2,800
TOTAL	150	1510	$591,000	$1,128,000	$31,000

Figure 19: Inland road section between Pilyuul and Tenwak.

4.2.7 Other road sections

Other sections of coastal road

There are a number of other sections of the coastal road where the steep volcanic topography extends to the shore. In these locations there is little potential to relocate the road further inland. These sections include:

- Tenwak to Mutunlik.
- Wiya to Malsu.
- Causeway and Lelu Island.

Protecting, or upgrading and continuing to protect these sections with coastal defences is the most likely option for the foreseeable future (Section 5). At Malsu the road and surrounding land is low-lying as it is the outlet of two streams. Both river flooding and overwashing during high tides and/or large swells will continue to be an issue. At this location however there appears limited option to relocate further inland and a more detailed investigation of options is required.

Mutunnenea to Mutunlik

Between Mutunnenea, through Tofol to Mutunlik the road is located well back from the harbor shoreline and unlikely to be significantly affected by sea-level rise or coastal change over the next few generations. Only between the outlet of the Tafuyat River and southern part of Mutunlik, where the road elevation is low is there a need for improved protection and potentially raising the road elevation to avoid inundation when this becomes a too frequently occurring issue.

Utwe to Walung

The section of road from Utwe to Walung is currently being upgraded with Chinese Government support. The alignment of the road around the edge of the lower section of the volcanic part of the island is a good example of a road that is well positioned to minimize the impacts of potential coastal hazards and the future effects of sea-level rise. However, extending the road along the coastline at Walung to Insiaf is not well advised and is not aligned to a long term strategy to reduce the risk of damage to infrastructure from coastal hazards.

Okat to Yela

This road is currently being upgraded and extended as part of the Pacific Adaptation to Climate Change project. This includes “climate proofing” the culvert size to accommodate increased intensity rainfall and a minimum road surface level. Where the road is located directly behind the fringing mangroves it will be elevated to a minimum of 3 feet above high spring tide level.

It is suggested that developing an alternative inland road network as outlined and prioritised in the earlier sections of this document is a much higher priority than any further upgrading or extension of this section of road.

4.2.8 Other infrastructure: Airport and Okat Harbour

Over the next one to two generations both the airport and port infrastructure are likely to cope with the modest increases in sea-level rise and other climate change effects although maintenance requirements may increase. However, as sea-level rise continues to increase in to the future, the airport facility and runway will be increasingly impacted if improvements in coastal defences are not implemented. Increasing frequency and magnitude of wave overtopping of the present coastal defences surrounding the runway must be expected and given the importance of this facility continued monitoring and a focus on upgrading coastal protection (and in the future potentially runway and shoulder elevations) will be an important priority as sea levels rise.

4.3 Safe development and relocation of existing property

Strategy 4: Ensure new development (property, infrastructure) is located away from areas at risk from present and future coastal hazards.

Strategy 5: A programme of encouraging existing residential property to be relocated away from areas at risk from present and future hazards as it is replaced or renovated.

Over time reducing the number of residential properties located on land that is too low lying or too close to the shoreline is critical if Kosrae is to build communities resilient to the future effects of coastal hazards and climate change.

More effective application of the KIRMA Regulations for Development in ensuring new properties are not located in coastal-hazard prone areas is fundamental (see Section 3 and Figure 12). This should aim to avoid future development in locations:

- Seaward of the paved section of road between Okat and Utwe.
- Within 50 feet (15 m) of the shore or mangrove vegetation line or top of seawall structures (including no further land reclamation over mangrove or beach areas).

- Located on land less than the 4 m (4 m contour) above land vertical datum on Kosrae (this is approximately 6 feet (2 m) above the present day high water mark) or in mangrove areas.

For existing properties relocation does not need to happen immediately, rather it may take place in a gradual, planned and proactive manner over the next one to two generations. For example as homes are replaced or significantly upgraded these could be assisted to relocate to less vulnerable areas. It is also recommended that no further ad hoc coastal defences be permitted to be built to protect existing property.

4.3.1 Incentives for developing in safer locations

Strategy 6: Incorporate a grant component in to the loan programme to help encourage new property to be constructed in areas not exposed to coastal, river floor or landslide hazards.

Whilst the KIRMA Regulations for Development Projects provided a regulatory mechanism for controlling future development of residential and commercial property in locations at risk from coastal hazards, there is also opportunity for providing an incentive mechanisms for achieving effective adaptation.

A substantial proportion of housing redevelopment or construction of new property is carried out with financial assistance in the form of a loan from the Housing and Renovation Division of the Department of Resources and Economic Development. The Division also administers the two USDA Rural Development loan programmes (Table 7).

At present all new housing loans are reviewed by a number of Government Departments including KIRMA (Development Permit and EIA requirements), Historic and Preservation, Sanitation, Governor's Office (land use rights and to ensure not to be located on Government land) and the Department of Resources and Economic Development (who act as trustee and ensures the property is not located above the Japanese Line or below the high water mark).

Incorporating a grant component in to the loan that does not need to be paid back could provide an incentive to encourage people when building a new house to relocate further inland (assuming that they own accessible land or alternative land is made available). Given the number of new loans on Kosrae the total costs may be relatively modest (of the order of \$100k–\$150k per year for an incentive of \$2,000–\$3,000 per loan). The potential for donors to fund the grant programme as adaptation support to Kosrae should be explored.

Strict guidelines would need to be defined and applied to ensure clear understanding of what acceptable criteria for recipients of the grant would be. In addition to meeting all current State clearing house requirements and KIRMA Development Project Regulation requirements, at the very minimum it is suggested the following be included:

- Be located on land levels greater than 6 feet (2 m) above present high tide levels.
- Not be located on the storm or beach berm, on reclaimed land over the shoreline, mangroves, saline or freshwater swamp areas, or on any other areas affected by coastal erosion or flooding from wave overwash.
- Not involve clearing of, or construction on, steep land or on land with a potential landslip risk (including access road).
- Not be located in areas prone to river or stream flooding or with current waterlogging or drainage issues.
- Have a buffer of at least 50 feet between land cleared for the property and any coastal, mangrove or river/stream waterway.

Table 7: Housing loan programmes available on Kosrae.

Programme	Purpose	Annual number of loans	Loan value	Loan duration
Housing loan programme	New residential property construction	30–50	Maximum of \$30,000	6–20 years
USDA 502	New residential or commercial property construction	Unknown	\$8,000–\$80,000 secured against property (state acts as trustee)	10–15 years
USDA 504	Residential property renovation	50–60	\$500 - \$7,500 not secured	Up to 20 years

4.3.2 Development of a relocation strategy

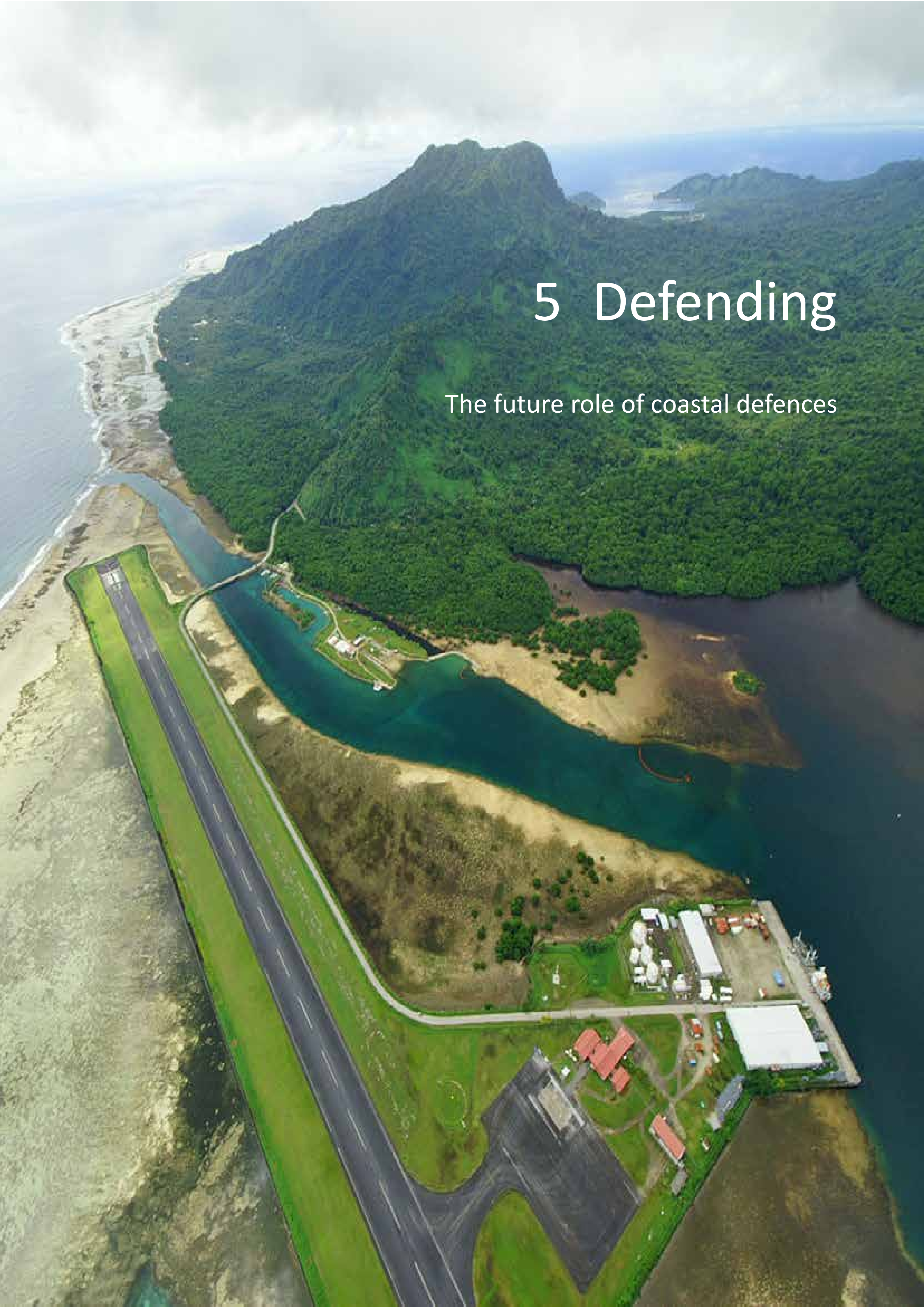
Strategy 7: Commence community and state discussions to develop a relocation strategy identifying potential approaches to support relocation from areas exposed to coastal hazards where no alternative land is available.

Whilst many families on Kosrae have access to alternative land areas on the higher volcanic parts of the island away from the coastline, there will be a significant number of families who do not own alternative safe land for relocation. It will be important to begin community discussions with a view to developing approaches on Kosrae to ensure there are community options for everyone. Whilst this may not be a significant issue over the next one to two generations such discussions maybe take several years to conclude and will be a complex and sensitive. Therefore starting such consultations now, rather than waiting until the situation forces decisions to be made, would provide certainty and security.

Examples of approaches could include land swaps with surplus Government land, opening up small areas of low gradient land above the Japanese line (e.g., between Innem and Okat), or development of a community relocation fund to support the purchase of land.

5 Defending

The future role of coastal defences



5.1 Introduction

On Kosrae, as in many other places, seawalls or other forms of constructed coastal defences are typically seen as the "solution" to coastal erosion and flooding problems.

Unfortunately such approaches:

- Are reactive usually in response to damaging coastal hazard events.
- Rarely the most effective or sustainable option in the long-term, particularly in areas prone to coastal flooding given the levels of sea-level rise likely to be experienced in the latter part of this century.
- Can lead to a false sense of security and often encourage further development behind coastal defences (Figure 20). No present seawall on Kosrae will prevent wave overwashing and resulting damage, from severe events such as occurred during the December 2008 swells on the Tafunsak coast or if a major typhoon was to track close to Kosrae.
- Often lead to other environmental damage (such as exacerbated erosion as occurred at Sandy Beach Hotel) and impacts on other community values (such as access to the reef flat).
- Typically result in an expectation that protection provided by such defences will continue to be maintained by the Government, leading to ever increasing financial commitment to maintain and upgrade such defences, and ever increasing difficulty in implementing more sustainable development options.
- On a retreating coastline such as south of Malem, the effectiveness of such defences is continually being reduced whilst the potential negative impacts caused by the defence often increases.

Where such structures become permanent features there will be longer-term impacts that will affect the ability of Kosrae's coastline to naturally respond to the long-term effects of sea-level rise. Such aspects are rarely considered but are important if Pacific Islands such as Kosrae are to successfully adapt to climate change effects.

For example the reclaimed areas of Lelu Island and Utwe village are two highly developed areas that will face particular challenges due to sea-level rise. The level of the reclaimed land in both villages is barely above present high (king) spring tide levels with some areas already experiencing frequent high tide flooding. Whilst both these areas are protected by seawall structures, these structures will not prevent the ever increasing frequency of flooding of the low-lying land behind them.

For revetment and seawall structures constructed on the open sections of coast, such as at Tafunsak and Malem villages, sea-level rise will significantly reduce the effectiveness of these defences, for example:

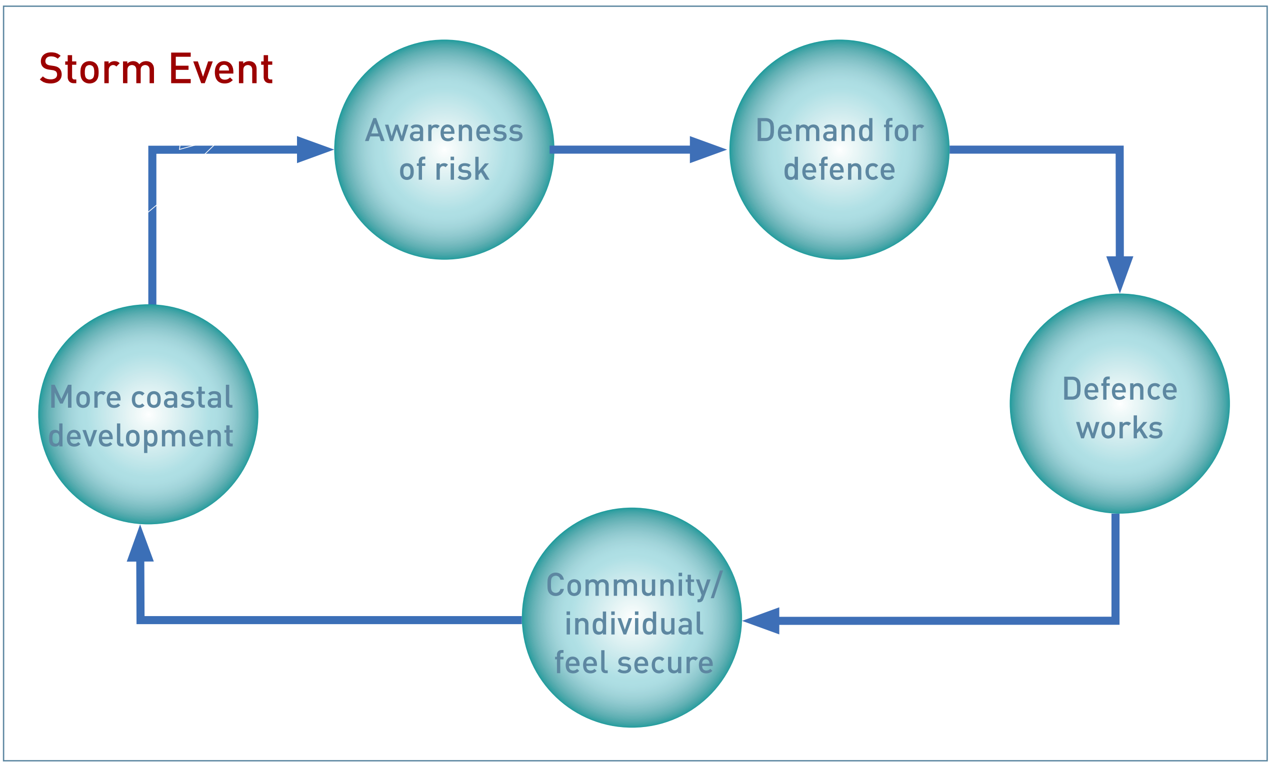


Figure 20: The develop-defend-develop cycle. Seawalls are often built in response to a storm event. This often then leads to a sense of security within the community that they are "protected" often leading to further development on land that is either too low lying or too close to the shoreline. When a further storm occurs, or the coastal defence breaks down and does not provide as much protection as anticipated there is a demand for bigger and better defences. This develop-defend-develop cycle that results typically causes the hazard problem to become more complex over time as the root cause of the problem is ignored, that is that people reside and infrastructure is developed on land that is at risk from coastal hazards.

- The frequency that these defences are overtopped by waves will increase due to greater water depths at the structure allowing larger waves to propagate over the reef flat and reach the structure.
- Greater water depths at the structure and increased exposure of the defence to larger waves will increase the risk of damage and failure of the defence. For example with rock structures, the size of rock required for stability is directly proportional to the cube of the significant wave height. Hence even a small increase in wave conditions at the defence can result in a large increase in the size of rock armour required to achieve the same present-day stability.

Over the next one to two generations, the effect of sea-level rise on the ability of existing defences to provide a "satisfactory" level of protection is likely to be manageable through, for example upgrading the level of protection of these existing defences. However, beyond this time the magnitude of sea-level rise is expected to be too great to enable such protection to be effective or affordable other than at locations where there are no other management or adaptation options.

As Kosrae has discovered, adequately constructed coastal defences have a high capital cost, typically have a high maintenance requirement, and have a limited lifespan at best probably around 20 to 30 years. As a long-term approach they are typically a very expensive option. A transition needs to occur where coastal defences are only used where there are no other cost effective options to reduce coastal hazard-related risk.

As part of this transition, both the State and Municipal Governments on Kosrae already face a considerable future financial commitment ensuring existing coastal defences are maintained and upgraded, to provide a satisfactory level of protection to enable longer-term adaptation strategies to be implemented and before any further new coastal defences are planned.

Strategy 8: A strategic approach is adopted for the ongoing provision of coastal defences only where it is a sustainable long-term option or where a transitional approach to protecting areas over the short to medium term to enable repositioning strategies to be implemented.

Such a strategy requires:

- Long-term defences: a priority on protecting sections of road or other critical infrastructure where there is no other feasible option to reposition away from coastal hazards.
- Transitional defences:
  - Upgrading sections of existing defences to provide adequate temporary protection for the road or highly developed areas over the short to medium term (1 to 2 generations) to enable longer-term adaptation strategies (namely relocation) to be implemented.
  - Limiting any new sections of coastal defences only to the areas where the road is critically threatened at present (e.g., at Pal and Mosral). This would be undertaken only with a view to provide short to medium term (1 to 2 generations) protection to enable longer-term adaptation strategies to be implemented.

The locations where long-term and transitional protection will be required are shown in Figure 21. Most areas marked as "transitional defences" already have coastal defences in place. Maintaining, and in some cases, upgrading these existing defences will be required to enable the longer term strategies outlined in Sections 4.2 and 4.3 to be implemented.

5.1.1 Long-term protection requirements

There are several locations where there are limited or no other adaptation options available. At this time most of these sections of shoreline already have coastal defences in place however upgraded engineering will be required over the long-term (beyond 2 generations/the 2050's) to protect infrastructure. Future requirements for these defences are summarised in Table 8 and Figure 22.

In the majority of cases this will require maintaining the existing defences when damage occurs, upgrading rock armour layers where they are currently inadequate (for example Lelu Causeway), and improving on the wave overtopping performance as sea-level rise results in higher volumes and more frequent wave overtopping of existing defences. In the short to medium term (1 to 2 generations) this may require additional crest protection, such as mass concrete upstands/wave return walls at the landward edge of the rock revetment crest.

In the longer term, given the rates of sea-level rise likely to be experienced over the second half of this century, rock revetments may need to be replaced with larger structures, higher crest levels and potentially infrastructure raised behind the protection.

Only at Wiya is there likely a need for new long-term protection. Around the headland between Wiya and Malsu there is no scope to reposition the road further inland. Whilst between Wiya and Yekula, the road could be moved back slightly, however future protection would likely still be required.

A current (2013) proposal for Japanese assistance to upgrade a number of coastal defences covers a number of the sections included in Table 8 including:

- Upgrading the armour protection along the harbour side of Lelu Causeway.
- Headland between Malsu and Wiya and along the Wiya shoreline.

Defending

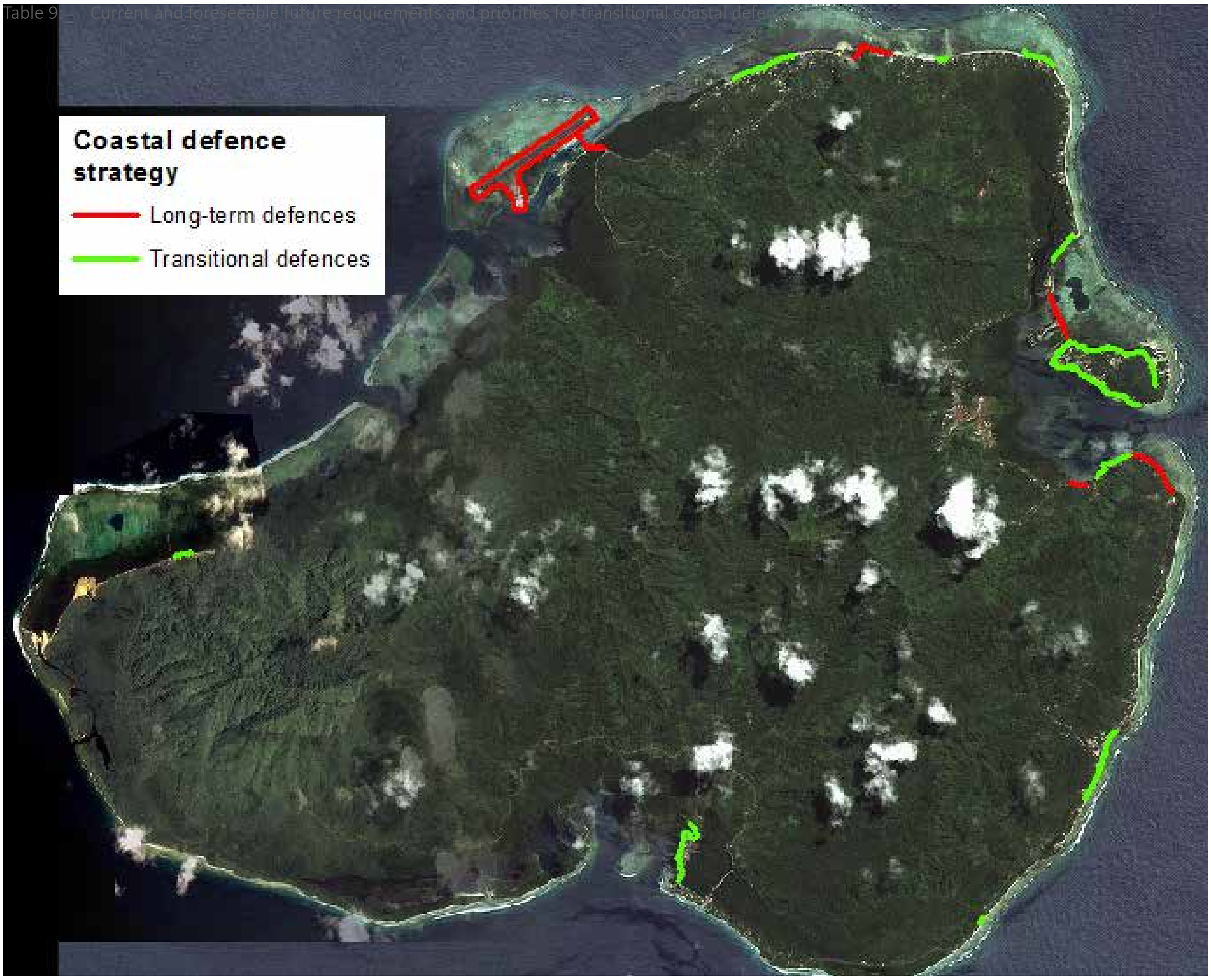


Figure 21: Location of where long term and transitional coastal defences will be required.

Table 8: Current and forseeable future requirements and priorities for sections of coast requiring long term coastal defences.

Location	Approx. length of protection	Current Priority	Details
Okat Airport/Port	3000 m 3300 yards	Low	Continued maintenance and upgrading of the rock armour protection around the airport runway. In the future this may require further crest protection along the ocean-facing exposed sections to reduce any increased frequency of wave overtopping. Maintenance requirements to rock armour along the ocean-facing side may increase as sea-level rise allows larger waves to reach the defence. Continued maintenance of concrete wharf and walls at the port.

Okat access road	620 m 680 yds	Low	Continued maintenance and future upgrading if required to the rock protection along the landward access to the bridge to the airport and dock.
Headland between Malsu and Wiya	290 m 320 yds	Medium	Upgrade of existing rock protection to the road and FSM Telecom tower from Malsu around the corner to Wiya. The revetment armour layer should be at least two rocks thick and at a slope no greater than 1 : 1. Given the minimal width of road shoulder or revetment crest, a concrete upstand may be required at the crest between the road edge and the rock armour.
Wiya	290 m 320 yds	Low	New rock revetment to protect the road between Wiya and Yekula. The revetment armour layer should be two rocks thick, at a preferred slope of 1 : 3, with a crest width of three rocks wide at the shoulder of the road.
Lelu Causeway (seaward)	650 m 715 yds	Medium	Upgrade armour protection of the causeway with single layer of rock armour at a 1 : 1 slope. A secondary layer may be required in the future as well as further crest protection such as a concrete upstand.
Lelu Causeway (Harbour-Lelu Island to Marine Resources)	245 m 270 yds	Medium	Upgrade armour protection of the causeway with single layer of rock armour at a 1 : 1 slope.
Lelu Causeway (Harbour-Marine Resources to Finpukal)	310 m 340 yds	Medium	Upgrade armour protection of the causeway with single layer of rock armour at a 1 : 1 slope.
Tafuyat	225 yds 245 yds	Medium	Upgrade existing rock protection if high tide wave overtopping becomes too frequent with concrete wave upstand between revetment crest and road.
Leyot to Mutunlik	800 m 875 yds	Medium	Upgrade existing rock protection with a second armour layer. If high tide wave overtopping becomes too frequent install concrete wave upstand between revetment crest and road.

5.1.2 Transitional protection requirements

Future requirements for defences required over the short to medium term (1 to 2 generations) to enable longer-term adaptation strategies to be implemented are summarised in Table 9 and Figure 22. Again many of these defences are already in place and the financial commitment to maintain and in many cases upgrade them to provide an adequate level of protection over the next one to two generations will be considerable. In the longer-term, over the second half of this century, the rate of sea-level rise will mean that these coastal defences either:

- Become increasingly in-effective: particularly where the impacts are due to increasingly more frequent high tide flooding (such as the reclaimed areas upon which Lelu and Utwe villages are located).
- Become too expensive to maintain, upgrade or replace to continue to provide a suitable standard of protection.

The highest priority for transitional defences remains the upgrade of the defences at Malem village, extension of protection to the south along the critically exposed section of road at Pal and at Mosral. These section should be the priority focus for any further coastal defence work in the immediate future.

Defending

Table 9: Current and foreseeable future requirements and priorities for transitional coastal defences.

Location	Approx. length of protection	Current Priority	Details
Tafunsak village	880 m 970 yds	Medium	Maintain existing rock armour defence. Potential upgrades include: • Reconfiguring western end of defence to alleviate downdrift erosion impacts. For example, short breakwater with beach nourishment behind (similar to Sandy Beach). • Extending the revetment across the outlet of Infal Mutunte (now relocated to Malsu) to prevent high tide and swell inundation through the opening in the defence. • Constructing a concrete wave upstand at the landward edge of the revetment crest to improve the performance in reducing wave overtopping during large swell events.
Finfukul	160 m 175 yds	Medium	Maintain existing rock armour defence. Constructing a concrete wave upstand at the landward edge of the revetment crest to protect edge of the road and improve the performance in reducing wave overtopping.
Finaunpes	525 m 575 yds	Low	Maintain current rock revetment and breakwater.
Pacific Treelodge/ Putuk	425 m 465 yds	Medium	Replacement when required of the concrete mattress revetment with a sloping rock revetment to the same slope as the existing revetment. Replace vertical concrete wall with sloping rock revetment. The revetment should be founded on the reef flat and located at the crest of the beach. The beach should be reinstated on the seaward side of the structure. Any mangroves should be retained.
North Lelu Island	1560 m 1710 yds	Medium	Upgrading of sections of largely coral rock wall protection as required with a sloping rock revetment at a 1 : 1 slope and crest above the level of the road (as is currently in place along various sections). The emphasis should be on maintaining the current line of land with no further reclamation occurring. Any mangroves fronting the defences should be retained.
South Lelu Island	2210 m 2420 yds	Medium	Upgrading of sections of largely coral rock wall protection as required with a sloping rock revetment at a 1 : 1 slope and crest above the level of the road (as is currently in place along various sections). The emphasis should be on maintaining the current line of land with no further reclamation occurring.
Muntunlik	615 m 675 yds	Low	Upgrading of sections of largely coral rock wall protection as required with a sloping rock revetment at a 1 : 1 slope and crest above the land level. The emphasis should be on maintaining the current line of land with no further reclamation occurring.
Malem village (North)	340 m 370 yds	Low	Reconstruct existing poorly constructed rock revetment to provide a consistent revetment profile with a 1 : 3 slope, average rock size of 0.66 m (2 feet), double layer or armour and crest of three rocks wide. Future upgrade to include mass concrete wave upstand wall at landward edge of revetment crest if wave overtopping frequency increases with sea-level rise.

Location	Approx. length of protection	Current Priority	Details
Mali village (Kotfwa)	500 m 550 yds	High	Northern section: Upgrade existing single layer rock armour revetment to two layers, maintaining the 1 : 3 slope, average rock size of 0.66 m (2 feet),with a revetment crest of 3 rocks wide. Southern section: Reconstruct existing poorly constructed rock revetment to provide a consistent revetment profile with a 1 : 3 slope, double layer or armour and crest of three rocks wide. Future upgrade to include mass concrete wave upstand wall at landward edge of revetment crest if wave overtopping frequency increases with sea-level rise.
Pal	160 m 175 yds	High	New rock revetment from the southern end of the exiting rock armour along the section where the road is critically exposed. Existing dumped concrete rubble will need to be removed. The revetment should be to the same profile as the upgraded sections to the north with a 1 : 3 slope, double layer of rock armour, average rock size of 0.66 m (2 feet), and a crest 3 rocks wide. Given the proximity of the road a mass concrete wave upstand wall at the landward edge of revetment crest may also be required to ensure wave overtopping is minimised, either now or sometime in the future. The new revetment will need to extend behind the existing shoreline at the southern end to prevent outflanking and further downdrift erosion. However, further retreat of the shoreline will occur at the southern end and some form of additional low reef flat breakwater may also be required to 'stabilise' the shoreline at the southern end of the revetment to prevent further exposure of the road.
Mosral	110 m 120 yds	High	New rock revetment from the outlet of Infal Mosral tideflex structure along the section where the road is critically exposed. The existing mass concrete bags can be retained with the revetment constructed seaward of them. The revetment should be at a 1 : 2 to 1 : 3 slope, double layer of rock armour, average rock size of 0.66 m (2 feet), and a crest 3 rocks wide. Given the relatively low-level of the road a mass concrete wave upstand wall at the landward edge of revetment crest may also be required to ensure wave overtopping is minimised, either now or sometime in the future. Outflanking and further downdrift erosion will occur at the southern end of the revetment and some form of additional low reef flat breakwater may also be required to 'stabilise' the shoreline at the southern end of the revetment to prevent further exposure of the road.
Utwe village	1015 m 1110 yds	Medium	Upgrading of sections of largely coral rock wall protection as required with a sloping rock revetment at a 1 : 1 slope and crest above the land level. The emphasis should be on maintaining the current line of land with no further reclamation occurring.
Walung (Insiaf)	230 m 250 yds	Medium	Maintain existing rock armour revetment.

6 Monitoring adaptation progress

The measures outlined above are intended to provide a strategic approach to long-term reduction of coastal hazard risks to infrastructure and communities on Kosrae. They will also provide a means to effectively adapt to the physical changes that climate change and sea-level rise will cause to Kosrae's present coastal margins.

Such risks (e.g., from exposure to the impacts of inundation or erosion, or the consequences of a damaging event) to the communities in Kosrae will change with time. Some activities or decisions will increase such risks, other activities will reduce them. An important aspect to help inform decision-making is to monitor and assess how such risks are changing over time and whether the relevant decisions that have previously been made have been effective in helping reduce coastal hazard related risks.

Outlined below is an initial attempt at developing a set of quantifiable measures, based on the strategies outlined above, that could be used to assess how the risks associated with coastal hazards change over time and how well Kosrae is progressing in addressing these changing risks. It is by no means a complete list and may well require further refinement in the future. By carrying out an assessment of the relevant factors that will increase or decrease risk on say an annual basis, the progress that Kosrae makes in reducing their risks to coastal hazards can be monitored.

1. Number of community awareness and outreach activities implemented with a focus on reducing and minimising human impacts on the natural coastal defences over the last 2 years.
2. Number of sand mining incidents reported/investigated by KIRMA over the last 2 years.
3. KIRMA regulations updated to better incorporate risk reduction and adaptation considerations in to the development review progress.
4. Total number of developments (farm roads, properties) above the Japanese Line.
5. Total length of new inland primary road constructed.
6. Total number of residential properties located seaward of the circumferential road in Lelu, Malem, Utwe and Tafunsak.
7. Total number of residential properties located on the beach berm in Walung.
8. Total number of properties located below or seaward of the 4 m contour.
9. Long-term relocation strategies developed for at-risk communities.
10. Total number (and length) of long-term coastal defence recommendations implemented.
11. Total number (and length) of transitional coastal defence recommendations implemented.
12. Total number (and length) of seawall structures built without KIRMA permit or not aligned with requirements identified in this strategy.

Table 10 provides a summary of the situation as of late 2013.

Monitoring adaptation progress

Table 10: Summary of indicators as of late 2013 and goal over the next two generations.

No.	Indicator	Required progress direction	2013	By 2050
1	Number of community awareness and outreach activities implemented with a focus on reducing and minimising human impacts on the natural coastal defences over the last 2 years.	↑	?	?
2	Number of sand mining incidents reported/investigated by KIRMA over the last 2 years.	↓	?	0
3	KIRMA regulations updated to better incorporate risk reduction and adaptation considerations in to the development review progress.	–	No	Yes
4	Total number of developments (farm roads, properties) above the Japanese Line.	↓	?	0
5	Total length of new inland primary road constructed.	↑	0	–
6	Total number of residential (2010 census) properties located on the beach/storm berm/ reclaimed land and seaward of the circumferential road: • Lelu • Malem • Utwe • Tafunsak	↓	75 48 43 20	0
7	Total number of residential (2010 census) properties located on the beach berm in Walung.	↓	29	0
8	Total number of properties (2010 census) located below or seaward of the 4 m contour: • Lelu • Malem • Utwe • Tafunsak • Walung	↓	334 222 145 87 32	0 0 0 0 0
9	Long-term relocation strategies developed for at-risk communities.	–	No	Yes
10	Total number (and length) of long-term coastal defence recommendations implemented.	↑	0	9
11	Total number (and length) of transitional coastal defence recommendations implemented.	↑	0	13
12	Total number (and length) of seawall structures built without KIRMA permit/not aligned with requirements identified in this strategy in last 2 years.	↓	–	0

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Appendix A

Summary of progress on the recommendations made in the Shoreline Management Plan in 2000

Recommendation	Progress	Comments
The natural environment **Coral reef and reef flat:**		
Every effort needs to be directed at continuing to protect the health of Kosrae's living coral reef from land based human impacts.	✓	An ongoing issue.
The present practice of not removing coral rubble, shingle and sand from the reef flat be continued and that it be regulated if such activity re-commences.	✓	Rubble and sediment from the reef flat has not been removed.
A full Environmental Impact Assessment is carried out by qualified personnel before any further reef flat dredging is permitted. However, it is strongly recommended that no further dredging of any part of the fringing reef flat be conducted.	✓	No further dredging (other than at the ship repair facility) has taken place.
Stricter regulation, enforcement, training and education aimed at managing and reducing both residential and industrial sources of pollution will be vital for the long-term health of Kosrae's living reef biota.	✓	No significant suggestion that pollution from land-based sources is.
Beaches and the shoreline:		
A long-term source of construction sand needs to be developed to meet Kosrae's future development needs. Existing sand resources in the coastal hinterland are extremely limited and increasingly will not meet Kosrae's construction demands.	✗	Still a pressing issue.
Sand mining from the beaches of Kosrae needs to be regulated. However, experience from other small island developing states suggests that this is likely to only be effective once a suitable long-term alternative to beach sand is available.	=	Sand mining from beaches has reduced considerably due to KIRMA awareness effort but still practiced and is still an issue.
Vegetation clearing be discouraged for at least 50 m behind the vegetation line at the shoreline. Where possible the planting of typical coastal strand vegetation should be encouraged.	✗	Still a pressing issue.
Construction of new coastal defences and land reclamation over the beach be strictly controlled and regulated through the Development Review Process. This is particularly important on the exposed sections of coastline (i.e., those facing the open ocean).	✗	Inappropriate reclamation and coastal defences still being constructed.
Mangroves		
Mangrove replanting, to provide natural coastal protection to the coastline, is a suitable mechanism in the following areas: • Lelu lagoon:- potentially from Mitais, all along the northern coastline of Lelu Island, the Causeway and Finpukal. • Lelu Harbour:- Mutunnenea area (south of the bridge). • Tafuyat:- mainly the area where mangroves died off due to the oil spill that occurred sometime in the 1980's.	✗	Some mangrove planting attempted in Lelu lagoon but have not established.
The area of mangrove replanting should be at least 50 meters wide. This is approximately the width, in a mature mangrove strand, that would effectively dissipate a 1 m high wave.	✗	-
Should a severe storm or typhoon affect the mangrove strands on Kosrae, it is recommended that human activity, such as the removal of felled trees, be discouraged from the damaged areas and immediate surroundings to allow the damaged area to recover naturally.	✓	No typhoons or serious storms have affected Kosrae.
From a coastal protection viewpoint, that harvesting of mangrove timber is discouraged from within 100 m of the outer mangrove fringe and from within 50 m of major channels.	✓	No significant suggestion that detrimental Mangrove harvesting is occurring .

Appendix A

Recommendation	Progress	Comments
Wetland areas and rivers		
Where it is deemed necessary to develop swamp areas for activities such as agriculture, it is recommended that buffer zones of at least 100m be established around rivers and major drainage channels and along the coastal edge of the swamp.	✘	Buffer zones rarely applied.
Further farm roads through wetland swamp areas, particularly between Tenwak and Kuplu, be discouraged	✓	No further roads appear to be constructed
Future culverts and bridges over natural drainage channels and rivers are of sufficient size to have as little influence as possible on the passage of flood flows due to high rainfall events.	✓	New guidance being developed and implemented as part of PACC project
Development or alteration of artificial river or drainage channels outlets is not recommended and should be controlled within the Development Review Permitting Process	=	No further significant river or drainage channel works conducted.
The built environment **Infrastructure:**		
Building further sea walls or other forms of coastal defences is not a recommended, appropriate or affordable option for the long-term protection of most of the existing infrastructure at risk from coastal hazards.	✘	Continued.
With the current re-negotiation of the Compact Funding, it is recommended that now is an ideal opportunity for the Government of Kosrae to consider a program of developing Kosrae's essential infrastructure inland away from such high risk areas. Within the next 10 to 15 years an inland road will be required between Utwe and Tenwak, and between Mutunnenea and Yekula or Wiya. Over this time, it is recommended that this road be developed as the main road linking the Municipalities	✘	No progress on developing inland roads. General conditions of existing inland farm roads have deteriorated.
It is recommended that the existing practice of constructing the inland road around the perimeter of the lower slopes of the volcanic part of the island, above the freshwater swamp areas be continued, taking due care to minimize road slopes, run-off, and ensuring adequate culverts are installed to minimize changes to drainage patterns and to cope with periods of heavy rainfall.	✓	Being applied in the extension of the road from Utwe to Walung and the extension of the road from Okat as part of the PACC project.
In developing the new sections of inland road, priority be given to: • Extend the inland road between Malem village (Mutacsrisr) and Mosral. • Developing the road behind Sialat and Finfukul to Yekula or Wiya.	✘	No progress.
Further development of the circumferential road beyond Okat bridge, towards Walung, be constructed around the perimeter of the lower slopes of the volcanic part of the island above freshwater swamp areas, taking due care to minimize road slopes, run-off, and ensuring adequate culverts are installed to minimize changes to drainage patterns and to cope with periods of heavy rainfall.	✓	Being incorporated as part of the PACC project.
Upgrading and construction of coastal defences is recommended to protect the existing road at certain key areas where there is little opportunity to develop further inland.	✓	Sea walls have been upgraded or constructed at Finfukal, Tafuyat, Leyot/ Mutunlik and Malem.
Residential property		
Over the next ten to fifteen years, reducing the number of residential properties constructed or located within coastal hazard areas is of the highest priority.	✘	No strategic progress made.

Recommendation	Progress	Comments
The Government assist individuals in developing residential property out-with coastal hazard risk areas by gradually developing the existing essential infrastructure (roads, electricity, telecommunications) along an inland route.	✗	No progress made.
Where new development and property construction does occur close to the coastline, a general set-back zone of at least 100 feet from the vegetation line at the coastline be adopted.	✗	Not applied.
The construction of sea walls or other forms of coastal defence to protect individual property is not permitted where there is no existing coastal protection structures. Future construction of sea walls or other forms of low cost coastal defences is not a recommended option for the protection of residential property outwith certain locations.	✗	Ad hoc seawall structures still being built.
Land owners / housebuilders are advised that no hard structures will be permitted in front of newly built properties that have been located seaward of the circumferential road.	✗	Not occurring to any great extent.
The DRC continue to work with the Housing Renovation Loan Fund Office (Department of Commerce and Industry) and the Rural Development Office (USDA) to minimize the development of loan-funded housing within coastal hazard areas.	✓	Ongoing as part of the housing loan application process.
If it is felt that regulation of residential development is required in coastal hazard areas, above the measures that have been incorporated within the Housing Renovation Loan Fund and Rural Development processes, it is recommended that changes be made to the Development Review Process to include all residential housing.	=	Strengthening the Development Review regulations is currently being conducted.
Private Sector		
Future tourism, and other major commercial development is controlled within the Development Review Process. It is recommended that the use of Environmental Impact Assessments be continued as a pre-requisite for all major development projects.	✓	Generally being applied.
Through the Development Review Process, it is recommended that no commercial development be permitted in high risk coastal hazard areas (and certainly not within 100 feet of the coastline or on land that could potentially flood).	✗	A number of Laundromats have been permitted on reclaimed areas over the shoreline
The risk to develop land with any coastal hazard risk for commercial purposes, must be borne by the Developer. It is recommended that, at the project review stage, it is made clear to the Developer that the construction of coastal defences will not be permitted during the lifetime of the development to protect the development from storm damage or flooding where no coastal defences currently exist.	✓	Generally being applied.
It is recommended that the Development Review Process ensures that appropriate technology be utilized to ensure that effluent discharge to the fresh water or marine environment from any proposed commercial development has minimal detrimental or cumulative impact.	✓	Generally being applied.
Coastal defences		
The construction of engineered sea walls or other forms of coastal defence, such as breakwaters (wave breakers) are not an appropriate coastal management, or cost effective solution, for reducing the risks posed by coastal erosion, flooding and storms around much of the coastline of Kosrae.	✗	Ad hoc seawall structures still being built and viewed as the preferred solution.
Construction or upgrading of coastal defences in locations where such an approach is the most effective long-term strategy for the protection of infrastructure or property.	=	Some upgrading of defences has occurred (e.g., at Leyot).

Appendix B

An overview of coastal change on Kosrae

Types of coastline

Kosrae has a varied coastline the current characteristics of which depends on the width of the reef flat and the relative exposure to tradewind waves and occasional, severe, storm or typhoon waves (Figure B 1). These characteristics have also defined how development has occurred, how vulnerable parts of the coastline are to inundation events, and how the shoreline has changed and will continue to change in the future.

Beach berm

This is a dominantly sandy coast found along the north facing Tafunsak and Walung coastlines that are moderately exposed to tradewind-related waves, and along the northern part of Lelu Lagoon (between Putuke to Finpukal).

It is characterised by a wide reef flat with seagrass beds, narrow wave built sand berm upon which the coastal road and most development has occurred, with low lying infill swamp or farmland behind the berm to the volcanic part of the island. At Walung, and between Putuke and Finpukal, mangrove occurs between the narrow beach berm and the volcanic uplands (Figure B 2).

The beach sediments along the Tafunsak and Walung coasts are dominated by reef-flat derived foraminiferal tests and other reef and reef flat derived biogenic fragments (corals, algae, gastropods and bivalves). Beach sediment generated upon the reef flat continues to be an important source of sediment to these beach systems.

Along the north coast the beach berm has developed from the supply of dominantly reef-flat derived sediments, a trade-wind wave induced net longshore transport of beach sediment to the west, and the shape of the outer fringing reef, which

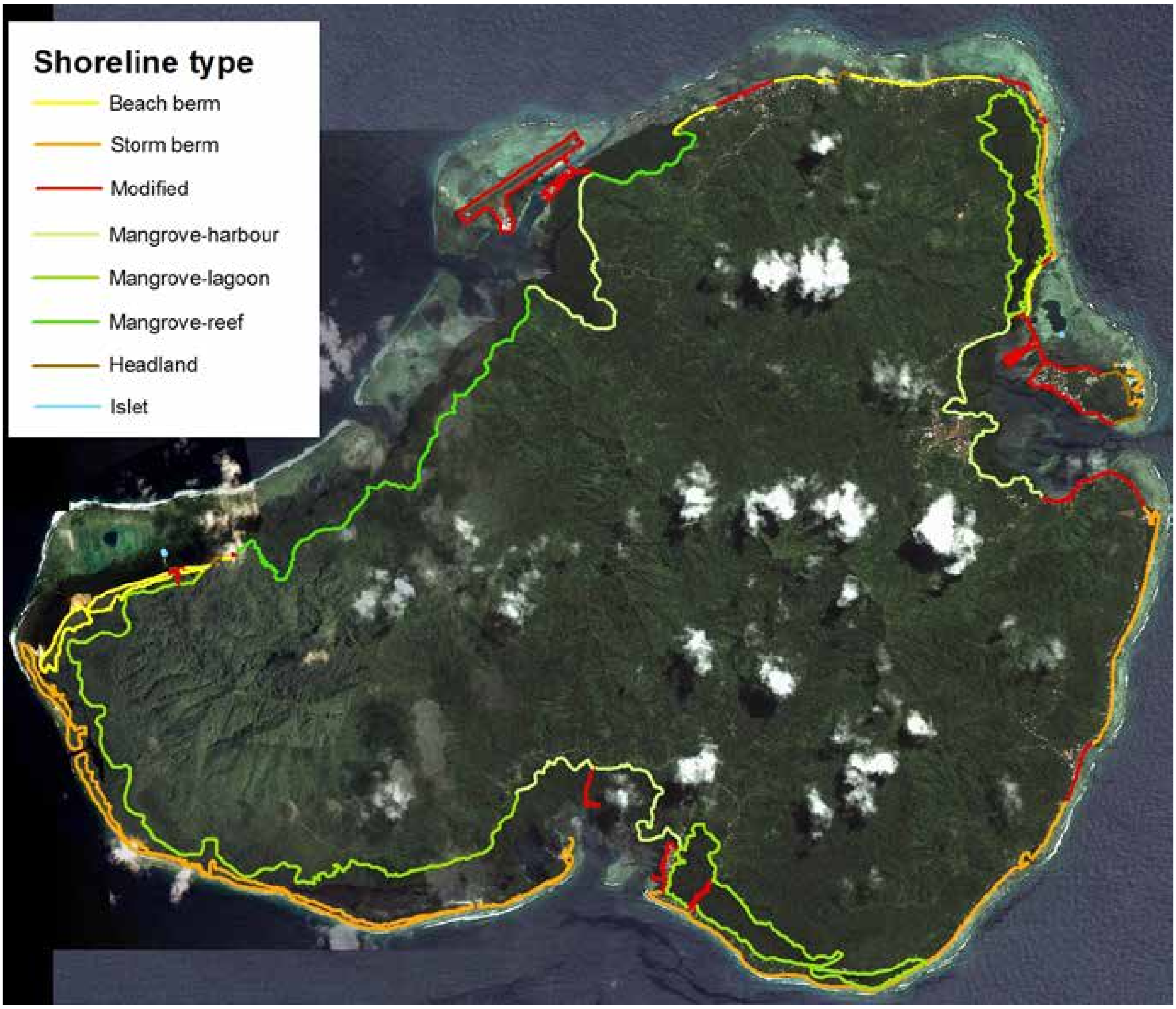


Figure B 1: Basic shoreline types on Kosrae.

Appendix B

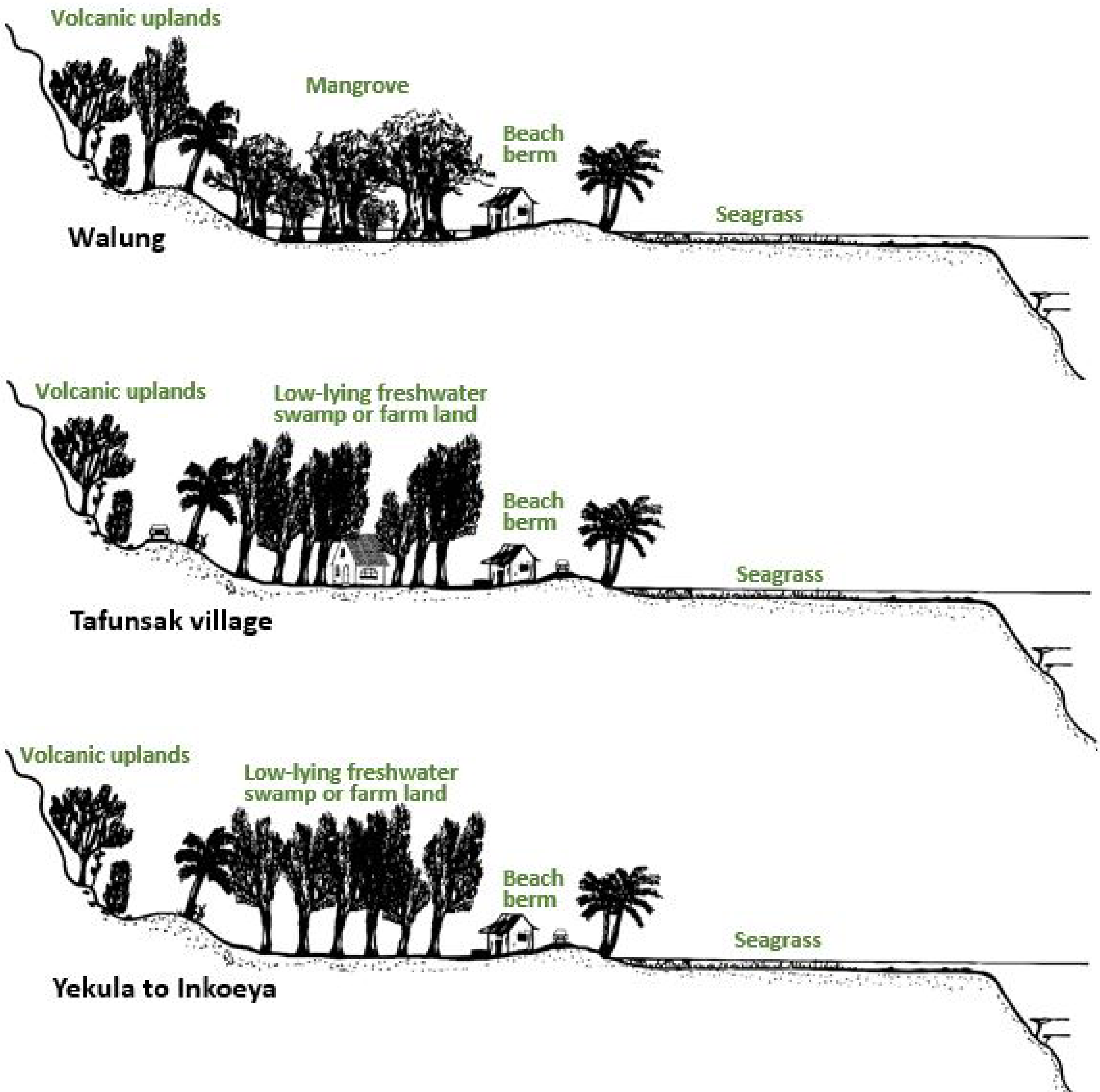


Figure B 2: Typical cross-sections for the coastline at Walung (top), Tafunsak village (middle) and between Yekula and Inkoeya (bottom).

Figure B 3: Key sediment sources, longshore transport processes, and sediment losses along the Tafunsak shoreline.

influences the way waves propagate to the shoreline over the reef (Figure B 3 to Figure B 5).The elevation of the beach berm is also strongly related to wave exposure and tends to be higher along the Tafunsak coastline and relatively lower at Walung and the northern part of Lelu Lagoon.

Key coastal process features along the Tafunsak coastline include:

- Primary sediment sources are from the sediments generated over the wide reef flat areas along this north-facing coast and transported by waves onshore. Sediment is also generated and trapped within the extensive seagrass beds occurring along the inner to mid-part of the reef flat. This raises the level over the reef flat and helps stabilise the shoreline from wave-induced change.
- Another important source of sediment to this coastline is from longshore transport from the Finaunpes region as the large salient that built up at Finaunpes due to protection provided by past banks of coral rubble on the outer reef flat has retreated landward (see coastal change figures later in this Appendix). This has resulted in a general build-up of land from Inkoyea to Sialat over at least the last fifty years.
- At Finfukal the shape of the outer reef and shallow channel influence the way waves approach this part of the shoreline causing beach sediment to be moved away from the beach at Finfukal (drift divide). This has resulted in ongoing retreat of this short section of coast requiring a rock armour revetment to protect the road.
- At Wiya and Finfokoa the position of the coastline has moved little when comparing the position of the coast between 1944 and the present (see section below). Occasional cut down of the beach does occur during large wave events, particularly at Finfokoa with the issue along both these areas being the proximity of the coastal road right on top of the beach crest, rather than any retreat of the shoreline.
- The dredge pits at Tafunsak have been, and may well continue to be a sink of both beach and reef flat sediments.
- The net westerly longshore transport of beach sediment means that downdrift erosion problems (such as occurred at Sandy Beach and to a lesser extent at the western end of the Tafunsak seawall) are likely where poorly considered seawalls or reclamation is conducted.

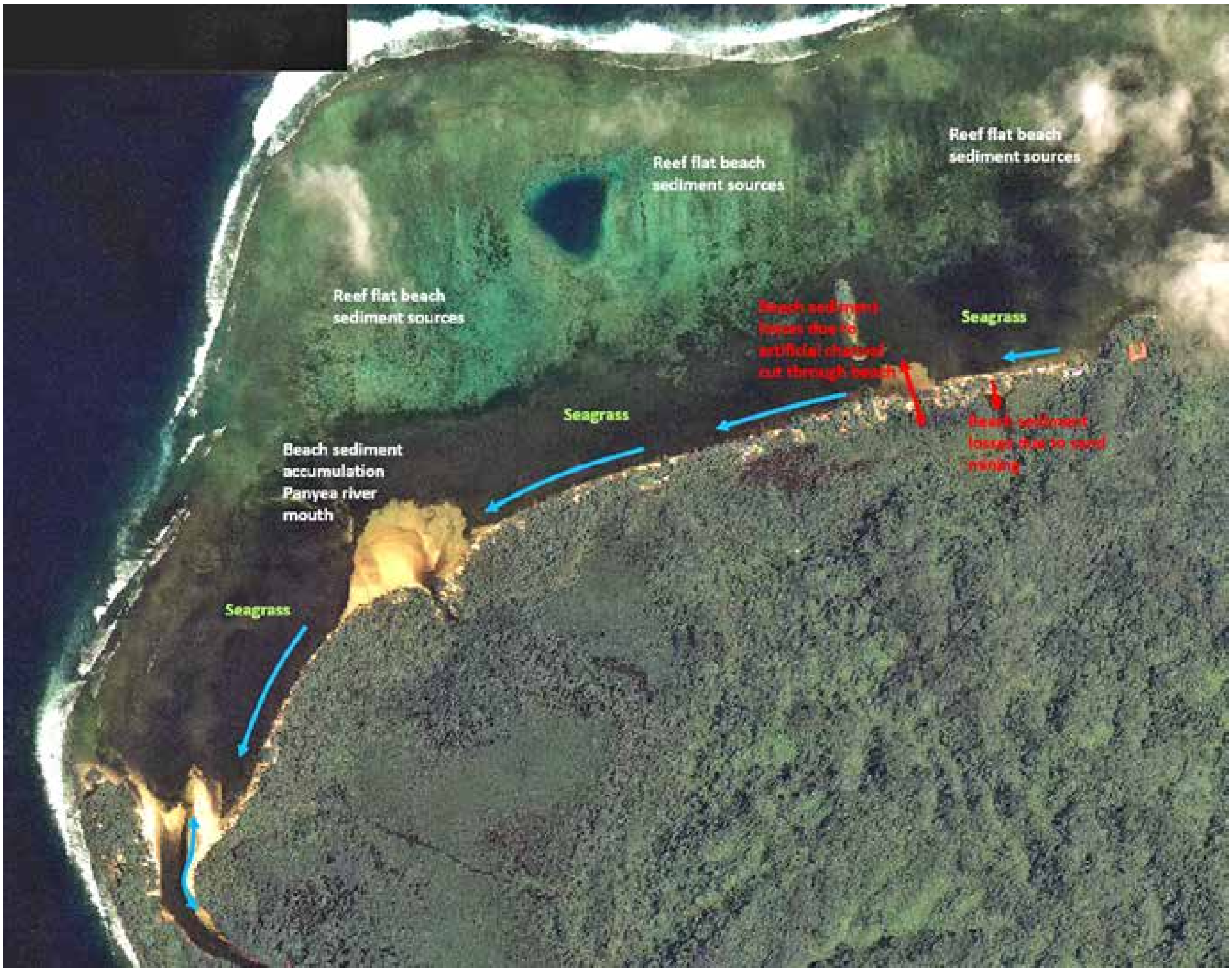


Figure B 4: Key sediment sources, longshore transport processes, and sediment losses along the Walung shoreline.

Appendix B

Key coastal process features along the Walung coastline include:

- Again the reef flat will have been the primary sediment sources for sediments forming the beach berm between Insiaf and Koasr, and for the beach at Mwot which is separated by a rock headland. However, due to the relatively much more sheltered wave environment, present day sediment movements from the reef flat to the shoreline are likely to be relatively modest.
- Between Insiaf and Leap, this lack of sediment entering the beach system is one of the causes for the erosion occurring along this section. However, this has been significantly exacerbated by two activities: 1) the cutting of the drainage channel at Leap in the 1970s, and 2) the removal of sediment from the beach for building construction.
- Between Leap and the entrance to the channel between Koasr and Saoksa the position of the shoreline between 1944 and the present day has been relatively stable (see Section below), with some slight changes at the mouth of Infal Panyea and on the eastern flank of the Utwe-Walung channel entrance both associated with the general westerly longshore transport of beach sediment.
- The net westerly longshore transport of beach sediment means that downdrift erosion problems are likely where poorly considered seawalls or reclamation is conducted. This occurred at Leap after the opening of the channel

Figure B 5: Key sediment sources, longshore transport processes, and sediment losses along the Putukte to Finpukal shoreline.

and construction of the seawall in the 1970s (Xue, 1996) and would have occurred with the construction of the new seawall associated with the road extension at Insiaf. However the western end of the seawall was terminated at a large Ituc tree (Calophyllum inophyllum) the roots of which have extended over the beach over many years acting as a groyne which has held the position of the shoreline to the east but resulted in downdrift erosion to the west of the tree.

Key coastal process features along the Putukte to Finpukal coastline include:

- Historically, the majority of sediment that has formed the beach berm between Putukte and the Mutunnenea channel will be have been transported southwards along the Pukusruk shoreline into the northern part of Lelu lagoon. However, present day transport of beach sediment from the Pukusruk shoreline is now extremely low.
- The effect of mangroves in trapping sediment and building up the beach can be seen along the central section of the shoreline.
- Changes in position of the shoreline between 1944 and the present day has shown relatively little movement (see Section below). At Putukte the cut back of the beach, resulting in the concrete mattress protection in from to the Treelodge Hotel is typically where there is a net south-westerly net movement of sediment towards Finpukal but with little new sediment being transported around the corner from the Pukusruk shoreline.

Storm berm

Much of the east and south coastline on Kosrae has been built by storm and typhoon events over many years. The east coast is characterised by relatively narrow fringing reef, a narrow storm berm upon which the coastal road and most development has occurred, with areas of low lying infill swamp, farmland or lagoon mangrove, behind the berm to the volcanic part of the island (Figure B 6 and Figure B 7).

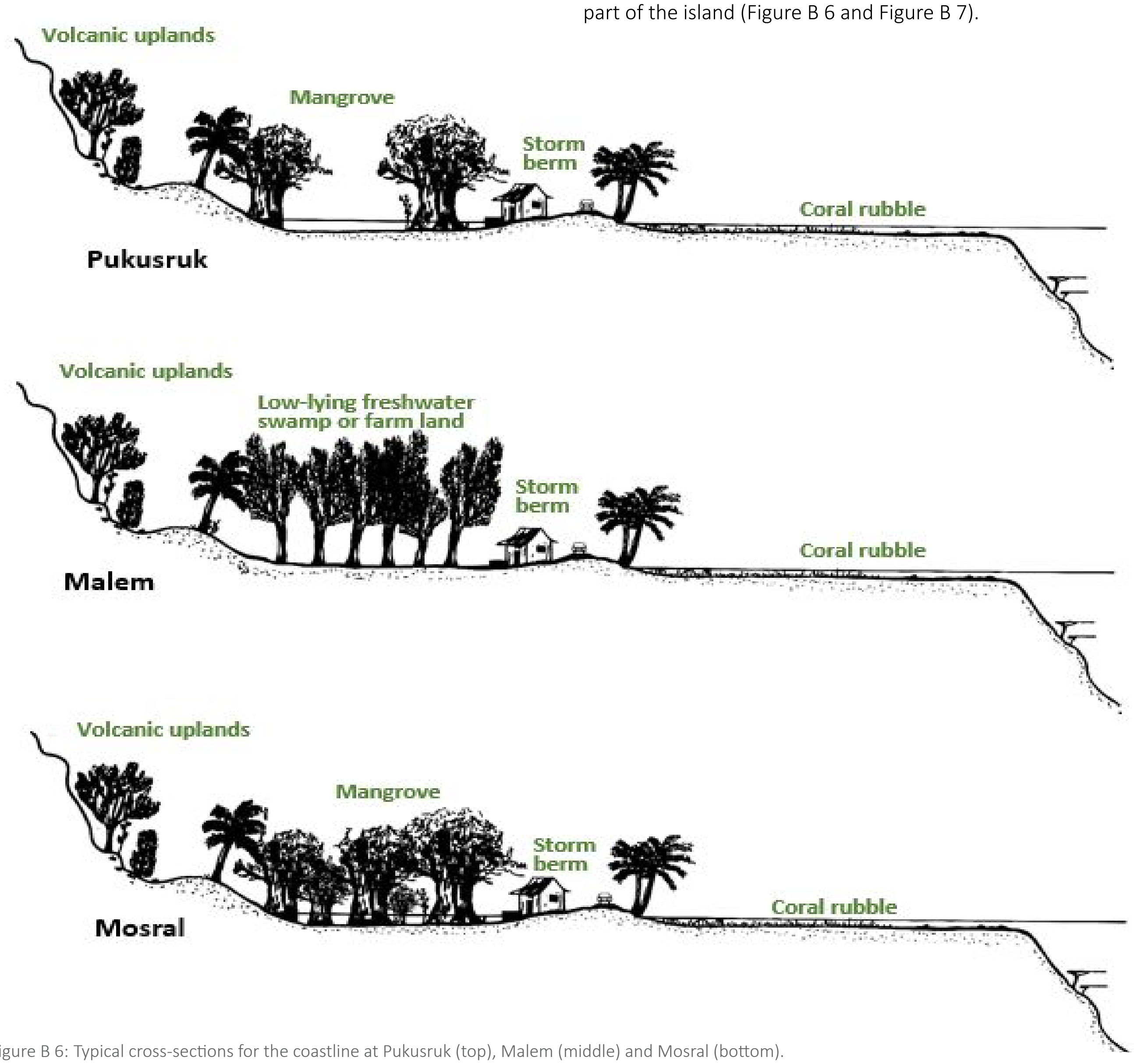


Figure B 6: Typical cross-sections for the coastline at Pukusruk (top), Malem (middle) and Mosral (bottom).

Appendix B

The storm berm probably began to form some 2500 to 3000 years before present when the post-glacial rate of sea level rise slowed and relative sea level reached its present level (there is little evidence of sea-level high stand and subsequent fall in sea level at this time on Kosrae). Along the eastern facing Lelu and Malem exposed coastline, this storm berm will have formed due to many storm/typhoon events depositing coral rubble and sediment on the reef flat. Over time wave action moves this coral rubble and sediment landwards which “feeds” and builds up the storm berm (Figure B 8). The height of the storm berm is also closely related to the incident wave conditions experienced along the shoreline.

On the leeward south coast from Kuplu all the way to Saoksa in Walung the storm berm will have formed from much more infrequent but severe typhoon events which results in larger blocks of coral being deposited (as can be seen along the coastline at Kuplu). At Kuplu, there are a number of historic

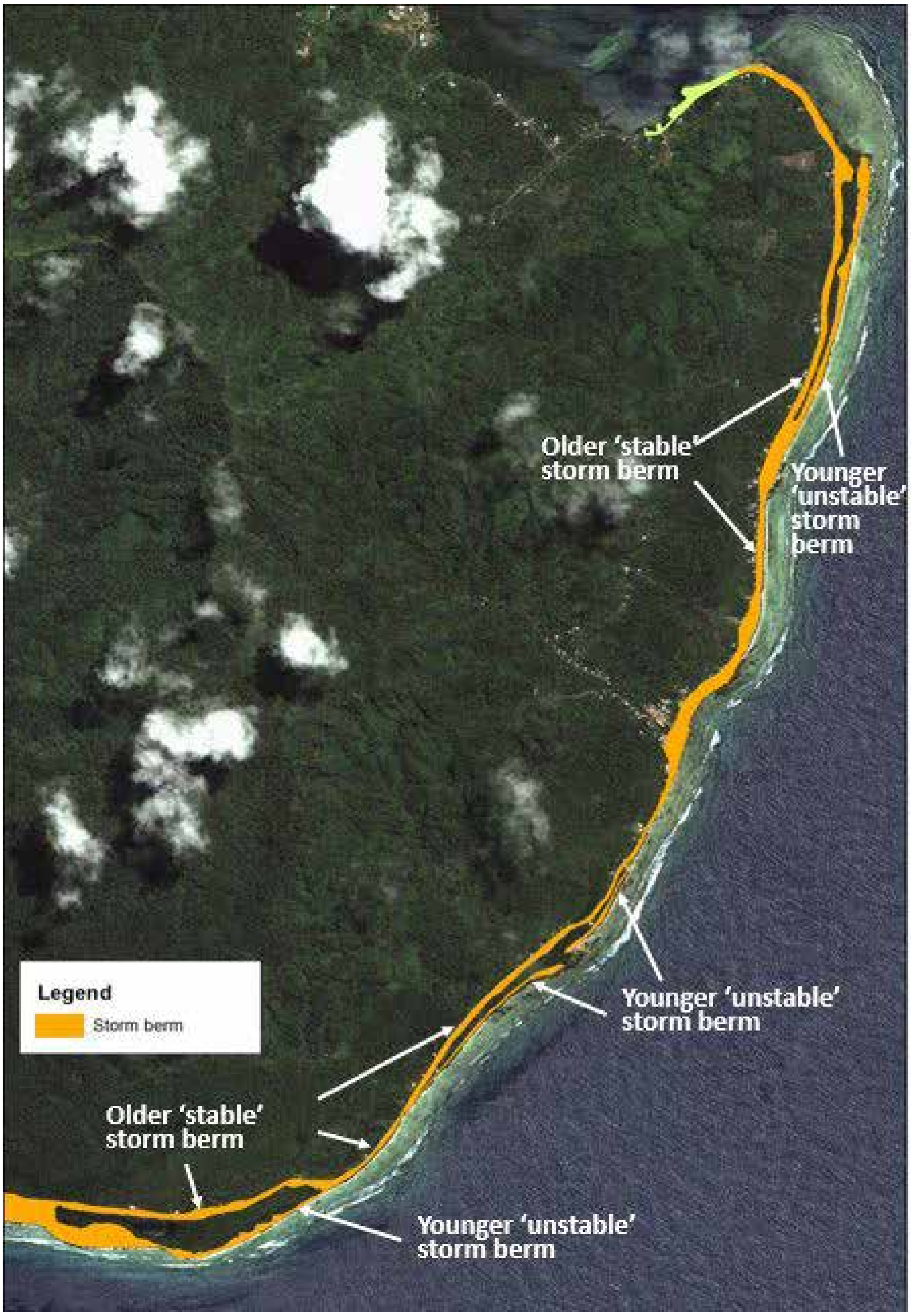


Figure B 7: Location of the storm berm along the Malem coast.

storm berms evident (which have formed the lake at Infulu Kuplu) but between Uwte Ma and Saoksa the storm berm is narrow and formed close to the edge of the reef (reflecting the generally mild wave climate with the very occasional storm or typhoon event).

To understand why coastal changes are occurring, particularly along the eastern facing Lelu and Malem shorelines, it is necessary to look back to the end of the 19th century. Kosrae is rarely affected by cyclone events, with the main tracks located to the north and west of the island (see Appendix C). The last major cyclone was in 1905 but it was a cyclone in 1891 that resulted in a bank of coral rubble being deposited on to the reef flat along much of the eastern coastline. In places it was so high that the breaking waves could not be seen.

This bank of coral rubble acted as a breakwater blocking a substantial amount of the incident wave energy that would have normally reached the shoreline. This sheltered environment in the lee of the rubble rampart enabled the shoreline to gradually build out and fringing reef mangrove strands to develop at the mouths of streams over much of the early to mid-part of the last century. Over the subsequent decades these rubble banks gradually broke down but continued to provide a substantial level of protection to the eastern shoreline (Figure B 9).

However, it was in the decades after World War II when considerable development commenced, including the circumferential road, and the widening of a causeway. These projects utilised large amounts of coral rubble sourced from

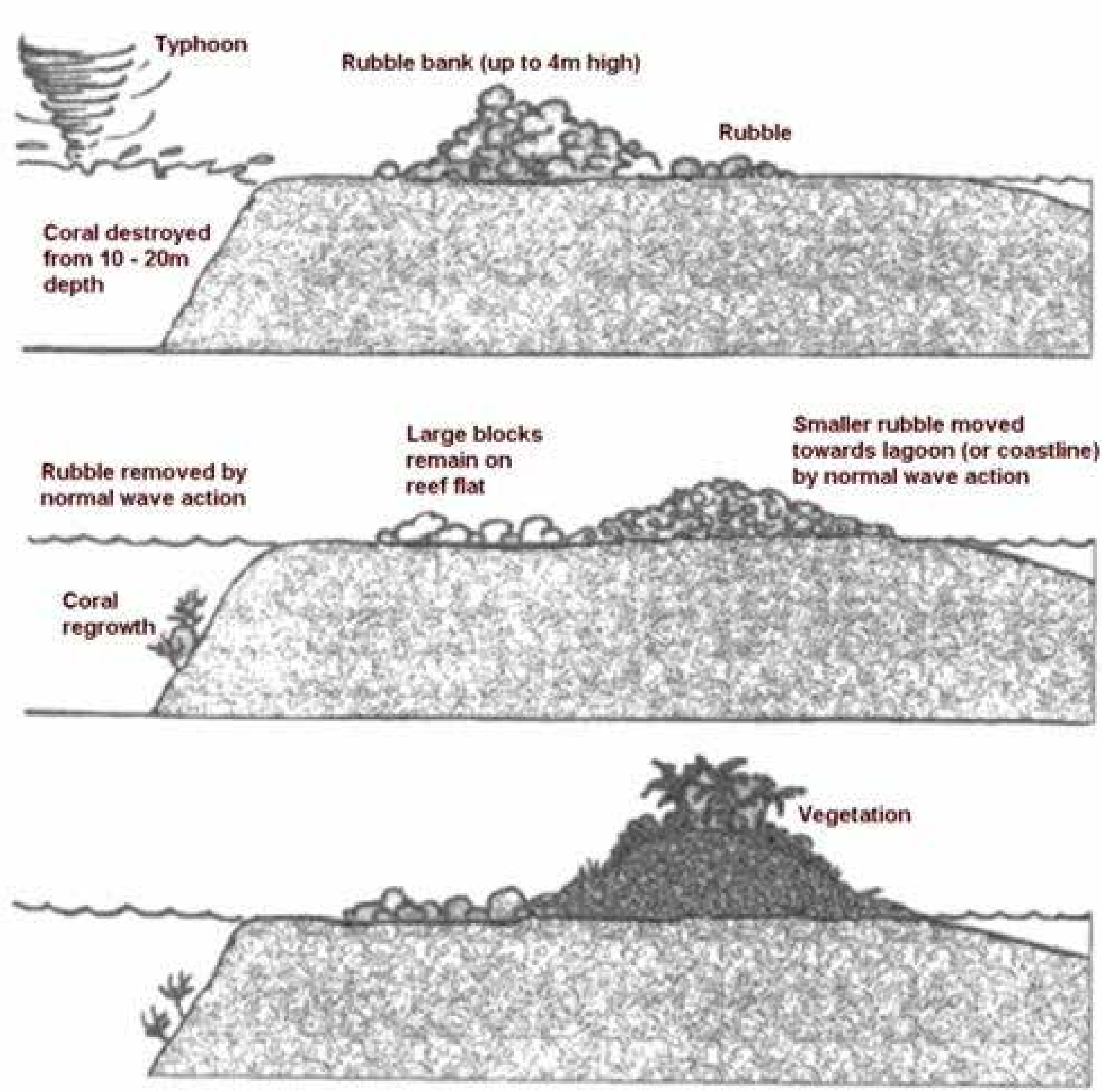


Figure B 8: Basic process forming the storm berm along the eastern facing Lelu and Malem shorelines and southern coastline of Utwe.

