AFB/PPRC.16/6
29 March 2015

Adaptation Fund Board
Project and Programme Review Committee
Sixteenth Meeting
Bonn, Germany, 7-8 April 2015

Agenda Item 6 b)

PROPOSAL FOR FEDERATED STATES OF MICRONESIA

Background

1. The Operational Policies and Guidelines (OPG) for Parties to Access Resources from the Adaptation Fund (the Fund), adopted by the Adaptation Fund Board (the Board), state in paragraph 45 that regular adaptation project and programme proposals, i.e. those that request funding exceeding US$ 1 million, would undergo either a one-step, or a two-step approval process. In case of the one-step process, the proponent would directly submit a fully-developed project proposal. In the two-step process, the proponent would first submit a brief project concept, which would be reviewed by the Project and Programme Review Committee (PPRC) and would have to receive the endorsement of the Board. In the second step, the fully-developed project/programme document would be reviewed by the PPRC, and would ultimately require the Board's approval.

2. The Templates approved by the Board (OPG, Annex 4) do not include a separate template for project and programme concepts but provide that these are to be submitted using the project and programme proposal template. The section on Adaptation Fund Project Review Criteria states:

> *For regular projects using the two-step approval process, only the first four criteria will be applied when reviewing the 1st step for regular project concept. In addition, the information provided in the 1st step approval process with respect to the review criteria for the regular project concept could be less detailed than the information in the request for approval template submitted at the 2nd step approval process. Furthermore, a final project document is required for regular projects for the 2nd step approval, in addition to the approval template.*

3. The first four criteria mentioned above are:
   1. Country Eligibility,
   2. Project Eligibility,
   3. Resource Availability, and
   4. Eligibility of NIE/MIE.

4. The fifth criterion, applied when reviewing a fully-developed project document, is:
   5. Implementation Arrangements.

5. It is worth noting that since the twenty-second Board meeting, the Environmental and Social (E&S) Policy of the Fund was approved and consequently compliance with the Policy has been included in the review criteria both for concept documents and fully-developed project documents. The proposals template was revised as well, to include sections requesting demonstration of compliance of the project/programme with the E&S Policy.

6. In its seventeenth meeting, the Board decided (Decision B.17/7) to approve "Instructions for preparing a request for project or programme funding from the Adaptation Fund", contained in the Annex to document AFB/PPRC.8/4, which further outlines applicable review criteria for both concepts and fully-developed proposals. The latest version of this document was launched in conjunction with the revision of the Operational Policies and Guidelines in November 2013.

7. Based on the Board Decision B.9/2, the first call for project and programme proposals was issued and an invitation letter to eligible Parties to submit project and programme proposals to the Fund was sent out on April 8, 2010.

8. According to the Board Decision B.12/10, a project or programme proposal needs to be received by the secretariat no less than nine weeks before a Board meeting, in order to be considered by the Board in that meeting.

9. The following project concept titled “Enhancing the Resilience of Vulnerable Island Atoll Communities in FSM to Climate Change Risks through a "Living with the Sea" National Risk Management Framework” was submitted by the Secretariat of the Pacific Regional Environment Programme, which is an accredited Regional Implementing Entity of the Adaptation Fund. This is the second submission of the project concept. It was first submitted as a project concept, using the two-step approval process, for the twenty-third Board meeting, and the Board decided to:

(a) *Not endorse the project concept, as supplemented by the clarification response provided by the Secretariat of the Pacific Regional Environment Programme (SPREP) to the request made by the technical review;*

(b) *Suggest that SPREP reformulate the proposal taking into account the observations in the review sheet annexed to the notification of the Board’s decision, as well as the following issues:*

(i) The proposal should provide a clear and reasoned explanation of how the range of adaptation planning measures including plans, policies, regulations, guidelines, standards and protocols will be enforced in the Federated States of Micronesia given the apparent barriers to enforcement of the current policy and regulatory framework;

(ii) The proposal should provide a logical justification of how the proposed project activities have been selected based on adaptation reasoning. It should demonstrate how the proposed engineering works to protect the coast provide resilience to communities with regards to their vulnerability to future climate change, and how these investments themselves are made resilient to the impacts of future climate change;

(iii) The proposal should account for the need to undertake an Environmental Impact Assessment to provide assurances that potential negative impacts of infrastructure works have been adequately considered, that potential maladaptation has been avoided to the extent possible and that provisions are in place for an environmental and social management plan for the relevant activities that would require risk mitigation and monitoring during project execution;

(iv) The proposal should avoid confusion with regards to the implementation of the project, such as references to the United Nations Development Programme (UNDP) Country Office being engaged in monitoring and evaluation of the project, the use of auditing in line with UNDP finance regulations, and oversight and technical support being delivered by UNDP for the implementation of the project. As the accredited implementing entity acting on behalf of the Federated States of Micronesia, SPREP’s roles and responsibilities for the implementation of the project must be reflected in the proposal; and

(c) *Request SPREP to transmit the observations referred to in paragraph (b) above to the Government of the Federated States of Micronesia.*

(Decision B.23/10)

10. The present submission was received by the secretariat in time to be considered in the twenty-fifth Board meeting. The secretariat carried out a technical review of the project proposal, assigned it the diary number FSM/RIE/Coastal/2014/1, and completed a review sheet.

11. In accordance with a request to the secretariat made by the Board in its 10th meeting, the secretariat shared this review sheet with SPREP, and offered it the opportunity of providing responses before the review sheet was sent to the PPRC.

12. The secretariat is submitting to the PPRC the summary and, pursuant to decision B.17/15, the final technical review of the project, both prepared by the secretariat, along with the final submission of the proposal in the following section.

Project Summary

Federated States of Micronesia – Enhancing the Resilience of Vulnerable Island Atoll Communities in FSM to Climate Change Risks through a "Living with the Sea" National Risk Management Framework

Implementing Entity: SPREP
Project/Programme Execution Cost: USD 450,000
Total Project/Programme Cost: USD 7,650,000
Implementing Fee: USD 266,175
Financing Requested: USD 8,967,600

Programme Background and Context:

The proposed project seeks to engineer a shift in the management of flood risk and marine resources from an ad hoc problem centric approach to a holistic strategic coastal management and watershed drainage management approach. The specific objectives aim to: prepare institutional and regulatory frameworks, policies and guidance; build long-term coastal community relocation planning into state-wide land use and marine management policies; introduce including soft coastal engineering techniques, climate resilient planting techniques and groundwater protection techniques; preparing Shoreline Management Plans for Yap, Chuuk and Pohnpei with each defining sets of maintenance targets and integrating recurrent and capital expenditures; implement transitional planning projects on the island of Kosrae to help deliver the Shoreline Development Plan and provide communities with the infrastructure to migrate away from high risk coastal inundation regions.

Component 1: Strengthening national institution and capacity development measures to support delivery of climate resilient costal management in FSM ("Living with the sea")
(US$ 1,385,000)

Component 1 will support all four states in FSM in preparing suitable regulatory and institutional frameworks to support the decision making of sustainable coastal management in a way that embraces the lessons learnt from demonstration activities carried out in Kosrae (2010-2014). The Component shall particularly focus on improving the connectivity between state legislation and national law with regard to climate change implementation. A formal approach to addressing these two issues will be integrated in the existing National Policy for Climate Change, and a separate information management tool to assist evidence-based decision making systems will be developed along with the necessary technical capacity building. Specific activities include: legal and regulatory enforcement support for climate resilient coastal and marine management for each FSM State; preparation of policy guidelines for each state to help deliver the "Living with the Sea" approach; establish road and building standards for each state; institutional reform and capacity development; the establishment of a knowledge and information system and the establishment of performance measurement procedures.

Component 2: Practical intervention support for the states of Yap, Chuuk and Pohnpei to implement climate resilient coastal management ("Living with the sea") (US$ 3,075,000)

Component 2 will provide technical and administrative assistance to the States of Yap, Chuuk and Pohnpei to help deliver climate resilient coastal management in the immediate and longer term. The Component will help establish the technical evidence base and associated regulatory structures necessary to create the future pathway for State wide coastal resilience in light of

climate change. Specific activities include: piloting sustainable “low cost” coastal adaptation options (incorporating food security and water resource management) in each state; training programmes on the coastal development and environmental policy guidance and state-specific roads and building standard for each state; and education and awareness programmes.

Component 3: Kosrae Shoreline Management Plan: priority measures (US$ 3,145,000)

This Component focuses specifically on the recommended implementation tasks that the State of Kosrae (through the Governors requests and SMP recommendations) has prioritized. The road infrastructure interventions reflect the state wide needs as identified in the endorsed SMP for Kosrae and the approaches already adopted as part of the Pacific Adaptation to Climate Change Pilot initiative that has taken place between 2011 and 2014. The specific activities include: maintenance coastal protection projects; a new road section construction plus access routes to the two villages; new capital coast protection schemes; community engagement and flood resilience programmes and education and awareness training.

ADAPTATION FUND BOARD SECRETARIAT TECHNICAL REVIEW OF PROJECT/PROGRAMME PROPOSAL

PROJECT/PROGRAMME CATEGORY: Regular-sized Project Concept

Country/Region: **Federated States of Micronesia (Micronesia)**
Project Title: **Enhancing the resilience of vulnerable island atoll communities in FSM to climate change risks through a "Living with the Sea" national risk management framework**
AF Project ID: **FSM/RIE/Coastal/2014/1**
NEI/MEI Project ID:
Requested Financing from Adaptation Fund (US Dollars): **8,967,600**
Reviewer and contact person: **Hugo Remaury**
Co-reviewer(s): **Daouda Ndiaye**
IE ContactPerson: **Espen Ronneberg**

Review Criteria	Questions	AF Comments 23 Feb	AF comments 13 Mar
Country Eligibility	1. Is the country party to the Kyoto Protocol?	Yes. Signature: 17 March 1998 Ratification : 21 June 1999 Entry into force : 16 February 2005	
	2. Is the country a developing country particularly vulnerable to the adverse effects of climate change?	Yes. **CR 1**: It would be useful to be further document the document by providing information on specific studies and climate change risks scenarios for FSM.	**CR1**. Addressed. These relevant information would need to be included in an updated project document.
Project Eligibility	1. Has the designated government authority for the Adaptation Fund endorsed the project/programme?	Yes, letter dated 10th of February 2015, signed by the DA (Hon. Lorin S. Robert, Secretary (Minister) of Foreign Affairs)	
	2. Does the project / programme support concrete adaptation actions to assist the country in addressing adaptive capacity to the adverse effects of climate change and build in	To a certain extent. **CR 2**: Please demonstrate how the project strategy will make sure that the proposed plans, policies, regulations, guidelines, standards	**CR 2**. Addressed. These information will need to be updated into the new document.

	climate resilience?	and protocols will yield the expected outcomes and support, as best possible, in enforcing these rules and regulations.	
		CR 3: Please demonstrate that the most vulnerable local communities have been consulted and have identified the road infrastructure proposed in component 3 as a priority intervention for providing their communities with adaptation benefits.	**CR 3**. Partly addressed. The scope of the consultative process that took place in local communities look rather small (7 potential beneficiaries'' households have been interviewed). It is thus unclear if local communities, including land users, consider this road as an adaptation priority, and are supportive of this infrastructure. See CR 11.
		CR 4: Please discuss how investments under output 3.1 and output 3.2 component 3 will provide resilience to future climate change, and how these	**CR 4**. Not addressed. According to the additional information provided, the suggested road investment under output 3.1 will

		investments themselves will be made resilient to future climate change. **CR 5**. Output 1.5: Could you provide additional information on	rest upon the results and findings of the ADB's PPCR CBA currently being undertaken. This situation makes it difficult for the AF to assess the legitimacy of the proposed project and to make a funding decision, as such study may bring key insights on the relevance, soundness, resilience and feasibility of such investment. At fully developed proposal, it would be useful to provide, to best extent possible, a strategy about how investments under output 3.2. will be sustained overtime. Finally, the proposal still does not discuss how the proposed investments themselves will be made resilient to future climate change. **CR 5**. Addressed. These relevant information would need to be included in an updated project document.

		the tasks that will be implemented to ensure that the main objective of this output is met?	
	3. Does the project / programme provide economic, social and environmental benefits, particularly to vulnerable communities, including gender considerations, while avoiding or mitigating negative impacts, in compliance with the Environmental and Social Policy of the Fund?	Yes, the proposed project has the potential to provide benefits to vulnerable communities. However, some questions persist as for the potential impacts of the project on involuntary resettlements and protection of natural habitats, as highlighted in the CR in section 13.	
	4. Is the project / programme cost effective?	Somewhat. **CR 6**. Please clarify how the proposed infrastructural investments have been chosen amongst potential alternatives, and how the decision analysis have led to the prioritization of the proposed activities.	**CR 6**. Partially addressed. Further evidence are needed to clarify how the road infrastructure investment has been selected as a priority investment amongst potential future adaptation options within local communities. Furthermore, as the participation of potential beneficiaries (communities) remains unclear, it remains uncertain that they consider such investment as a priority.
	5. Is the project / programme consistent with national or sub-national sustainable development strategies, national or sub-national development plans, poverty reduction strategies, national communications and adaptation programs of action	Yes, the project is consistent with the relevant legislation discussed in the proposal. The *Nationwide Climate Change Policy (2009)* includes a commitment to addressing climate change adaptation through a framework in which: “all development activities in FSM to take into account	

	and other relevant instruments?	projected climatic changes in the design and implementation as stipulated in the FSM Strategic Development Plan/Infrastructure Development Plan." This has now been replaced by the *Nationwide Integrated Disaster Risk Management and Climate Change Policy (2013).*	
	6. Does the project / programme meet the relevant national technical standards, where applicable, in compliance with the Environmental and Social Policy of the Fund??	Yes, however more information are needed concerning the EIA legislation and technical standards that will apply. **CR 7**. Please demonstrate the extent to which the EIA will be enforced for the activities proposed, and provide an update on the EIA legislation in FSM highlighting how the relevant standards will be applied through the implementation of the proposed project.	**CR 7**. Addressed. Please update the project document accordingly.

		CR 8. Please clarify what relevant technical standards (can be internationals if nationals do not exist yet) will be used where applicable in the proposed project.	**CR 8**. Addressed. Please update the project proposal accordingly, and provide more details on the listed guidelines and standards mentioned as answers to CR 8.
	7. Is there duplication of project / programme with other funding sources?	**CR. 9**. Please update information on the GCCA project and explain how the proposed project will seek synergies and avoid duplication and clarify how the project will avoid duplication of activities related to the establishment of a knowledge and information system with the PPCR-funded programme.	**CR 9**. Mostly addressed. Potential synergies that the project will develop with existing initiatives and strategy to avoid duplication will need to be further developed at fully developed proposal stage, as for instance, the CBA of output 3.1 is not mentioned in the proposal.

	8. Does the project / programme have a learning and knowledge management component to capture and feedback lessons?	Yes. **CR 10**. Can you please describe the process that will allow lessons to be systematically captured, before project staff document them with the support of the CTA?	**CR 10**. Addressed.
	9. Has a consultative process taken place, and has it involved all key stakeholders, and vulnerable groups, including gender considerations?	Yes, however the scope of this process needs to be further described. **CR 11**. Please describe in what extent the following stakeholders have been consulted, including proof of gender considerations, and evidences about the extent to which they support the implementation of the proposed solutions: - direct beneficiaries and local communities of this project, notably marginally vulnerable groups living in the targeted areas; - stakeholders responsible for land/costal management; - land users and land owners; - private sectors (including construction sector); - Universities/research centres.	**CR 11**. Partially addressed. The fully developed proposal should encompass a consultative process specific to the proposed project. Such comprehensive consultation process should involve all direct and indirect stakeholders of the project/programme (notably those mentioned under CR 11), including vulnerable groups and taking into account gender considerations. A particular attention should be given to minority groups, marginalized and vulnerable groups, and indigenous people in the project/programme target areas, where relevant. The results of the consultative process must be reflected in the project design.
	10. Is the requested financing justified on the basis of full cost of adaptation reasoning?	**CR 12**. As there are currently a wide range of initiatives that includes activities that have a close link with the proposed	**CR 12**. Mostly addressed. The information provided demonstrates the existence of a coordination framework

		project, it seems relevant to outline how the project will deliver its outcomes and outputs, regardless of the success of these other projects.	orchestrated by SPREP. However some information provided, such as the fact that the CBA analysis of the road investment is being undertaken by the PPCR project, outlines that there might be areas where other initiatives may have linkages with the proposed project. Consequently, the proposal should demonstrate further how the proposed project will deliver its outcomes and outputs regardless of such initiatives outside the range of AF.
	11. Is the project / program aligned with AF's results framework?	No. **CR 13**. The alignment table is not properly completed as it does not include AF outcome or output indicators. Please update the document accordingly.	**CR 13**. Addressed.
	12. Has the sustainability of the project/programme outcomes been taken into account when designing the project?	Yes, but additional information are needed as for the rationality of the reasoning provided. **CR 14**. The proposal suggests that the local capacity that will be built will demonstrate "*that in the FSM context, communities can maintain the physical constructions*". Please describe in more details the rationale for this assumption, by for example providing examples of previously experiences, and highlight what capacity gaps had been overcome in such cases to	**CR 14**. Not addressed. The strong support from the government in sustaining the project outcomes has been highlighted as a key driver of long-term sustainability. The support from communities is also described as a key aspect of sustaining and maintaining the proposed investments. However, since the involvements of communities, described as a pillar of the sustainability strategy, in selecting and prioritizing the proposed investments remains

		allow community maintenance of infrastructure, and how the project sustainability strategy will build upon these lessons learned.	vague, there are no evidence that of communities' willingness in sustaining the investments, as their overall support to the proposed project is not demonstrated.
	13. Does the project / programme provide an overview of environmental and social impacts / risks identified?	No. **CR 15**. The risks table under section K (p. 49) concludes that for none of the 15 principles of the ESP further assessment or management inputs are required. This is inconsistent with the programme approach under which for each sub-project the environmental and social risks remain to be identified and assessed as needed. For example, the table states that no further assessment is required for compliance with the principle on involuntary resettlement but at the same time the possibility and modalities of coastal village relocation are discussed. Another example is on compliance with the principle on protection of natural habitats - no further assessment is said to be required since habitat protection is at the forefront of the programme. Yet, the largest programme activity that also already has been identified - the new road construction in Kosrae -	**CR 15**. Not addressed. The actions requested under the initial CR 15 need to be addressed as early as concept stage. **CR 16**. Not addressed. The actions requested under the initial CR 16 need to be addressed as early as concept stage.

		is located in what appear to be forested areas and will have an impact on these natural habitats. Please demonstrate in a rational way the proposed project compliance with the environmental and social principles as outlined in the ESP, including how relevant standards will be applied through the project implementation, when applicable. Further assessment is notably required for principles on access and equity, marginalized and vulnerable groups, gender equity and women's empowerment, indigenous peoples (it doesn't state that there is none), involuntary resettlement, protection of natural habitats, physical and cultural heritage and land and soil conservation. As a number of EIAs (and/or ESIAs) are to be prepared during the project implementation, an ESMP will be requested at the full proposal stage. **CR 16**. Please categorize the proposed programme in line with the ESP (A, B or C).	
Resource Availability	1. Is the requested project / programme funding within the cap of the country?	Yes.	
	2. Is the Implementing Entity Management Fee at or below 8.5 per cent of the total	Yes. **CR 17**: Please clarify the	**CR 17**. Not addressed. The actions requested under the initial

	project/programme budget before the fee?	reasoning behind the budget allocation to “Project Cycle Management Fee charged by the national government”. According to the AF guidelines, only implementing entities can charge the budget with fees, not national governments.	CR 17 need to be taken into account in an updated version of the project document.
	3. Are the Project/Programme Execution Costs at or below 9.5 per cent of the total project/programme budget (including the fee)?	Yes.	
Eligibility of IE	4. Is the project/programme submitted through an eligible Implementing Entity that has been accredited by the Board?	Yes.	
Implementation Arrangements	1. Is there adequate arrangement for project / programme management?	**CR 18**. Please clarify the following sentence: “SPREP will be engaged, through single source selection, to manage the program. As such, SPREP will have responsibility for the daily management of program implementation and for providing the required technical advice for the project. SPREP will also manage and administer studies and surveys, training programs, workshops, and conferences, including subcontracting service providers such as academic and training institutions, NGOs, and community-based organizations as necessary.”	**CR 18**. Not addressed. According to the additional information provided, SPREP is likely to provide direct services to the project, and will thus be defined as an executing entity. As a result, the proposal should clarify in a non-evasive way the role it will have in implementing the proposed project. In the case that SPREP intends to serve both as the executing entity and the implementing entity, SPREP should provide a letter from the government requesting direct services support and providing appropriate justification for such a request. In such case, the

		It should be clarified whether SPREP will act only as an IE or if it will also act as an EE (hence using the $450,000 execution costs). The letter of endorsement does not refer to SPREP as an EE, but OEEM. As a reminder, and as per the AF operational policies and guidelines, when an entity intends to serve both as the implementing entity and the executing entity for a project/programme, the execution costs are capped at 1.5% of the total budget requested, before the implementing entity fees. **CR 19**. Please clarify the services that SPREP will provide to the OEEM, as they are not listed in annex G unlike stated. Similarly, please clarify what stakeholders will be part of the Project Board, as there is no mention of this in Part II/Section H, unlike stated. **CR 20**. Please confirm that the Project Implementation unit will be located within the OEEM, as there may be a typo in the document, paragraph 5, page 52.	execution costs to be claimed by SPREP for its services are capped at 1.5% of the total budget requested, before the implementing entity fees. **CR 19.** Not addressed. Please refer to CR 18 as for the clarification of the role played by SPREP in project implementation vis-à-vis OOEM. Finally, it should be clarified what stakeholders will be part of the Project Board, as there is no mention of this in Part II/Section H, unlike stated. **CR 20**. Addressed.
	2. Are there measures for financial and project/programme risk management?	N/A	
	3. Are there measures in place for the management of for	N/A	

	environmental and social risks, in line with the Environmental and Social Policy of the Fund? Proponents are encouraged to refer to the draft Guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social Policy, for details.		
	4. Is a budget on the Implementing Entity Management Fee use included?	N/A	
	5. Is an explanation and a breakdown of the execution costs included?	N/A	
	6. Is a detailed budget including budget notes included?	N/A	
	7. Are arrangements for monitoring and evaluation clearly defined, including budgeted M&E plans and sex-disaggregated data, targets and indicators?	N/A	
	8. Does the M&E Framework include a break-down of how implementing entity IE fees will be utilized in the supervision of the M&E function?	N/A	
	9. Does the project/programme's results framework align with the AF's results framework? Does it	See CR 13.	

	include at least one core outcome indicator from the Fund's results framework?		
	10. Is a disbursement schedule with time-bound milestones included?	N/A	

Technical Summary	The overall objective of the proposed programme is to support the four State governments in FSM in building an institution frameworks and development planning tools to help coastal communities to adapt to future higher sea levels. The proposed interventions are foreseen to bring the following benefits: - Developing the capacity of the FSM government to deliver climate resilient policies and enforce regulations for the coastal zones in all FSM states. - Reducing the vulnerabilities of coastal communities and infrastructure investments to climate risks through adaptation measures and capacity building efforts. - Increasing resilience of coastal communities through the delivery of engineering infrastructures in Kosrea. The project concept does not provide enough information in some sections of the proposal to fully evaluate the proposed project. As a result, the concept needs to be revised before it can be recommended for endorsement. The initial review made 20 Clarifications Requests (CR) where further information are requested, to allow a full review of the proposed project: **CR 1**: It would be useful to be further document the document by providing information on specific studies and climate change risks scenarios for FSM. **CR 2**: Please demonstrate how the project strategy will make sure that the proposed plans, policies, regulations, guidelines, standards and protocols will yield the expected outcomes and support, as best possible, in enforcing these rules and regulations. **CR 3**: Please demonstrate that the most vulnerable local communities have been consulted and have identified the road infrastructure proposed in component 3 as a priority intervention for providing their communities with adaptation benefits. **CR 4**: Please discuss how investments under output 3.1 and output 3.2 component 3 will provide resilience to future climate change, and how these investments themselves will be made resilient to future climate change. **CR 5**. Output 1.5: Could you provide additional information on the tasks that will be implemented to ensure that the main objective of this output is met? **CR 6**. Please clarify how the proposed infrastructural investments have been chosen amongst potential alternatives, and how the decision analysis have led to the prioritization of the proposed activities. **CR 7**. Please demonstrate the extent to which the EIA will be enforced for the activities proposed, and provide an update on the EIA legislation in FSM highlighting how the relevant standards will be applied through the

	implementation of the proposed project. **CR 8**. Please clarify what relevant technical standards (can be internationals if nationals do not exist yet) will be used where applicable in the proposed project. **CR. 9**. Please update information on the GCCA project and explain how the proposed project will seek synergies and avoid duplication and clarify how the project will avoid duplication of activities related to the establishment of a knowledge and information system with the PPCR-funded programme. **CR 10**. Can you please describe the process that will allow lessons to be systematically captured, before project staff document them with the support of the CTA? **CR 11**. Please describe in what extent the following stakeholders have been consulted, including proof of gender considerations, and evidences about the extent to which they support the implementation of the proposed solutions: - direct beneficiaries and local communities of this project, notably marginally vulnerable groups living in the targeted areas; - stakeholders responsible for land/costal management; - land users and land owners; - private sectors (including construction sector); - Universities/research centres. **CR 12**. As there are currently a wide range of initiatives that includes activities that have a close link with the proposed project, it seems relevant to outline how the project will deliver its outcomes and outputs, regardless of the success of these other projects. **CR 13**. The alignment table is not properly completed as it does not include AF outcome or output indicators. Please update the document accordingly. **CR 14**. The proposal suggests that the local capacity that will be built will demonstrate "*that in the FSM context, communities can maintain the physical constructions*". Please describe in more details the rationale for this assumption, by for example providing examples of previously experiences, and highlight what capacity gaps had been overcome in such cases to allow community maintenance of infrastructure, and how the project sustainability strategy will build upon these lessons learned. **CR 15**. The risks table under section K (p. 49) concludes that for none of the 15 principles of the ESP further assessment or management inputs are required. This is inconsistent with the programme approach under which for each sub-project the environmental and social risks remain to be identified and assessed as needed. For example, the table states that no further assessment is required for compliance with the principle on involuntary resettlement but at the same time the possibility and modalities of coastal village relocation are discussed. Another example is on compliance with the principle on protection of natural habitats - no further assessment is said to be required since habitat protection is at the forefront of the programme. Yet, the largest programme activity that also already has been identified - the new road construction in Kosrae - is located in what appear to be forested areas and will have an impact on these natural habitats. Please demonstrate in a rational way the

	proposed project compliance with the environmental and social principles as outlined in the ESP, including how relevant standards will be applied through the project implementation, when applicable. Further assessment is notably required for principles on access and equity, marginalized and vulnerable groups, gender equity and women's empowerment, indigenous peoples (it doesn't state that there is none), involuntary resettlement, protection of natural habitats, physical and cultural heritage and land and soil conservation. As a number of EIAs (and/or ESIAs) are to be prepared during the project implementation, an ESMP will be requested at the full proposal stage. **CR 16**. Please categorize the proposed programme in line with the ESP (A, B or C). **CR 17**: Please clarify the reasoning behind the budget allocation to "Project Cycle Management Fee charged by the national government". According to the AF guidelines, only implementing entities can charge the budget with fees, not national governments. **CR 18**. Please clarify the following sentence: "SPREP will be engaged, through single source selection, to manage the program. As such, SPREP will have responsibility for the daily management of program implementation and for providing the required technical advice for the project. SPREP will also manage and administer studies and surveys, training programs, workshops, and conferences, including subcontracting service providers such as academic and training institutions, NGOs, and community-based organizations as necessary." It should be clarified whether SPREP will act only as an IE or if it will also act as an EE (hence using the $450,000 execution costs). The letter of endorsement does not refer to SPREP as an EE, but OEEM. **CR 19**. Please clarify the services that SPREP will provide to the OEEM, as they are not listed in annex G unlike stated. Similarly, please clarify what stakeholders will be part of the Project Board, as there is no mention of this in Part II/Section H, unlike stated. **CR 20**. Please confirm that the Project Implementation unit will be located within the OEEM, as there may be a typo in the document, paragraph 5, page 52. Despite the additional information provided, the final review finds that the proposal fails to correctly address the corrective action requests, and clarifications requests made in the initial review. The following observations are made: i. Despite having explicitly requested the project proponent to submit a revised project document, only a response sheet was provided as an additional document for the final technical review. Any revised proposal would need to incorporate, in the proposal itself, the changes suggested in the response sheet. ii. The proposal should clarify the validity of the proposed investment under output 3.1. In fact, according to the additional information provided, such investment rests upon the results and findings of the PPCR's Cost Benefit Analysis currently being undertaken. This situation makes it difficult for the AF to assess the legitimacy of the proposed project and to make a funding decision, as such study may bring key insights

	on the relevance, soundness, resilience and feasibility of such investment. iii. The fully developed proposal should encompass a consultative process specific to the proposed project. Such comprehensive consultation process should involve all direct and indirect stakeholders of the project/programme, including vulnerable groups and taking into account gender considerations. Particular attention should be given to minority groups, marginalized and vulnerable groups, and indigenous people in the project/programme target areas, where relevant. The results of the consultative process must be reflected in the project design. This is of the utmost importance as the support from communities is outlined as a cornerstone in sustaining and maintaining the proposed investments. iv. The proposal should demonstrate in a rational way the proposed project compliance with the environmental and social principles as outlined in the Fund's Environmental and Social Policy (ESP), including how relevant standards will be applied through the project implementation, when applicable. Further assessment is notably required for principles on access and equity, marginalized and vulnerable groups, gender equity and women's empowerment, indigenous peoples (if any), involuntary resettlement, protection of natural habitats, physical and cultural heritage and land and soil conservation. As a number of Environmental Impact Assessments (and/or Environmental and Social Impact Assessments, ESIAs) are to be prepared during the project implementation, an Environmental and Social Management Plan (ESMP) will be requested at the full proposal stage. v. The proposal should clarify the implementation arrangements. If SPREP intends to provide a range of services to the project, it would be considered an executing entity. In such case, the AFB decision B.17/17 to "cap execution costs for projects/ programmes implemented and executed by the same entity at 1.5% of the project/programme cost" would apply. As a result, the execution costs that could be claimed by SPREP would be capped at 1.5% of the total budget requested, before the implementing entity fees. In such case, as per AFB decision B.17/17, SPREP should provide a letter from the government requesting direct services support and providing appropriate justification for such a request.
Date:	31 March 2015