Figure B 9: Aerial photograph of the north-east Kosrae coast in 1944 (top) and the remnants of the rubble ridge in 2013 at Putukte (bottom). The rubble ridge extending from Finaunpes all the way down the Pukusruk shoreline to Putukte can be clearly seen in 1944. The size of the ridge between Finaunpes and Finfokoa resulted in a build out of the shoreline in a bulge in the lee of the ridge. With the breakdown/removal of the rubble ridge, the sediment in this bulge in the shoreline has been redistributed along the adjacent coastline (see shoreline position comparisons in the section below).

these banks. The removal of such a large amount of rubble from the banks both accelerated the breakdown and shoreward migration of the remaining coral rubble but also substantially reduced the protection provided to the shoreline. The increase in wave energy reaching the shoreline has subsequently resulted in a loss of the fringing mangroves along the Malem coastline and long-term and on-going readjustment of the shoreline along much of the eastern coastline with much higher rates of erosion than has been occurring on any of the other shorelines around Kosrae.

The tradewinds and resulting waves also result in coral rubble and beach sediments being moved in a net southwards direction along much of the east coast. Along the Pukusruk coast (Figure B 10):

- Sediment tends to move away from the Finfokoa area moved alongshore both to the north and to the south. However, the rate of longshore transport, particularly to the south will be presently relatively small.
- Along the Pukusruk coast there are a couple of small, very shallow channels through the outer reef (Figure B 10). These may be locations in the past where part of the Mutunnenea channel drained through and are locations where some beach/reef flat sediment will be lost offshore.
- Changes in position of the shoreline between 1944 and the present day has shown relatively little movement (see Section below) for much of the Pukusruk shoreline south of Finfokoa. The most notable retreat is occurring at the locations of the two shallow channels which may allow greater wave energy to reach the shoreline.

Along the Malem coastline (Figure B 11):

- The net southerly longshore transport can be observed by the build-up of beach sediment to the north of the old Japanese blockhouse and subsequent downdrift erosion

Figure B 10: Key sediment sources, longshore transport processes, and sediment losses along the Pukusruk shoreline.

to the south at the house of Chris Collin's in Pilyuul and similarly at the position of the Tideflex outlet at the Mosral River mouth.

- The increased wave energy reaching the shoreline and resulting southward longshore transport also result the mouths of some of the smaller rivers being blocked.
- The reef flat channels at Malem, and Pilyuul are locations where beach / reef flat sediment will be lost offshore. The locations of these channels are also where erosion problems tended to most significant, notably at Malem. However, continued retreat of the shoreline at Pilyuul will increasingly expose the road.

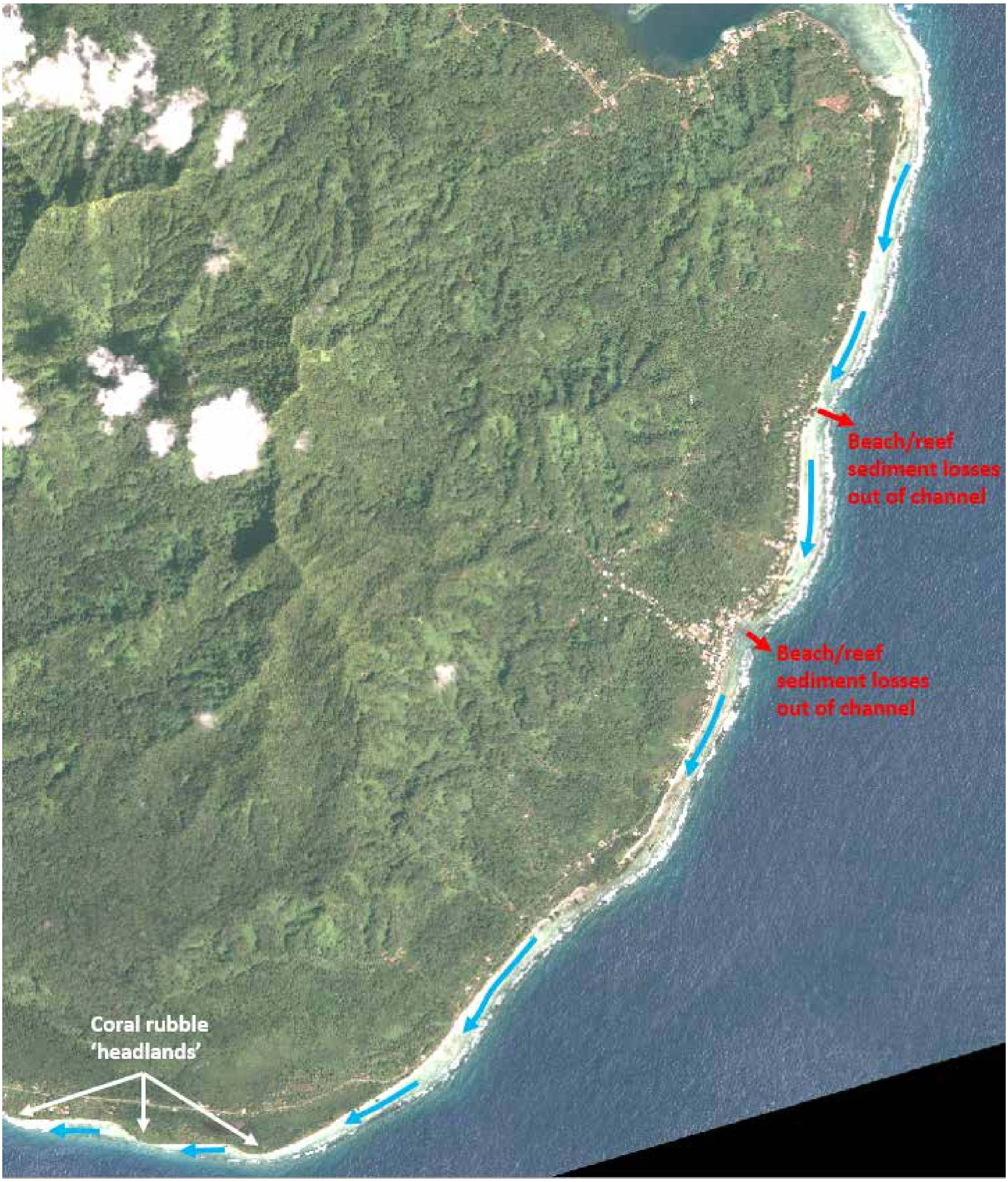


Figure B 11: Key sediment sources, longshore transport processes, and sediment losses along the Malem shoreline.

- The Kuplu area has been an area of sediment deposition with some significant changes apparent between 1944 and the present day (see section below) including the closing of the eastern outlet of Infulu Kuplu.

Along the south coast, from Kuplu to Utwe, sediment tends to be moved westwards. However, deposits of large coral boulders on the reef flat tends to create a series of headlands and bays with the shoreline rotated to face the incident wave direction and longshore transport rate is likely to be low.

Mangrove coastlines

Mangroves only provide coastal protection along relatively sheltered coastlines, i.e., those that experience low wave energy. Mangrove areas on Kosrae provide direct coastal protection for about 22% of the coastline and are also an important component of the overall natural coastal defences where they are located in back lagoon settings (but do not provide direct coastal protection to ocean waves).There are three basic mangrove settings (Figure B 12) on Kosrae:

- Reef flat mangroves: The mangroves along the coastline between Tafunsak and Mwot is the only significant strand that provides protection on a reef flat location, albeit one that is relatively sheltered from typical tradewind wave conditions.
- Harbour mangroves: Located around the fringes of Okat, Lelu and Utwe where some ocean wave energy can be experienced but predominantly local wind-waves generated within the harbours.
- Lagoon mangroves located behind storm or beach berms, for example Mutunnenea, between Utwe and Mosral and between Utwe Ma to Walung which are largely sheltered from any wave action.

The effectiveness of mangroves in providing shoreline protection is highly context specific, depending on the geomorphology of the area and the frequency and magnitude of storm events that have the potential to cause shoreline change, the width, age, density and structure of the mangrove strand.

The narrow strands of mangroves that previously occurred on the outer coastlines, such as along the Malem coastline, provided little effective coastal protection from wave and storm conditions. Mangroves only developed along coastlines such as Malem, due to the protection from waves provided by the coral rubble banks that were previously located on the outer part of the reef flat. The loss of mangroves from these more exposed coastlines is related to the loss of the rubble banks and has not been a dominant cause of the erosion along these sections of coastline.



Figure B 12: Key mangrove settings on Kosrae. Top left: reef flat mangroves between Okat and Yela; Bottom left: Fringing harbour mangroves in Lelu Harbour at Tofol; Right: Back lagoon mangroves between Nefalil and Utwe Ma.

Modified or man-made coastlines

A substantial amount of Kosrae's development and infrastructure is located on land that has been modified by reclamation or engineered structures:

- Reclaimed areas upon which development is located, for example the main part of Lelu village on Lelu Island, the area upon which Utwe village is located and the airport and port infrastructure at Okat.
- Seawall or revetment structures built to protect land or development, such as at Tafunsak and Malem.

All these modified areas tend to be fronted by form of engineering structures resulting in natural coastal change limited, except where such structures have been poorly built or maintained. If a severe typhoon or storm were to occur many of these defences would not provide adequate protection and significant wave overtopping damage would be expected. The most significant changes are where poorly designed structures have exacerbated erosion on adjacent sections of coastline, for example at Sandy Beach Hotel in the 1980s and 1990s.

Assessment of coastal change between 1944 and 2011

Introduction

An assessment of the change in shoreline position between aerial photographs collected in 1944 and a Quickbird high resolution satellite image collected in 2012. After an initial assessment of the resolution of the scanned 1944 aerial images it was decided that these would need to be scanned at a higher resolution. Copies of the original prints are held at the US Forestry Service Institute of Tropical Forestry in Hilo, Hawaii with rescanning of the prints at 1200 dpi kindly conducted by Mr Thomas Cole.

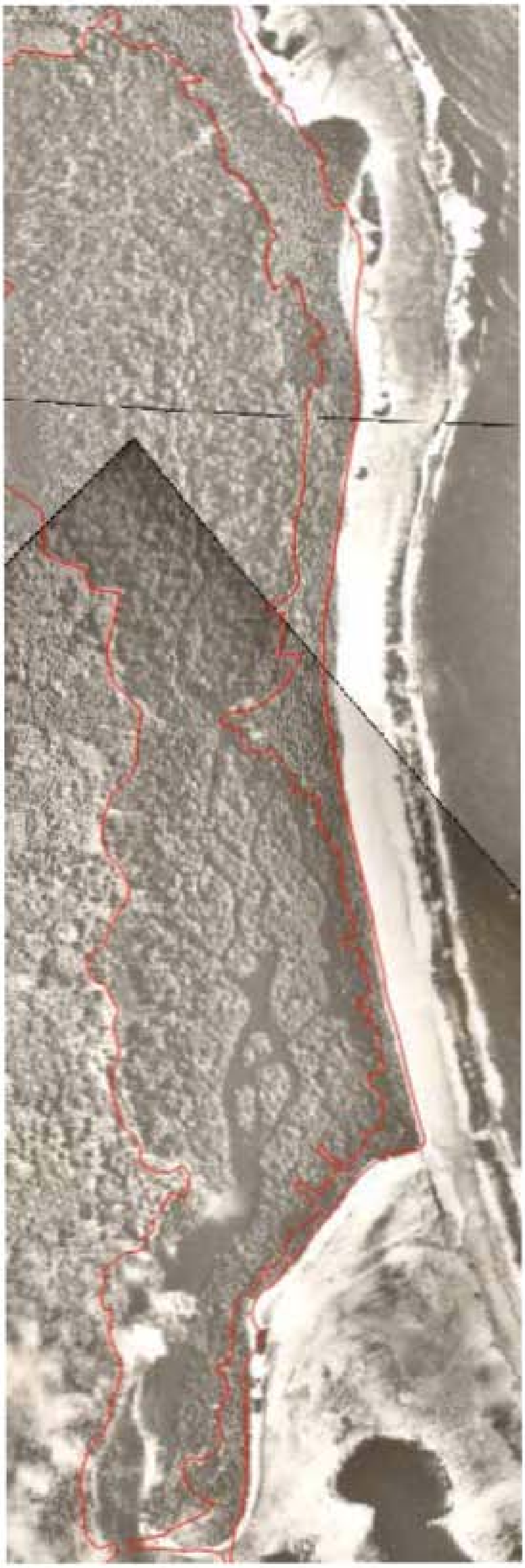
A total of 21 of the 1944 scanned aerial images were georeferenced and rectified against the 2012 satellite image using Erdas Imagine 2013 software. For each scanned print over one hundred matching control points between the 1944 image and the 2012 satellite image were identified and used to rectify the 1944 aerial photographs. The process was repeated until error was reduced to the minimum possible however this varied depending on the quality of imagery, cloud cover and reliability of control points.

Once all images had been rectified the shoreline (terrestrial vegetation line, not mangroves) was digitised for both the 1944 and 2012 images and the shorelines compared. The quality of the 1944 imagery was not sufficient to assess quantitatively shoreline positional change but general gross patterns of change were reliably observed.

The Figures below show the general shoreline changes between 1944 and 2012 around coastline of Kosrae:

- The image on the left shows the rectified 1944 aerial image with the digitised 2012 shoreline (red line). Where:
  - The red line is seaward of the shoreline shown in the 1944 aerial image, the coastline has built out (accreted) between 1944 and 2012.
  - The red line is landward of the shoreline shown in the 1944 aerial image, the coastline has eroded between 1944 and 2012.
- The right hand image shows the 2012 satellite image with the 1944 digitised shoreline (orange line). Where:
  - The orange line is seaward of the shoreline shown in the 2012 satellite image, the coastline has eroded between 1944 and 2012.
  - The orange line is landward of the shoreline shown in the 2012 satellite image, the coastline has built out (accreted) between 1944 and 2012.

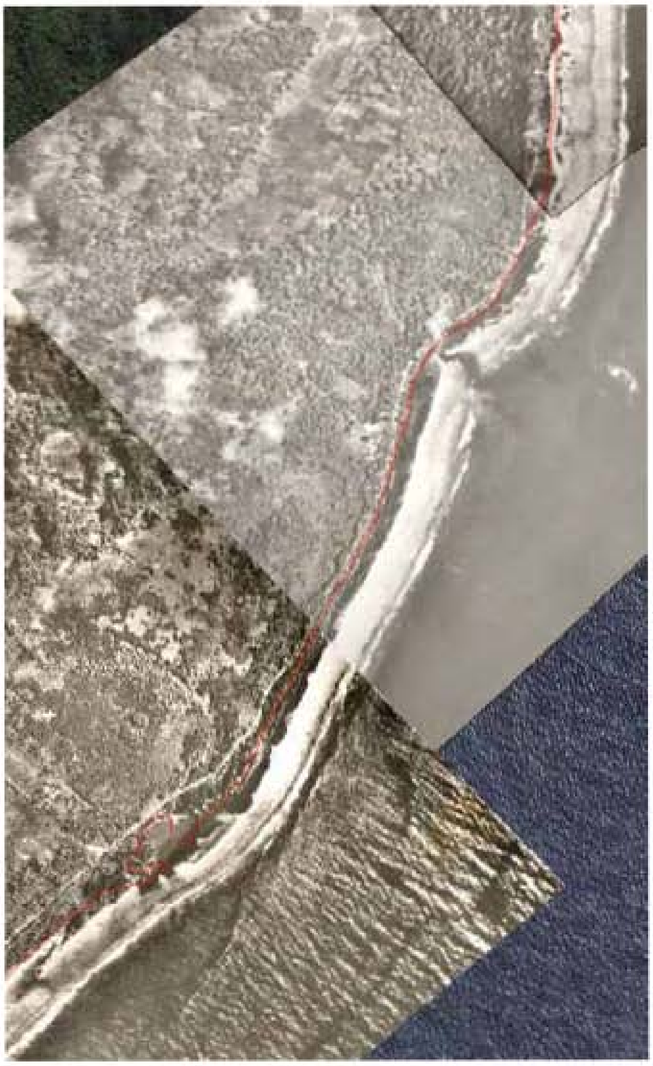
Lelu: Finfokoa to Finpukal



Lelu: Lelu Island and Tofol

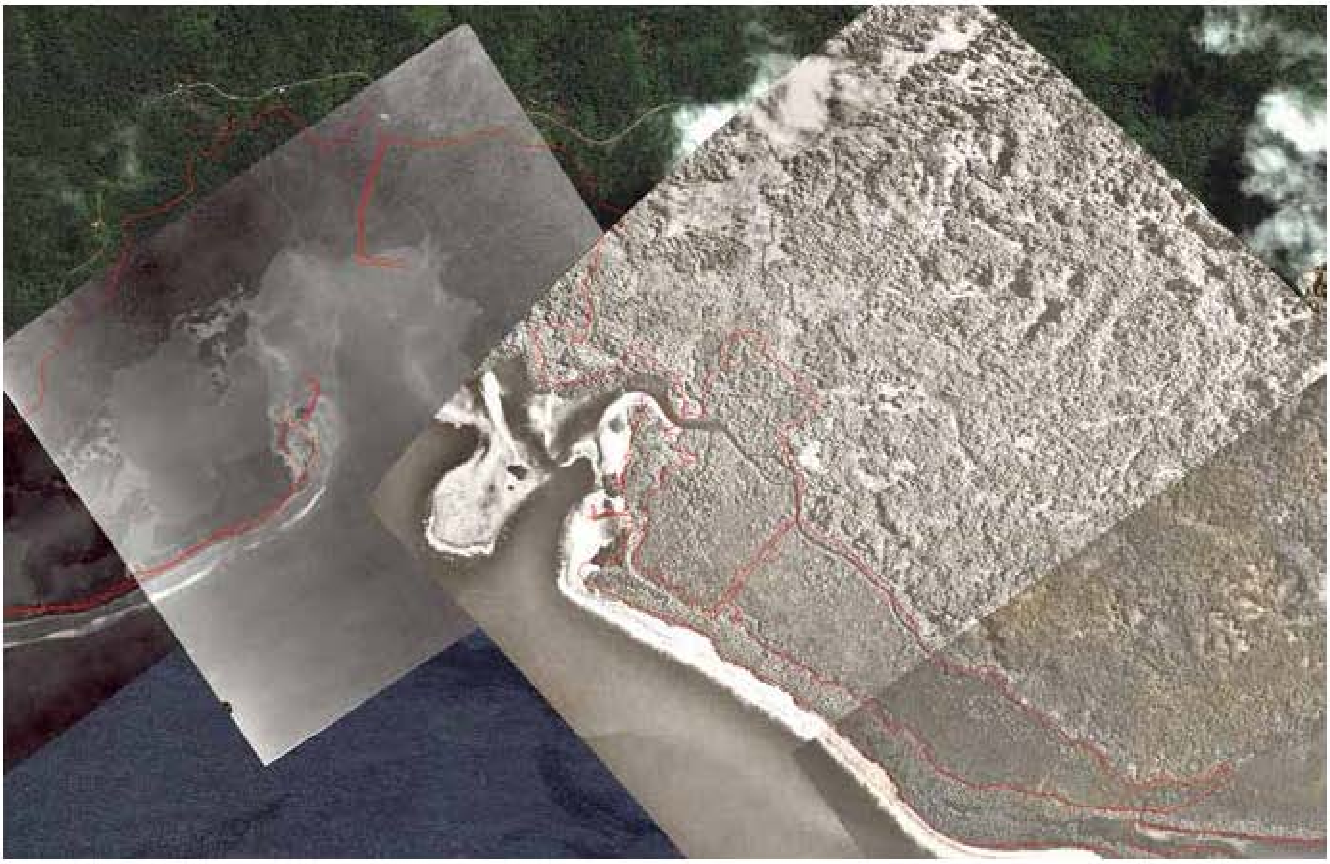
Lelu: Tafuyat to Pilyuul

Malem: Yewak to Yeseng



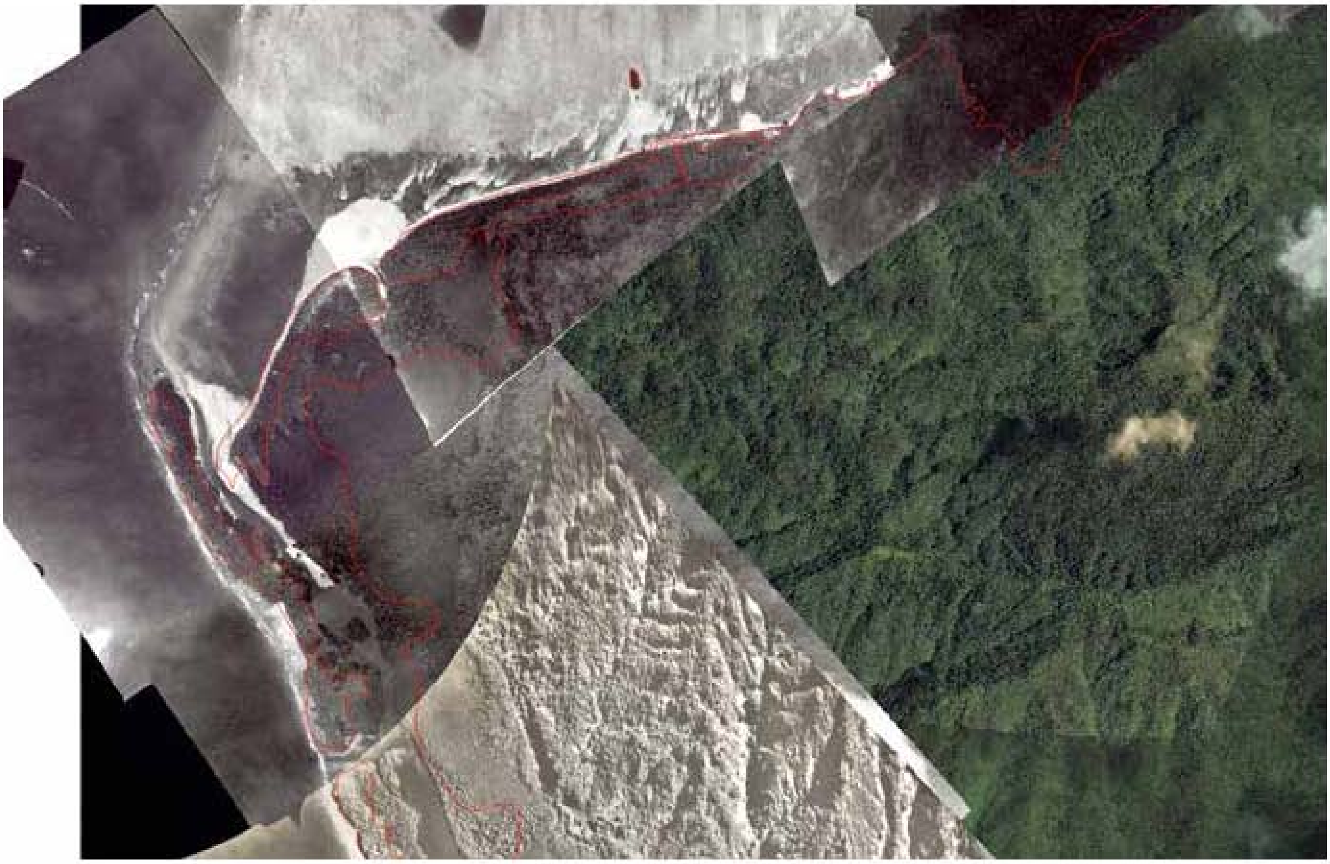
Malem: Mosral to Kuplu

Utwe: Kuplu to Utwe Ma



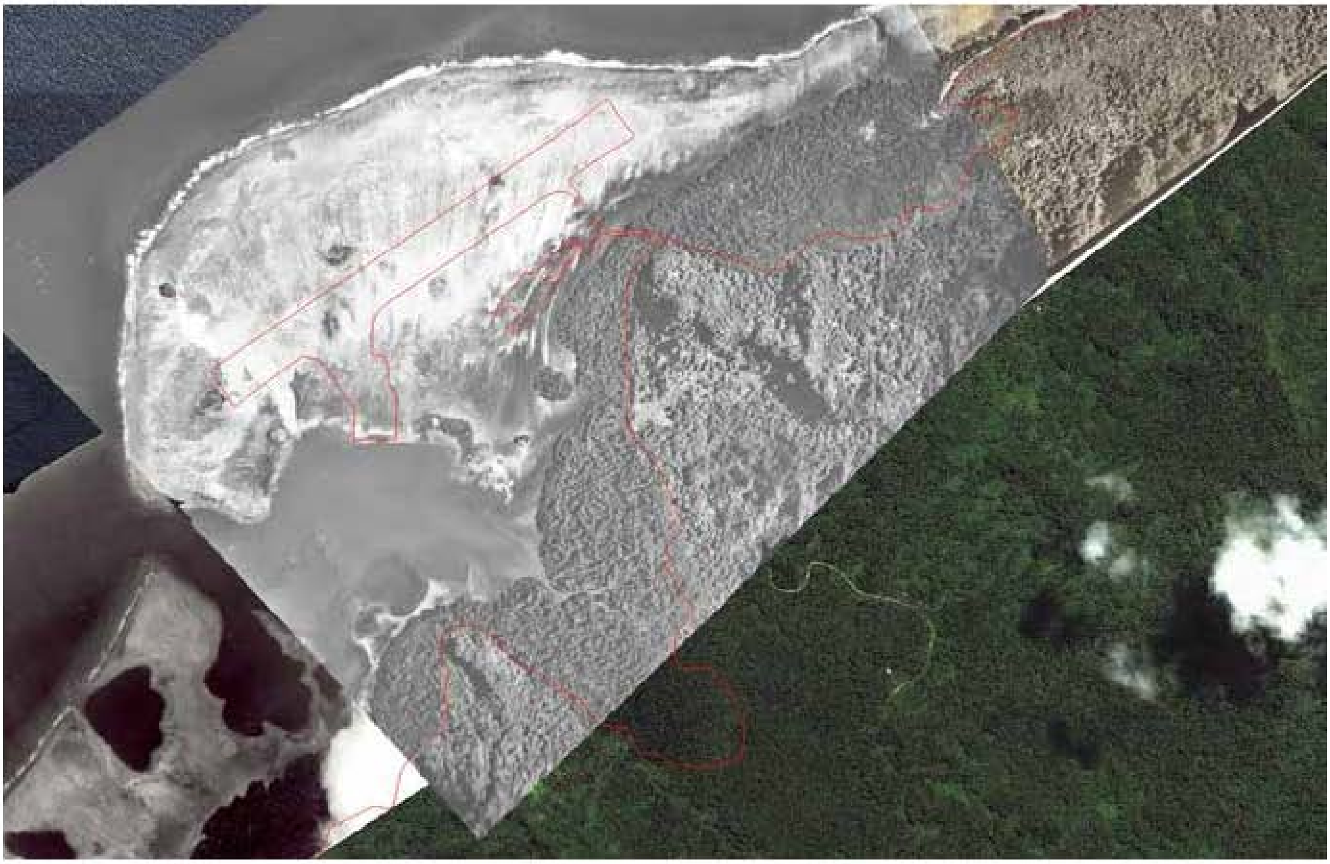
Utwe: Utwe Ma to Tukunsru

Walung: Tukunsru to Mwot



Appendix B

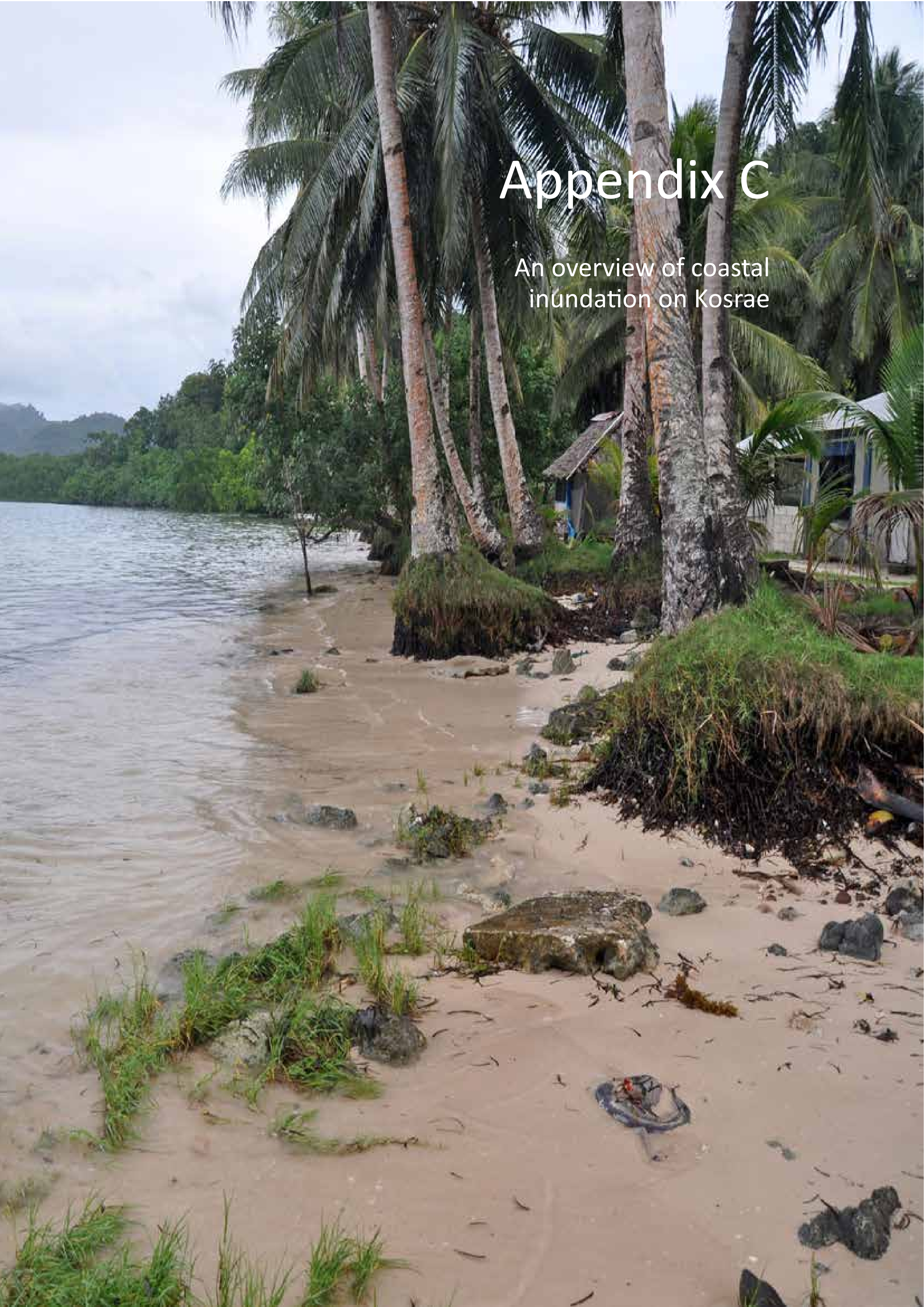
Tafunsak: Okat



Tafunsak: Tafunsak to Finaunpes

Appendix C

An overview of coastal inundation on Kosrae



Flooding of land from the sea on Kosrae tends to occur episodically due to three types of event, Table C 1. Further information on sea-level components, variability and change on Kosrae are provided in Appendix D.

Table C 1: Current and foreseeable future requirements and priorities for transitional coastal defences.

Inundation event	Indicative frequency of occurrence
Higher than normal high tide levels.	• Every year: – Particularly between December and February. – Much higher than normal every 2 to 4 years during period of La Niña.
Large swell waves caused by distant storms in the north Pacific.	• Once in a generation.
Typhoon events that track close to Kosrae.	• Once in a lifetime: – the last cyclone to directly impact Kosrae was in 1905, beyond the living memory of all current residents.

High (King) tides

Flooding of land on Kosrae most commonly occurs due to higher than normal high tide levels, or high tides occurring at the same time as moderate to large wave conditions. With the exception of storm or typhoon-related flooding events (see next sections) which are rare on Kosrae, coastal flooding tends to most commonly occur:

- Between November and February and June to August.
- During strong phases of La Nina.

This is because high water levels, and hence inundation experienced around Kosrae, tend to occur when a number of components combine:

- The most significant is the astronomical tide – the regular rise and fall of water level due to the influence of the moon and the sun. Tide levels on Kosrae tend to be higher between November and February and between June and August.
- The influence of El Nino and La Nina oscillations. During strong El Nino events, sea levels around Kosrae tend to be depressed. During strong La Nina's, the opposite occurs and sea levels tend to be higher. This can cause variations in sea-level of up to 0.25 m (10 inches) or more.
- The effect of continuous north-east trade winds which tend to increase tide levels between November and April.

Hence when larger tides, combine with La Nina conditions and north easterly trade winds, as occurred around December/ January 1999/2000 (Figure C 1) and November 2007 to February 2008, higher sea-levels occur and inundation and coastal damage is more likely.

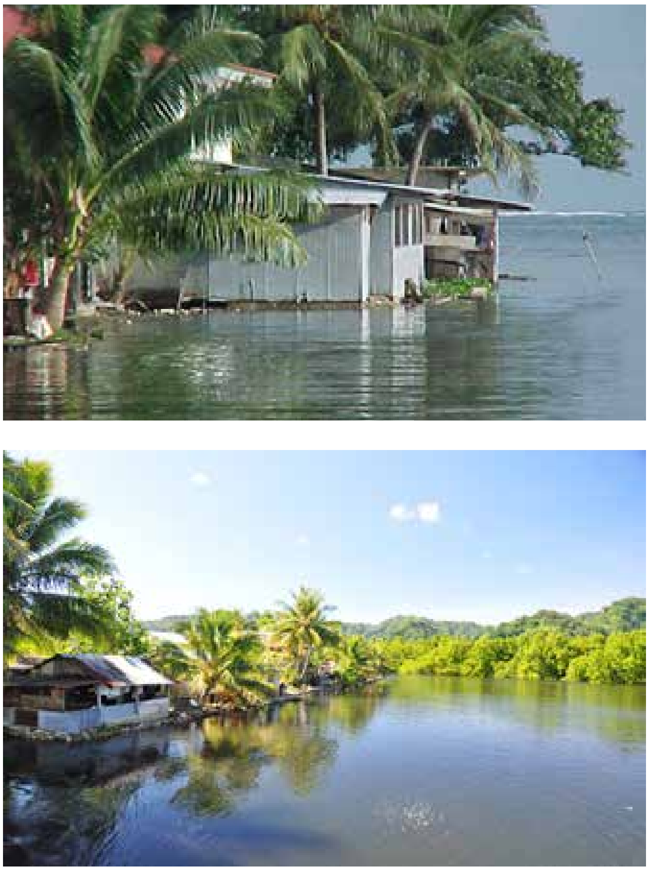


Figure C 1: High tide levels at Lelu during December 1999 (left) and Utwe during December 2010 (right).

The main locations where high tides alone cause inundation problems to property or infrastructure tends to be where land has been reclaimed in the harbour areas or within the mangroves sheltered from waves:

- **Lelu Island** – Much of the reclaimed areas on Lelu Island have land levels that are barely above present day high tide levels. Flooding of land during December and January commonly occurs adjacent to the canal sections in Lelu.
- **Pukusruk** – Landward of the road, many properties are built on reclaimed land in to the mangrove with levels barely above high tides.
- **Utwe village** – Much of Utwe village lies on reclaimed land on top of a sand spit. Again the level of the land is barely above present day high tide levels.
- **Walung** – The section of coast between Insiaf and Pilyuul (old elementary school) is largely sheltered from waves with the level of the coastal berm barely above high tide levels.
- **Tafunsak** – The communities at Malsu, Yekula, Finfukul and Sialat that are located on land that is lower than the crest of the beach berm / coastal road, and overwashing of the seawall at Finfukul on to the road.

Figure C 2: Wave overwashing at Fukrin in Malem during February 2000 (left) and high tide wave overtopping of the seawall at Malem village during December 2010).

On the open, generally eastern-facing, coastlines of Lelu and Malem Municipalities, high tides and tradewind generated waves combine to cause overwashing of the coastal berm. This is where larger waves reach the shoreline due to deeper water depths over the reef flat, run-up the beach or seawall and overwash the coastal berm behind the beach.

The height of the coastal berm along this eastern coast is generally related to the height of waves experienced along it:

- Along the Pukusruk coast (Finaunpes to Sroanef) and from Tenwak to Malem, the coastal berm tends to be higher and wave overtopping less of an issue unless waves are higher than normal.
- From Shroanef to Finpukal and Malem south to Mosral, the coastal berm tends to be lower and wave overwashing tends to occur when normal tradewind waves coincide with most spring high tides, for example at Fukrin and Pal in Malem (Figure C 2).

It is on the frequency and magnitude of high-tide related flooding that sea-level rise will have the most significant impact.

Inundation from swell wave events

The coastal flooding that affected the northern coastline (Tafunsak, Walung and parts of the Lelu coastline) of Kosrae during the 8 and 9 of December 2008 (Figure C 3) was due to large swell waves generated by a severe storm far to the north of Kosrae . The inundation extent along the Tafunsak coastline is shown in Figure C 4 which shows some particular characteristics:

- The seawall at Tafunsak did not provide any greater protection to the land behind from overwashing waves than the beach sections of coast.
- The extent of inundation was worst over the low-lying land adjacent to the stream outlets at Yekula, Malsu (Senny's Store) and at the old outlet of Infal Mutunte in Tafunsak village).
- Inundation extent was least where there was a largely natural vegetated buffer behind the beach (e.g., between Finaunpes/Inkoeya and Sialat) or seawall (such as west of the church in Tafunsak).

Figure C 3: Debris from overwashing of the seawall at Tafunsak (left) and at Malsu (right) during the swell event of 8-9 December 2008.

Figure C 4: Extent of inundation along the Tafunsak coastline during the swell event of 8-9 December 2008. Inundation extent information courtesy of KIRMA.

These large swell events, due to particular storm conditions well north of Kosrae, appear to happen infrequently and generally impact on the northern coastline (Walung, Tafunsak and to a lesser extent the Pukusruk coast of Lelu). Known events include:

- **1979**: A swell wave event damaged the old school buildings in Walung. This is likely to have been the same event in late November 1979 that caused much damage in the Marshall Islands .
- **1969:** In December 1969, two storms in the North Pacific between 40ºN and 50ºN resulted in swell waves of between 4 m and 6 m (12 to 18 ft) travelling over 7000 km to the south. This is likely to have affected the north coast of Kosrae as well as the northern coasts of islands in Kiribati, Tuvalu, Samoa, Cook Islands and Tahiti.
- **1961:** On October 13 and 14, large waves inundated parts of Walung causing much damage to property at Insiaf and Leap. The waves caused a coconut tree to fall resulting in the deaths of two small children.

Typhoons

Despite no typhoon directly affecting Kosrae since 1905, there is a very real risk that should a typhoon or severe tropical storm track close to Kosrae, catastrophic damage would occur.

Table C 2: Summary of past cyclones experienced on Kosrae.

Year	Details
1780?	–
1835/37?	Severe typhoon
1874	**15 March**: Severe storm or typhoon from the south sinks Bully Hayes ship.
1891	**3–4 March**: Typhoon from the south through Kiribati, Kosrae, Pingelap, Mokil, Pohnpei, Chuuk and the Mortlocks. All but six houses left standing and virtually all breadfruit and coconut trees destroyed.
1900?	Typhoon
1905	**19–23 April**: Typhoon lasting seven hours with much destruction of property and trees.
1986	**19 May**: Typhoon Lola passed to the north west of Kosrae.
1992	**5 January**: Typhoon Axel passed 75 km north of Kosrae. Maximum sustained winds of up to 80 knots were recorded resulting in severe crop losses, trees and vegetation damaged, and some wooden and tin-roofed structures destroyed.
2001	**17 December**: Tropical Storm 31W (Faxia) tracked west of Kosrae causing overwashing on the east coast.

Table C 3: General cyclone tracks and resulting areas on Kosrae most likely to be affected by inundation.

Typhoon track (westerly movement)	Areas most likely to be inundated
North of Kosrae	• North-east Lelu, Tafunsak and possibly Walung coastlines.
South of Kosrae	• All of the Utwe and Malem coastline and possibly parts of the Lelu coastline. • A cyclone tracking just south of Kosrae is likely to cause the most significant inundation-related damage.
Directly over Kosrae	• Inundation-related damage would be most significant on the right-hand side of the typhoon track. • The most significant inundation is likely to occur along the Malem and/or Lelu coastlines. • Tafunsak, Walung and Utwe coastlines may also experience inundation as the typhoon passes over Kosrae.

Many of the typhoons that affect Guam and the western FSM islands originate in the region around Kosrae as tropical depressions and tropical storms, developing into full typhoons further to the west and north. Typhoons tend to occur between June and November and are more likely to track closer to Kosrae during El Niño phases.

Whilst strong winds are likely to cause most of the damage, higher sea levels due to storm surge (only if the cyclone tracks close or directly over Kosrae), and large waves (which also increases the water level at the shoreline due to wave set-up on the fringing reef) would cause significant wave overwashing and inundation of the immediate coastal margins. Inundation would also be exacerbated by heavy rainfall which would cause flooding of low-lying swamp and agricultural areas.

The location and severity of wave overwashing, inundation and resulting damage depends on the track of the typhoon relative to Kosrae. Typically typhoons track in a westerly direction and are more likely to occur to the north of Kosrae.

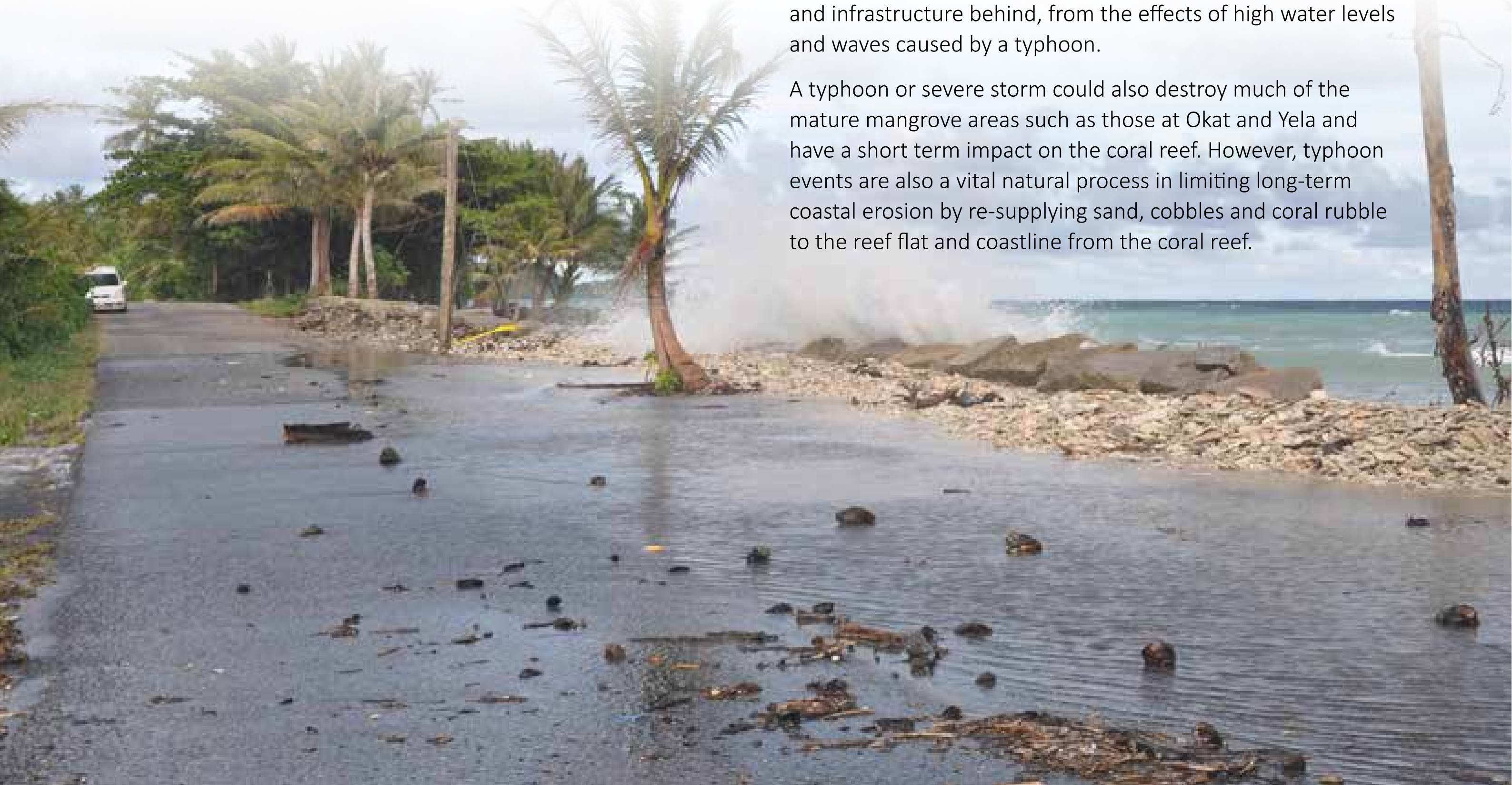
Virtually everyone on Kosrae lives on land that is less than 4 m (12 feet) above mean sea level. All of this land is at very high risk from the impacts of a typhoon with there being potential for significant loss of life and destruction of a high percentage of residential property from the effects of wind and storm surge and waves.

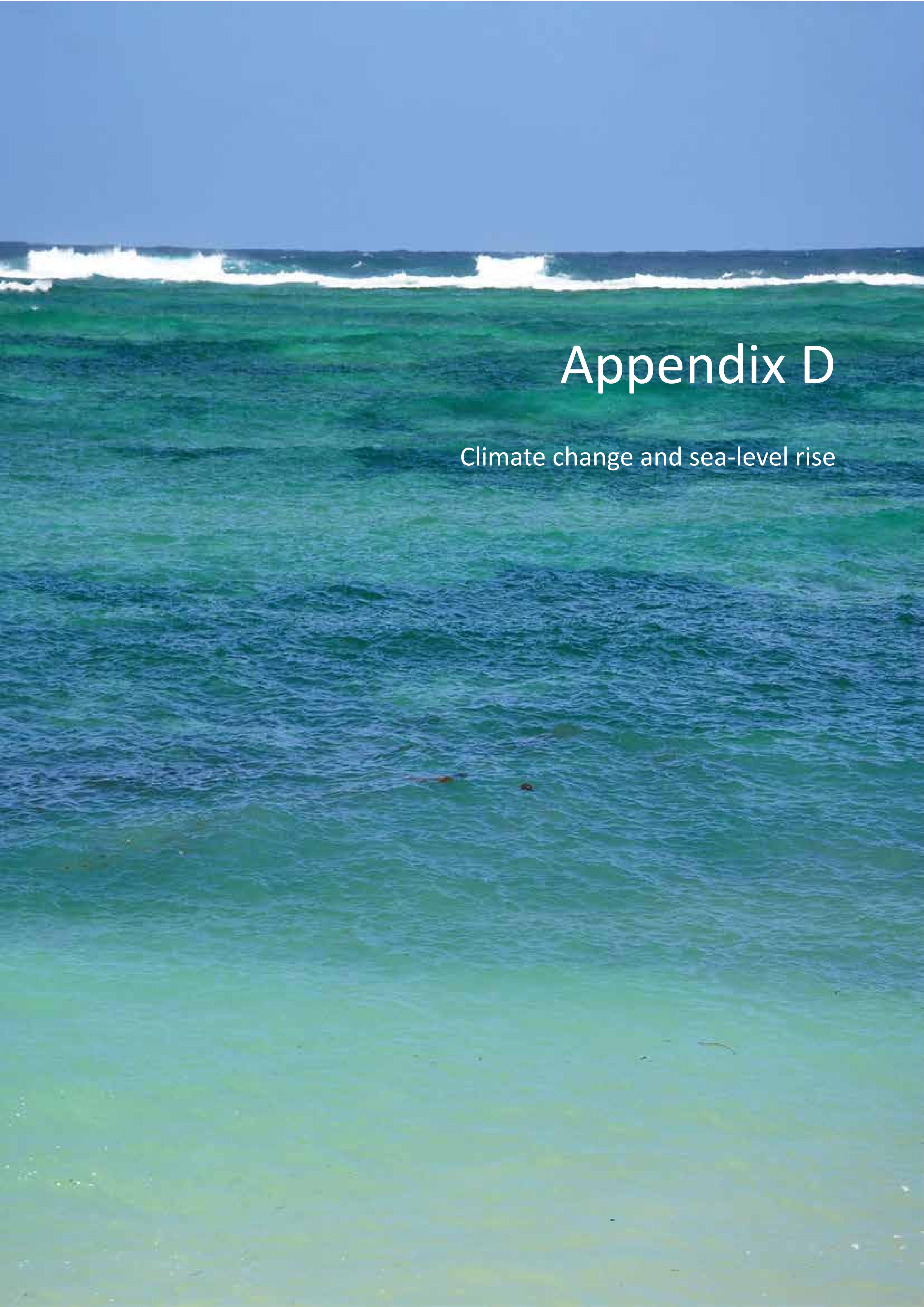
The areas potentially at greatest risk are those parts of the coastline fronted by a narrow reef with low-lying swamp land behind a narrow strip of coastline, such as:

- Finfokoa to Pukushruk in Lelu.
- Virtually all of the Malem coastline.
- The southern part of Utwe village.

Furthermore, all of Kosrae's infrastructure (roads, utilities) are located on low land close to the coastline. If a typhoon were to directly affect Kosrae there would be significant damage to the road, disruption to traffic between villages, and loss of much power and telecommunication infrastructure. Existing coastal defences will not protect the coastline, or the land, property and infrastructure behind, from the effects of high water levels and waves caused by a typhoon.

A typhoon or severe storm could also destroy much of the mature mangrove areas such as those at Okat and Yela and have a short term impact on the coral reef. However, typhoon events are also a vital natural process in limiting long-term coastal erosion by re-supplying sand, cobbles and coral rubble to the reef flat and coastline from the coral reef.





Appendix D

Climate change and sea-level rise

Background

The most recent assessment of past and potential future climate change was carried out by the Australian funded Pacific Climate Change Science Program. For the FSM this concluded that for the course of the 21st century:

- Surface air temperature and sea surface temperature are projected to continue to increase (very high confidence).
- The intensity and frequency of days of extreme heat are projected to increase (very high confidence).
- Ocean acidification is projected to continue (very high confidence).
- Mean sea-level rise is projected to continue (very high confidence).
- Annual and seasonal mean rainfall is projected to increase (high confidence).
- The intensity and frequency of days of extreme rainfall are projected to increase (high confidence).
- The incidence of drought is projected to decrease (moderate confidence).
- Tropical cyclone numbers are projected to decline in the tropical North Pacific Ocean basin (0–15°N, 130°E–180°E) (moderate confidence).

The assessment also concluded that a warming trend was evident for Pohnpei and Yap in annual and seasonal mean air temperatures for the periods 1950–2009 and 1951–2009 respectively but that annual and seasonal rainfall trends were not statistically significant.

Sea levels have also risen within the FSM, with increasing global sea levels a well-established consequence of global climate change. The following sections provide background information on sea-levels and sea-level change on Kosrae.

What influences sea levels around Kosrae?

The level of the sea around Kosrae is influenced by a number of components:

- The astronomical tide: The twice-daily rise and fall of water has the largest influence on the particular sea-level occurring at any time. High and low tide times and levels can be accurately predicted many years in advance Over a year, tide levels on Kosrae tend to be higher between November and February (Figure D 1). Most coastal flooding occurs on Kosrae when larger than normal waves coincide with high tide conditions. However, tide levels can be elevated (or lowered) by a number of factors outlined below.
- The 2 to 5 year El Niño Southern Oscillation (ENSO) cycle: During El Niño phases sea levels around Kosrae are pushed down (resulting in lower high tide levels), and conversely during La Niña phases sea levels are pushed up, (resulting in higher high tide levels), Figure D 2. These effects can occur over a number of months to a year or more and can result in reductions in sea levels during strong El Niños of up to 20 to 25 cm (8 to 10 inches) and increased in sea levels during string La Niñas of up to 15 to 20 cm (6 to 8 inches), Figure D 3. However for about 80% of the time fluctuations in mean level of the sea are within ±0.1 m (±4 inches).
- Decadal/Inter-decal Pacific Oscillation: Over longer 20

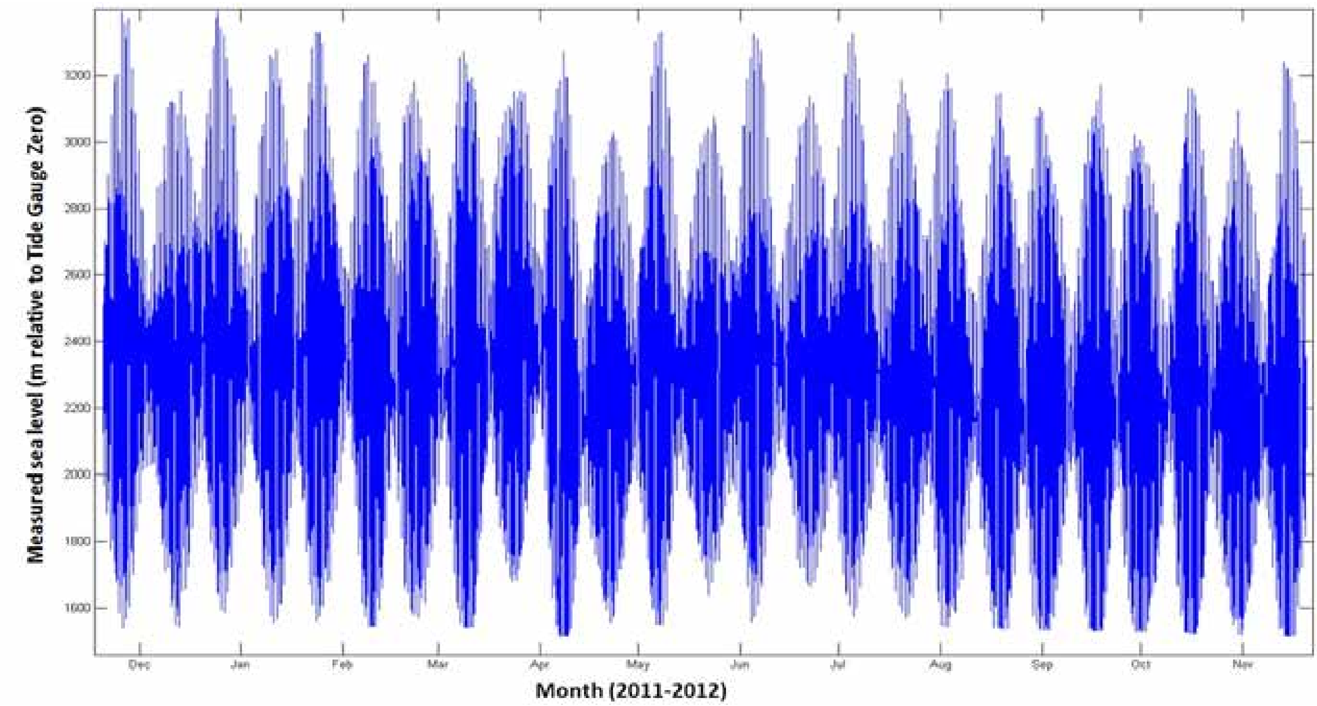


Figure D 1: Measured sea levels within Lelu Harbour between 20 November 2011 to 20 November 2012.

to 30 year cycles a climate-ocean feature known as the Pacific Decadal Oscillation (DPO) or Interdecadal Pacific Oscillation (IPO) influences the frequency and intensity of ENSO events. Between about 1978 to 2000, the IPO was in a phase where El Niño events were stronger and more frequent, hence sea levels over this period tended to be lower on average. Since around 2000 the IPO has been in a phase where La Niña events have been more

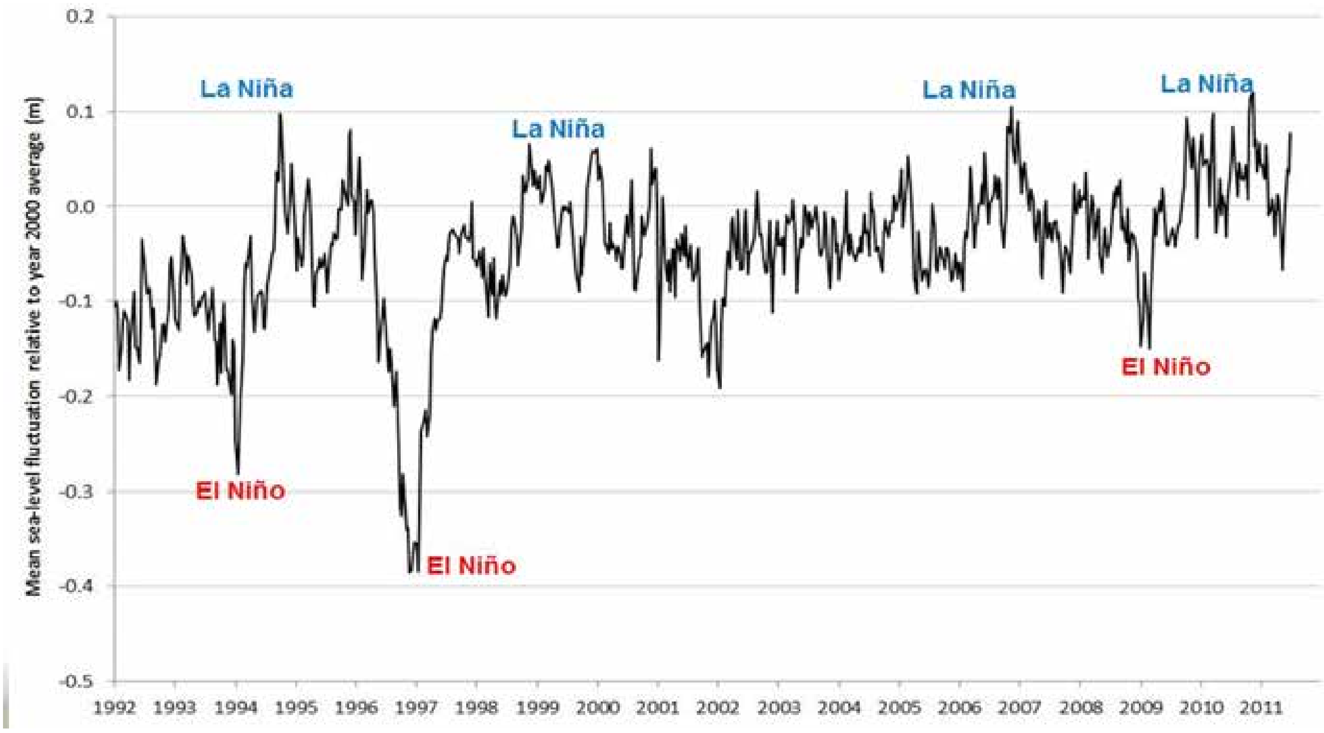


Figure D 2: Mean sea-level fluctuations between 1992 and 2012 for Kosrae showing effects of El Nino and La Nina periods on sea levels. Sea level anomalies measured by satellite and downloaded from http://sealevel.colorado.edu/content/interactive-sea-level-time-series-wizard.

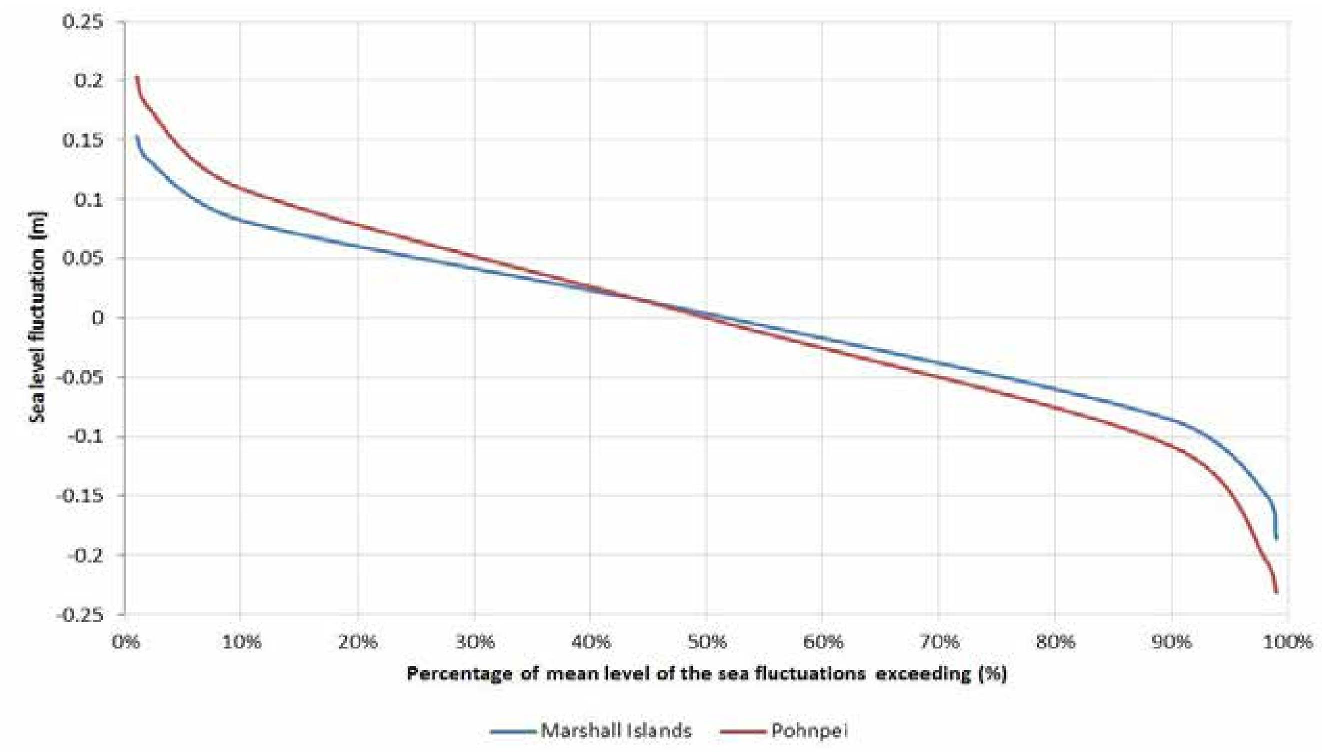


Figure D 3: Percentage exceedence in mean level of the sea fluctuation for Pohnpei and the Marshall Islands.

common resulting in more frequent and higher sea levels relative to the twenty year period prior to 2000.

- Storm surge: Storm surge is the temporary increase in sea level over 1 to 3 days due to a reduction in atmospheric pressure and influence of wind on the sea surface. Due to the lack of severe storms and cyclones affecting Kosrae, storm surge only ever has a very minor influence (few cms) on sea levels. Only if a severe typhoon was to pass close to Kosrae would storm surge result in any significant increase short-term in sea levels.
- Wave setup: On ocean shorelines, the effect of large waves breaking on the seaward edge of the reef raises (sets up) water levels over the reef flat. This has a much larger influence on sea levels along the ocean shorelines than storm surge. This can raise reef flat water levels by up to about 1 m (more during a large typhoon event), particularly during large swell conditions such as the event that affected the Tafunsak coastline on the 8-9th December 2008.
- Sea-level rise: The long-term increase in sea levels due to increasing global temperatures resulting primarily in a warming of the oceans causing them to expand, and melting or discharge of ice sheets and glaciers on land.

How much have sea levels risen around Kosrae?

Increasing global sea levels are a well-established consequence of global climate change. Measurements of mean sea-level changes over the last two centuries have primarily come from long-term data from tide gauges mounted on land, supplemented since around 1993 by measurements made by satellites. The longest records suggest that the rate of rise of global mean sea levels began to increase from around the early to mid-1800s compared with a relatively stable sea level in the preceding century.

The latest Intergovernmental Pannel for Climate Change (IPCC) Fifth Assessment Report concluded that

"it is virtually certain that the rate of global mean sea level rise has accelerated during the last two centuries. It is very likely that the mean rate was 1.7 [1.5 to 1.9] mm per year between 1901 and 2010 for a total sea level rise of 0.19 [0.17 to 0.21] m. Between 1993 and 2010, the rate was very likely higher at 3.2 [2.8 to 3.6] mm per year; similarly high rates likely occurred between 1930 and 1950. It is likely that global mean sea level has accelerated since the early 1900s, with estimates ranging from 0.000 to 0.013."

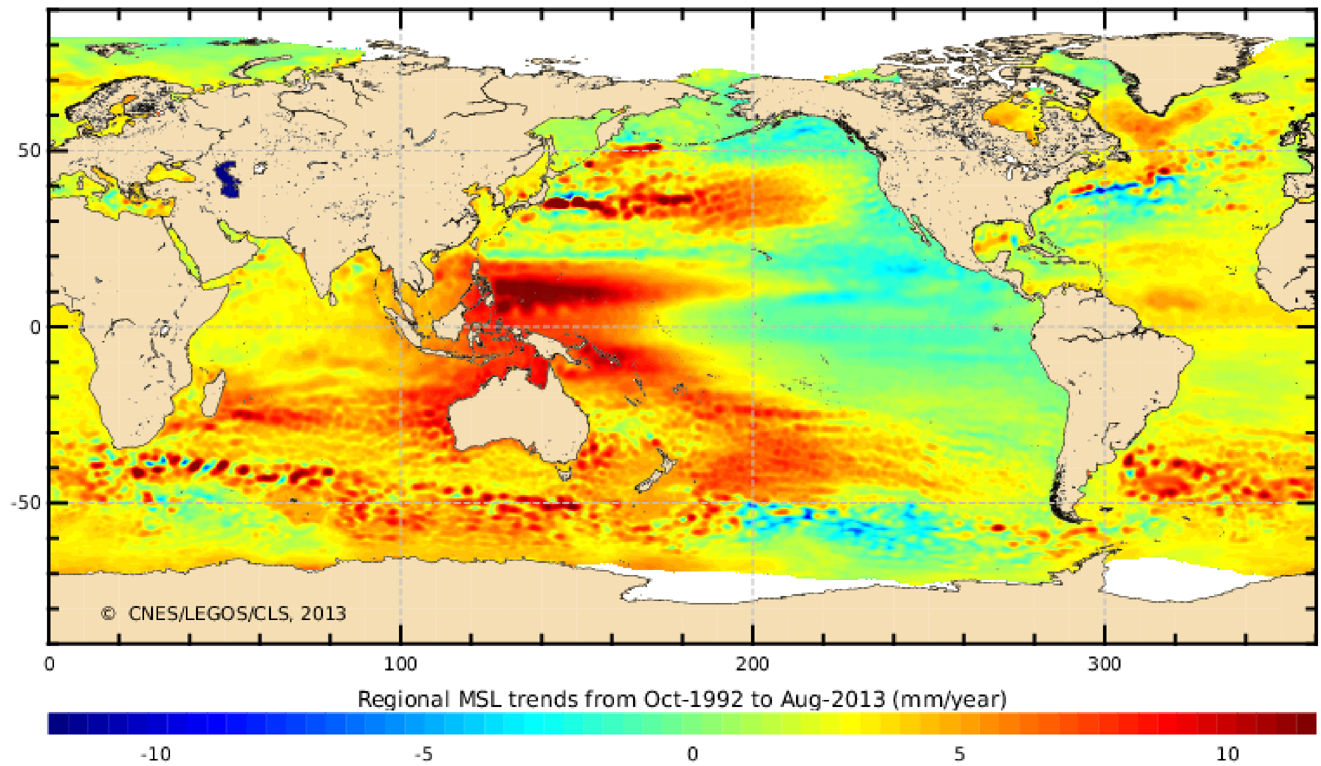


Figure D 4: Global distribution of the rate of absolute sea-level rise between October 1992 and April 2013 as measured by satellite altimeter data. Source: **http://www.aviso.oceanobs.com/en/applications/ocean/mean-sea-level-greenhouse-effect/regional-trends.html.**

The rate of rise of sea levels across the globe is far from uniform. In some places, notably the western Pacific, sea levels have been rising rapidly (> 10 mm a year in some places), in others it has fallen. Since 1993 these regional differences have been measured by satellite and are shown in Figure D 4. The higher rates of sea level rise in the western Pacific over the last ten years (significantly higher than global average rates) are not necessarily an indication of long term increased rates of sea-level rise. Rather it is largely thought to be due to tradewind and oceanographic influences predominantly attributable to inter-decadal variability and not necessarily primarily due to a long-term higher rate of sea-level rise.

Sea-levels are also measured at particular locations by sea-level gauges. In Kosrae a sea level gauge was installed in Lelu Harbour in November 2011. However, there needs to be at least around 25 years of sea-level records before some judgement of long-term relative sea-level rise rates can be made. Longer-records, albeit still less than 25 years, are available from the SEAFRAME tide gauge network for surrounding islands to Kosrae (Pohnpei, Marshall Islands, Nauru). Given the length or records, particularly at Pohnpei there will continue to be monthly and annual variations in the rate of sea-level rise over the foreseeable future.

Table D 1: Relative sea-level rise rates on surrounding islands to Kosrae from the SEAFRAME tide gauge network. Source: http://www.bom.gov.au/ntc/IDO60101/IDO60101.201206.pdf.

Island	Period of record	Rate of sea level rise (mm/year)
Pohnpei	Dec 2001–Jun 2012	+17.8
Marshall Islands	May 1993–Jun 2012	+5.7
Nauru	Jul 1993–Jun 2012	+4.0

Is storm surge increasing?

Storm surge (the short term increase in sea level due to low atmospheric pressure and influence of wind) is a very minor component (except if a typhoon were to occur) of the sea levels experienced in Kosrae. There is nothing obvious to suggest that storm surge has increased in magnitude or frequency or will do so.

Are king tides becoming more frequent?

King tide is a popular name referring to any high tide or sea level that is well above an average height. Over much of the last ten years or so the perception is that king tides have become more frequent. This is indeed likely and is due to a combination of an increased frequency of La Niña events (compared to the period prior to 2000) which has pushed sea levels up and is further exacerbated by the decadal elevation of sea level (e.g., Figure D 4) and sea-level rise.

Long-term sea-level rise will continue to push sea levels higher resulting in high tide levels increasingly exceeding what may be presently considered a king-tide level.

How much sea level rise will occur in the future?

Sea levels will continue to rise primarily because of thermal expansion within the oceans and loss of ice sheets and glaciers on land. How much sea-level rise occurs depends on how humans continue to live and emit greenhouse gases. However, even if greenhouse gas emissions were stabilised today, sea levels would continue to rise. Indeed sea levels to about 2050 are relatively insensitive to changes in emissions over this timeframe because of the long time it takes the oceans to respond to changes in carbon dioxide and atmospheric temperatures, but future changes and trends in emissions become increasingly important in determining the magnitude of sea level rise beyond 2050.

The basic range of projected global mean level rise estimated in the Intergovernmental Panel for Climate Change Fourth Assessment Report (AR4) is for a rise of 0.18 m to 0.59 m (relative to the 1980-1999 average) with potentially an additional 0.1 to 0.2 m in the upper estimates due to additional ice sheet discharge if contributions to sea-level rise were to grow linearly with global temperature change for each emission scenario (Figure D 5). It was also clearly stated that larger contributions from the Greenland and West Antarctic ice sheets over this century could not be ruled out. Subsequently, the increasing component of present-day sea-level rise due to ice-sheet losses has led to a number of more recent estimates of sea-level rise over the 21st century.

These sea-level rise projections are similar in magnitude to the recently released Intergovernmental Panel for Climate Change (IPCC) Fifth Assessment Report . This concluded that the rate of global mean sea level rise during the 21st century will exceed the rate observed during 1971–2010 due to increased ocean warming and loss of mass from glaciers and ice sheets. For the period 2081–2100, compared to 1986–2005, global mean sea level is likely to be between 0.26–0.54 m for the lowest emission scenario considered (Representative Concentration Pathway scenario, RCP2.6) to between 0.45–0.81 m for the highest emission scenario (RCP8.5). The latter scenario corresponds to a rise by 2100 of between 0.53–0.97 m.

The IPCC Fifth Assessment Report also concluded that based on current understanding, only the collapse of marine-based sectors of the Antarctic Ice Sheet, if initiated, could cause global mean sea level to rise above the likely range during the 21st century. This potential additional contribution cannot be precisely quantified but there is medium confidence that it would not exceed several tenths of a meter of sea level rise during the 21st century.

How much sea level rise should we allow for when planning development and infrastructure?

As we don't know exactly how much greenhouse gases will be emitted in the future and what the response of the large ice sheets in Greenland and Antarctica will be to rising temperatures, it is difficult to provide a best or upper estimate of sea-level rise over this century.

Deciding on an appropriate sea-level rise amount to accommodate for a particular decision depends on a pragmatic decision based on a balance between the level of risk that is willing to be accommodated and the associated costs of addressing that level of risk. Essentially it comes down to a balanced consideration between:

- The possibility of a particular sea-level being reached within the planning timeframe or design life. For example over the next 100 years there is a faint possibility that mean sea levels could rise by 2 m but it is much less likely than sea levels rising by 1 m. However, we cannot say for certain for example whether a 0.7 m rise is more or less likely than a 1 m rise over this time period (however, bearing in mind that beyond 2100 sea levels will continue to rise).

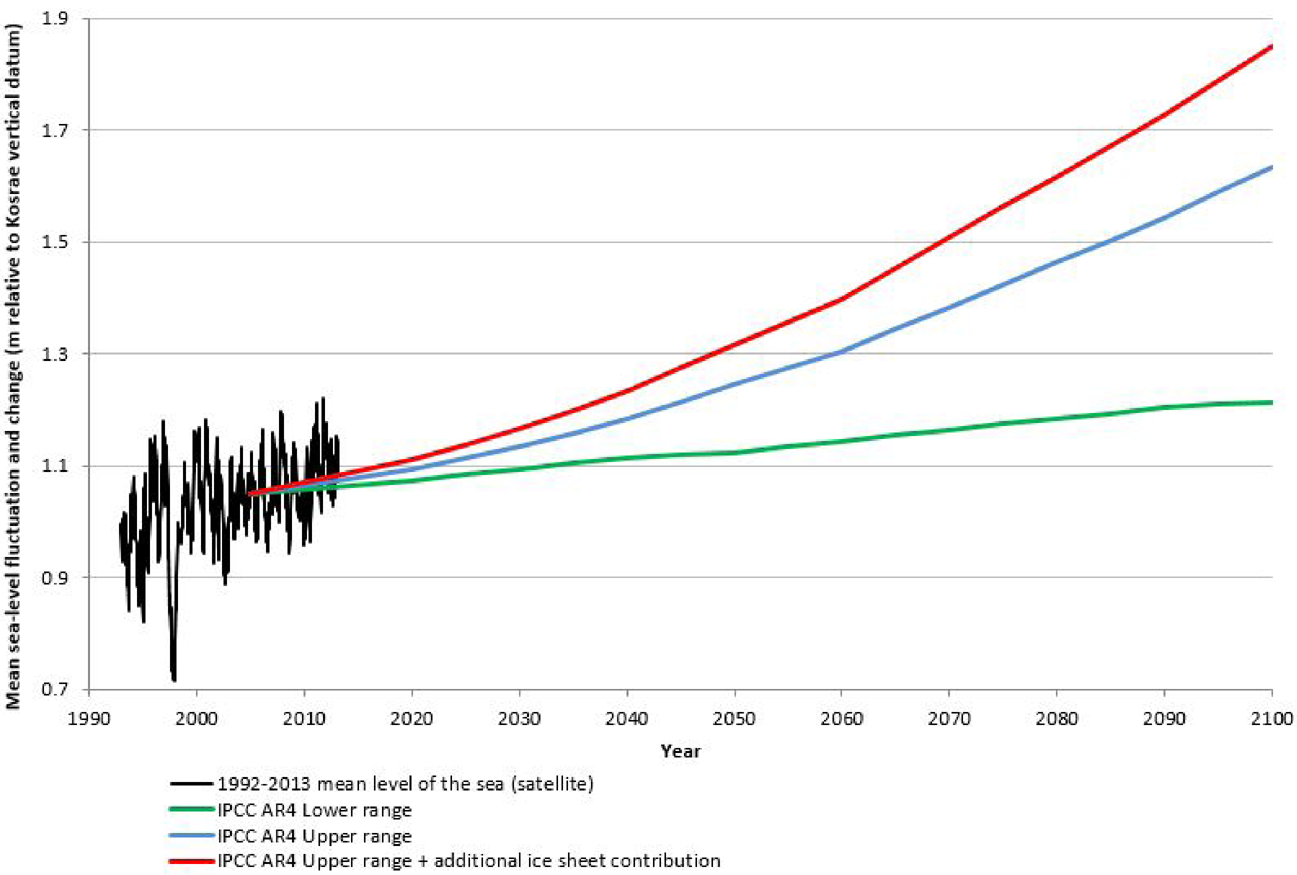


Figure D 5: Absolute mean level of the sea measured at Kosrae by satellite between 1992 and 2013 and the range in IPCC AR4 sea level projections out to 2100. All levels are relative to Kosrae vertical datum based on a comparison between mean level of the seas from satellite and the Kosrae tide gauge at Lelu between November 2011 to November 2012. The sea level projections have been adjusted to 2000-2009 average.

- The associated consequences and potential adaptation costs. For example the consequences of a 2 m rise in sea level are in most cases likely to be much greater than a 1 m rise in sea level, likewise the costs of accommodating a 2 m rise in mean sea level would be much greater than a 1 m rise.
- How any residual risks would be managed for any consequences if sea-level rise occurs at a quicker rate than that accommodated.

As a pragmatic start,Table D 2 provides suggested sea-level rise amounts to be accommodated for coastal-related development, infrastructure and hazard planning activities for the remainder of this century.

Table D 2: Suggested relative sea-level rise allowances relative to the present day for development planning and infrastructure design. The present day is assumed to be the 2000–2009 average.

Timeframe/Design life	Generational timeframe	Sea level rise (m)	Sea-level rise (feet)
2030s	1 generation	0.15	0.5
2050s	2 generations	0.3	1
2070s	3 generations	0.6	2
2090s	4 generations	0.9	3

How much more frequently will present-day high tide levels occur in the future?

Using the sea-level rise allowances over the four different future timeframes in Table D 2, Figure D 6 shows how frequently the high tide levels are expected to be exceeded in Kosrae. A high tide level of 2 m (relative to vertical land datum on Kosrae) is presently a very high tide on Kosrae. A high tide of 2 m is currently only exceeded on average by 2.8% of all high tide levels. Put another way, approximately 97% of all high tides in Kosrae are less than 2m high. However, with sealevel rise these statistics will change, by the:

- 2030s, the high tide level of 2 m will be exceeded by 12% of all high tides.
- 2050s, the high tide level of 2 m will be exceeded by 27% of all high tides.
- 2070s, the high tide level of 2 m will be exceeded by 69% of all high tides.
- 2090s, the high tide level of 2 m will be exceeded by 95% of all high tides.

Essentially by the end of the century, assuming the sea-level rise rates indicated in Table D 2 eventuate, virtually every high tide which occurs on Kosrae will be above what is presently considered a very high (king) tide level. Figure D 7 shows the same exceedence plot as Figure D 6 but with the levels in feet relative to Kosrae's vertical datum. Also shown is the level of the road at Tafuyat (solid black horizontal line) which, at a level of around 9 feet relative to the vertical land datum, and is one of the lowest sections of the coastal road. The exceedence plot shows that for high tide and mean sea-level fluctuations in the:

- 2070s, the road at Tafuyat will be inundated only on the very highest of tides.
- 2090s, the road at Tafuyat will be inundated on average by 14% of high tides.

Appendix D

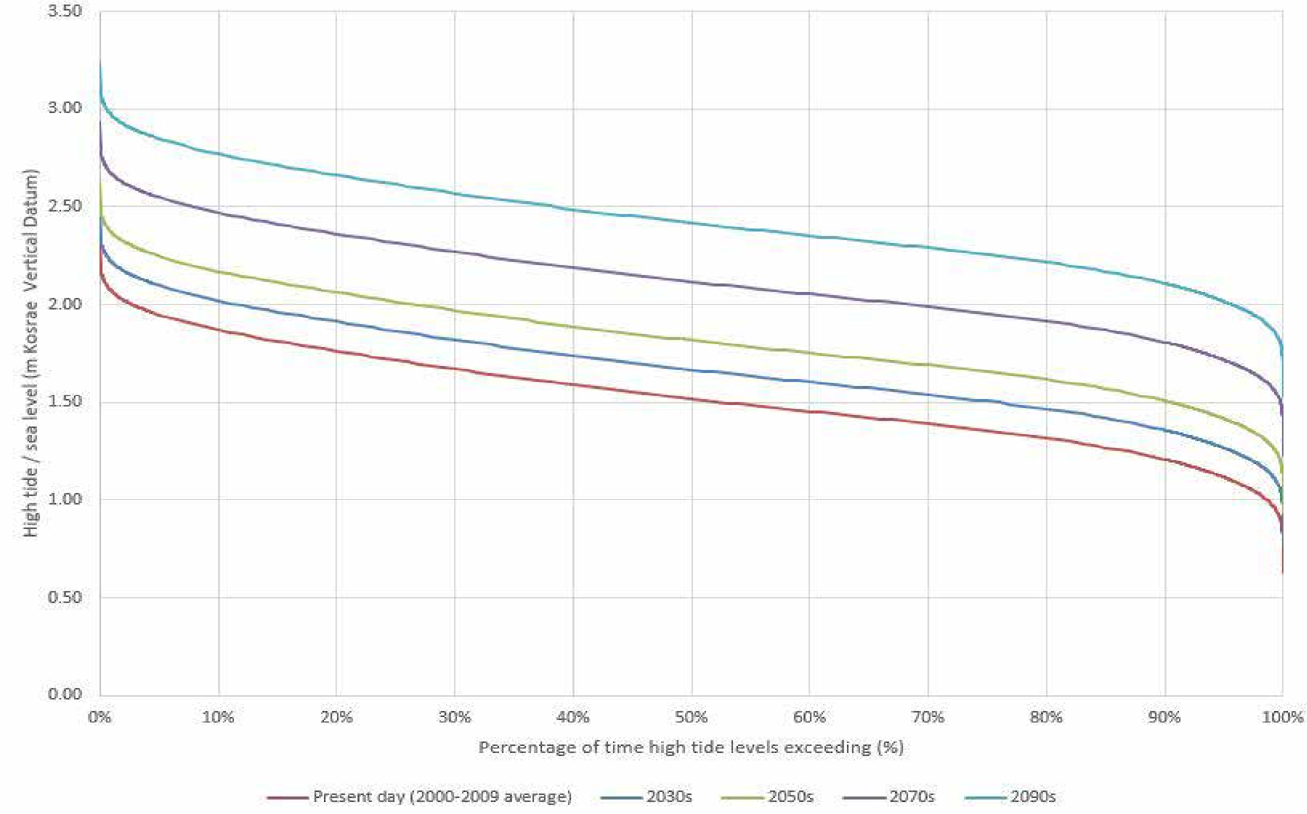


Figure D 6: High tide exceedence curves for the present day and for the 2030s, 2050s, 2070s and 2090s.

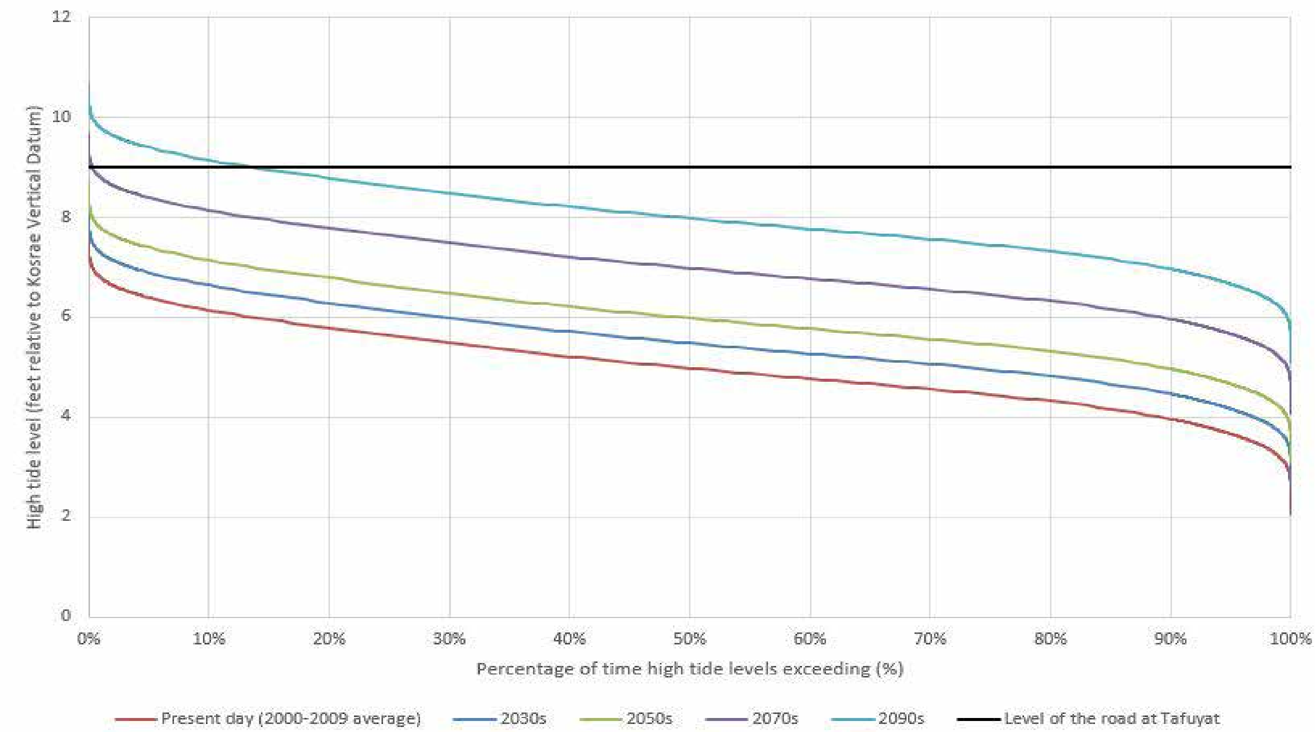


Figure D 7: High tide exceedence curves for the present day and for the 2030s, 2050s, 2070s and 2090s relative to the level of the road at Tafuyat.

What effects will climate change have on other factors influencing coastal hazards?

Much less is known about how climate change will affect other factors that influence coastal hazards (such as swell and wave conditions, storm frequency and intensity and influence of El Niño). However:

- Large swell events, such as occurred in December 2008, will occur occasionally in the future. Climate change is unlikely to have any noticeable change in the frequency of occurrence of such events (although sea-level rise may result in such events causing more significant or damaging inundation).
- A typhoon could potentially significantly impact Kosrae, most likely during an El Niño phase. At present there is little evidence to suggest that climate change will alter the potential for a typhoon to impact on Kosrae – indeed there is some indication that with climate change typhoons may track slightly further north. Whilst Kosrae has not directly experienced a typhoon for over a century there is still a small chance that a typhoon will impact Kosrae in the future.

How will sea-level rise affect overwashing of land and seawalls?

Increases in sea level, and hence increased water depths over the reef flats, will result in larger wave conditions reaching the shoreline on Kosrae. As both wave run-up and overwashing of the beach or coastal defences can be extremely sensitive to small changes in water levels and wave conditions reaching the shoreline, even very small changes in sea-level rise may have a significant impact on the frequency and volume of inundation of the immediate coastal margins of the ocean shorelines of Kosrae.

How will sea-level rise affect low-lying swamp or farm land areas between the coastal berm and the volcanic part of the island?

Increases in sea level (and rainfall) will also affect drainage of low-lying swamp and farm land areas behind the coastal berm leading to an increased frequency of waterlogging and flooding of land, reduced effectiveness of drainage, and potentially increased frequency of drainage and stream outlet blockage at the coast.

Federated States of Micronesia
INFRASTRUCTURE DEVELOPMENT PLAN
FY2016-FY2025

Outline:

Introduction, Volume 1 and Annexes

Introduction

This Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025 comprises the following:

The following Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025 documents are available:

Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025 (all parts)

FSM Infrastructure Development Plan FY2016-FY2025 Outline (Introduction, Volume 1 & Annexes)

National Infrastructure Development Plan FY2016-FY2025 (Volume 2)

Chuuk State Infrastructure Development Plan FY2016-FY2025 (Volume 3)

Kosrae State Infrastructure Development Plan FY2016-FY2025 (Volume 4)

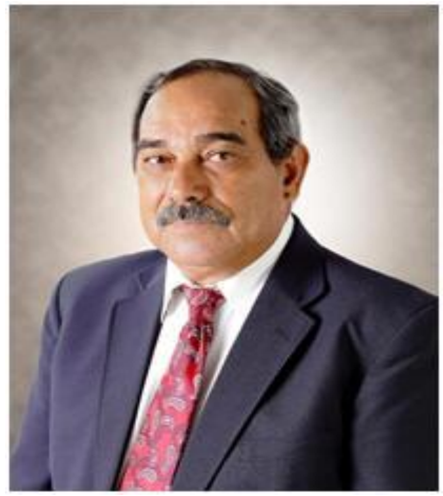
Pohnpei State Infrastructure Development Plan FY2016-FY2025 (Volume 5)

Yap State Infrastructure Development Plan FY2016-FY2025 (Volume 6)

FSM Infrastructure Development Plan FY2016-FY2025 Summary (abbreviated outline and listings of projects)

The President
Palikir, Pohnpei
Federated States of Micronesia

Foreword



As the 8th President of the Federated States of Micronesia I am pleased to present to you an update of our Infrastructure Development Plan for the period FY2016 – FY2025. This ranks with the most important and significant plans of the last 10 years for FSM as a nation.

The key for me is that this Plan presents a truly collaborative approach to infrastructure development for our country. As well as setting out the case for developing infrastructure across the FSM, it documents the priority projects in stand-alone State Plans providing a direct connection to communities and their needs.

I particularly welcome the inclusion of projects directly linked to climate change adaptation – these are important first steps to a mainstream infrastructure adaptation program in future Plans. FSM citizens can also look forward to schools, hospitals, roads and other facilities that are kept in better condition as we improve the way we manage our infrastructure over its life.

A realistic level of funding is included in the Plan, representing 70 percent of FSM's infrastructure needs over 10 years. This sets the challenge for the FSM governments and our development partners to work together to close the funding gap, beginning with the Development Partners Forum that we will convene in 2016.

Finally I recognize the considerable effort that has gone into the Plan from State Infrastructure Planning and Implementation Committees and the State Executives. The assistance of the Asian Development Bank is also acknowledged for providing the technical assistance team that supported the Plan development.

I commend this Infrastructure Development Plan to the people of FSM, at home and abroad, and look forward to the support of our development partners as we begin the challenge of delivering on our vision.

Sincerely,

Peter M. Christian
President of the Federated States of Micronesia

Executive Summary

Plan Investments

This Infrastructure Development Plan for the Governments of the Federated States of Micronesia was prepared by the Department of Transportation, Communication and Infrastructure in consultation with the States of Chuuk, Kosrae, Pohnpei and Yap. The Plan covers the infrastructure in ten sectors: electric power, water/wastewater systems, solid waste management, road and pedestrian facilities, maritime transportation, air transportation, telecommunications, education, health and government administrative buildings.

The priority infrastructure development projects that make up the majority of the Plan have been identified and prioritized by each of the governments through a structured and transparent process to produce project listings that best meet their development needs over the next 10 years. This included assessing the priority development projects against nine strategic objectives to ensure that they make a strong contribution to one or more of the objectives associated with the FSM's economic development, social development, environment and institutional capacity.

The priority infrastructure development projects in the ten sectors at National and State level plus project management costs, institutional projects and infrastructure maintenance represent a total investment of $1,082 million over the 10-year Plan period. For the first time a project specifically targeted at cross-sector climate change adaptation is included. This project in Yap will be followed in the future by similar projects identified through the Joint National/State Action Plan processes that are now coming on-line across the FSM.

The Plan incorporates the following investments by sector and by government:

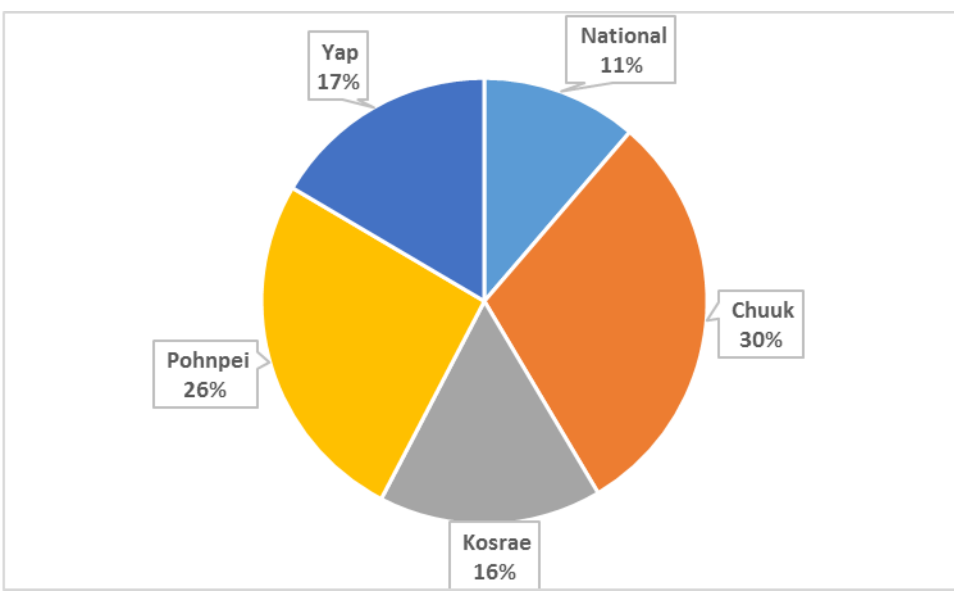
Infrastructure Sector	Planned Infrastructure Investment ($ millions)					
	National	Chuuk	Kosrae	Pohnpei	Yap	All
Electric Power	-	7.8	17.6	62.6	7.1	**95.1**
Water/Wastewater Systems	-	7.0	14.6	35.7	16.8	**74.1**
Solid Waste Management	-	3.5	0.3	4.5	3.7	**12.0**
Road and Pedestrian Facilities	-	95.0	51.0	45.0	18.1	**209.0**
Maritime Transportation	-	8.5	21.6	6.7	41.9	**78.7**
Air Transportation	0.5	34.2	31.0	0.6	32.8	**99.1**
Telecommunications	13.4	-	-	-	-	**13.4**
Education	69.3	44.7	3.0	73.1	15.7	**205.8**
Health	-	73.0	18.5	15.3	1.7	**108.5**
Government Administrative Buildings	28.1	-	1.1	5.2	16.9	**51.3**
Climate Change Adaptation	-	-	-	-	4.0	**4.0**
Program Management	7.5	10.0	4.0	5.0	4.0	**30.5**
Development Subtotal:	**118.7**	**283.7**	**162.7**	**253.8**	**162.4**	**981.4**
Institutional	2.4	2.0	-	-	-	**4.4**
Infrastructure Maintenance	1.2	40.6	12.6	25.5	16.3	**96.2**
Total Infrastructure Investment:	**122.3**	**326.3**	**175.3**	**279.3**	**178.7**	**1,082.0**

Implementation has been planned over three periods; Period 1: FY2016 to FY2019, Period 2: FY2020 to FY2023, Period 3: FY2023 to FY2025. Appropriation of all Amended Compact funding arrears is included in Period 1. The proposed sources of funding for the FSM's 10 year infrastructure investment program by implementation period are outlined in the following table:

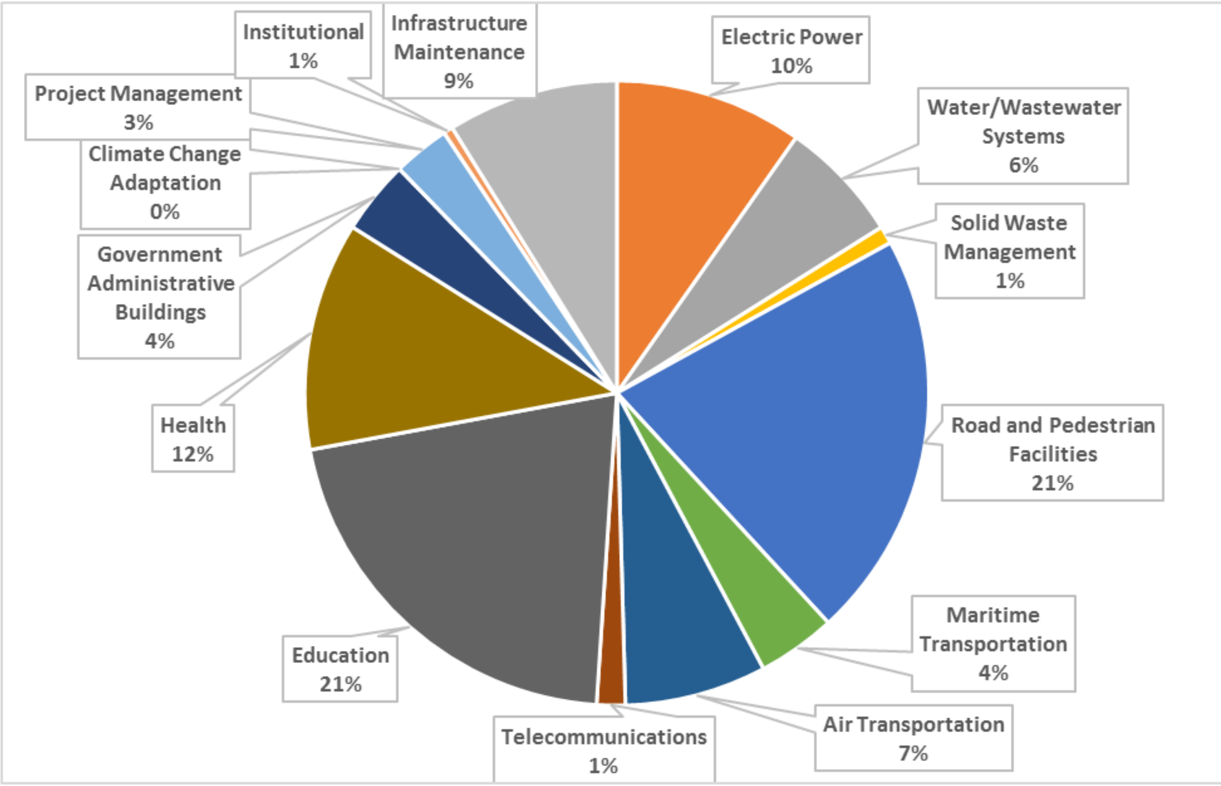
Infrastructure Investment Funding Source	Funding Amount ($ millions)			
	FY2016 FY2019	FY2020 FY2022	FY2023 FY2025	FY2016 FY2025
FSM National Government	77.2	48.9	48.9	**175.0**
FSM State Governments (matching maintenance funds)	4.8	3.6	2.4	**10.8**
Bilateral Development Partners				
Amended Compact	207.4	71.7	23.8	**302.9**
Compact Trust Fund			24.5	**24.5**
US Federal Agencies	27.0			**27.0**
European Union	16.5	8.7	10.8	**36.0**
Japan	20.0	15.0	15.0	**50.0**
PR China	24.4	15.0	15.0	**54.4**
UN Climate Adaptation Funds	7.2	11.8	12.0	**31.0**
Multilateral Development Partners				**0.0**
Asian Development Bank	17.0	16.5	16.5	**50.0**
World Bank Group		10.5	10.5	**21.0**
Total:	**401.5**	**201.7**	**179.4**	**782.6**

The following charts illustrate the infrastructure investments by sector/activity and by government, as well as infrastructure funding by source.

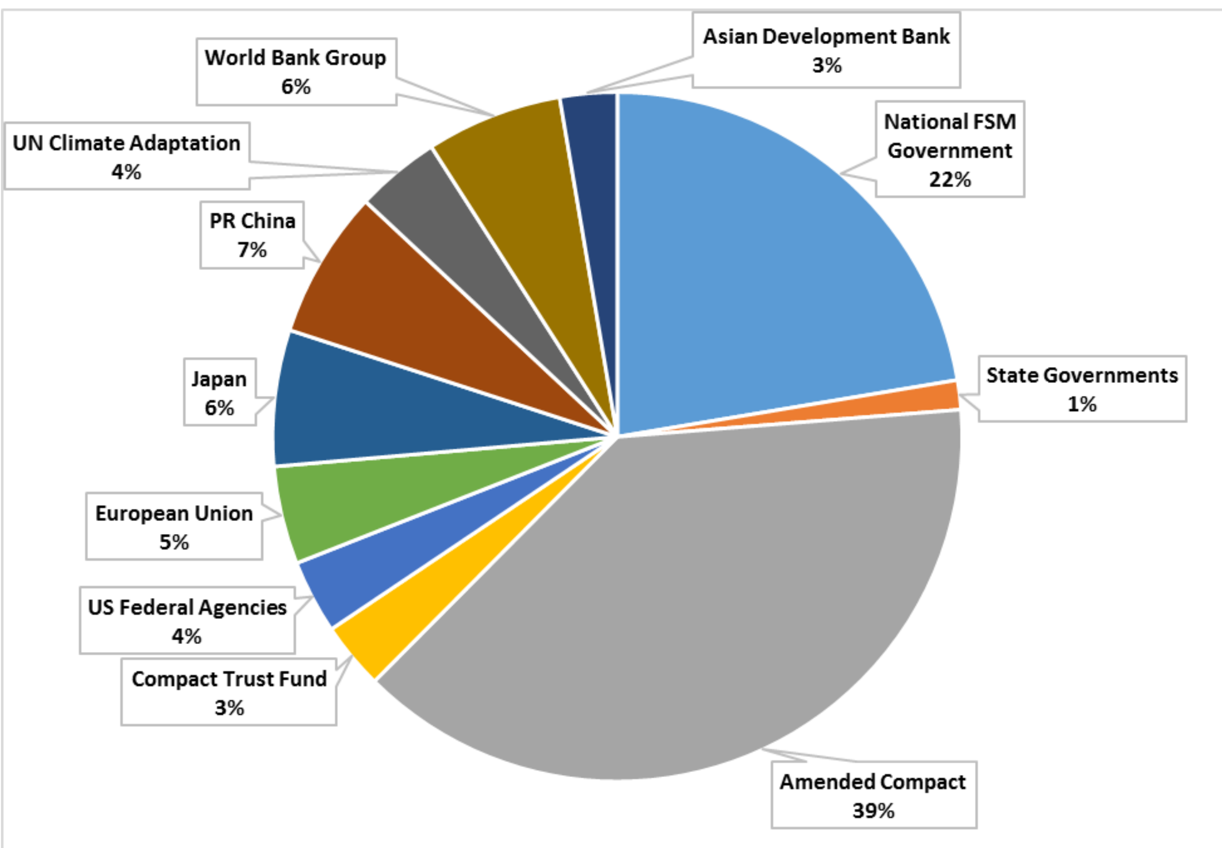
Infrastructure Investments by Government



Infrastructure Investment by Sector and Activity



Infrastructure Funding by Source



Plan Implementation

Accountability for implementing the Plan at State level will lie with the Infrastructure Planning and Implementation Committees that were established more than 10 years ago. An important improvement in this Plan is the establishment of a Project Management Office in each State, responsible to the Committee for the day-to-day planning and implementation of projects, initially on Amended Compact funded projects and progressively for the projects funded from other sources.

At National level the Department of Transportation, Communication and Infrastructure will assume the overall program coordination role, supported by the Program Management Unit, and will work closely with the Departments of Finance and Administration and Foreign Affairs as the interfaces with bilateral and multilateral development partners.

With a number of projects having already been designed under the initial 2004 Infrastructure Development Plan, implementation of this Plan will begin immediately.

Acronyms & Abbreviations

ADB	Asian Development Bank
ADF	ADB Asian Development Fund
AIP	FAA Airport Improvement Program
Amended Compact	Amended Compact of Free Association
CC	Climate Change
CMD	Compact Management Division
Compact	Compact of Free Association
COM	College of Micronesia
CPUC	Chuuk Public Utility Corporation
CTF	Compact Trust Fund
DFA	Department of Foreign Affairs
DOI	US Department of Interior
DRD	Department of Resources and Development
DTCI	Department of Transportation, Communication and Infrastructure
EDF	European Development Fund
EIA	Environmental Impact Assessment
ENSO	El Niño-Southern Oscillation
EU	European Union
FAA	US Federal Aviation Administration
FSM	Federated States of Micronesia
FSMTC	FSM Telecommunications Corporation
FY	Financial Year (1 October to 30 September)
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IDP	Infrastructure Development Plan FY2016 – FY2025
IDP 2004	Infrastructure Development Plan FY2004 – FY2023
IMF	Infrastructure Maintenance Fund
IPIC	Infrastructure Planning and Implementation Committee
JEMCO	Joint Economic Management Committee
JICA	Japanese International Cooperation Agency
JNAP	Joint National Action Plan
JSAP	Joint State Action Plan
KIPIC	Kosrae Infrastructure Policy Implementation Committee
KSDP	Kosrae Strategic Development Plan
KUA	Kosrae Utilities Authority
OCR	Ordinary Capital Resources
ODA	Overseas Development Assistance
ODAD	Overseas Development Assistance Division
OEEM	Office of Environment and Emergency Management
OIA	Office of International Affairs
O&M	Operations and Maintenance
Plan	Infrastructure Development Plan FY2016 – FY2025
PMO	Project Management Office
PMU	Program Management Unit
PSDP	Pohnpei Strategic Development Plan
PUC	Pohnpei Utilities Corporation
RUS	USDA Rural Utilities Service
SDC	Sustainable Development Council
SDP	Strategic Development Plan (2004 – 2023): Achieving Economic Growth and Self-Reliance
SPC	Secretariat of the Pacific Communities
UNFCCC	United Nations Framework Convention on Climate Change
USDA	US Department of Agriculture
US	United States of America
YSPSC	Yap State Public Service Corporation

Volume 1 Plan Outline

Contents

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Part 1 Context

1.1 Country Information

1.1.1 General and Demographic information

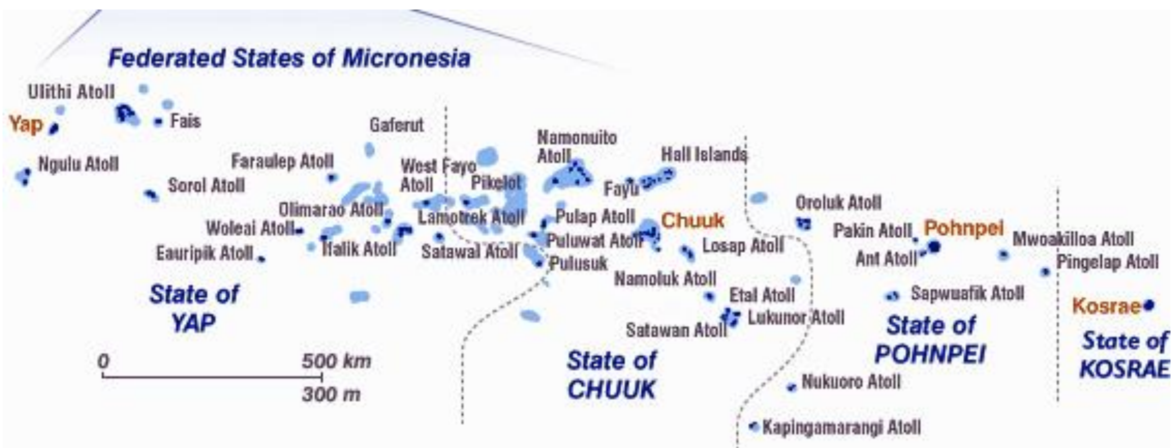
The Federated States of Micronesia (FSM) is a sovereign country comprised of 607 small islands spread over more than one million square miles of ocean in the Western Pacific. Only 67 of the islands are inhabited. Total land mass area is small, amounting to 270.8 square miles, with only 6 percent of the land arable. The other two Compact of Free Association nations are its closest neighbors, Marshall Islands to the northeast and Palau to the west. North of the FSM lie the United States territories of Guam and the Northern Mariana Islands.

The FSM's population is predominately Micronesian and comprised of eight major ethnolinguistic groups and numerous spoken dialects. Each state has its own languages, culture, local government, and traditional systems. With such diversity, English is the country's official language of government (although less so at the state or municipal levels), and for secondary and tertiary education. Communal values influence politics, daily business and personal transactions in both direct and indirect ways.

Twenty-two percent of all inhabitants live in "urban" town areas but may own property elsewhere in their respective states.

Land is part of family trusts that pass down land use rights, surface and subsurface, from generation to generation within the extended matrilineal family system. Clans hold many parcels, leading to fractional ownership and uncertain boundaries and titles. By Constitution, only citizens can own land. Domestic corporations that have non-citizen shareholders may not own land.

Figure 1 – Map of the Federated States of Micronesia



At the time of the 2010 census FSM had a population of 102,843 comprised of: Yap 11,377, Chuuk 48,654, Pohnpei 36,196 and Kosrae 6,616. This population count was a decline of 4,344 persons (-4.1 percent) relative to the 2000 census total. At the state level between 2000 and 2010, Chuuk and Kosrae had negative growth while in Pohnpei and Yap the rate of growth was positive but very low at 0.4 percent and 0.1 percent respectively. Out-migration to the United States and other parts of Micronesia is the primary cause of the overall decline in population with a reducing fertility rate also contributing.

Long-range population projections suggest a continuation of little or no population growth for the foreseeable future. Projections to 2030 suggest no population growth from 2010 and less than 10percent total growth up to 2050. The level of urbanization in FSM remains relatively low at 22

PLAN OUTLINE

percent[1]. Most people live a rural lifestyle largely dependent on their gardens and fishing for daily food requirements, although imported food is an increasing part of the diet. People are attracted to urban centers for incomes directly or indirectly derived from offshore transfers in the form of grants from the United States (US) and other donors.

Based on a 2008 poverty assessment[2], 11 percent of the population suffered from food poverty, while 29.9 percent of the population suffered from basic needs poverty. The opportunities for income generation are limited, especially in the rural parts of the country. With the stagnation of real incomes since 2005 accentuated by sharp decreases in gross domestic product (GDP) since 2012, poverty will have worsened.

1.1.2 Government Framework

The Constitution of the FSM provides for three separate branches of government at the national level similar to those of the U.S. The National Congress, however, is unicameral. It has four at-large senators, one from each state that serves four years, and ten senators who have two-year terms. The President and Vice President are senators at-large elected by Congress rather than by popular vote. The last Congressional election for four-year terms was in March 2015. The 19th FSM Congress elected Pohnpei's Peter M. Christian to be the eighth President of the Federated States of Micronesia.

The nation itself is a loose federation. State affiliation tends to overshadow national identity.

The FSM Constitution limits the FSM national government's (executive branch) power and confers "residual powers" to the states, necessitating a complex and lengthy consultative process before the implementation of new national policies, regulations and programs.

1.1.3 Compact of Free Association

In 1986 FSM entered into a Compact of Free Association (Compact) with the US. FSM has full control over all aspects of domestic and foreign policy, with the exception of defense and security issues for which the United States is responsible. The Compact also affords the US defense and operating rights in FSM and grants FSM citizens access to US federal programs and favorable provisions for travelling to and working in the US.

A second Compact agreement, the Amended Compact of Free Association (Amended Compact), came into effect in 2004 and provides $1.8 billion of funding over twenty years, including contributions to a Compact Trust Fund (CTF) intended to replace the direct financial assistance that concludes in 2023.

1.2 Economic and Strategic Planning

1.2.1 The Economy

The FSM economy has languished over the last decade and real GDP growth has averaged -0.4 percent. This has resulted in declining living standards and contributed to net outward migration. An ongoing excess of imports over exports sees a continuing deficit in the trading account of the balance of payments. The economy is firmly tied to overseas aid which is significant relative to domestic revenues at the State level and is dominated by funding coming from the Amended Compact.

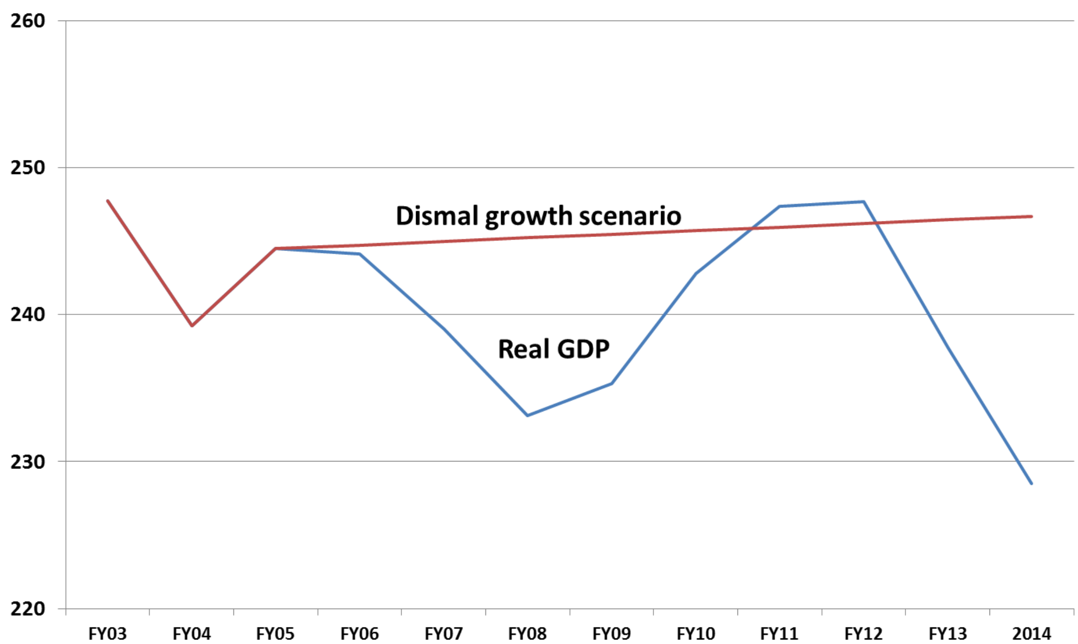
Most recently the March 2012 JEMCO resolution that no further Amended Compact infrastructure grants will be made until the IDP 2004 is updated has led to a decline in construction activity of 26 percent in FY2013 followed by 41 percent in FY2014. Along with a 15 percent decline in domestic fisheries in 2013 this has contributed to the worst period of economic performance since the start of Amended Compact

[1] (Jones, 2011) - The State of Pacific Towns and Cities
[2] (World Bank, 2014) - International Development Association and International Finance Corporation Country Partnership Strategy for the Federated States Of Micronesia for the period FY2014 – 2017

in FY2004 with sharp contractions in GDP of -3.6 percent in FY2013 followed by -3.4 percent in FY2014 as illustrated in Figure 2.

At the end of FY2015 there is $111.3 million in unallocated Amended Compact infrastructure funds. Obtaining the release of these funds is critical to restoring construction activity and getting GDP out of negative growth. Infrastructure development will contribute to significant improvement in GDP with the availability of Amended Compact arrears and annual appropriations over the next four years.

Figure 2 – Real GDP Levels ($ millions)



Source: CMD presentation to JEMCO, August 2015 – "Dismal growth scenario" was the lowest forecast growth scenario in the SDP

In view of past economic performance and the end of Amended Compact grants in 2023 the FSM governments developed an economic growth strategy, the **2023 Action Plan** (section 1.2.3), the aim of which is to ensure that the transition from Amended Compact grants to CTF revenue does not threaten service delivery. The thrust of the plan is to grow the economy by strengthening the private sector while lessoning the dependence on the public sector. The overall target of 2 percent per annum economic growth is dependent on reforming structure, tax and public administration. The economic growth target also requires improved performance in six key areas: tourism, agriculture, fisheries, energy, information and communication, and infrastructure.

Expanding public infrastructure will add to the productive capacity of the economy in the longer term and in the short term create jobs. To facilitate this a key component of the 2023 Action Plan is to accelerate appropriation of the Amended Compact infrastructure arrears of $111.3 million over four years (FY2016 to FY2019). Together with the renewed flow of annual Amended Compact infrastructure funds, this will provide a $207.4 million boost to the construction sector in particular and the economy in general.

1.2.2 Previous Strategic and Infrastructure Planning

Strategic Development Plan 2004 – 2023

FSM's Strategic Development Plan 2004 – 2023: The Next 20 Years, Achieving Economic Growth and Self-Reliance (the SDP) was prepared with broad participation of a wide range of stakeholders and provides a road map for social and economic development in FSM for the period 2004 – 2023. The SDP states four main objectives:

1. Stability and security - to maintain economic assistance at levels that support macroeconomic stability; achievement of this objective requires levels of funding close to prevailing levels, to avoid the large periodic step downs in funding that were a characteristic of the first 14- year Compact funding package.
2. Improved enabling environment for economic growth - to be achieved through the FSM commitment to economic reform and the provision of an enabling environment to support open, outward - oriented and private sector led development.
3. Improved education and health status – use of the annual Compact grant to support the provision of basic services in education and health.
4. Assured self-reliance and sustainability - to be achieved through establishment of a Trust Fund that would, after a period of time, replace the annually appropriated transfers from the US.

The sustained growth strategy presented in the SDP has six key areas:

1. macroeconomic stability
2. good governance
3. developing an outward-oriented, private sector-led economy
4. investing in human resources (improved health and education services)
5. investing in infrastructure
6. long-term environmental sustainability

The SDP consists of three volumes. Volume 1 provides for the macro-economic framework and the policies for each sector, Volume 2 contains the sector planning matrices and Volume 3 is the Infrastructure Development Plan.

1.2.3 Recent Economic and Strategic Planning

Working with Development Partners

While the US through the Amended Compact and Federal grants is the dominant partner, other main bilateral partners include Australia, China, Japan, the European Union through regional bodies such as the Secretariat of the Pacific Communities, and the United Nations.

Historically, FSM's dialogue and coordination with non-US bilateral development partners has been weak due to the dominance of the Compact, but with 2023 looming has recently been strengthened. An Overseas Development Assistance (ODA) policy was approved by Congress in January, 2014. The purpose of the policy is to establish approaches to managing ODA such that benefits are maximized for all stakeholders. The policy acknowledges, recognizes and respects the unique circumstances of each state but also seeks commonalities across FSM. Implementation of the policy began in 2014.

A Development Partners Meeting took place in November, 2012 with the purpose of accelerating implementation of the SDP and seeking development partner support across four broad areas:

1. growing the local economy through enhancing agriculture production and the production of value added agriculture products, maximizing benefits of FSM's fisheries resources, promoting tourism, developing clean, renewable energy sources
2. developing economic infrastructure, including transport, communications, and power
3. improving health and education services
4. mainstreaming responses to climate change and mitigating threats to the environment

A second Development Partners meeting is scheduled for 2016 where development partners will be invited to commit to funding IDP priority projects.

2023 Action Plan

The FSM Governments prepared the **2023 Action Plan** in 2014 aimed at addressing the fiscal and economic challenges leading up to and post FY2023. It is based on the mutual principals of Amended Compact which are to "promote the economic advancement, budgetary self-reliance, and economic self-sufficiency of the FSM". The 2023 Action Plan includes a long-term fiscal reform strategy and a long-term sustainable growth strategy with the emphasis on private sector led growth.

With infrastructure investments an important driver for economic growth, directly by generating employment and income and indirectly facilitating the development of other sectors of the economy, a key component of the plan is to eliminate the infrastructure funding backlog within four years.

1.2.4 State Strategies

Chuuk

Chuuk is currently developing a strategic development plan to guide the future development of the State.

Kosrae

In 2013 the **Kosrae Strategic Development Plan: 2014 – 2023** (KSDP) was finalized, recognizing the needs and aspirations of the Kosrae community and stakeholders in Kosrae. The KSDP takes a 10 year view of Kosrae and its place in Federated States of Micronesia and the North Pacific region and the opportunities and concerns that it faces.

Additional aspects of the KDSP are included in Volume 4.

Pohnpei

The **Pohnpei State Strategic Development Plan** (PSDP) is a strategic policy document intended to organize and integrate existing sector plans and programs, and the SDP to meet the unique needs of Pohnpeian citizens and residents and to present a unified vision of Pohnpei's future.

Additional aspects of the PDSP are included in Volume 5.

Yap

Yap is currently without its own strategic development plan.

1.2.5 Sector Policies

Sector Policies

The goals and institutional reforms included in the IDP 2004 for each sector have largely been incorporated into the IDP. More recently policies have been released for the energy and telecommunications sectors, and more relevant objectives in the education sector have been identified in State school repair and construction master plans and in the College of Micronesia Master Plan.

Energy Sector Policy

The National Energy Policy[3] has four primary components: Policy and Planning, Conventional Energy (fossil fuel), Energy Efficiency and Conservation, and Renewable Energy.

The policy has targets to increase the share of renewable energy to 30 percent of energy supply by 2020 and to increase energy efficiency by 50 percent, also by 2020. With the electric power sector being an important component of the larger energy sector these targets have been taken into consideration when identifying and prioritizing projects in the IDP.

[3] (DRD, DoE, 2010) - Federated States of Micronesia Energy Policy, Volumes I and II

Telecommunications Sector Policy

The Information and Communications Technology (ICT) Policy[4] aims at:

1. achieving accessible and affordable communications for all
2. strengthening ICT human resources and increasing human resource development opportunities through ICT
3. improving economic growth and sustainable development through ICT
4. utilizing ICT for good governance
5. creating an enabling ICT environment through policy reform and improved legal frameworks

The aims of the policy have been taken into consideration when identifying and prioritizing projects in the IDP.

1.3 Infrastructure Planning

1.3.1 Infrastructure Development Plan 2004-2023

The **Infrastructure Development Plan 2004-2023** (IDP 2004) (Volume 3 of the SDP) was prepared by the Department of Transportation, Communication and Infrastructure (DTCI) in consultation with the States and under the guidance of a national IDP Steering Committee. IDP 2004 assessed the state of infrastructure and the needs in nine sectors and incorporated a program and budget covering the period FY2004-FY2023. Special consideration was given to the likely funding available from the Amended Compact and from other sources.

The National Vision and Objective statements in IDP 2004 for Infrastructure are:

> **Vision:** To improve the life and livelihood of all FSM citizens with affordable, reliable and environmentally sound infrastructure.
>
> **Objective:** To promote the sustainable social and economic development of FSM through the provision and utilization of cost-effective, safe, reliable and sustainable infrastructure.

The IDP 2004 included $748 million of indicative funding for infrastructure investments to be implemented over the 20-year period. The IDP 2004 also included a further $878 million of "unfunded projects" for a total of $1,626 million. Amounts by sector are shown in Table 1.

Actual funding in FY2004 to FY2015 amounted to $600 million representing 80 percent of IDP 2004 indicative funding with eight years of the IDP 2004 to run. If the withheld Amended Compact funding FY2013 to FY2015 had been granted actual funding would be around 90 percent of the IDP 2004 indicative funding.

Compared with the average IDP 2004 funding of $35 million per year, the actual average funding rate of around $58 million per year with full Amended Compact funding demonstrates FSM's ability to source additional infrastructure funds.

[4] (DTCI, DoC, 2012) - Federated States of Micronesia National ICT and Telecommunications Policy

Table 1 – Planned IDP 2004 Sector Investments

Sector	IDP 2004 Project Totals 2004-2023 ($ Millions)			Actual FY2004 to FY2015[1]		
	Funded	Unfunded	Total	Total ($ millions)	% of IDP Funded	% of IDP Total
Electric Power	81.1	56.9	138.0	48.0	59%	35%
Water/Wastewater Systems	141.9	266.2	408.1	41.0	29%	10%
Solid Waste Management	40.8	102.5	143.3	0.3	1%	0%
Roads and Pedestrian Facilities	120.9	155.6	276.5	56.8	47%	21%
Maritime Transportation	88.5	141.6	230.1	32.5	37%	14%
Air Transportation	68.4	17.1	85.5	237.8	348%	278%
Telecommunications[2]				51.4		
Education	135.4	138.1	273.5	45.8	34%	17%
Health	32.5	0.0	32.5	11.2	34%	34%
Government Administrative Buildings	27.3	0.0	27.3	17.5	64%	64%
Infrastructure Maintenance[3]				36.2		
Program Management (incl. PMU, designs)	10.7	0.0	10.7	21.1	197%	197%
TOTAL	**747.5**	**878.0**	**1,625.5**	**599.6**	**80%**	**37%**

Notes:

1. Estimate based on Amended Compact Grants, ODA Funding & National & State Government appropriations
2. Telecommunications Systems was included in IDP 2004 as a sector but did not have an investment plan
3. Maintenance funding included in IDP 2004 sector funding

1.3.2 Infrastructure Development Plan 2016 - 2025

This **Infrastructure Development Plan FY2016 – FY2025** (the IDP or Plan) outlines the governments of the FSM priorities and plans for major infrastructure initiatives over the next 10 fiscal years. This is the second infrastructure development plan and the prioritization of projects will be reviewed at regular intervals as part of the national and state planning and budgeting processes. The next review of project priorities will be undertaken in FY2019.

The IDP includes infrastructure development initiatives of national, state and local significance. It is the result of extensive consultation with infrastructure managers and stakeholders at national, state and local level and covers the following sectors:

- electric power
- water/wastewater systems
- solid waste management
- roads and pedestrian facilities
- maritime transportation
- air transportation
- telecommunications
- education
- health
- government administrative buildings

PLAN OUTLINE

The IDP presents a systematic approach to infrastructure planning, coordination and implementation, setting out the governments' priorities for infrastructure investments, developed at the national level and across the states and sectors on a project by project basis. In particular the IDP provides:

- the foundation for medium and longer term infrastructure budget planning through its overview of the scale and sequencing of future investment and financing needs
- a strengthened institutional framework for infrastructure planning and implementation at program and project levels
- an approach for transitioning to whole-of-life asset management
- consolidated guidance for FSM's development partners on the priorities and scope of FSM's infrastructure needs over the next 10 years

1.3.3 Amended Compact Requirements

Article V of the Amended Compact sets out the Pre-Award Requirements for grant assistance including the submission of annual implementation plans developed by the Government of the FSM in conjunction with its budget process. It further goes on to describe additional requirements for infrastructure assistance, including:

> (e) The Government of the Federated States of Micronesia shall develop and submit a nationwide infrastructure development plan (IDP) to the Government of the United States for review. Projects may be phased over two or more years. The annual implementation plan for the infrastructure sector referred to in (b) above, shall include a list of integrated state and national priorities for new and reconstructed capital infrastructure to be financed by Compact funds, cost requirements, and implementation schedule. This project list and any revision thereto shall be submitted to the Government of the United States. Insofar as Grant funds are involved, the IDP shall be subject to the concurrence of the Committee.

1.4 Environment and Climate

The SDP incorporates an Environment Sector Strategic Plan with its own strategic goals, policies and outcomes, including:

> **Strategic Goal 1**: Mainstream environmental considerations, including climate change, in national policy and planning as well as in all economic development activities
>
> (SDP, section 7.2.1)

FSM's climate change profile and vulnerability and disaster risk reduction have been documented in a range of reports, including:

- Analysis of Integrating Disaster Risk Reduction and Climate Change Adaptation in the US Pacific Islands and Freely Associated States[5]
- Climate Change Profile, Federated States of Micronesia[6]
- Climate Variability, Extremes and Change in the Western Tropical Pacific[7]

[5] (Anderson, 2012) - Analysis of Integrating Disaster Risk Reduction and Climate Change Adaptation in the US Pacific Islands and Freely Associated States, Technical Report 201105, Hazards, Climate, and Environment Program
[6] (GCCA, July 2013) - Climate Change Profile, Federated States of Micronesia, Version 2
[7] (ABM/CSIRO, 2014) - Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports, Pacific-Australia Climate Change Science and Adaptation Planning Program

1.4.1 Environmental Planning

The Environmental Sector Strategic Plan includes the following outcome measure for Strategic Goal 1:

> Environmental Impact Assessments (EIA) carried out for 100% of all government and non-government development activities to minimize adverse impacts of development on the nation's environment from 2005 onwards
>
> (SDP, section 7.2.1, para 57)

Environmental legislation does not necessarily require EIAs on all projects however in keeping with the intent of Strategic Goal 1 and the above outcome measure **all IDP projects will comply with relevant environmental planning provisions**, unless explicitly exempt.

1.4.2 Current Climate

Due to the geographical spread of the FSM, the climate varies on an east to west basis. There is little seasonal variation in temperature with less than 3°F (1.5°C) between the average hottest and coolest months. There are two distinct seasons; a wet season from November to April and a dry season from May to October. Droughts, tropic storms, storm waves, flooding and landslides all affect FSM.

FSM's climate can vary considerably from year to year due to the El Niño-Southern Oscillation (ENSO) that sees both El Niño and La Niña events on a cyclic basis. El Niño events are associated with drier conditions and occasional droughts when associated water and food shortages can occur. During La Niña, above-average numbers of tropical storms occur as well as more rainfall.

1.4.3 Expected Future Climate

Predictions of climate change in countries of the Western Pacific, including FSM, has been developed under Pacific-Australia Climate Change Science and Adaptation Planning Program [7]. All emissions scenarios show that temperatures will rise in FSM, as will sea level and ocean acidification. The intensity and frequency of days of extreme rainfall are projected to increase and tropical storm frequency is projected to decline.

The ENSO is expected to continue to influence variability in FSM's climate however as there is no consistency in projections of future ENSO activity it is not possible to determine whether inter-annual variability in rainfall will change in the future.

For the period to 2100, the latest global climate model projections and climate science findings indicate:

1. El Niño and La Niña events will continue to occur in the future (very high confidence), but there is little consensus on whether these events will change in intensity or frequency;
2. annual mean temperatures and extremely high daily temperatures will continue to rise (very high confidence)
3. average annual rainfall is projected to increase (medium confidence), with more extreme rain events (high confidence)
4. drought frequency is projected to decrease (medium confidence)
5. ocean acidification is expected to continue (very high confidence)
6. the risk of coral bleaching will increase in the future (very high confidence)
7. sea level will continue to rise (very high confidence)
8. wave height is projected to decrease in December–March (low confidence), and waves may be more directed from the south in the June–September (low confidence)

1.4.4 Response to Climate Change

National Level

The National Climate Change Policy of 2009[8] includes the following key elements related to infrastructure:

1. Mitigation
…..
c. To maintain and enhance FSM as a negative carbon country through effective management of our natural sinks, bio-sequestration, promotion of renewable energy and energy efficiency and other appropriate means.
d. To prioritize actions that address both mitigation and adaptation such as water development using renewable energy (solar water desalination) and other relevant actions.

2. Adaptation
a. To require all development activities in FSM to take into account projected climatic changes in the design and implementation as stipulated in the FSM Strategic Development Plan/Infrastructure Development Plan (SDP/IDP).
b. To use eco-system based approaches where applicable.

3. Technology Transfer
a. To optimize the use of local technologies where available.
b. To identify technologies that are locally appropriate.
c. To enhance easy access to, and sustainable use of new technologies.

4. Finance
a. To maximize the use of local resources through establishment of sustainable financing mechanism to support adaptation, mitigation and resource management initiatives.

In 2012 FSM published an Action Plan[9] and in 2013 passed a Climate Change Law[10], a key requirement being that certain National Departments prepare plans and policies on climate change consistent with the provisions of the Climate Change Policy.

In June 2013 Government produced the Nation Wide Integrated Disaster Risk Management and Climate Change Policy[11] under which the DTCI will integrate the Policy into its infrastructure development policy and plans.

A Council on Environmental Management and Sustainable Development (or Sustainable Development Council) chaired by the Vice-President was established through Presidential Order No. 14. The functions and purposes of the Sustainable Development Council are to advise and make recommendations to the President on matters affecting the environmental management and sustainable development of the FSM.

Potential projects and the approach to climate proofing were previously addressed in a study in 2006[12]. In 2014 DTCI prepared a Climate Adaptation Guide for Infrastructure[13]. This provides a first step in mainstreaming climate change in all infrastructure projects in FSM.

State Level

Climate Change Action Plans have been developed for Kosrae and Yap; preparation of an Action Plan for Pohnpei is ongoing and for Chuuk has yet to start.

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[8] (GoFSM, 2009) - Nationwide Climate Change Policy 2009.
[9] (GoFSM, 2012) - National Climate Change and Health Action Plan, December 2012.
[10] (GoFSM, 2013a) - Eighteenth Congress Of The Federated States Of Micronesia Second Regular Session, 2013 Congressional Bill No. 18-72, C.D.1, C.D.2, C.D.3 Pc No. 18-178 Public Law No. 18-34.
[11] (GoFSM, 2013b) - Nation Wide Integrated Disaster Risk Management and Climate Change Policy
[12] (ADB Pacific Studies Series, 2006) - Climate Proofing – A Risk-based Approach to Adaptation
[13] (DTCI, DoI, 2014) - Climate Adaptation Guide for Infrastructure

The current State Action Plans identify requirements for infrastructure under three headings, and their relevance to the IDP are summarized as:

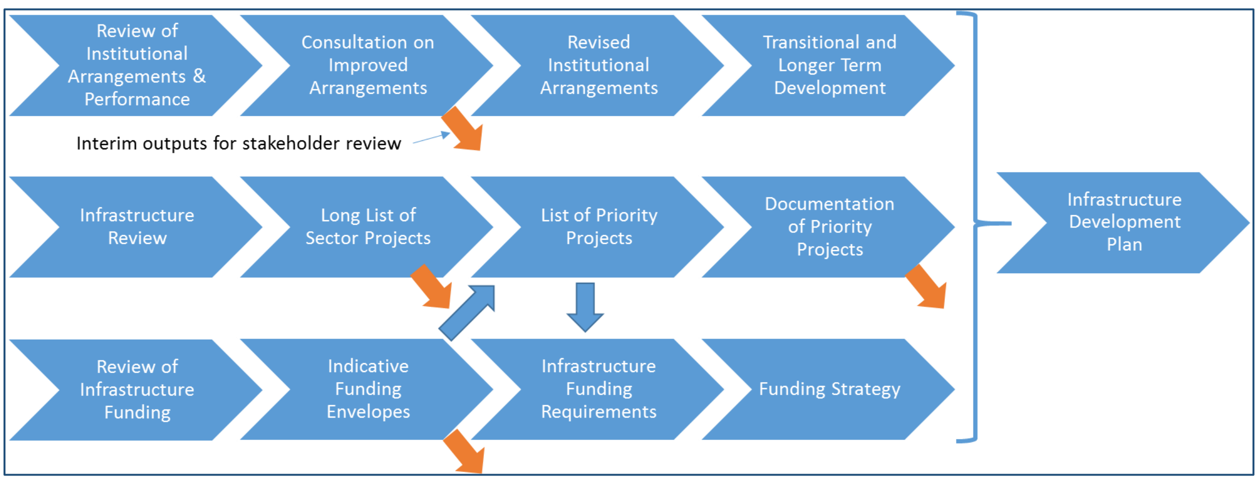
- Strengthen the integrity of the development consent process and environmental impact assessments: environmental concerns, including both impacts and geo-hazard issues should be identified:
- early in the scoping phase, so that the costs of mitigation can be allowed for when setting budget
- during design, so that appropriate mitigation measures are part of the design
- during construction to ensure the appropriate environmental management plan is followed and mitigations properly implemented
- Apply Land Use Planning: available flood, sea level change and landslide risk maps are used particularly in assessing sites for infrastructure development
- Actively Enforce Building Codes: in the absence of formal building codes, adopt and follow standards and practices that are appropriate to the infrastructure being developed, including aspects relevant to climate change adaptation

1.5 Plan Development Process

1.5.1 Components and Overall Approach

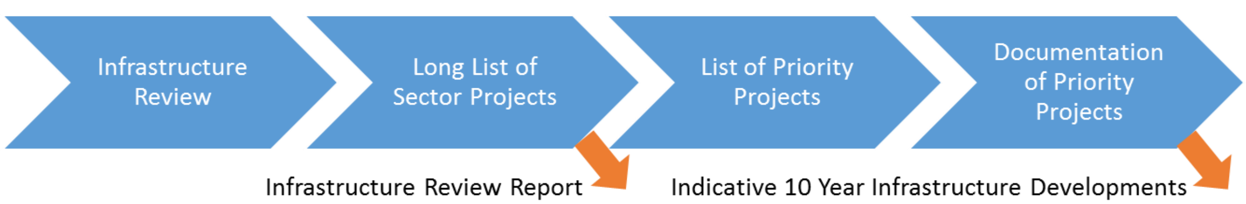
Development of the IDP involved three main components; **infrastructure**, **institutional** and **funding**, and the overall approach illustrated in Figure 3.

Figure 3 – IDP Development Approach



The three components are described below.

1.5.2 Infrastructure



The **infrastructure review** determined the current status of infrastructure in the ten sectors across FSM, including the demand for infrastructure and current infrastructure performance. Background reports and data were reviewed and visits were made to the States to learn of the demands and needs from the

Executive and infrastructure managers. From these sources **long lists of sector projects** were produced and the results documented in the ***Infrastructure Review Report***.

Subsequent to the infrastructure review and long lists of projects, additional interactions at national level and in each State produced a **list of priority projects** for each jurisdiction with the **indicative funding envelopes** providing guidance on the total funding available for the priority projects. The additional interactions also collected and/or confirmed all of the information for the **documentation of priority projects** in the form of the **priority project outlines** included in Part 4 of each of the following IDP volumes.

Project prioritization was undertaken with a group that included representatives of the Executive and Legislature, infrastructure managers and civil society representatives. Inputs to the process included current Infrastructure Planning and Implementation Committee (IPIC) listings and priorities and the long list of projects. The process set out in Figure 4 was followed by the group to identify, prioritize and rate the projects included in their IDP.

Figure 4 – Project Prioritization

Step 1

produce the priority project list

- **Is a project in the long list infrastructure that the Nation/State needs in the next 10 years?** – if yes, add the project to the initial list of priority projects
- **Considering the indicative funding envelope, is it realistic to expect that all of the initial priority projects can be implemented?** – if no, remove projects from the list of priority projects to the point that the total estimate of priority projects was more realistic in the context of the indicative funding envelope

Step 2

prioritize projects by funding period

- **Relative to other projects, should the priority project funded in the first, second or third period of the IDP?** (FY2016-FY2019, FY2020-FY2022 or FY2023-FY2025) – indicate the identified period(s) in the list of priority projects
- **Considering the indicative funding envelope for each period, is it realistic to expect that all of the identified priority projects can be implemented in that period?** – if no, revise the funding periods until the total estimate in each period is more realistic in the context of the indicative funding envelope

Step 3

contribution of priority projects to the strategic objectives

- **To what extent does each priority project contribute to the strategic objectives?** – indicate the contribution rating against each strategic objective in the list of priority projects
- **Does the priority project make a strong contribution to the strategic objectives?** – reconsider the inclusion of any project that does not make a strong contribution to the strategic objectives

The prioritization group also assessed the contribution that each priority project makes to the Strategic Objectives (section 2.2) to produce a **Strategic Rating** out of 10. Priority projects were rated for their contribution to each of the nine component objectives using the contribution ratings in Table 2. The Strategic Rating was determined using the following formula:

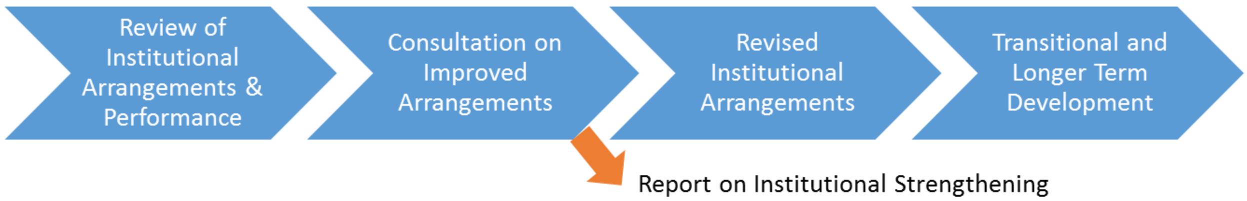
$$\text{Strategic Rating (out of 10)} = \sum Rating\ of\ each\ strategic\ objective\ \ /\ 4.5$$

The ***indicative 10 year infrastructure developments*** from each State project prioritization exercise were consolidated in a report to the Governor for review and endorsement. Any revisions to the information provided have been carried forward into the IDP.

Table 2 – Contribution ratings

Rating 1	The project will make **little or no** contribution to the strategic objective
Rating 2	The project will make a **low** contribution to the strategic objective
Rating 3	The project will make a **medium** contribution to the strategic objective
Rating 4	The project will make a **high** contribution to the strategic objective
Rating 5	The project will make a **very high** contribution to the strategic objective

1.5.3 Institutional Component

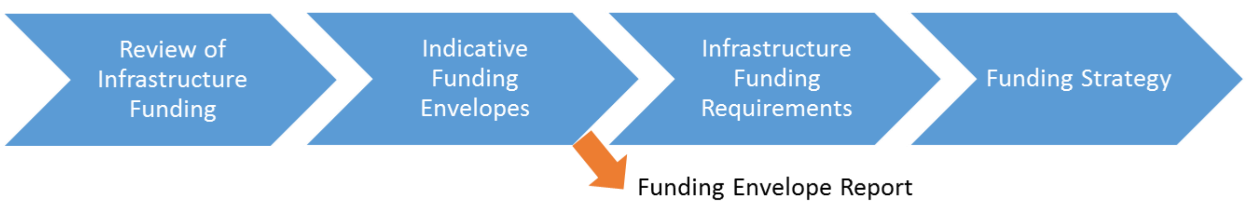


The **review of institutional arrangements & performance** determined the strengths and weaknesses of the institutional arrangements that have been in place in the period since 2004. Background reports and data were reviewed, discussions were held with the Program Management Unit (PMU) and visits were made to the States to learn of their IDP implementation issues and expectations.

A number of alternative models were developed for **consultation on improved arrangements** with national and state stakeholders, at the conclusion of which a ***Report on Institutional Strengthening*** was finalized.

The recommended institutional arrangements were strongly endorsed by all State Governors and supported by the President. **Revised institutional arrangements** were subsequently developed in more detail, including identification to changes in legislation and regulations. Actions for **transitional and longer term development of the institutional arrangements** have been identified and incorporated into the IDP.

1.5.4 Funding Component



The **review of infrastructure funding** identified $608 million of indicative baseline funding for infrastructure development expected from traditional sources over the next 10 years, including from:

- National Government revenue
- Amended Compact
- multilateral development banks
- bilateral development assistance

The **indicative funding envelopes** set out the availability of infrastructure development funding by source by year for each state and the national program and provided guidance to the identification of priority projects. The indicative funding envelopes did not:

- factor in future one-off project funding that is additional to the baseline funding

- include any provision for UN-related climate change adaptation funding

A ***Funding Envelope Report*** provided full details of the review of infrastructure funding and the resultant indicative funding envelopes.

The **infrastructure funding requirements** derived from the **lists of priority projects** exceed the indicative baseline funding, recognizing the availability of additional funding for infrastructure development in addition to the baseline funding.

The **funding strategy** set out in Part 3 incorporates:

- an increase in the indicative baseline funding to $751.9 million, including $31 million of climate adaptation funding over 10 years
- the annual appropriation of funds by source and by sector over the duration of the IDP

Part 2 Infrastructure Strategy

2.1 Role of Infrastructure

Infrastructure is a critical component of the economic and social fabric of society. In the context of the IDP it is the fundamental facilities and systems providing the services and facilities necessary for the economy and society to function. It comprises the roads, bridges, schools, hospitals, ports, airports, water supply, waste water, solid waste, electrical grids and telecommunications; the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions.

> One way to increase economic output quickly is to expand public infrastructure that would add to the productive capacity of the economy in the longer term and create jobs in the near term. A key component of the Action Plan is the accelerated spending of the infrastructure arrears of $126 million over the next four years.
>
> Development literature and field experience worldwide underscore the influence of market expanding infrastructure in fostering economic growth and productivity, particularly in emerging economies and there is ample evidence that market expanding infrastructure both raises growth and lowers income inequality.
>
> (2023 Action Plan)

2.2 Strategy Objectives

2.2.1 Vision and Objective

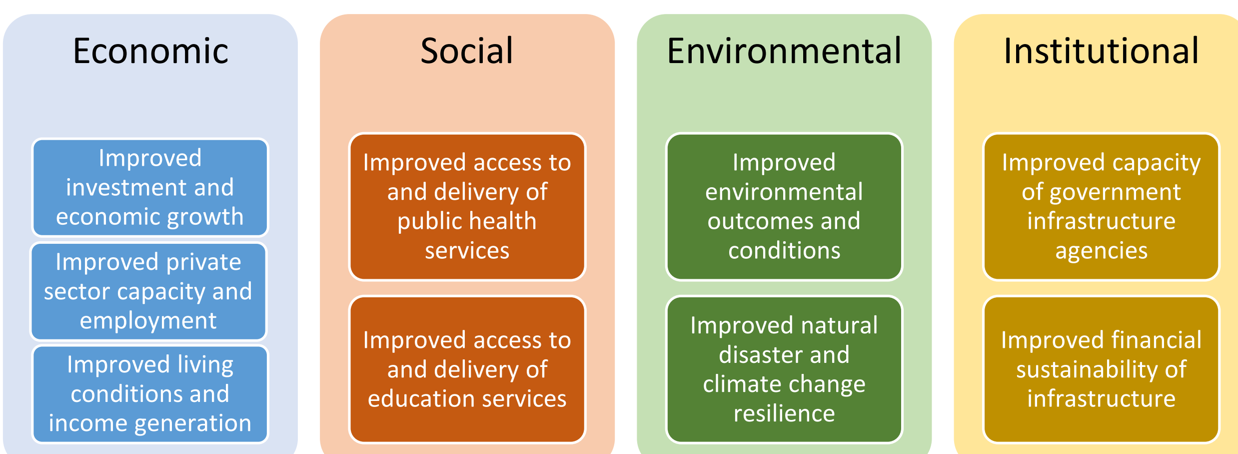
The national **Vision** and **Objective** statements in IDP 2004 remain appropriate for the IDP:

Vision: To improve the life and livelihood of all FSM citizens with affordable, reliable and environmentally sound infrastructure.
Objective: To promote the sustainable social and economic development of FSM through the provision and utilization of cost-effective, safe, reliable and sustainable infrastructure.

2.2.2 Component Objectives

Taking into account the strategic statements in the IDP 2004 and more recently the 2023 Action Plan and the challenges presented by climate change, the component objectives in Figure 5 have been adopted in the IDP. All priority infrastructure projects have been rated against these objectives to ensure the overall alignment of the IDP investments with its strategic objectives.

Figure 5 – Component Strategic Objectives



2.3 Sector Objectives

Within the overall infrastructure development objectives each sector has a number of identified goals consistent with those incorporated into the IDP 2004.