Correct Version - Amended in November 2013

REQUEST FOR PROJECT/PROGRAMME FUNDING FROM THE ADAPTATION FUND

The annexed 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

ADAPTATION FUND

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT/PROGRAMME INFORMATION

Project/Programme Category:	REGULAR PROGRAMME
Country/ies:	FEDERATED STATES OF MICRONESIA (FSM)
Title of Project/Programme:	**"ENHANCING THE RESILIENCE OF VULNERABLE ISLAND ATOLL COMMUNITIES IN FSM TO CLIMATE CHANGE RISKS THROUGH A "LIVING WITH THE SEA" NATIONAL RISK MANAGEMENT FRAMEWORK"**
Type of Implementing Entity:	RIE
Implementing Entity:	SPREP
Executing Entity/ies:	Office of Environment and Emergency Management (OEEM), KOSRAE STATE GOVERNMENT, POHNPEI STATE GOVERNMENT, YAP STATE GOVERNMENT, CHUUK STATE GOVERNMENT
Amount of Financing Requested:	**US$8,967,600** (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.

a) Problem the proposed programme is aiming to solve

The Federated States of Micronesia (FSM) comprise of a diverse array of island types and ecosystems. Low-lying atoll islets of FSM, in particular, pose special management challenges, and hence are included as one of the focal areas of this proposal. Dozens of atoll islets in the FSM are occupied by human communities of a few hundred people each. These islets are composed of sedimentary accumulations of calcium carbonate (CaCO3) sands and cobbles derived from the skeletal fragments of reef dwelling organisms including coral and various carbonate-secreting algae. Some sediment is 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 re-deposited on the island surface by storm overwash and winds. Some researchers hypothesize that the tendency for high energy wave and tidal forces carry sediment from the reef margin into island interiors which often result in the topography of these islands to alter and hence adapt to sea level rise (accreting in response to rising sea levels). The islet "landform" might thus persist under a regime of accelerated sea level rise associated with global warming, if natural systems are allowed to operate unabated. Other researchers speculate that atoll islets are "fixed" onto the reef by rock ramparts and when rising waters breach these cemented deposits on oceanic shores, the islet will become unstable and rapidly erode. Either way, there is a sensitive balance between ecosystem dynamics, the health of the marine environment, human settlement patterns and coastal resource use.

The human communities on these atoll islands therefore need to better appreciate these balances. Without this appreciation, there will be increased pressure within FSM to consider the sensitive issues of community relocation to less vulnerable higher ground within each FSM State or to neighbouring FSM States unless a climate adaptation strategy is developed. The "Living with the Sea" project (this proposal) has therefore been designed to try and provide some answers to this issue and provide a framework that is delivered and implemented nationally for atoll communities for all 4 States of FSM. It seeks to help introduce a paradigm shift in the management of flood risk and marine management issues for each State, moving from an ad hoc site/problem-centric approach towards a more holistic strategic coastal and watershed management approach, where "whole island" natural defence systems (such as outer reefs, mangroves, beaches and coastal vegetation) are managed in an integrated manner to enhance and improve flood resilience and to climate proof livelihoods and businesses along the coastal zone. Ultimately these measures will also have beneficial impacts on food security and freshwater management. The "Living with the Sea" approach also links tangible adaptation techniques to address flood risk with existing marine management principles for fisherfolk in the outer atolls.

The project will promote an integrated approach towards fostering shoreline, marine management and ecosystem based adaptation (EBA) where possible, which balances environmental management with sustainable development. This shall also complement the Least Developed Countries Fund (LDCF) "Ridge to Reef" (R2R) approach being proposed regionally within the Pacific and also specifically for the High Islands of FSM (being pursued under a complementary project managed through UNDP for "High Islands"). Amongst other things, the approach shall set-up a multi-sector planning platform to balance competing environmental, social and economic objectives in the coastal zone. Through a new set of formally adopted Shoreline Management Plans (SMPs) for each State (Kosrae already adopted their formal SMP in 2014), the project shall seek to identify sustainable shoreline management policies for lengths of islands coasts which may include building hard sea defence measures or the relocation of coastal infrastructure, such as roads etc). It also shall seek to encourage the promotion of soft engineering solutions (ecosystem based adaptation such as tree planting, reef rehabilitation and beach ridge enhancement schemes – see Appendix E) that considers the introduction of livelihood security techniques (e.g.: defence barriers to enable taro plantations to grow in non-salt inundated areas) in tandem with reducing coastal erosion and flooding problems. From this, it is intended that the project shall improve the sustainability of coral reefs (marine management improvements etc), mangrove forest and wetlands management as natural defence measures so as to maintain the flow of vital natural defence mechanisms and sustain the livelihoods of local coastal communities. *Mangrove forests, in particular provide a valuable role in buffering the force of waves, including storm surges, and thus protect the coastline from erosion. The "fringe" (seaward) mangrove is therefore seen as being especially valuable for this coastal protection function and such "ecosystem based adaptation" measures will be promoted throughout the project design.*

The project is purposely designed (initially though a formal consultation process arranged and delivered during December 2013 and subsequently during 2104 – see Appendix A and letters of endorsement in Appendix A)) to ensure the integration of core climate change sectoral intervention areas, namely food security, water resources and coastal management. To this end, the "Living with the Sea" policy framework (and its supporting "tools" to help its delivery) will help each State in FSM to promote sustainable shoreline management by encouraging appropriate and justifiable engineering measure and practices such as relocating roads inland away from current or future "risk" zones thus encouraging communities to relocate (at their own will) to safer settlement areas on higher ground where crops (such as taro and sweet potato) are better able to thrive and be cultivated, and groundwater supplies are less prone to saline intrusion and inundation. The project approach shall also provide the framework to encourage the implementation of more innovative and cost effective planning solutions, to better deliver coastal protection measures that integrate food security and (where possible) water conservation and groundwater protection where these are deemed of urgent necessity (and where clearly stated within the state wide SMP – see Component 2). The approach is also neatly embedded within the compliance objectives of the R2R project (i.e.: the relocation of populations inland must not contribute further to any existing or newly introduced environmental stressors on highland ecosystems that may arise). The "Living with the Sea" project will ultimately help towards providing the planning tools required to better integrate

the various donor project objectives that address similar theme issues whilst also improving FSM State Government capacities to effectively manage their coastal zones in a more sustainable manner.

b) Vulnerability of FSM to sea level rise

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 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. 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 trade-wind 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 judgment 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.

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.

c) Vulnerability of the targeted sectors and areas

FSM, due to its small population and relative isolation, has limited capacity and expertise in key technical and functional areas relevant to climate change adaptation. Geographically, FSM Islands faces steep challenges: the habitable islands are widely scattered over a vast ocean space. It is difficult and expensive to simply maintain contact with the communities that live on outer islands, to say nothing of supplying them with essential services and integrating them closely into the national economy, which is a FSM National Government commitment but one that is difficult to implement in practice. To avoid demise of many of these communities, either in a sudden disaster or by slow attrition due to out-migration, strenuous efforts are required to provide basic sustenance and physical protection.

An effort to fully integrate climate risks into fundamental project and programme design processes, with associated budgeting, manpower planning, training, and other activities is needed to ensure that future risks are systematically and cost-effectively addressed and that all islands remain habitable and continue to support livelihoods. Such integration will require a sustained effort to instil awareness of climate related risks to all households, businesses, social service organisations including non-governmental organisations (NGOs), public- and private-sector planners and investors, and government agencies and provide them with the tools to respond to such risks effectively.

Through practical adaptation work (much of it investment-intensive, including climate-proofing of major assets such as harbour facilities, water supply systems, coastal roads, sanitation, protective shelters, etc) on the ground in all islands, integrative policy development work, training and awareness

raising, the proposed “Living with the Sea” programme will support the “mainstreaming‟ of climate risk into development processes in FSM, at the island level, sectoral level, and national policy level.

d) ***Institutional Context***

Despite the professional efforts of the FSM States to address the creeping problems caused by climate change in an efficient and sustainable manner, the approach to climate change risks at present, including shoreline protection, is reactive and with limited national/regional guidance. Whilst there is a national climate change policy in place for FSM, given the geographical challenges faced by outer islands, how this centrally-driven policy will be effective in practice at the outer island level remains uncertain unless there is clear guidance and State Government legislative and regulatory commitment to make a difference. In addition to the above, FSM currently has no national strategy for integrated coastal zone management (ICZM), and as a result, there is no agreed approach for implementing ICZM between the 4 States of FSM.

e) Current Barriers to climate change adaptation, needs and gaps in adaptive capacity

Though many projects and policy frameworks have introduced participatory planning processes, mobilized communities, and have supported improved resource management and policy development at local, State and national government levels in FSM, they do not adequately integrate or “mainstream” climate change risk considerations and adaptation responses. Adaptation implementation at the outer island level throughout FSM is severely constrained by the pursuit of distinct, as opposed to an integrated national strategy for climate change, land degradation, disaster prevention, preparedness and management; shortage in resource and key national assets to systematically monitor changes from various actions that are taking place over time; limited understanding and monitoring of the coastal environment; limited capacity to assess the impact of both technological and policy measures for climate-related concerns; and lack of adequate legislation covering key areas such as coastal risk management.

Project / Programme Objectives:

List the main objectives of the project/programme.

Project Strategy

a) Overview

The overall project strategy is to provide all four (4) State Governments in FSM with the institutional frameworks and development planning tools to help coastal communities to prepare and adapt for future higher sea levels. This is to be achieved through a new policy framework concept entitled “Living with the Sea” which is iterative and long term in its nature. It embraces the combined aspects of marine management principles, coastal protection (soft and hard measures), water resource management (protection of groundwater) and food security (techniques to help climate resilient planting of taro in salt affected areas etc). This principle addresses the important concept of “working with nature” so that cost-effective, sustainable and adaptive measures are introduced in an integrated and sustainable manner, with due consideration to ecosystem based adaptation approaches. The project shall introduce interim soft coastal engineering measures on 6 atoll islands (within 3 FSM States) to help provide suitable protection prior to the implementation of a more formal and planned “transitional” period which plans for long term community and critical infrastructure relocation that helps to deliver livelihood security for communities living along vulnerable atoll island shorelines in Yap, Chuuk and Pohnpei in the short to medium term (up to 20 years).The project shall also provide support to the State of Kosrae towards implementing the priority engineering intervention as set out in the recently endorsed Kosrae SMP (2014).

b) Purpose and Need for the Intervention

The pressures of climate change, sea level rise, coastal fishery habitat destruction and the need for socio-economic regeneration of FSM coastal zones and watersheds are very well documented. Climate change is a fact. Its effect on the coast is now becoming clearly evident. FSM is a developing country vulnerable to tropical storms, typhoons and drought, effects which are presently modulated by the El Nino Southern Oscillation. Future climate change is expected to increase the intensity and frequency of extreme rainfall events. Sea level is observed to be rising at 28-36mm/decade (Pohnpei tide gauge) exacerbating coastal erosion and placing at risk human communities in coastal areas of atoll islands and islets. Already, FSM has seen coastal features (including beaches, mangroves, reefs etc) beginning to change more dramatically and often in unpredictable ways. Many coastal livelihoods are increasingly threatened by coastal flooding and erosion and the reality of rising sea levels and increased storm frequency will inevitably increase that risk. The "**Living with the Sea**" principle is designed to instil climate resilience within State Government development planning for FSM's islands and shorelines. Instead of a sectoral focus on, for example coastal protection, efforts to address climate change through an integrated sectoral approach is proposed now for FSM.

Of equal concern (and despite considerable new efforts by FSM with regards to the preparation of new climate change legislation in Kosrae and a recently endorsed Kosrae SMP 2014, there is still an apparent lack of strategic delivery of an integrated risk management approach policy to address these concerns for ALL FSM States. Even in Kosrae, the updated SMP (2014) makes clear that there is an urgent need to improve the decision making regarding coastal adaptation and climate change resilience in the coast. Coastal protection and sea defence structures are currently not planned with regard to their purpose, their outcome and importantly, their long term maintenance costs. There is also negligible consideration of how a coastal protection scheme or policy action can help with protecting groundwater supplies or improve food security issues (i.e.: combining agriculture crop planting design to mitigate saltwater intrusion or overtopping etc). Despite the professional efforts of Kosrae to address the problems being faced, the approach to shore protection (at present) and catchment flood management is reactionary and without long term national planning mechanisms in place.