2.3.1 Electric Power

The **Goal** is to develop electric power infrastructure to ensure that all areas of the country are provided with electric power in an efficient and effective manner in accordance with demand such that:

1. households are provided with power for basic livelihood purposes
2. local manpower can realize production opportunities and potential
3. power is available for basic services such as schools, hospitals, water and wastewater systems
4. national targets for renewable energy are achieved

2.3.2 Water/Wastewater Systems

The **Goal** is to provide water and wastewater infrastructure that:

1. meets the demand for water supply and wastewater infrastructure in an effective and efficient manner
2. improves existing water abstraction, treatment and distribution systems
3. evaluates and institutes technologically appropriate liquid waste management systems
4. improves and initiates wastewater facilities to increase coverage and contribute towards improvements in public health and environmental conditions
5. contributes towards the prevention of water borne diseases through the provision of potable water supplies

2.3.3 Solid Waste Management

The **Goal** is to provide solid waste management infrastructure that:

1. meets the demand for solid waste infrastructure in an effective and efficient manner
2. evaluates and institutes technologically appropriate solid waste management systems
3. reduces volume of solid waste for disposal by maximizing recycling and separation opportunities thereby minimizing the land area required
4. prevents solid waste having adverse effects on the terrestrial and marine environments

2.3.4 Road and Pedestrian Facilities

The **Goal** is to provide road and pedestrian facilities infrastructure that:

1. enables transportation facilities to be adequate in terms of condition, capacity, reliability and safety to enable market opportunities to be realized for all areas of the country, including labor market opportunities, and to enhance the level of integration of state economies and the national economy
2. meets the demand for road and pedestrian infrastructure in an effective and efficient manner, including concrete/asphalt paving of all primary road systems
3. incorporates pedestrian walkways in the design and construction of roads
4. extends cross-island and inner roads to facilitate agricultural and other development
5. is resilient to the impacts of climate change

2.3.5 Maritime Transportation

The **Goal** is to provide maritime transportation infrastructure that:

1. enables market opportunities to be realized for all areas of the country, including labor market opportunities, and to enhance the level of integration of state economies and the national economy
2. provides improved dock facilities to meet both fisheries and commercial shipping needs
3. facilitates modern, safe and efficient inter-state and inter-island passenger and cargo vessels
4. coordinates and facilitates the improvement of aids to navigation

2.3.6 Air Transportation

The **Goal** is to provide air transportation infrastructure that:

1. provides adequate air transportation facilities and services in terms of condition, frequency, capacity, reliability and safety to enable market opportunities to be realized for all areas of the country
2. enables air carrier airports to improve safety and eliminate payload restrictions
3. improves all domestic airports to the required standards of safety

2.3.7 Telecommunications Systems

The **Goal** is to provide telecommunications systems infrastructure to:

1. achieve accessible and affordable communications for all
2. strengthen information and communications technology (ICT) human resources and increase human resource development opportunities through ICT
3. improve economic growth and sustainable development through ICT
4. utilize ICT for good governance
5. create an enabling ICT environment through policy reform and improvements in legal frameworks

2.3.8 Education

The **Goal** is to provide education infrastructure that:

1. ensures that the learning experience is enhanced and diversified
2. improves student and faculty interest and morale, and thereby improves the effectiveness of education and significantly increases the student retention rates through graduation from elementary or secondary schools
3. removes constraints on the availability of high school education for all graduates of elementary school, and to provide an array of post-secondary education opportunities for all high school graduates who seek further education
4. continues to assist and strengthen private educational institutions to the nation
5. is supported by facilities improvement programs that address the need for maintenance, renovation and construction of new facilities to support quality student instruction
6. is supported by equipment maintenance guidelines
7. is resilient to potential natural disasters and the impacts of climate change

2.3.9 Health

The five strategic goals of health care[14] are to:

1. improve primary health care services

[14] (DHSA, 2013) - Department of Health and Social Affairs Annual Report 2013

2. improve secondary health care services
3. prioritize health promotion services on major health problems
4. develop a sustainable health care financing mechanism
5. improve capacity and accountability systems

In support of those goals, the **Goal** of health infrastructure is to:

1. provide modern and efficient hospital facilities to meet the health needs of the nation
2. facilitate an upgraded the curative health system to minimize the needs for referrals to foreign medical facilities
3. provide health care facilities within reasonable access of all citizens
4. have facilities improvement programs that address the need for maintenance, renovation and construction of new facilities
5. have adequate funds for maintenance to prevent rapid deterioration of facilities
6. be resilient to potential natural disasters and the impacts of climate change

2.3.10 Government Administrative Buildings

The **Goal** is to provide government administrative building infrastructure that:

1. provides modern and efficient facilities required for government personnel to effectively undertake their functions
2. provides an environment that enables equipment used by government personnel to be adequately maintained
3. encourages a high morale and work ethic amongst government employees by providing a suitable work environment
4. provides elected officials with suitable office space and chambers in which to conduct their responsibilities

Part 3 Investment Strategy

3.1 FSM Infrastructure Funding

3.1.1 National Government

Fiscal position

The National Government has a relatively low level of debt providing latitude for judicious borrowing, including to leverage grant funds from other sources.

Infrastructure development

Prior to FY2014 national infrastructure projects were funded by donors including a 10 percent allocation from Amended Compact infrastructure grants. In FY2014 the government cut the Amended Compact infrastructure grant allocation to 5 percent and from FY2015 onwards the National Government receives no infrastructure funding from the Amended Compact.

As a response to the March 2012 Joint Economic Management Committee (JEMCO) resolution to withhold infrastructure grants pending the updating of the IDP 2004, the National Government is making a specific allocation from its own revenue amounting to $10 million in both FY2015 and FY2016 for State priority infrastructure projects. In addition there have been separate National Government appropriations for outer island airstrip improvements and power generation. The indicative estimate for FY2017 onwards is $11 million as shown in Table 3.

Infrastructure maintenance

National Government funding for maintenance of national and state assets is set out in Table 3.

The National Government provides a general appropriation for maintenance; $3.36 million in FY2016 and FY2017. The indicative estimate for FY2018 onwards is $3.5 million.

In addition the National Government appropriates funding for the maintenance of state secondary roads and water supply. The planned/indicative estimate for FY2016 onwards is $2.8 million.

Up until FY2014 the National Government received an allocation under the Amended Compact for Infrastructure Maintenance Fund (IMF) funding. The estimated amount of the National Government's unspent IMF allocation is $430,000, plus the National Government's matching funds.

3.1.2 State Governments

Fiscal position

The National Government's aggregate fiscal outcome in recent years masks the large difference between the performance of the four State Governments. Their performance varies but in FY2014 it was at an all-time low. For the first time all States recorded deficits and declines in their economies in the same year.

Infrastructure development

The States are dependent on development partner funding and National Government appropriations for virtually all infrastructure development.

Infrastructure maintenance

State governments struggle to match the 5 percent IMF Amended Compact infrastructure funding for maintenance. The Office of International Affairs' (OIA) process for releasing IMF grants requires physical evidence of the appropriation and deposit of matching funds by the States.

The amounts identified for maintenance in Table 3 include the funds required from the States to match the Amended Compact IMF grants. The funds required from FY2016 to FY2023 to match the Amended

Compact IMF grants and arrears for all States averages $1.9 million per annum. From FY2024 the funds required to match the CTF IMF grants is estimated at $0.6 million per year.

Table 3 – FSM Governments infrastructure development and maintenance funding

	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
National Government General Maintenance										
National	150,000	150,000	-	-	-	-	-	-	-	-
Chuuk	460,000	460,000	1,477,700	1,477,700	1,477,700	1,477,700	1,477,700	1,477,700	1,477,700	1,477,700
Kosrae	300,000	300,000	423,500	423,500	423,500	423,500	423,500	423,500	423,500	423,500
Pohnpei	-	-	984,550	984,550	984,550	984,550	984,550	984,550	984,550	984,550
Yap	300,000	300,000	614,250	614,250	614,250	614,250	614,250	614,250	614,250	614,250
Non-specific	2,150,000	2,150,000	-	-	-	-	-	-	-	-
Indicative	-	-	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
Total	3,360,000	3,360,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
National Government state secondary roads, water supply maintenance										
National	-	-	-	-	-	-	-	-	-	-
Chuuk	1,182,160	1,182,160	1,182,160	1,182,160	1,182,160	1,182,160	1,182,160	1,182,160	1,182,160	1,182,160
Kosrae	338,800	338,800	338,800	338,800	338,800	338,800	338,800	338,800	338,800	338,800
Pohnpei	787,640	787,640	787,640	787,640	787,640	787,640	787,640	787,640	787,640	787,640
Yap	491,400	491,400	491,400	491,400	491,400	491,400	491,400	491,400	491,400	491,400
Indicative	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000
Total	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000
National Government Development Funding										
National	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Chuuk	4,011,000	4,011,000	4,011,000	4,011,000	4,011,000	4,011,000	4,011,000	4,011,000	4,011,000	4,011,000
Kosrae	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000
Pohnpei	2,672,000	2,672,000	2,672,000	2,672,000	2,672,000	2,672,000	2,672,000	2,672,000	2,672,000	2,672,000
Yap	1,667,000	1,667,000	1,667,000	1,667,000	1,667,000	1,667,000	1,667,000	1,667,000	1,667,000	1,667,000
Total	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
All Governments Matching IMF Funding										
National	-	-	-	-	-	-	-	-	-	-
Chuuk	507,600	507,288	506,842	506,261	505,545	504,695	503,709	502,589	257,120	261,645
Kosrae	145,475	145,386	145,258	145,091	144,886	144,642	144,360	144,039	73,689	74,986
Pohnpei	338,200	337,992	337,695	337,308	336,831	336,264	335,607	334,861	171,312	174,327
Yap	210,999	210,870	210,684	210,442	210,145	209,791	209,382	208,916	106,880	108,761
IMF Arrears	1,531,268	1,531,268	1,531,268	1,531,268	-	-	-	-		
Total	2,733,542	2,732,804	2,731,746	2,730,370	1,197,407	1,195,392	1,193,058	1,190,405	609,000	619,718
TOTAL DEVELOPMENT	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**10,000,000**
TOTAL MAINTENANCE	**10,424,809**	**10,424,071**	**10,563,014**	**10,561,637**	**7,497,407**	**7,495,392**	**7,493,058**	**7,490,405**	**6,909,000**	**6,919,718**

Source: CMD

3.2 Amended Compact and other US Grant Funding

The US government provides infrastructure development and maintenance assistance to FSM through Federal grants (and potentially loans) and the Amended Compact.

3.2.1 Amended Compact

Under the Amended Compact FSM is to receive payments of $92.7 million per year (2004 dollars) with annual partial adjustments for inflation as sector grants, to finance an annual audit, and as contributions into the CTF. The Amended Compact provides a minimum 30 percent of sector grant funding for public infrastructure ($24 million in FY2015) and sets out the funding priorities.

> The highest priority shall be given to primary and secondary education capital projects and projects that directly affect health and safety, including water and wastewater projects, solid waste disposal projects, and health care facilities. Second priority shall be given to economic development-related projects, including airport and seaport improvements, roads, sea walls, and energy development including renewable energy that cannot be funded through the rate structure.
>
> (Amended Compact, Article II Economic Assistance Implementation)

Five percent of the sector grant for infrastructure is set aside for the IMF.

The FSM Congress legislates the distribution of the Amended Compact sector grants (Table 4). From FY2015 on, all the grants are distributed to the States.

Table 4 – Distribution of Amended Compact sector grants

	FY2012	FY2013	FY2014	FY2015 on
National	10.00 %	10.00 %	5.00 %	0.00 %
Chuuk	38.00 %	38.00 %	40.11 %	42.22 %
Kosrae	10.90 %	10.90 %	11.50 %	12.10 %
Pohnpei	25.31 %	25.31 %	26.72 %	28.13 %
Yap	15.79 %	15.79 %	16.67 %	17.55 %

Source: FSM Congress

The allocation of Amended Compact infrastructure grants is undertaken on an annual basis by the US and FSM through JEMCO which has three representatives from the US and two from the FSM. JEMCO decisions are intended to be reached on a consensus basis.

In August 2004 JEMCO delegated to the OIA the authority to approve individual projects that comply with the Fiscal Procedure Agreement requirements and conform to the consolidated list of projects that are consistent with the IDP. This resolution delegated the final approval of infrastructure grants to the OIA Grant Manager in Hawaii.

From FY2004 to FY2012, JEMCO allocated a total of $204 million for infrastructure. In March 2012 JEMCO passed a resolution that no further Amended Compact infrastructure grants will be made until the IDP 2004 is updated. The combination of the FY2013 to FY2015 funds that have not been allocated by JEMCO and the allocated funds that have not been granted by OIA over FY2004 to FY2012 is equal to $111.3 million (“the arrears”, $105.2 million for development and $6.1 million for IMF).

From FY2024 the Amended Compact funding shifts from direct grants to a drawdown from the CTF. The CTF is intended to accumulate sufficient funds by FY2023 to generate income equivalent to the Compact grants. At the current level of the fund and expected future contributions the amount in the CTF in FY2023 is unlikely to be enough for the revenue from the fund (after maintaining the real value of the capital) to match 2023 Compact grants.

The indicative infrastructure funding from the CTF from FY2024 is $12.2 million, of which $0.6 million is for the IMF, about half the Amended Compact infrastructure grant amounts in FY2023. This is based on opening capital in FY2024 of $1,015 million, the fund value maintained in real terms and a 4 percent distribution.

The indicative Amended Compact/CTF infrastructure funding from FY2016 to FY2025 is shown in Table 5. Over the ten year IDP period the total funds are $327.5 million ($310.6 million for development and $16.9 million for IMF).

Table 5 – Amended Compact assistance to FSM (including CTF)

	FY2016	FY2017	FY2018	FY2019	FY20FY20	FY2021	FY2022	FY2023	FY2024	FY2025	Total
Amended Compact											
Infrastructure Grants (30%)											
	24,045,480	24,030,720	24,009,576	23,982,048	23,948,136	23,907,840	23,861,160	23,808,096	12,180,000	12,394,368	216,167,424
FSM - IMF Grants											
	1,202,274	1,201,536	1,200,479	1,199,102	1,197,407	1,195,392	1,193,058	1,190,405	609,000	619,718	10,808,371
Infrastructure Development (excl IMF)											
	22,843,206	22,829,184	22,809,097	22,782,946	22,750,729	22,712,448	22,668,102	22,617,691	11,571,000	11,774,650	205,359,053
Arrears for Development											
	26,303,998	26,303,998	26,303,998	26,303,998							105,215,990
Arrears for IMF											
	1,531,268	1,531,268	1,531,268	1,531,268							6,125,070
Total Amended Compact/CTF Funding for Development (including arrears)											
National	2,786,387	2,786,387	2,786,387	2,786,387							11,145,547
Chuuk	20,084,441	20,078,520	20,070,040	20,058,999	9,605,358	9,589,196	9,570,473	9,549,189	4,885,276	4,971,257	128,462,748
Kosrae	5,636,369	5,634,672	5,632,242	5,629,077	2,752,838	2,748,206	2,742,840	2,736,741	1,400,091	1,424,733	36,337,808
Pohnpei	14,080,773	14,076,828	14,071,178	14,063,822	6,399,780	6,389,012	6,376,537	6,362,357	3,254,922	3,312,209	88,387,418
Yap	6,559,235	6,556,774	6,553,249	6,548,659	3,992,753	3,986,035	3,978,252	3,969,405	2,030,711	2,066,451	46,241,522
Total	49,147,204	49,133,182	49,113,095	49,086,943	22,750,729	22,712,448	22,668,102	22,617,691	11,571,000	11,774,650	310,575,043
Total Amended Compact/CTF for the IMF (including arrears)											
National	107,403	107,403	107,403	107,403							429,613
Chuuk	1,239,851	1,239,540	1,239,093	1,238,512	505,545	504,695	503,709	502,589	257,120	261,645	7,492,299
Kosrae	358,666	358,576	358,448	358,282	144,886	144,642	144,360	144,039	73,689	74,986	2,160,575
Pohnpei	658,430	658,223	657,925	657,538	336,831	336,264	335,607	334,861	171,312	174,327	4,321,318
Yap	369,191	369,061	368,876	368,634	210,145	209,791	209,382	208,916	106,880	108,761	2,529,636
Total	2,733,542	2,732,804	2,731,746	2,730,370	1,197,407	1,195,392	1,193,058	1,190,405	609,000	619,718	16,933,441

Source: CMD

3.2.2 US Federal Programs

Federal Aviation Administration

FSM's air transportation sector has benefited greatly across all states from the Federal Aviation Administration's (FAA) Airport Improvement Program[15] (AIP).

Between FY2004 and FY2015 AIP grants and matching funds totaled $192 million[16]. An additional $30.5 million of AIP grants and matching funds have been identified for two projects included in the IDP. A number of other IDP priority projects are strong candidates for AIP funding.

Department of Agriculture

The Rural Utilities Service (RUS) of the US Department of Agriculture (USDA) administers programs that provide infrastructure to rural communities[17].

FSM qualifies for RUS programs that cover infrastructure in the water/wastewater, solid waste, electric power and telecommunications sectors. FSM Telecommunications Corporation has a current RUS loan and a number of IDP priority projects are strong candidates for RUS program funding.

USAID

USAID has no regular development program in the FSM, however it responds to requests for disaster relief.

[15] www.faa.gov/airports/aip/overview/
[16] (DTCI, DCA, 2015) - Airport Improvement Program in FSM
[17] www.rd.usda.gov/about-rd/agencies/rural-utilities-service

3.3 Bilateral Development Partner Funding

3.3.1 Australia

Australia's aid program focuses on reforms in support of budgetary and economic self-reliance, environmental management and development coordination. A major area of support has been through Australia's Pacific Patrol Boat Regional Program, which aims to protect and manage the region's vital fisheries resources. While maintenance of the three patrol boats is critical to fisheries management under the fixed asset definition of infrastructure these vessels are not a concern of the infrastructure plan.

There is currently no Australian participation in FSM's infrastructure development.

3.3.2 China

The Peoples Republic of China assistance to FSM includes infrastructure, agricultural technical assistance and scholarships. Recent infrastructure investments include the Okat Bridge in Kosrae ($12.7 million in FY2014), the Chuuk State Government Complex ($10 million in FY2015) and an untied grant of $9.4 million scheduled for FY2016. Indicative funding for FY2017 to FY2025 is $5 million per year. Future assistance will be better coordinated in line with the FSM ODA Policy and the IDP.

3.3.3 European Union

The European Union's (EU) assistance to FSM is currently focused on renewable energy and is managed by the local office of the Secretariat for the Pacific Communities' (SPC) Economic Development Division, North Pacific ACP Renewable Energy and Energy Efficiency Project (North-REP). Funding of $10 million has been provided for the five years to FY2015 from the European Development Fund EDF 10 and has been used for solar power in Chuuk, Kosrae and Yap and to refurbish the hydropower station on Pohnpei.

EDF 11 which runs from FY2016 to FY2020 has a total funding of $18 million. This has been programmed for village access to electricity/solar for Chuuk, solar and transmission line upgrading for Pohnpei, proper sizing transformers on Kosrae and improving the efficiency and reliability of electricity of the outer islands of Yap. Around 75 percent of expenditure is expected to be used for equipment in FY2016 and FY2017.

Funding beyond FY2020 is expected to be similar to EDF 11 levels at $3.6 million per year although the EDF 12 focal sectors are yet to be determined.

3.3.4 Japan

Japan's assistance to FSM is administered by the Japan International Cooperation Agency (JICA) providing technical cooperation and grant aid.

Economic and social infrastructure forms the most significant component of grant aid with the most recent projects being the lengthening of the runway plus facility improvements at Pohnpei International Airport completed in 2012 at a cost of $37 million. This was followed by provision of the inter-island passenger and cargo vessel *Four Winds* in 2015 at a cost of $11.1 million.

With the Japanese Government's record of assistance to FSM over more than 30 years, indicative funding of $4 million per year for infrastructure is included in the IDP.

3.3.5 Summary

Estimated bilateral funding over FY2016 to FY2025 amounts to $140.4 million and is shown in Table 6.

Table 6 – Estimated Bilateral Funding

	FY2016	FY2017	FY2018	FY2019	FY20FY20	FY2021	FY2022	FY2023	FY2024	FY2025
China (PRC)										
Total	**9,400,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**
EU										
EDF 11 ($18m, 2015-2020)	6,750,000	6,750,000	1,500,000	1,500,000	1,500,000	-				-
Indicative	-	-	-	-	-	3,600,000	3,600,000	3,600,000	3,600,000	3,600,000
Total	**6,750,000**	**6,750,000**	**1,500,000**	**1,500,000**	**1,500,000**	**3,600,000**	**3,600,000**	**3,600,000**	**3,600,000**	**3,600,000**
Japan										
Total	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**	**5,000,000**
Total Bilateral	21,150,000	16,750,000	11,500,000	11,500,000	11,500,000	13,600,000	13,600,000	13,600,000	13,600,000	13,600,000

Source: CMD / ODAD / MFA

3.4 Multilateral Bank Funding

3.4.1 Asian Development Bank

The ADB provides loans, guarantees, equity investments, grants, and technical assistance to FSM. Loans are financed from ordinary capital resources (OCR) and the Asian Development Fund (ADF). OCR loans are provided at a quasi-market rate. ADF is a donor fund replenished every four years that provides loans at concessional terms (long maturities, lower interest rates) as well as grants.

ADB's indicative lending envelope for the FSM from FY2015 to FY2017 comprising $7.35 million of OCR and $8.73 million from the ADF[18] is being utilized for Pohnpei Port.

Based on ADB's country plans and average lending over recent years, an indicative $5 million per year is included in the IDP from FY2018 with follow-on technical assistance grants in FY2016 and FY2017. The IDP's institutional component includes priority projects that are strong candidates for ADB technical assistance funding.

3.4.2 World Bank Group

The World Bank's program focuses on two themes that support FSM's SDP:

1. strengthening the enabling environment for private sector development to help sustain growth; and
2. promoting a sustainable medium term fiscal situation to improve service delivery[19]

Up until FY2014 the World Bank has assisted FSM with a mix of investments, technical assistance and analytical activities.

The World Bank's engagement with FSM over the Country Partnership Strategy period (2014 – 2016) in FSM includes the following infrastructure-related sectors:

1. improving electricity supply and efficiency including increased use of renewable energy
2. enhancing telecommunications access and affordability
3. improving the management of the impact of climate change and natural hazards

Most significantly the Palau-FSM Regional Connectivity Project will bring fiber-optic connectivity to Yap and Chuuk, improved satellite connectivity to Kosrae and establishment of the FSM Telecommunication Regulation Authority. The FSM component of the project is financed by a FSM IDA17 grant allocation ($12.4 million) and FSM's portion of the regional grant allocation ($38.6 million).

[18] (ADB, 2014) - Country Operations Business Plan October 2014, Federated States of Micronesia 2015–2017

[19] (World Bank, 2014) - International Development Association and International Finance Corporation Country Partnership Strategy for the Federated States Of Micronesia for the period FY2014 – 2017

The Energy Sector Development project (IDA 16 $14.4 million) includes improvements to electric power generation and energy master planning.

The IDP includes indicative World Bank funding for infrastructure of $3.5 million per year from FY2019.

3.4.3 Multilateral Bank Summary

Table 7 shows total multilateral bank grants of $26 million over FY2016 to FY2025 and $45 million of debt funding making a total of $71 million available over the period of the IDP.

Table 7 – Estimated Multilateral Bank Funding

	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
ADB										
Grants Total	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Loan Total	-	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Total ADB	**500,000**	**5,500,000**	**5,500,000**	**5,500,000**	**5,500,000**	**5,500,000**	**5,500,000**	**5,500,000**	**5,500,000**	**5,500,000**
World Bank										
Indicative					3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
Total World Bank	-	-	-	-	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
ADB and WB Grants Total	500,000	500,000	500,000	500,000	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000
ADB and WB Grants & Debt Total	500,000	5,500,000	5,500,000	5,500,000	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000	9,000,000

Source: CMD / ODAD

3.5 Climate Change Funding

A major source of Climate Change (CC) financing is through the United Nations Framework Convention on Climate Change (UNFCCC). FSM's first proposal to the UNFCCC Adaptation Fund, "Enhancing the climate change resilience of vulnerable island communities in FSM", seeks $8.9 million for coastal management infrastructure over five years from FY2016 (total $9 million available to FSM for FY2016 to FY2020). The IDP includes additional Adaptation Fund funding of $2 million per year from FY2021.

Funding under the Green Climate Fund (GCF) will depend on international funding pledges being honored by 2020. FSM is receiving technical assistance to prepare proposals for this funding and the IDP includes indicative GCF funding of $2 million per year from FY2020.

Total climate change funding projected over FY2016 to FY2025 from the Adaptation Fund and the Green Climate Fund amounts to $31 million.

3.6 Summary of Available IDP Funding

Total available funding for the IDP over FY2016 to FY2025 is estimated at $751.9 million of which $655.7 million is for development and $96.2 million for maintenance. The annual total annual amounts are shown in Table 8 and Figure 6.

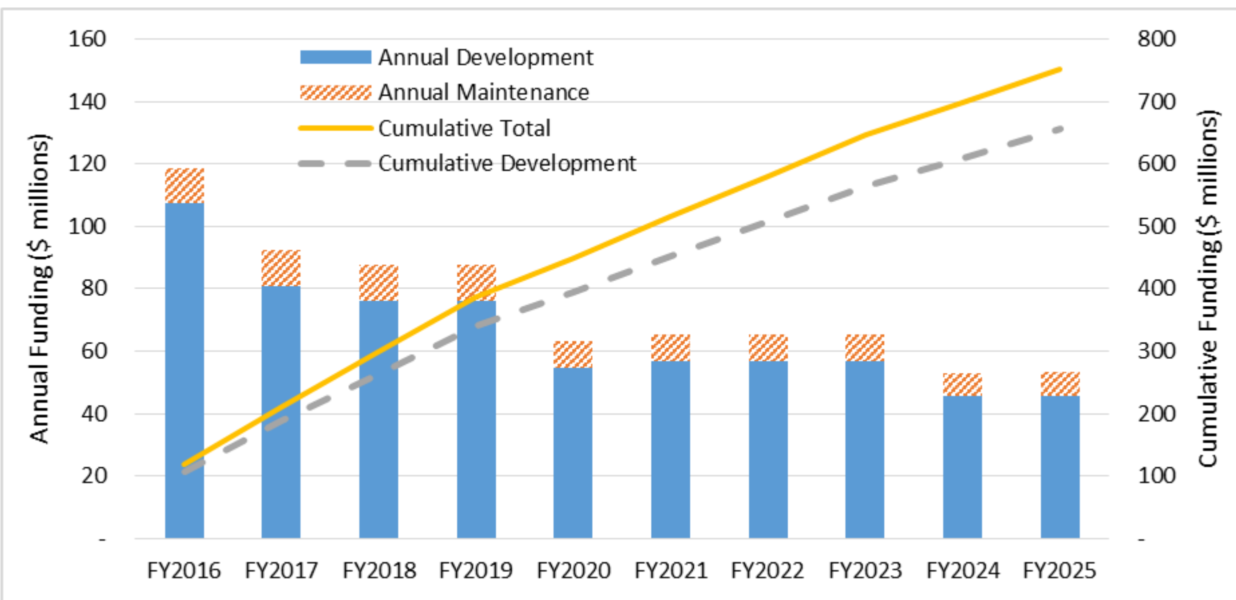
Each state receives a funding allocation under the IDP according to the source of funding. Amended Compact funds are split according the formula set by the FSM Congress. Funds associated with bilateral donors, multilateral banks and climate change may be for specific projects, in which case there is a direct allocation to the appropriate state. The underpinning nature of infrastructure warrants a more even distribution of infrastructure funding than the Amended Compact funding formula. The IDP allocates these funds to a pool and then distributes 25 percent each to Chuuk and Pohnpei, 20 percent to Kosrae and Yap and the remaining 10 percent to the National Government.

On this basis Chuuk is allocated 40 percent of total available infrastructure funding, Pohnpei 27 percent, Yap 17 percent, Kosrae 14 percent and the National Government 2 percent.

Table 8 – Total Available IDP Funding

	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
Total IDP Funding										
Development	107,252,204	80,778,182	76,033,095	76,006,943	54,620,729	56,652,448	56,608,102	56,557,691	45,511,000	45,714,650
Maintenance	11,412,083	11,410,607	11,763,493	11,760,740	8,694,814	8,690,784	8,686,116	8,680,810	7,518,000	7,539,437
TOTAL	118,664,287	92,188,789	87,796,587	87,767,683	63,315,543	65,343,232	65,294,218	65,238,501	53,029,000	53,254,086
National										
Development	1,786,387	3,286,387	3,286,387	3,286,387	500,000	500,000	500,000	500,000	500,000	500,000
Maintenance	364,807	364,807	214,807	214,807	-	-	-	-	-	-
TOTAL	2,151,193	3,651,193	3,501,193	3,501,193	500,000	500,000	500,000	500,000	500,000	500,000
Chuuk										
Development	58,457,941	30,102,020	28,781,040	28,769,999	19,691,358	20,250,196	20,231,473	20,210,189	15,546,276	15,632,257
Maintenance	4,659,363	4,658,739	5,138,047	5,136,885	3,670,950	3,669,249	3,667,278	3,665,038	3,174,100	3,183,150
TOTAL	63,117,303	34,760,760	33,919,087	33,906,883	23,362,308	23,919,445	23,898,751	23,875,227	18,720,376	18,815,407
Kosrae										
Development	11,476,369	11,594,672	10,542,242	10,539,077	8,762,838	9,218,206	9,212,840	9,206,741	7,870,091	7,894,733
Maintenance	1,786,131	1,785,953	1,479,197	1,478,864	1,052,072	1,051,585	1,051,020	1,050,378	909,678	912,272
TOTAL	13,262,500	13,380,625	12,021,438	12,017,941	9,814,911	10,269,791	10,263,860	10,257,119	8,779,769	8,807,004
Pohnpei										
Development	22,615,273	22,761,328	21,443,178	21,435,822	15,146,780	15,711,012	15,698,537	15,684,357	12,576,922	12,634,209
Maintenance	2,642,001	2,641,586	3,088,041	3,087,267	2,445,851	2,444,718	2,443,404	2,441,912	2,114,813	2,120,844
TOTAL	25,257,274	25,402,914	24,531,219	24,523,088	17,592,631	18,155,729	18,141,942	18,126,268	14,691,736	14,755,053
Yap										
Development	12,916,235	13,033,774	11,980,249	11,975,659	10,519,753	10,973,035	10,965,252	10,956,405	9,017,711	9,053,451
Maintenance	1,959,782	1,959,523	1,843,402	1,842,918	1,525,940	1,525,233	1,524,413	1,523,482	1,319,409	1,323,171
TOTAL	14,876,016	14,993,296	13,823,650	13,818,577	12,045,693	12,498,267	12,489,665	12,479,887	10,337,120	10,376,622

Figure 6 – Total Available IDP Funding



3.7 Plan Funding Requirements

3.7.1 Overall Funding Requirements

Infrastructure development

The overall funding requirements for infrastructure development are shown in Table 9 ($981 million) exceed available infrastructure development funding ($656 million) by around 50 percent. The equivalent measure between total project costs and available funding in IDP 2004 is 117 percent.

The additional funding required to cover the indicated shortfall is reasonable:

1. in the context of section 1.3.2, infrastructure funding between FY2004 and FY2015 was more than 60 percent above the pro-rata IDP 2004 funding over 12 years (assuming full Amended Compact infrastructure development grants),
2. given that no funding has been included from significant US Federal programs,
3. with other development partners providing large one-off project funding in the past outside of their annual funding envelopes, and
4. with climate change funding is likely to increase.

Table 9 – IDP Development Funding Requirement

	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
Total IDP Development Funding Requirement	80,597,000	40,416,000	81,935,000	266,928,000	136,323,000	109,873,000	111,667,000	73,013,000	36,889,000	40,262,000
National	1,378,000	10,731,000	10,263,000	46,356,000	8,608,000	1,372,000	17,201,000	2,738,000	6,348,000	13,748,000
Chuuk	39,030,000	10,594,000	27,703,000	83,995,000	41,598,000	39,839,000	29,324,000	8,425,000	1,000,000	1,000,000
Kosrae	22,420,000	4,590,000	17,534,000	25,678,000	24,940,000	25,263,000	6,000,000	10,332,000	18,400,000	7,253,000
Pohnpei	16,720,000	7,779,000	12,598,000	65,835,000	29,130,000	21,324,000	46,564,000	33,821,000	2,852,000	15,673,000
Yap	1,049,000	6,722,000	13,837,000	45,064,000	32,047,000	22,075,000	12,578,000	17,697,000	8,289,000	2,588,000

Infrastructure maintenance

The overall funding requirement of $96.2 million for infrastructure maintenance is shown in Table 10. This requirement matches with the available funding for infrastructure management.

Table 10 – Total IDP Maintenance Funding Requirement

	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
Total IDP Maintenance Funding Requirement	11,412,083	11,410,607	11,763,493	11,760,740	8,694,814	8,690,784	8,686,116	8,680,810	7,518,000	7,539,437
National	364,807	364,807	214,807	214,807	-	-	-	-	-	-
Chuuk	4,659,363	4,658,739	5,138,047	5,136,885	3,670,950	3,669,249	3,667,278	3,665,038	3,174,100	3,183,150
Kosrae	1,786,131	1,785,953	1,479,197	1,478,864	1,052,072	1,051,585	1,051,020	1,050,378	909,678	912,272
Pohnpei	2,642,001	2,641,586	3,088,041	3,087,267	2,445,851	2,444,718	2,443,404	2,441,912	2,114,813	2,120,844
Yap	1,959,782	1,959,523	1,843,402	1,842,918	1,525,940	1,525,233	1,524,413	1,523,482	1,319,409	1,323,171

3.7.2 Appropriation Profiles

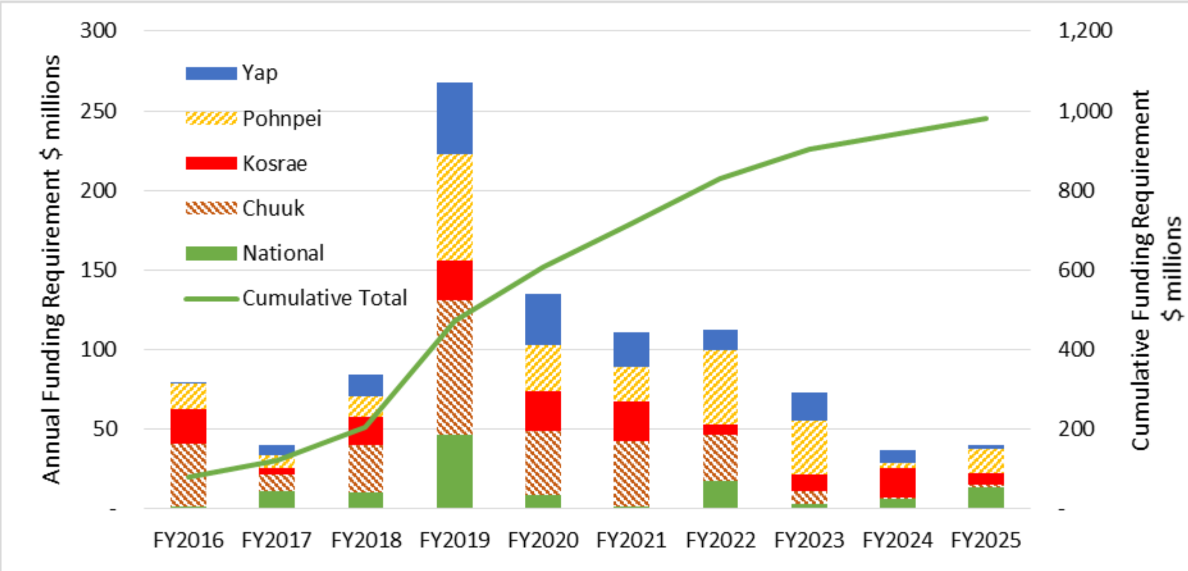
Infrastructure development

Each government identified and prioritized the projects included in the IDP. The estimated infrastructure development appropriations align with these priorities, taking into account a number of constraints and demands particularly for the first IDP period (FY2016 to FY2019).

Projects that are already designed and ready to move to construction are profiled for appropriation in FY2016. The remaining projects prioritized into the first IDP period are profiled taking account of the logistics, the need to develop the State PMOs and their short-term capacity, and considering their different support demands. These demands included projects where goods are to be purchased, that can be scheduled in an early year; projects where a limited amount of design is required, and construction procurement can follow on immediately, such as road rehabilitation; and projects where a full design is required, which will require procurement of a design consultant entity.

Projects in the other IDP periods (FY2020 to FY2022 and FY2023 to FY2025) are profiled more on the basis of smoothing overall resource demand on the State PMOs and consultant and contractors resources. The estimated annual and cumulative appropriation profiles are shown at Figure 7.

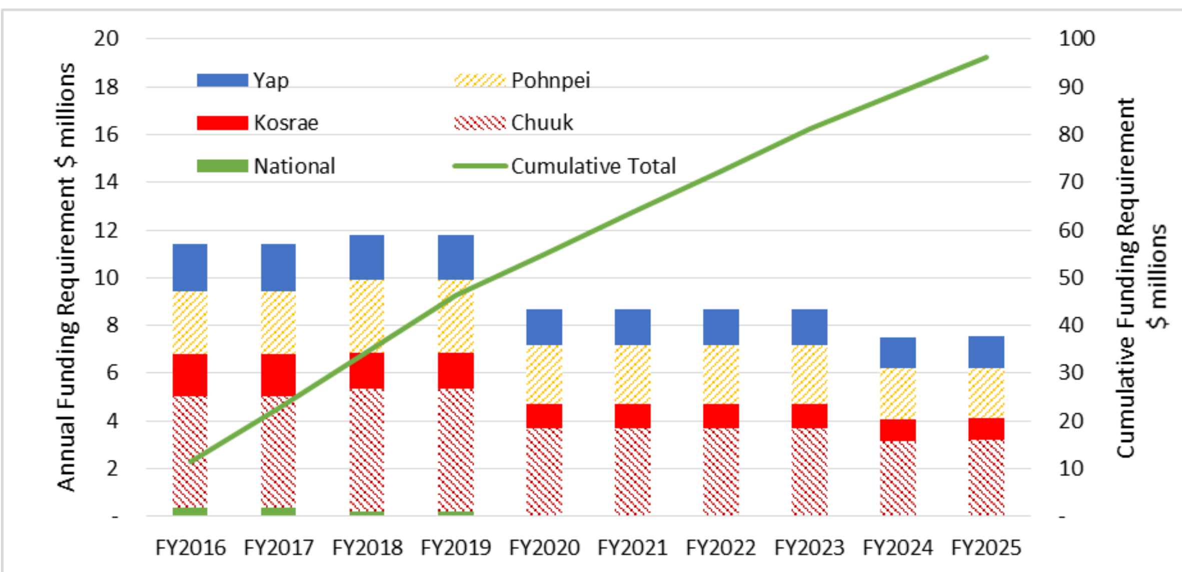
Figure 7 – Infrastructure Development Appropriations Profile



Infrastructure maintenance

The profiling of the infrastructure maintenance appropriations also matches the available funding profile with the estimated annual and cumulative appropriation profiles shown at Figure 8.

Figure 8 – Infrastructure Maintenance Appropriations Profile



3.7.3 Available Funding and Estimated Appropriations

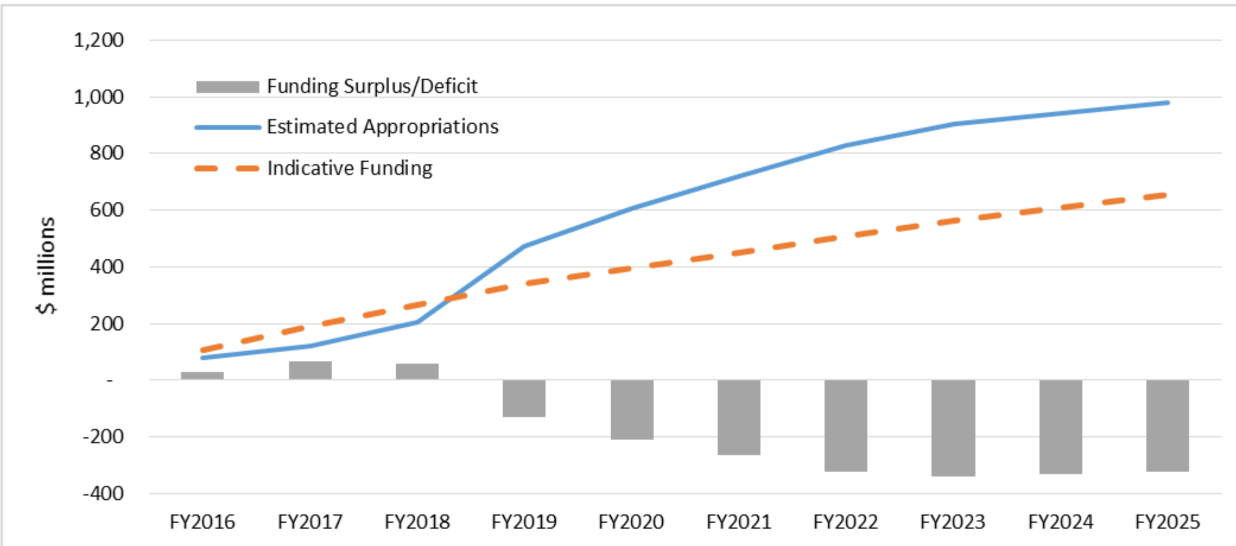
Infrastructure development

The IDP appropriation profile broadly balances with the available funding over the first four years as shown at Figure 9A. In the first three years available funding is greater than is required due to the backlog of design and procurement required as a result of the March 2012 JEMCO resolution. From FY2019 onwards the requirement for funding exceeds the available funds. The different governments have significantly different funding versus appropriation profiles as is highlighted in Figure 9B to Figure 9F.

From FY2019 onwards estimated appropriations exceed available funding so additional funding needs to be identified and/or priorities reassessed to defer projects or remove them from the IDP. The planned review of the IDP in FY2019 will provide the opportunity to undertake this reassessment.

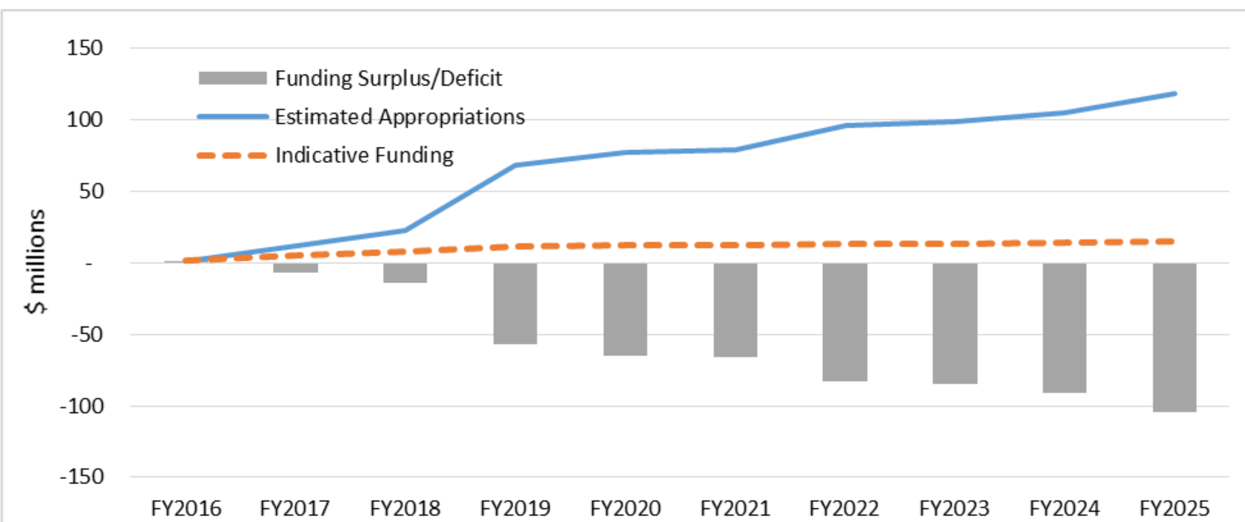
Figure 9 – Available Funding and Estimated Appropriations

A. IDP Cumulative Appropriations and Funding



B. National Government Cumulative Appropriations and Funding

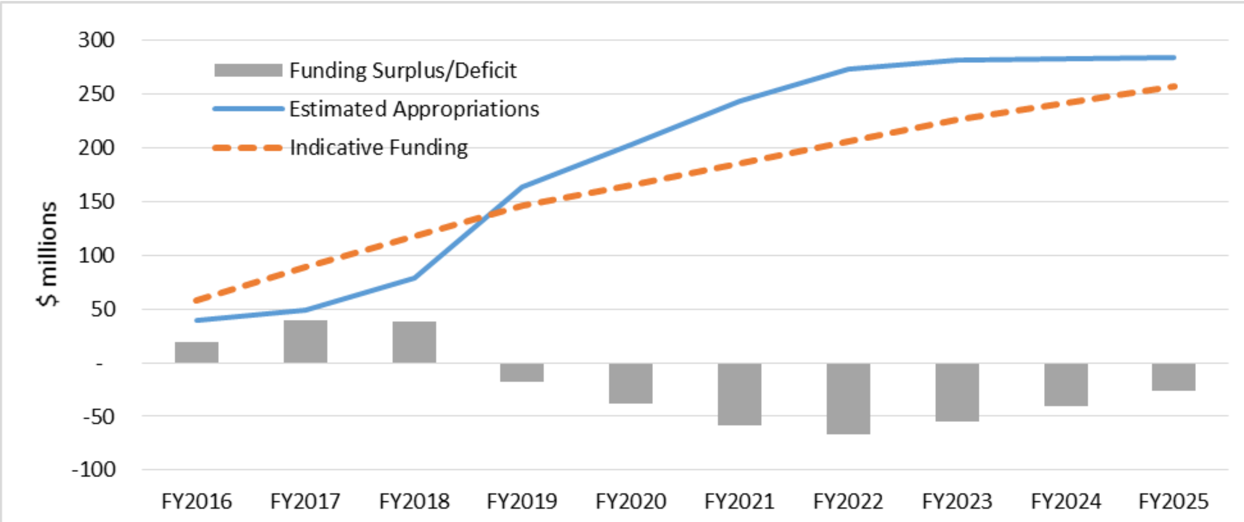
National Government funding is less than planned appropriations from FY2017, which becomes significant from FY2019 and the shortfall increases in subsequent years.



PLAN OUTLINE

C. Chuuk State Cumulative Appropriations and Funding

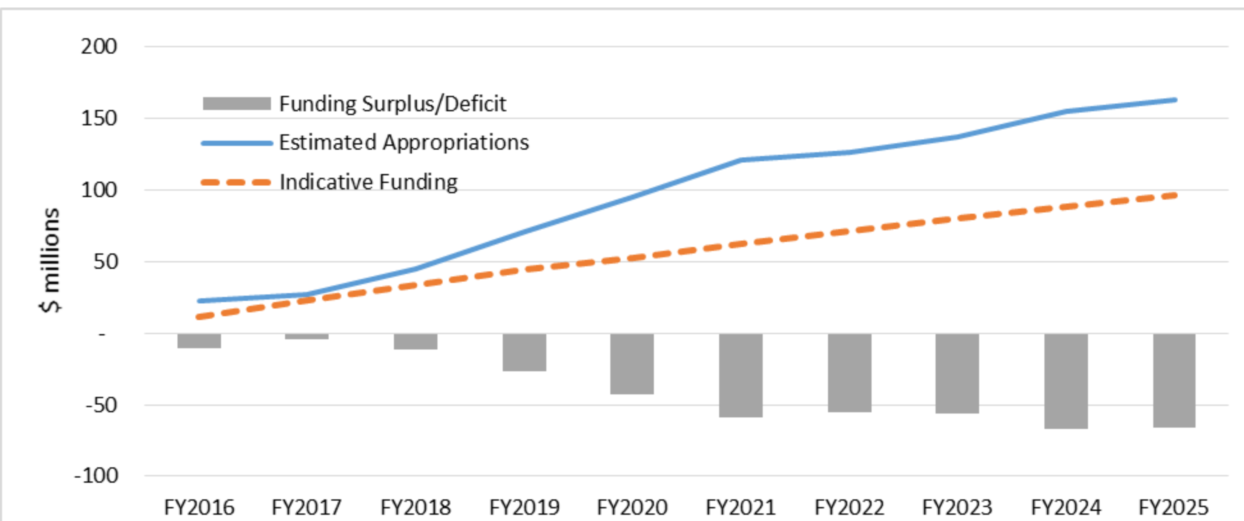
Chuuk planned appropriations do not exceed available funding until FY2020, reach a peak shortfall in FY2022 and then decline to almost balance by FY2025.



D. Kosrae State Cumulative Appropriations and Funding

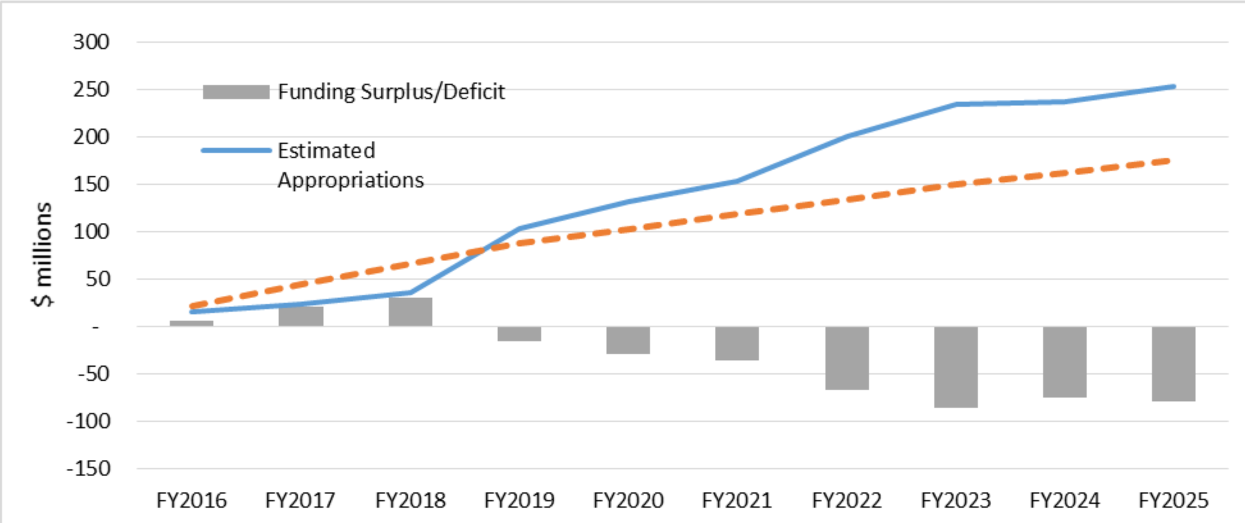
Kosrae planned appropriations are close to matching available funding until FY2019. From then on the funding gap increases to around $50 million by FY2021 and remains at this level for the remainder of the planning period.

The funding required for the Kosrae State Hospital construction grant in FY2016 exceeds Kosrae's Amended Compact arrears and FY2016 appropriation.



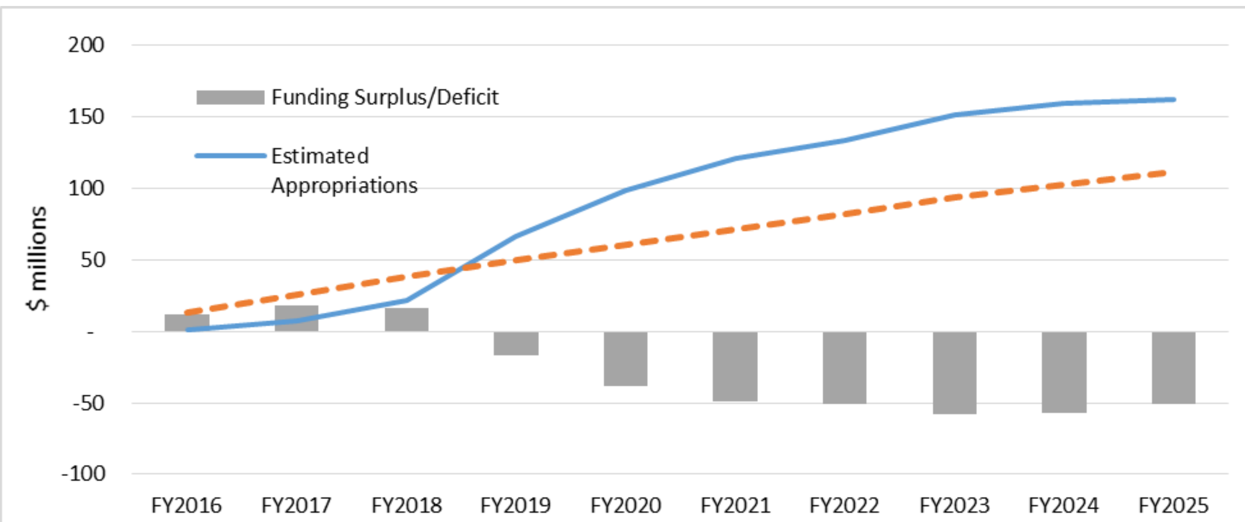
E. Pohnpei State Cumulative Appropriations and Funding

Pohnpei's priority projects can be funded until FY2020. From then on a shortfall opens up to peak in FY2023 and remains significant until the end of the planning period.



F. Yap State Cumulative Appropriations and Funding

Without any projects ready for construction in Yap there is a significant surplus of available funding until FY2019. Subsequently the funding shortfall opens up and remains substantial until the end of the planning period.



Infrastructure maintenance

With infrastructure maintenance appropriations intended to match the availability of funding, there is no issue with the funding shortfalls. Rather, the challenge for infrastructure maintenance is for the States to provide the matching funds so that the Amended Compact IMF funding can be utilized as it becomes available.

Part 4 Management and Implementation

4.1 Current Situation

IPICs were established in each State and at National level to coordinate IDP 2004 infrastructure implementation. At National level the Economic Policy Implementation Committee fulfilled the IPIC role although this and the Pohnpei State IPIC are no longer active.

Within the National Government, DTCI has responsibility for the delivery of infrastructure, including Amended Compact projects, and similar departments deliver infrastructure at State level. Large development partner programs have their own implementation units. Overall there is no consistency of implementation processes.

Amended Compact situation

The PMU was established in 2005 by regulation to deliver Amended Compact funded infrastructure projects in IDP 2004 and is currently a section within DTCI with contracted staff. The PMU is responsible for both program management and project management for all Amended Compact development projects. This includes:

for **program management:** systems, procedures, compliance with Amended Compact requirements and FSM IDP regulations, preparation of consolidated annual FSM program reviews and program liaison with the States

for **project management:** all documentation and procurement for design, construction and contract supervision services, review of preliminary and final designs with some consultation with the States and direct contract supervision by PMU staff located in the States

Issues with the current PMU arrangements include:

1. there is no clear and uniform process for the progression of a project, from the initial listing in the IDP, through pre design, detailed design and construction
2. State IPIC are not involved in scope changes
3. PMU project managers and engineers located in the States are not accessible by the State stakeholders
4. the flow of information between all the stakeholders is poorly documented and inconsistent

4.2 Strategic Considerations and Guiding Principles

4.2.1 Strategic considerations

Future institutional arrangements will incorporate the following strategic considerations:

Strong and strategic oversight at the program level – strategic oversight is a government function that will not be outsourced, although it can be reinforced with contracted expertise

Involvement of the States – State involvement is critical to planning and implementing clearly defined projects that meet stakeholder requirements

Autonomy of the States – the autonomy of the States in planning and implementing their programs is recognized in the institutional arrangements, notwithstanding the need to work to a consistent set of processes

Local capability to be developed – there will be a clear path for "localizing" the institutional arrangements over time and ensuring that those arrangements endure beyond the end of the IDP

International best practice will be considered – best practice program delivery arrangements such as “Centers of Excellence” will be considered to efficiently utilize resources and maintain consistency across the program

4.2.2 Guiding principles

In addition to the strategic considerations, the institutional arrangements are designed to achieve the following principles:

1. program and project management processes ensure transparency of decision making
2. competitive bidding processes will be followed to ensure best value outcomes
3. there will be appropriate standards and sanction and segregation of roles and functions to maintain probity and integrity
4. capability building of local resources will be a primary responsibility of any external resource

4.3 Initial Institutional Arrangements

The initial institutional arrangements in this section takes into account the above strategic consideration and guiding principles and will apply to all Amended Compact funded infrastructure delivery.

4.3.1 Strategic oversight

A reformed PMU residing within DTCI will collate information for program level Amended Compact infrastructure delivery.

The National Government to US Government interface will be through the Department of Finance and Administration.

Jointly CMD and PMU will develop and implement coordinated processes for controlling both financial and delivery aspects of the Amended Compact infrastructure program.

In time it is intended that this oversight arrangement will apply to all infrastructure programs as a long term development initiative with the Government to Government/Development Partner interface being managed by CMD or the Aid Coordination Group depending on the funding source.

4.3.2 Governance

Effective State IPICs provide the basis for strong governance of infrastructure delivery at the State program and project level once the coordinated control processes have been established.

Most importantly the upgraded role of the IPICs and establishment of the implementation framework outlined below will allow the devolution of planning and implementation responsibilities to the States without compromising control, integrity and governance. The reinstatement of the Pohnpei State IPIC is a priority action for the incoming State Executive.

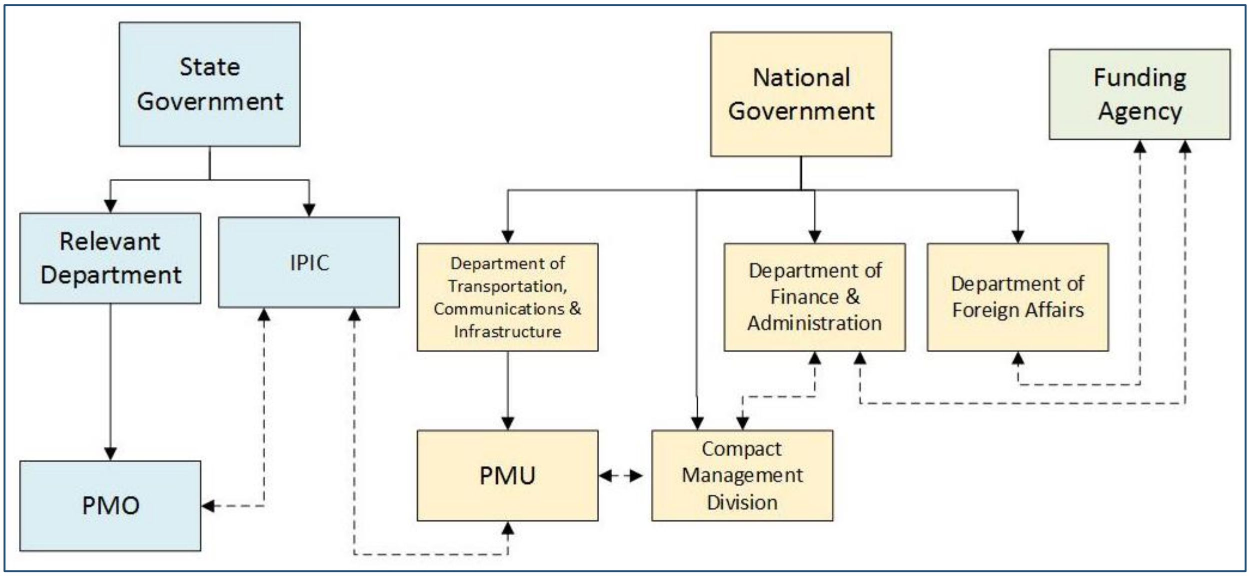
4.3.3 Implementation model

The implementation model retains the PMU within DTCI but restructures the unit to focus on **Program Management**. The PMU will provide ongoing support to each State to ensure standards are developed and shared, subsequent design and construction contracts are consistent with appropriate risk management and provide peer review expertise as required.

Project Management, from initial planning, through design to construction completion, is devolved to the States by the formation of four Project Management Offices (PMOs). The PMOs will undertake all the project management activities from initial design through to construction and completion.

The general structure of the implementation model is shown in Figure 10.

Figure 10 – Organization Chart of Infrastructure Delivery



A key part of the model is for a single external party to undertake the initial PMO role in each State. Each State will have its own contract with the external party establishing direct accountability to each State. This arrangement provides an optimum balance between State responsibility and consistency and efficiency across the four States.

The model addresses the key aspects of delivering an infrastructure program across FSM by:

- establishing an immediate increase in project management capacity by engaging the external party to operate in each State
- providing the States with direct involvement in the planning and implementation of their State program and projects
- retaining PMU to provide guidance on standards and contracts, risk management and conduct peer reviews and program management oversight
- retaining PMU as a National Government entity to ensure appropriate controls and segregation of duties
- having PMU provide central coordination of Amended Compact activities and institutional interfaces on program delivery matters, including tracking and reporting of program status, expenditure and funding availability
- using one external party to undertake all four PMO roles to provide consistency across all States in terms of project management approaches, processes and methodologies
- enabling performance comparison between States to facilitate continuous improvement and identification of particular weaknesses and solutions
- providing opportunities for State government employees to build skills and knowledge by working as part of or with the external PMO entity
- obligating the external PMO entity to developed capacity in each State
- sharing knowledge on technical and project management matters across all States via the PMU
- providing a foundation for the delivery of all infrastructure programs and projects over time
- providing greater opportunities for local companies to be involved in design and construction contracts

In the case of the Pohnpei State PMO, additional support will be provided to DTCI to assist in delivery of National Amended Compact infrastructure projects.

Proposed PMU Structure

The PMU's current technical/engineering focus needs to change. In addition to a Program Manager and administration support, the following skills and expertise are required refocus the unit in its program management and coordination role:

Contracting/Procurement Expertise

- establish, maintain and support standard procurement and contract documentation
- provide ongoing guidance to the States on scope definition, contract duration, special conditions of contract and risk management
- conduct peer reviews
- manage the prequalification of design consultants and contractors

Program Management Skills

- manage the current and future program portfolio, including tracking each project on a time, cost and quality basis in support of the States
- preparing periodic reports
- working with the States to plan and adjust programs to offset delays
- liaising with the funding agency on technical and other matters

Engineering Expertise

- support the engineering staff in each State by advising/developing appropriate local standards
- conducting peer reviews of design consultant proposals and design submissions, where required
- establishing and managing a consolidated engineering library including designs, standards and cost information for use across FSM
- assisting with the prequalification of design consultants and contractors
- supporting and building project management capacity of DTCI staff engaged in project management of National infrastructure projects

Proposed State Project Management Offices

Each State PMO will initially have external party resources to establish its project management capability supplemented by State and other FSM resources. The following resources will be required in each PMO.

Project Management skills

A Project Manager/PMO Manager is required in each State with larger State programs potentially requiring additional project manager(s).

Contracting Officers

Each PMO requires staff with the ability to undertake procurement and contracting responsibilities. A Project Manager may be able to undertake this role in States with smaller programs.

Resident Engineers and Inspectors

Resident Engineers and Inspectors are required in each State PMO and these could be State employees or other local resources. Other local resources can be progressively brought in as part of the capacity building process to initially understudy experienced staff.

Technical Specialists

From time to time specialist technical advice may be required on complex or challenging projects and the contract with the external party will enable technical specialists to work within the PMO on a short term basis.

General Considerations

The cost of each PMO is estimated to be between 5 and 7 percent of the State program which is within international benchmarks and internationally recognized as a legitimate program cost.

The IDP includes provision for the required funds for the PMU and State PMOs; the PMU funds will continue to come from the National Government, and the PMO funds are part of the Amended Compact component of each State's infrastructure development program (noting that Amended Compact PMO funding is dedicated to the delivery of Amended Compact projects).

The external party engaged to manage the PMO will be excluded from participating in any further contract for the design, construction or supervision on an IDP project for which it has project management responsibilities to ensure probity is maintained.

The external party will be contractually bound to build local project management capacity in each State and will have its capacity building plans and performance regularly reviewed by IPIC.

The link between each State PMO and the PMU is very important. The PMU will provide strong process guidance, contracting expertise, engineering standards and OIA liaison, legitimizing its role and avoiding being isolated from the PMOs.

The roles and responsibilities for each party involved in planning, implementation and management of the IDP's Amended Compact component are documented in Annex A.

4.4 Process Enhancements

All infrastructure projects require defined project management processes from pre-design through funds release, design and construction to successful completion. Best practice processes incorporate key steps, hold points, client reviews and concise and complete documentation to support such processes.

It is also good practice to release funds at two stages; initially to release funds to enable the full project design to be undertaken and then, prior to the construction procurement process commencing, the funding required for construction. This approach facilitates the orderly progress of the project while ensuring that after design there is a review of the project scope, time and cost and any changes are formally signed off before committing funds for construction.

Pre-Design and initial funds release

The PMO will fully document the project scope and formally agree this information with its IPIC, including:

- project outline, scope and justification
- other options considered if relevant
- reference to IDP, sector and prioritization
- whole of life cost estimate broken down to estimates for project management, design, construction and maintenance
- delivery strategy, including number and type of contracts, project phasing and timing, links to other projects and arrangements for construction supervision
- risks and issues that need to be resolved, for instance site access or geotechnical data
- outline program broken down to include key review points at say 30 percent design, end of design and construction completion

The project will be submitted for the release of initial (generally design) funds once endorsed by the IPIC.

Once the initial funds have been appropriated, the PMO will conduct (if required) a competitive procurement process in accordance with the prevailing procurement process and regulations to identify and contract the design consultant.

Design and construction funds release

The PMO will formally review each project with the IPIC twice during design. The PMO will also hold regular client meetings with sector representatives.

The IPIC reviews will be held when the design is 30 percent complete and when it is 100 percent complete (but still subject to review). The 30 percent design review will ensure that designs remain on an agreed path before significant design costs are incurred.

Following a design being accepted as complete a second submission will be made to the funding agency for the appropriation of construction funds.

Construction procurement

Once construction funds have been appropriated, the PMO will conduct a competitive procurement process in accordance with the prevailing procurement process and regulations to identify and contract the construction contractor and any required supervision consultant.

Variations

The PMO will process variations generally as follows:

- variations in scope require IPIC approval to ensure project outcomes remain fully agreed
- variations in scope or cost that require additional funding will be endorsed by IPIC before submission to Government and/or OIA (as required) for approval
- change orders to a contract will be processed in accordance with the PMU's contract management manual

Completion

The PMO will prepare a Project Completion Report for endorsement by the IPIC. This report will include analysis of the project on a time, cost and quality basis and the PMO will ensure that all contract completion activities are finalized, including provision of as-built drawings and operations and maintenance (O&M) manuals.

4.5 Transitional Arrangements and Longer Term Developments

4.5.1 Transitional arrangements

The target for the implementation model to be in place is Q3 FY2016.

Transition to the implementation model

The transition from the existing arrangements to the State-focused implementation model is complex and needs to be completed quickly to minimize any further delays in infrastructure delivery. DTCI will establish the overall transition program and responsibilities and manage its implementation.

The role of PMU during the transition period will be three-fold:

1. to refocus itself on the evolved program management role identified in the implementation model, including the recruitment of staff to fill any gaps in required skills and expertise
2. support DTCI in implementing the transition program
3. continue to manage on-going projects until the PMOs are in place and ready to take responsibility for their infrastructure delivery

The overall transition program will involve DTCI working closely with State representatives to:

1. define the scope of services required to meet the PMU and State requirements for project management services and capacity building
2. undertake a procurement process to identify the preferred external party that is best suited and able to fulfill the role and functions identified for the PMO in each State, including the ability to build the capacity of local resources
3. develop a draft contract agreement for each State to negotiate with the preferred external party – the draft contract agreements will have common general terms, conditions and schedules and any requirements that may be particular to any State

Each State will then enter into its own contract with the external party.

Other transition activities

In parallel with the transition to the implementation model:

The Attorney General will prepare legislation required to facilitate and support the institutional arrangements and work with State counterparts to make complementary changes to State legislation.

The Secretaries of Finance and Administration and TCI will prepare replacement Procurement Regulations for IDP Projects to establish a single set of regulations for procurement of Amended Compact funded contracts and work with State counterparts on any complementary changes to State regulations.

4.5.2 Longer term developments

The institutional arrangements, including the implementation model, provide enhanced delivery for Amended Compact funded infrastructure with strong governance at State level and coordination of the program at a National level. When fully established and optimized, discussions will be held with development partners to deliver their infrastructure projects under the same arrangements. This has a number of advantages including:

- ensuring that the expertise, both private sector and that developed through capacity building, is employed to deliver all infrastructure
- providing development partners with clearly identified National and State-based entities to interface with on infrastructure projects
- ensuring FSM maximizes the infrastructure development funding opportunities available
- ensuring high standards of consistent governance and process are applied to all infrastructure projects

The funding of the PMO under such a revised arrangement will need to be agreed with the development partners.

Part 5 Sector Overview

5.1 Institutional Arrangements

5.1.1 Power and Water Sector Utilities

The public utilities corporations/authorities created during the 1990s continue to improve their management, financial, technical and service delivery capacities and performance, assisted by ongoing infrastructure investment from external funding sources. Broadly the utilities are now at the point that their management and administration and O&M activities are covered by tariff revenue. However service extension and rehabilitation will require external funding for the foreseeable future.

All power utilities are actively planning and implementing renewable energy projects and are moving steadily towards the Energy Policy targets.

Water and wastewater services in Kosrae remain the responsibility of the Department of Transportation and Infrastructure. However a framework exists for future infrastructure projects to include transfer of responsibilities to the Kosrae Utilities Authority (KUA).

Chuuk Public Utilities Corporation (CPUC) receives Amended Compact funding support for four managerial positions. This support is due to finish no later than FY2018.

The Pacific Power Utilities Benchmarking Report Fiscal Year 2012[20] rates the performance of the FSM electric power utilities with their overall financial performance shown in Table 11.

Table 11 – Electric Power Utilities Performance

Electric Power Utility	Operating Ratio[1]
Chuuk Public Utilities Corporation	108.2 percent
Kosrae Utilities Authority	111.4 percent
Pohnpei Utilities Corporation	109.1 percent
Yap State Public Services Corporation	106.8 percent
Pacific Average	98 percent

Note:
1. *"OR" = [(total operating costs + depreciation) / (total revenue)] x 100*
   OR below 100 indicates profitability

The Pacific Water and Wastewater Utilities Benchmarking Report 2013[21] rates the performance of the FSM water utilities with their overall performance shown in Table 12.

Table 12 – Water Utilities Performance

Water Utility	Overall Efficiency Indicator	Operating Cost Recovery Ratio
Chuuk Public Utilities Corporation	18 percent	30 percent
Pohnpei Utilities Corporation	66 percent	**169 percent**
Yap State Public Services Corporation (2012)	47 percent	**127 percent**
Southern Yap Water Authority (2011)	**89 percent**	92 percent

[20] (PPA, 2012) - Pacific Power Utilities Benchmarking Report Fiscal Year 2012
[21] (PWWA, 2013) - Pacific Water and Wastewater Utilities Benchmarking Report 2013

Gagil-Tomil Water Authority	**96 percent**	103 percent
Pacific Benchmark	70 percent	120 percent

Note:

2013 indicators unless noted

Operating Cost Recovery Ratio:

$$\frac{\textit{operating revenues (excluding subsidies)}}{\textit{operating costs (excluding depreciation and debt servicing)}}$$

CPUC only started water billing in July 2012 with on-going new meter installation – further gains in operating cost recovery ratio were made in 2014[22]

5.1.2 Solid Waste Management

There are effective, regulated solid waste management systems in place for the primary state population/activity centers and there is developing private sector involvement in solid waste management services. All primary landfill sites utilize the Fukuoka method and there is increasing separation of recyclable and hazardous wastes from general refuse.

Operational costs are funded from general revenues and there are currently no environmental levies on industry or consumers.

The solid waste management regulators and operators have identified the need for additional investment to improve existing facilities, develop new facilities and extend the scope and coverage of solid waste management, albeit still limited to the main population activity centers.

5.1.3 Roads and Pedestrian Facilities

Road and pedestrian facilities are largely the responsibility of state departments for infrastructure/public works. Although improvements to the condition of roads and bridges are required, the road networks in the primary population/activity centers are largely in place with the exception of the Southern Namoneas and Faichuk groups in Chuuk lagoon.

The key institutional challenge is to introduce an approach to road and bridge asset management that delivers safe and serviceable road conditions at optimum whole-of-life costs. Extensive development of both public sector road management capacity (including planning, inspection and contract management capacity), and private sector maintenance and construction capacity is required.

5.1.4 Maritime Transportation

Port development and management is the responsibility of independent authorities in Kosrae, Pohnpei and Yap that retain revenue generated from operations and have responsibility for operating costs and making investments. In Chuuk the port is the responsibility of the Department of Transportation and Public Works. These agencies have broader responsibilities for navigational aids throughout their respective States although this is limited in practice.

The private sector provides stevedoring services at the major ports.

Regulation of maritime safety and security is a national responsibility within DTCI and is a key component of planned revisions to transportation legislation. The capacity of DTCI's Marine Division in this area is currently limited and will be developed as part of implementing revised legislation. There are opportunities to leverage regional capabilities in this area through the Micronesia Shipping Commission.

[22] (CPUC, 2014) - CPUC – Annual Report FY 2014

5.1.5 Air Transportation

In the IDP "**airport**" refers to the international airports, one in each State, and "**airstrip**" refers to the aircraft landing facilities on the outer islands.

Airport development and management is the responsibility of independent authorities in Kosrae and Pohnpei that retain revenue generated from operations and have responsibility for operating costs and making investments. In Chuuk and Yap the airport is the responsibility of the Department of Transportation and Public Works.

The Civil Aviation Division within DTCI provides an oversight function of all airports and outer island airstrips and works closely with the US Federal Aviation Agency on aviation safety and security. DTCI's Civil Aviation and Infrastructure Divisions liaise with the State departments responsible for outer island airstrip infrastructure and maintenance.

Regulation of aviation safety and security is also a key component of planned revisions to transportation legislation. The capacity of Civil Aviation Division will need to be developed as part of the introduction of the revised legislation. Again there are opportunities to leverage regional capabilities in the area of aviation safety and security.

5.1.6 Telecommunications

The FSM Telecommunications Act of 2014 established the FSM Telecommunication Regulation Authority and opened the door to market competition. Establishing and building the Authority's capacity is part of the current regional telecommunications connectivity project.

FSM Telecommunications Corporation (FSMTC) currently remains the sole telecommunications provider and continues to improve management, financial, technical and service delivery capacities and performance. FSMTC is proactive in leveraging external investments, particularly connections to the international fiber optic network, to bring contemporary telecommunications services and pricing to consumers.