The "Living with the Sea" approach seeks to introduce clear transitional advice for FSM on how to adapt to climate change in the short and longer terms. It shall be designed to learn from the existing approach undertaken by the State of Kosrae. It seeks to use the Kosrae Strategic Development Plan (2013-2024) as a model document for other States to follow and prepare so that climate resilience can be planned for the next generation and beyond. This strategic plan, supported by more detailed climate proofed Shoreline Management Plans (already prepared by Kosrae in 2014 – see Appendix B for structure) enables the introduction of robust and sustainable land use planning for the long term for each State. It also encourages a "mind shift" (where appropriate) from "hard" engineering solutions alone (such as building sea walls) to a more "soft" approach to climate change adaptation on the coast (such as methods used to enhance the natural features or processes such as beach replenishment, artificial coral placement or coastal vegetation planting), which involves local communities in identifying risk areas, implementation and monitoring. In remote and small outer islands, soft approaches shall be considered that attempt to protect land for food security and where possible, the soft engineering measure can combine higher areas for planting crops whilst also protecting important ground water lens locations. An island feasibility assessment shall be undertaken on each of the 6 proposed outer atoll islands, to ensure that only feasible adaptation options are considered, especially on islands where the hydrodynamics dictate that regular overtopping is a daily problem (i.e.: land topography is so low that options for soft measures are significantly reduced. Such soft engineering approaches (almost exclusively mangrove plantations) are not totally new in FSM. However, these have only been trialed on a very small scale in FSM to date and no formal monitoring has been carried out on these pilot areas. Consequently, no clear lessons have been learned from these initiatives. Preliminary findings of these approaches do, however, suggest that a good scientific understanding is required not only of the locally species of beach binding vegetation required, but also of the local geomorphology of the receiving island location. The modelling and baseline data collection exercises proposed for each Shoreline Management Plan (Activity 2.1) shall help towards establishing a baseline understanding of key reaches where engineering intervention is being proposed.

FSM also needs to protect its natural coastal and marine assets (e.g.: fish nursery grounds) if they want to safeguard their man-made infrastructure assets. They have to promote and encourage working (in partnership) *with* the sea and watersheds draining into it rather than trying to fight natures' unstoppable response to global sea level rise and increases in precipitation and flood frequency. The platform from which to promote this and to launch an EFFECTIVE and SUSTAINABLE coastal management is the "Living with the Sea" programme, which is hoped to be devised through revised legislation, with clearer institutional responsibilities and be delivered in PARTNERSHIP with key institutions for all 4 FSM States.

The "Living with the Sea" approach is proposed to be achieved in tandem with work ongoing for sustainable land management (SLM) and also the new **"Ridge to Reef – R2R"** programme (UNDP Fiji initiative) which is linking SLM with protected area management in FSM. "Living with the Sea" act as a strategic "glue" to merge together the work of the Kosrae SMP, R2R and SLM (see Figure 2a). It also shall support actions for high islands and low lying atoll islands (Figure 2b) in an integrated way (through the design of State specific Shoreline Management Plans –see Appendix B).

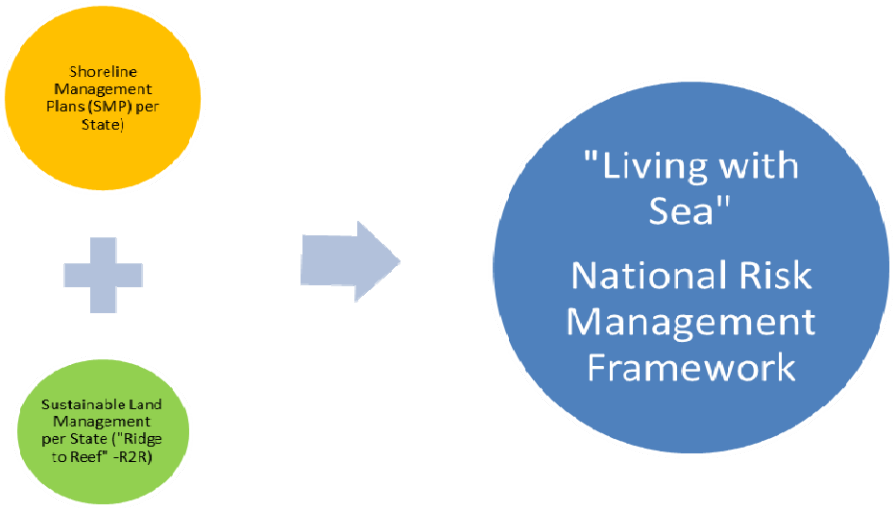

Figure 2a – Concept Approach for the Living with the Sea Concept for FSM

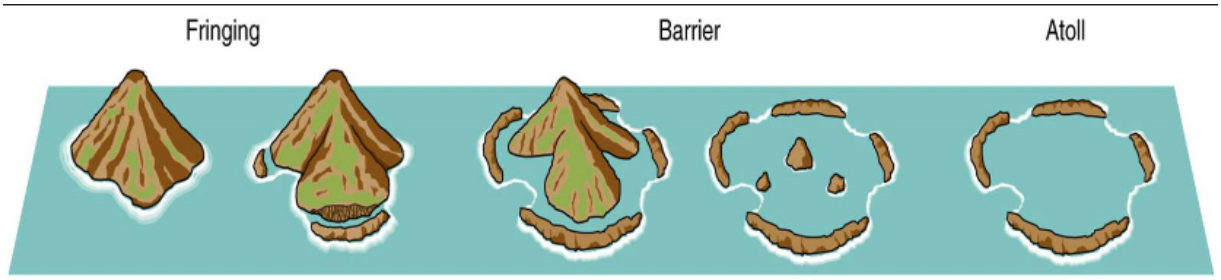

Figure 2b – Living with the Sea approach to cover all major island types in FSM (taken from Micronesia Conservation Trust "Ridge to Reef – Adapting to Climate Change" 2012)

c) Aims of the "Living with the Sea" Framework

The "Living with the Sea" framework can be defined as an approach to managing the risks that are associated both with living on the coast of "high islands" (R2R project) AND on small atoll islands (on each FSM State) in order to maintain resilience in the face of climate related extremes. Specific to Kosrae, support shall be provided to address sediment erosion in watersheds as proposed within the Shoreline Management Plan (2013). It integrates food security and water resource management into coastal and marine management planning. This is important as most of the real climate related challenges that the people of the each FSM State are grappling with at present is coastal related (in particular coastal fisheries and lagoon community livelihood protection). These include coastal erosion and flood inundation, saline intrusion, precipitation flash flooding and associated pollution via land drainage impacting on marine biodiversity and water supply. This concept builds on the experiences and lessons that the Pacific Adaptation to Climate Change (PACC) project generated in 14 Pacific countries in the past four years.

The specific aim of this proposal is therefore to support FSM in preparing a regulatory and institutional framework to help support sustainable coastal and marine management decision making. Its primary aim is to help set policy for lengths of shore or islands (similar to the SMP for FSM – 2013) to better provide economical and sustainable solutions to "live with the sea" for all FSM States. The approach sets a framework for the eventual delivery of a national strategy for Integrated Coastal Zone Management (ICZM) and marine spatial planning (MSP) for FSM.

The success of the "Living with the Sea" will be related to the need to mainstream its objectives and aims within the overall national planning framework of existing or new planning regulations for each FSM State, and articled within the update to the FSM National Policy on Climate Change (2011). This is key as there is an important need to consider climate change adaptation within a formal State wide land-use planning mechanism which would provide the policy and development standards for implementation of a new development approval process. At present, only Kosrae State has such a land use plan mechanism (SDP 2013-2024).

d) How will the Living with the Sea Framework make a difference for FSM?

The "Living with the Sea" concept takes an ecosystems based adaptation (EBA) approach but focuses more on what needs to be done to deal with the risks that are related to the coasts and marine

resources surrounding each FSM State. Traditionally, villages in FSM commonly are situated very close to the shore (70% of Kosraes' population living within the coastal lowlands and circa 95% of the Yap population living in their coastal lowlands – Buncle 2014[1]) for ease of transportation and sources of livelihood and sustenance. At present, that co-existence is now becoming a real challenge threatened by the extreme weather events that FSM is now facing. Therefore, the need to consider the watershed and coastal areas as an integrated component is needed especially where people and ecosystems co-exist. This FSM project therefore proposes (via the work undertaken in Kosrae) to provide leadership in all of FSM and in the region so that the development and future security of coastal communities are assured.

As part of the overall framework, a new legally defined Shoreline Management Area (SMA) shall be established for each FSM State (updated flood risk hazard areas) whereby all land use development (including defences) shall need to comply to new national climate change regulations which shall be integrally linked to a separate State Development Plans as appropriate. Kosrae is the only State that has embarked on this approach, and this is proposed to be up-scaled to the other 3 States in FSM. In addition, marine management areas (MMA) shall be defined to help with future delivery of sustainable marine management principles for outer atoll islands.

Project Objectives

The objective of the programme is to strengthen the ability of all FSM coastal communities, and State Governments (the public service), to make informed decisions and manage anticipated climate change driven pressures (including extreme events) in a pro-active, integrated and strategic manner. In achieving this objective, the programme will support (at the national, sectoral, State and island levels) the implementation of FSMs new 2013 Policy on Disaster Risk Management and Climate Change Adaptation (recently endorsed by National Government).

The proposed programme will also contribute to all outcomes listed within the 2 objectives 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:

1. Prepare the necessary institutional and regulatory frameworks, policies, guidance and "tools" to help deliver the "Living with the Sea" climate resilient approach for all FSM States.

2. Implement the "Living with the Sea" approach through the effective mainstreaming of climate resiliency and long term coastal planning into State wide development plans.

3. Introduce "transitional planning" livelihood security measures (including the integration of marine management with soft coastal engineering techniques, climate resilient taro planting techniques and groundwater protection techniques) to help 6 outer atoll islands implement the long term delivery of the "Living with the Sea" approach within the States of Yap, Chuuk and Pohnpei.

4. Implement priority "Living with the Sea" transitional planning projects on Kosrae to help contribute towards the delivery of the Kosrae SDP and adopted Shoreline Management Plan (SMP2014) and to provide communities with the necessary infrastructure to help relocate from high risk coastal inundation sites.

Project / Programme Components and Financing:

[1] *(Buncle (2014)*
Situation Analysis of Natural Disaster Risk Mainstreaming in Kosrae
Informing the Directions of the Pilot Program for Climate Resilience : Pacific Regional Track

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.

Figure 3 provides a strategic summary of the approach to the project components.

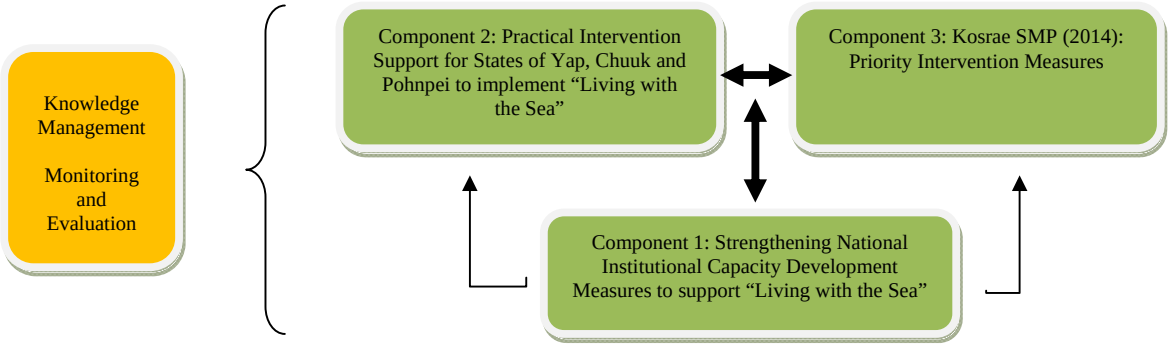

Figure 3: Relationship between Project Components

The programme has a 3-pronged approach, ultimately focusing on the implementation of on-the ground coastal adaptation and climate resilient measures at the community level at 6 locations within the States of Yap, Chuuk and Pohnpei and one strategic location on the State of Kosrae (Yeseng to Malem). This will be integrated with sustainable State wide capacity building and wider institutional development processes, and supported through enhanced national policy and knowledge management capacities.

The planned activities directly address the barriers and intended project outputs listed below. Through implementation of integrated and climate-resilient State wide Shoreline Management Plans targeting all 4 States (based on latest 2010 Census of Population and Housing) and covering all beneficiary populations from outer atoll islands and at least 2000 households and a minimum of 15,000 coastal community members (over 15% of the current population), it aims at the:

- National level - strengthening policy and institutional capacity and public awareness on climate change and coastal risk reduction, through conducting SMPs and updating climate risk assessments, mainstreaming climate resilient land use planning and development tailored towards assisting the most vulnerable sectors, training policy makers and technicians in the relevant government departments;
- State level - increasing the adaptive capacity of coastal communities and affected sectors, such as agriculture, water supply, tourism, health, fisheries, coastal management, and enhancing the adaptive capacity of local communities through engagement in island level SMP planning process linked with Island Development Plans and the National Joint Action Plan, and targeted training and awareness-raising activities using different media;
- Island level - strengthening livelihoods through introducing "soft" of "hard" coastal protection measures, diversifying food production, processing and related subsistence and income-earning activities amongst local communities, and enhancing the resilience of terrestrial, coastal and marine ecosystems on which the communities, businesses and sectors depend.

Component 1 prioritises the institutional and capacity support and planning tools required to take forward the “Living with the Sea” policy framework at a national (all 4 States) level. Component 2 of the proposed programme pays attention to helping to take forward the Living with the sea policy framework for the States of Yap, Chuuk and Pohnpei, focusing on island-level coastal adaptation interventions that are linked to specific State wide planning processes. Approaches shall ensure that any existing regulatory system is adjusted in response to the capacity needs identified by State Governors and leaders during this AF proposal formulation phase. This component is seen as strategic in the programme design, in order to enable the effective implementation of adaptation measures needed for the outer island communities. Component 3 builds on the “recommended model” for FSM, already established by Kosrae (through their recently adopted Shoreline Management Plan - 2014) and as designed during Component 1 for all States to help prioritise coastal intervention measures (road realignment between Yeseng and Malem) to help improve community resilience and encourage community relocation away for the highest risk coastal areas (as published in the formally accepted SMP for Kosrae (2014).

Table 4 presents the relationships the three project components and the expected concrete outputs and outcomes, and the corresponding budgets.