FSMTC's financial position has reached the point that it is able to enter into at least concessional loans to invest in new infrastructure and facilities.

5.1.7 Education

There are Boards of Education in each State and the College of Micronesia (COM) has a Board to manage its affairs.

Sector coordination is undertaken through the FSM Association of Chief State School Officers comprised of the Secretary of Education, State Directors of Education and the COM President.

5.1.8 Health

Within the health sector there are a number of regulatory responsibilities that include licensing medical professionals and setting food safety standards.

There is also a Healthcare Coalition established under a memorandum of understanding comprised of the Secretary of Health, State Directors of Health and the head of private health provider Genesis. The role of the Coalition is to coordinate on operational and emergency response matters, ensuring that medical resources across the whole of FSM can be mobilized as and when required. The Coalition also acts as FSM's oversight group on projects and grants in the health sector.

5.1.9 Government Administrative Buildings

The national or state infrastructure/public works agency is responsible for government administrative buildings.

5.2 Sector Plans

5.2.1 Current Sector Plans

Table 13 – Sector Plans and Studies

Sector	Title	Status
Air Transportation	Airport Master Plan (all States)	Completed 2012
Maritime Transportation	Regional Study on Maritime Transport Systems in the North Pacific Countries	Draft May 2015
	Pohnpei Port Scoping Study	Completed in 2011
Electric Power	Regional Energy Plan	In Progress
Solid Waste Management	FSM draft National Solid Waste Management Strategy 2010-2014	Unknown
Education	School Facility Repair and Construction Master Plan (Chuuk, Pohnpei & Yap)	Completed 2012/13
	College of Micronesia - FSM Space Utilization and Facilities Master Plan (all campuses)	Completed 2013
Climate Change	Kosrae Joint State Action Plan Kosrae Shoreline Management Plan Yap Joint State Action Plan	Completed 2015 Completed 2014 Completed 2015
Tourism	National Tourism Policy and State Investment Plans	Draft 2015

5.2.2 Proposed Sector Plans

Maritime Transportation

The domestic maritime transportation sector requires plans for each State. An early and appropriate maritime project in each State will be selected to prepare the first stage of the maritime sector plan by identifying and documenting all existing maritime assets, including jetties, landing places, nature of access from land and sea. This information will also form part of the asset register as described in section 6.3.

Most sector planning can be done in isolation from the other sectors however an integrated approach to air and maritime transportation planning for the outer islands is important so that the two modes complement rather than compete with each other, avoiding the risk of separately planned services failing.

Air Transportation

The intended development of Airport Safety and Security Plans under the AIP is an important step towards having IDP air transportation projects considered for implementation funding under this program.

Education

An Education Sector Infrastructure Code will be developed at State level, with coordination at National level, to set minimum spatial planning standards for education buildings, additional to Building Codes.

This will be generated out of the early design stages of initial projects and compiled as standard documents by the PMU.

Health

A Health Sector Infrastructure Code will be developed at State level, with coordination at National level, to set minimum spatial planning standards for health buildings, additional to Building Codes. This will be generated out of the early design stages of initial projects and compiled as standard documents by the PMU.

Part 6 Institutional Aspects

6.1 Whole of Life Costs

The costs associated with new infrastructure do not end with purchase or construction. It is one step in the life cycle of an asset that begins with the initial identification of needs through to the disposal of the asset at the end of its useful life. The stages of the asset life cycle include: concept and planning, detailed design specification, construction/supply, contract supervision, operation and maintenance and disposal/decommissioning. Each stage requires planning and coordination and involves costs and time.

When all these costs are combined, the total may be more than double the cost of the initial purchase/construction price[23]. Neglecting to consider and budget for whole of life costs results in preventative maintenance not being undertaken and a generally shorter life than expected. With the cost-effectiveness of preventative maintenance well established[23], this represents a waste of scarce resources and imposes an unnecessary burden of infrastructure renewal on future budgets where money could be better utilized elsewhere.

The provision of adequate funding for preventative maintenance as part of a whole of life approach to asset management is a key institutional issue for FSM, like other Pacific Island countries.

The IDP distinguishes between the costs of keeping an asset in a usable condition (**maintenance costs**) and the costs of using the asset to deliver services (**operating costs**). Maintenance costs are generally related to standardized activities of a routine or periodic nature that can be reasonably estimated. Operating costs on the other hand are related to service delivery that can be highly variable over the life of an asset and between similar assets used in similar situations.

Each of the priority projects included in the National and State IDP volumes incorporate an estimate of the maintenance costs over the life of resulting asset, providing an estimate of the whole of life cost of owning the asset and keeping it in a usable condition (but not operating it and delivering services). Unlike maintenance costs, FSM sector managers have a reasonable understanding of, and make reasonable budgetary provision for, the cost of operating their assets.

Standardized maintenance cost factors for the IDP sectors are shown in Table 14.

Table 14 – Maintenance Cost Factors

Sectors & Components	Life (Years) (A)	Maintenance Costs per annum (percent Construction Cost[1]) (B)	Maintenance Costs over Asset Life (percent of Construction Cost) (A x B)
Electric Power			
Poles & wires	20	2.5 percent	50 percent
Solar Power (feed-in)	20	3.0 percent	60 percent
Diesel Generators	15	15.0 percent	225 percent
Water/Wastewater Systems			
Pipes, Tanks	50	2.0 percent	125 percent
Plants	30	4.0 percent	120 percent
Solid Waste Management	20	2.0 percent	40 percent

[23] (PIAC, 2013) - Infrastructure Management in the Pacific

Sectors & Components	Life (Years) (A)	Maintenance Costs per annum (percent Construction Cost[1]) (B)	Maintenance Costs over Asset Life (percent of Construction Cost) (A x B)
Roads and Pedestrian Facilities			
Paved Roads	20	3.5 percent	70 percent
Bridges	50	3.0 percent	150 percent
Maritime Transportation			
Docks	50	3.0 percent	150 percent
Other Facilities	20	3.0 percent	60 percent
Air Transportation			
Runways & Aprons	20	12.0 percent	240 percent
Other Facilities	20	3.0 percent	60 percent
Telecommunication Systems	50	8.0 percent	400 percent
Health	50	4.0 percent	200 percent
Education	50	2.5 percent	125 percent
Government Administrative Buildings	50	3.0 percent	150 percent
Vehicles, Plant and Equipment	10	20.0 percent	200 percent
Vessels	20	20.0 percent	400 percent

Notes:

Based on 8 percent discount rate applied to whole of life maintenance costs

In addition to the quoted reference[23], total maintenance costs per annum are based on broad assessments internationally of similar types and standards of infrastructure

6.2 Infrastructure Maintenance

Like other Pacific Island countries FSM has difficulty in achieving key infrastructure maintenance objectives: cost effective asset preservation, and acceptable levels of infrastructure safety and amenity.

Virtually all sectors in all jurisdictions consider that funding for infrastructure maintenance is inadequate. The exception is in the utility sectors where tariff revenue now provides a reasonable amount for preventative maintenance of water, wastewater and electric power assets (and the delivery of services).

Effectively 10 percent of Amended Compact infrastructure funds are set aside for maintenance (5 percent Amended Compact and 5 percent matching funds) and the National Government allocates maintenance funds from local revenue. Despite funding being available for infrastructure maintenance, there is little in the way of formal infrastructure maintenance programs other than in the utility sectors. The capacity of the States to match the available Amended Compact IMF funding is a major constraint that is compounded by the OIA's requirements for releasing those funds. The unspent Amended Compact IMF funds through to FY2015 are $6.1 million (around $12.2 million in total with the matching funds).

Although the annual funding for maintenance from IMF and National Government sources is in the order of $6 million, this is still a relatively small proportion of the total maintenance needs across FSM.

Adopting an average maintenance funding rate of 3 percent from Table 14, the IDP infrastructure development program by itself will generate a maintenance funding requirement between 4 and 5 times the current level of maintenance funding without even considering the maintenance funding requirement for existing infrastructure assets.

Improving the maintenance of FSM's infrastructure is a major institutional challenge that needs to be addressed through the IDP, not just with the infrastructure sector agencies, but with the governments and their policies, strategies and management of financial resources. The following section 6.3 sets out the FSM's planned transition to contemporary asset management, supported by technical assistance projects that are part of the IDP institutional component.

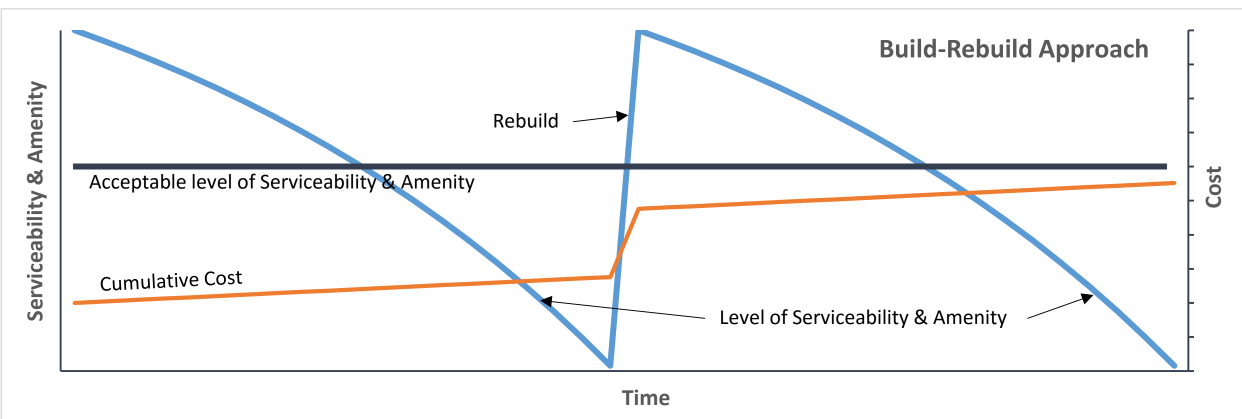
6.3 Transition to Contemporary Asset Management

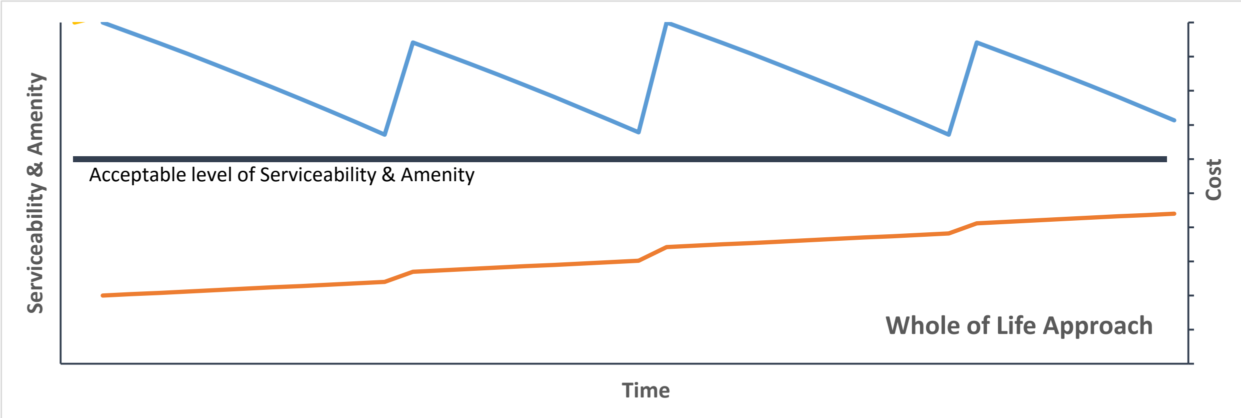
6.3.1 Introduction

Good quality and sustainable infrastructure is vital to the national economy. It delivers essential services, drives economic growth and is a significant contributor to the quality of life of the population. With the buildup of infrastructure assets over the years and questions over the level of investment beyond 2023, it is essential that the FSM takes steps towards an approach to asset management that minimizes costs on a whole-of-life basis.

The broad objective is to minimize the life-cycle cost of infrastructure assets whilst maintaining acceptable levels of amenity and serviceability. This contrasts with the "build then rebuild" approach that is characterized by the asset being replaced before the intended design life being reached and low levels of serviceability and amenity over much of the asset life. These two approaches are illustrated in Figure 11.

Figure 11 – Asset Lifecycle Approaches





The whole of life costs can be heavily influenced by the design of infrastructure assets so it is critical that designs are sympathetic to the prevailing climatic conditions and skills and equipment available in the FSM.

In summary, the whole of life approach is founded on the principles of:

1. maintaining the serviceability and amenity of assets at acceptable levels in the most cost effective manner, and
2. infrastructure design and construction that is appropriate to the FSM

The core benefits that will accrue to the FSM from this approach are:

1. the total capital and recurrent investment in infrastructure assets is minimized over the whole of life, and
2. assets generally meet the users' needs for serviceability and amenity and avoid the cost and other impacts that arise from sub-standard assets

6.3.2 Implementing Whole-of-Life Asset Management

DTCI is the National Government's lead agency for planning and implementing a whole-of-life approach to asset management and will work in close coordination and cooperation with its counterpart agencies in the States.

Policy

The FSM Governments will establish an **infrastructure asset management policy** that includes an overall policy statement, elements of policy specific to infrastructure sub-sectors and responsibilities for policy application and implementation.

A core principle will be "**keeping good assets good**", that is resources should be prioritized to ensure that assets of good standard do not deteriorate unnecessarily and incur higher whole of life costs and/or fail to meet the required standards for serviceability and amenity.

Strategies

The infrastructure asset management policy will be supported by an **overall strategy** and **separate sector strategies**. These strategies will describe the approaches and methodologies that the FSM Governments will follow in implementing the policy, including:

1. strategy objectives and performance measures (e.g. condition and safety of roads, quality and availability of water)
2. classification of assets
3. broad allocation of available resources between and within sub-sectors

4. addressing the backlog of sub-standard infrastructure to bring it to a standard that makes ongoing maintenance cost effective
5. action plans for implementing the asset management policy and strategies at sub-sector level

Information

Implementation of the policy and strategies is highly dependent on the **availability and quality of asset information**, particularly the following components:

asset registers – records of ownership, location, physical, administrative and cost information for individual assets that provide base information for asset management planning, programming and evaluation
collection tools – systems, procedures, equipment and resources that ensure that asset register information is collected and is complete, timely and of suitable quality
analysis and modelling tools – systems, procedures, equipment and resources that facilitate analysis of asset register information to prepare programs and evaluate the effectiveness of asset management – this can vary from integrated spreadsheets to specialist modelling software

Programs

With the above policy, strategies and information in place, it will be possible to develop **asset management programs** for each sector in each State, separated out for each asset category and program component (see below).

Asset management programs will be integrated into Government budget planning processes and have a single set of guidelines to provide a national basis for budget targets, criteria and prioritization.

Programs will be prepared on an annual basis with a three year outlook – an “approved” program and budget for Year 1 and “indicative” programs and budgets in Years 2 and 3. This will permit the infrastructure agencies to plan and implement asset management programs more efficiently, particularly through multi-year maintenance contract arrangements.

Accountability for and management of the programs will be integrated into the Government processes that include ongoing performance reporting and annual program evaluation.

Program Components

Each sector program will include the following asset management program components:

routine maintenance – maintenance undertaken on a continuous basis to address minor defects before they contribute to further damage or deterioration to the asset, such as potholes in roads, leaks in water supply systems or broken windows in Government buildings
periodic maintenance – maintenance undertaken on a cyclic basis to restore at least some of the serviceability and amenity of assets that are lost over time and to protect against further unnecessary deterioration such as resurfacing of roads, painting of Government buildings or intensive cleaning of water treatment facilities
rehabilitation – work that is undertaken to “renew” the asset when routine and/or periodic maintenance is no longer cost-effective, for example replacing failed hard-stand dock areas, replacing cladding of timber buildings or replacing lengths of water supply lines that are continually leaking

Capital Investment Projects

A capital investment project will generally be required when:

1. asset management program components are no longer cost-effective in maintaining the serviceability and amenity of the asset, for example to maintain a bridge to carry its design load or to maintain a building in a safe condition
2. the capacity or function of the asset no longer meets the needs of users, for example a road needs to carry more traffic, a water supply main needs to supply more water or a dispensary needs additional space to treat more patients

6.4 Institutional Projects

Asset Management

The IDP includes an institutional project to support the implementation of whole of life asset management in the FSM through technical assistance and capacity building, including:

Policy and Strategies – establish the overall asset management policy and strategy and sector strategies with the participation and commitment of all governments and stakeholders, including a basis for adequate and sustainable funding over and above capital investment

Asset Identification, Ownership and Registration – develop registers of infrastructure assets and progressively add details of ownership/responsibility, category, condition and maintenance need

Capacity – plan then develop and implement asset management capacity in terms of:

- **People** – dedicated and sufficient resources with responsibility and skills for collecting and analyzing asset information and planning, managing and implementing asset management programs
- **Processes** – procedures, guidelines and tools for evaluating and prioritizing asset management needs and monitoring and reporting the effectiveness of programs
- **Technology** – appropriate systems to support the collection, recording, analysis, monitoring and reporting of asset management information
- **Budgets** – adequate budget for a sustainable asset management capacity and optimized asset management programs
- **Private sector service providers** – a sustainable and competitive pool of service providers to undertake asset management activities

Transportation Regulation

The IDP includes a technical assistance project to support DTCI's implementation of revised maritime and air transportation safety and security regulations, including any regional integration or cooperation.

FSM Building Code

At present projects are generally designed in accordance with international codes, standards and guidelines, but with only limited account taken of the specific circumstances of FSM. Some guidelines have been developed for specific aspects including seismic and wind loading and are summarized in Climate Adaptation Guide for Infrastructure[24].

It is therefore intended that a National Building Code will be developed, with State specific requirements where appropriate. The Code will be based on the International Building Code and other US based codes and standards, but take account of the requirements of FSM and incorporate existing state and national guidelines.

[24] (DTCI, DoI, 2014) – Climate Adaptation Guide for Infrastructure

Chuuk Land Registry

The IDP includes a project to support the efforts of Chuuk State to reestablish its land title records. This will involve the recovery of records kept in Guam and Hawaii, identification of land title boundaries through consultation with stakeholders and survey, and recording legally sufficient title information.

Successful implementation of the Chuuk IDP education and health sector programs depends on establishing public ownership over school and dispensary land through this and the targeted land definition and acquisition projects included in Volume 3. However the benefits of the project will be more far-reaching than just the implementation of the IDP projects.

List of Institutional Projects

The IDP institutional projects are listed in Table 15 and outlined in the following project proformas.

Table 15 – Institutional Projects

ID	Project Title	Required Funding ($)	Target Period
IN/1	Asset Management Technical Assistance	2,000,000	All
IN/2	National Building Code	200,000	1
IN/3	Strengthen Transportation Regulation	200,000	1
IN/4	Re-establish Chuuk Land Title Records	2,000,000	2
	Total Funding Required	**4,400,000**	

Project I 1 – Asset Management Technical Assistance (IN/1)

Project Title:	Asset Management Technical Assistance	**Sector:**	Institutional
		Estimated Cost:	2,000,000

Project Description/Scope:	Plan, develop and implement a contemporary approach to asset management for infrastructure across FSM, including:
	• Policy and Strategies
	• Asset Registers
	• Capacity Development involving:
	    • People
	    • Processes
	    • Systems and Equipment
	    • Budgets
	    • Private sector service providers		

Agencies Responsible:	DTCI in conjunction with sector managers at national and state level		
Project Objectives/ Outcomes:	Implement a whole of life approach to asset management such that costs are minimized and asset are maintained to acceptable levels of safety and amenity		
Project Justification:	Whole of life infrastructure costs are not minimized, asset management is not adequately funded and adequate levels of safety and amenity are not maintained		
Project Status:	Concept		
Inclusions:	To be defined as part of TA scoping		
Exclusions:	To be defined as part of TA scoping		
Risks & Dependencies:	To be identified as part of TA scoping		

Project I 2 – National Building Code (IN/3)

Project Title:	National Building Code	**Sector:**	Institutional
		Estimated Cost:	200,000
Project Description/Scope:	Develop and implement a National Building Code appropriate to the FSM based on the International Building Code and other relevant codes and standards and incorporating specific aspects on a state-by-state basis including seismic and wind loading.		
Agencies Responsible:	DTCI		
Project Objectives/ Outcomes:	FSM infrastructure is designed and constructed according to relevant and appropriate codes and standards		
Project Justification:	At present projects are generally designed in accordance with international codes, standards and guidelines, but with only limited account taken of the specific circumstances of FSM		
Project Status:	Concept		
Inclusions:	State-specific provisions and implementation at national and state levels		
Exclusions:	To be defined as part of TA scoping		
Risks & Dependencies:	Available codes and standards do not adequately cover FSM's needs		

Project I 3 – Strengthen Transportation Regulation (IN/3)

Project Title:	Strengthen Transportation Regulation	**Sector:**	Institutional
		Estimated Cost:	200,000
Project Description/Scope:	Provide assistance to establish the regulatory arrangements included in the revised transportation legislation, including the development of management, process and resource capacity		
Agencies Responsible:	DTCI – Divisions of Civil Aviation and Marine		
Project Objectives/ Outcomes:	Undertake transportation regulation in accordance with revised legislation		
Project Justification:	FSM has identified gaps in its regulation of transportation and revised legislation is being developed – establishing the regulatory agencies and developing management, process and resource capacity is critical to fulfilling the objectives of the revised legislation		
Project Status:	Legislation is being prepared		
Inclusions:	To be defined as part of TA scoping		
Exclusions:	To be defined as part of TA scoping		
Risks & Dependencies:	To be identified as part of TA scoping		

Project I 4 – Reestablish Chuuk Land Title Records (IN/4)

Project Title:	Re-establish Chuuk Land Title Records	**Sector:**	Institutional
		Estimated Cost:	2,000,000
Project Description/Scope:	Reestablish Chuuk's land title records from: • Information held by institutions in Guam and Hawaii • Collecting and registering of additional land tenure and title information • Consulting and negotiating with stakeholders		
Agencies Responsible:	Division of Commerce and Industry		
Project Objectives/ Outcomes:	Reestablish definitive land title records for Chuuk		
Project Justification:	Most matters dealing with land title in Chuuk are impacted by the absence of definitive land title records		
Project Status:	Planning		
Inclusions:	Establishment of land title records from existing and reconstructed information		
Exclusions:	Supporting/enabling legislation		
Risks & Dependencies:	Lack of legislative support for reestablishment of land title records		

Part 7 Monitoring & Reporting

Performance Indicators

A range of performance indicators that are influenced by the infrastructure in each sector (other than government administrative buildings) are included in Annex B. The indicators cover aspects including accessibility, quality, efficiency, safety and affordability/financial sustainability.

Monitoring and Evaluation

Infrastructure managers and IPICs will monitor ongoing infrastructure performance to identify and plan improvements to infrastructure performance and service delivery and changes in the IDP priority projects and priorities.

Reporting

The performance indicators will be measured on an annual (fiscal year) basis and reported by the National Government within 3 months of the end of the fiscal year.

Annexes

Annex A Infrastructure Development Responsibility Matrix

FSM Agency / Activity	Aid Coordination Group	Compact Management Division	DTCI	State IPICs	PMU[1]	State PMOs[1]
Preparing the Annual Implementation Plan		Accountable			Responsible	Consulted
Collating submissions to JEMCO and OIA		Accountable			Responsible	Consulted
Collating other aid submissions (EU, JICA, etc.)	Accountable				Responsible	Consulted
Program coordination and performance analysis	Accountable				Responsible	Informed
Manage transition to the PMU/PMO model			Accountable		Responsible	Consulted
Project completion analysis and lessons learnt				Accountable	Responsible	Consulted
Knowledge management (design criteria, standards, terms, conditions)			Accountable		Responsible	Informed
Design consultant pre-qualification			Accountable		Responsible	Informed
Design consultant selection				Accountable		Responsible
Contractor pre-qualification				Accountable	Responsible	Informed
Contractor selection						Responsible
Peer reviews			Accountable		Responsible	Consulted
Project management				Accountable		Responsible
Forward project programs and cash flows - Compact		Accountable				Responsible
Forward project programs and cash flows –EU, JICA…	Accountable					Responsible
Planning and design				Accountable		Responsible

Activity \ FSM Agency	Aid Coordination Group	Compact Management Division	DTCI	State IPICs	PMU[1]	State PMOs[1]
Construction supervision				Accountable		Responsible
Scope and design verification				Accountable		Responsible
Capacity Building				Accountable	Informed	Responsible
Variation control				Accountable		Responsible

Notes:

1. PMU and PMO involvement in non-Compact infrastructure development projects is a longer term development and subject to agreement of the relevant funding agencies

Annex B Performance Indicators

B.1 Electric Power

Operational performance indicators for FSM electric power utilities are available from the annual **Pacific Power Utilities Benchmarking Report** prepared by the **Pacific Power Association** (www.ppa.org.fj)

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Accessibility Indicators					
1. Households with access to grid connected electrification (percent)	2012	80	77	96	57
2. Electricity production (000 kWh)	2012	13,866	5,463	32,351	12,255
3. Electricity load factor (percent)	2012	59.2	54.8	62.4	67.0
Quality Indicators					
4. System Average Interruption Frequency (SAIFI) events per customer	2012	(a)	(a)	(a)	16.7
5. System Average Interruption Duration (SAIDI) mins per customer	2012	78,120	845	(a)	17,704
Efficiency Indicators					
6. Specific fuel oil consumption (kWh per liter)	2012	3.68	3.58	3.23	3.81
7. Distribution losses (percent of output)	2012	28.1	1.8	19.0	25.1
8. Renewable energy share (percent)	2012	0.0	0.0	0.0	0.2
Affordability Indicators					
9. Average residential end-user electricity tariff (cents/kWh)	2012	0.56	0.40	0.49	0.44
10. Average commercial end-user electricity tariff (cents/kWh)	2012	0.59	0.42	0.49	0.46

Notes:

(a) Information not included in the PPA Benchmarking Report

ANNEXES

B.2 Water/Wastewater Systems

Operational performance indicators for FSM water and wastewater utilities are available from the annual **Pacific Water and Wastewater Utilities Benchmarking Report** produced by the **Pacific Water and Wastes Association** (www.pwwa.ws)

Indicator	Baseline Year	Chuuk CPUC	Kosrae DTI	Pohnpei PUC	Yap		
					YSPSC	GTWA	SYWA
Accessibility Indicators							
1. Access to improved urban water source (percent total population)	2012	90	82	(a)	93	92	100
2. Access to improved urban sanitation (percent total population)	2012	63	40	(a)	70	n/a	n/a
3. Availability of water supply in piped water supply systems (average hours per day)	2012	24	20	(a)	24	24	24
Efficiency Indicators							
4. Employees (per 1000 connections)	2013	14.6	9.6	7.2	14.9 (2012)	8.0	(a)
5. Non –revenue water (percent of water produced)	2013	72	100	16	47 (2012)	4	(a)
Affordability and Financial Sustainability Indicators							
6. Cost recovery (tariff revenue/operating cost (percent))	2013	30	n/a	169	127 (2012)	103	92 (2011)
7. Average tariff for water services ($ per 1,000 gal)	2013	1.55	n/a	2.08	1.51	2.27	1.70
Safety Indicators							
8. No. of drinking water safety plans in place	2013	1	2	3	1	1	0
9. Drinking water quality compliance (%) – residual chlorine/microbiological	2013	100 / 85	0 / 50	83 / 96	90 / 90	100 / 71	0 / 70

Notes:

(a) Information not included in the PWWA Benchmarking Report

ANNEXES

B.3 Solid Waste Management

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Accessibility Indicators					
1. Access to regular solid waste collection service in urban areas (percent of urban population)	20__				
2. Frequency of solid waste collection service in urban areas (number per week)	20__				
Quality Indicator					
3. Facilities with up-to-date environmental monitoring reports readily available (number)	20__				
Efficiency Indicator					
4. Cost of waste disposed ($ per capita)	20__				
Sustainability Indicators					
5. Systems for sorting solid/recyclable/hazardous wastes (number)	20__				
6. Exported recyclable commodities or waste (number of shipping containers)	20__				

B.4 Roads and Pedestrian Facilities

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Accessibility Indicators					
1. Total road network (miles)	20__				
2. Paved roads (miles)	20__				
3. Unpaved roads (miles)	20__				
4. Registered motor vehicles (number)	2013	362	801	5,275	2,564
Quality Indicator					
5. Condition of roads (percent of road network in poor condition)	20__				
Efficiency Indicator					
6. Road network receiving regular routine maintenance (percent of road network)	20__				

B.5 Maritime Transportation

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Accessibility Indicators					
1. International container services (annual number of container ships)	2014	72	30	53	48
2. Container throughput (annual number of containers (TEU) imported & exported)	2014	1,155	421		714
Quality Indicator					
3. Vessel turnaround time (average time in days)	2014		<1.0	1.0	
Efficiency Indicator					
4. Delay waiting to enter port (average time in days)	20__				
Affordability Indicator					
5. Port charges ($/Twenty-foot Equivalent Unit)	20__				
Safety Indicator					
6. Maritime incidents (Number)	20__				

B.6 Air Transportation

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Accessibility Indicators					
1. Operational airports/airstrips (number)	2015	1/3	1/-	1/3	1/2
2. Scheduled international airport in-bound passenger flights (average flights per week)	2015	7	6	8	3
3. Scheduled airstrip in-bound flights (average flights per week)	20__		n/a		
4. Cost of international airfreight ($/ton-mile)	20__				
Quality Indicator					
5. IATA Level of Service for international airports	20__				
Safety Indicators					
6. Aviation incidents (number)	20__				
7. ICAO safety audit indicator for international airports	20__				

B.7 Telecommunications Sector

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Accessibility Indicators					
1. Mobile-cellular network coverage (percent of population)	20__				
2. Fixed broadband internet subscriptions (percent of population)	20__				
3. 3G (minimum) mobile-cellular network coverage (percent of population)	20__				
4. 4G (minimum) mobile-cellular network coverage (percent of population)	20__				
Quality Indicator					
5. Internet bandwidth (Mbit/s per capita)	20__				
Affordability Indicators					
6. Cost of mobile-cellular prepaid ($ per minute local call)	2015	0.50	0.50	0.50	0.50
7. Cost of international mobile-cellular ($ per minute call to Hawaii)	2015	0.75	0.75	0.75	0.75
8. Cost of 3G data ($ per MB for pre-paid)	2015	0.08	0.08	0.08	0.08
9. Cost of fixed internet ($/month for 512 kbps service)	2015	65	65	65	65

B.8 Education

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Quality Indicator					
1. Schools meeting the FSM School Accreditation Standards (percent)	2014	6	100	82	15

B.9 Health

Indicator	Baseline Year	Chuuk	Kosrae	Pohnpei	Yap
Accessibility Indicator					
1. Patient encounters provided in homes and dispensaries (number)	2014	77,156	8,738	135,604	18,281
Efficiency Indicator					
2. Average length of stay in State hospitals (days)	2014	4.9	5.3	4.6	4.8

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KIRMA

Kosrae Island Resource Management Authority

AMENDMENTS TO REGULATIONS FOR DEVELOPMENT PROJECTS

RELATING TO

CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

PART 1 AUTHORITY

These Regulations are promulgated and adopted by Kosrae Island Resource Management Authority (KIRMA) pursuant to Kosrae State Code, Title 19, Section 19.102(18), Title 19, Chapter 2 and State Law No. 10-2. These Regulations amend selected provisions of Regulation No. 67-05, as set forth below.

PART 2 FINDINGS AND PURPOSE

Climate change is a real and continuing process with substantial impact upon the natural and human environment of Kosrae State. Climate change impacts of increasing temperatures, rising sea levels, increased precipitation and other severe weather events have impacted and will continue to impact the environment, sustainable development, food production, and existing and future infrastructure of Kosrae State.

The purpose of these Regulations is to amend the Regulations For Development Projects, Regulation No. 67-05, to require development activities in Kosrae State to take into account projected climate change impacts, and to require the design and implementation of public infrastructure projects such as roads and buildings to incorporate climate change adaptation measures consistent with the *FSM National Climate Change Policy 2009*.

The technical specifications in these Regulations are based upon following references:

- Climate change in the Pacific: Scientific assessment and new research; Volume 2 Chapter 4: Federated States of Micronesia Country Report (Australian Bureau of Meteorology, Commonwealth Scientific and Industrial Research Organization, 2011);
- Climate Proofing: A Risk-based Approach to Adaptation (Asian Development Bank, 2005);
- Climate Change in the Federated States of Micronesia – Food and Water Security, Climate Risk Management, and Adaptive Strategies, Report of Findings 2010 (Charles H. Fletcher and Bruce Richmond, 2002);
- Kosrae Shoreline Management Plan (DRC, 2000) (*currently under revision*).

The Regulations also include other amendments to ensure that the Regulations are consistent with best practice in international environmental law, such as by including the precautionary principle; to provide greater certainty as to the types of projects for which an EIA may be required; and to introduce a development review permit fee.

PART 3 GENERAL PROVISIONS

Section 1.1 of Regulation No. 67-05 is amended as follows:

1.1 Authority. These Regulations are promulgated and issued by Kosrae Island Resource Management Authority pursuant to ~~Title 7, Chapter 4~~ Title 19 Chapter 2 of the Kosrae State Code. These Regulations have the force and effect of law.

Section 1.2 of Regulation No.67-05 is amended and a new Section 1.2 paragraph (c) is added as follows:

1.2 Purpose. The purpose of these Regulations is to implement ~~Title 7, Chapter 4~~ Title 19 Chapter 2 of the Kosrae State Code by establishing standard procedures for the formal review of development projects. The Environmental Impact Assessment (EIA) process is intended to help the general public and government officials make decisions with the understanding of the environment consequences of their decisions, and take actions consistent with the goal of protecting, restoring and enhancing the environment. In addition, these regulations are intended to:

(a) Integrate the EIA process into the early planning of projects to insure timely consideration of environmental factors in order to avoid delays;

(b) Identify at an early stage the significant environmental issues requiring further study and de-emphasize insignificant issues, thereby defining the scope of the Environmental Impact Statement (EIS); and

(c) Identify and require development and public infrastructure projects to incorporate climate change adaptation measures.

PART 4 DEFINITIONS

Section 1.4, paragraphs (g), (k), (m) and (n) of Regulation No. 67-05 are amended, and new paragraphs (hh), (ii), (jj), (kk), (ll) and (mm) are added as follows:

1.4 Definitions. As used herein, unless the context otherwise requires, the term:

...

(g) "Development project" means any plan, proposal or intention by any person to embark on any activity, scheme, construction, development, or undertaking. ~~the construction, alteration, movement, fill, removal, disposal or any other modification to the land or coastal areas. A development project can include, but is not limited to the installation, placing, or building of surface structures, land reclamation, navigational channels, harbors, utility lines, piers, shopping centers, clearing land, causeways, golf courses, apartment complexes, hotels, schools, roads, parking areas, or any other similar activity~~. It includes, but is not limited to, activities such as the:

(i) Construction, alteration, movement, fill, removal, disposal or any other modification to the land, coastal or marine area;

(ii) Installation, placing, or building of surface structure, land reclamation, navigational channels, harbors, utility lines, piers, shopping centers, clearing land, causeways, golf courses, apartment complexes, hotels, schools, roads, parking area, or any other similar activity;

(iii) Commercial harvesting of marine resources, and/or aquaculture or mariculture of marine resources (including where a permit may be required under Title 19 Chapter 3, as may be amended); and

(iv) Harvest of mangrove or other timber resources (including where a permit may be required under Title 19 Chapter 8, as may be amended).

(k) "Effects" means direct or indirect results ~~which~~ that are reasonably foreseeable, are caused by an activity and occur either close to the time and place of the activity, or are manifested at a subsequent time. Effects may include ~~growth inducing~~ development effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, land and water and their associated natural systems, and ecosystems. These effects of an activity may also be subject to climate change impacts such as sea level rise, extreme swell events and increased frequency or intensity of typhoon events.

Effects and impacts as used in these regulations have the same meaning. Effects may be physical, ecological, aesthetic, historic, cultural, economic, social or health, whether direct, indirect or cumulative.

(m) "Environmental Impact Assessment" or "EIA" means the process by which all environmental, social, cultural and economic impacts of a project, including project alternatives, are identified and analyzed before the decision to approve the project is made. The EIA is used to predict the likely economic, social, cultural and ecological consequences of the proposed activity; i.e., the effect on the environment. The EIA is also used to assess the effects of natural change, impacts of extreme weather and climate events, and climate change on the proposed activity and the need to incorporate adequate climate change adaptation measures for the proposed operating life of the project. The EIA is intended to take a precautionary approach to help in planning to prevent or reduce adverse effects to acceptable levels, including the potential for maladaptation, before investment is committed.

(n) "Environmental Impact Statement" or "EIS" means a comprehensive and detailed document that describes a proposed development project, the types of impacts likely to be caused by the proposed project, consequences of those impacts and ways to modify the project or otherwise to lessen the impacts. The requirements of an EIS are listed under Part 5 of these Regulations. ~~This document is similar to documents required under 25 F.S.M. 702, Environmental Impact Assessment Statement (EIA Statement), and as to those of the U.S. National Environmental Policy Act (P.L. 91-190), as amended).~~

(hh) "Climate change" means a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

(ii) "Climate change adaptation measures" means responses that seek to reduce the vulnerability of natural and human systems to existing and changing climate and weather variability and extremes, and minimize the predicted impacts;

(jj) "Coastal development risk area" means the areas identified as at risk from climate change impacts, and are illustrated in the diagram annexed to these Regulations as Schedule 1. This area encompasses areas included in the Shoreline Erosion Hazard Areas identified in the Kosrae Land Use Plan;

(kk) "Cultural impact" includes the impact of a proposed development or activity on sites registered or eligible for registration as a historic property, and the impact on intangible cultural heritage;

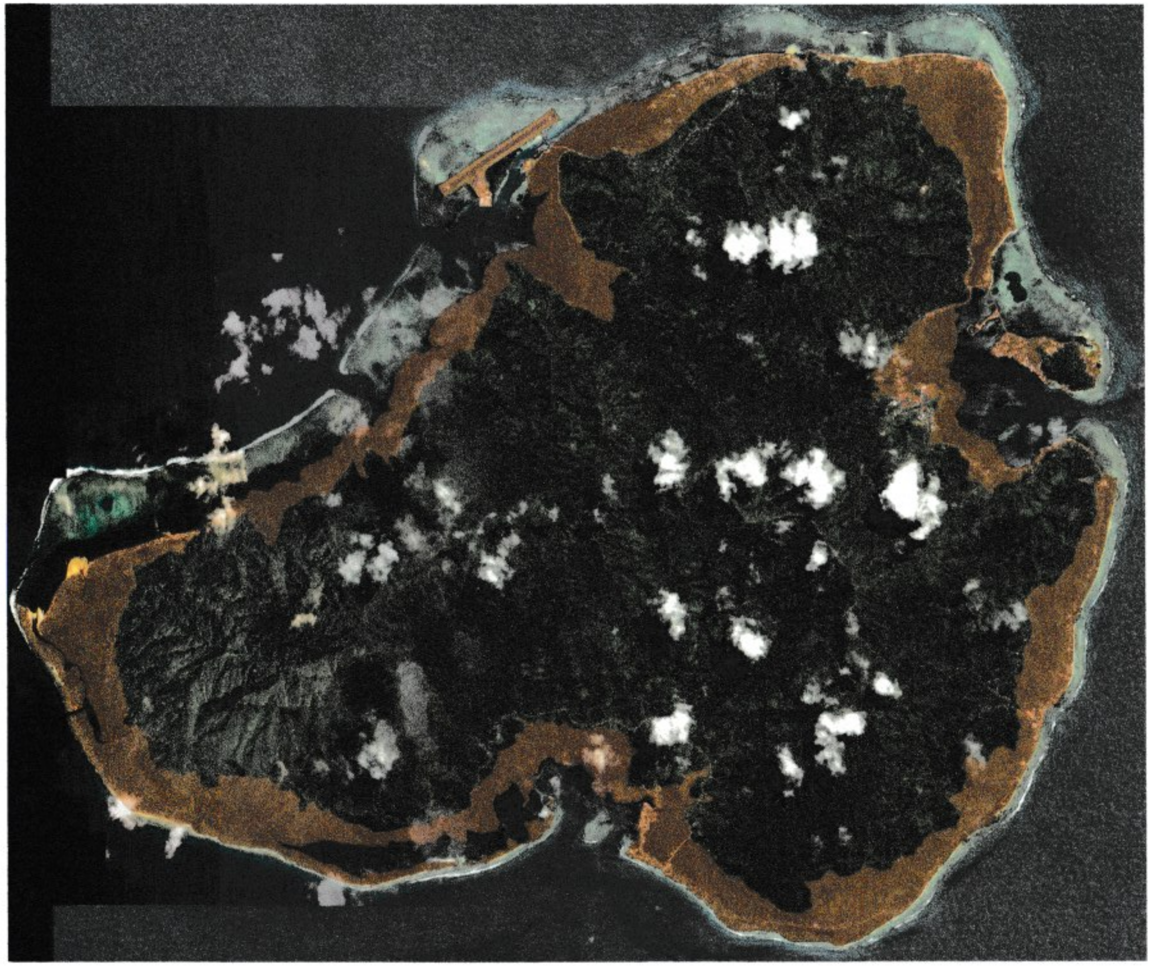
(ll) "Precautionary approach" means that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation;

(mm) "Maladaptation" means any change in natural or human systems that inadvertently increases vulnerability to the effects of natural change, impacts of extreme weather and climate events, and climate change; an adaptation that does not succeed in reducing vulnerability but increases it instead.

A new Schedule 1 is added to Regulation 67-05 as follows:

Schedule 1: Coastal Development Risk Area

A Development Review Permit is required for all projects in the Coastal Development Risk Area, shown in red.



PART 5 DEVELOPMENT REVIEW PERMIT PROCESS

Section 3.1 of Regulation No. 67-05 is amended as follows:

3.1 Development Review Permit. A Development Review Permit shall be required for development projects that fall within the parameters of ~~Section 7.402 of Title 7~~ Section 19.201 of Title 19 of the Kosrae Code or for development projects satisfying any of the following criteria:

(a) Projects involving any earthmoving activities;

(b) Projects located ~~below the mean high water mark (including mangroves)~~ within a coastal development risk area;

(c) Projects which cost over $5,000;

(d) Projects which are incompatible with surrounding land uses;

(e) Projects involving the disposal or removal of dredged material, including all sand-mining operations;

(f) The use, handling, or disposal of toxic or hazardous chemicals, pesticides, petroleum, oil and lubrication; or

(g) Projects involving the commercial harvest of aquatic, marine or timber resources.

PART 3 of Regulation No. 67-05 is amended by adding a new Section 3.1A as follows:

3.1A Duty to Advise KIRMA of Project with Significant Impact.

(1) Any person who intends to undertake a project, or who becomes aware of a project, that is likely to have a significant impact on the environment, even if the project is not or does not appear to fall within categories (a) to (g) in Section 3.1 of this Part, shall immediately:

(a) Advise KIRMA of the proposal; and

(b) Forward to KIRMA any plans, specifications and other relevant information.

(2) KIRMA shall, within five (5) days of being notified of the project, determine whether a development review permit is required and notify the project proponent of their decision in writing.

PART 5 DEVELOPMENT REVIEW PERMIT PROCESS

Section 3.2 of Regulation No. 67-05 is amended by adding a precondition to paragraph (b) as follows:

3.2 Exemptions. A Development Review Permit shall not be required:

(a) When land is tilled or plowed for small-scale (no greater than a 2,500 sq.ft. total area) agricultural purposes;

(b) For a residential building that is built within a 10,000 sq. ft. area, and is not part of a subdivision and where no part of the building is located within a coastal development risk area, and provided the landowner contacts the Program Office and informs them of the source and type of building materials and location; or

(c) For activities associated with the normal maintenance, operation and improvement (with the exception of increasing the floor area) of existing households.

PART 6 CONTENT OF DEVELOPMENT REVIEW PERMIT APPLICATION

Section 3 of Regulation No. 67-05 is amended by amending paragraphs (e) and (g) and inserting a new paragraph (k) of Section 3.3 as follows:

3.3 Content of Development Review Permit Application. Application shall be made by the property owner, operator or other responsible person on forms furnished by Kosrae Island Resource Management Authority and shall include the following:

(a) The name of the person, agency or group filling out the application.

(b) The name of the person who owns the parcel of land to be developed and proof of ownership. If the applicant is not the same person owning the land, the consent of the owner must be given in writing.

(c) Estimated project start and completion dated.

(d) Location of the proposed project on a map, including municipality, area of municipality (inkul), and tract number.

(e) An accurate, scaled site plan showing:

(i) all existing and proposed natural and human-made features in relation to the project, including distance of the features from the shore vegetation line when the project is adjacent to the ocean or lagoon shoreline, or adjacent to mangroves;

(ii) a cross-section of the proposed development showing all fill/land levels and project levels where the proposed activity is within the coastal development risk area.

(f) A description of the proposed project including its purpose and intended use, any construction and earthmoving activities and other alterations to the land and water landscapes.

(g) A description of the public utilities needed for the construction and operation of the project, including any needed toilet facilities and sewage disposal systems, <u>including the distance from any stream, river, mangrove, shoreline or other water body</u>.

(h) Detailed plans for improvements or construction including siting, dimensions, building materials and any other use made of the project area.

(i) Plans for any proposed earthmoving activities below the mean high water mark showing elevation, slope, drainage, material to be used, compaction and other related information.

(j) If the project involves any earthmoving activities, the project proponent must also submit an erosion and sedimentation control plan according to specifications in 6.2 of these regulations.

(k) <u>Estimated intended operating life of the project and intended actions at the end of the intended life of the project, for example, removal, re-development and continued use, or abandonment.</u>

(l) All applicants must acknowledge and agree that the actual development activities will be in accordance with the plan and specifications submitted and approved by the KIRMA Board. Furthermore, the applicant must agree to comply with all applicable national, state and municipal laws and regulations.

PART 7 COMPREHENSIVE ENVIRONMENTAL IMPACT STATEMENT

Section 4.1 of Regulation No. 67-05 is amended by adding a new paragraphs (h), (i) and (j) as follows:

4.1 <u>Decision to Conduct EIS.</u> An EIS shall be prepared whenever the Authority determines that the project may have a significant impact on the environment, or when there is serious public controversy concerning potential environmental impacts of a project. The preparation of an EIS will be required if one or more of the following criteria are applicable to a project proposal:

(a) It is reasonably foreseeable that the project will cause a significant environmental impact on:

- Marine and coastal resources
- Mangrove resources
- Social/cultural/historical resources

- Plants and animals (especially endangered species)
- Human health and welfare

(b) It is reasonably foreseeable that the project will fail to comply with ~~all~~ any applicable minimum environmental quality standards for water and air quality, waste management and noise control.

(c) It is reasonably foreseeable that the project will disturb more than 10,000 square feet of land surface.

(d) It is reasonably foreseeable that the project will require more than 5,000 cubic yards of fill.

(e) It is reasonably foreseeable that the project will be incompatible with surrounding land and water uses.

(f) It is reasonably foreseeable that the project is controversial and will invoke public opposition.

(g) The project involves a foreign investment permit.

(h) It is reasonably foreseeable that the project may cause, or exacerbate, in areas adjacent to the project:

(i) Coastal erosion or other shoreline change; or

(ii) Coastal, stream or river flooding or land drainage impacts.

(i) It is reasonably foreseeable that the project may impact on the water quality of streams, rivers, mangroves, lagoons and harbors, coastal areas or other water bodies.

(j) It is reasonably foreseeable that the project, during its estimated operating life, will be significantly impacted or damaged by:

(i) Loss of land associated with ongoing, or storm or typhoon-related, shoreline change or coastal erosion;

(ii) Coastal flooding from high tides, large swell, storm or typhoon-related events;

(iii) Extreme rainfall and associated flooding, including from rivers and streams, or waterlogging and drainage of low-lying land;

(iv) Land-slipping or erosion of sloping land;

(v) The effects of sea-level rise or other climate change influences on the above hazards. For the purposes of this section, the proposed project will consider:

(a) The upper ranges of potential climate change provided in Table 4.4 of the Federated State of Micronesia Chapter in Climate Change in the Pacific: Scientific Assessment and New Research, Volume 2 Chapter 4: Federated States of Micronesia Country Report (Australian Bureau of Meteorology, Commonwealth Scientific and Industrial Research Organization, 2011) and available from the KIRMA Office;

(b) Daily rainfall extremes for Kosrae presented in Appendix 1 of Climate Proofing: A Risk-based Approach to Adaptation (Asian Development Bank, 2005) and available from the KIRMA Office;

(c) Any updated climate change guidance as advised by KIRMA.

PART 8 CONTENTS OF ENVIRONMENTAL IMPACT STATEMENT

PART 5 of Regulation No. 67-05 is amended by adding a new Section 5.3A as follows:

Section 5.3A Climate Change Effects and Potential Adaptation Options.

(a) Each EIS shall discuss the potential effects of natural change, impacts of extreme weather and climate events, and climate change on the proposed activity. Where applicable, this will include consideration of some or all of the following:

(i) loss of land associated with ongoing, or storm or typhoon-related, shoreline change or coastal erosion;

(ii) coastal flooding from high tides, large swell, storm or typhoon-related events;

(iii) extreme rainfall and associated flooding, including from rivers and streams, or water-logging and drainage of low-lying land;

(iv) Land-slipping or erosion of sloping land; and

(v) The effects of sea-level rise or other climate change influences on the above hazards. For the purposes of this section, the proposed project will consider:

(a) The upper ranges of potential climate change provided in Table 4.4 of the Federated State of Micronesia Chapter in Climate Change in the Pacific: Scientific Assessment and New Research, Volume 2 Chapter 4: Federated States of Micronesia Country

Report (Australian Bureau of Meteorology, Commonwealth Scientific and Industrial Research Organization, 2011) and available from the KIRMA Office;

(b) Daily rainfall extremes for Kosrae presented in Appendix 1 of Climate Proofing: A Risk-based Approach to Adaptation (Asian Development Bank, 2005) and available from the KIRMA Office;

(c) Any updated climate change guidance as advised by KIRMA.

(b) Where natural change, extreme weather and climate events, and climate change may impact on the proposed activity, each EIS shall include proposed risk mitigation and adaptation measures to minimize potential impacts, both upon the proposed project, and on any resulting potential vulnerability of human users of the proposed project (including potential damage to the project from the effects of climate change, potential dislocation of human users of the project or abandonment of the project due to the effects of climate change). Adaptation measures should address the location of the project and potential alternative locations, construction methods and materials, site drainage, and other activities to reduce or mitigate potential impacts. Upon request, KIRMA shall provide consultation on climate change impacts and potential adaptation measures to the location, design and construction of public projects and other development projects.

PART 9 PERMIT FEES

A new Part 10 is inserted into Regulation 67-05 as follows:

Section 10.1 Permit Fees.

(a) The project proponent is required to pay the following fee for a development review permit:

Type of application	*Project*	*EIS requirement*	*Permit fee*
Standard	Private	EIS Checklist	$10.00
	Commercial	EIS Checklist	$100.00
Complex	Private	Comprehensive EIS	$100.00
	Commercial	Comprehensive EIS	$250.00

(b) The permit fee is payable at the time the application for a permit is made, or at the time the project proponent is advised of the requirement for a comprehensive EIA.

(c) A "private" project refers to a development or activity that is undertaken by or on behalf of a private individual where the outcome of the project is for private non-commercial or subsistence purposes; for example, the construction of a private residence, or the clearance of an agricultural plot for subsistence purposes.

(d) A "commercial" project refers to a development or activity that is undertaken with the intention of creating or expanding a commercial enterprise or profit-earning business (whether or not the enterprise does so); a "commercial" project also includes a development or activity undertaken by or on behalf of a government, or government department or agency, including the construction of infrastructure and utilities, buildings and other developments or activities financed by public or donor funding.

Section 10.2 Waiver of Permit Fee. KIRMA may, on the written request of the project proponent, waive the permit fee for development review permit applications from government agencies or recognized non-governmental organizations or associations formed for a community purpose, such as the management of a marine protected area that is included in the Protected Areas System.

PART 10 TIME AND REFERRALS

A new Part 11 is inserted into Regulation No. 67-05 as follows:

If the Program Office requests further information from the project proponent due to the provision of incomplete or inadequate information, the relevant time period for making recommendations or a decision in accordance with these Regulations shall recommence on the date the requested information is provided by the project proponent.

The Program Office may refer the application to another agency or expert for assessment and/or the provision of expert advice. If so, the relevant time period for making recommendations or a decision in accordance with these Regulations shall recommence on the date the requested information is provided by the other agency or expert, provided however that the other agency or expert shall be given no more than thirty (30) days to provide their assessment and/or advice.

PART 11 CONSEQUENTIAL AMENDMENTS

The following amendments are made to correct inaccuracies or incorrect legislative references.

Section 3.4 of Regulation 67-05 is hereby amended as follows:

3.4 Initial Project Consultation. The project proponent consults with the Program Office about the Project. The Program Office will determine if a Development Review Permit, and other permits are needed. Foreign investors must secure a Foreign Investment Permit from the ~~Foreign Investment Board~~ Department of the Kosrae State, unless and until such time as a specific environmental fund is established. Further, any penalties assessed may be in addition to any criminal charges filed.

PART 12 SEVERABILITY CLAUSE

If any provision of these Regulations or the application of any provision of these Regulations to any person or circumstance is held invalid, the application of such provision to other persons or circumstances and the remainder of these Regulations or Regulation No. 67-05 shall not be affected thereby. Except for those amendments shown above, the provisions of Regulation No. 67-05 remain unchanged, effective and enforceable.

PART 13 DATE OF EFFECT

These Regulations shall become effective upon publication and shall have the force and effect of law as of that date.

These regulations have been reviewed by the Office of the Attorney General and are found to conform with law.

________________________ Date: 1/2/14

Office of the Attorney General

The undersigned certifies that these regulations are adopted in compliance with Kosrae State Code, Section 2.402. The Kosrae Island Resource Management Authority hereby adopts these regulations.

________________________ Date: 12-23-13

Robert H. Jackson, Administrator

________________________ Date: 12-24-13

Daniel Thomson, Senior Commissioner

I hereby approve the adoption of these Regulations.

______________________ Date: 1-6-14

Lyndon H. Jackson
Governor, Kosrae State

Filing of Regulation No. 87-14

for ______________________ Date: 1-6-14

Office of Public Affairs, Kosrae State Government

GOVERNMENT OF KOSRAE
Office of the Governor
Post Office Box 158
Kosrae, Federated States of Micronesia 96944
Telephone: 691-370-3002/3003..Facsimile: 691-370-3162

P1S

March 25, 2011

The Honorable Lyndon P. Abraham
Speaker
Tenth Kosrae State Legislature
Tofol, Kosrae FM 96944

Dear Mr. Speaker,

Pain kom a kulo nu sin God ke moul mwowo lasr nukewa.

Nga engan in tukakin nu sum la nga insese a sainiya L.B. No. 10-07, nuke masap, su orala Kosrae State Law No. 10-2. Sifwa u fwak mu:

> "To amend Titles 1, 5, 7 and 11 of the Kosrae State Code to add new definitions and requirements relating to climate change and climate change adaptation measures; and for other purposes."

Certified copy ke masap se inge pa attached nu ke letter luk.

Kulo ma lulap.

Lyndon H. Jackson
Governor
State of Kosrae

/jpa

TENTH KOSRAE STATE LEGISLATURE
FIRST REGULAR SESSION, 2011

L. B. No. 10-07

A BILL FOR AN ACT

To amend Titles 1, 5, 7 and 11 of the Kosrae State Code to add new definitions and requirements relating to climate change and climate change adaptation measures; and for other purposes.

BE IT ENACTED BY THE KOSRAE STATE LEGISLATURE

Section 1. Findings and Purpose. The Legislature finds that climate change is a real and continuing process with substantial impacts upon the natural and human environment of the State of Kosrae. Climate changes of increasing temperatures, rising sea levels, increased precipitation and other severe weather events have impacted and will continue to impact the environment, sustainable development, food production, and existing and future infrastructure of the State of Kosrae.

The purposes of this act are to recognize and define climate change and climate change adaptation measures, and to require development activities in Kosrae State to take in account projected climatic changes, and to require the design and implementation of public infrastructure such as roads and buildings incorporate climate change adaptation measures consistent with the requirements of the FSM Nationwide Climate Change Policy of 2009, as presented by the Asian Development Bank in "Climate Proofing, Risk Based Approach to Adaptation" (2005) and "Climate Change Adaptation in the Pacific" (2005), and as reflected through the continuing proceedings of the United Nations Framework Convention on Climate Change (1992 et seq).

Section 2. Amendment. Title 1, Section 1.201 of the Kosrae State Code is hereby amended to read as follows.

"Section 1.201. Definitions. Unless another meaning clearly appears in the Code, the following terms have the meaning indicated:

(88) "climate change": A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

(89) "climate change adaptation measures": Responses that seek to reduce the vulnerability of natural and human systems to the changing climate and weather extremes, and minimize the predicted impacts of climate change."

Section 3. Amendment. Title 5, Section 5.202(4) of the Kosrae State Code is hereby amended to read as follows.

"Section 5.202. Powers and duties of principal departments. In addition to other powers and duties provided by law a director of a principal department is responsible to the Governor for the exercise of the departmental powers and duties indicated below by subsection. The Governor may delegate additional Executive powers and duties to a director as the Governor deems necessary.

* * *

(4) The Department of Transportation and Infrastructure

(a) constructs a primary road encircling the island;

(b) constructs a primary road from Innem to Okat;

(c) maintains primary roads, overseeing their structure and operational safety;

(d) develops, designs for, calculates cost effectiveness of, and conducts inspections of public projects, with all location, design and construction to include and incorporate consideration of weather and climate extremes and climate change adaptation measures; and

(e) maintains Government-owned buildings and equipment."

Section 4. Amendment. Title 7, Section 7.402 of the Kosrae State Code is hereby amended to read as follows:

"Section 7.402. Powers and duties. The Authority has the power and duty to:

* * *

(18) Adopt climate risk reduction and climate change adaptation measures based upon existing weather and climate extremes and projected climate changes, and to provide consultation on application of climate change impacts and adaptation measures to the location, design and construction of public projects and other development projects."

Section 5. Amendment. Title 7, Section 7.405(1) of the Kosrae State Code is hereby amended to read as follows:

"Section 7.405. Environmental impact studies. The Authority requires that:

(1) All persons include in their development proposals an environmental impact assessment study which shall include consideration of the effects of climate change and potential adaptation options in accordance with regulations established by the

Authority."

Section 6. Amendment. Title 11, Section 11.2104(1) of the Kosrae State Code is hereby amended to read as follows:

"Section 11.2104. Provisions of the Code. The Kosrae State Building Code shall be designed to achieve the following:

(1) To provide reasonably uniform standards and requirements for construction and construction materials, consonant with accepted standards of engineering and fire prevention practices and which shall include appropriate climate risk reduction and climate change adaptation measures."

Section 7. Effective Date. This Act takes effect upon approval by the Governor or upon its becoming law without such approval.

PASSED BY THE KOSRAE STATE LEGISLATURE ON THE 11TH DAY OF MARCH, 2011

Lyndon P. Abraham
Speaker, Tenth Kosrae State Legislature

Attested by: ____________
Chief Clerk

Lyndon H. Jackson
Governor, State of Kosrae

Date: 3-25-11

Malem-Utwe Inland Road and Relocation Initiative Kosrae
Monitoring and Evaluation Framework

SECRETARIAT OF THE PACIFIC REGIONAL ENVIRONMENT PROGRAMME (SPREP)

Prepared by:

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Acronyms and Abbreviations

AF	Adaptation Fund
CBEM	Community-Based Ecosystem Management
CCA	Climate Change Adaptation
DAF	Department of Administration and Finance
DREA	Department of Resources and Economic Affairs
DT&I	Department of Transport and Infrastructure
EOPO	End-of-project (or program) outcome
FE	Final Evaluation
FSM	Federated States of Micronesia
FSP	Financial Service Provider
FY	Financial Year
GDP	Gross Domestic Product
HH	Household(s)
HIES	Household Income and Expenditure Survey
IRR	Inland Road and Relocation
KCSO	Kosrae Conservation and Safety Organization
KIRMA	Kosrae Inland Resource Management Authority
KSDP	Kosrae Strategic Development Plan
KSG	Kosrae State Government
KSMP	Kosrae Shoreline Management Plan
M&E	Monitoring & Evaluation
MEF	Monitoring & Evaluation Framework
MTE	Midterm Evaluation
N/A	Not Applicable
OEEM	Office of Environment and Emergency Management (National)
PPCR	Pilot Program for Climate Resilience
SBOC	Office of Statistics, Budget and Economic Management
SPREP	Secretariat of the Pacific Regional Environment Programme
TBD	To be determined
VAW	Variation Against Workplan

Table of Contents

1. INTRODUCTION

This document is the Monitoring and Evaluation Framework (MEF) for the Malem-Utwe Inland Road and Relocation Initiative (IRRI) of the Kosrae State Government (KSG), Federated States of Micronesia (FSM). The Framework is aligned with the the FSM Action Plan for 2023[1], the climate-responsive Kosrae Strategic Development Plan (KSDP) for 2014-2023, and the Kosrae Shoreline Management Plan (KSMP) updated in 2014. The KSMP sets out the principles for coastal development in Kosrae over the coming decades, and details key strategies for increasing the resilience of Kosrae's coastal communities.

The preparation of the Malem-Utwe IRRI is supported by the Secretariat of the Pacific Regional Environment Programme (SPREP), an intergovernmental organisation charged with promoting cooperation among Pacific Island Countries and territories to protect and improve their environment and ensure sustainable development. In partnership with the Asian Development Bank, SPREP is implementing the ~~Pilot Program for Climate Resilience (PPCR): Pacific Regional Track~~ . The PPCR includes an initiative to build the capacity of an interdepartmental team in the use of monitoring and evaluation frameworks. The team is comprised of representatives from the the Governor's Office and from the Departments of Administration and Finance (DAF), Resources and Economic Affairs (DREA), Transport and Infrastructure (DT&I) and the Kosrae Island Resource Management Authority (KIRMA), to jointly implement Monitoring and Evaluation (M&E) in the infrastructure sub-sector. This MEF was developed to support this effort.

IRRI is largely a combination of strategies from the KSMP, which is specifically aimed at the Malem to Utwe area. The main strategies from the KSMP are:

- Inland repositioning of a priority section of the road (the Malem-Yeseng-Utwe section (KSMP section 4.2.4.)
- Transitional revetment defences, specifically the highest priority defences at Mosral and Paal (KSMP section 5.1.2)
- Develop a relocation strategy (KSMP section 4.3.2)
- Create incentives to relocate to safer areas (KSMP section 4.3.1).

[1] The 2023 Action Plan is a response to the economic challenge facing FSM to reverse the trend over the first 10 years of the Amended Compact where real gross domestic product growth (GDP) averaged -0.5 percent per annum. Implementing a long-term sustainable growth strategy is the Government's top priority. However, the challenge of growing the private sector at a rate sufficient to produce jobs and entrepreneurial opportunities and to close the fiscal gap in FY2024 is daunting. The Action Plan targets average real growth of 2 percent per annum over the remaining years of the Amended Compact. From 2024 onwards the FSM states will face serious fiscal deficits without any interventions or reforms. A key challenge in fiscal reform is that fiscal policy is formulated individually by the national and state governments, with separate expenditure and revenue policies. However, in order to meet the 2023 challenge, all five governments will need to undertake both revenue and expenditure reforms that reflect the nations long term goals and aspirations. Surpluses for the National Government prior to FY2024 will allow it to achieve two goals. Firstly, it will be able to set aside $15 million per annum into the 2023 Investment Development Fund which will be used to stimulate economic growth. A further $15 million will be invested into the FSM Trust Fund to assist with financing State deficits from FY2024 and beyond. The fiscal challenge in FY2024 occurs at the State level and in particular in Chuuk and Kosrae. The economies of Pohnpei and Yap are stronger and have the capability to partially absorb the fiscal gap of FY2024. The centerpiece of the national strategy for achieving private sector growth is to "ignite tourism" by upgrading over 100 tourism sites, and, obtaining World Heritage Site status for Nan Madol in Pohnpei (and the associated Lelu site in Kosrae). The intent is to link agriculture and fisheries production to tourism as part of FSM's unique destination, offering the supply of fresh fruits, vegetables and fisheries produce. This will require development of farmers' and shipping supply chains to boost supply of local food to hotels and restaurants. Source: FSM 2023 Action Plan; http://whc.unesco.org/en/tentativelists/5652/ (Accessed 9 Dec 2015)

Several Development Partners will contribute to the initiative. One of the Development Partners is the Adaptation Fund[2] (AF), and IRRI is part of a wider proposal for AF funding. The elements to be included in the AF proposal and in complementary proposals will be determined in early 2016. The AF aims to provide all four (4) State Governments in FSM with development planning tools and institutional frameworks to help coastal communities prepare and adapt for higher sea levels and adverse and frequent changes in extreme weather and climate events. These tools and frameworks may include national, state, island, municipal, community and sector plans, policies, regulations, guidelines, standards and protocols.

The MEF was prepared following a Guidance Note prepared by SPREP[3] (see Appendix section 0~~6.1~~ for a brief outline of the methodology).

1.1 Objective

The objective of this MEF is to guide a KSG Team and partners, to conduct M&E of the proposed inland road and relocation initiative (IRRI) for the municipalities of Malem and Utwe. The purpose of the MEF is fourfold, assisting management and adaptation, while supporting learning and accountability.

- **Management**: tracking progress of intervention implementation against plans and to be able to, in a timely manner, adjust program inputs, activities and outputs to successfully achieve expected outcomes where needed.
- **Adaptive Management**: improving the design and performance of an intervention during its implementation and making overall assessments as to its quality, value and effectiveness.
- **Accountability**: reporting on the use of allocated resources to Government, funders, members of the public and intervention beneficiaries.
- **Learning**: inform future planning and revisions of the KSG's IRRI by generating knowledge about good practice, learning from experience as to what works and what does not, and why the intervention has been successful or not, in its particular context.

A particular emphasis of the MEF is to support adaptive management and learning. This is because the IRRI is a new area of work for KSG and will serve as a pilot for future relocation initiatives involving other areas of Kosrae as identified in the KSMP.

1.2 MEF Audiences and Use

The primary audiences for this MEF and the resulting information and knowledge are the Kosrae State Government and its non-governmental partner in the Malem-Utwe IRRI, the Kosrae Conservation and Safety Organization (KCSO) and the Adaptation Fund-related Project Board, Director and Manager at the National Level and other Development Partners who may contribute to the initiative. A key use by the relevant state government departments and KSCO is for ongoing

[2] The Adaptation Fund was established under the Kyoto Protocol of the UN Framework Convention on Climate Change, and has committed US$ 331 million in 54 countries since 2010 to climate adaptation and resilience activities. The Fund is financed in part by government and private donors, and also from a two percent share of proceeds of Certified Emission Reductions issued under the Protocol's Clean Development Mechanism projects.

[3] SPREP. 2015. M&E Guidance Note Kosrae.

planning and adaptive adaptive management. Table 1 summarizes the main audiences, uses and main activities of the MEF[4].

Table 1. Audience, Use and Main Activities of the Monitoring and Evaluation Framework

Audience		M&E Framework Use	Main Activities
Primary	Directors and Heads of Divisions of DAF, DREA, DT&I, KIRMA; Director and staff of KCSO;	Build consensus on the purpose, outcomes and strategies of the, initiative; Planning and adaptive management; Assess progress against expected outcomes; evaluate risks and assumptions; identify lessons and recommendations	• Monitoring • Planning and review meetings • Quarterly Report • Annual Progress Report
	Development Partners including the AF National Project Board, Director, Manger and Technical working group; Governor's Office; Divisions of DAF, DREA, DT&I, KIRMA Director and staff of KCSO	Assess progress against expected outcomes; evaluate risks and assumptions; inform future climate change adaptation- related initiatives, revisions of the KSDP, and strategic planning for the next KSDP, and future investment	Monitoring Visits Annual Progress Report Project Annual Review Project Board Meetings[5] Independent Mid-term Evaluation[6] Independent Final Evaluation[7][8]
Secondary	FSM, Kosrae, Yap, Chuuk and Pohnpei state leaders	Lessons and recommendations to inform future climate change adaptation-related initiatives	Monitoring Visits Independent Mid-term Evaluation Independent Final Evaluation
	Regional organisations	Assess progress against outcomes; identify areas for support; identify effective practices for knowledge sharing	
	Donors/funding partners	Assess progress against outcomes; identify effective practices for knowledge sharing; inform future investment	

[4] The activities are based on the draft proposal to the Adaptation Fund (v.010915)
[5] Annually after PAR; also after MTE and FE
[6] After 2 years of implementation
[7] Within 3 months following implementation closure
[8] SPREP will manage implementation of the MTE and FE

2. INTERVENTION PROFILE AND LOGIC MODEL

2.1.1 Problem Statement[9]

The Malem to Utwe coastal zone area of Kosrae is an 'unstable' storm berm that was created in large part by a series of large typhoons in 1891 and 1905. This coastal margin area is dynamic and subject to continuous change. The rate of change and structure of this area is also affected by climate change-related sea-level rise and changing frequencies and intensities of typhoon events. Uncontrolled mining of beach aggregate and inappropriately designed coastal protection measures are also contributing to coastal erosion in these areas.

The coastal road and a significant number of homes and other infrastructure is located on this narrow (10-50 m wide) berm, with wetland or mangrove between the berm and the upland part of the island. The establishment of the coastal road encouraged settlement along the exposed coastline. Unfortunately, limited information and understanding about the magnitude of flooding hazards and related risks in this area existed at the time of urbanization. Consequently, homes and other infrastructure located in these coastal zone areas are increasingly vulnerable to erosion and associated overwash from king tide events and typhoons. According to a recent Cost-Benefit Analysis (CBA) of infrastructure options (Holland, 2015), potential overwash events are expected to result in the following consequences:

- impacts (damage) on housing, school and church infrastructure
- impacts (damage) on road, power and other essential public infrastructure
- impacts (damage) on safety of the community including potential loss of life
- indirect impacts (losses) associated with damage to road infrastructure. These include reduced earnings and educational opportunities and health effects, when access to work, school and the hospital are hampered by road breaches, and reduced food security, through the destruction of home gardens, which are an important element of food security on the island.

The magnitude of these expected impacts is significant. A conservative estimate of this impact for the next 50 years is around US$146,000 per annum - and this expected impact is increasing in line with increasing frequencies of overtopping and flooding events.

The impact of these effects is exacerbating the already lower economic status of the residents of Malem and Utwe, who have lower average earnings than the residents of the other Kosrae municipalities of Lelu and Tafunsak.

KIRMA estimates that approximately 98 households (HH) (25% of the total number of HH in Malem and Utwe based on the 2010 Kosrae Census) are potentially under threat of overwash/inundation on the stretch of coastal road from Malem to Utwe.

In community consultations, families in Malem and Utwe stated that if the coastal threats were not addressed the area would cease to be a safe and sustainable place to live, and that emigration from

[9] Sources for this section: 1) Holland, P. 2015. Cost-Benefit Analysis in Coastal Zone Management in Kosrae (FSM): Economic Assessment of Coastal Road Relocation; 2) Ramsay et al. 2013. Kosrae Shoreline Management Plan; 3) KSG. 2013. Kosrae State Strategic Development Plan 2014-2023. 4) SBOC. 2014. Federated States of Micronesia Household Income and Expenditure Survey 2014/14. Main Analysis Report.

Kosrae and/or FSM would be the most feasible option remaining to them. Considering that Kosrae is FSM's smallest state, and that the island lost a quarter of its population between 2000 and 2014 due to economically motivated outward migration, further migration to avoid coastal hazards to could have serious consequences.

The capacity of the Malem and Utwe communities to adapt to/manage these risks through relocation to safer areas inland in particular, is considered low.

2.1.2 Barriers to Adaptation

The key barriers and constraints affecting the adaptive capacity of the Malem and Utwe communities include:

- Lack of an inland road to provide access to safer areas inland
- Lack of land in safer inland areas. Approximately 50% of households located in the vulnerable coastal area do not own land inland. This is complicated by legal restrictions affecting the use and sale of land inland[10].
- Lack of access to affordable finance.

2.1.3 Objective and Strategies of the Malem-Utwe Inland Road and Relocation Initiative

The primary objective of the IRRI is to increase the capacity of the Malem and Utwe communities to adapt and manage risks associated with coastal erosion and coastal flooding. More specifically, the IRRI aims to create conditions to enable the Malem and Utwe communities located in coastal hazard zones to gradually relocate to safer areas inland over the coming 50 years.

The IRRI consists of five key strategies for achieving this objective:

Strategy 1: Construction of an inland road and related public infrastructure
Strategy 2: Increase access to land
Strategy 3: Increase access to affordable finance
Strategy 4: Community-Based Ecosystem Management
Strategy 5: Limit Further Coastal Development

The first three address the three barriers constraining relocation. The fourth is aimed at ensuring that relocation is environmentally sustainable and building resilience to primary climate risks in the inland areas. These primary risks are extreme rainfall events and related flooding and landslide risks.

[10] Currently all land in Kosrae above the so-called *Japanese Line* is under government control. During the Japanese occupation of Kosrae, public lands were expanded to include the shoreline below the mean high water mark, the mangroves and the upland forests above the Japanese Line, which includes approx. 67% of the total land area of Kosrae. As much as 50% of this area is too steep for any development and should be maintained as forest for watershed protection. A Constitutional amendment (Amen 19, 1995) was passed which allows reclamation of land above the Japanese Line by the original landowners. Land will be awarded by issuing a Certificate of Title to an individual or to the Tenancy-in-Common, however, a procedure for reclamation must be established by law before any advancement can be made. (Sources: FSM 2023 Action Plan (pgs 47-48); Kosrae State Land Use Plan 2003)

The fifth strategy is limiting further development of public and private infrastructure in the Malem-Utwe coastal hazard zone.