PROJECT COMPONENTS	EXPECTED OUTCOMES	EXPECTED CONCRETE OUTPUTS	AMOUNT (US$)
1. **STRENGTHENING NATIONAL INSTITUTIONAL AND CAPACITY DEVELOPMENT MEASURES TO SUPPORT DELIVERY OF CLIMATE RESILIENT COASTAL MANAGEMENT IN FSM ("LIVING WITH THE SEA")**	1.1 Capacity developed for efficient and effective support at national level to deliver climate resilient policies and enforce regulations for the coastal zones of all FSM states.	Output 1.1: Legislative and policy support to help improve regulatory enforcement of climate resilient coastal and marine management for each FSM State;	150,000
		Output 1.2 Preparation of Shoreline Management Plans for Yap, Chuuk and Pohnpei States with each defining sets of maintenance targets and integrate recurrent and capital expenditures.	600,000
		Output 1.3: Prepare Coastal Development and Environmental Policy Guidelines for each State to help deliver the "Living with the Sea" approach (i.e.: linking R2R and SMP policy direction).	150,000
		Output 1.4 Establish climate resilient engineering and construction (building) standards and protocols for future coastal infrastructure construction within each FSM State.	175,000
		Output 1.5 Capacity developed to improve coordination for future Living with the Sea policy compliance (for each FSM State) including "performance measure" procedures for key staff/departments.	110,000
		Output 1.6 Establish a national knowledge and information system for "Living with the Sea" delivery.	200,000
SUBTOTAL FOR COMPONENT 1			**1,385,000**
2. **PRACTICAL INTERVENTION SUPPORT FOR THE STATES OF YAP, CHUUK AND POHNPEI ON TO IMPLEMENT CLIMATE RESILIENT COASTAL MANAGEMENT ("LIVING WITH THE SEA")**	2.1 Vulnerability of coastal communities and infrastructure investments to climate risks is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.	Output 2.1 Six (6) sustainable "Pilot soft coastal adaptation interventions" (incorporating food security and water /marine resource management where possible) on 6 atoll islands within the States of in Yap, Chuuk and Pohnpei.	2,600,000
		Output 2.2 Training programmes for State Government and island specific technical on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the States of in Yap, Chuuk and Pohnpei (linking to Output 2.1).	275,000
		Output 2.3 Education and awareness programmes for the wider community on "Living with the Sea" principles for the 3 FSM States.	200,000

SUBTOTAL FOR COMPONENT 2			**3,075,000**
3. **KOSRAE SHORELINE MANAGEMENT PLAN (2014): PRIORITY INTERVENTION MEASURES**	3.1 Increased climate resilience of coastal communities (Malem, Utwe, Pal, Mosral and Walung) through the effective delivery of priority engineering "climate proof intervention measures" as set out in the Kosrae SDP (2014-2023) and Kosrae Shoreline Management Plan (SMP).	Output 3.1 Intervention A: New road section construction (Malem to Yeseng) plus access routes to the two villages.	2,100,000
		Output 3.2 Intervention B: Transitional coast protection schemes (Mosral and Pal)	750,000
		Output 3.3 Training programmes for the Kosrae State Government on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the State of Kosrae.	150,000
		Output 3.4 Education and awareness programmes for the wider community engagement on "Living with the Sea" principles for Kosraen villages.	145,000
SUBTOTAL FOR COMPONENT 3			**3,145,000**
Implementing Entity Management fee (8.5% of Total Project Cost - ceiling limit – see Appendix F)			646,425
Project/Programme Execution Cost (including M&E costs)			450,000
Total Project/Programme Cost			$7,605,000
Project Cycle Management Fee charged by National Govt (3.5% of Total Project Cost- national FSM fee) (*)			$266,175
Amount of Financing Requested			**$8,967,600**

Table 4: Proposed Components and Activities

(*) At the request of the Government of FSM, the programme will be implemented by SPREP using the RIE modality. SPREP is able to provide the following implementation services through its country office, regional and headquarters networks: programme identification, formulation, and appraisal; determination of execution modality and local capacity assessment of the national executing entity; briefing and de-briefing of programme staff; oversight and monitoring of AF funds, including participation in programme reviews; receipt, allocation and reporting to the AF Board of financial resources; thematic and technical capacity building and backstopping; support with knowledge transfer; policy advisory services; technical and quality assurance; and troubleshooting assistance to the national programme staff.

Projected Calendar:

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

Milestones	Expected Dates
Start of Project/Programme Implementation	May 2015
Mid-term Review (if planned)	June 2017
Project/Programme Closing	March 2019
Terminal Evaluation	June 2019

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. 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 NATIONAL INSTITUTIONAL AND CAPACITY DEVELOPMENT MEASURES TO SUPPORT DELIVERY OF CLIMATE RESILIENT COASTAL MANAGEMENT IN FSM ("LIVING WITH THE SEA")

Outcome 1: Capacity developed for efficient and effective support at national level to deliver climate resilient policies and enforce regulations for the coastal zones of all FSM states.

Overview

The specific aim of Component 1 is to provide institutional and capacity development support to all FSM States though assisting towards the preparation of suitable regulatory and institutional frameworks that help support improved sustainable coastal management decision making which embraces the lessons learnt from demonstration activities carried out for the recent PACC funded climate resilience project in Kosrae (2010-2014). The Component shall particularly focus on improving the connectivity between State legislation and national law with regard to climate change implementation. A formal approach to addressing this will be to ensure compliance with the existing National Policy for Climate Change whilst providing new planning and regulatory tools, capacity building training and information management systems to help longer term planning, current day regulatory enforcement plus introduce improved evidence-based decision making systems.

The justification for this Component is that despite the existing National Policy for Climate Change (2013) which covers all 4 States, there remains no formal requirement to formally mainstream the climate resilient policy intentions into State wide coastal management decision making. To this end, it is crucial that a set of "tools" are created, that address State Government institutional frameworks, plans, regulations and standards are developed to address these issues in a manner that can be sustainable and executable by local communities and that could be implemented and mainstreamed into future State wide Strategic Development Plans.

Kosrae (using PACC funds) have already embarked on this process, and have devised a series of climate resilient environmental regulations and legislatures and have prepared planning "tools" such as the first Shoreline Management Plan (SMP) which links directly towards helping with the implementation of the existing Kosrae SDP (2013-2024). It is envisaged that this "model" shall be scrutinised and evaluated for potential up-scaling to a national level to better integrate sectors and communicate climate change adaptation approaches for each of the other 3 FSM States. Specifically, a set of State specific legislative policy support measures, SMPs, guidance manuals, standards and protocols, capacity building programmes and knowledge / information systems will be prepared for national and State wide benefit.

Through the completion of this Component, by end of the project, a "Living with the Sea" Risk Management Framework shall be established for FSM which is linked clearly to the delivery of sustainable climate resilient intervention measures for outer islands (in Component 2) for Yap,

Chuuk and Pohnpei and to ensure priority interventions for Kosrae (Component 3) are delivered in total compliance with the Kosrae SMP and Kosrae SDP (2013-2024). Appropriately trained and empowered agencies shall be assigned to implement and carry out future M&E, ensuring that responsible parties feel engaged and committed with clear responsibilities and capacity to carry out their responsibilities.

Component 1 will consist of the following outputs:

Output 1.1: Legislative and policy support to help improve regulatory enforcement of climate resilient coastal and marine management for each FSM State

This activity shall engage national government fully in addition to State Governments and provide legislative and policy support on how each State can implement the 2013 Policy on Disaster Risk Management and Climate Change Adaptation (recently endorsed by National Government). Kosrae is the only State with specific climate change legislation in place, which is supported by a Strategic Development Plan (2013-2024) and a climate proofed Shoreline Management Plan (SMP). The SMP was an initiative in 2000 of the Development Review Commission (now Kosrae Island Resource Management Authority). As a consequence, a thorough legal and regulatory policy assessment shall be undertaken to assess the most practical and suitable institutional approaches to support climate resilient coastal management for FSM nationally and within each State (adhering to the lessons learned from Kosrae where possible and if appropriate).

A review of defined regulatory inspection procedures shall be undertaken along with improved clarity on the regulatory remits within the government structures. Proposed management approach options (scenarios) shall be proposed for consultation and compared against the present day situation. From this, areas for enhancement will be identified and consultations undertaken to secure improved interfaces and from this propose improvements to better permit collective working. Significant gaps will be addressed through institutional reform, which will be implemented within the lifetime of the project. Enhancing work reforms to fill gaps will lead to improved coordination of future coastal risk management and land use development, physical interventions and sea defence maintenance. The above shall involve a detailed consultation and participatory stakeholder engagement exercise which shall culminate in a detailed “road map” and implementation action plan for the national government to adhere to and promulgate, to ensure that climate resilient mainstreaming is endorsed and is set out as digestible actions. The output of this Activity shall feed directly into the design of terms of reference (ToR) for the bespoke delivery of Outputs 1.2, 1.3, 1.4, 1.5 and 1.6.

The Output shall seek to stimulate cooperation by organising joint inspections and exchange (send or invite) inspectors to and from other States in FSM. Joint inspections is hoped to result in inspections in which different State enforcement authorities (e.g.: KIRMA in Kosrae) better cooperate on a national and State wide level. This measure is seen as very important to help with implementation of the Output as in most States, improved cooperation is necessary to help not only with environmental regulation inspections, but also to mobilise the capacity, skills and experiences of different participants which will assist towards mainstreaming climate resilient coastal management in FSM. This strengthening will in turn ensure that resilience to climate risks is integrated into the sectoral strategies, related policy instruments and the work programmes of all relevant government agencies.

Output 1.2 Preparation of Shoreline Management Plans for Yap, Chuuk and Pohnpei States with each defining sets of maintenance targets and integrate recurrent and capital expenditures.

At present, there is no formal approach towards addressing the key climate change challenges of increasing coastal erosion in the States of Yap, Chuuk and Pohnpei. Under changing climatic conditions, unless these issues are addressed according to a proper institutional framework, efforts to combat them

will remain ad hoc, reactive and uncoordinated, resulting in ineffective and inefficient use of limited resources.

In Kosrae, the Strategic Development Plan (SDP 2013-2024) is a mechanism that guides the way in which Kosrae's development is planned, budgeted and executed. The purpose of the SDP is to take a strategic, community-based approach to ensure a sustainable socioeconomic development. Currently, only Kosrae has a climate proofed SDP. The vehicle to assist the SDP consider coastal hazards and risks is the Shoreline Management Plan, which has recently been updated and endorsed in 2014 to incorporate new information of coastal hazards, climate change and what it means for coastal areas on Kosrae and the communities and development located there. It 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.

Following consultation visits to each State in FSM (as part of this AF proposal), it is clear that with the exception of Kosrae, there is no structured approach is adopted towards promoting sustainable coastal planning on main islands and outer islands. In addition, there is no long term planning to help plan for critical infrastructure (roads etc) to be "climate proofed" to assist island populations to (in the future) migrate away from coastal hazard areas. Instead, it is common that "wish lists" of development actions within each State are identified in a non-formal way (separate State wide internal documents etc) that loosely comply with the Millennium Development Goals (MDGs).

The AF resources will therefore be used to prepare a series of "planning tools" that seek to build on the existing SMP platform created in Kosrae to further integrate potential risks of climate change and from this, design appropriate actions (presented in the form of a State wide SMP). Specifically, the SMP "tool" shall be founded on new detailed diagnostic and modelling studies to help provide the scientific and engineering information required to help identify specific areas of climate vulnerability. The SMP will be appended to each States SDP (linked to Output 1.1) and will include the designation of "hazard zones" and "future development zones" plus the recommended areas for future coastal defence needs and road infrastructure relocation. This ensures that future land use and coastal infrastructure are appropriately developed and cognizant of flood risk inundation or erosion hazards zones. The consultative processes required under this Output will involve key representatives from other FSM States so that the lessons learnt can be applied during the revision or formulation of SDPs for all States. See Appendix B for an indicative process of formulating consistent SMPs across FSM.

Tasks under Output 1.2 shall include:

- A review of the existing knowledge and baseline understanding of coastal behaviour, groundwater conditions and shoreline dynamics in each State;
- Carrying out new field data assessments on coastal processes with supporting atoll geomorphological and hydrodynamic modelling studies;
- Consolidating the assessments of observational surveys and results from any parallel donor initiative to help identify strategic or vulnerable areas and coastlines to future flood, erosion and inundation risks;
- Formulation of a series of State wide "Shoreline Management Groups" who (with assistance from the project team), shall lead all State level consultations on the main island and outer atoll islands;
- Define the coastal features of each island in each State including the assets at risk, the economic benefits and social issues relating to future relocation issues to "High Islands".
- Production of coastal vulnerability maps for each State (and associated atoll islands);
- Preferred future coastal planning scenario identified and confirmed through sensitivity testing, environmental and socio-economic assessment exercises (i.e.: accommodation of sea level rise or relocation etc);
- Provide a detailed description of current and proposed (within five years) developments for each State's coastal zone,

- Describe the current problems, such as erosion, faced by the State, focusing on flood risk and future land use planning/zoning;
- Provide a description of the changing climate of the coastal zone looking at the 30-year climatological period in the past and in the future (i.e. – use of model results)
- Describe how the problems identified above may be induced or exacerbated by climate change and describes the potential consequences of the said problems/risks in relation to climate change over a future thirty-year climatological period, focusing on flood risk and land use planning
- Costing exercise for priority actions identified and draft an SMP to be appended to a future State SDP;
- Public examination and consultations for the revision of the SDP.

Output 1.3: Prepare Coastal Development and Environmental Policy Guidelines for each State to help deliver the "Living with the Sea" approach (ie: linking R2R and SMP policy direction).

Environmental Impact Assessment (EIA) requirements in FSM (excluding Kosrae) are generic on the issue of coastal development or environmental policy guidance and this represents a major stumbling block towards the effective delivery of sustainable coastal management. The State of Kosrae has recently introduced efforts to "climate proof" EIA regulations and approaches, though this remains embryonic and needs to be supported with some clear guidance manuals to better communicate the "signposts" for future planning identified in the SMP and the Kosrae SDP 2013-2024. This Output shall therefore set clear formal guidelines to communicate the responsibility to coordinate and provide policy direction on "climate proofing" of development initiatives and climate change adaptation measures within each FSM State. The following tasks shall be undertaken to help produce Output 1.3.

1. A series of 4 State specific ***coastal development guidance manuals*** shall be produced, each with a clearly defined objective that, among others:
    i. describes the physical and geomorphological conditions of the coastal zone for the State as defined in the SMP (Output 1.2);
    ii. provides detailed engineering advice for future-proofing coastal infrastructure;
    iii. proposes methods for enhancing understanding, by the population, of potential coastal hazards and associated risks within the context of climate change;
    iv. present the document before a joint session of the *Technical Advisory Team* (TAT) for a critical review;
    v. present each State document before a national validation workshop for finalization and adoption by the FSM Government.

Appendix D identifies the ToR for the production of the Coastal Development Manuals.

2. Produce an ***environmental policy guideline*** as an addendum to the current EIA guidelines/procedure that presents a standard procedure for the provision of resources for EIA and delivery of coastal adaptation strategies; the specific activities are, among others:
    i. critical review of the current EIA guidelines in particular the decision-making procedure, including the categorization of projects and the approval of licenses for operations of development activities within the coastal zone; this review should particularly highlight:
        1. the level of involvement of all stakeholders within the coastal zone
        2. the actual practice of allocation of space and licenses for development in the coastal zone, especially when this is different from the stipulation in the EIA guideline
    ii. critical review of current EIA guidelines as in 'i' above but focusing only on coastal structures
    iii. critical review of the EIA Regulation, focusing on development activities in the coastal zone.

iv. based on above reviews, produce a guideline document that addresses deficiencies of, and enhancements for, both the EIA guidelines and Regulation bearing in mind:
    1. improvement of decision-making process in the allocation of space, and approval of licenses, for coastal development activities
    2. improvement of stakeholders' participation in the above decision-making process
v. present the document before a joint session of the Technical Advisory Team (TAT) for a critical review;
vi. present each State document before a national validation workshop for finalization and adoption by the FSM Government.