2.2 Logic model

The Logic Model (Figure 1) provides a graphic illustration of the IRRI design. It was developed through a process summarized in Appendix 2. It shows how a five-year project focused on construction of an inland climate-proofed road with power and water lines supplying designated inland village areas, supported by efforts to 1) improve access to land and finance, (particularly for Malem and Utwe HH who have no land in safer inland areas), 2) protect ecosystems and 3) carefully manage land converted for agriculture are expected to enable the gradual inland relocation of Malem and Utwe HH over the subsequent 5-50 years. Revetment of the existing coastal road would permit continuity of access to services in the meantime. The main strategies for achieving inland relocation are supported by Public Information and Capacity Development. The model also identifies plausible linkages between a road and inland relocation initiative, intended to increase resilience to climate-change, and the KSG/FSM national priority of private sector development.

Before the end of the first five years, KSG will also need to develop plans and access finance for provision of the other critical public infrastructure required for inland village areas; and review this approach to identify gaps and opportunities.

The initiative is intended to generate learning to help provide a roadmap for the eventual relocation of other Kosrae communities to safer inland areas, and contribute to the 50-year vision of:

A sustainable population of Kosraens are living in inland village areas safe from coastal climate change hazards, protecting their ecosystems, participating in a growing private sector, including the development of inland agriculture, and experiencing rising social well-being and equity.

The expected outcomes for the initial five-year period fall in the time zone labeled inception to five years. The outcomes in the ten-year band represent the expected impact of the initiative.

Risks and assumptions relating to each strategy and outcome of the IRRI are also made explicit in the model. A key risk is the potential for environmental degradation associated with inland development. The magnitude of this risk in Kosrae is clear from several older proposals and studies.[11] The environmental risks together with social and cultural issues including land tenure and access are summed up by Monnereau and Abraham (2013)[12] and in the CBA of coastal infrastructure options.

The importance of finding culturally sound solutions to land access matters and the avoidance of degradation through effective community-based ecosystem management can not be overemphasized.

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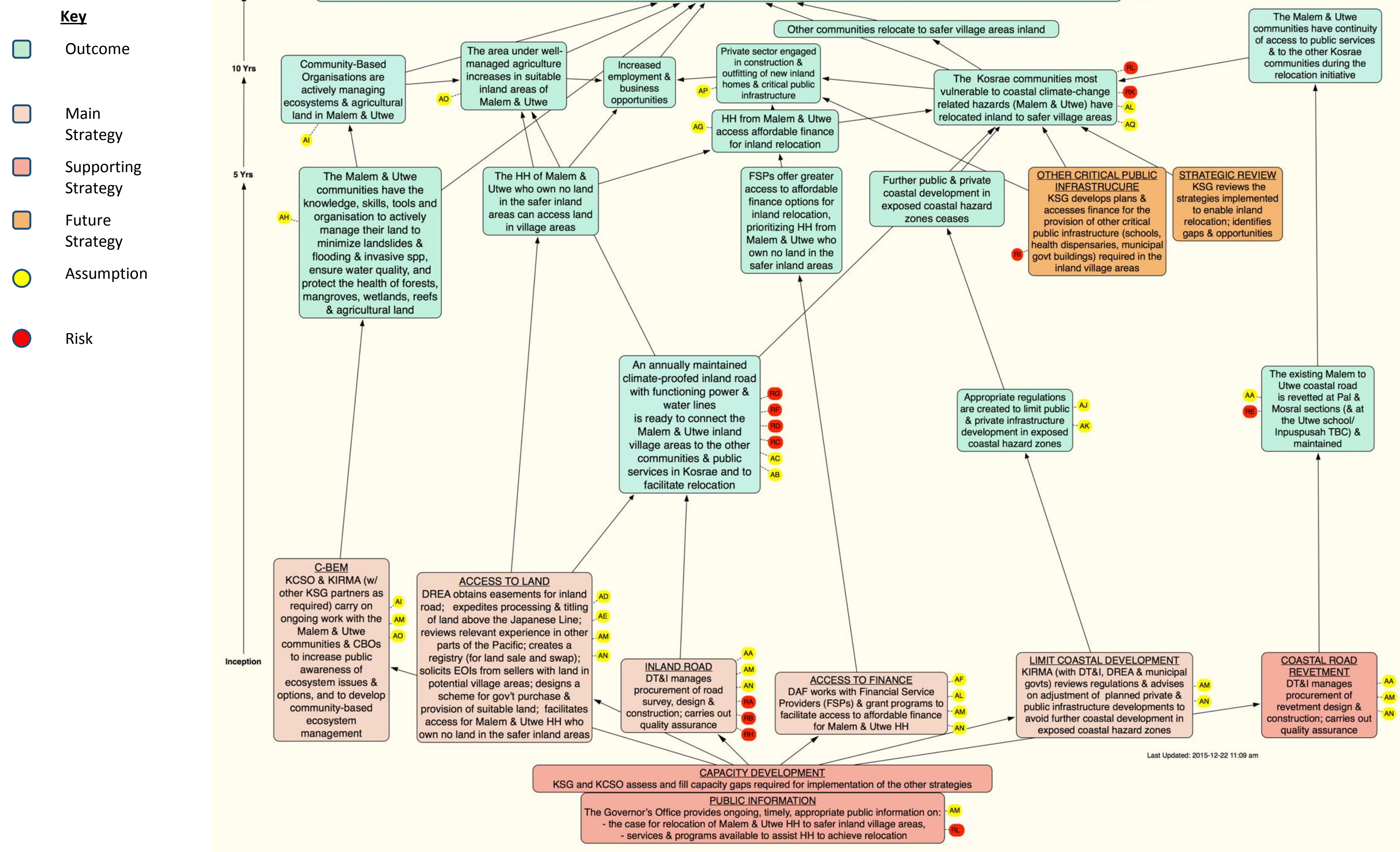
[11] 1) Bell F, 1992. Environmental Analysis for Kuplu Wan Golf Course Proposal Unpublished report USDA Forest Service); 2) Gorenflo LJ. 1993 Demographic Change in Kosrae State, federated states of Micronesia. Pacific Studies 16(2):67-118; 3) Naylor RL, KM Bonine, KC Ewel and E Waguk. 2002. Migration, Markets and Mangrove Resource Use o Kosrae, Federated States of Micronesia. Ambio 31(4):340-50.

[12] Monnereau I and S Abraham. 2013. Loss and damage from coastal erosion in Kosrae, Federated States of Micronesia. Loss and Damage in Vulnerable Countries Initiative. Case Study Report. Bonn: United Nations University Institute for Environment and Human Security.

Figure 1~~2~~. A) Logic Model for Malem to Utwe Inland Road and Relocation Initiative; B) Assumptions and Risks

A)



B)

Assumptions:

Infrastructure:
AA: KSG can secure quality contractors to design & build the road/revet the existing road
AB: KSG is able to fund maintenance of the inland road
AC: KSG is able to fund maintenance of the other new power & water infrastructure in Malem & Utwe

Access to Land:
AD: Land swaps happen (between private owners & between private owners and KSG)
AE: KSG is able to successfully negotiate with private land owners for appropriate sites & appropriate prices

Access to Finance:
AF: KSG will be able to apply for GEF6 and other funding in relation to housing and broader development
AG: HH taking loans for relocations have adequate levels of financial literacy

Environmental Management:
AH: Communities & CBOs participate in initiatives for Community-Based Management of ecosystems
AI: Community-based Management of ecosystems is effective

Coastal Development:
AJ: HH will not invest money to build permanent homes in the coastal risk area
AK: Landowners, FSPs & Municipal Govts comply with regulations limiting infrastructure development in coastal hazard zones

Cross cutting:
AL: Malem & Utwe HH willing and able to relocate
AM: Implementing partners have adequate capacity
AN: TA required is available and of adequate quality
AO: Landowners in the inland area opened by the road engage in agriculture
AP: The private sector plays a role in increasing the affordability of house construction
AQ: Relocation occurs gradually with the HH in the most exposed coastal risk zones relocating first

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Risks:

RA: Agreement can not be reached with all landowners on easements required for building the inland road

RB: Climate hazards are more severe than anticipated leading to higher climate-proofing related costs for building the inland road

RC: Landslides damage new inland road

RD: Climate proof-design for the road is not effective

RE: Road revetment de-incentivises and delays inland movement by Malem and Utwe HH

RF: Utwe municipal government fails to permit use of water to supply Malem needs related to inland relocation

RG: Private HH are not willing to negotiate access for to enable power line installation passing through their land

RH: KSG is unable to access sufficient funding for the entire Malam to Utwe inland road

RI: KSG is unable to access sufficient funding for the other public infrastructure needed to facilitate inland relocation

RJ: The opening of the new road and inland area facilitates environmental problems such as incursion of invasive species, forest degradation or erosion

RK: Discord/conflicts between communities and or individuals emerge in relation to land, finance or other issues

RL: Adequate rate and/or density of relocation is not achieved

3. EVALUATION QUESTIONS

The logic model shows that achieving relocation to safer inland areas of two of Kosrae's four municipalities is a complex, long-term strategic initiative with several embedded projects, each corresponding to a component strategy, and requiring coordination at both the individual and overall levels. This complexity implies a considerable burden of data collection and analysis for M&E. To focus the effort, and reduce the risk of overwhelm, it is critical to develop an M&E framework that is flexible and addresses the most critical information and learning needs. The formulation of priority evaluation questions helps to focus the M&E effort and to ensure it addresses the most critical information and learning needs.

The priority evaluation questions identified by KSG and KSCO are shown in Table 2. The "How Addressed" column shows which questions require the collection of monitoring data that will be fed into evaluation (M→E), and which questions will be handled exclusively through evaluation (E).

Table 2. Priority Evaluation Questions

	Questions & Sub-questions	How Addressed
Efficiency	1) To what extent were the key actions associated with each strategy (access to land, access to finance, construction of inland climate proof road, revetment, control of further coastal development; community-based ecosystem management, public information, capacity development) achieved? a) Was the new road completed as designed and planned?	1: M→E
Effectiveness	2) How effective were the strategies?	
	a) What community based ecosystem management projects/actions are being implemented, and what are they achieving?	2a: M→ E
	b) What depth and quality of community participation is being achieved in community-based ecosystem management work?	2b: M→E
	c) How suitable are the sites designated as village areas?	2c: E
	d) How well were the Malem and Utwe HH with no land in the inland area served by the actions to enable access to land?	2d: M→E
	e) How well were the Malem and Utwe HH served by actions to enable access to finance? i) How well were the Malem and Utwe HH with no land in the inland area served?	2e: M→E
	f) How effective are the Public Information efforts at facilitating community participation and ownership?	2f: M→E
	g) How well did changes in new and existing policies and regulations function in limiting further coastal development?	2g: M→E
	3) What worked well and less with with each of the strategies and why?[13]	3: E

[13] Prioritise Inland Road Construction, Access to Land and CBEM strategies if not feasible to analyze all during the Mid-term and final evaluations

	Questions & Sub-questions	How Addressed
Impact	4) What proportion of Malem and Utwe HH are planning, preparing, ready to relocate, or have already done so? 5) What is enabling and constraining readiness for relocation by HH from Malem and Utwe? 6) How are agricultural issues influencing readiness for relocation by HH from Malem and Utwe? 7) How is the private sector influencing readiness for relocation by HH from Malem and Utwe? 8) Were there any unintended effects of the KSG inland road and relocation initiative (positive and negative)?	4: M→E 5: E 6: M→E 7: E 8: E
Sustainability	9) How resilient is the new road to the heavy/extreme rainfall events and associated climate-change related hazards? 10) What, if any, were the gaps in the overall approach? i) What if any are the gaps in the individual strategies? 11) What opportunities exist for addressing these gaps? 12) How sustainable are the strategies implemented by KSG to enable relocation?	9: M→E 10: E 11: E 12: E
Synthesis	13) What are the key lessons for Kosrae from the inland road and relocation initiative?	13: E

4. MONITORING PLAN

Good quality information and data is required to address the key evaluation questions outlined in Section 3 (i.e. questions 1; 2a,b,d,e,f,g; 4; 6; 9). This section outlines a plan for ensuring that **the basic data** needed to help answer these questions is collected. The basic data collected as part of monitoring are 'performance indicators' - quantitative or qualitative variables that measure progress in a specific area of intervention performance.

The 'Monitoring Plan' can also serve to collect information needed for regular progress reporting - for the purposes of informing routine management decision-making, as well as accountability.

To be consistent with the formats utilised by the Adaptation Fund, the Monitoring Plan is presented as a 'Project Results Framework'. The detailed Monitoring Plan or Results Framework is provided at Appendix 3.

5. EVALUATION PLAN

Monitoring information on its own is generally not sufficient to provide answers to all relevant evaluation questions. In particular, monitoring information is not able to explain the reasons why or why not objectives (or performance areas more generally) were achieved, or identify specific success factors or barriers. More in-depth information collected at discrete points in time is needed for this.

This section outlines a plan to ensure the in-depth information needed to fully answer the evaluation questions (and complement indicators collected as part of Monitoring) is collected, and that the methods for doing this are appropriate. For the purposes of this M&E Framework, this is called an 'Evaluation Plan'.

The Evaluation Plan is presented in Table 3 below. This format is different from, but also related to, that used in the Monitoring Plan. It specifies the evaluation questions (column 1); a summary of relevant indicator information collected as part of Monitoring (column 2); and the suggested data collection tool/method for collecting in-depth information needed to fully answer the evaluation question (column 3).

Table 3 Evaluation Plan

	Questions & Sub-questions	Summary of Monitoring	Data collection tool/method
Efficiency	1) To what extent were the key actions associated with each strategy (access to land, access to finance, construction of inland climate proof road, revetment, control of further coastal development; community-based ecosystem management, public information, capacity development) achieved? b) Was the new road completed as designed and planned?	Performance indicators for *Outputs* 3.1.1, 3.2.1, 3.3.1, 3.4.1, 3.5.1, and 3.6.1	1: Analysis of Progress Reports - no additional data collection required
Effectiveness	2) How effective were the strategies? a) What community based ecosystem management projects/actions are being implemented, and what are they achieving? b) What depth and quality of community participation is being achieved in community-based ecosystem management work? c) How suitable are the sites designated as village areas? d) How well were the Malem and Utwe HH with no land in the inland area served by the actions to enable access to land? e) How well were the Malem and Utwe HH served by actions to enable access to finance? i) How well were the Malem and Utwe HH with no land in the inland area served? f) How effective are the Public Information efforts at facilitating community participation and ownership? g) How well did changes in new and existing policies and regulations function in limiting further coastal development?	Performance indicators for *Outcomes* 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6.	2.a: Analysis of Progress Reports; Key informant interviews to learn about achievements; and Most Significant Change (MSC) stories 2.b: Analysis of Progress Reports; case studies of CBO leaders and of a purposeful sample of CBO members; and possible use of MSC stories 2.c: Analysis of Progress Reports; Key informant interviews comparing views against Village Area Designation Criteria, Direct observation/Expert Opinion 2.d: Key informant interviews 2.e: Survey and/or key informant interviews with Malem and Utwe HH. Include sample of HH with no land inland (prioritized for relocation assistance); Case studies illustrating key learning 2.f: Analysis of Progress Reports; Key informant Interviews 2.g: Analysis of evidence complemented by Key Informant interviews if necessary
	3) What worked well and less with with each of the strategies and why?[14]	Builds on monitoring information collected for 1 and 2, mentioned above	3: Analysis of progress reports; and key Informant Interviews

[14] Prioritise Inland Road Construction, Access to Land and CBEM strategies if not feasible to analyze all during the Mid-term and final evaluations

	Questions & Sub-questions	Summary of Monitoring	Data collection tool/method
Impact	4) What proportion of Malem and Utwe HH are planning, preparing, ready to relocate, or have already done so? 5) What is enabling and constraining readiness for relocation by HH from Malem and Utwe? 6) How are agricultural issues influencing readiness for relocation by HH from Malem and Utwe? 7) How is the private sector influencing readiness for relocation by HH from Malem and Utwe? 8) Were there any unintended effects of the KSG inland road and relocation initiative (positive and negative)?	4: Performance indicator for *Impact*	4: Analysis of Progress Reports; and Key informant interviews 5: Analysis of progress reports; and Key informant interviews 6: For change in areas: Rapid survey (Malem, Utwe); Aerial photographs For views: Key informant interviews 7: Key informant interviews and survey of private sector actors, Most Significant Change (MSC) stories 8: Analysis of progress reports; and Key Informant Interviews
Sustainability	9) How resilient is the new road to the heavy/extreme rainfall events and associated climate-change related hazards? 10) What, if any, were the gaps in the overall approach? i) What if any are the gaps in the individual strategies? 11) What opportunities exist for addressing these gaps? 12) How sustainable are the strategies implemented by KSG to enable relocation?	9: Performance indicator for Outcome 3.1	9: Analysis of progress reports; and Key Informant Interviews 10, 11: Stakeholder workshop; Analysis and synthesis of evidence 12: Analysis and synthesis of evidence
Synthesis	13) What are the key lessons for Kosrae from the inland road and relocation initiative?	All performance indicators	13: Analysis and synthesis of evidence

An independent evaluation specialist will be responsible for collecting the evaluation information. This will be undertaken as part of the mid-term evaluation and the final/terminal evaluation.

Indicative Terms of Reference for the independent MTE including a cost estimate are in Appendix 4. The team size, the process outline and the associated budget reflect a very comprehensive approach that can be scaled down. The Terms of Reference for the FE would be similar but subject to adjustment depending on the evolution of the initiative and learning from the commissioning of the MTE.

6. COMMUNICATION & KNOWLEDGE MANAGEMENT

Given the interdepartmental nature of the IRRI, the creation of a common repository for reports, resources and monitoring data is recommended. This could consist of an online password-protected folder accessible to all partners (e.g., via Google Docs or Dropbox) with a clear directory structure for key data, progress, evaluation and research reports. The system could be set up and overseen by the lead agency.[15] Each department would be responsible for managing relevant subfolders.

A plan for communication and knowledge management related to the MTE and FE reports is outlined below in Table 4~~Table 3~~. It recommends ways to pre-package and repackage information and knowledge from these evaluations to ensure effective communication and increase the probability of use.

[15] The lead agency remains to be determined.

Table 4~~5~~. Communication and Knowledge Management Plan

Report type	Audiences	Timeline	Pre-packaging & Repackaging	Dissemination	Cost (USD)	Knowledge Management
MTE & FE	KSG/KCSO and Development Partners (MTE/FE Steering Committee)	Inception Phase	Consultation on strategies to ensure achieve effective dissemination and use findings	N/A	See MTE TOR	N/A
	KSG /KSCO implementing team	Before MTE/FE report is finalised	Validation Workshop (see TOR, Appendix section 0~~6.4~~)	Workshop for feedback on findings & recommendations & to create ownership. Gather recommendations on dissemination approaches and modify this plan accordingly.	TBD	See recommendation above on creation of repository for IRRI related information
	KSG policy makers	After Validation Workshop	Briefing for Governor	Short presentation of key findings and recommendations accompanied by short written brief. Obtain recommendations for dissemination approaches to FSM national government audience.	See MTE TOR	Knowledge products become part of KSG/KCSO IRRI repository
	FSM policy makers	After finalization of MTE/FE report	Action approaches recommended by MTE Steering Committee, implementing team and Governor		TBD	
	Kosrae communities		Depending on recommendations develop press releases to disseminate via Kosrae radio, posters with infographics, and also possibly video, photo essay and web material as appropriate. Churches are powerful institutions in Kosrae and should be considered in the dissemination strategy.		TBD	
	Development Partners		Depending on recommendations develop website, infographics, video etc. material		TBD	

7. CONCLUDING REMARKS

This framework outlines the approach that the KSG will take - working with Development Partners - to monitor and evaluate the implementation of the Malem-Utwe Inland Road and Relocation Initiative (IRRI).

A key feature of the framework is to focus the M&E work on answering a number of key evaluation questions and sub-questions - which were discussed and agreed by stakeholders during a workshop in November 2015.

The intention for this M&E framework is to be a 'living document' that will be periodically updated and adjusted according to the priority learning needs of KSG.

Appendix 1 Methodology

This M&E Plan was prepared following the Guidance Note for Developing Monitoring and Evaluation Frameworks: Strengthening the effectiveness and Resilience of Development Efforts in Kosrae. (SPREP, 2015)

Step 1: Summarise the evidence and logic of intervention design

Step 2: Incorporate external factors and risk into the Logic Model

Step 3: Formulate key evaluation questions

Step 4: Prepare a Monitoring Plan

Step 5: Prepare an Evaluation Plan

Step 6: Prepare Terms of Reference for key evaluative analyses

Step 7: Prepare a Communication, and Knowledge Management Plan

Step 8: Putting it all together

Appendix 2 Development of the Logic Model

The logic model for the Malem-Utwe IRRI was developed through a two step process: 1) initial framing and, 2) refinement. The initial framing occurred at a workshop with key stakeholders attended by the key KSG Departments of Infrastructure and Transport (DT&I), Finance and Administration (DFA); Resources and Economic Affairs (DREA) and the Kosrae Inland Resources Management Authority (KIRMA), the Governor’s Office and a representative from the NGO, Kosrae Conservation and Safety Organization (KCSO). The facilitation style involved the use of plain language and avoidance of M&E jargon. A report of the workshop was prepared by SPREP and is available upon request.

The initial facilitation questions were:

- **What changes do you intend to achieve by the end of the project.**
  These were referred to as EOPOs (End-of-Project Outcomes)
- **What needs to be in place to achieve the EOPOs: What barriers must be overcome?**

These questions led to the identification of a series of outcomes that were grouped into three time horizons: within five, ten and fifty years. The outcomes desired within 50 years were formulated into a broad, guiding statement of vision linked to the KSDP. Achievement of gradual relocation of Malem and Utwe HH inland was seen as being a 10-year process, and the five-year project lifecycle was seen as a first phase, and the time required to create conditions to enable relocation. The principal outcomes identified were construction of an inland climate-proofed road, and achievement by Malem and Utwe HH of access to land and finance for inland relocation. Once the desired outcomes were identified for these at 10 and 5-year time horizons, a new facilitation question was introduced.

- **What are the main strategies (related groups of activities required to bring about the EOPOs)**

The main strategies identified were: Inland Road (Malem to Utwe) Construction; Access to Land, Access to Finance, Limiting Further Coastal Development, and Community-Based Ecosystem Management (CBEM). Three supporting and cross-cutting strategies were added: Coastal Road

Revetment, Public Information and internal Capacity Development. Main activities together with institutional responsibilities were identified for the strategies of Inland Road Construction and Revetment, Access to Land, Access to Finance and Limiting Further Coastal Development. Further work will be required to identify the main activities to be carried out under the CBEM, Public Information and internal Capacity Development.

A visualization of the emerging logic model was prepared based on the discussions up to this point, shared, discussed and refined further.

Using the logic model visualization as the basis for discussion, assumptions and risks were identified in relation to the strategies and EOPOs. The facilitation questions were

- **What are our beliefs** (assumptions) **about how things will work in this project?**
- **What are the forseeable risks** (factors beyond our control that may be manageable) **associated with implementation of this project?**

Assumptions and risks were identified in relation to both strategies and outcomes.

The process of creating the logic model led to the identification of several outcomes, strategies and related stakeholders that had not been envisioned initially as being within the scope of project (Access to Land, Access to Finance and the supporting strategies of Public Information and Capacity Development). Financial Service Providers (FSPs) were identified as a key stakeholder group that needed to be brought into the process.

The refinement phase of the logic model involved meetings with each KSG department, KCSO, and with FSPs to revisit or present the logic model. The meetings were also used to collect information for constructing a baseline situation analysis. The discussions and information gathered at these meetings pointed to the need to align the model more closely with the KSDP, and also with the national level FSM 2023 Action Plan, which both emphasize the fiscal and economic development challenges facing Kosrae and FSM, and the need to reduce dependency on the public sector by developing the private sector.

The following facilitation question was used at the M&E workshop with KSG and KCSO to make a first cut at prioritizing information needs:

- **What are the questions you would like to be able answer at the 5-year mark to guide the next phase of the 10-year Malem & Utwe relocation initiative?**

The evaluation questions prioritised by two working groups at the M&E workshop and draft questions prepared by the M&E Specialist were compared and discussed until consensus was reached.

Appendix 3 Monitoring Plan/Project Results Framework

Notes:

- This PRF assumes that the cross cutting areas of public information and capacity development are covered under Component 4 of the overall project
- Total numbers of HH and residents in Malem, Utwe and other Kosrae municipalities are based on 2010 census and can be updated based on the HIES if we receive a information from SBOC in time. Alternatively, DREA might be able to supply the latest figures
- The numbers of HH in the coastal hazard zone, the number of road easements required were supplied by DREA and are current
- In a number of cases the activities corresponding to each output (listed at the end) have been broken down into more steps compared to the budget table set to KSG
- Yellow highlighting indicates one of the following: 1) missing information that needs to be supplied; 2) info that could be updated based on the HIES; 2) baselines or targets requiring checking or endorsement by KSG

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
Impact: The Kosrae communities most vulnerable to coastal climate change-related hazards (Malem and Utwe) are relocating inland to safer village areas	% of Malem and Utwe HH relocated inland	0	Gradual inland relocation over the next 10-20 years of the 236 HH in Malem and the 161 HH in Utwe, starting with the 93 HH (83 in Malem and 10 in Utwe) currently in the coastal hazard zone	DREA and Municipal Govt records	**Risks:** Discord/conflicts between communities and/or individuals emerge in relation to land, finance or other issues Adequate rate of relocation is not achieved **Assumptions:** Malem and Utwe HH are willing and able to relocate Relocation occurs gradually with HH in the most exposed coastal zones relocating first
Outcome 3.1. An annually maintained climate-proofed inland road with functioning power and water lines is servicing the municipalities of Malem and Utwe and enabling relocation to safer inland areas	No. of people benefitting from the road	0	Targeted beneficiaries are the 2,283 people resident in the Malem[16] and Utwe[17] municipalities. Indirect beneficiaries include 4,333 residents of the other Kosrae Municipalities	DREA and Municipal Govt records	**Risks:** The opening of the new road and inland area facilitates environmental problems such as incursion of invasive species, forest degradation, erosion. KSG is unable to access sufficient funding for other public infrastructure (in addition to road, power, water) needed to facilitate inland relocation

[16] Gender and age breakdown for Malem: Adult men 286; Adult women 284; Youth 252; Children 478
[17] Gender and age breakdown for Utwe: Adult men 196; Adult women 241; Youth 180; Children 366

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
	Condition of road after extreme rainfall event (xx mm)		A rubric[18] for assessing road conditions after rainfall events will be developed and the target set based on this	Expert opinion from DT&I assessment report	Landslides damage the new inland road The climate-proof design for the road is not effective
Output 3.1.1. Malem-Utwe road section plus access routes to the two villages produced	No. road easements obtained/No. road easements required Agreement with Utwe municipal govt for provision of water to supply Malem No. power line access agreements obtained/No. power line access agreements required No. of km of inland road produced to climate-resilience standards	0 Current inland road (xx km) is gravel only, in poor condition, and does not meet climate resilience standards No agreement currently exists 0 0	71 road easements (estimate of the number required[19]) are produced Utwe-Malem water supply agreement produced 100% of required powerline access agreements are produced X km of inland road produced to climate resilience standards	DREA and DT&I reports	**Risks:** Agreement can not be reached with all landowners on easements required for building the inland road Utwe municipal govt fails to permit use of water to supply Malem needs related to inland relocation Private HH are not willing to negotiate access to enable power line installation passing through their land Climate hazards are more severe than anticipated leading to higher climate-proofing related costs for building the inland road **Assumptions:** DT&I has adequate capacity DT&I can secure quality contractors to design and build the road KSG is able to fund maintenance of the new road KSG is able to fund maintenance of the new power and water infrastructure in Malem and Utwe
Outcome 3.2. The Malem and Utwe communities have continuity of access to public services and to the other Kosrae	Number of people benefitting from the transitional defences at Mosral and Pal	0	Targeted beneficiaries are the 2283 children resident in the Malem and Utwe municipalities who are affected	DREA and Municipal Govt records	**Risks:** Construction of transitional defences at Mosral and Pal de-incentivises and delays inland movement by Malem and Utwe

[18] For definition and examples of rubrics see: http://betterevaluation.org/evaluation-options/rubrics
[19] This estimate will need to be adjusted after the road route is finalised

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
communities while new inland road is being built and over the course of gradual inland relocation			by the vulnerable state of the coastal road at Mosral and Pal, particularly during extreme tidal surge events. Indirect, potential beneficiaries include the 4,333 resident in the other Kosrae Municipalities who may use the coastal road.		HH
Output 3.2.1 Transitional coast protection at Mosral and Pal produced	No. of m of transitional defences produced	0 Ineffective loose boulder defences at Mosral and Pal patched only after extreme events	X m of transitional defences produced	DT&I reports	**Assumptions:** KSG can secure quality contractors to design and build the transitional defences KSG is able to fund maintenance of the transitional defences
Outcome 3.3. The HH of Malem and Utwe who own no land in safer inland areas can access land to enable relocation	% of HH without land inland who accessed land inland Area (m^2) of safe land inland identified for access	0 0	100% of the HH in the coastal hazard zone with no land inland access land (18 HH in Malem; 9 in Utwe) TBD	DREA records and reports	**Assumptions:** Land swaps occur (between private owners and between private owners and KSG) KSG is able to successfully negotiate with private land owners for appropriate sites and appropriate prices
Output 3.3.1. A State program established to facilitate access to land in inland areas for homes and public infrastructure (schools, municipal govt buildings)	Land purchase/swap registry used by Malem and Utwe HH who own no land inland Legislative amendment(s) to enable access to and use of land above Japanese line are produced	No program currently exists to facilitate land access. Land above the Japanese line is currently owned by KSG and can not be used; however, there is a legislative request to amend the constitution to facilitate access to land	100% of the HH in the coastal hazard zone with no land inland use the land purchase/swap registry (18 in Malem; 9 in Utwe) All legislative amendment(s) required to enable access to and use of land above Japanese line are produced	DREA records and reports Legislative Amendment(s)	

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
		above the Japanese line			
Outcome 3.4. The Malem and Utwe communities have the tools, skills, and organisation to actively manage their land to minimize landslides and flooding, and manage environmental risks associated with conversion of land for agriculture	Participation by CBO members in management of environmental risks CBEM skills of CBO members improved CBOs established	No CBEM is occurring presently. Several existing plans & studies[20] provide a starting point for CBO establishment, tools & skills development	Assessments of CBO participation quality for a cross-section of members using 1-5 scale[21]; Target: moderate to high Self-assessments by a cross-section of members using 1-5 scale[22] on extent of improvement of key skills; Target: moderately to mostly improved Two CBOs established (in Malem and Utwe)	KSCO reports	**Assumptions:** Community-based ecosystem management skills development is effective
Output 3.4.1. CBO members trained	No. of CBO members trained (by type e.g., women's group, school group, elders etc.) in application of environmental risk management tools or methods	0	At least X% of Malem and Utwe adults and youth are trained in application of each environmental risk management tool or method	CBO workplans and KSCO newsletters and reports	**Risks:** Implementing partner has adequate capacity **Assumptions:** Communities and CBOs participate in initiatives for community-based ecosystem management

[20] Utwe biosphere Reserve Management Plan (2011); Draft Olum Watershed (in Malem) Management Plan (2013); Feasibility study for management of Invasive Species in Kosrae (2012)

[21] 1: No participation; 2: low participation; 3: Moderate participation; 4: high participation; 5: very high participation. Scale rubric TBD

[22] 1: Not improved; 2: Somewhat improved; 3: Moderately improved; 4: Mostly improved; 5: Fully improved. Scale rubric TBD

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
	CBO tools and/or methods produced No. CBO members by type: (women's group, school group, elders etc.)		At least 1 tool or method is produced for each key dimension of risk management (landslides, flooding, agricultural land); with 1-5 scale[23] used for reporting progress on tools development At least X% of Malem and Utwe adults and youth become members of the CBOs		
Outcome 3.5. HH from Malem and Utwe can access affordable finance for inland relocation	No. of people who have used the adapted finance mechanism Existing housing finance mechanisms adapted	Existing loan mechanisms are offered by Kosrae Housing Authority[24] and FSM Development Bank[25]	At least XX people have used the adapted finance mechanism At least 1 existing program is adapted to improve affordability of finance for house construction inland	DAF reports	**Assumptions:** Schemes prioritise vulnerable HH in coastal hazard zones
Output 3.5.1. Mechanisms for improving access to affordable finance for inland relocation identified and support	Recommendations are produced by a review of programs and practices in Kosrae and other Pacific	Most applicants for the FSM Development Bank loans do not	Recommendations address affordability of finance	DAF and study reports	

[23] 1: Not produced; 2: Somewhat produced; 3: Moderately produced; 4: Mostly produced; 5: Fully produced

[24] Kosrae Housing Authority (HA) currently offers loans through two mechanisms: 1) Housing Loan Program; 2) USDA-funded Rural Development Program. The HA house loan lending target is 200-300K/yr; Disburse 15-20 loans/yr between USD 7-10,000. Loan terms are 15-20 yrs with a fixed rate (7%). Most loan takers are aged 25-40 yrs. Staff explain the T&C, particularly related to the promissory note and deed of trust. A second type of loan is for senior citizens (over 62) with funding from the USDA. These are "rural development" loans that can also be used to improve home sites. Interest rate is 4%. HA would like to add new program, with USDA funding of USD 50-80,000/yr; does not currently qualify. Main requirement: USD 500,000 escrow; Have only USD 300,000

[25] FSM Development Bank has capitalization from the FSM National Govt plus USD 2M and 5M loans (5 yr term) from China EXIM and the European Investment Bank. FSMDB's national lending target is USD 9 M/yr. In Kosrae lending target is 1.5 M/yr; Housing Loans make up 20% of the National portfolio but only 1% of the Kosrae portfolio; Housing Loans: up to USD 100,000; terms of up to 20 yrs; Interest rate: 9% flat. Currently most applicants are not not eligible (do not meet income criteria of USD 10-30,000 per adult). If declined, can apply under personal/consumer loan category or go to Housing Authority. Consumer loans are for up to USD 30,000; 5 yr term, 15% flat rate; Have translated legal docs to Kosraen to help clients understand T&C; Options for FSM Dev Bank to increase affordability are 1) seeking additional sources of funding; 2) advocate for govt social housing scheme (standard housing).

Design Summary	Performance Indicators	Baseline	Target	Sources of Verification	Risks and Assumptions
provided to adapt these mechanisms	Island Countries	meet eligibility criteria; Kosrae Housing Authority loan sizes ae small relative to home construction costs	Recommendations identify ways to serve needs of vulnerable HH in coastal risk zones		
Outcome 3.6. Further public and private infrastructure development in coastal hazard zones in Malem and Utwe ceases	No. of new developments (public, private) in Malem and Utwe coastal zone	Planned developments will be identified as part of the review	Once regulations are in place no new developments are initiated in the Malem and Utwe coastal zones	KIRMA records	**Assumptions:** Landowners, Financial Service Providers and Municipal Governments comply with regulations limiting infrastructure development in coastal hazard zones
Output 3.6.1. Coastal development infrastructure regulation measures are produced and/or strengthened	Regulations are produced and/ or strengthened	Existing regulations will be identified as part of the review	At least 1 regulation limiting public and private coastal development is produced or strengthened	Text of official regulations	**Assumptions:** Draft regulations developed after the review are approved by the Kosrae State Government

Activities for Output 3.1.1.
1. Reconnaissance survey to determine road route
2. Finalise road easement terms and conditions (DREA)
3. Topographic Survey
4. Procure engineering design for road, water and powerlines (civil, geotechnical and environmental) including climate-proofing
5. Quality assurance for engineering design for road, water and powerlines
6. Procure construction of road, water and power lines
7. Construct road including water and power lines
8. Quality assurance for road, water and power line construction
9. Develop maintenance plan
10. Yearly maintenance of road

Activities for Output 3.2.1
1. Procure services for review to finalise design for transitional coastal protection at Mosral and Pal
2. Quality assurance for transitional coastal protection designs for Mosral and Pal
3. Procure construction of transitional coastal protection at Mosral and Pal
4. Quality assurance for construction of transitional coastal protection at Mosral and Pal
5. Develop maintenance plan
6. Yearly maintenance of transitional coastal protection at Mosral and Pal

Activities for Output 3.3.1
1. Obtain easements for the inland road
2. Identify private land owners in upland areas including those with traditional ownership claims above the Japanese Line
3. Identify vulnerable HH in coastal hazard areas that are without land inland
4. Set up a registry to facilitate land purchases and swaps
5. Expedite legislative amendments related to land above the Japanese line
6. Expedite processing, titling related to land above the Japanese line
7. Research and develop options for a land provision scheme that prioritises vulnerable HH from the coastal hazard zone who are without land inland
8. Swap/purchase land inland that can be used for schools and municipal government buildings
9. Swap/purchase land inland that can be accessed by vulnerable HH from the coastal hazard zone through the land provision program

Activities for Output 3.4.1
1. Review existing assessments related to landslide, flooding and agricultural development risks in upland areas and identify gaps; based on assessments determine community-based risk management responses
2. Undertake additional assessments (to fill gaps) related to management of risks associated with landslides, flooding and agricultural development in upland areas; based on assessments determine community-based risk management responses
3. Implementation of community-based landslide and flooding risk management responses (invasive species management, regulation of timber harvesting, water catchment activities etc.)
4. Implementation of community-based agricultural risk management responses (e.g. requirements for buffer zones, control of pesticide/herbicide use etc)

Activities for Output 3.5.1
1. Review existing access to finance (for home construction) programs/schemes in Kosrae
2. Review access to finance schemes (for home construction) programs/schemes in other Pacific Island Countries
3. Support adaptations to existing local schemes, ensuring they cater for vulnerable households in coastal hazard zones
4. Develop applications to the GEF6 via non-grant instrument

Activities for Output 3.6.1
1. Review regulations relevant to management of infrastructure development in coastal hazard zones
2. Strengthen and/or develop regulations for management of infrastructure development in coastal hazard zones
3. Review planned public infrastructure developments in the Malem and Utwe municipal areas (e.g. schools, municipal offices, health dispensaries)
4. Develop plan to site public infrastructure in upland areas
5. Proper application and enforcement of regulations aimed at managing infrastructure development in coastal hazard zones
6. Develop funding proposals for public infrastructure (e.g. schools, municipal offices, health dispensaries)

Appendix 4 Draft Terms of Reference for Mid-Term Evaluation

DRAFT

Background and Context

The island of Kosrae is the easternmost island in FSM. Kosrae is a 112 km^2 volcanic island surrounded by mangroves and coastal strand forests that have been historically used for lumber and fuel by residents. There is a shallow fringing reef spotted with boulders of limestone quarried from the fore-reef by high-energy wave events (storms, tsunamis, and other overwash processes). There are no outer islands. The island has steep, heavily vegetated watersheds with unstable slopes. Intense rainfall denudes exposed soil in areas of deforestation. Invasive vegetation is prolific and has taken a foothold in every watershed.

The Kosrae Inland Road and Relocation Initiative (IRRI) is a long-term undertaking by the Kosrae State Government (KSG) to increase the resilience of Kosrae to climate change. The Long term vision is:

A sustainable population of Kosraens are living in inland village areas safe from coastal climate change hazards, protecting their ecosystems, participating in a growing private sector, including the development of inland agriculture, and experiencing rising social well-being and equity.

Within 5 years the IRRI aims to create the conditions necessary to enable gradual inland relocation, starting with the most vulnerable households in the most vulnerable communities of Malem and Utwe.

The Program Logic is summarised in Table 1.

Table 1: [Insert Program Logic including diagram and assumptions & risks chart]

The initiative consists of five main and three supportive strategies. The main strategies are Construction of a Climate-Proofed Inland Road, Access to Land, Access to Finance, Community-Based Ecosystem Management and Limitation of further Coastal Development.

Land access issues are critical to the initiative. The construction of the inland road requires easements for approximately 71 privately owned parcels. Some of the households located in the coastal hazard zone have no land inland for the building of a new home. The relocation of the Malem-Utwe section of the circumferential road to the interior and the relocation of the Malem and Utwe households to the interior (with priority given to those currently living in the coastal hazard zone) both mean engagement with complex issues of land rights and titling. Land in Kosrae is managed under a complex mix of modern and traditional systems and intricately connected to people's perception of inheritance and community. This needs to be tackled with a long-term perspective and disputes also can take an inordinately long period of time to resolve.

Some of the land required for the IRRI is above the so called *Japanese Line*, which delineates an undeveloped zone consisting of 65% of the interior of the mountainous island. The Government owns all the land above the Japanese Line and the health of Kosrae' forests, mangroves, reefs and watersheds is due in large part to its existence.

A key risk for IRRI is the potential for environmental degradation associated with inland development. Other risks are that (i) the revetment of the coastal road, essential to keep it functioning while the inland road is built, de-incentivizes inland relocation, and (ii) the engineering design of the inland road is not 'proofed' from flooding and landslide hazards.

Access to finance for housing and other household relocation costs is also a challenge because the income levels of borrowers is often below the threshold needed to qualify for the loan products that are currently available.

In addition to Coastal Road Revetment, the other supportive strategies are Public Information and Capacity Development. The role of Public Information is to build a case for inland relocation to safer village areas, and to inform people of the services and programs available to assist households to achieve successful relocation. The role of Capacity Development is to ensure that KSG and partners have the capacity to able successfully implement the other strategies.

The first five year phase of IRRI began in [201X] with a total funding envelope of [USD] from [donor1, donor2] and [donorx].

A 'Framework' has been developed to assist monitor and evaluate the IRRI in a systematic and focussed manner. The development of this M&E framework was supported by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank through the Pilot Program for Climate Resilience (PPCR): Pacific Regional Track. A copy of this M&E framework document is provided at [Annex A].

Purpose and Use

The main purpose of this midterm evaluation is learning for adaptive management. The evaluation will identify practices, opportunities, lessons and corrective actions needed for the next phase of implementation and to ensure the realization of the expected outcomes.

The findings and recommendations will be used by KSG and IRRI Development Partners to identify key strategic adjustments to the overall approach and/or to the component strategies.

Scope

The Midterm Evaluation covers the entire time period since inception of IRRI, and will evaluate the efficiency, effectiveness, impact and sustainability of the five main strategies and the three supportive strategies. In line with the learning purpose of the evaluation, priority will be given to the evaluation criteria of effectiveness, impact and sustainability.

The Evaluation will aim to include all the relevant stakeholder groups including the implementing KSG departments (DT&I, DREA, KIRMA, DAF, Governor’s Office), contractors and consultants, and KCSO, Malem and Utwe municipal governments, households and Community-Based Organizations, Financial Service Providers, The Chamber of Commerce and other Private Sector actors.

Evaluation Questions

During the inception phase the KSG and its partner, the Kosrae Conservation and Safety Organisation (KSCO) identified the following key evaluation questions. It is intended that this will be the primary focus of the mid-term evaluation.

Efficiency	1) To what extent are the key actions associated with each strategy (access to land, access to finance, construction of inland climate proof road, revetment of the coastal road, control of further coastal development; community-based ecosystem management, public information, capacity development) being achieved? a) Has the new road been completed as designed and planned?
Effectiveness	2) How effective are the strategies? a) What community based ecosystem management projects/actions are being implemented, and what are they achieving? b) What depth and quality of community participation is being achieved in community-based ecosystem management work? c) How suitable are the sites designated as village areas? d) How well are the Malem and Utwe HH with no land in the inland area being served by the actions to enable access to land? e) How well are the Malem and Utwe HH being served by actions to enable access to finance? i) How well are the Malem and Utwe HH with no land in the inland area being served? f) How effective are the Public Information efforts at facilitating community participation and ownership? g) How well are changes in new and existing policies and regulations functioning to limit further coastal development?
	3) What is working well and less with with each of the strategies and why?[26]
Impact	4) What proportion of Malem and Utwe HH are planning, preparing, ready to relocate, or have already done so? 5) What is enabling and constraining readiness for relocation by HH from Malem and Utwe? 6) How are agricultural issues influencing readiness for relocation by HH from Malem and Utwe? 7) How is the private sector influencing readiness for relocation by HH from Malem and Utwe? 8) Were there any unintended effects of the KSG inland road and relocation initiative (positive and negative)?
Sustainability	9) How resilient is the new road to the heavy/extreme rainfall events and associated climate-change related hazards? 10) What, if any, are the gaps in the overall approach? i) What if any are the gaps in the individual strategies? 11) What opportunities exist for addressing these gaps? 12) How sustainable are the strategies implemented by KSG to enable relocation?
Synthesis	13) What are the emerging lessons for Kosrae from the inland road and relocation initiative?

[26] Prioritise Inland Road Construction, Access to Land and CBEM strategies if not feasible to analyze all during the Mid-term and final evaluations

Timing

The evaluation will be carried out over a three-month period between [when] to [when] during the last quarter of the initiative.

Management and Governance

The evaluation will be managed by [insert]. [Insert relevant title or role] will be responsible for contracting the evaluation tea and monitoring the evaluation process against the TOR deliverables. An Advisory Committee comprised of a Senior KSG official from the implementing team, representatives of [Development Partner 1, Development Partner 2…] and [Development Partner X], and a Peer Evaluation Adviser designated by SPREP. The Advisory Committee will be responsible for reviewing and approving the MTE TOR, the Inception report and the draft Evaluation reports.

Methodology

Effective methodologies engender stakeholder ownership, build evaluation capacity, support accountability, foster independence, and ensure the transparency and reliability of findings. These are the principles that SPREP and KSG expect to be upheld over the course of this evaluation:

Partnership: Work in partnership with development partners and other stakeholders to design and implement the evaluation.

Transparency and independence: Ensure the evaluation process is transparent (open and understood by all partners), and independent (carried out in a way that avoids adverse effects of political or organisational influence).

Participation: Ensure that stakeholders are appropriately involved at all stages of the review or evaluation

Capacity building: Design the evaluation so that KSG capacity to participate in evaluations is enhanced through involvement in the process.

After identification of the team leader and member, the Midterm Evaluation will be conducted in three stages described below. Drawing on the Monitoring and Evaluation Framework, the Evaluation Questions, analysis of relevant document and inception meetings the team leader will prepare the evaluation design and schedule (Evaluation Plan).

The time requirements after the inception phase will be determined by the team leader as part of the evaluation plan.

Phase	Processes	Deliverables
Inception (Team Leader Only)	Contextual Analysis: Reading/analysis of relevant documents	
	Inception meetings in Kosrae with steering group and with key KSG, KCSO and SPREP staff including stakeholder analysis, identification of key informants potential case studies, use and dissemination of findings and recommendations	**Inception Report**
	Preparation of Inception Report and Evaluation Plan including interview guides, surveys, and participatory tools as required	
	Revision of Evaluation Plan based on feedback	**Evaluation Plan**

Phase	Processes	Deliverables
Field Work (Full evaluation team)	Orientation of team member	
	Engagement with implementers, contractors, consultants, municipal govts, communities, CBOs, FSPs and private sector actors: Carry out interviews, meetings, workshops, field trips, case studies, surveys etc. as per evaluation plan with emphasis on the evaluation questions related to effectiveness, impact and sustainability	
	Processing and preliminary analysis of data from field work and review of stakeholder surveys/feedback	
	Carry out remote interviews (skype/phone) as required. Further field work to fill information gaps, check hypotheses	
Briefing	Workshop with the KSG/KCSO implementing team and SPREP to review the program model in light of the findings and identify key strategic changes	
	Preparation of briefing to Steering Group	
	Briefing of Steering Group	**Briefing: Preliminary Findings**
Analysis and Writing (at SPREP for at least part of the time; to enable team to work together)	Processing and analysis of data	
	Draft Report preparation	**Draft Report**
	Preparation of Advanced Draft Report	**Advanced Draft Report**
Validation (Team leader only)	Preparation of validation workshop	
	Validation workshop in Kosrae Briefing for Governor	
	Preparation of Final Report	**Final Report**
Total Days		

Evaluation Team

The evaluation team will consist of two members with the following profiles:

<u>Team Leader</u> (TL): A senior evaluator with a minimum of 10-15 years of experience in designing and managing program theory-based evaluations, plus experience of conducting evaluations of Community based Ecosystem Management (or similar programs), and access to finance and/or land programs. Pacific experience is essential. Experience with designing evaluations for road infrastructure and/or climate change adaptation programs is highly desirable.

<u>Infrastructure Specialist</u> (IS): An road infrastructure specialist with a minimum of 10-15 years experience including experience with climate-proofing designs. Experience in evaluating infrastructure projects is highly desirable. Pacific experience is essential.

Deliverables

See above

Indicative Budget

Tasks	Days, TL	Days, IS	Total Days	Cost @ 550 USD/day
Planning and Preparation	6	1	7	
Field work	10	5	15	
Preliminary analysis & Briefing	2	2	4	
Analysis	5	4	9	
Reporting	5	4	9	
Validation	0	0	0	
SUBTOTAL	28	16	44	24,200
Travel	**TL**	**CCS**	**Total**	**Cost**
Kosrae @ USD 5000/trip	1	1	2	10,000
Samoa @ USD 3000/trip	0	0		
Rental car days @ USD 50/day	20	10	30	1,500
Per diem days @ USD 166/day	20	10	30	4,900
SUBTOTAL				16,400
TOTAL				**40,600**

Key Documents

- IRRI project design document
- FSM 2023 Action Plan
- Kosrae Strategic Development Plan
- Kosrae Shoreline Management Plan
- Infrastructure Cost Benefit Analysis
- IRRI Progress Reports
- [insert other relevant documents]

Appendix:

[insert MEF here]

GOVERNMENT OF KOSRAE
Office of the Governor
Post Office Box 158
Kosrae, Federated States of Micronesia 96944
Telephone: 691-370-3002/3003..Facsimile: 691-370-3162

November 6, 2015

H.E. Peter Christian
President
Federated States of Micronesia
Palikir, Pohnpei 96941

RE: Prioritizing Inner Roads within IDP Framework for Kosrae State

Dear President Christian:

I present my compliments with sincere hope that this letter finds you in the best of your health and spirit. With reference to the recently updated FSM Infrastructure Development Plan 2016 to 2023, I do understand that said IDP updating was undertaken primarily at the request of our U.S./OIA partners, but in many respect and as you are fully aware, the IDP also supports and provides credence to our ongoing dialogue with our other development partners.

With infrastructure investments an important driver for economic growth, directly by generating employment and income and indirectly facilitating the development of other sectors of the economy, I am pleased to inform you that Kosrae is seriously re-assessing its infrastructure priorities in view of the limited resources at hand.

Now with the upcoming development partner forum planned for the early part of the coming new year and also given the accelerating threats from climate change induced hazards to certain segments of the state's road system, Kosrae has decided to give high priority to our road infrastructure projects. It is in this respect that I take this opportunity to formally inform your office that Kosrae will seek assistance toward its inland road projects.

A resolution by the Kosrae Legislature endorsing the same is forthcoming and will be transmitted to your office. In the meantime, please feel free to let me know should you have question or need additional information.

Sincerely,

Lyndon H. Jackson
Governor

Cc : V/President George
Speaker Palik
Lt. Governor Sigrah

ELEVENTH KOSRAE STATE LEGISLATURE
P. O. BOX 187
TOFOL, KOSRAE STATE
FEDERATED STATES OF MICRONESIA 96944
TELEPHONE: (691)370-3019/3177

Tulensa W. Palik
SPEAKER

Robert I. Taulung
VICE SPEAKER

Jarinson M. Charley
FLOOR LEADER

LELU:
Albert T. Welly
Gilton A. Esahu
Reedson P.Abraham
Salpasr E. Tilfas
Tulensa W. Palik

TAFUNSAK:
Alokoa Jb. Sigrah
Maker L. Palsis
Robert I. Taulung
Rolner L. Joe

MALEM:
Jarinson M. Charley
Morgan S. Jonas
Sasaki L. George

UTWE:
Josaiah F. Waguk
Rinson H. Edmond

November 24, 2015

The Honorable Wesley Simina
Speaker
19th FSM Congress
Palikir, Pohnpei FM 96941

Dear Speaker Simina,

I have the honor to transmit herewith L.R. No. 11-106, which was adopted by the Eleventh Kosrae State Legislature, Fourth Special Session, 2015.

Respectfully yours,

Andy J. Andrew
Deputy Chief Clerk
Kosrae State Legislature

Enclosures

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Josaiah F. Waguk
Rinson H. Edmond

LEGISLATIVE RESOLUTION No. 11-106

We hereby certify that the foregoing Resolution was adopted by the Legislature, Fourth Special Session, 2015, by two-thirds of the members of the Eleventh Kosrae State Legislature.

Tulensa W. Palik
Speaker
Eleventh Kosrae State Legislature

Andy J. Andrew
Deputy Chief Clerk
Eleventh Kosrae State Legislature

ELEVENTH KOSRAE STATE LEGISLATURE

FOURTH SPECIAL SESSION, NOVEMBER 2015 L.R. No. 11-106

A RESOLUTION

Endorsing the inner road construction projects as one of the highest infrastructure priority projects for the State of Kosrae and for other purposes.

WHEREAS, the Kosrae State Legislature has adopted the Kosrae State Shoreline Management Plan (hereafter "KSMP") in 2013; and

WHEREAS, the KSMP was developed primarily to address the increasing threats from sea level rise in Kosrae's coastline; and

WHEREAS, the KSMP calls for relocation inland of certain road sections, including power, telecommunications and water lines, around the state due to their impending destruction from coastal erosion; and

WHEREAS, these proposed inner roads under KSMP were incorporated and made part of the updated Kosrae State Infrastructure Development Plan 2016-2025; and

WHEREAS, in consideration of the projected acceleration of the sea level threats to the State's coastline, and the consequential adverse socio-economic impact to the State; **NOW, AND THEREFORE,**

BE IT RESOLVED, that this Eleventh Kosrae State Legislature, on its Fourth Special Session, November 2015, hereby endorses the construction of the inner roads as one of its top priority infrastructure projects and thus declares its intention to mobilize all available resources, including development partners' support, toward this end, and

BE IT FURTHER RESOLVED, that certified copies of this resolution be transmitted to the Honorable Lyndon H. Jackson, Governor of Kosrae State, the

LEGISLATIVE RESOLUTION No. 11-106

ELEVENTH KOSRAE STATE LEGISLATURE
FOURTH SPECIAL SESSION
NOVEMBER 5, 2015

A RESOLUTION

ENDORSING THE INNER ROAD CONSTRUCTION PROJECTS AS ONE OF THE HIGHEST INFRASTRUCTURE PRIORITY PROJECTS FOR THE STATE OF KOSRAE AND FOR OTHER PURPOSES.

INTRODUCED BY: Senator Rinson H. Edmond

DATE: November 13, 2015

Andy J. Andrew
Deputy Chief Clerk
Kosrae State Legislature

ELEVENTH KOSRAE STATE LEGISLATURE

FOURTH SPECIAL SESSION, NOVEMBER 2015 L.R. No. 11-106

Honorable Peter Christian, President of the Federated States of Micronesia and the Honorable Wesley Simina, Speaker of the FSM Congress.

Adopted: November 17, 2015

Tulensa W. Palik
Speaker, Eleventh Kosrae State Legislature

Attested by: ______________________
Deputy Chief Clerk

WORKSHOP REPORT

Developing a Monitoring and Evaluation Framework for a project to reduce climate risks faced by the Malem and Utwe communities

Background

The Strategic Program for Climate Resilience: Pacific Regional Track (SPCR-PR) is a regional program which aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes (i.e. 'climate change and disaster risk mainstreaming'). The SPCR-PR is being implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank (ADB). The SPCR-PR is funded through the Climate Investment Funds (CIF)[1].

One initiative being implemented under the SPCR-PR is a monitoring and evaluation (M&E) initiative. The objectives of this initiative include to:

- further build capacity within Kosrae State Government (KSG) to formulate, implement and use (strategic and project-level) M&E, and climate change and disaster risk elements therein;
- prepare good quality (strategic and project-level) M&E frameworks to help inform adaptive management and future design of strategic plans/projects in the food security and infrastructure related 'sectors'; and
- strengthen linkages between relevant parts of national, sector, project-level M&E (and planning more generally).

The SPCR-PR M&E initiative endeavours to take a practical, learning-by-doing approach to build Pacific Island Country Governments' capacity in the use of M&E. The key components of the initiative for Kosrae comprise (1) development of brief guidance materials to develop monitoring and evaluation frameworks; (2) in-country training workshops in the application of the guidance materials, (3) mentoring to support Kosrae State Government (KSG) officials prepare and implement M&E frameworks for food-security and infrastructure related sector interventions, and (4) mentoring to help KSG strengthen linkages between M&E of (relevant sub-sectors of) the Kosrae Strategic Development Plan, national food-security and infrastructure related sector plans, and food-security and infrastructure related sector projects.

The draft Guidance Note prepared as part of component one - to assist KSG officials develop M&E frameworks - is available at the following dropbox link, https://www.dropbox.com/sh/eggdwferqxbfv45/AACusyF00CJbg9wEW9pgjh_La?dl=0.

This report documents a workshop undertaken to implement components 2 and 3 of the M&E initiative - an in-country training workshops and mentoring support to prepare a monitoring and

[1] More information on this program can be found at https://www.climateinvestmentfunds.org/cif/node/7295.

evaluation framework for a project/program to reduce coastal flooding risks for Malem and Utwe coastal communities.[2]

Note also, the case study application (a project/program to reduce coastal flooding risks for Malem and Utwe coastal communities) is the same as that examined in related cost-benefit analysis and central agency appraisal initiatives supported by the SPCR-PR. The case study is also the subject of a project proposal that is currently being formulated (with assistance from SPREP) for submission to the Adaptation Fund (AF).

Overview of workshop

The M&E training workshop was conducted in Tofol on Tuesday 24, Wednesday 25 and Friday 27 November. The specific objectives of the training workshop were to:

- strengthen KSG capacity in the preparation of Monitoring & Evaluation frameworks;
- raise awareness of the important role M&E plays in the context of adapting to climate change; and
- draft key elements (a logic model, key evaluation questions, and monitoring plan) of a M&E framework for a project/program to reduce climate risks faced by Malem and Utwe communities.

The workshop was organised into five main parts as follows:

1. The first part was a general overview of what monitoring and evaluation is and how it used within the Kosrae policy cycle. It then outlined the suggested nine-step approach for preparing a M&E Framework. This session followed PART A of the draft Guidance Note.

2. The second part was an introduction of the case study application for the workshop - which was a project/program to reduce climate risks faced by Malem and Utwe communities (hereafter referred to as the 'case study project').

3. The third part applied step 1 (i.e. summarise the evidence and the logic of the plan/program/project) of the Guidance Note to the case study project. This comprised of an introductory presentation on key concepts followed by several interactive group work sessions to collectively prepare a draft 'logic model' for the project.

4. The fourth part applied step 2 (i.e. incorporate external factors and risk into the logic model) of the Guidance Note to the case study project.

5. And the final part applied step 3 (i.e. formulate evaluation questions) of the Guidance Note to the case study project.

The workshop facilitators were Ann Braun (consultant), Aaron Buncle (Mainstreaming Specialist, SPCR-PR), and Peniamina Leavai (SPREP).

A copy of the workshop agenda is provided at Appendix 1. Workshop participants are listed at Appendix 2.

[2] This case study application is the same as that examined in related cost-benefit analysis and central agency appraisal initiatives supported by the SPCR.

Participant Feedback and Facilitator Reflections

Participants were asked to fill in a brief workshop evaluation form - see Appendix 5. Responses from these evaluation forms are summarised under the five sub-headings below, with facilitator reflections added at the bottom of these sub-sections as appropriate:

I. Expectations and relevance

Participants were asked to state what they had wanted to achieve from the workshop and then to rate to what extent their expectations were met (from "not at all", "to a small extent", "to some extent", and "to a large extent").

Statements about what participants wanted to achieve were mostly around how to practically apply monitoring and evaluation to their existing work (at plan level and project level). Several participants further stated they wanted to use this workshop to contribute their inputs and ideas to the Adaptation Fund proposal.

Three out of the six participants that completed evaluation forms rated that their expectations had be met "to a large extent", with the remaining three participants rating it as "to some extent".

II. Information

The evaluation form asked two different questions about the information covered in and provided for the workshop. Participant responses are summarised in Table 1 below.

Table 1 Participant responses to workshop evaluation questions 3 and 4

Evaluation Form Question	"too little"	"about right"	"too much"
3. The amount of information covered was:		●●●●● ●●●	●
4. The amount of information provided was:		●●●●● ●●●	●

III. What worked well

Participants were asked to identify the two best things about the workshop. Responses were quite broad. Many commented on the participatory nature of the workshop. A sample of such responses are provided below:

- "everyone work together"
- "active participation"
- "the discussion among participants"
- "identifying EOPO's [end-of-program-outcomes]"
- "how all things just came together and made an easily comprehensible picture/vision [of the case study proposal] with supporting activities"
- "discussing evaluation questions"

Participants also commented that the workshop was well facilitated and well executed.

The consultant engaged to support this activity was a key ingredient in facilitating the workshop. In particular, the consultant was very effective at explaining evaluation concepts without needing to use a lot of (sometimes confusing) new terminology. The consultant was also very effective at engaging participants and soliciting feedback on what they thought should be included in the logic model - and hence project design and M&E framework.

Moreover, a feature of the workshop that appeared to work well was that most officials that participated will be responsible for either planning or implementing the case study application - as opposed to officials who participate in the workshop to learn about M&E but not necessarily apply it to the identified case study (as was the approach in the earlier Kosrae SPCR-PR M&E workshop in June 2015). This allowed for more informed and focussed group discussions which in turn resulted in a more productive workshop in terms of developing a draft logic model and evaluation questions. This feature should be retained for future M&E workshops.

IV. What could be improved

Participants were also asked to detail any ways in which the workshop could be improved. Key feedback provided on how the workshop could be improved centered around including a broader stakeholder representation in the workshop. Specific feedback provided on this included:

- "the workshop could have invited community representatives to share community perspectives"; and
- "could have included the Municipal Government representatives of Malem and Utwe"

It is also the facilitators view that the workshop could be improved by including some broader stakeholder representation.

V. Changes in participants understanding and ability to apply monitoring and evaluation

Participants were further asked to self-assess - on a scale from 1 to 10 - their understanding and ability to apply monitoring and evaluation - before and after the workshop. On average, participants reported that - as a result of the workshop:

- their knowledge and understanding of monitoring had increased by 2.6 points;
- their ability to carry out monitoring responsibilities had increased by 3.1 points;
- their knowledge and understanding of evaluation had increased by 2.9 points; and
- their ability to manage reviews and evaluations had increased by 3.0 points.

Concluding Remarks and Next steps

Overall, the M&E training workshop was well-received by KSG participants and was an important (early) step to help strengthen the capacity of KSG to effectively undertake and utilise M&E, including on climate change and disaster risk elements.

One element of the M&E training workshop that appeared to work particularly well was the preparation of a draft logic model for the case study (refer Appendix 3). In addition to helping establish a sound and shared understanding of the case study project on which to base the M&E work, the logic model also showed to be a very useful project design tool - to clarify, augment and improve the design of the project/program. A key strength of the logic model tool for this purpose is that it is a very effective way to share information and experiences from different stakeholder perspectives (and expertise) which in turn can be used to inform the design of an improved proposal. It also helps to foster a greater sense of ownership.

The next steps for the M&E initiative are for the consultant engaged to support the case study application (Ann Braun) to continue working with KSG officials to complete the drafting of the M&E framework for the case study application. A copy of the draft logic model and evaluation questions developed as part of the workshop are provided at Appendix 3 and Appendix 4 respectively.Once completed, it is anticipated that the M&E framework will be used to support one or more ODA proposals - including a proposal currently being prepared for the Adaptation Fund (AF).

In addition, the M&E Guidance Note used for the workshop training in Kosrae is considered a working draft. Refinements and modifications to the M&E Guidance note will be made throughout the course of the initiative, including based on the workshop experience and lessons learned in the workshop. Feedback from participants is very much welcomed at any time.

By April 2016, a final M&E Guidance Note will be available for broad application in KSG planning processes. Advice and input from SPCR-PR stakeholders (including SPREP, GIZ, SPC) will be sought in the finalisation of the M&E Guidance Note.

Appendix 1 Agenda

AGENDA: Developing a Monitoring and Evaluation Frameworks for the Malem and Utwe climate risk reduction project

Tuesday 24, Wednesday 25, and Friday 27 November 2015, Governors Office

The Strategic Program for Climate Resilience: Pacific Regional Track (SPCR-PR) is a regional program which aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes (i.e. 'climate change and disaster risk mainstreaming'). The SPCR-PR is being implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank (ADB). The SPCR-PR is funded through the Climate Investment Funds (CIF)[3].

One initiative being implemented under the SPCR-PR is a monitoring and evaluation initiative. The objectives of this initiative include to:

- further build capacity within Kosrae State Government (KSG) to formulate, implement and use (strategic and project-level) M&E, and climate change and disaster risk elements therein;
- prepare good quality (strategic and project-level) M&E frameworks to help inform adaptive management and future design of strategic plans/projects in the food security and infrastructure related 'sectors'; and
- strengthen linkages between relevant parts of national, sector, project-level M&E (and planning more generally).

The SPCR-PR M&E initiative endeavours to take a practical, learning-by-doing approach to build Pacific Island Country Governments' capacity in the use of M&E. The key components of the P-CBA Initiative for Kosrae comprise (1) development of brief guidance materials; (2) in-country training workshops, (3) mentoring to support Kosrae State Government (KSG) officials prepare and implement M&E frameworks for food-security and infrastructure related sector plans, and (4) mentoring to help KSG strengthen linkages between M&E of (relevant sub-sectors of) the Kosrae Strategic Development Plan, national food-security and infrastructure related sector plans, and food-security and infrastructure related sector projects.

The draft Guidance Note prepared as part of component one - to assist KSG officials develop M&E frameworks - is available at the following dropbox link, https://www.dropbox.com/sh/eggdwferqxbfv45/AACusyF00CJbg9wEW9pgjh_La?dl=0.

This workshop is to deliver components 2 (in country training workshops) and 3 (mentoring to prepare M&E frameworks for select plans and project).

Workshop objectives

The specific objectives of the training workshop are to:

- strengthen KSG capacity in the preparation of Monitoring & Evaluation frameworks;

[3] More information on this program can be found at https://www.climateinvestmentfunds.org/cif/node/7295.

- raise awareness of the important role M&E plays in the context of adapting to climate change; and
- draft key elements (a logic model, key evaluation questions, and monitoring plan) of a M&E framework for a project/program to increase the resilience of Malem and Utwe communities to coastal flooding risks.

For more information on the workshop or the PPCR-PR more generally, please contact either Kenye Phillip on fsmpaccadminassist@mail.fm or Aaron Buncle on aaronb.ext@sprep.org.

Tuesday 24 November		Activity	Facilitator
Morning	8:45 – 9:00	Registration	
	9:00 - 9:20	Opening prayer and address	Nena Williams
	9.20 - 10:00	Workshop introduction Overview of Monitoring and Evaluation	Aaron Buncle (SPREP)
	10:00 - 10:30	Background presentation on the project proposal	Lipar George (ODA, DA&F) Peniamina Leavai (SPREP)
	10:30 – 11:00	Morning tea break	
	11:00 - 11:30	Summarise the evidence and logic of intervention design (step 1)	Aaron Buncle (SPREP)
	11:30 - 12:00	Activity: Defining inputs, outputs, outcomes, impacts, results	Aaron Buncle (SPREP)
	12:00 - 12:30	Group work to prepare a logic model for the case study applications (step 1)	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)
	12:30 – 1:30	Lunch	
Afternoon	1:30 - 1:40	Ice-breaker	Peniamina Leavai (SPREP)
		Group work to prepare a logic model for the case study applications (step 1) cont..	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)

Wednesday 25 November		Activity	Facilitator
Morning	9:00 - 9:15	Re-cap of Day 1	Workshop participant to be determined at start of workshop
	9.15 - 9:40	Incorporating external factors and risk into the Logic Model (step 2)	Aaron Buncle (SPREP)
	9:40 - 10:30	Group work to incorporate external factors and risk into the logic model for the case study applications (step 2)	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)

	10:30 – 11:00	Morning tea break	
	11:00 - 11:20	Formulate evaluation questions (step 3)	Aaron Buncle (SPREP)
	11:20 - 12:30	Group work to formulate key evaluation questions for case study applications (step 3)	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)
	12:30 – 1:30	Lunch	
Afternoon	1:30 - 1:50	Prepare a Monitoring Plan (step 4)	Aaron Buncle (SPREP)
		Group work to prepare a Monitoring Plan for the case study applications (step 4)	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)

Friday 27 November		Activity	Facilitator
Morning	9:00 - 9:15	Re-cap of Day 1	Workshop participant to be determined at start of workshop
	9.15 - 9:30	Revisiting Step 3: further prioritising Evaluation questions - ensuring the M&E framework meets priority learning needs whilst also being practical and achievable	Aaron Buncle (SPREP)
	9:30 - 10:30	Group work to review and refine evaluation questions in light of data collection requirements of Monitoring Plan (step 3)	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)
	10:30 – 11:00	Morning tea break	
	11:00 - 12:30	Group work to further develop the Monitoring Plan (step 3)	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)
	12:30 – 1:30	Lunch	
Afternoon	1:30 - 1:45	Prepare an Evaluation Plan (step 4)	Ann Braun (consultant)
	1:45 - 2:45	Group work to prepare an Evaluation Plan for the case study applications (step 4)	Ann Braun (consultant) Aaron Buncle (SPREP) Peniamina Leavai (SPREP)
	2:45 - 3:00	Next steps for completing the case study M&E frameworks	Ann Braun (consultant)
	3:00	Workshop close	TBD

Appendix 2 workshop participants

Participants

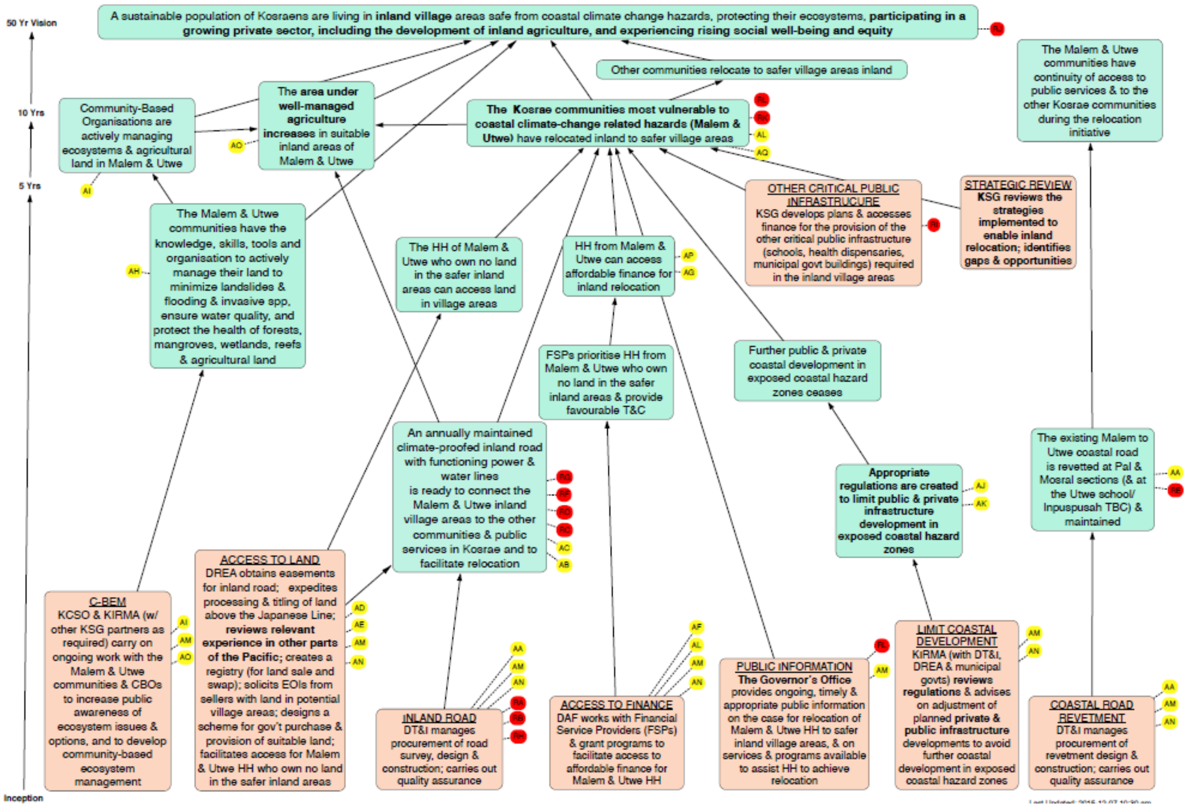
1. Nena William, kosraedco@mail.fm
2. Lipar George, ODA Unit (Department of Administration & Finance), lgeorge_kos@mail.fm
3. William Palik, Personnel (Department of Administration & Finance), wpalik@outlook.com
4. Blair Charley, KIRMA
5. Jason Jack, DREA
6. Leandro Olano, DT&I
7. Hairom Livaie, DT&I
8. Heidi Sigrah, DREA
9. Palikkun Kilafwasru, DA&F
10. Andy George, KCSO
11. Robert Jackson, KIRMA

Facilitators

1. Ann Braun, consultant supporting SPCR M&E work
2. Aaron Buncle, SPCR Mainstreaming Specialist
3. Peniamina Leavai, SPREP

Appendix 3 draft logic model

The below logic model was collectively prepared by the workshop team.