Output 1.4 Establish climate resilient engineering and construction (building) standards and protocols for future coastal infrastructure construction within each FSM State.

Currently there are no written guidelines on how to build or how to inculcate climate change resilience into coastal erosion control, land reclamation, harbour/wharf development and coastal road development. The purpose of this Output is therefore for State Government and other relevant agencies to address gaps in technical knowledge and know-how on how best to plan and develop coastal roads, wharves, conduct land reclamation, other major developments and manage coastal erosion in a changing climate without increasing vulnerability (both hard and soft coastal engineering measures).

The purpose of this Activity is therefore to formulate an FSM specific set of engineering guidelines for climate risk resilient coastal infrastructure (sea defences/roads/housing etc), using a participatory approach that shall link directly to amend (as appropriate) existing Land Use Planning and Environmental Impact Assessment (EIA) regulations for each FSM State, new National Building Codes, Transport Plans and the latest Disaster Management and Climate Change national policy (2013) in the future to better address climate change adaptation. The Activity shall provide pragmatic evidence based advocacy that shall be supported by high level political endorsement for standards and protocols produced.

A separate parallel exercise shall also be carried out (that complements the above) which focuses specifically on the roads sector. The purpose of this Activity is to improve adaptation to climate change in FSM by encouraging adherence to a specific roads standard that shall comply to the State wide SMP policy on road relocation, rebuild, maintenance or relocation inland advice. The Standard shall provide the engineering detail required for drainage and construction approaches/materials for "critical road infrastructure" in key areas (as identified in the SMP). This shall also link directly to the Coastal Development Guidelines (Output 1.3) to enforce the incorporation of climate risk scenarios into road transport infrastructure design that is based on latest climate change science and risk information tools available. Details of the "Climate Resilient Roads Standard Project for each State is identified as a draft Terms of Reference in Appendix C *(NB: the production of the Coastal Development Guidelines shall be important to informing the specific content of the Climate Resilient Roads Standard output)*.

Output 1.5 Capacity developed to improve coordination for future Living with the Sea policy compliance (for each FSM State) including "performance measure" procedures for key staff/departments.

This Output focuses on strategic national delivery of the "Living with the Sea" policy framework approach. It differs from Outputs 2.3 and 3.3 as those are designed to be specific to each State. This output is designed to be national in its context. It is more programmatic in its approach and shall contribute to the systematic capacity building of government officials and other key players at the different levels, supporting top-down and bottom-up and cross-sectoral linkages, to enable effective development and implementation of climate-sensitive coastal policy frameworks in the longer term. This activity is designed to address the institutional and capacity development needed to help implement the "Living with the Sea" approach in terms of how to inculcate measures to ensure SMP policies are implemented

correctly within each State (training to implement Outputs 1.1, 1.2, 1.3 and 1.4). One focus will be institutional strengthening to enhance coordination of efforts at the national level and ensure more effective delivery of national initiatives at State and island level. Another focus will be human resources development, to ensure that staffs in relevant State agencies and organisations possess the ability to support island and community development initiatives that reduce vulnerabilities and build resilience to climate change.

The Output will target all key national and local institutions and individuals and various planning departments and will involve a detailed institutional analysis exercise and creation of clear and costed training and capacity action requirements. Currently gender aspects of coastal management are not mainstreamed into national development policy. However, gender considerations play an important role in the successful integration of coastal management considerations into State wide development priorities. Understanding and addressing gender-differentiated consequences of climate related hazards and coastal change is critically important. The equitable participation of both men and women in implementing SMP policies and interventions helps ensure the long-term sustainability of both adaptation and coastal risk reduction measures. The Output is also designed to address how to inculcate key performance measures into staff contracts and to set up incentive requirements to ensure the policy is implemented correctly within each State.

Specifically, the training will focus on making effective use of coastal information services, coastal and climate risk assessments, and climate resilience management techniques. The knowledge and expertise of the University of the South Pacific, University of Hawaii and research institutes in New Zealand (NIWA) and regional NGOs will augment that of national institutions in FSM.

Output 1.6 Establish a national knowledge and information system for "Living with the Sea" delivery.

Under this Output, a knowledge and information management system will be established to assist with future evidence-based decision making needed to implement the Living with the Sea policy framework. This is required as currently a complex institutional architecture exists with respect to addressing coastal risk management and this is a key obstacle towards preventing informed decision making in FSM. The ongoing PACC project in Kosrae program is a good example of a project that has attempted to enhance key information collection capacity in Kosrae for both real time climate data (precipitation) and also tide data (sea level rise monitoring), however, this approach now needs to be formalised and made implementable for all 4 States.

Enhanced data management systems are often an integral part of improved shoreline management decision-making under a changing climate. Therefore, this "gap" needs to be filled in FSM. Not only will this assist in establishing the infrastructure for storing and managing information, engagement of island communities and State Governments in monitoring of beaches but it will also ensure that real time information can be effectively used for future decision making. Through the PPCR programme (Component 1- mainstreaming), a complementary initiative is already planned, though clear differences exist between the two (hence complementarity is ensured). Through detailed consultation of engagement with the PPCR project teams, it is anticipated that data collection capacity will be greatly enhanced at the community level in each State. In addition, topographic information collected through the use of LiDAR for Kosrae (University of Hawaii), coupled with mapping of shoreline position and geomorphology, and tide gauge information shall be developed further to create a significant baseline of data to feed into the SMP process (Output 1.2).

While this would enable the government to access comprehensive set of information through state-of-art technologies for better decision making, there is a risk that the tremendous opportunities will be lost if the information is not properly stored and managed in a manner that is more accessible to a wider group of stakeholders beyond some key technicians in KIRMA. To strengthen communication, knowledge sharing, and more active cooperation among various scientific and research institutions in climate change related research across institutions, the database will be managed by a team based in Kosrae with clear

guidelines produced to ensure national compatibility of system architecture and data management protocols (input/output etc). This will have immediate impact beyond the project sphere as local communities can start populating their specific coastal related database at no additional costs.

The approach to be adopted is NOT to introduce an expensive GIS or complicated database system. Instead, a community focused "monitoring system" is to be promoted, that is based on a similar system designed in Samoa (Climate Early Warning System – CLEWS) or the CLiDE system from NIWA). http://www.sprep.org/climate-change/samoa-met-division-providing-clews

Tasks under Output 1.6 include:

- User Needs Assessment meeting to agree spatial data infrastructure requirements;
- Consultancy studies to identify needs for a Spatial Data Infrastructure (SDI) for future shoreline management needs;
- Purchase, install and operate recommended hardware and software;
- Training on data capture, storage and coastal database management, software design and document control, both at the island and central level;
- Cross link with Output 1.5 with regards to the training and education aspects of Component 2 on State wide (specific) coastal protection integrated data collection needs.

The Output is therefore designed to develop a national coastal zone monitoring program that is functional to support planning, management and evidence-based decision-making. The monitoring program will be managed through the Office of each State Governor (appropriate organisation such as KIRMA) as befitting their institutional remit and also the strengthening of their institutional operational capacities. Clear roles of research institutions shall be set out in order to monitor and advise on aspects such as coastal habitat change and project /engineering design performance etc. Guidance for monitoring support roles of local committees shall also be introduced at this time to help support delivery of Outputs 2.2 and 3.3.

This output shall be designed to integrate with other donor funded initiatives, especially the PPCR support project for integrated coastal zone management and the mainstreaming of climate change' project in order to ensure synergy and complementarity.

COMPONENT 2 - PRACTICAL INTERVENTION SUPPORT FOR THE STATES OF YAP, CHUUK AND POHNPEI ON TO IMPLEMENT CLIMATE RESILIENT COASTAL MANAGEMENT ("LIVING WITH THE SEA")

Outcome 2: Vulnerability of coastal communities and infrastructure investments to climate risks (in Yap, Chuuk and Pohnpei) is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.

Overview

The specific aim of Component 2 is to provide technical and administrative assistance to the States of Yap, Chuuk and Pohnpei to help deliver climate resilient coastal management in the immediate and longer term. The Component shall assist by providing experienced gained from the PACC project in Kosrae to help establish the technical evidence base and associated regulatory structures necessary to create the future pathway for State wide coastal resilience in light of climate change.

The process of developing low cost soft coastal engineering adaptation measures for highly vulnerable outer atoll islands will help to provide a "learning by doing" strategic vehicle for each State Government. It shall entail mutual learning on the part of policymakers, stakeholders, and the general public. The selected measures adopted as part of Output 2.1 shall provide direct learning opportunities for specific shoreline management actions, inform updates to State wide SMP (Output 1.2), and as

implementation proceeds, help accumulate the knowledge base that shall feed directly into the knowledge and information management system (Output 1.6).

Finally, building capacity and instilling greater awareness of climate change risks at the regional, island, and community levels is important to build long term sustainability of climate adaptation initiatives as well as the ability of communities to replicate adaptation "best practices" on their own. In addition, activities to encourage behaviour change at the local level and motivate communities to place greater value on protecting those natural resources that build each island's resilience to climate change impacts should be the core focus of any education and awareness programs. Involving communities early and continuously in the process and building on-the-ground ownership of adaptation activities is vital to maximizing success and longevity of climate adaptation work and integrating information gleaned from this Component into an improved understanding and buy-in at the community level of the need and importance any such activities carried out. Given the challenges for State Government to provide sufficient public services in remote islands, it is crucial that community involvement be encouraged and their capacity enhanced to minimize the gap between the actual and desired service delivery. Also community engagement is one of the key elements of the "Living with the Sea" principle. In particular, the capacity building sessions will be organized and offered to community groups and members that are relevant for the maintenance of the soft engineering shoreline management schemes implemented under Output 2.1. Component 2 will consist of the following outputs:

Output 2.1 Six (6) sustainable "Pilot soft coastal adaptation interventions" (incorporating food security and water /marine resource management where possible) on 6 atoll islands within the States of in Yap, Chuuk and Pohnpei.

The specific aim of this Output is to implement a series of small scale "soft engineering" demonstration projects/ approaches (supported in line with the engineering advice set out within the Coastal Development Manual – Output 1.3) on their construction and maintenance. The focus is NOT necessarily to replicate or upscale the PACC work undertaken on Kosrae (road relocation etc), but instead to provide some tangible low cost and short term engineering approaches that may assist in "buying time" for communities to plan for a more transitional strategy to relocate to "safer islands". The focus of this activity is to specifically construct up to 6 small scale soft coastal adaptation measures on outer atoll islands in Yap, Pohnpei and Chuuk States (see Appendix E for possible soft engineering approaches and Appendix H for possible locations).

While robust and fixed engineering approaches (to be demonstrated under Component 3 for Kosrae) can provide a long-term adaptation measure, for areas where urgent actions are required or where there is a need for a "transition" approach to be adopted (ahead of a more permanent community relocation strategy for outer atoll islands), softer more temporary engineering solutions offer low-cost, and often more sustainable engineered options that make use of the in-built buffering capacity of natural ecosystems and therefore often provide a more flexible approach to managing shoreline volatility. Soft engineered solutions can take the form (often implemented in combination) of rehabilitating coastal habitats, by introducing shoreline vegetation, coral recruitment programmes (for attenuating wave forces and trapping sediments), wetland rehabilitation, temporary groynes and small-scale beach nourishment (see Appendix E). The adoption of soft engineering solutions, at an island scale, is crucial for countries like FSM where public funds are limited, transporting rock and hard materials is both expensive and technically challenging, and there is a dearth of technical baseline information of structure/scheme performance, which is a prerequisite for the effective implementation of hard engineering solutions.

Soft engineering solutions are more effective in locations where shoreline erosion is the result of habitat deterioration or where sediment provenance (i.e. its source) is unknown or in net deficit, or in locations where the future dynamics/equilibrium of shorelines are unknown – which is the case for many outer atoll islands in FSM. The soft engineering approach to be adopted in this Output which shall seek to use island ecosystem functions or low-cost temporary structures to either attenuate wave forces, generate accretion of sand in key areas and redistribute sediment, or mitigate the impact of wave actions (such as salt spray). The technical simplicity and low-cost nature in their applications allow local

communities to “adapt by learning”. This is particularly important for States such as Yap and Chuuk, in particular, which include a number of atoll islands where the prevailing knowledge on soft engineering approach is very limited. The outcome of this Output is that atoll communities will be able to re-design the location and types of intervention (e.g. the use of temporary groynes) relatively easily depending on the level of erosion and growing understanding of seasonal sediment movements. This flexibility is particularly important for effective, resilient adaptation when climate change is likely to increase the level of uncertainty about the severely of erosion.

Under this Output, up to six soft engineering approaches will be demonstrated within the States of Yap, Chuuk and Pohnpei (see Part II (B)), allowing island communities to customize a locally suitable set of measures, therefore expanding the knowledge base for available options to be replicated. The selection and coordination of island-level interventions will follow usual (or revised) FSM procedures. Determining outer atoll island development priorities will be carried out through a participatory approach involving representatives of State Government, traditional chiefs and the community at large, leading to an integrated and strategic approach. The implementation of the identified actions will be carried out based on site-specific assessments in line with the preparation of the State wide SMPs as established under Output 1.2.

Lessons learnt from these activities will be synthesized and codified. Based on such knowledge, the initial Coastal Development Guidance Manual (Output 1.3) will be updated and ultimately disseminated as part of education and training Activities within Component 2 (Outputs 2.2 and 3.3). The Coastal Development Guidance Manual will be dedicated to provide clear assistance on how the replication of these soft engineering measures can be achieved across FSM.

Through specific tasks under this Activity, local communities will be involved in a direct manner in implementing these measures, offered trainings on the techniques, and made aware of benefits of such techniques along with beach monitoring principles. At least two atoll islands in Yap State are selected as demonstration sites based on their currently vulnerability as a consequence of the recent typhoon Haiyan event that was spawned from Yap in November 2013. Potentially 2,000 people should benefit from the intervention (Census 2010). The measures will be planned and implemented as proposed from the Ste specific SMP (Output 1.2) and the State wide strategic development plans, bringing together ongoing efforts to enhance land use, water supply and land management practices, through area- and ecosystem-based adaptation and disaster risk reduction approaches to manage the coastal area in a coherent way.