Assumptions:

Infrastructure:
AA: KSG can secure quality contractors to design & build the road/revet the existing road
AB: KSG is able to fund maintenance of the inland road
AC: KSG is able to fund maintenance of the other new power & water infrastructure in Malem & Utwe

Access to Land:
AD: Land swaps happen (between private owners & between private owners and KSG)
AE: KSG is able to successfully negotiate with private land owners for appropriate sites & appropriate prices

Access to Finance:
AF: KSG will be able to apply for GEF6 and other funding in relation to housing and broader development
AG: HH taking loans for relocations have adequate levels of financial literacy

Environmental Management:
AH: Communities & CBOs participate in initiatives for Community-Based Management of ecosystems
AI: *Community-based Management of ecosystems is effective*

Coastal Development:
AJ: HH will not invest money to build permanent homes in the coastal risk area
AK: *Landowners, FSPs & Municipal Govts comply with regulations limiting infrastructure development in coastal hazard zones*

Cross cutting:
AL: Malem & Utwe HH willing and able to relocate
AM: Implementing partners have adequate capacity
AN: TA required is available and of adequate quality
AO: *Landowners in the inland area opened by the road engage in agriculture*
AP: *The private sector plays a role in increasing the affordability of house construction*
AQ: *Relocation occurs gradually with the HH in the most exposed coastal risk zones relocating first*

Risks:

RA: Agreement can not be reached with all landowners on easements required for building the inland road

RB: Climate hazards are more severe than anticipated leading to higher climate-proofing related costs for building the inland road

RC: Landslides damage new inland road

RD: Climate proof-design for the road is not effective

RE: Road revetment de-incentivises and delays inland movement by Malem and Utwe HH

RF: Utwe municipal government fails to permit use of water to supply Malem needs related to inland relocation

RG: Private HH are not willing to negotiate access for to enable power line installation passing through their land

RH: KSG is unable to access sufficient funding for the entire Malam to Utwe inland road

RI: KSG is unable to access sufficient funding for the other public infrastructure needed to facilitate inland relocation

RJ: The opening of the new road and inland area facilitates *environmental problems such as incursion of invasive species, forest degradation or erosion*

RK: Discord/conflicts between communities and or individuals emerge in relation to land, finance or other issues

RL: *Adequate rate and/or density of relocation is not achieved*

Appendix 4 draft evaluation questions

The below evaluation questions were collectively formulated by the workshop team.

	Questions/sub-questions	How addressed
Effectiveness	1) To what extent were the key actions associated with each strategy (access to land, access to finance, construction of inland climate proof road, control of further coastal development; community-based ecosystem management and public information) achieved?	1) M→E
	2) How effective were the strategies? a) Was the new road completed as designed and planned? b) What community based ecosystem management projects/actions have been implemented, and what have they achieved? c) What depth and quality of community participation was achieved in community-based ecosystem management work? d) How suitable are the sites designated as village land areas? e) How well were the Malem and Utwe HH with no land in the inland area served by the actions to enable access to land? f) How well were the Malem and Utwe HH served by actions to enable access to finance? i) How well were the Malem and Utwe HH with no land in the inland area served? g) How effective were the public communication and information efforts? h) How well did changes in new and existing policies and regulations function in limiting further coastal development?	2) a) M→E b) M→E c) M→ E d) E e) M→E f) M→E fi) M→E g) M→E h) M→E
	3) What worked well and less with with each of the strategies?[4]	3) E
Impact	4) What proportion of Malem and Utwe HH are planning, preparing, ready to relocate, or have already done so? 5) What is enabling and constraining readiness for relocation by HH from Malem and Utwe? 6) What if any issues related to agriculture are influencing readiness for relocation by HH from Malem and Utwe? 7) Were there any unintended outcomes of the KSG inland road and relocation initiative (positive and negative)?	4) M→E 5) E 6) M→E 7) E
Sustainability	8) How resilient is the new road to to climate-change related hazards (landslides/flooding/others?) 9) What, if any, were the gaps in the overall approach, and in the individual strategies? 10) What opportunities exist for addressing these gaps? 11) How sustainable are the strategies implemented by KSG to enable relocation?	8) M→E 9) E 10) E 11) E
Synthesis	12) What are the key lessons for Kosrae from the inland road and relocation project?	12) E

[4] Prioritise access to land and inland road construction strategies if not feasible to analyse all

Appendix 5 workshop evaluation form

PILOT PROGRAM FOR CLIMATE RESILIENCE: DEVELOPING MONITORING AND EVALUATION FRAMEWORKS TRAINING WORKSHOP

FACILITATORS: ANN BRAUN, AARON BUNCLE & PENIAMINA LEAVAI, KOSRAE 24, 25 AND 27 NOVEMBER 2015

1. What did you want to achieve from this workshop?

2. To what extent were your expectations met?

not at all ☐ *to a small extent* ☐ *to some extent* ☐ *to a large extent* ☐

3. The amount of information covered was:

too little ☐ *about right* ☐ *too much* ☐

4. The amount of information provided was:

too little ☐ *about right* ☐ *too much* ☐

5. What do you think were the two best things about the workshop?

i.
ii.

6. Are there any ways in which the workshop could be improved? If so, please detail below

Please think back **before this training** workshop and respond to the following questions using a scale of 1 (low) to 10 (high)

1. Given what you know now about **monitoring**, through participation in this training workshop, how would you have rated your knowledge and understanding of monitoring before the training?

Low --- High

1	2	3	4	5	6	7	8	9	10

2. Given what you know now about **monitoring**, through participation in this training, how would you have rated your ability to carry out your monitoring responsibilities before the training?

Low --- High

1	2	3	4	5	6	7	8	9	10

3. Given what you know now about **evaluation**, through participation in this training, how would you have rated your knowledge and understanding of evaluation at the beginning of the training?

Low --- High

1	2	3	4	5	6	7	8	9	10

4. Given what you know now about **evaluation**, through participation in this training, how would you have rated your ability to manage a review or evaluation at the beginning of the training?

Low --- High

1	2	3	4	5	6	7	8	9	10

Thinking about your situation **now,** please answer the following questions:

5. How do you now rate your knowledge and understanding of **monitoring**?

Low --- High

1	2	3	4	5	6	7	8	9	10

6. How do you now rate your ability to carry out **monitoring** responsibilities as required in your current role?

Low --- High

1	2	3	4	5	6	7	8	9	10

7. How do you now rate your knowledge and understanding of **evaluation**?

Low --- High

1	2	3	4	5	6	7	8	9	10

8. How do you now rate your ability to manage **reviews and evaluations** in your current role?

Low --- High

1	2	3	4	5	6	7	8	9	10

WORKSHOP REPORT

Pacific Cost-Benefit Analysis Initiative (P-CBA): Examining the methodology, results and findings of the draft cost-benefit analysis study for the Malem to Utwe inland road proposal

Kosrae, November 2015

Background

The Strategic Program for Climate Resilience: Pacific Regional Track (SPCR-PR) is a regional program which aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making **processes** (i.e. 'climate change and disaster risk mainstreaming'). The SPCR-PR is being implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank (ADB), and is funded through the Climate Investment Funds (CIF).[1]

One initiative being implemented under the SPCR-PR is the Pacific Cost-Benefit Analysis Initiative (P-CBA). The P-CBA builds on previous work undertaken as part of the Pacific Adaptation to Climate Change (PACC) project, and is being jointly implemented by a number of Council of Regional Organisations in the Pacific (CROP) agencies and Development Partners active in the Pacific Region.

The key components of the P-CBA Initiative comprise (1) in-country training workshops, (2) flexible mentoring to support Government officials conduct CBAs on priority Government projects, and (3) technical assistance to strengthen integration of cost-benefit analysis into existing Government policy-making processes (including climate change and disaster risk elements).

The objectives of P-CBA initiative in Kosrae include to:

- further build capacity within Kosrae State Government (KSG) to conduct and use CBA's;
- prepare good quality (preliminary + full quantitatve) CBA reports to help inform selection and design of 'climate-resilient' projects in food-security and infrastructure related sectors; and
- strengthen integration of cost-benefit analysis (including climate change and disaster risk elements) into existing KSG policy-making processes.

[1] More information on this program can be found at https://www.climateinvestmentfunds.org/cif/node/7295.

P-CBA Activities undertaken to date

The first training workshop (component 1) undertaken as part of the P-CBA initiative was conducted in October 2014. This was followed by mentoring support (component 2) to help KSG officials complete two preliminary (i.e. mostly qualitative) CBA studies. These preliminary CBA studies pertain to a water infrastructure proposal in Lelu and an inland road infrastructure proposal for the Malem to Utwe link.

In June 2015, a workshop was conducted to consider the results and recommendations of the preliminary CBA studies and to map out (any) next steps to further develop these studies into detailed quantitative analyses[2]. As per the actions agreed at the June workshop, this was followed by another round of technical assistance to complete detailed quantitative CBA studies. For the inland road CBA, this technical assistance is being provided by Paula Holland (Secretary of the Pacific Community).

This report documents the latest activity undertaken under the P-CBA in November 2015 - a workshop to consider the DRAFT results and findings of the detailed quantitative CBA study prepared for the inland road infrastructure proposal from Malem to Utwe. The report is organised as follows:

1. Objectives and structure of the workshop
2. Summary of group discussions
3. Concluding Remarks and Next steps

1. Objectives and structure of the Workshop

The specific objectives of the workshop were to:

- review and provide feedback on methodology, results and findings of the draft detailed CBA study for the inland road infrastructure proposal from Malem to Utwe; and
- discuss how the CBA can be utilised to support a proposal application to the Adaptation Fund.

The workshop also aimed to contribute to:

- the capacity of KSG officials (the road CBA team in particular) to apply the CBA framework; and
- awareness about how the cost-benefit analysis framework can be used to assess climate change and disaster risk(s) elements of project design.

[2] and to use them to (i) inform investment prioritisation decisions and (ii) help secure overseas development assistance (ODA)

The workshop was conducted over a one-day period on 23 November 2015 and was organised into three main sessions as follows:

1. The first session was an overview presentation on the methodology, results and recommendations of the draft detailed CBA of the road infrastructure proposal for Malem. This presentation was made by Lipar George (ODA Unit, KSG) - team leader of the coastal CBA team. A copy of this presentation is available from the SPCR-PR upon request.

2. The second session was a 'group discussion' to further explore certain methodological aspects and findings of the draft CBA study. This session was facilitated by Aaron Buncle (Mainstreaming Specialist, SPCR-PR).

3. The third session was another 'group discussion' to investigate how the draft CBA can be utilised to inform the related application to the Adaptation Fund (AF). More specifically, this session considered and discussed recommendations outlined in a draft information brief prepared for the CBA study. A copy of the draft information brief on the CBA study is provided at Appendix 3. This session was facilitated by Peniamina Leavai (Project Design, SPREP).

A copy of the workshop agenda is provided at Appendix 1 and a list of workshop participants is provided at Appendix 2.

2. Summary of group discussions

As outlined above, the workshop included two group discussion sessions. Feedback provided at each of these sessions is summarised below.

Group discussion session 1: Further exploring select methodological aspects and findings of the draft CBA study

The group discussions exploring select methodological aspects and the draft CBA study were robust and very constructive.

The key feedbacks provided during these discussions were:

- <u>FOOD PRODUCTION BENEFITS</u>: perhaps of most importance, the group noted that the analysis has not quantified benefits relating to increase agriculture production that would be generated from the inland road. The group suggested that it is possible to find data to make <u>indicative</u> estimations of this benefit category. Blair Charley (KIRMA) advised that he has a photograph of agriculture production undertaken by the Japanese in the Malem and Utwe areas in the WW2 period - and that this could be used to plausibly approximate the (incremental) area of land used for agriculture resulting from the inland road. It was further agreed that follow up meetings with Remos Livaie (Agriculture Division, DREA) would be organised to solicit information and data relating to crop productivity.

- <u>RELOCATION RATES:</u> the other main methodological aspect discussed related to assumptions around rates of household relocation from coastal hazard areas to inland areas. It was noted that the section of the draft report exploring the implications of lower than planned/expected rates of relocation has not accounted for the capital re-investment in the existing coastal road that would likely be required in this scenario.

Leandro Olano and Hairom Livaie (DT&I) advised that the existing coastal road can only be kept functional for another 20 years maximum - and that this is only possible if revetments are constructed at the Pal and Mosral sections and maintenance is undertaken annually. After this time (i.e. 2036), significant reinvestment in the existing coastal road would be required to keep it operational.

Leandro and Hairom further clarified that inland access roads would not likely be sufficient to provide transport links for all households who are still locating in the coastal hazard zone - if the existing coastal road is not kept operational after 2036. That is, some households located in the coastal hazard zone would eventually be 'cut-off' by road breaches if they don't relocate inland and the existing road is not kept operational beyond 20 years (i.e. beyond 2036). The group then agreed that, if relocation is slower than anticipated such that a number of households are left in the coastal hazard zone and are 'cut-off' from transport links, then it would be expected that KSG would have to re-invest substantial financial resources to keep the existing coastal road operational.

The group then briefly discussed what approximate rate of relocation would likely be needed to avoid this situation. The group reasoned that relocation rates greater than 5 households every 5 years should be sufficient, especially if households most at risk of being 'cut-off' are targetted in other complementary measures implemented to assist with relocation. The group figured this situation is likely to happen if relocation rates are slower than anticipated, approximated at < 5 households every 5 years.

- <u>ASSUMPTIONS ABOUT FUTURE DEVELOPMENTS IN COASTAL HAZARD ZONE AREA:</u> The group noted the quantitative modelling for the option to up-grade the coastal road (rather than re-route the road inland) assumes that populations and infrastructures in the coastal hazard zone will remain at current levels into the future. The group agreed it would also be beneficial to include some additional quantitative analysis to explore the scenario where population and developments increase in the coastal hazard zone area in the future. This scenario could be expected if the coastal road was to be up-graded and this in turn encouraged/incentivised increased development in the coastal hazard area.

  The group agreed this scenario is a real possibility and suggested that numbers/rates to be used in the modelling of this scenario could be drawn from the high-level growth goals of the Kosrae Strategic Development Plan (2013). To this end a rate of 3% per annum could be used - which is the target indicator for GDP growth stipulated on page 14 of the Kosrae Strategic Development Plan.

- <u>COSTING OF THE INLAND ROAD:</u> It was noted that the costings included in the CBA for the inland road were different to costings outlined in the Kosrae Shoreline Management Plan (Table 2, p.32) for the same infrastructure. This matter was investigated by the group, drawing on costings prepared by Leandro. It was found the difference pertained primarily to the access road from Utwe to Fisrem. The amount included in the Kosrae Shoreline Management Plan is much higher, on a per km basis, than that for other road sections included in the Shoreline Management Plan and in Leandro's costings. It was thus concluded costings included in the CBA are correct. Leandro confirmed this matter.

- DISCOUNT RATE: The sensitivity of the results to discount rates was highlighted and discussed. Participants confirmed that KSG does not have a preferred discount rate that it uses. Some participants expressed that they personally think a lower discount rate is more appropriate - especially given that a large part of the broader strategy to relocate is aimed at reducing exposure/risks for future generations (i.e. intergenerational equity).

- CLIMATE CHANGE UNCERTAINTY: It was noted by several participants that the uncertainty of forecasting of future typhoon events was not assessed in the quantitative analysis. Given typhoon hazards are a major aspect of the project, the group recommended that uncertainty of future typhoon hazard frequencies and intensities be examined as a sensitivity analysis test.

Group discussion 2: Informing and supporting the Adaptation Fund (AF) proposal

As mentioned above, this session considered and discussed recommendations outlined in a draft information brief prepared for the CBA study (refer Appendix 3). The recommendations included in the draft information brief as well as the groups response to these recommendations are summarised in Table 1 below.

Table 1 Summary of recommendations for AF proposal and Group response

RECOMMENDATION	GROUP RESPONSE
To be effective at achieving its objective, the proposal should also include a number of additional measures to complement the road infrastructure component. These complementary measures should target other barriers constraining the capacity of Malem and Utwe communities' to (autonomously) adapt to coastal flooding risks including, but not necessarily limited to, those related to: a. land access for residential development; and b. access to finance (e.g. to finance construction of new house).	***Agreed*** It was also noted however that there is budget constraint for the AF of around US$2.9m for activities relating to the relocation/inland road component - which is insufficient even to cover the road construction. Multiple ODA proposals will likely be required to achieve the project/program objective.
The proposal should consider removing the component to revet sections of the existing coastal road at Mosral and Paal - or include as a contingency only. The reasoning for this is that revetments may act as disincentive for timely relocation to safer areas inland.	***DISAGREED*** As noted in session 2, the existing coastal road needs the revetment at the Mosral and Paal sections for it to remain operational for a period of 20 years - which is the expected time needed to for coastal households at risk of being cut off from transport links to move inland. If this revetment does not occur, breaches are expected within 5 years.

To reduce (high) financial risks to the project, funding for the construction and maintenance for the full road section between Malem and Utwe should be secured in full at the outset - or at least demonstrate with high confidence that the full amount will be secured in the time needed.	***Agreed***
There are possible environmental (and cultural) costs associated with the road that have not properly been assessed in the CBA. These should be considered through the required environmental and social impact management planning.	***Agreed*** The Group further that noted work is underway to conduct an Environmental Impact Assessment of this proposal

The group also noted that, in order to serve as strong evidence in support of the AF proposal application, the CBA should be updated to reflect feedback provided in the first group session (as summarised above).

Concluding remarks and next steps

The workshop provided a very effective fora to solicit feedback on the draft CBA report - and thus improve the accuracy and usefulness of the analysis. This feedback - along with other agriculture production data to be collected from Remos - will be passed on to Paula Holland (SPC) and an updated/final CBA report completed in January 2016.

Once the CBA report has been finalised, the information brief provided at Appendix 3 will be updated and provided to Directors of KSG Agencies.

The workshop also provided a good fora to discuss insights from the CBA that could inform improvements to the design of the AF proposal. These insights/design aspects will be further discussed and elaborated on as part of the related workshop to develop a monitoring and evaluation (M&E) framework for the AF proposal - and in particular the formulation of a 'logic model'.

Appendix 1: Workshop Agenda

WORKSHOP AGENDA: Pacific Cost Benefit Analysis (P-CBA) Initiative

Monday 23 November 2015, Governor's Conference Room

The Strategic Program for Climate Resilience: Pacific Regional Track (SPCR-PR) is a regional program which aims to strengthen integration of climate change and disaster risk considerations into 'mainstream' policy making and related budgetary and decision-making processes (i.e. 'climate change and disaster risk mainstreaming'). The SPCR-PR is being implemented by the Secretariat of the Pacific Regional Environment Program (SPREP) and Asian Development Bank (ADB). The SPCR-PR is funded through the Climate Investment Funds (CIF)[3].

One initiative being implemented under the SPCR-PR is the Pacific Cost-Benefit Analysis Initiative (P-CBA). The P-CBA builds on previous work undertaken as part of the Pacific Adaptation to Climate Change (PACC) project, and is also being co-ordinated with other similar initiatives in the Pacific Region.

The objectives of Kosrae P-CBA initiative include to:

- further build capacity within Kosrae State Government (KSG) to conduct and use CBA's; and
- prepare good quality (preliminary + full quantitative) CBA reports to help inform selection and design of 'climate-resilient' projects in food-security and infrastructure related sectors.

Activities to date

In October 2014, the first training workshop for Kosrae (under component 1 of the P-CBA) was conducted. This was followed by mentoring support (component 2) to help KSG officials complete two preliminary (i.e. primarily qualitative) CBA studies. These preliminary CBA studies pertain to a water infrastructure proposal in Lelu and an inland road infrastructure proposal for the Malem to Utwe link.

In June 2015, a full-day workshop was conducted to consider the results and recommendations of the preliminary CBA studies and to map out next steps to further develop these studies into detailed quantitative analyses - and to use them to (i) inform investment prioritisation decisions and (ii) help secure overseas development assistance (ODA). As per the agreed actions of the June workshop, another round of technical assistance was then provided to further develop and the preliminary studies into detailed quantitative cost-benefit studies. For the inland road CBA, this technical assistance is being provided by Paula Holland (Secretary of the Pacific Community).

This workshop is a follow-up activity to consider the results of the draft detailed quantitative CBA study prepared for the Malem to Utwe inland road proposal.

Workshop objectives

[3] More information on this program can be found at https://www.climateinvestmentfunds.org/cif/node/7295.

The specific objectives of the workshop are to:

- further develop the capacity of KSG officials (the road CBA team in particular) in the application of the CBA framework;
- further raise awareness of how the cost-benefit analysis framework can be used to assess climate change and disaster risk(s) elements of project design;
- review and provide feedback on methodology, results and findings of the draft detailed CBA study; and
- map out how the CBA will be utilised to support a proposal application to the Adaptation Fund.

For more information on the workshop or the SPCR-PR more generally, please contact either Kenye Phillip on fsmpaccadminassist@mail.fm or Aaron Buncle on aaronb.ext@sprep.org.

Monday 23 November		Activity	Facilitator
Morning	9:00 – 9:15	Registration	
	9:15 - 9:30	Opening prayer and address	Nena Williams (Governors Office) Andrea Volentras (SPREP)
	9:30 - 9:45	Overview of workshop structure and objectives	Aaron Buncle (SPREP)
	9:45 - 10:30	Presentation of CBA case study results and findings	Lipar George (Leader, coastal CBA team)
	10:30 – 11:00	Morning tea break	
	11:00 - 12:30	Further exploration of key aspects of study including, but not limited to, climate change risk assessment	Aaron Buncle (SPREP)
	12:30 – 1:30	Lunch	
Afternoon	1:30 - 2:30	Informing project design: CBA study recommendations relevant for the Adaptation Fund proposal, summing up..	Peniamina Leavai (SPREP)
	2:30 - 3:00	Next steps	Aaron Buncle (SPREP)
	3:00	Closing	TBD

Appendix 2 Workshop participants

Participants

1. Nena William, kosraedco@mail.fm
2. Lipar George, ODA Unit (Department of Administration & Finance), lgeorge_kos@mail.fm
3. William Palik, Personnel (Department of Administration & Finance), wpalik@outlook.com
4. Blair Charley, KIRMA
5. Jason Jack, DREA
6. Leandro Olano, DT&I
7. Hairom Livaie, DT&I
8. Heidi Sigrah, DREA
9. Palikkun Kilafwasru, DA&F
10. Ann Braun, consultant supporting SPCR M&E work

Facilitators

Aaron Buncle, SPCR Mainstreaming Specialist

Peniamina Leavai, SPREP

Appendix 3 Draft information brief on CBA study

INFORMATION BRIEF

Cost-benefit analysis study of a road infrastructure proposal to reduce coastal flooding risks faced by Malem and Utwe communities

RECOMMENDATION(S)

It is recommended the Director:

NOTE the key findings of a cost-benefit analysis study undertaken to assess the merits of a road infrastructure proposal to reduce coastal flooding risks faced by Malem and Utwe communities; and

NOTE the cost-benefit analysis study will be used to help inform the design of the Adaptation Fund project proposal currently being formulated.

BACKGROUND

As part of the Strategic Program for Climate Resilience (SPCR), a cost benefit analysis (CBA) study has been undertaken to assess the merits of a road infrastructure project to reduce coastal flooding risks faced by Malem and Utwe communities. More specifically, the project option aims to reduce barriers constraining the Malem and Utwe communities' capacity to (autonomously) adapt to these coastal flooding risks associated with inadequate[4] public road (and power & water) infrastructure. A copy of the CBA study is provided at Attachment A.

The CBA study was undertaken by a multi-agency team of Kosrae Government officials with external technical assistance from the Secretariat of the Pacific Community (SPC).

The results of the CBA study are intended to inform prioritisation of infrastructure investments under the Infrastructure Development Plan (IDP) listing as well as the design of overseas development assistance requests - and in particular a proposal to the Adaptation Fund.

SCOPE OF ANALYSIS

The road infrastructure options assessed in the CBA study were taken from the Kosrae Shoreline Management Plan (2014). The options analysed are:

i. re-route the Malem and Utwe road inland - thus providing access to (and relocate in) areas that are less exposed to coastal flooding hazards as well as providing for reliable transport links between Malem and Utwe;
ii. re-route the Malem and Utwe road inland whilst also maintaining the existing coastal road for a 10 to 20 year period; and

[4] in terms of providing access to safer inland areas and providing reliable transport links between Utwe and Malem.

iii. re-route the Malem and Utwe road inland whilst also revetting vulnerable sections of the existing coastal road. The revetment of the existing coastal road is to allow more time for households located in coastal hazard zones to autonomously relocate to safer areas inland.

These options were compared against a 'business-as-usual' scenario whereby the existing coastal road is replaced and maintained at its current engineering design standard. It was also compared against a variety of other possible road infrastructure options including to up-grade the existing coastal road to an engineering standard that is more resilient to coastal flooding hazard events.

The cost categories considered in the analysis were the construction (including replacement) and maintenance costs of infrastructure, land acquisition costs, as well as potential environmental and cultural impacts.

The benefit categories considered were (i) avoided clean-up costs from coastal flooding events; (ii) avoided damages to cars; (iii) avoided damages to home gardens; (iv) avoided damages to housing infrastructure; (v) avoided damages to road infrastructure; (vi) avoided trauma and loss of life (from major typhoon event); (vii) avoided income losses associated with road damages (preventing access to workplaces); (vii) avoided disruptions to schooling; (viii) avoided disruptions to accessing hospitals; and (ix) increased food production achieved through improved access to inland farm areas. The methods used for measuring benefit categories are summarised at Attachment B.

Due to data constraints, the analysis did not quantify all cost and benefit categories in quantitative/economic terms. Of particular note, the important benefit categories of (vi) avoided trauma and loss of life; (vii) avoided disruptions to schooling, and (ix) improved access to inland farm areas were not quantified. This means that these benefits are not reflected in the numerical results of the CBA but are considered in the recommendations, as discussed below.

KEY FINDINGS AND INSIGHTS

The CBA report suggests that the option to re-route the Malem and Utwe road inland does represent a worthwhile use of scarce resources - providing certain pre-conditions are satisfied and important project risks are effectively managed. This option offers slightly higher payoffs than establishing an inland road with maintenance of the existing coastal road for a 10 to 20 year period and establishing an inland road with revetment of the existing coastal road. Moreover, reveting the existing coastal road could serve to discourage households to relocate to safer areas in a timely manner.

The quantitative analysis indicates that the investment to re-route the Malem and Utwe road inland in the short-term will generate benefits that almost break-even with the capital and operational costs invested (at a benefit:cost ratio of 0.81 relative to the business as usual scenario, using a 4% discount rate). When the important non-quantified benefits (i.e. avoided trauma and loss of life, avoided disruptions to schooling, and improved access to inland farm areas) are also taken into account, the CBA report suggests it is reasonable to expect the project will generate a net (social) benefit. That is, the (quantified + unquantified) benefits of the road to the Malem and Utwe communities and the Kosrae State Government are expected to outweigh the investment costs of constructing and operating the new inland road.

However, the results also suggest that the success of the project will depend on whether certain pre-conditions are in place and if important project risks are addressed. Key pre-conditions and risks identified are as follows:

1. other important barriers constraining the Malem and Utwe communities' capacity to (autonomously) adapt to coastal flooding risks are also addressed. If other important barriers constraining the Malem and Utwe communities' capacity to (autonomously) adapt to coastal flooding risks - and to relocate in particular - are not adequately addressed, then the rate of relocation to safer inland areas achieved would be expected to be slower.

A sensitivity analysis exploring this showed that, at a 4% discount rate, the present value of avoided damages to houses and avoided loss of earnings generated from re-routing the road inland is estimated to be approximately US$0.2m lower if relocation rates are slow (defined as 1 household every 5 years) compared to if relocation rates are moderate (defined as 5 households every 5 years). With other non-quantified benefit categories also considered (e.g. avoided loss of life and trauma), this effect would be expected to be even higher.

Also if certain households whom are at risk of being cut-off from transport links (i.e. households located in-between sections of the road that are most vulnerable to breach) don't relocate in a timely manner, then Kosrae State Government may be required to re-establish the coastal road. This would represent a significant additional cost for KSG, potentially in the order of US$3.4m.

Key barriers identified in the CBA that potentially constrain the Malem and Utwe communities' capacity to (autonomously) adapt to coastal flooding risks relate to (i) land ownership, and (ii) access to finance (e.g. to finance construction of new house).

2. The road is fully constructed and fully funded from the outset. A sensitivity analysis exploring the situation where funding is only secured to fund part of the Malem to Utwe inland road showed this would result in lower payoffs relative to complete construction (a reduction in the benefit:cost ratio from 0.85 to 0.72). The reasons for this result was that only a smaller proportion of households would receive benefits from the inland road segment, and the Kosrae State Government would still have to replace a substantial proportion of the existing coastal road to achieve road transport links between Malem and Utwe - if the remainder of the inland road was not completed in a timely fashion. This result highlights the importance of minimising financial risks to the project.

Other important aspects of the analysis pertaining to (i) the timing of road infrastructure investment, (ii) comparisons with an option to up-grade the existing coastal road to an engineering standard that is more resilient to coastal flooding hazard events, and (iii) assessment of environmental and cultural impacts are summarised at Attachment 3.

INFORMING THE PRIORITISATION OF INFRASTRUCTURE INVESTMENTS

[To be developed]

INFORMING THE ADAPTATION FUND PROPOSAL

The CBA study provides insights that are useful for informing and strengthening the design of the Adaptation Fund (AF) proposal. Key points that could be considered for the AF proposal are as follows:

1. To be effective at achieving its objective, the proposal should also include a number of additional measures to complement the road infrastructure component. These complementary measures should target other barriers constraining the capacity of Malem and Utwe communities' to (autonomously) adapt to coastal flooding risks including, but not necessarily limited to, those related to:
    a. land access for residential development; and
    b. access to finance (e.g. to finance construction of new house).
2. The proposal should consider removing the component to revet sections of the existing coastal road at Mosral and Paal - or include as a contingency only. The reasoning for this is that revetments may act as disincentive for timely relocation to safer areas inland.
3. To reduce (high) financial risks to the project, funding for the construction and maintenance for the full road section between Malem and Utwe should be secured in full at the outset - or at least demonstrate with high confidence that the full amount will be secured in the time needed.
4. There are possible environmental (and cultural) costs associated with the road that have not properly been assessed in the CBA. These should be considered through the required environmental and social impact management planning.

CONCLUDING REMARKS AND NEXT STEPS

Due to a lack of empirical data, the quantitative analysis undertaken as part of this cost-benefit analysis study has had to rely to a large extent on expert judgements. For this reason, and given the magnitude of the said investment, it would be prudent to approach results and recommendations with some caution.

This said, the key findings and insights appear to be logical and are consistent with the recommendations made in the Kosrae Shoreline Management Plan (2014) - with the possible exception of the revetment at Mosral and Paal sections. They have also been reviewed by a number of different stakeholders, including technical officials from within SPC.

[informing/confirming infrastructure prioritisation, to be developed]

The next steps are to provide copies and briefings of the CBA study to officials and partners involved in the preparation of the Adaptation Fund proposal.

Attachment 3: Summary of analysis pertaining to (i) the timing of road infrastructure investment, (ii) comparisons with an option to up-grade the existing coastal road, and (iii) assessment of environmental and cultural impacts

Important aspects of the analysis pertain to (i) the timing of road infrastructure investment, (ii) comparisons with an option to up-grade the existing coastal road to an engineering standard that is more resilient to coastal flooding hazard events, and (iii) assessment of environmental and cultural impacts. Each of these aspects are briefly discussed in turn.

(i) Timing of infrastructure investment

The analysis looked at the optimal timing for the construction of the inland road (i.e. now, in 10 years time, or in 20 years time). The results of this quantitative analysis were highly dependent on the rate of discount rate chosen. At 4% and 10% discount rates, the quantitative analysis indicates that delayed construction may be more efficient, whilst at 0% discount rate the most efficient timing was to construct now. For an inter-generational issue such as climate change, there is a case for applying a low(er) discount rate.

(ii) Comparisons with an option to up-grade the existing coastal road to an engineering standard that is more resilient to coastal flooding hazard events

The quantitative analysis showed that the inland road has a lower payoff relative to an option to up-grade the existing coastal road to an engineering standard that is more resilient to coastal flooding hazard events.

However, the broader analysis (i.e. quantitative + qualitative) suggests that the construction of the inland road is preferred to the option to up-grade the existing coastal road for the following two key reasons:

i. Re-routing of the road inland will avoid further development within coastal hazard areas. Conversely up-grading the coastal road may encourage further economic developments and populations to settle in these coastal hazard areas (i.e. adjacent to the coastal road) over time - above what is modelled in the analysis, which assumes population and economic developments in the Malem and Utwe areas remain at current levels. This will likely increase climate change and disaster risks faced by Kosrae in the future - especially relating to typhoon hazards - which in turn is expected to disrupt and constrain future (sustainable) economic development.
ii. the unquantified benefits of the option to re-route the Malem and Utwe road inland of avoided trauma and loss of life, and improved access to inland farm areas are judged to be very important. These benefits are generated by the option to re-route the road inland but are not generated by the option to up-grade the existing coastal road.

If it were feasible to include the above matters in the quantitative analysis, the CBA report suggests it is reasonable to expect the option to re-route the Malem and Utwe road inland would show higher payoffs (in quantitative NPV terms) relative to the option to up-grade the existing coastal road to an engineering standard that is more resilient to coastal flooding hazard events.

(iii) Assessment of environmental and cultural impacts

The cost-benefit analysis study does not assess in any detail the potential environmental and cultural impacts (i.e. costs) associated with the construction of the inland road. This should be considered as part of an Environmental Impact Assessment (EIA) or similar.

Stakeholder Consultations : Planning Stages

Process of Consultations

The process at which the consultation was carried out was by segregation into gender-based focus group discussions. The focus groups were therefore divided in line with the traditional village community group set ups of men, youth, women and senior citizens. Where youth were few in numbers and only male, they joined the men's group. This was the same for the young women who naturally joined the women's group

The focus group discussions for Yap, Chuuk and Pohnpei were carried out in a similar format. Each of the groups was asked to go through each and all charts and answer the guiding questions provided starting with any chart. Groups were encouraged to discuss within their group and provide their responses on the charts and post-it materials provided. During plenary discussions, the meeting will go through each chart and discuss responses openly and seek agreement and clarification of responses provided. Agreements and disagreements were noted and recorded. The differing points were maintained that addressed particular concerns of that group. For example, where women opt for sanitation activities to be made explicit under water security measures, these were maintained as it pertained to women's needs, vulnerabilities and opportunities where they excel. The consultations were provided with the following charts and guiding questions for Yap, Chuuk and Pohnpei consultations.

Table 1 Consultation Charts for Focus Group Discussions - Yap, Chuuk and Pohnpei State only.

CHARTS PROVIDED	CHART QUESTIONS	QUESTION OBJECTIVITY / INDICATORS
CHART X: Community Priorities	• In 2014, initial consultations identified priority sectors for the 2 islands. They are: **food security, water, and marine resource management** 1. Do you agree with these priorities? Y/n 2. What reasons your group selected y or n? 3. What are **other** priorities that are equally important? 4. What can we do to include these others?	• Gauge if priorities changed in view of recent events (typhoon Maysak March 2015, elections, tidal surges Feb-July 2015, etc.) • Reconfirm priorities from communities • Seek alternatives outside of existing priorities • Guidance from communities on actions, activities of the project

CHARTS PROVIDED	CHART QUESTIONS	QUESTION OBJECTIVITY / INDICATORS
CHART Y: Ranking the Priorities	• Rank the project's priorities, the group's identified priorities and alternatives to priorities in view of most urgent and needed to least urgent and important	• Priorities are ranked by communities themselves in terms of importance, urgency • Gauge if pre-consultation priorities remain high priority for the project to pursue • Degree of sustainability of project measures • Degree of ownership of priorities and activities of the project
CHART Z: Practical things to do	• Presented the 3 key outputs of the project - per output 2.1, 2.2, 2.3 • What are three (3) examples that your group can do under each of the 3 outputs? • What are three (3) examples that your group need under each of the 3 outputs?	• Community ownership of outputs • Community understanding of the project outputs • Seek guidance and range of activities from communities to achieve the outputs • Gauge capacity to carry out activities (do), and ability to identify what activities that are needed.
CHART A: Planning and Doing	• Kosrae state – has a **state shoreline management plan** recently endorsed in 2014. • It helps the state secure support to protect their coast and shoreline from climate change impacts • This project plans to do a shoreline management plan for each state. • Questions: • Does [the state] need a similar plan? Y/n • Do you know if [state / community / island] has a plan? Y/n • Should our islands have specific coastal management plans?	• Gauge community awareness of coast management plans at any level (local, state, national) • Probe the need of a state coastal management plan in the State • Evidence that communities disagree or agree with the need for a shoreline management plan as outlined by the project proposal

Pohnpei Community Consultations

On 22 June 2015, OEEM, Pohnpei Environment Protection Agency (EPA) and SPREP organized a meeting in Pohnpei with island community representatives, church ministers, NGOs, and government agency representatives. The participants discussed the risks and vulnerabilities, priorities and alternative options for the outer islands. The meeting concluded that water security, food security and marine resources management in that order are top priorities for the selected islands (Table 7). The women in the women and senior group identified water and sanitation needs as important for women's needs in these islands, and that radio as the most effective means to communicate changes in outer islands. All conveners agreed to the need for a coastal management plan similar to that of the 2014 Kosrae Shoreline Management Plan as well as the required legal and regulatory instruments that may be required to endorse the implementation of the plan.

Table 2 Pohnpei State – Combined results for Chart X and Y: Community priorities

Ranking	*Group 1: Women & Senior Group*	*Group 2: Men's Group*
1	Water security with a focus on sanitation	Water & Food Security combined
2	Food Security	Marine resource management
3	Marine resource management	Coastal defences
4	Communications to outer islands	Nursery & shredder for organic matters for soil rejuvenation
5	Health & Education	Seasonal closing program for water marine resources in decline

Chuuk Community Consultations

On 24 June 2015, OEEM, Chuuk EPA and SPREP organized a meeting in Chuuk with government managers and directors, women council president, island agriculture extension officers, foresters, farmers, senator, funding coordinators, program managers, researchers, specialists, and administration assistants and NGOs. The consultation meeting was divided into men, women and senior groups, combined discussions perused on coastal erosion as a serious case of vulnerability on island shores. Asking whether or not a coastal plan is required, all women and men groups provided similar responses and agreed that Chuuk State will benefit from a Shoreline Policy, requiring a shoreline management plan similar to the Kosrae plan. There is a land use plan and a disaster risk management plan, but that it no way addresses the climate risks for Chuuk. All women and men's groups, regardless of their area of expertise, ranked water security as highest priority, relative to food security and marine resources management and other important sectors such as transportation (Table 8). The women emphasised the need to focus on infrastructure (roof gutters, down piping, water tanks), water treatment and maintenance, including protection of natural water sources (e.g., wells). Illegal fishing practices and pollution and lack of traditional conservation practices of the coastline are reasons for prioritising marine resources management. Participants agreed with the men's group that there is an urgent need to trial agriculture practices that promote the growth of taro, breadfruit, pandanus and coconuts in the outer islands. The lessons drawn from other successful agriculture programs in Chuuk were also discussed to be considered.

Table 3 CHUUK State: Combined results for Charts X and Y - Community Priorities

Rank	Group 1: Women	Group 2: Seniors	Group 3: Men
1	Water Security - infrastructure, treatment and maintenance (incl. natural sources)	Water Security	Water Security
2	Food Security -	Food Security with focus on sustainable food crops	Food Security - focus on taro, breadfruit, pandanus, coconuts and balanced nutrition programs
3	Marine resource management - with focus on fishing practices, and minimize pollution	Coastal Management - conservation and protection of resources	Marine Resource Management
4			Other - Transportation

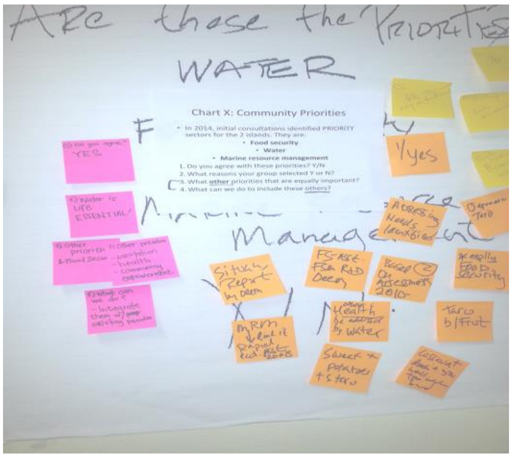


Figure 1 Identifying community priorities. Group posts in response to the questions of Chart X. (Pink posts - Women; Orange - Men, Yellow - Senior Citizens. (photo: Simpson, 24 June 2015)

Figure 2 Women's group discussing their priorities identified (photo: Simpson, 24 June 2015)

Yap Community Consultations

On 30 June 2015, OEEM, Yap EPA, Yap Office of Planning & Budget (OPB), Yap Resources and Development (R&D), and SPREP organized a meeting in Yap with community leaders from all islands of the State. The main island chiefs representing the traditional council of Pilung (COP), and the outer island chiefs that make up the traditional council of Tamol (COT). Also present were government departments and NGOs that carry out work in the outer islands.

The participants discussed and agreed that the priorities identified in the initial consultations are seriously supported as those that must be implemented by this project. The chiefs raised their concern particularly with food security pointing to the need to invest in conservation and protection of their food sources (marine environment) and land (planting food crops), and pulling together of traditional knowledge and science to help identify and advance management of the resources.

The conveners discussed at length management plans as land ownership issues will increase and become more complex. Shoreline management plans as what the State of Kosrae developed is urgently needed and must be added to the government's priority list of plans to develop. The management plans, however, will need to be island-specific inclusive as the needs for each islands are unique ecologically, socially and economically. The women's group stressed that the plan should be developed for the state with an overall framework for Main Island and neighbouring islands. There is also a need to establish respective atoll committees to contribute to developing the island specific issues and priorities for implementation.

The conveners in sum agreed that food security, water management, and marine resources management will need to be enhanced by this project for climate-resilient atoll communities. They stressed that it must build on ongoing programs that are carried out by government already (see Appendix F). This is in partnership with organizations and institutions, such as the International Organization for Migration (IOM) and One People One Reef. IOM works with Yap State to implement hazard, vulnerability and capacity mapping with several outer island communities. Marine scientists and agriculture researchers from One People One Reef are working with outer island communities in collecting ecological and produce data that inform and improve resource planning and management. Accordingly, the participants felt these are quantitative and qualitative baseline information that this project will need to build its activities on and achieve its outcomes.

Kosrae Government Follow Up Meeting

On 6 July 2015, OEEM, Kosrae Island Resource Management Authority, and SPREP called for a meeting with the Lieutenant Governor of the State of Kosrae, Mr. Carson K Sigrah and key government stakeholders including NGOs and sub-region organization representatives. The Lt. Governor emphasized the need to consider the severe impacts of climate on the planned infrastructure works of Kosrae that is already being felt both in terms of impact on investments already made on the roads of Kosrae and the resource support to continue to maintain them.

The conveners discussed the shoreline management plan and the developments listed in the infrastructure list of the Infrastructure Policy Implementation Committee (IPIC) and that requires immediate attention and urgency. The participants concurred about the need to consider the Malem to Utwe inland road a key activity of the IPIC infrastructure list. It is important in that it secures high-risk infrastructure in government plans for continued maintenance. Members of the IPIC responded that the 'Malem Inner Road' is listed in the June 2015 IPIC Master List that is summarised in equation 1and 2 charts below. The investment by this project is guaranteed to be maintained as a result.

On the 28 July 2015, following its July 2015 monthly IPIC meeting, the Government of Kosrae released its official Master Infrastructure Policy Implementation Listing, denoting a SO rating[1] of 8.9 for the ‘Inland Road Development - Phase 1 Malem to Yeseng to Utwe’. This translates to a high priority for any project support and development for this particular section of the government road infrastructure assets. The Malem-Utwe road section is now a high priority for the government to mobilize support and secure resources for this development. As such, places this project and other projects pertaining to the road section, in high commitment from the government of Kosrae. It is important to note one of the criterions of the IPIC listing is ‘natural disaster and climate change resilience’ (refer also to Equation 2 chart below).

[1] SO rating used by the IPIC Priority List averages nine criteria’s that ensure the road development is high priority for the Government. (1.0 is little or no contribution to 5.0 very high contributions). The nine criterion are: Investment and economic growth, Private sector capacity and/or employment, Living conditions and/or income generation, Access to/delivery of public health services, Access to/delivery of education, Environmental outcomes/ conditions; Natural disaster/ climate change resilience; Capacity of government infrastructure agencies, Financial sustainability of infrastructure (Kosrae Government, 2015)

 Figure 3 Lt. Governor Carson addresses the government stakeholder's meeting on the AF proposal 6 July 2015 (source: Simpson Abraham)	 Figure 4 Government stakeholder participation meeting for Kosrae State, 6 July 2015, Government Administrative building (source: Simpson Abraham)

Kosrae Malem community consultations

On 6 July 2015, a community consultation with the municipal community of Malem on the island of Kosrae brought together senior citizens, women, and men's groups. Individual members of the youth participated and joined both the women and men's groups throughout the consultation.

The set of questions for the Kosrae community differed from those carried out for Yap, Chuuk and Pohnpei consultations. The questions targeted the community's agreement, evidence of support against those investments 3.1 and 3.2 of the project proposal (Table 9)

Table 4 Consultation Charts for Focus Group Discussions – Kosrae Malem community

CHARTS PROVIDED	CHART QUESTIONS	QUESTION OBJECTIVITY / INDICATORS
CHART X: Community Priorities	In 2014, initial consultations of this project identified the priorities for KOSRAE is the (A) New road section construction from Malem to Yeseng - plus access routes to the 2 villages (B) Pal and Mosral rock revetment (wall, alongside coastline road)	

CHARTS PROVIDED	CHART QUESTIONS	QUESTION OBJECTIVITY / INDICATORS
CHART X: Community Priorities…	1. Do you agree with these priorities? 2. Post up reasons to support your answers. 3. What other alternatives that this project could focus on? *one post = one alternative* *RANKING* *4. Please RANK YOUR ALTERNATIVES & THE 2 PRIORITIES by placing them in the H – High, M – Medium, L – Low - area of the chart*	• Gauge views of communities against pre-agreed priorities • Identify supporting reasons for agreement to priorities • Identify if other priorities and alternatives and whether these options be prioritized
CHART Y: Extreme Events	From your experiences and memory, please post up • WHAT is the extreme event? (king tides, typhoon, drought, surges, landslides, tsunami) • WHEN did it happen? (month, year please) • WHAT happened? (house flooded, no water) • WHAT did you do? (moved, rebuild, buy water)	• Gauge the level of experiences on aspects of vulnerability (degree of exposure, sensitivity and adaptive capacity) • Understand the level of vulnerability from a community perspective • Identify community-level coping strategies that can be enhanced, scaled up or replicated
CHART Z: Cut-Off Roads	SCENARIO1: The road section at Mosral and Pal has been completely cut off by Typhoon Simpson. There are no inland roads. • What would you do? • What would happen to your normal day routine? Or to your business? • What should/would you do now to prepare for these kinds of challenges? •	• Gauge the level of ownership of communities to the project, activities • Understand community perceptions on options of community responsibilities that may assist in addressing sustainability needs of the project and of the community • Gauge the level of willingness to own and sustain the investments in Output 3 of the project

CHARTS PROVIDED	CHART QUESTIONS	QUESTION OBJECTIVITY / INDICATORS
Exercise 2: Partnership Mapping	On a flipchart, write the name of your community in the middle. Circle it Write names of the projects, programs, groups, government, NGOs that your community is involved in. Circle that one. Link the 2 circles with a line. Explain ON THE LINE what services, information the village provides TO that program, etc. Explain further ON THE LINE what services, benefits the community receives FROM that program.	• Gauge level of awareness of partners and their work that influence the community; • Gauge partnership services perception • Identify and understand the level of ownership, commitment and support of the community of the project

Chart Y: Each group provided responses and shared experiences of cases of vulnerability to extreme events in recent memory. All groups recall similar climate extreme events during their lifetime. These include for example the droughts of 1983, 1996-97 that saw forest and wild fires spreading, farms and nearby homes affected. The whole island experienced the shortage of water and government had to transport water to all municipal communities. King tides in 2008-09, 2014, and 2015 brought flooding in coastal and upland areas where good hard soil remained inundated (oversaturated) and developed wetness features that led to drainage blocks. The communities responded autonomously, through changes in farming, for example giving up farming of taros but relying more on bananas and breadfruit, relocated and grew *misac* and *musalah* plants. Communities also resorted to reliance on other new crops but more heavy reliance on imported rice.

Chart Z: The responses from each group to a future scenario for Malem where the coastal road sections Mosral and Pal are severely eroded and cut off due to impacts of sea level rise (excess wave overtopping, sea surges, king tides) - were highly relevant to the development of activities of this project (Figure 19). The results of the chart exercise found that groups acknowledged serious interruption to life and livelihoods if no action is done to address the immediate risks with road sections Mosral and Pal. The routine activities include access to business, market, farmlands, hospitals, school, government, sea and airports, and access to water and food supplies as posted on charts shown in Figure 19. The women addressed public health concerns by stating 'zumba' and playgrounds will be closed down and will need relocation. The discussions went as far as indirect results in the long-term, such as the inability to curb non-communicable diseases such as gout, high blood pressure and obesity.

When seeking immediate means to respond against these scenarios, the women's group saw the need for calling all municipal women group meeting and come up with decisions to address the problem. Some of the reactive responses included seeking immediate assistance from government, checking municipal government emergency plans, and finding alternative routes of transportation.

Figure 5 Stakeholder mapping chart developed by the men’s group. The women’s group later added in their stakeholders – shown in Figure 16. (picture: Carlos. C., 6 July 2015, Malem Community Consultation, Kosrae State)

Figure 6 Members of the women’s group working on their rendition of the stakeholder mapping exercise. (Malem community consultations, Kosrae State, 6 July 2015)

Figure 7 Men’s group presentation of their stakeholder map – Government and Community consultations, Pohnpei State. (Picture: Carlos. C., 23 June 2015)

Figure 8 Senior citizen’s group presentation on the stakeholder mapping exercise by the group – Government and Community consultations, Pohnpei State. (Picture: Carlos. C., 23 June 2015)

Figure 9 Senior Citizens group. Malem Community consultation, Malem Municipal Government Community Hall. (source: Carlos. C., 6 July 2015)

Figure 10 Women's group during their group discussions. Men and youth group on the LHS, with some interested observers in the women's group discussions. (Source: Carlos, C., 6 July 2015)

Figure 11 Men's Group. During consultation discussions on actions they believe should be priorities that the project should address. (Source: Carlos, C., July 2015)

Figure 12 Men's Group. Members of the youth participated in this group and contributed to the discussions through the men's group. The men welcomed the inputs from the youth. (Source: Carlos. C., 6 July 2015)

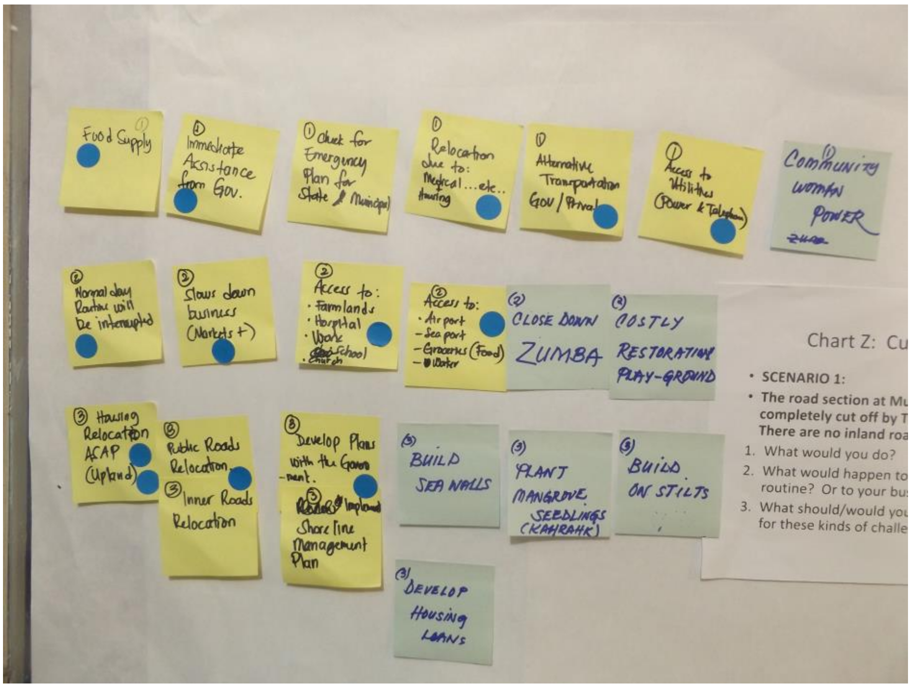


Figure 13 Results of community group responses to future scenarios where road sections at Mosral and Pal have been cut off. The chart exercise was to seek natural habit and behavioral responses and opinions of various vulnerable groups of Malem community if no action was taken to address the highly exposed and high risk sections of the Malem coastal road identified. These include Mosral and Pal identified as highly sensitive shore line areas of the coastal road identified by the KSMP 2014. The blue circle stickers denote agreement to those points in the yellow posts. The blue circle stickers belong to the women's group (photo: Carlos. C., 6 July 2015)

Chart X: The results of the identification of alternatives and ranking of these against existing priorities of this project showed that all groups agree and support the two investment priority adaptation actions of the proposal (Table 10).

Table 5 Chart X: Rankings of priorities identified by community - Kosrae State, Malem Community

Rank	Group 1: Seniors	Group 2: Women	Group 3: Men & Youth
High (1)	1 - Option (A) new road section Malem to Yeseng 2 - Option (B) Pal and Mosral rock revetment 3 - Relocation strategies 4- Agriculture Drainage	1 - Option (A) new road section Malem to Yeseng 2 - Option (B) Pal and Mosral rock revetment 3 Typhoon Shelters 4 Malem Women Centre	1- (A) new road section Malem to Yeseng 2- (B) Pal and Mosral rock revetment 3 - 0% interest housing program 4 - Improve existing / establish new drainage
Med (2)			5 Rehabilitation of Mangrove forest at Pal

		road section 6 Relocation of schools and public places, etc.
Low (3)		7 Disaster Centre 8 Build dispensaries - e.g., Health Centres

The men's group proposed the investment in priority (B) will need to integrate the rehabilitation of the mangrove forest area of the Pal area. This was in line with the activity to improve existing drainage and establish new drainage including agriculture drainages for low-lying farmland areas that were discussed. The women's group agreed with the proposed changes but also identified typhoon shelters and a Malem Women's Centre as high priorities that must be addressed. The men's group agreed for such a disaster centre including health dispensaries are essential for the communities but in the low priority list under this project.

RAINWATER CATCHMENT DESIGN

AND

INSTALLATION STANDARDS

by

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August 28, 2009

RAINWATER CATCHMENT DESIGN AND INSTALLATION STANDARDS

TABLE OF CONTENTS

1.0 SCOPE

1.1 General

1.1.1 Rainwater Catchment System is defined as a system that utilizes the principal of collecting and using precipitation from a rooftop or other manmade, above ground collection surface.

1.1.2 This Rainwater Catchment Design and Installation Standard, (hereinafter referred to as the *Standard*) has been developed by a joint effort of the American Rainwater Catchment Systems Association (ARCSA) and the American Society of Plumbing Engineers (ASPE). The purpose of this standard is to assist engineers, designers, plumbers, builders / developers, local government, and end users in safely implementing a rainwater catchment system. This standard is intended to apply to new rainwater catchment installations, as well as alterations, additions, maintenance and repairs to existing installations.

1.1.3 The standards mentioned herein are intended to be consistent with, and complimentary to, the requirements of the Uniform Plumbing Code, International Plumbing Code, National Institute of Health, and local Board of Health. However, installers are advised to consult with the plumbing authority regarding local conditions, requirements and restrictions.

1.2 PERFORMANCE OBJECTIVES

1.2.1 Rainwater systems are capable of producing high quality water, to levels meeting public utility standards, but only if properly maintained by the system owner or operator. The objectives of this Standard are to provide guidance in how to provide and maintain a healthy alternative to utility provided water, and to optimize rainwater utilization, while ensuring that:

A. Consumers of rainwater are safeguarded from illness as a consequence of poor design, installation, maintenance or illegal work.

B. The public is safeguarded from injury or loss of amenity due to a failure of the supply, installation, maintenance, or operation of the rainwater catchment system.

C. The Rainwater System will serve to maintain and enhance the quality of the environment while ensuring compliance with the intent of relevant regulations and government officials.

1.2.2 This Standard applies to the following applications

A. Non-Potable

B. Potable

C. Fire Protection

D. Agricultural

E. Industrial

1.3 UNITS OF MEASUREMENT

1.3.1 Values are stated in U.S. Customary Units and shall be considered as the standard.

1.4 RELATED STANDARDS

1.4.1 NSF International Protocol P151: Health Effects From Rainwater Catchment System Components.

1.4.2 NSF / ANSI 61: Drinking Water System Health Effects.

End of Section

2.0 ACCEPTABLE MATERIALS AND COMPONENTS

2.1 General

2.1.1 The following standards are referenced in this document.

2.1.2 The listing of a reference in this consensus standard shall imply the application of the latest issue, revision or affirmation, including all referenced documents listed therein.

2.2 Related Standards

2.2.1 American National Standards Institute (ANSI)

A. ANSI A21.10 — ANSI Standards for Ductile-Iron and Gray-Iron Fittings.

B. ANSI B16.22 — Wrought Copper and Copper Allow Solder Joint Pressure Fittings.

2.2.2 ASTM International (ASTM)

A. ASTM B 32 — Specifications for Solder Metal.

B. ASTM B 75 — Specifications for Seamless Copper Tub.

C. ASTM B 828 — Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

.

D. ASTM B 638 — Test Method for Tensile Properties of Plastics.

E. ASTM B 695 — Test Method for Compressive Properties of Rigid Plastics.

F. ASTM D 1599 — Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tube and Fittings.

G. ASTM D 1600 — Terminology for Abbreviated Terms Relating to Plastics.

H. ASTM 1785 — Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedule 40, 80, and 120.

I. ASTM D 2104 — Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.

J. ASTM D 2241 — Specification for Poly Vinyl Chloride (PVC) Pressure Plastic Pipe.

K. ASTM D 2282 — Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR).

L. ASTM 2466 — Standard Specification for Poly Vinyl Chloride (PVC) Plastic Fittings, schedule 40.

M. ASTM 2467 — Standard Specification for Poly Vinyl Chloride (PVC) Plastic Fittings, Schedule 80.

N.	ASTM D 2447	Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
O.	ASTM D 2468	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40.11
P.	ASTM D 2657	Practice for Heat-Joining Polyolefin Pipe and Fittings.
Q.	ASTM D 2661	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
R.	ASTM D 2665	Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
S.	ASTM D 2855	Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
T.	ASTM D 2949	Specification for 3.25-in. Outside Diameter Poly (Vinyl Chloride)(PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
U.	ASTM D 3261	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
V.	ASTM D 3311	Specification for Drain, Waste, and Vent (DWV) Plastic Fittings.
W.	ASTM D 3350	Specification for Polyethylene Plastics Pipe and Fittings Materials.
X.	ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials.
Y.	ASTM E 412	Terminology Relating to Plastic Piping Systems.
Z.	ASTM F 628	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
Aa.	ASTM F 714	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
Bb.	ASTM F 1866	Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings.
Cc.	ASTM F 1901	Specification for Polyethylene (PE) Pipe and Fittings for Roof Drain Systems.

2.2.3 American Water Works Association (AWWA)

A.	AWWA C110	Standard for Ductile-Iron and Gray-Iron Fittings, 3 in.- 48 in. (76 mm-1,219 mm), for Water C606 Grooved and Shouldered Joints.
B.	AWWA C.606	Grooved and Shoulder Joints.

2.2.4 Cast Iron Soil Pipe Institute (CISPI)

A. CISPI 301

B. CISPI 310 Specification for Couplings for Use In Connection With Hubless Cast Iron Soil Pipe and Fittings For Sanitary and Storm Drain Waste and Vent Piping Applications.

2.2.5 American Society of Mechanical Engineers (ASME)

A. ASME A 112.6.4 Roof, Deck and Balcony Drains.

2.2.6 Copper Development Association (CSA)

A. Copper Tube Handbook.

2.2.7 Crane Technical Paper No. 410, - Flow of Fluids Through Valves, Fittings and Pipe,@ 1988.

2.2.8 International Organization for Standardization (ISO)

A. ISO 899 Plastics- Determination of Tensile Creep Behavior.

2.2.9 National Weather Service

A. NWS HYDRO-35 Five to Sixty Minute Precipitation Frequency of the Eastern and Central United States.

B. National Climate Data Center http://www.ncdc.noaa.gov/oa/ncdc.html

2.2.10 NOAA Technical Memorandum

A. NOAA Short Duration Rainfall Frequency Relations for California.

B. NOAA Short Duration Rainfall Frequency Relations for the Western United States.

2.2.11 NSF International

A. Protocol P151: Health Effects from Rainwater Catchment System Components.

B. NSF / ANSI Standard 14: Plastic Piping System Components and Related Materials.

C. NSF / ANSI Standard 42: Drinking Water Treatment Units--Aesthetic Effects.

D. NSF / ANSI Standard 53: Drinking Water Treatment Units-- Health Effects.

E. NSF / ANSI Standard 55: Ultraviolet Microbiological Water Treatment Systems.

F. NSF / ANSI Standard 58: Reverse Osmosis Drinking Water Treatment Systems.

G. NSF / ANSI Standard 60: Drinking Water System Chemicals Health Effects.

H. NSF / ANSI Standard 61: Drinking Water System Components Health Effects

2.2.12 American Public Health Association

A. Standard Methods for the Examination of Water and Wastewater.

End of Section

3.0 DESIGN AND INSTALLATION REQUIREMENTS

3.1 Collection Parameters.

3.1.1 All piping and plumbing component materials used in the installation of a rainwater harvesting system shall be as approved for the specific use per local plumbing code, or be listed by an ANSI accredited product certification program as available.

A. Collection roofing, gutters, piping, fittings, valves, screens, down spouts, leaders, flushing devices, tanks, and liners, shall be approved for the intended use.

B. All tank interior surfaces, and equipment shall be washed clean before they are put into service.

C. For water storage volumes less than 360 gallons (1,363 liters), or intended for minor utility, irrigation and garden use, no treatment is required.

D. Water level control devices that control pumps, makeup water valves, etc, in contact with the water supply, shall be mercury free devices.

E. Overhanging vegetation and proximity to air borne pollution sources are to be avoided.

F. These standards do not apply to the collection of rainwater from vehicular parking or other similar surfaces.

3.1.2 For non-potable water applications,

A. The collection surface may be constructed of any above-ground, hard surface, impervious material.

B. Harvested rainwater must be filtered or treated to an appropriate quality suitable for intended use. No treatment is required for sub surface irrigation, agricultural, or garden use. For above surface Irrigation, the local authority having jurisdiction should be consulted regarding required water quality.

3.2 Conveyance System

3.2.1 The Roof Drainage System. Gutters and downspouts used to collect rainwater shall comply with the following:

A. All piping, plumbing components, and material used shall be manufactured of material approved for the intended application, conforming to the standards described herein in Chapter 2, and meeting the intent of applicable Building and Plumbing Codes.

B. Gutter and down spout systems leading to the cistern shall be fitted with debris excluder or equivalent device.

3.2.2 Washers and Pre-filtration. All collected rainwater, for potable water application, shall pass through a roof washer or pre-filtration system before the water enters the cistern(s). Roof washer systems shall meet the following design requirements:

A. A sufficient amount of rainwater shall be wasted, and not allowed to enter the cistern, to wash accumulated debris from collection surface. Approximate amount of rainfall to be wasted shall be adjustable as necessary to minimize cistern water contamination. (See Chapter Five, *Acceptable Piping Schematics*, for guidance in determining pre-wash water volume)

B. The inlet to the roof washer shall be provided with a debris screen that protects the roof washer from the intrusion of waste and vermin. The debris screen shall be corrosion resistant and shall have openings no larger than 0.5 inches and no smaller than 0.25 inches nominal. Pre-filters which have a self-cleaning design are not required to have the aforementioned debris screen.

Exception: This item is not required for pre-filters which provide their own method of diverting the prescribed first flush.

C. Water drained from the first-flush diverter or pre-filter will be piped away from the storage tank and terminate in a location which will not cause damage to property or cause erosion.

D. If more than one cistern is used a screen, roof washer or pre-filtration system shall be provided for each cistern.

Exception: Where cisterns are interconnected to supply water in series, a single pre filter will be permitted

E. First flush diverters and pre-filters shall be provided with an automatic means of self draining between rain events.

F. Roof washers shall be readily accessible for regular maintenance.

G. Pre-filtration screens or filters shall be maintained consistent with manufacturer's specifications.

3.3 CISTERNS / STORAGE. The following are the minimum requirements for cisterns:

3.3.1 General:

A. Cisterns may be used as storm-water collection points that help to minimize flood damage, while providing a reservoir for later use. Cisterns shall have access to allow inspection and cleaning.

3.3.2 Installation:

A. Cisterns may be installed either above or below grade

B. Tank shall comply with the Administrative Authority having jurisdiction, local building codes and ordinances, and / or as certified by a structural engineer.

C. Above grade plastic tanks shall be certified by the manufacturer for intended application.

D. Above grade cisterns shall be protected from direct sunlight and shall:

1. Be constructed using opaque, UV resistant, materials: i.e. heavily tinted plastic, lined metal, concrete, wood, or painted to prevent algae growth,

   or

2. Have specially constructed sun barriers e.g. installed in garages, crawlspaces, sheds, etc.

E. Below grade cisterns, located outside of the building, shall be provided with manhole risers a minimum of 4 inches above surrounding grade and / or installed in such a way as to prevent surface or ground water from entering through the top of any fittings.

F. Where the installation requires a foundation, the foundation shall be flat and shall be designed to support the cistern weight when the cistern is full consistent with bearing capability of adjacent soil.

G. In areas where sustained freezing temperatures occur, provisions will be made to keep cistern and the related piping from freezing.

H. All cisterns shall be installed in accordance with the manufacturer's installation instructions.

1. Underground tanks shall comply with OSHA's construction Industry Standards Part 1926 Subpart P, Fall protection rules and regulations and any local codes relating to excavation and backfill technique or safety.

2. Above grade tanks shall be installed on a sturdy and level, foundation or platform, adequately secured with adequate drainage.

I. In a situation where the soil can become saturated, an underground tanks shall be ballasted, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down ballast should meet or exceed the buoyancy force of the tank, calculated as follows:

Example:

1. Buoyant force of Cistern (lbs) =

Cistern Volume (cubic feet) x 62.4 (lbs / cubic foot) e.g.

For 1000 gallon tank, Buoyant force will be 1000 gallons x (1 cubic foot / 7.48 gallons) x 62.4 (lbs / cubic foot

= 8342 lbs

2. If concrete used as ballast, the volume needed will be:

Volume (cubic feet) = 8342 lbs x cubic feet / 150 lbs

= 55.6 cubic feet (2.1 cubic yards)

J. Cisterns shall be provided with a means for draining and cleaning.

K. All cistern openings shall be protected from unintentional entry by humans or vermin. Manhole covers shall be provided and shall be secured to prevent tampering.

1. Where an opening is provided that could allow the entry of personnel, the opening shall be marked,

"DANGER - CONFINED SPACE@.

3.3.3 Inlets, Outlets and Openings.

A. Cistern inlets shall be provided to permit water to enter tank with minimum turbulence.

B. The overflow outlet, or flap valve, shall be protected with a screen having openings no greater than 0.125 inches, or as otherwise appropriate, for preventing entrance of insects or vermin entering the cistern.

1. Overflow outlet shall be sized in accordance with prevailing gutter and down spout requirements.

2. Water from the cistern overflow shall be discharged in a manner consistent with local storm water runoff requirements and as approved by the local authority having jurisdiction, or may be allowed to infiltrate excess collected water into the aquifer.

3.4 PUMP.

3.4.1 Where a pump is provided in conjunction with the rainwater harvesting system, the pump shall meet the following provisions:

A. The pump and all other pump components shall be listed and approved for use with potable water systems.

B. The pump shall be capable of delivering a minimum of 15 psig residual pressure at the highest and / or most remote outlet served. Minimum pump pressure shall allow for friction and other pressure losses. Maximum pressures shall not exceed 80 psig. A pressure reducing valve shall be provided at water branch distribution piping if the pump is capable of exceeding 75 psig.

3.5 FILTRATION. Filtration shall meet the following provisions

3.5.1 Where rainwater is used for non-potable use and for non critical operations, such as irrigation, wash down, etc., a final stage filtration system is not required.

3.5.2 Where rainwater is used for non-potable use, interior to an occupied facility, for makeup for laundry, toilets, process, etc.; the water is to be filtered as a safeguard against sediment or discoloration, and for proper operation of valves or other devices.

3.6 PIPING

3.6.1 There shall be no direct connection of any rainwater harvesting pipe system and a public utility- provided domestic potable water pipe system without an approved back flow device.

3.6.2 Separation shall be maintained between potable and non potable water systems at all times. Cross connections, without proper protection in accordance with local applicable plumbing code, will not be permitted.

A. All material used as part of a rainwater harvesting system shall be as listed for the purpose intended, as designated by local applicable code.

B. Where rainwater harvesting pipe and potable water pipe are installed in the same trench, wall cavity, or other location, the potable water pipe shall be separated by a minimum distance of twelve inches (12") above the rainwater-harvesting pipe. Both pipes shall be installed below local frost depth.

3.6.3 Piping Materials.

A. Rainwater distribution water piping, fittings and other related system components shall be suitable for domestic water application as indicated in the applicable local building and / or plumbing code, or as otherwise described in Section 2.

B. Plastic piping shall be protected from UV radiation by a factory apply protective coating, or painted with a compatible latex paint. Piping and solvent cements shall be approved for the intended use.

3.6.4 Labeling. If a Rainwater Harvesting System is applied to any building, facility or residence, it shall be so indicated as follows:

A. All rainwater supplied fixtures, not specifically treated for potable water use, shall be prominently labeled

"NON-POTABLE - DO NOT DRINK@

B. Non-potable water piping shall be designated by colored bands and solid color piping as specified by the authority having jurisdiction or national code agencies, and labeled:

ANON POTABLE - RAINWATER"

C. Outlets and fixtures served with harvested rainwater shall be easily recognizable by color or a symbol for non-potable water.

3.6.5 Inspections. Rainwater harvesting systems are considered a private water system under the responsibility of the building owner / operator, and shall be minimally inspected according to the following schedule:

A. Inspection of all elements before they are covered (rough-in inspection)

B. Final inspection including testing.

C. In addition to testing required by the code for plumbing systems, the following also apply:

1. Testing and Commissioning

2. Piping. A flow test shall be preformed through the system to the point of water distribution and disposal. In addition, the water distribution system shall be tested and proved tight at the operating pressure. Where the manufacturer permits, a 50-psi hydrostatic test may substitute for the test above. All lines and components shall be watertight.

D. Other inspections as needed to assure proper system operation.

3.6.6 System Maintenance. It is the property owner's responsibility to maintain the system components according to manufactures written recommendations.

3.6.7 Rainwater harvesting systems shall be maintained in functioning order for the life of the system.

A. Filtration and Disinfection systems shall be serviced in accordance with manufactures recommendations.

B. System Abandonment. If the owner of a rainwater harvesting system elects to cease use of, or fails to properly maintain such system, they shall abandon the system. To abandon the system, the system owner shall minimally:

1. Remove or disable all system connecting piping to utility provided water system..

2. Replace the rainwater harvesting pipe system with an approved potable water supply pipe system. Where an existing potable pipe system is already in place, fixtures may be re-connected to the existing system.

3. Secure cistern from accidental access by sealing or locking tank inlets and access points, and / or filling with sand or equivalent.

3.7 POTABLE RAINWATER APPLICATIONS

3.7.1 Collection Surfaces for potable water applications shall be as noted in 3.1.1 above but shall also be made of non-toxic material.

A. Painted surfaces are only acceptable if paint has been certified to ensure the toxicity level of the paint is acceptable for drinking water contact. Lead, chromium or zinc based paints are not permitted.

B. Enameled Steel.

C. Flat Roofs: Roof products shall be certified to NSF Protocol P151.

D. Collection of water from vehicular parking surfaces is prohibited.

Not approved for potable water

E. Wood / Cedar shake roofing.

F. Copper roofing materials.

G. Lead flashing is not approved for potable water.

Not Recommended for Potable Water or to be used with caution.

H. Bitumen / Composition roofing.

I. Galvanized, zinc-coated metal.

3.7.2 Cistern Inlets:

A. Methodology of water entering cistern shall be to maintain A quiet flow A in the cistern by minimizing splashing and disturbance of sediment in bottom of cistern.

B. For potable water applications, and recommended for maintaining good water quality, the pipe entering the cistern shall terminate in a return bend elbow pointed upward at the bottom of the tank, or equivalent calming device.

3.7.3 Cistern outlets shall be provided with floating inlet to draw water from the cistern just below the water surface.

A. Alternate: Cistern outlet to be located at least 4 inches above the bottom of the cistern.

3.7.4 Cisterns shall be intended for potable water use.

A. Cisterns shall be certified for use with potable water with NSF, or recognized equivalent. Plastic tanks shall be constructed of virgin plastic and shall adhere to requirements of NSF / ANSI Standard 61.

B. Cisterns shall not be connected directly to a public or community water supply without approved back-flow protection. Make-up water to rainwater storage tanks, when provided, may be made through a reverse pressure principle back flow device or an air gap per local plumbing codes.

C. If installed below grade, cisterns shall be separated from sanitary waste piping a distance as recommended by local authority having jurisdiction, or local plumbing codes, and up gradient from septic field piping where applicable.

3.7.5 Filtration

A. Carbon filtration may be provided for reduction of taste, odor and organic chemicals.

B Filtration and Disinfection systems shall be located after water storage tank and as close to the final point of use as possible.

C. All particulate filtration shall be installed upstream of disinfection systems.

D. Filters shall be adequate size to extend service time and must be comply with NSF / ANSI Standard 53.

3.7.6 Water Disinfection

A. Chlorination: Chlorination may be used with an automated demand feed system, and if used, shall enable adequate contact time and residual according to local health authorities.

B. Ozone: Ozone may be used with an approved ozone system ensuring adequate contact time with the ozone. Provision must be made to off- gas ozone to a safe environment.

C. Ultra-violet disinfection may be used and shall be provided between final filtration (5 micron maximum) and final point of use.