Specific actions, as identified by representatives and State government administrations during the consultations, may include:

- Upgrade seawalls in harbour access areas and, emergency shelters to ensure they are capable of withstanding stronger storm surges and category five cyclones;

- Coastal vegetation planting to prevent wind and salt spray;
- Enhancement of the existing ridges;
- Install sand trap technologies that have proven to be effective in other small island situations;
- Implement measures to reduce sand mining, including alternative sources of sand and of livelihoods;
- Taro planting “mounds” (similar to the proven design of pulaka pits in Tuvalu);
- Coastal vegetation planting to stabilize the ridges;
- Embankment structures to protect water resources and to promote crop growing on broad ridge designs;
- Temporary groynes;
- Small-scale beach recharge;
- Artificial coral reefs;
- Setbacks and embankment defense creation.

More details on each of these techniques are presented in Appendix E.

Tasks under Output 2.1 include the following:

- Assessments of vulnerable shorelines, to identify the exact locations of up to six demonstration sites in Yap, Chuuk and Pohnpei States;
- EIA requirements and compliance ahead of any intervention measure.
- Synthesize existing lessons learned from the past community-level initiatives on soft coastal engineering solutions; and from this analysis of suitable intervention measures (involving possibly local tolerant coral and plant species for artificial coral reef plantation and coastal vegetation in FSM etc);
- Identify sources where local coral planulae can be imported from for the artificial coral reef intervention.
- Engineering contracting and construction.

Output 2.2 Training programmes for State Government and island specific technical on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the States of in Yap, Chuuk and Pohnpei (linking to Output 2.1).

One of the key barriers preventing FSM States from achieving sustainable and affordable shoreline management and climate resilient land use planning practices stems from the lack of technical understanding about a suite of effective and (often) low-cost soft engineering techniques that can be easily adopted in the country. Through activities envisaged under this project Output, it is expected that government engineers, coastal-related managers and other officers involved in coastal management and engineering operations (both stationed at the National and State level) will obtain the necessary technical training required to remedy this capacity gap. Training activities will therefore be designed to cover technical aspects such as climate change-induced acceleration of shoreline dynamics, methodologies for implementing an array of soft and hard engineering shoreline management measures, and the linkages between sea defence, groundwater protection and sustainable land use planning. It is important for technical officers to acknowledge that these measures are not necessarily spatially linked together in some locations (i.e. building a seawall may not necessarily protect a nearby groundwater aquifer from becoming saline). This project Output is complementary to Activity 2.1 since demonstration activities in at least 6 island locations will expose the target officers to sufficient number of tested techniques. Lessons will also be drawn from the SPREP managed Ecosystem Based Adaptation project in Lami, Fiji and similar approaches made in Choiseul, Solomon Islands (multi-partner project). (see http://www.sprep.org/biodiversity-ecosystems-management/what-is-ecosystem-based-adaptation)

This project output also presents a great degree of complementarity with Output 2.4 which proposes to enhance the capacity of communities to maintain and monitor the investments envisaged under Component 2. It is also crucial that the two elements of community engagement and technical clearinghouse capacity are developed in a mutually reinforcing manner.

Tasks under Output 2.2 include:

- Organize targeted technical trainings for officers in Yap, Chuuk and Pohnpei Stateson soft engineering shoreline management measures, which include benefits on groundwater protection.
- Organize study visits to outer island demonstration sites in Yap, Chuuk and Pohnpei.
- Prepare project briefs on the implementation of shoreline management measures including technical specifications, baseline assessments, costs, benefits and maintenance requirements.
- Complete a training workshop for key national and state officers on the application of the State wide SMP (Output 1.2) and Coastal Development Guidelines (Output 1.3) for “Living with the Sea” techniques at the state level to test their ability to fully engage in climate change adaptation related activities within the framework of “Living with the Sea”.

- Training of and awareness raising for local communities, and NGOs on locally suitable soft engineering techniques and their engagement for community-based monitoring of techniques;
- Update to the "Living with the Sea Best Practice" technique Guidance Note based on pilot project findings.
- Encouragement of livelihood security and food security design options to integrate crop growing, water conservation and coastal protection into "integrated Living with the Sea" engineering schemes.

Output 2.3 Education and awareness programmes for the wider community on "Living with the Sea" principles for the 3 FSM States.

This project Output, and set tasks under it, intends to ensure that the adaptation benefits will be maintained within the project target areas beyond the project cycle. In particular, it will enhance the framework and capacity within local communities to maintain and monitor the investments delivered, especially under Output 2.2 plus also link directly to the Knowledge Management System being designed in Component 1 (Output 1.6). As described earlier, there is presently limited understanding among communities of a suit of soft engineering measures available for shoreline protections and the need for periodic maintenance for village water supply infrastructure. Under this project Activity, following the lessons learned from Output 2.1 in implementing adaptation measures and in mobilizing communities, similar sets of activities will be replicated outside the project target areas.

Tasks under Activity 2.4 include:

- Conduct awareness-raising activities on climate change impacts and adaptation options in each of the 6 target islands. Materials will be prepared using existing experience from Micronesian Conservation Trust (MCT) and partners. Awareness will be built through integrating messaging with community workshops and meetings, especially where experiences from other Pacific communities can be documented and shared. This will help share issues and ideas between project target sites. Activities will be led by the main partner organization at each site.
- Identify and select staff of key local partners at the 6 sites in the FSM, who will lead the education and building awareness of climate change and island resilience in local communities on each island. The campaign will represent the start of a three year program on each island to build local capacity and understanding of key issues surrounding ecosystem resilience and climate change adaptation.
- Effectively monitor campaign results and knowledge/behaviour in local communities through periodic, education/community attitudes and behaviour specific knowledge surveys conducted before the campaign, as a baseline, and after the campaign to judge its impact (Linking in Activity 1.5 – design of the knowledge management system. These surveys will measure the community knowledge, attitude, and behaviours at targeted sites Information gleaned from this work and from work with the communities in general will build greater on-the-ground context for national, regional and global level policymakers.
- Organize awareness raising and training sessions on the maintenance of the particular shoreline management scheme demonstrated under Activity 2.2.
- Formulate an action plan in each atoll community for the periodic monitoring and maintenance of their shorelines.
- Explore the possibility of affecting school curriculum for participatory learning of the "Living with the Sea" concept and a beach monitoring programme (similar to UNESCO SandWatch approach).
- Organize trainings on the data collection methodologies for shoreline monitoring in accordance with the approaches defined under Output 2.1.
- Arrange study visits of members of other States at least twice during the implementation of soft engineering shoreline management measures.
- Produce at least two project briefs for each community-based program
- Prepare local media news items about the project on TV, radio and newspaper

COMPONENT 3 - KOSRAE SHORELINE MANAGEMENT PLAN (2014): PRIORITY INTERVENTION MEASURES

Outcome 3: Vulnerability of coastal communities and infrastructure investments to climate risks (in priority locations on Kosrae) is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.

OVERVIEW

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 initiatives now, rather than waiting until the situation forces decisions to be made, would provide a degree of certainty and security. To achieve this, a series of engineering interventions are recommended. This may involve new inland road constructions or adequately constructed coastal defences (with design lives of 20 or 30 years).

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. At present priority sections of coastal road at Pal and Mosral are critically threatened by coastal erosion and flood overtopping. In the foreseeable future, both ongoing coastal change and the exacerbating effects of sea-level rise and climate change, will result in this and further sections of road becoming increasingly exposed to damage and flooding. 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 also 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.

Therefore, 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.

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). Consequently, 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 4).

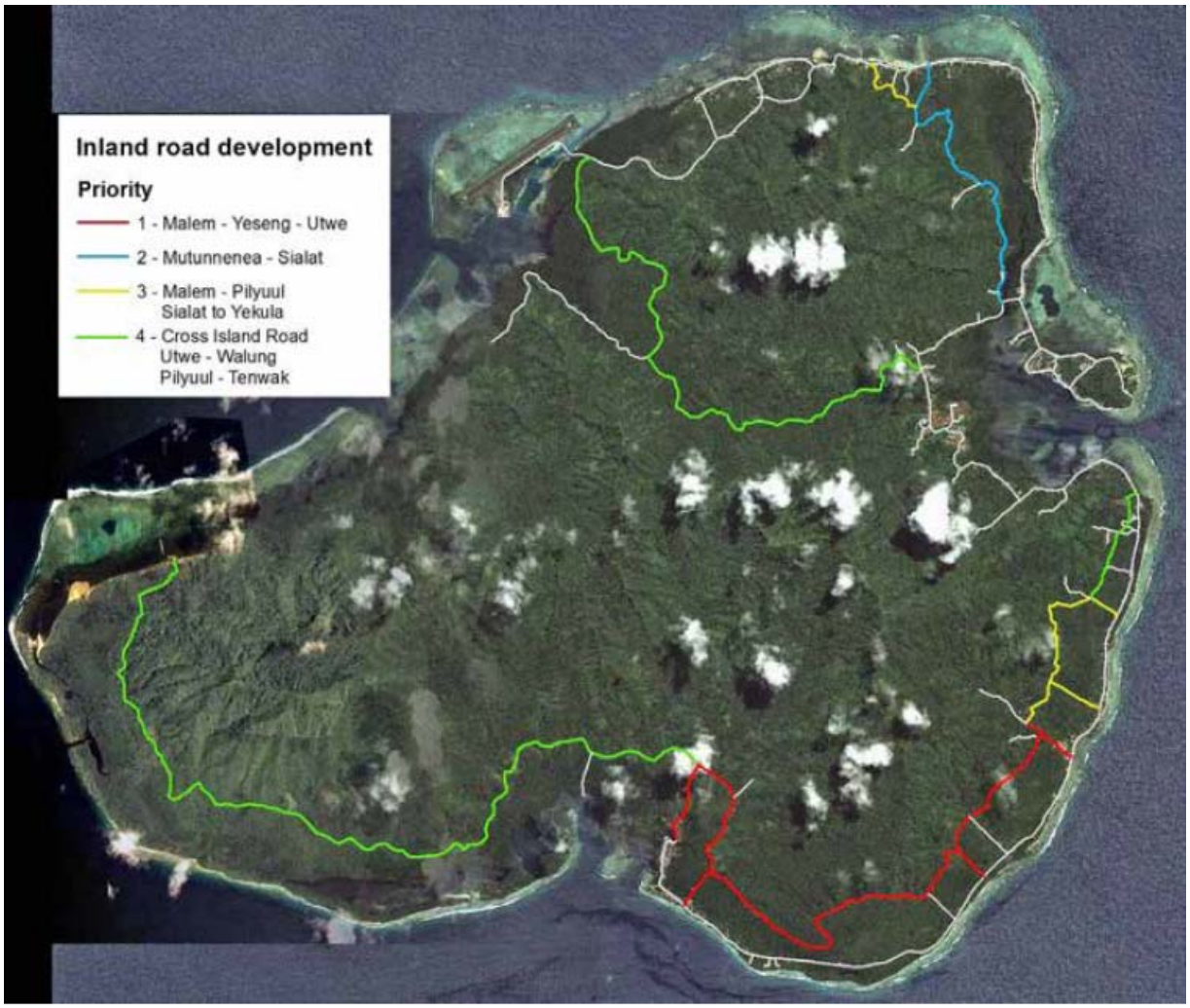

Figure 4: Priority section (Malem – Yeseng – Utwe) of the development of the inland road in Kosrae.

This Component shall therefore focus specifically on implementing the priority intervention task identified in the Kosrae SMP (2014) and already endorsed by State Government (roads and "transitional" coastal defences) that will assist in delivering a future community relocation strategy.

Output 3.1 Intervention A: New road section construction (Malem to Yeseng) plus access routes to the two villages

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. This intervention (based on costs) only focuses on the priority construction of a new stretch of road from Malex to Yeseng plus access routes to the two villages. Other donor money should be sought for the new inland

road from Yeseng to Utwe. This intervention is prioritised as there is a very real present day risk that road access from Malem to Yeseng could be cut off (Malem community of 1300 according to the 2010 Census). 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 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. 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. 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 (see Figure 5).

Figure 5: Indicative inland road between Utwe and Malem showing requirements of new and upgraded sections of road

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. At Pal despite rock protection being extended south from Malem and further concrete rubble being dumped along the most exposed section a significant investment is required to provide adequate protection of this section in the short to medium term. 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. There is a very real present day risk that road access to Utwe could, as a result, 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 over-washing where it is exposed. The proposed intervention is set out below for the new road construction between Malem and Yeseng (see Table 5).

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.

Table 5: Indicative costs 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 (taken from Kosrae SMP 2014).

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: Malem to Yeseng		2000	$746,000	$1,392,000	$38,000
Access: Malem	870		$163,000	$444,000	$16,300
Access: Yeseng	500		$94,000	$255,000	$9,400
TOTAL	**1370**	**2000**	**$1,003,000**	**$2,091,000**	**$63,700**

It can be seen that circa US$2.1million is identified for the delivery of Output 3.1.

Output 3.2 Intervention B: Transitional coast protection schemes (Mosral and Pal)

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 proposed within this Output 3.2 for Mosral and Pal villages. These defences, already in place, will command high financial commitments to maintain and in many cases upgrade if they are to provide an adequate level of protection over the next one to two generations. It is most likely that in the longer-term (over the second half of this century) the rate of sea-level rise will mean that these coastal defences become too expensive to maintain, upgrade or replace to continue to provide a suitable standard of protection.

As a consequence of this, the Kosrae (2014) SMP clearly states that the highest priority for "transitional defences" is the 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. These sections are therefore the priority focus for transitional coastal defence work as part of Output 3.2.

This activity investment shall improve the resilience to climate change for coastal communities at Mosral and Pal through the construction of new rock revetments. This investment is likely to support resilience through protection from coastal inundation for a further 25 years, enabling communities to continue with their livelihoods as present day yet "buy" sufficient time for the State of Kosrae to construct sufficient infrastructure inland to cater for population migration away from coastal risk areas.(as stated in the latest SMP for Kosrae – 2014). The proposed intervention is set out below for the new capital coast protection scheme between Mosral and Pal (taken from the Kosrae SMP 2014):

Location	Length of Defence	Details
Pal	160 m 175 yards	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 that is 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 yards	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.

This Output shall only be implemented following the acceptance and completion of all necessary KIRMA environmental regulations (EIA etc) as appropriate plus the preparation of clear compliance to a project specific environmental and social impact assessment Plan will be created.

Output 3.3 Training programmes for the Kosrae State Government on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the State of Kosrae.

This Output shall focus on assisting the completion of, and training on, the updated KIRMA *Regulations for Development Projects* which require amendment to ensure update to include the design and implementation of public infrastructure such as road and building to incorporate climate change adaptation measures consistent with the new FSM National Climate Change Policy of 2013. Training focus shall therefore be on how to implement these revised guidelines and regulations to help regulators 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.