3.7.7 Operation and Maintenance

A. After several cycles of rain harvesting, a initial sample of the resultant accumulated water shall be tested for compliance according to procedures listed in the latest edition of Standard Methods for the Examination of Water and Wastewater (ALPHA).

B. For a Private System, prior to placing the water system into service, water quality testing, at a minimum shall be performed for E. Coli, Total Coliform, and heterotrophic bacteria. Subsequent periodic testing to assess the ongoing integrity of ths system is recommended.

C. For a Public System (defined as a system where 25 different persons consume water from the system over a 60 day period):

1. In addition to the above tests, water shall be tested for cryptosporidium.

2 Subsequent annual tests shall be made for Total Coliform, E Coli, Heterotrophic bacteria and any chemicals of concern.

3 Records of test results shall be maintained for at least two (2) years.

End of Section

4.0 DEFINITIONS

In addition to definitions used in the Uniform and International Plumbing Codes, the following definitions apply to rainwater harvesting systems:

1. AUXILIARY SUPPLY:	Water supply that is arranged and protected from contamination that is available to provide an alternate means of filling a cistern.
2. CALMING INLET:	A device that permits water to enter a storage tank with minimal disturbance to particles that may have settled to bottom of the tank. See Quiescent Flow.
3. CISTERN :	The central storage component of the rainwater harvesting system. Protection and maintenance of the cistern is essential for the health of the system.
4. CODE:	Refers to the local written authority i.e. the Uniform Plumbing Code, International Plumbing Code, NSF International, etc.
5. COLLECTION AREA:	Area from which rainwater is collected for use in a rainwater harvesting system (e.g. roof area).
6. DEBRIS EXCLUDER:	A screen or other device installed on the gutter or down spout system to prevent the accumulation of leaves, needles, or other debris in the system.
7. DISINFECTION:	Reduction of viable micro-organisms to a level that is deemed suitable for the intended application. Typical units of measure are Colony Forming Units per deca-liter (cfu / dl).
8. DRY RUN PROTECTION:	System for protecting the water pump against running dry.
9. EVAPORATION FIELD:	Element in the ground that is filled with gravel, ballast or special non-permeable plastic elements and that stores rainwater that is fed into it on an intermediate basis before the water evaporates into the atmosphere or seeps into the surrounding soil.
10. FILTRATION:	Physical removal of liquid-borne contaminants by means of separation from the output flow. Particulate filtration removes suspended particles (measured in units of Total Suspended Solids (TSS); while other forms of filtration, such as carbon / absorption filtration, removes dissolved compounds measured in units of Total Dissolved Solids (TDS).

11. GROUND WATER:	Water that saturates into the ground and no longer flows across the surface, it is considered “Groundwater”
12. FIRE SPRINKLER RESERVE:	Volume of water needed for fire protection that is not available for any other use and accessible only by the fire pump
13. FLAT:	Having a slope no greater than 1 in 50.
14. HARVESTED WATER:	Process water system for utilizing rainwater for potable, non-potable, industrial or irrigation application.
15. LEACH FIELD, EVAPORATION / TRANSPIRATION FIELD:	Element in the ground that is filled with gravel, ballast or special permeable plastic elements and that stores rainwater that is fed into it on an intermediate basis before the water seeps into the surrounding soil.
16. MINIMUM WATER VOLUME:	Recoverable water volume that is constrained by the process such that neither sediment nor scum can be sucked into the deliverable water.
17. OVERFLOW LEVEL:	The highest level that water from a drainage system can rise to.
18. OVERFLOW LINE:	Line for leading away rainwater when the rainwater reservoir is full, e.g. into the sewage system or a seepage system
19. PIPING SYSTEM:	Pipes that conveys the harvested rainwater and distributes it to various fixtures.
20. POINT OF USE:	A point in a domestic water system, nearest to a water consuming plumbing fixture, where water is used.
21. PRECIPITATION:	Water that has precipitated from the atmosphere (e.g. rain, snow, mist, dew)
22. PRECIPITATION CHARACTERISTICS:	Characteristics of a precipitation event (e.g. intensity, duration)
23. PRIVATE WATER SYSTEM:	System used by less than 25 persons over a 60 day period.
24. PROCESS WATER:	Water to be used for household and commercial applications.
25. PROCESS WATER LINE:	System of lines from the process water pump to the individual points at which water is drawn.

26. PROCESS WATER PUMP:	Pumps process water from the rainwater reservoir to the points at which it is drawn.
27. PROCESS WATER REQUIREMENTS:	Planning value for the process water amount that is expected to be required in a specified period of time.
28. PUBLIC WATER SYSTEM:	System that is used by 25 or more different persons over a 60 day period.
29. QUANTITY OF PRECIPITATION:	Precipitation at a certain place, expressed as the water height over a horizontal area for a span of time under consideration .
30.QUIESCENT INFLOW:	Routing of rainwater into rainwater reservoirs so that the existing sediment is not activated in the rainwater reservoir and an immediate sedimentation of solids is possible.
31. RAINWATER :	Water from natural precipitation that was not contaminated by use.
32. RAINWATER HARVESTING SYSTEM:	Water system for utilizing rainwater, consisting of a cistern(s), pipe, fittings, pumps and/or other plumbing appurtenances, required for and/or used to harvest and distribute rainwater.
33. RAINWATER LINE:	Supply, drainage, overflow and emptying lines of a rainwater harvesting system.
34. RAINWATER YIELD:	Net water volume (water inflow) ,determined over a certain period of time, available for use as process water. Typically this is approximately 80% of theoretical collectable rainwater.
35. RETURN ELBOW :	A section of pipe with a 180-degree bend.
36. ROOF DRAINAGE SYSTEM:	A system, comprised of roof drains, overflow drains, scuppers, gutters and down spouts, used to convey the rainwater from the roof surface to the roof washer and the cistern.
37. ROOF SURFACE :	The surface rainwater harvesting systems rely on for the collection of rainwater that has fallen on a building roof.
38. ROOF WASH OR ROOF WASHER:	A device or method for removal of sediment and debris from collection surface by diverting initial rainfall from entry into the cistern(s). Also called a First Flush Device
39. SCREEN:	A filtration device, constructed of corrosion resistant wire or other approved mesh, having openings in determined sizes.

40. SEDIMENTATION:	Separation of solids from the water via gravity.
41. SLOPE OR SLOPING:	Having a slope greater than 1 in 50.
42. SUB-SURFACE IRRIGATION:	Water that is applied below ground level, and is not directly exposed to the above ground surface and/or surrounding air.
43. SUCTION LINE:	Water pump inlet piping.
44. SUN BARRIERS :	A cover, or erected structure, specifically to shelter a cistern from the direct rays of the sun.
45. SUPPLEMENTAL SUPPLY:	Equipment for providing a supplemental supply of drinking water or non-drinking water into process water systems
46. SURFACE IRRIGATION:	Water that is applied above ground level and is directly exposed to the above ground surface and/or air.
47. SURFACE WATER:	Any rain water that touches the ground and flows across the surface of the ground (roadway, parking surface, gully, creeks, streams etc.) to be termed “surface water”.
48. SYSTEM CONTROL UNIT:	Control unit for the automatic operation of the rainwater harvesting system .
49. TRANSFER PUMP:	A mechanical device to transfer collected water from down spouts to remote cisterns.
50.USEFUL VOLUME:	Volume that can be completely used during operation (Typically .80 - .90 of storage volume).
51. YIELD COEFFICIENT:	Ratio of the rainwater annually flowing into the rainwater harvesting system to the total amount of rainwater in the accompanying precipitation area , allowing for leakage, splashing, evaporation, etc. (Typically .75 - .90).

End of Section

5.0 ACCEPTABLE PIPING SCHEMATICS

Figure 1: Potable and / or Non-Potable Water

Figure shows an above ground application in a non-freeze environment. In an environment where freezing is possible, tank should be moved to a heated environment or buried below the frost line, as shown in the following details.

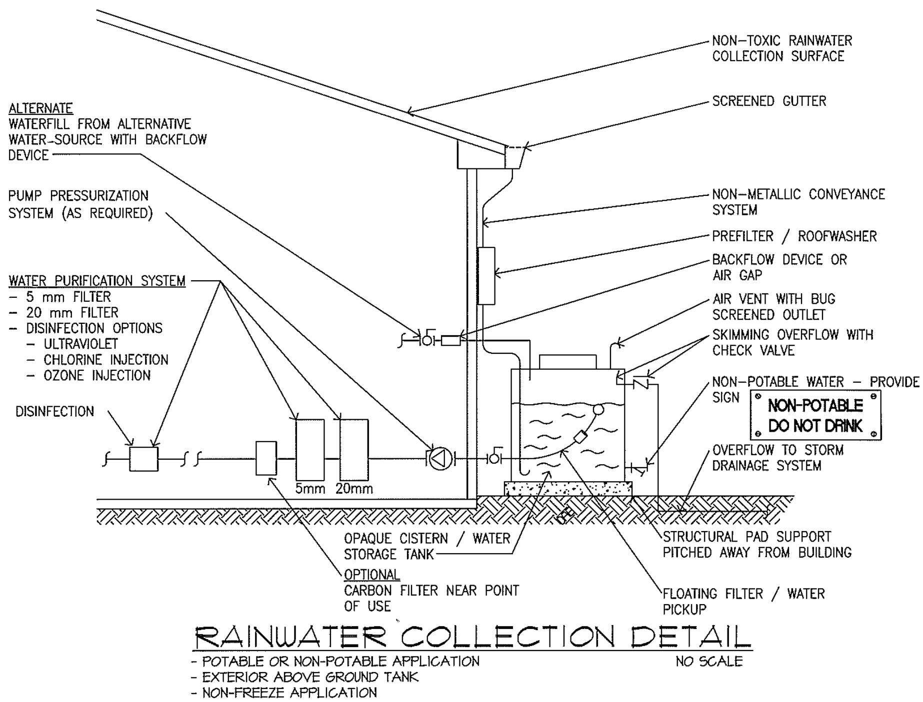

Figure 1

Figure 2: Underground Exterior Cistern for Potable Application.

Where carbon filters are used, they may be put down stream of chlorine and ozone disinfection systems, but are recommended to be upstream of Ultraviolet disinfection systems. Where soil saturation is a possibility, it is recommended that the combined weight of the tank and ballast must meet or exceed the buoyancy upward force of an empty cistern. This buoyance force (lbs.) is equal to the volume of the tank (cubic feet) x 62.4 lbs / cubic feet, or tank volume (gallons) x 8.34 lbs / gallon water

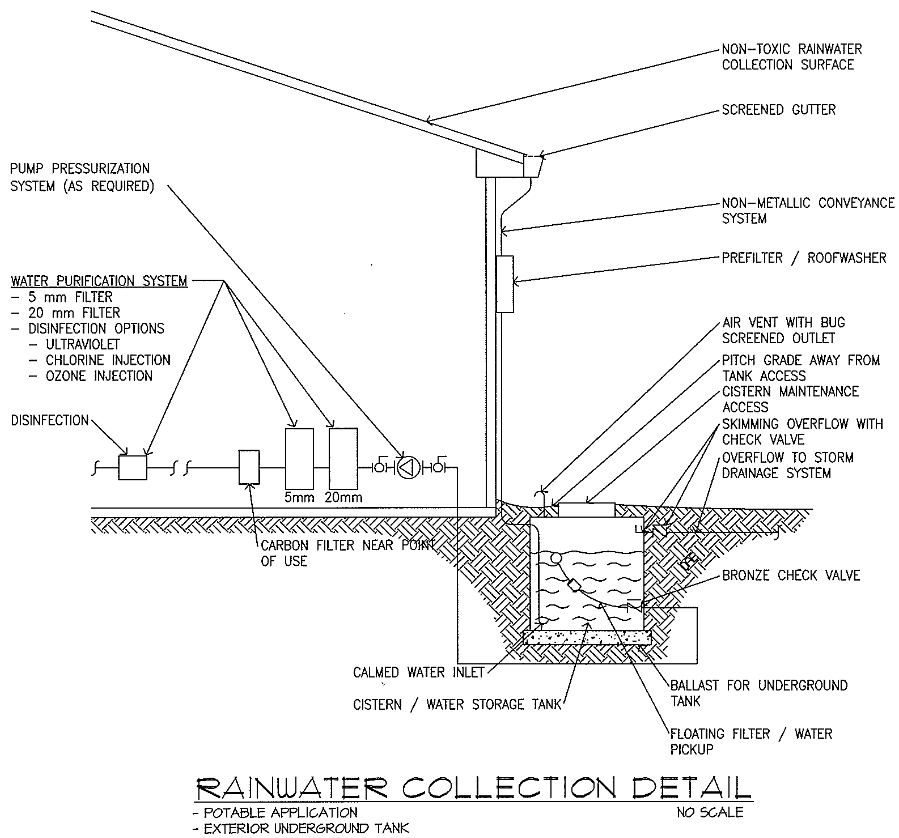

Figure 2

Figure 3: Non-Potable Water

This application is suitable for lawn and plant irrigation or process water makeup. Filters to remove particulate may be added to improve water quality in order o avoid problems with sprinkler or process devices. Signage marking water outlets as " Non-Potable, Do Not Drink " are required in a public environment and highly recommended elsewhere.

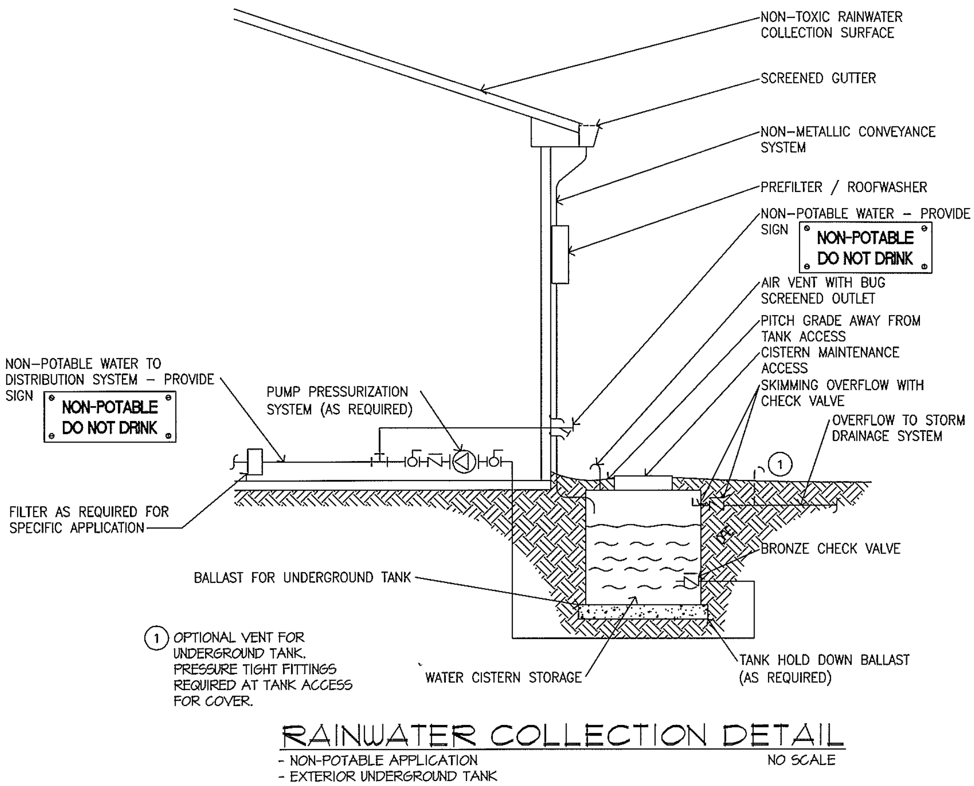

Figure 3.

Figure 4: Potable and Non-Potable Water

Installing a water storage tank in a heated environment is preferred for an installation subject to freezing. Appropriate signage is necessary to label non-potable water outlets.

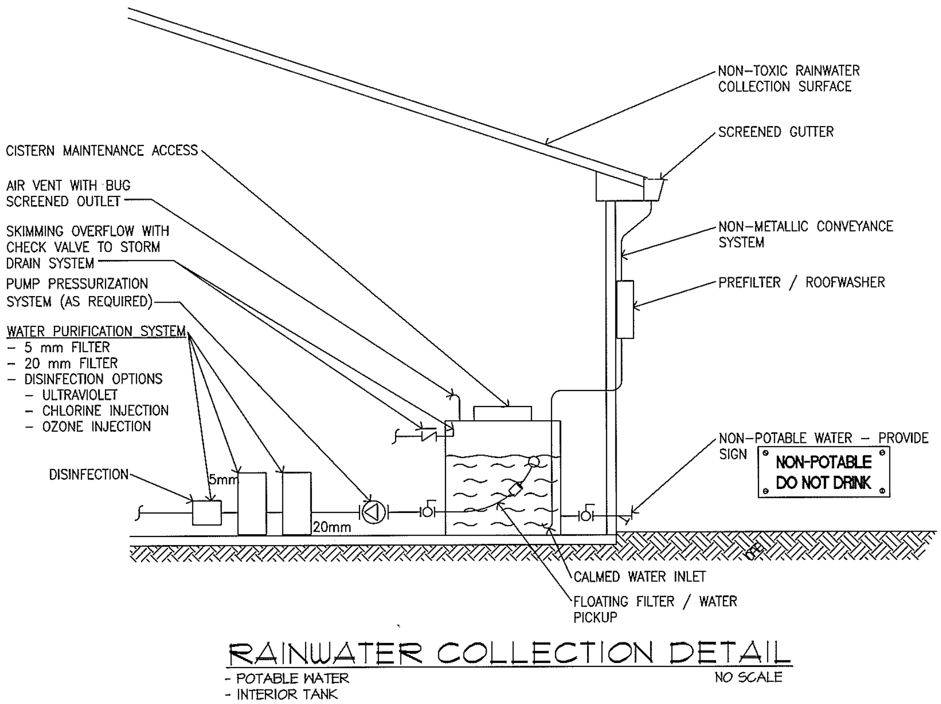

Figure 4.

5.1 ROOF WASHER

Roof Washers are commonly used to waste the initial water coming off the collection surface before being allowed to fill the cistern. Commonly used roof wash amounts are indicated below, but may be varied to reflect actual site and seasonal conditions.

Estimated Roof Contamination Potential

High Contamination [1]	Medium Contamination	Low Contamination[2]
.03" / 8mm	.01" / 2 mm	.002" / .5mm

Notes:

(1) High Contamination is considered to have high content of organic debris from animal waste, adjacent trees, and / or airborne contamination.

(2) Low Contamination is considered to either have frequent rainfall to keep collection surface clean, and / or minimal non toxic contamination.

(3) Sample Calculation: 1000 square foot collection surface, medium contamination:

Gallons = .01" rain x 1000 Square Feet x .623 gallons / square foot - inch:
= 6.23 gallons

Figure 5.

There are many different styles of roof wash devices. The simplest versions involve filling a stand pipe section of piping that contains adequate volume, that once full, then overflows into the cistern.(See Figure 6). A short coming of this concept is that it allows mixing from the contaminated pre-wash volume and the water to be saved in the cistern.

Another commercially available first flush diverter (See Figure 7.) attempts to address the mixing issue by using a stand pipe and floating ball. Once the standpipe is filled with the pre-wash water, a floating ball seals off the remaining flow preventing the pre-wash water from being mixed with the remaining flow. The remaining rainfall is then diverted to the
cistern. This device has a drain at the bottom that allows diverted water to slowly drain after each rainfall event and a clean-out plug to clean out any accumulated debris.

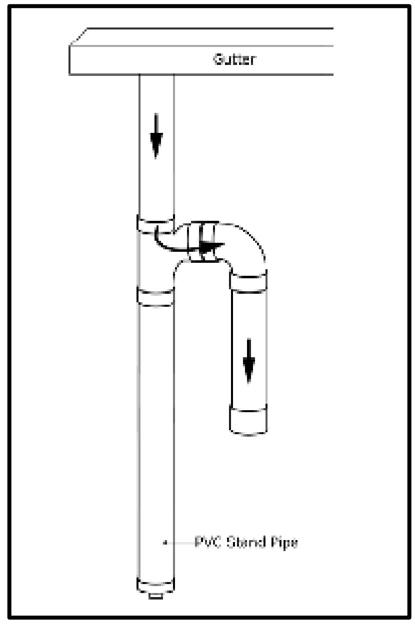

Figure 6.

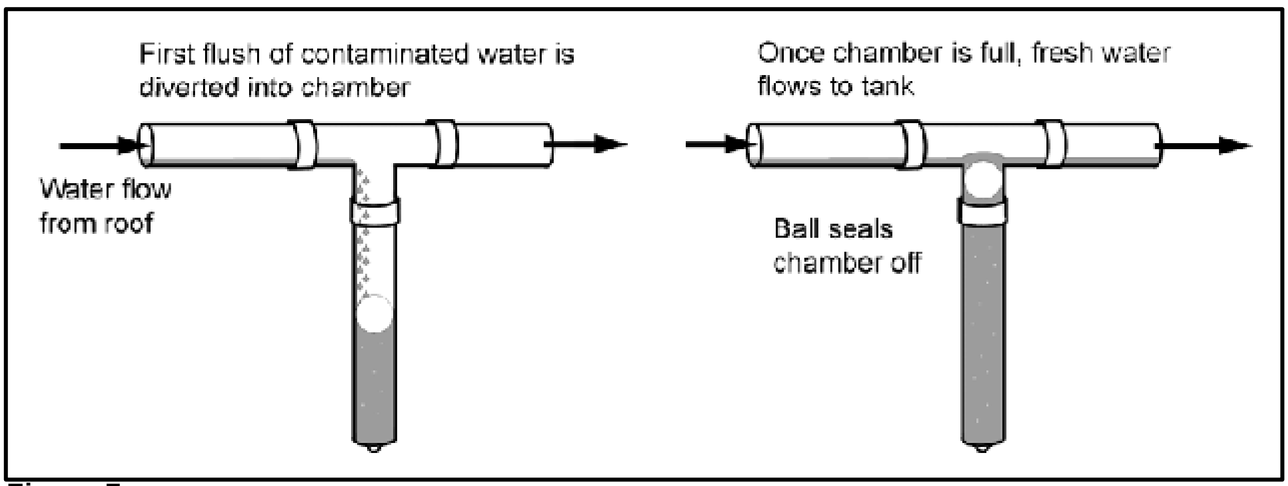

Figure 7.

Other commercially available combination pre-filter and roof wash devices are available to help maintain the water quality of the rainwater harvesting system.

The volume of pre-wash for a nominal 4" (4.046 inch actual) diameter PVC pipe can be determined as follows in Figure 8a.

4" PVC Pipe Storage Volume

Length : feet (meters)	Volume: gallons (liters)
1 (.3)	.7 (2.6)
3 (.9)	2.0 (7.6)
5 (4.6)	3.3 (12.5)
10 (3.0)	6.7 (25.4)
15 (4.6)	10.5 (38.1)

Figure 8a.

The volume of pre-wash for a nominal 6" (6.065 inch actual) diameter PVC pipe can be seen in Figure 8b.

6" PVC Pipe Storage Volume

Length : feet (meters)	Volume: gallons (liters)
1 (.3)	1.5 (5.7)
3 (.9)	4.5 (17.0)
5 (4.6)	7.5 (28.4)
10 (3.0)	15.0 (56.8)
15 (4.6)	22.5 (85.2)

Figure 8b.

Maintenance Worksheet for

____

	Change UV light	Change or Rinse Filters	Test For Bacteria	Clean First Flush	Check for leaks	Test for Giardia/Cryptos-poridium
Frequency:	Annually	Quarterly or as needed	Quarterly	Quarterly or after each rain	After Each Rain or Quarterly	initially and as required
Date Done						
Date Done						
Date Done						
Date Done						

Date	Meter Reading	Date	Meter Reading	Date	Meter reading	Date	Meter Reading	Date	Meter Reading	Date	Meter Reading

Installer: name; Phone
Test Water: _____Health Department; address/phone_______________ (retain all records)
Order UV Light From (Size):_______________
Order Filters (Size and Specs)____ From____________

Calculation Procedure

Step 1: Estimate demand:

Interior Water Requirement*: On average, a conserving American household uses 45.2 gallons per person/day to operate toilets, showers, clothes washers, sinks, and other water -using fixtures and appliances. Water demand can be minimized by using water efficient water fixtures. An example of how to estimate water demand is shown as follows:

Residential Indoor Water Use

Fixture	**Flow Rate (per use or min) ****	**Average # uses/day or min/day per person**	**Daily Demand / person (gal)**	**Number of people in household**	**Household Total Daily Demand/ (gal)**	**Household Total Monthly demand (gal)**	**Household Total Yearly demand (gal)**
Toilets	1.6	5.1	8.16	3	24.48	742	8,935
Shower (based on 2.5 gal/min)	1.66	5.3	8.80	3	26.39	800	9,634
Faucets (based on 2.5 gal/min)	1.66	8.1	13.45	3	40.34	1,222	14,723
Dishwasher (1997- 2001) (gal/use)	4.5	0.1	0.45	3	1.35	41	493
Clothes washer (1998 - 2001) (gal/use)	27	0.37	9.99	3	29.97	908	10,939
Total Demand					**122.5**	**3,713**	**44,724**

*Source: "Handbook of Water Use and Conservation" Amy Vickers, 2001, Waterplow Press, Amherst, MA, ISBN I-931579-07-5

** Actual Flow (MFR)

Irrigation Water Requirement: Water used to irrigate landscaping often equals or exceeds interior water use. Supplemental irrigation water requirements can be greatly reduced by the use of 3 inches or more of top mulch, selecting native plants or plants that thrive in regions with similar climate, and using passive rainwater techniques. Because plant water needs vary greatly depending on soils, climate, plant size, etc. it is recommended that a calculator for your region be referenced. For calculators, visit the ARCSA website at: www.arcsa.org.

Step 2: Sizing the Collection System

The collection surface is often dictated by architectural constraints, such as roof area, etc. The amount of surface area, based on the needed water volume, is described as follows:

Surface Area (Square Feet) = Demand (Gallons) / 0.623 x Precipitation Density (inches) x system efficiency

Note:

- 0.623 (gallons / square foot / inch) conversion factor = 7.48 (gallons / cubic foot) / 12 (inches per foot). 1 inch of water covering 1 square foot of surface area = 0.623 gallons
- Surface area is horizontal projection of roof surface and not actual surface area (measure the area the roof covers, not the actual roof).
- Precipitation Density period consistent with time period being considered (monthly, yearly, etc)
- This coefficient accounts for collection system loss from leakage, evaporation, roof composition, etc. Roof coefficients are approximately 0.80 – 0.85.

Step 3: Sizing the Storage[1]

Once the area of roof catchment has been determined and the average rainfall has been established the maximum amount of rain that can be collected can be calculated using the formula:

Run-off (Gallons) = A x ***(Rainfall - B)*** x ***Roof Area***

A is the efficiency of collection and values of 0.80-0.85 (i.e. 80-85% efficiency) have been used.

B is the loss associated with adsorption and wetting of surfaces and a value of .08 inches per month (2.0 inches per year) has been used (eg Martin, 1980).

Rainfall should be expressed in Inches and ***Roof Area*** in Square Feet

[1]Adapted from Martin, T.J. (1980). *Supply aspects of domestic rainwater tanks*. South Australian Department of Environment, Adelaide.

The maximum volumes of rainwater that can be collected from various areas of roof and at a range of average annual rainfalls are shown in Appendix III. This information should only be used as an initial guide. If the maximum volumes are less than the annual water demand then either the catchment area will need to be increased or water demand will need to be reduced.

The next step is to calculate the size of the tank. The tank needs to be large enough to ensure that:

1. The required volume of water can be collected by the tank.

2. The volume of water in the tank will be sufficient to meet demand during the drier months or through periods of low or no rainfall.

The simplest way of checking a tank size estimated to provide water throughout an average year is to use monthly rainfall data and to assume that at the start of the wetter months the tank is empty. The following formula should then be used for each month:

Vt = V t-1 + (Run-off - Demand)

Vt = theoretical volume of water remaining in the tank at the end of the month
V t-1 = volume of water left in the tank from the previous month.
Run-off should be calculated as discussed above (***A*** = 0.80, ***B*** = .08 inches).

Starting with the tank empty then ***Vt-1*** = 0. If after any month ***Vt*** exceeds the volume of the tank then water will be lost to overflow. If ***Vt*** is ever a negative figure then demand exceeds the available water. Providing the calculated annual run-off exceeds the annual water demand, ***Vt*** will only be negative if periodical overflows reduce the amount of water collected so that it is less than the demand.

Tank size is not necessarily based on collecting total roof run-off. For example, the maximum water that can be collected from a roof area of 20 square feet with a monthly rainfall of 4.0 inches, will be about 40 gallons. If the water demand is less than this, some overflow may occur while demand is still met. If water demand is to be met throughout the month, the tank should be large enough so that ***Vt*** is never negative.

Calculations should be repeated using various tank sizes until ***Vt*** is 0 at the end of every month. The greater the values of ***Vt*** over the whole year, the greater the security of meeting water demand when rainfalls are below average or when dry periods are longer than normal.

The greater the security, the higher the cost of the tank.

Step 4: System Adjustment

To optimize performance and cost, going back through the calculation modifying surface area and the cistern storage capacity is recommended.

NORMALS 1971-2000	YRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
BIRMINGHAM AP,AL	30	5.45	4.21	6.10	4.67	4.83	3.78	5.09	3.48	4.05	3.23	4.63	4.47	53.99
HUNTSVILLE, AL	30	5.52	4.95	6.68	4.54	5.24	4.22	4.40	3.32	4.29	3.54	5.22	5.59	57.51
MOBILE, AL	30	5.75	5.10	7.20	5.06	6.10	5.01	6.54	6.20	6.01	3.25	5.41	4.66	66.29
MONTGOMERY, AL	30	5.04	5.45	6.39	4.38	4.14	4.13	5.31	3.63	4.22	2.58	4.53	4.97	54.77
ANCHORAGE, AK	30	0.68	0.74	0.65	0.52	0.70	1.06	1.70	2.93	2.87	2.09	1.09	1.05	16.08
ANNETTE, AK	30	9.67	8.05	7.96	7.37	5.73	4.72	4.26	6.12	9.49	13.86	12.21	11.39	100.83
BARROW, AK	30	0.12	0.12	0.09	0.12	0.12	0.32	0.87	1.04	0.69	0.39	0.16	0.12	4.16
BETHEL, AK	30	0.62	0.51	0.67	0.65	0.85	1.60	2.03	3.02	2.31	1.43	1.37	1.12	16.18
BETTLES,AK	30	0.84	0.61	0.55	0.38	0.85	1.43	2.10	2.54	1.82	1.08	0.90	0.87	13.97
BIG DELTA,AK	30	0.34	0.41	0.22	0.20	0.77	2.38	2.77	2.11	1.03	0.73	0.59	0.39	11.94
COLD BAY,AK	30	3.08	2.59	2.48	2.30	2.65	2.89	2.53	3.59	4.51	4.54	4.79	4.33	40.28
FAIRBANKS, AK	30	0.56	0.36	0.28	0.21	0.60	1.40	1.73	1.74	1.12	0.92	0.68	0.74	10.34
GULKANA,AK	30	0.45	0.52	0.36	0.22	0.59	1.54	1.82	1.80	1.44	1.02	0.67	0.97	11.40
HOMER, AK	30	2.61	2.04	1.82	1.21	1.07	0.96	1.45	2.28	3.37	2.77	2.87	3.00	25.45
JUNEAU, AK	30	4.81	4.02	3.51	2.96	3.48	3.36	4.14	5.37	7.54	8.30	5.43	5.41	58.33
KING SALMON, AK	30	1.03	0.72	0.79	0.94	1.35	1.70	2.15	2.89	2.81	2.10	1.54	1.39	19.41
KODIAK, AK	30	8.17	5.72	5.22	5.48	6.31	5.38	4.12	4.48	7.84	8.36	6.63	7.64	75.35
KOTZEBUE, AK	30	0.55	0.42	0.38	0.41	0.33	0.57	1.43	2.00	1.70	0.95	0.71	0.60	10.05
MCGRATH, AK	30	1.04	0.74	0.81	0.66	1.02	1.45	2.32	2.75	2.36	1.46	1.46	1.44	17.51
NOME, AK	30	0.92	0.75	0.60	0.65	0.74	1.14	2.15	3.23	2.51	1.58	1.28	1.01	16.56
ST. PAUL ISLAND, AK	30	1.74	1.25	1.12	1.12	1.21	1.41	1.91	2.96	2.79	2.70	2.87	2.13	23.21
TALKEETNA, AK	30	1.45	1.28	1.26	1.22	1.64	2.41	3.24	4.53	4.35	3.06	1.78	1.96	28.18
UNALAKLEET, AK	30	0.40	0.31	0.39	0.35	0.55	1.25	2.15	2.92	2.10	0.89	0.66	0.47	12.44
VALDEZ, AK	30	6.02	5.53	4.49	3.55	3.08	3.01	3.84	6.62	9.59	8.58	5.51	7.59	67.41
YAKUTAT, AK	30	13.18	10.99	11.41	10.80	9.78	7.17	7.88	13.27	20.88	24.00	15.17	15.85	160.38
FLAGSTAFF, AZ	30	2.18	2.56	2.62	1.29	0.80	0.43	2.40	2.89	2.12	1.93	1.86	1.83	22.91
PHOENIX, AZ	30	0.83	0.77	1.07	0.25	0.16	0.09	0.99	0.94	0.75	0.79	0.73	0.92	8.29
TUCSON, AZ	30	0.99	0.88	0.81	0.28	0.24	0.24	2.07	2.30	1.45	1.21	0.67	1.03	12.17
WINSLOW, AZ	30	0.46	0.53	0.61	0.27	0.36	0.30	1.18	1.31	1.02	0.90	0.55	0.54	8.03
YUMA, AZ	30	0.38	0.28	0.27	0.09	0.05	0.02	0.23	0.61	0.26	0.26	0.14	0.42	3.01
FORT SMITH, AR	30	2.37	2.59	3.94	3.91	5.29	4.28	3.19	2.56	3.61	3.94	4.80	3.39	43.87
LITTLE ROCK, AR	30	3.61	3.33	4.88	5.47	5.05	3.95	3.31	2.93	3.71	4.25	5.73	4.71	50.93
NORTH LITTLE ROCK, AR	30	3.37	3.27	4.88	5.03	5.40	3.51	3.15	2.97	3.53	3.81	5.74	4.53	49.19
BAKERSFIELD, CA	30	1.18	1.21	1.41	0.45	0.24	0.12	0.00	0.08	0.15	0.30	0.59	0.76	6.49
BISHOP, CA	30	0.88	0.97	0.62	0.24	0.26	0.21	0.17	0.13	0.28	0.20	0.44	0.62	5.02
EUREKA, CA.	30	5.97	5.51	5.55	2.91	1.62	0.65	0.16	0.38	0.86	2.36	5.78	6.35	38.10
FRESNO, CA	30	2.16	2.12	2.20	0.76	0.39	0.23	0.01	0.01	0.26	0.65	1.10	1.34	11.23
LONG BEACH, CA	30	2.95	3.01	2.43	0.60	0.23	0.08	0.02	0.10	0.24	0.40	1.12	1.76	12.94
LOS ANGELES AP, CA	30	2.98	3.11	2.40	0.63	0.24	0.08	0.03	0.14	0.26	0.36	1.13	1.79	13.15
LOS ANGELES C.O., CA	30	3.33	3.68	3.14	0.83	0.31	0.06	0.01	0.13	0.32	0.37	1.05	1.91	15.14
MOUNT SHASTA, CA	30	7.06	6.45	5.81	2.65	1.87	0.99	0.39	0.43	0.87	2.21	5.08	5.35	39.16
REDDING, CA	30	6.50	5.49	5.15	2.40	1.66	0.69	0.05	0.22	0.48	2.18	4.03	4.67	33.52
SACRAMENTO, CA	30	3.84	3.54	2.80	1.02	0.53	0.20	0.05	0.06	0.36	0.89	2.19	2.45	17.93
SAN DIEGO, CA	30	2.28	2.04	2.26	0.75	0.20	0.09	0.03	0.09	0.21	0.44	1.07	1.31	10.77
SAN FRANCISCO AP, CA	30	4.45	4.01	3.26	1.18	0.38	0.11	0.03	0.07	0.20	1.04	2.49	2.89	20.11

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SAN FRANCISCO C.O., CA	30	4.72	4.15	3.40	1.25	0.54	0.13	0.04	0.09	0.28	1.19	3.31	3.18	22.28
SANTA BARBARA, CA	30	3.57	4.28	3.51	0.63	0.23	0.05	0.03	0.11	0.42	0.52	1.32	2.26	16.93
SANTA MARIA, CA	30	2.64	3.23	2.94	0.91	0.32	0.05	0.03	0.05	0.31	0.45	1.24	1.84	14.01
STOCKTON, CA	30	2.71	2.46	2.28	0.96	0.50	0.09	0.05	0.05	0.33	0.82	1.77	1.82	13.84
ALAMOSA, CO	30	0.25	0.21	0.46	0.54	0.70	0.59	0.94	1.19	0.89	0.67	0.48	0.33	7.25
COLORADO SPRINGS, CO	30	0.28	0.35	1.06	1.62	2.39	2.34	2.85	3.48	1.23	0.86	0.52	0.42	17.40
DENVER, CO	30	0.51	0.49	1.28	1.93	2.32	1.56	2.16	1.82	1.14	0.99	0.98	0.63	15.81
GRAND JUNCTION, CO	30	0.60	0.50	1.00	0.86	0.98	0.41	0.66	0.84	0.91	1.00	0.71	0.52	8.99
PUEBLO, CO	30	0.33	0.26	0.97	1.25	1.49	1.33	2.04	2.27	0.84	0.64	0.58	0.39	12.39
BRIDGEPORT, CT	30	3.73	2.92	4.15	3.99	4.03	3.57	3.77	3.75	3.58	3.54	3.65	3.47	44.15
HARTFORD, CT	30	3.84	2.96	3.88	3.86	4.39	3.85	3.67	3.98	4.13	3.94	4.06	3.60	46.16
WILMINGTON, DE	30	3.43	2.81	3.97	3.39	4.15	3.59	4.28	3.51	4.01	3.08	3.19	3.40	42.81
WASHINGTON DULLES AP, D.C		3.05	2.77	3.55	3.22	4.22	4.07	3.57	3.78	3.82	3.37	3.31	3.07	41.80
WASHINGTON NAT'L AP, D.C.	30	3.21	2.63	3.60	2.77	3.82	3.13	3.66	3.44	3.79	3.22	3.03	3.05	39.35
APALACHICOLA, FL	30	4.87	3.76	4.95	3.00	2.62	4.30	7.31	7.29	7.10	4.18	3.62	3.51	56.51
DAYTONA BEACH, FL	30	3.13	2.74	3.84	2.54	3.26	5.69	5.17	6.09	6.61	4.48	3.03	2.71	49.29
FORT MYERS, FL	30	2.23	2.10	2.74	1.67	3.42	9.77	8.98	9.54	7.86	2.59	1.71	1.58	54.19
GAINESVILLE, FL	30	3.51	3.39	4.26	2.86	3.23	6.78	6.10	6.63	4.37	2.50	2.17	2.56	48.36
JACKSONVILLE, FL	30	3.69	3.15	3.93	3.14	3.48	5.37	5.97	6.87	7.90	3.86	2.34	2.64	52.34
KEY WEST, FL	30	2.22	1.51	1.86	2.06	3.48	4.57	3.27	5.40	5.45	4.34	2.64	2.14	38.94
MIAMI, FL	30	1.88	2.07	2.56	3.36	5.52	8.54	5.79	8.63	8.38	6.19	3.43	2.18	58.53
ORLANDO, FL	30	2.43	2.35	3.54	2.42	3.74	7.35	7.15	6.25	5.76	2.73	2.32	2.31	48.35
PENSACOLA, FL	30	5.34	4.68	6.40	3.89	4.40	6.39	8.02	6.85	5.75	4.13	4.46	3.97	64.28
TALLAHASSEE, FL	30	5.36	4.63	6.47	3.59	4.95	6.92	8.04	7.03	5.01	3.25	3.86	4.10	63.21
TAMPA, FL	30	2.27	2.67	2.84	1.80	2.85	5.50	6.49	7.60	6.54	2.29	1.62	2.30	44.77
VERO BEACH, FL	30	2.89	2.45	4.20	2.88	3.80	6.03	6.53	6.04	6.84	5.04	3.04	2.19	51.93
WEST PALM BEACH, FL	30	3.75	2.55	3.68	3.57	5.39	7.58	5.97	6.65	8.10	5.46	5.55	3.14	61.39
ATHENS, GA	30	4.69	4.39	4.99	3.35	3.86	3.94	4.41	3.78	3.53	3.47	3.71	3.71	47.83
ATLANTA, GA	30	5.03	4.68	5.38	3.62	3.95	3.63	5.12	3.67	4.09	3.11	4.10	3.82	50.20
AUGUSTA,GA	30	4.50	4.11	4.61	2.94	3.07	4.19	4.07	4.48	3.59	3.20	2.68	3.14	44.58
COLUMBUS, GA	30	4.78	4.48	5.75	3.84	3.62	3.51	5.04	3.78	3.07	2.33	3.97	4.40	48.57
MACON, GA	30	5.00	4.55	4.90	3.14	2.98	3.54	4.32	3.79	3.26	2.37	3.22	3.93	45.00
SAVANNAH, GA	30	3.95	2.92	3.64	3.32	3.61	5.49	6.04	7.20	5.08	3.12	2.40	2.81	49.58
HILO, HI	30	9.74	8.86	14.35	12.54	8.07	7.36	10.71	9.78	9.14	9.64	15.58	10.50	126.27
HONOLULU,HI	30	2.73	2.35	1.89	1.11	0.78	0.43	0.50	0.46	0.74	2.18	2.27	2.85	18.29
KAHULUI, HI	30	3.74	2.36	2.35	1.75	0.66	0.23	0.49	0.53	0.39	1.05	2.17	3.08	18.80
LIHUE, HI	30	4.59	3.26	3.58	3.00	2.87	1.82	2.12	1.91	2.69	4.25	4.70	4.78	39.57
BOISE, ID	30	1.39	1.14	1.41	1.27	1.27	0.74	0.39	0.30	0.76	0.76	1.38	1.38	12.19
LEWISTON, ID	30	1.14	0.95	1.12	1.31	1.56	1.16	0.72	0.75	0.81	0.96	1.21	1.05	12.74
POCATELLO, ID	30	1.14	1.01	1.38	1.18	1.51	0.91	0.70	0.66	0.89	0.97	1.13	1.10	12.58
CHICAGO,IL	30	1.75	1.63	2.65	3.68	3.38	3.63	3.51	4.62	3.27	2.71	3.01	2.43	36.27
MOLINE, IL	30	1.58	1.51	2.92	3.82	4.25	4.63	4.03	4.41	3.16	2.80	2.73	2.20	38.04
PEORIA, IL	30	1.50	1.67	2.83	3.56	4.17	3.84	4.02	3.16	3.12	2.77	2.99	2.40	36.03
ROCKFORD, IL	30	1.41	1.34	2.39	3.62	4.03	4.80	4.10	4.21	3.47	2.57	2.63	2.06	36.63
SPRINGFIELD, IL	30	1.62	1.80	3.15	3.36	4.06	3.77	3.53	3.41	2.83	2.62	2.87	2.54	35.56
EVANSVILLE, IN	30	2.91	3.10	4.29	4.48	5.01	4.10	3.75	3.14	2.99	2.78	4.18	3.54	44.27
FORT WAYNE, IN	30	2.05	1.94	2.86	3.54	3.75	4.04	3.58	3.60	2.81	2.63	2.98	2.77	36.55
INDIANAPOLIS, IN	30	2.48	2.41	3.44	3.61	4.36	4.13	4.42	3.82	2.88	2.76	3.61	3.03	40.95
SOUTH BEND, IN	30	2.27	1.98	2.89	3.62	3.50	4.19	3.73	3.98	3.79	3.27	3.39	3.09	39.70
DES MOINES, IA	30	1.03	1.19	2.21	3.58	4.25	4.57	4.18	4.51	3.15	2.62	2.10	1.33	34.72

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DUBUQUE, IA	30	1.28	1.42	2.57	3.49	4.12	4.08	3.73	4.59	3.56	2.50	2.49	1.69	35.52
SIOUX CITY, IA	30	0.59	0.62	2.00	2.75	3.75	3.61	3.30	2.90	2.42	1.99	1.40	0.66	25.99
WATERLOO, IA	30	0.84	1.05	2.13	3.23	4.15	4.82	4.20	4.08	2.95	2.49	2.10	1.11	33.15
CONCORDIA, KS	30	0.66	0.73	2.35	2.45	4.20	3.95	4.20	3.24	2.50	1.84	1.45	0.86	28.43
DODGE CITY, KS	30	0.62	0.66	1.84	2.25	3.00	3.15	3.17	2.73	1.70	1.45	1.01	0.77	22.35
GOODLAND, KS	30	0.43	0.44	1.20	1.51	3.46	3.30	3.54	2.49	1.12	1.05	0.82	0.40	19.76
TOPEKA, KS	30	0.95	1.18	2.56	3.14	4.86	4.88	3.83	3.81	3.71	2.99	2.31	1.42	35.64
WICHITA, KS	30	0.84	1.02	2.71	2.57	4.16	4.25	3.31	2.94	2.96	2.45	1.82	1.35	30.38
GREATER CINCINNATI AP	30	2.92	2.75	3.90	3.96	4.59	4.42	3.75	3.79	2.82	2.96	3.46	3.28	42.60
JACKSON, KY	30	3.56	3.68	4.38	3.79	5.16	4.67	4.59	4.13	3.77	3.18	4.20	4.27	49.38
LEXINGTON, KY	30	3.34	3.27	4.41	3.67	4.78	4.58	4.81	3.77	3.11	2.70	3.44	4.03	45.91
LOUISVILLE, KY	30	3.28	3.25	4.41	3.91	4.88	3.76	4.30	3.41	3.05	2.79	3.81	3.69	44.54
PADUCAH KY	30	3.47	3.93	4.27	4.95	4.75	4.51	4.45	2.99	3.56	3.45	4.53	4.38	49.24
BATON ROUGE, LA	30	6.19	5.10	5.07	5.56	5.34	5.33	5.96	5.86	4.84	3.81	4.76	5.26	63.08
LAKE CHARLES, LA	30	5.52	3.28	3.54	3.64	6.06	6.07	5.13	4.85	5.95	3.94	4.61	4.60	57.19
NEW ORLEANS, LA	30	5.87	5.47	5.24	5.02	4.62	6.83	6.20	6.15	5.55	3.05	5.09	5.07	64.16
SHREVEPORT, LA	30	4.60	4.21	4.18	4.42	5.25	5.05	3.99	2.71	3.21	4.45	4.68	4.55	51.30
CARIBOU, ME	30	2.97	2.06	2.57	2.64	3.28	3.31	3.89	4.15	3.27	2.99	3.12	3.19	37.44
PORTLAND, ME	30	4.09	3.14	4.14	4.26	3.82	3.28	3.32	3.05	3.37	4.40	4.72	4.24	45.83
BALTIMORE, MD	30	3.47	3.02	3.93	3.00	3.89	3.43	3.85	3.74	3.98	3.16	3.12	3.35	41.94
BLUE HILL, MA	30	4.78	4.06	4.79	4.32	3.79	3.93	3.74	4.06	4.13	4.42	4.64	4.56	51.22
BOSTON, MA	30	3.92	3.30	3.85	3.60	3.24	3.22	3.06	3.37	3.47	3.79	3.98	3.73	42.53
WORCESTER, MA	30	4.07	3.10	4.23	3.92	4.35	4.02	4.19	4.09	4.27	4.67	4.34	3.80	49.05
ALPENA, MI	30	1.76	1.35	2.13	2.31	2.61	2.53	3.17	3.50	2.80	2.33	2.08	1.83	28.40
DETROIT, MI	30	1.91	1.88	2.52	3.05	3.05	3.55	3.16	3.10	3.27	2.23	2.66	2.51	32.89
FLINT, MI	30	1.57	1.35	2.22	3.13	2.74	3.07	3.17	3.43	3.76	2.34	2.65	2.18	31.61
GRAND RAPIDS, MI	30	2.03	1.54	2.59	3.48	3.35	3.67	3.56	3.78	4.28	2.80	3.35	2.70	37.13
HOUGHTON LAKE, MI	30	1.61	1.25	2.05	2.29	2.57	2.93	2.75	3.72	3.11	2.26	2.14	1.75	28.43
LANSING, MI	30	1.61	1.45	2.33	3.09	2.71	3.60	2.68	3.46	3.48	2.29	2.66	2.17	31.53
MARQUETTE, MI	30	2.60	1.85	3.13	2.79	3.07	3.21	3.01	3.55	3.74	3.66	3.27	2.43	36.31
MUSKEGON, MI	30	2.22	1.58	2.36	2.91	2.95	2.58	2.32	3.77	3.52	2.80	3.23	2.64	32.88
SAULT STE. MARIE, MI	30	2.64	1.60	2.41	2.57	2.50	3.00	3.14	3.47	3.71	3.32	3.40	2.91	34.67
DULUTH, MN	30	1.12	0.83	1.69	2.09	2.95	4.25	4.20	4.22	4.13	2.46	2.12	0.94	31.00
INTERNATIONAL FALLS, MN	30	0.84	0.64	0.96	1.38	2.55	3.98	3.37	3.14	3.03	1.98	1.36	0.70	23.93
MINNEAPOLIS-ST.PAUL, MN	30	1.04	0.79	1.86	2.31	3.24	4.34	4.04	4.05	2.69	2.11	1.94	1.00	29.41
ROCHESTER, MN	30	0.94	0.75	1.88	3.01	3.53	4.00	4.61	4.33	3.12	2.20	2.01	1.02	31.40
SAINT CLOUD, MN	30	0.76	0.59	1.50	2.13	2.97	4.51	3.34	3.93	2.93	2.24	1.54	0.69	27.13
JACKSON, MS	30	5.67	4.50	5.74	5.98	4.86	3.82	4.69	3.66	3.23	3.42	5.04	5.34	55.95
MERIDIAN, MS	30	5.92	5.35	6.93	5.62	4.87	3.99	5.45	3.34	3.64	3.28	4.95	5.31	58.65
TUPELO, MS	30	5.14	4.68	6.30	4.94	5.80	4.82	3.65	2.67	3.35	3.38	5.01	6.12	55.86
COLUMBIA, MO	30	1.73	2.20	3.21	4.16	4.87	4.02	3.80	3.75	3.42	3.18	3.47	2.47	40.28
KANSAS CITY, MO	30	1.15	1.31	2.44	3.38	5.39	4.44	4.42	3.54	4.64	3.33	2.30	1.64	37.98
ST. LOUIS, MO	30	2.14	2.28	3.60	3.69	4.11	3.76	3.90	2.98	2.96	2.76	3.71	2.86	38.75
SPRINGFIELD, MO	30	2.11	2.28	3.82	4.31	4.57	5.02	3.56	3.37	4.83	3.47	4.46	3.17	44.97
BILLINGS, MT	30	0.81	0.58	1.12	1.74	2.48	1.89	1.28	0.85	1.34	1.26	0.75	0.67	14.77
GLASGOW, MT	30	0.35	0.26	0.47	0.75	1.72	2.20	1.78	1.25	0.98	0.71	0.39	0.37	11.23
GREAT FALLS, MT	30	0.68	0.51	1.01	1.40	2.53	2.24	1.45	1.65	1.23	0.93	0.59	0.67	14.89
HAVRE, MT	30	0.47	0.36	0.70	0.87	1.84	1.90	1.51	1.20	1.03	0.62	0.45	0.51	11.46
HELENA, MT	30	0.52	0.38	0.63	0.91	1.78	1.82	1.34	1.29	1.05	0.66	0.48	0.46	11.32
KALISPELL, MT	30	1.47	1.15	1.11	1.22	2.04	2.30	1.41	1.25	1.20	0.96	1.45	1.65	17.21

NORMALS 1971-2000	YRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MISSOULA, MT	30	1.06	0.77	0.96	1.09	1.95	1.73	1.09	1.15	1.08	0.83	0.96	1.15	13.82
GRAND ISLAND, NE	30	0.54	0.68	2.04	2.61	4.07	3.72	3.14	3.08	2.43	1.51	1.41	0.66	25.89
LINCOLN, NE	30	0.67	0.66	2.21	2.90	4.23	3.51	3.54	3.35	2.92	1.94	1.58	0.86	28.37
NORFOLK, NE	30	0.57	0.76	1.97	2.59	3.92	4.25	3.74	2.80	2.25	1.72	1.44	0.65	26.66
NORTH PLATTE, NE	30	0.39	0.51	1.24	1.97	3.34	3.17	3.17	2.15	1.32	1.24	0.76	0.40	19.66
OMAHA EPPLEY AP, NE	30	0.77	0.80	2.13	2.94	4.44	3.95	3.86	3.21	3.17	2.21	1.82	0.92	30.22
OMAHA (NORTH), NE	30	0.76	0.77	2.25	3.07	4.57	3.84	3.75	2.93	3.03	2.49	1.67	0.95	30.08
SCOTTSBLUFF, NE	30	0.54	0.58	1.16	1.79	2.70	2.65	2.13	1.19	1.22	1.01	0.80	0.56	16.33
VALENTINE, NE	30	0.30	0.48	1.11	1.97	3.20	3.01	3.37	2.20	1.61	1.22	0.72	0.33	19.52
ELKO, NV	30	1.14	0.88	0.98	0.81	1.08	0.67	0.30	0.36	0.68	0.71	1.05	0.93	9.59
ELY, NV	30	0.74	0.75	1.05	0.90	1.29	0.66	0.60	0.91	0.94	1.00	0.63	0.50	9.97
LAS VEGAS, NV	30	0.59	0.69	0.59	0.15	0.24	0.08	0.44	0.45	0.31	0.24	0.31	0.40	4.49
RENO, NV	30	1.06	1.06	0.86	0.35	0.62	0.47	0.24	0.27	0.45	0.42	0.80	0.88	7.48
WINNEMUCCA, NV	30	0.83	0.62	0.86	0.85	1.06	0.69	0.27	0.35	0.53	0.66	0.80	0.81	8.33
CONCORD, NH	30	2.97	2.36	3.04	3.07	3.33	3.10	3.37	3.21	3.16	3.46	3.57	2.96	37.60
MT. WASHINGTON, NH	30	8.52	7.33	9.42	8.43	8.21	8.36	8.02	8.08	8.55	7.66	10.49	8.84	101.91
ATLANTIC CITY AP, NJ	30	3.60	2.85	4.06	3.45	3.38	2.66	3.86	4.32	3.14	2.86	3.26	3.15	40.59
ATLANTIC CITY C.O.,NJ	30	3.44	2.88	3.79	3.25	3.16	2.46	3.36	4.16	3.02	2.71	2.96	3.18	38.37
NEWARK, NJ	30	3.98	2.96	4.21	3.92	4.46	3.40	4.68	4.02	4.01	3.16	3.88	3.57	46.25
ALBUQUERQUE, NM	30	0.49	0.44	0.61	0.50	0.60	0.65	1.27	1.73	1.07	1.00	0.62	0.49	9.47
CLAYTON, NM	30	0.30	0.27	0.62	0.99	2.08	2.21	2.81	2.69	1.56	0.74	0.54	0.32	15.13
ROSWELL, NM	30	0.39	0.41	0.35	0.58	1.30	1.62	1.99	2.31	1.98	1.29	0.53	0.59	13.34
ALBANY, NY	30	2.71	2.27	3.17	3.25	3.67	3.74	3.50	3.68	3.31	3.23	3.31	2.76	38.60
BINGHAMTON, NY	30	2.58	2.46	2.97	3.49	3.55	3.80	3.49	3.35	3.59	3.02	3.32	3.03	38.65
BUFFALO, NY	30	3.16	2.42	2.99	3.04	3.35	3.82	3.14	3.87	3.84	3.19	3.92	3.80	40.54
ISLIP, NY	30	4.27	3.33	4.76	4.13	3.90	3.71	2.93	4.48	3.39	3.63	3.86	4.13	46.52
NEW YORK C.PARK, NY	30	4.13	3.15	4.37	4.28	4.69	3.84	4.62	4.22	4.23	3.85	4.36	3.95	49.69
NEW YORK (JFK AP), NY	30	3.62	2.70	3.79	3.75	4.13	3.59	3.92	3.64	3.50	3.03	3.48	3.31	42.46
NEW YORK (LAGUARDIA AP), NY		3.56	2.75	3.93	3.68	4.16	3.57	4.41	4.09	3.77	3.26	3.67	3.51	44.36
ROCHESTER, NY	30	2.34	2.04	2.58	2.75	2.82	3.36	2.93	3.54	3.45	2.60	2.84	2.73	33.98
SYRACUSE, NY	30	2.60	2.12	3.02	3.39	3.39	3.71	4.02	3.56	4.15	3.20	3.77	3.12	40.05
ASHEVILLE, NC	30	4.06	3.83	4.59	3.50	4.42	4.38	3.87	4.30	3.72	3.18	3.82	3.40	47.07
CAPE HATTERAS, NC	30	5.84	3.94	4.95	3.29	3.92	3.82	4.95	6.56	5.68	5.31	4.93	4.56	57.75
CHARLOTTE, NC	30	4.00	3.55	4.39	2.95	3.66	3.42	3.79	3.72	3.83	3.66	3.36	3.18	43.51
GREENSBORO-WNSTN-SALM-NC		3.54	3.10	3.85	3.43	3.95	3.53	4.44	3.71	4.30	3.27	2.96	3.06	43.14
RALEIGH, NC	30	4.02	3.47	4.03	2.80	3.79	3.42	4.29	3.78	4.26	3.18	2.97	3.04	43.05
WILMINGTON, NC	30	4.52	3.66	4.22	2.94	4.40	5.36	7.62	7.31	6.79	3.21	3.26	3.78	57.07
BISMARCK, ND	30	0.45	0.51	0.85	1.46	2.22	2.59	2.58	2.15	1.61	1.28	0.70	0.44	16.84
FARGO, ND	30	0.76	0.59	1.17	1.37	2.61	3.51	2.88	2.52	2.18	1.97	1.06	0.57	21.19
GRAND FORKS, ND	30	0.68	0.58	0.89	1.23	2.21	3.03	3.06	2.72	1.96	1.70	0.99	0.55	19.60
WILLISTON, ND	30	0.54	0.39	0.74	1.05	1.88	2.36	2.28	1.48	1.35	0.87	0.65	0.57	14.16
AKRON, OH	30	2.49	2.28	3.15	3.39	3.96	3.55	4.02	3.65	3.43	2.53	3.04	2.98	38.47
CLEVELAND, OH	30	2.48	2.29	2.94	3.37	3.50	3.89	3.52	3.69	3.77	2.74	3.38	3.14	38.71
COLUMBUS, OH	30	2.53	2.20	2.89	3.25	3.88	4.08	4.62	3.72	2.92	2.31	3.19	2.93	38.52
DAYTON, OH	30	2.60	2.29	3.29	4.03	4.17	4.21	3.75	3.49	2.65	2.72	3.30	3.08	39.58
MANSFIELD, OH	30	2.63	2.17	3.36	4.17	4.42	4.52	4.23	4.60	3.44	2.68	3.76	3.26	43.24
TOLEDO, OH	30	1.93	1.88	2.62	3.24	3.14	3.80	2.80	3.19	2.84	2.35	2.78	2.64	33.21
YOUNGSTOWN, OH	30	2.34	2.03	3.05	3.33	3.45	3.91	4.10	3.43	3.89	2.46	3.07	2.96	38.02
OKLAHOMA CITY, OK	30	1.28	1.56	2.90	3.00	5.44	4.63	2.94	2.48	3.98	3.64	2.11	1.89	35.85
TULSA, OK	30	1.60	1.95	3.57	3.95	6.11	4.72	2.96	2.85	4.76	4.05	3.47	2.43	42.42

NORMALS 1971-2000	YRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
ASTORIA, OR	30	9.62	7.87	7.37	4.93	3.28	2.57	1.16	1.21	2.61	5.61	10.50	10.40	67.13
BURNS,OR	30	1.18	1.11	1.24	0.85	1.05	0.66	0.40	0.45	0.50	0.72	1.11	1.30	10.57
EUGENE, OR	30	7.65	6.35	5.80	3.66	2.66	1.53	0.64	0.99	1.54	3.35	8.44	8.29	50.90
MEDFORD, OR	30	2.47	2.10	1.85	1.31	1.21	0.68	0.31	0.52	0.78	1.31	2.93	2.90	18.37
PENDLETON, OR	30	1.45	1.22	1.26	1.13	1.22	0.78	0.41	0.56	0.63	0.99	1.63	1.48	12.76
PORTLAND, OR	30	5.07	4.18	3.71	2.64	2.38	1.59	0.72	0.93	1.65	2.88	5.61	5.71	37.07
SALEM, OR	30	5.84	5.09	4.17	2.76	2.13	1.45	0.57	0.68	1.43	3.03	6.39	6.46	40.00
SEXTON SUMMIT, OR	30	4.71	4.29	3.92	2.38	1.35	0.94	0.35	0.61	1.20	2.93	5.32	5.18	33.18
ALLENTOWN, PA	30	3.50	2.75	3.56	3.49	4.47	3.99	4.27	4.35	4.37	3.33	3.70	3.39	45.17
ERIE, PA.	30	2.53	2.28	3.13	3.38	3.34	4.28	3.28	4.21	4.73	3.92	3.96	3.73	42.77
HARRISBURG, PA	30	3.18	2.88	3.58	3.31	4.60	3.99	3.21	3.24	3.65	3.06	3.53	3.22	41.45
MIDDLETOWN/HARRISBURG APT		3.18	2.88	3.58	3.31	4.60	3.99	3.21	3.24	3.65	3.06	3.53	3.22	41.45
PHILADELPHIA, PA	30	3.52	2.74	3.81	3.49	3.89	3.29	4.39	3.82	3.88	2.75	3.16	3.31	42.05
PITTSBURGH, PA	30	2.70	2.37	3.17	3.01	3.80	4.12	3.96	3.38	3.21	2.25	3.02	2.86	37.85
AVOCA, PA	30	2.46	2.08	2.69	3.28	3.69	3.97	3.74	3.10	3.86	3.02	3.12	2.55	37.56
WILLIAMSPORT, PA	30	2.85	2.61	3.21	3.49	3.79	4.45	4.08	3.38	3.98	3.19	3.62	2.94	41.59
BLOCK IS.,RI	30	3.68	3.04	3.99	3.72	3.40	2.77	2.62	3.00	3.19	3.04	3.77	3.57	39.79
PROVIDENCE, RI	30	4.37	3.45	4.43	4.16	3.66	3.38	3.17	3.90	3.70	3.69	4.40	4.14	46.45
CHARLESTON AP,SC	30	4.08	3.08	4.00	2.77	3.67	5.92	6.13	6.91	5.98	3.09	2.66	3.24	51.53
CHARLESTON C.O.,SC	30	3.62	2.62	3.83	2.44	2.77	4.96	5.50	6.54	6.13	3.02	2.18	2.78	46.39
COLUMBIA, SC	30	4.66	3.84	4.59	2.98	3.17	4.99	5.54	5.41	3.94	2.89	2.88	3.38	48.27
GREENV'L-SPARTANB'RG AP, SC		4.41	4.24	5.31	3.54	4.59	3.92	4.65	4.08	3.97	3.88	3.79	3.86	50.24
ABERDEEN, SD	30	0.48	0.48	1.34	1.83	2.69	3.49	2.92	2.42	1.81	1.63	0.75	0.38	20.22
HURON, SD	30	0.49	0.57	1.67	2.29	3.00	3.28	2.86	2.07	1.80	1.59	0.89	0.39	20.90
RAPID CITY, SD	30	0.37	0.46	1.03	1.86	2.96	2.83	2.03	1.61	1.10	1.37	0.61	0.41	16.64
SIOUX FALLS, SD	30	0.51	0.51	1.81	2.65	3.39	3.49	2.93	3.01	2.58	1.93	1.36	0.52	24.69
BRISTOL-JOHNSON CTY TN	30	3.52	3.40	3.91	3.23	4.32	3.89	4.21	3.00	3.08	2.30	3.08	3.39	41.33
CHATTANOOGA, TN	30	5.40	4.85	6.19	4.23	4.28	3.99	4.73	3.59	4.31	3.26	4.88	4.81	54.52
KNOXVILLE, TN	30	4.57	4.01	5.17	3.99	4.68	4.04	4.71	2.89	3.04	2.65	3.98	4.49	48.22
MEMPHIS, TN	30	4.24	4.31	5.58	5.79	5.15	4.30	4.22	3.00	3.31	3.31	5.76	5.68	54.65
NASHVILLE, TN	30	3.97	3.69	4.87	3.93	5.07	4.08	3.77	3.28	3.59	2.87	4.45	4.54	48.11
OAK RIDGE,TN	30	5.13	4.50	5.72	4.32	5.14	4.64	5.16	3.39	3.75	3.02	4.86	5.42	55.05
ABILENE, TX	30	0.97	1.13	1.41	1.67	2.83	3.06	1.70	2.63	2.91	2.90	1.30	1.27	23.78
AMARILLO, TX	30	0.63	0.55	1.13	1.33	2.50	3.28	2.68	2.94	1.88	1.50	0.68	0.61	19.71
AUSTIN/CITY, TX	30	1.89	1.99	2.14	2.51	5.03	3.81	1.97	2.31	2.91	3.97	2.68	2.44	33.65
AUSTIN/BERGSTROM, TX	30	2.21	2.02	2.36	2.63	5.12	3.42	2.03	2.51	2.88	3.99	3.02	2.53	34.72
BROWNSVILLE, TX	30	1.36	1.18	0.93	1.96	2.48	2.93	1.77	2.99	5.31	3.78	1.75	1.11	27.55
CORPUS CHRISTI, TX	30	1.62	1.84	1.74	2.05	3.48	3.53	2.00	3.54	5.03	3.94	1.74	1.75	32.26
DALLAS-FORT WORTH, TX 30		1.90	2.37	3.06	3.20	5.15	3.23	2.12	2.03	2.42	4.11	2.57	2.57	34.73
DALLAS-LOVE FIELD, TX	30	1.89	2.31	3.13	3.46	5.30	3.92	2.43	2.17	2.65	4.65	2.61	2.53	37.05
DEL RIO, TX	30	0.57	0.96	0.96	1.71	2.31	2.34	2.02	2.16	2.06	2.00	0.96	0.75	18.80
EL PASO, TX	30	0.45	0.39	0.26	0.23	0.38	0.87	1.49	1.75	1.61	0.81	0.42	0.77	9.43
GALVESTON, TX	30	4.08	2.61	2.76	2.56	3.70	4.04	3.45	4.22	5.76	3.49	3.64	3.53	43.84
HOUSTON, TX	30	3.68	2.98	3.36	3.60	5.15	5.35	3.18	3.83	4.33	4.50	4.19	3.69	47.84
LUBBOCK, TX	30	0.50	0.71	0.76	1.29	2.31	2.98	2.13	2.36	2.57	1.70	0.71	0.67	18.69
MIDLAND-ODESSA, TX	30	0.53	0.58	0.42	0.73	1.79	1.71	1.89	1.77	2.31	1.77	0.65	0.65	14.80
PORT ARTHUR, TX	30	5.69	3.35	3.75	3.84	5.83	6.58	5.23	4.85	6.10	4.67	4.75	5.25	59.89
SAN ANGELO, TX	30	0.82	1.18	0.99	1.60	3.09	2.52	1.10	2.05	2.95	2.57	1.10	0.94	20.91

NORMALS 1971-2000	YRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
SAN ANTONIO, TX	30	1.66	1.75	1.89	2.60	4.72	4.30	2.03	2.57	3.00	3.86	2.58	1.96	32.92
VICTORIA, TX	30	2.44	2.04	2.25	2.97	5.12	4.96	2.90	3.05	5.00	4.26	2.64	2.47	40.10
WACO, TX	30	1.90	2.43	2.48	2.99	4.46	3.08	2.23	1.85	2.88	3.67	2.61	2.76	33.34
WICHITA FALLS, TX	30	1.12	1.58	2.27	2.62	3.92	3.69	1.58	2.39	3.19	3.11	1.68	1.68	28.83
MILFORD, UT	30	0.73	0.77	1.21	0.99	0.94	0.44	0.76	1.04	0.92	1.12	0.77	0.58	10.27
SALT LAKE CITY, UT	30	1.37	1.33	1.91	2.02	2.09	0.77	0.72	0.76	1.33	1.57	1.40	1.23	16.50
BURLINGTON, VT	30	2.22	1.67	2.32	2.88	3.32	3.43	3.97	4.01	3.83	3.12	3.06	2.22	36.05
LYNCHBURG, VA	30	3.54	3.10	3.83	3.46	4.11	3.79	4.39	3.41	3.88	3.39	3.18	3.23	43.31
NORFOLK, VA	30	3.93	3.34	4.08	3.38	3.74	3.77	5.17	4.79	4.06	3.47	2.98	3.03	45.74
RICHMOND, VA	30	3.55	2.98	4.09	3.18	3.96	3.54	4.67	4.18	3.98	3.60	3.06	3.12	43.91
ROANOKE, VA	30	3.23	3.08	3.84	3.61	4.24	3.68	4.00	3.74	3.85	3.15	3.21	2.86	42.49
OLYMPIA, WA	30	7.54	6.17	5.29	3.58	2.27	1.78	0.82	1.10	2.03	4.19	8.13	7.89	50.79
QUILLAYUTE, WA	30	13.65	12.35	10.98	7.44	5.51	3.50	2.34	2.67	4.15	9.81	14.82	14.50	101.72
SEATTLE C.O., WA	30	5.24	4.09	3.92	2.75	2.03	1.55	0.93	1.16	1.61	3.24	5.67	6.06	38.25
SEATTLE SEA-TAC AP, WA	30	5.13	4.18	3.75	2.59	1.78	1.49	0.79	1.02	1.63	3.19	5.90	5.62	37.07
SPOKANE, WA	30	1.82	1.51	1.53	1.28	1.60	1.18	0.76	0.68	0.76	1.06	2.24	2.25	16.67
WALLA WALLA WA	30	2.25	1.97	2.20	1.83	1.95	1.15	0.73	0.84	0.83	1.77	2.85	2.51	20.88
YAKIMA, WA	30	1.17	0.80	0.70	0.53	0.51	0.62	0.22	0.36	0.39	0.53	1.05	1.38	8.26
BECKLEY, WV	30	3.23	2.96	3.63	3.43	4.39	3.92	4.78	3.45	3.23	2.64	2.88	3.09	41.63
CHARLESTON, WV	30	3.25	3.19	3.90	3.25	4.30	4.09	4.86	4.11	3.45	2.67	3.66	3.32	44.05
ELKINS, WV	30	3.43	3.20	3.92	3.53	4.77	4.61	4.84	4.26	3.83	2.86	3.42	3.44	46.11
HUNTINGTON, WV	30	3.21	3.09	3.83	3.33	4.41	3.88	4.46	3.88	2.80	2.73	3.32	3.37	42.31
GREEN BAY, WI	30	1.21	1.01	2.06	2.56	2.75	3.43	3.44	3.77	3.11	2.17	2.27	1.41	29.19
LA CROSSE, WI	30	1.19	0.99	2.00	3.38	3.38	4.00	4.25	4.28	3.40	2.16	2.10	1.23	32.36
MADISON, WI	30	1.25	1.28	2.28	3.35	3.25	4.05	3.93	4.33	3.08	2.18	2.31	1.66	32.95
MILWAUKEE, WI	30	1.85	1.65	2.59	3.78	3.06	3.56	3.58	4.03	3.30	2.49	2.70	2.22	34.81
CASPER, WY	30	0.58	0.64	0.90	1.52	2.38	1.43	1.29	0.73	0.98	1.14	0.82	0.62	13.03
CHEYENNE, WY	30	0.45	0.44	1.05	1.55	2.48	2.12	2.26	1.82	1.43	0.75	0.64	0.46	15.45
LANDER, WY	30	0.52	0.54	1.24	2.07	2.38	1.15	0.84	0.57	1.14	1.37	0.99	0.61	13.42
SHERIDAN, WY	30	0.77	0.57	1.00	1.77	2.41	2.02	1.11	0.80	1.38	1.41	0.80	0.68	14.72
GUAM, PC	30	5.58	5.11	4.24	4.16	6.39	6.28	11.66	16.17	13.69	11.88	9.34	6.11	100.61
JOHNSTON ISLAND, PC	30	1.64	1.29	2.01	1.86	1.14	0.87	1.40	2.07	2.46	2.78	4.78	2.70	25.00
KOROR, PC	30	11.20	9.65	8.79	9.45	11.27	17.54	16.99	14.47	11.65	13.41	11.62	12.33	148.37
KWAJALEIN, MARSHALL IS., PC		5.12	3.73	3.82	7.63	8.62	8.86	10.24	10.42	11.82	11.46	10.74	7.94	100.40
MAJURO, MARSHALL IS, PC	30	8.09	6.86	8.43	11.30	11.53	11.09	12.41	11.95	11.96	13.73	12.81	11.50	131.66
PAGO PAGO, AMER SAMOA, PC		14.02	12.14	11.15	11.16	10.43	5.94	5.76	6.43	7.36	10.03	11.16	13.38	118.96
POHNPEI, CAROLINE IS., PC	30	12.52	9.78	13.96	16.94	19.41	17.06	16.72	16.37	14.94	16.30	14.74	15.87	184.61
CHUUK, E. CAROLINE IS., PC	30	8.58	8.77	8.15	10.94	11.29	12.82	12.45	15.09	13.12	10.69	11.09	10.98	133.97
WAKE ISLAND, PC	30	1.40	1.89	2.38	2.11	1.70	1.95	3.44	5.62	4.82	4.27	2.78	1.87	34.23
YAP, W CAROLINE IS., PC	30	7.24	5.45	6.14	5.58	8.15	13.46	13.25	14.41	13.53	12.25	8.82	9.34	117.62
SAN JUAN, PR	30	3.02	2.30	2.14	3.71	5.29	3.52	4.16	5.22	5.60	5.06	6.17	4.57	50.76