Training detail shall include lessons learned from Output 2.1 but with a tiered focus of training for technicians and decision makers in Kosrae State Government. Attention shall be placed in particular on training on how to avoid developing in areas prone to current or future coastal hazards over the lifetime of the development. Key training messages shall incorporate recommendations to avoid any further development seaward of the paved section of road between Okat and Utwe and 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 (see Figure 6 below).

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.

Figure 6: Low lying coastal areas where restrictions are required (from Kosrae SMP 2014).

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. There shall be a close working relationship with the team undertaking the PPCR project for Kosrae (Component 2) to ensure complementarity of intervention and effort at all times.

Output 3.4 Education and awareness programmes for the wider community engagement on "Living with the Sea" principles for Kosraen villages

This Output shall ensure that the community clearly understand the intervention measures carried out in Kosrae and are made very aware of the expected outcomes and limitations of the interventions in relation to protection against typhoon and extreme weather events. Community programmes shall be designed for each intervention measure undertaken, which are 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 (through this Output) shall therefore

continue to focus on reducing and minimising human impacts on the effectiveness and protection provided by the natural coastal defences

This project Output intends to ensure that the adaptation benefits will be maintained within the project target areas beyond the project cycle. In particular, it will enhance the framework and capacity within local communities to maintain and monitor the investments delivered, especially under Output 2.1 and mirror the approaches and tasks set out in Output 3.3. The focus of education programmes shall be on the following:

- 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.
- 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.

Given the challenges for Kosrae State Government to provide sufficient livelihood security to coastal communities, it is crucial that community involvement be encouraged and their capacity enhanced to minimize the gap between the actual and desired service delivery. Also community engagement is one of the key elements of the “Living with the Sea” principle. In particular, the capacity building sessions will be organized and offered to community groups and members that are relevant for the maintenance of the transitional engineering schemes implemented under Output 3.1 and 3.2. There shall be a close working relationship with the team undertaking the PPCR project for Kosrae (Component 2) to ensure complementarity of intervention and effort at all times.

B. Describe how the project / programme provides 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.

Appendix H presents a summary profile for the proposed 6 Target islands which are the focus of the adaptation interventions. For each island, information is provided on the resident population, gender, number of dwellings, land and lagoon areas and use, length of the barrier or fringing reef, issues and vulnerabilities related to the communities of each proposed outer atoll island.

In total, the project shall benefit (both directly and indirectly) all coastal communities in FSM. This calculates to a gross population of over 100,000 (based on 2012 population statistics). For Kosrae, all 6616 inhabitants would benefit from the interventions proposed in Component 3. In the outer atolls where intervention proposals are put forward, over 1800 isolated atoll inhabitants would benefit directly from the project (see Appendix H for Proposed project areas for intervention).

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. Overall, and as an outcome of the AF intervention, the beneficiary atoll island populations in Yap, Chuuk and Pohnpei (and the village communities in Kosrae) will all become less vulnerable to the effects of climate change on the coast from flooding and coastal erosion, and thus livelihood security is improved. By enhancing overall coastal resilience, coastal production systems will be more sustainable and will be supporting livelihoods into the future. Food security will also be enhanced by these resilience building measures. Households will additionally find immediate protection against coastal erosion and flood risk through improved shoreline management policies (including road relocation and “transitional” defence construction through the opportunity for communities now and in the future to relocate inland (through new road construction schemes).

The project shall also take on board the following basic assumptions and interpretations with regard to gender:

- Interventions shall be assessed based on an appreciation of the extent by which the livelihood of people working along the coastal strip is negatively affected by the coastal erosion/accretion within the stipulated time horizon of the study shall be ascertained.
- Mitigating measures are to be formulated with monitoring plans put in place only in those areas where people’s livelihood is presently threatened now or during the next 20 years.

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 women and children living in and deriving an income from the strip of land along the coastal zone.

Socio-economic benefits are introduced through all 3 Components, however, Components 2 (intervention measures for vulnerable atoll outer islands in Yap, Chuuk and Pohnpei) and Component 3 (specific interventions for Kosrae) shall focus on deliverable and tangible “on the ground” measures which may be used as examples of best practice for later replication around all States (see Table 6 plus Appendix H for a list of benefit types and expected outcomes as a consequence of this Living with the Sea proposal). For example, over 6600 inhabitants of Kosrae are likely to benefit from the intervention measures proposed (direct or indirect benefits) in Component 3. These measures as examples of best practice will also be widely disseminated throughout the Pacific Island Countries and Territories by SPREP through the Pacific Climate Change Portal (http://www.pacificclimatechange.net/).

Type of Benefits	Baseline	After the Project	Beneficiaries per Project Component
Social benefits	• Lack of mechanism to alert deteriorating quality of beach condition and marine resources • Limited awareness about low-cost, feasible shoreline management options • Subsistence-based farming becoming increasingly difficult along the ocean side of coastal zones due to salt sprays from heightened wave energy • Food security issues influenced by increased saline intrusion	• Prevented erosion and protected assets in Kosrae for the next 50 years, benefitting over 6000 island inhabitants in Kosrae. • Heightened awareness and enhanced technical capacity to implement and maintain community-based shoreline management techniques • Feasibility of coastal schemes maintained/promoted through demonstration of coastal vegetation to specifically address climate resilience. • New platforms to grow salt tolerant crops in tandem with coast protection schemes.	Component 1: Component 2: Component 3:
Economic benefits	• The government's tendency to opt for myopic coastal protection measures for high risk areas resulting in counter-cost-effective, suboptimal performance and maladaptation • Conventional government or community response to increasing erosion/inundation problem has been either high-cost seawall construction or low-cost but long-term mangrove plantation • Eroding/disappearing beaches negatively affects tourism potential	• 2 km of road and 1.37 km of sea defence upgraded/rebuilt on Kosrae. • Up to 6 new soft engineering schemes set up and implemented on outer atoll islands in 3 States benefitting almost 1800 inhabitants. • Increased knowledge on, and capacity to implement, a suit of soft engineering shoreline management techniques • Tourism potential promoted in those areas where beaches are nourished or artificial coral reefs are promoted	Component 1: Component 2: Component 3:
Environmental benefits	• Conventional hard engineering solutions for shoreline management are often associated with negative environmental side effects such as scouring of adjacent seabed and increased erosion in adjacent lengths of coast due to prevented surface runoff	• Soft engineering options demonstrated within this project, in particular artificial coral reefs, coastal vegetation and artificial beach recharge, are likely to improve coastal marine ecosystems and species abundance and diversity	Component 1: Component 2: Component 3

Table 6: List of Benefits accruing from the Proposal (overall and per Component).

In summary, the security of livelihoods at the island community level will be supported by reducing vulnerability of households and businesses to coastal erosion, land loss, and other climate-induced problems which, without this programme, will continue to adversely affect the populations of the islands. The policy changes introduced in sectoral plans and capacity building components of the programme will be designed in a way to create an enabling environment that will secure the long-term sustainability of the adaptation measures to be introduced by the programme in the different islands. The national capacity in the provision of climate information services, technical capacity of line departments and their extension/advisory services will be enhanced to provide support to communities in their on-the-ground adaptation measures in the long run. Linkages with other policy processes and related initiatives and

projects will ensure an effective maintenance and replication of the adaptation techniques introduced to support livelihood activities of villagers.

The expected main benefits of the programme are increased resilience to climate change-induced extreme events, protection of vital community assets (both natural and man-made), enhanced food and livelihood security, and social benefits (enhanced awareness of climate change, empowered communities and public institutions through the participatory planning and implementation process, including the involvement of women and youth).

The programme is expected to deliver the following environmental benefits, among others: improved coastal zone stability, and conservation of coastal, inland and reef ecosystems. The programme result framework quantifies the socio-economic and environmental benefits, to the extent possible.

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

The cost effectiveness of this proposal is demonstrated through the continuity link with the successful SPREP managed PACC Pilot project that is being completed for Tafunsak (Kosrae - due for completion by December 2014). The PACC project at Tafunsak has been the most ambitious and probably the most effective approach towards pursuing the mainstreaming of climate change adaptation, not only in Kosrae State, but more broadly in Micronesia and across the Pacific. The PACC project to date, in Kosrae, has not simply contributed to a series of policy drafting exercises, but has also actively facilitated collaborative programming, institutional strengthening and technical assistance work among a variety of other programs and projects concerned directly and indirectly with climate change, in FSM or more broadly. This has led to a number of important potential and actual partnerships for PACC and related climate adaptation initiatives. This work is of particular significance and relevance with regards to replicating processes to other States because of the abundance of developing programs with climate adaptation-related objectives that are taking place at the same time (e.g.: PPCR work and new UNDP R2R proposals etc).

Cost effectiveness will also be achieved through keeping the professional experience of the PACC Kosrae Coordinator as a project “lead” as his close engagement of the PACC EA, KIRMA, and its Director, appear to be major factors contributing to this success. The design of the Project Implementation Unit (PIU) in Part 4 demonstrates this link clearly. Cost effectiveness is to be achieved also through the lessons learnt that Kosrae has experienced during the challenging work packages of getting institutional and legal change initiated within the State. Cost savings are likely to be achieved if the same robust approaches and team ethic, that the PACC team demonstrated, is taken forward for this “Living with the Sea” proposal. The actions from Kosrae have taken the PACC project furthest towards the concept of forming a framework for climate adaptation programming in the sub-region of Micronesia (Palau, Marshall Islands, Nauru, Kiribati), and provides a good model for the other States to follow. It should be noted that a detailed cost benefit analysis (CBA) was carried out for the PACC pilot project for Tafunsak, and a similar approach is to be adopted for the intervention measures proposed in Output 3.1 and 3.2 to help justify the interventions prior to any site intervention.

The strategic approach to encourage the production of a State specific SMP (Output 1.2), prior to any hard engineering intervention being made, is a cost effective and sustainable strategy which is specifically designed as part of the “Living with the Sea” approach for FSM. There is no incentive to spend large sums of donor money on projects that are unsustainable (i.e.: building new seawalls to protect vulnerable atoll communities or building / upgrading an existing coast road if it is likely to be inundated by tides on an annual basis). In addition, no works will be carried out, even if it complies to the policy set within each SMP, unless the proposed intervention work clearly complies to environmental regulations for each State and that a formal EIA is completed (if requested by the States’ environmental regulatory body).

The cost-effectiveness of the Programme will be reflected at the operational level through the following approaches:

- Throughout the Programme, AF resources will be aligned with the financing and delivery of programme outputs that have competitive procurement components to ensure best value for money. In this regard, the programme will apply best practices in coastal engineering and adaptation identified by other, ongoing climate change adaptation projects in the country and the Pacific region. SPREP procurement procedures will be followed.
- This Programme will utilize existing government structures and processes for implementation. By building on existing government and institutional structures, the Programme will also harness in-kind support and contributions from offices at the national and State levels (office space, staff time, communications, etc.)
- Through the existing network of stakeholders, the results framework of the Programme, will be able to utilize existing baseline surveys of line agencies and harness existing delivery mechanisms if applicable. This will further expand the reach and replicability of outputs.
- The bulk of the Programmes funds will be directed to community-level activities and hence brings opportunities for local procurement of goods and services with it.
- The encouragement to support atoll communities to consider low cost soft engineering solutions, to help "buy time" for longer term transition to higher land or higher islands in FSM is understandably a sensitive issue, but one that FSM State Governors are currently discussing and planning for the longer term and this is represented as a cost effective measure through Output 3.1 and 3.2).

It is important to stress that cheaper and less robust engineering techniques, poor construction quality and poor material use (e.g.: as currently seen used in Kosrae) can lead to premature failure of defences very quickly. Coastal defence structures (soft or hard) that are subsequently abandoned by the users after only a few years of operation are clearly not cost-effective. Indeed, the term "cost-effective" for technologies improving coastal resilience in the context of climate change impacts, means optimum value for money invested over the long term. Coastal defence measure options are meant to be designed for a lifespan of up to 50 years and thus this is an appropriate financial investment horizon to consider in a cost-benefit estimate. The lowest cost of m^3or per unit length of defence measure is not always the best metric nor the most cost-effective over a climate-relevant planning horizon due to on-going repair or periodic replacement, particularly if construction quality is compromised to save money. In addition, with decaying defences there is some loss of protection function which can be caused by overtopping in specific locations, thus a reduced initial cost may lead to a reduction in coastal resilience. When considering cost-effectiveness of coastal defence types, this needs to include an appreciation of transporting materials between the "home" and the "source", the protection of the source from wave inundation, the cost of maintenance of the infrastructures and all these costs are difficult to apprehend without an evaluation of all the option and the environment in which they will be build and they will operate. Thus, the costs effectiveness of the option proposed (within each SMP – Output 1.2) will be guaranteed during the SMP production as this shall help to ensure that the building of the coastal protection techniques proposed will take in account the expectations and principles of cost-effectiveness to allow an economical and sustainable protection from beach erosion, sea level rise and increase storm inundation impacts.

The proposed investment budget outlined above will also support the acquisition of the best technical expertise to help towards full implementation, with the involvement of proven coastal engineers, coastal planners, drainage experts and supporting community stakeholders that will guide all future sea defence management in FSM. All Government staff involvement in the programme will be an "in-kind" contribution. The cost-effectiveness analysis of these options will be improved as more data become available during project implementation before the building of these technologies.

Appendix H has been prepared to help initially identify some proposed intervention areas for the programme. These were selected based on detailed consultation with National and State level stakeholders. Decisions were then taken based on a rapid assessment of options through a Multi-criteria analysis (MCA) approach mechanism. Decisions were therefore primarily made on the proposed technology options on the basis of financial effectiveness of the investment at that particular site in addition to clear recommendations as set out by the Kosrae Shoreline Management Plan (2014). However, additional factors were considered in order to make the final justification: (i) stakeholder views

and perception were taken into account (see Appendix H) in terms of the local and community desires for the target areas, (ii) additional benefits (financial and social) above coastal protection / damage prevention were also considered such as stabilising and establishing livelihoods and provision of new productive resources.

Thus, cost effectiveness tailored to the local stakeholder situation was used to define the proposed areas, islands and technologies. The specific amount of damages that might be avoided by any one option will be dependent on how and where the proposed intervention measures are actually implemented, as well as the characteristics of any particular storm event that is being designed for. It cannot be assumed at this time, that all options are equally effective in damage avoidance as some options rely on physical processes that are known to be less effective at dispersing wave energy. Some of the less expensive options (e.g., mangrove replanting) would most likely avoid less than 10% of damages, while the more expensive options (e.g. rock revetment work at Pal and Mosral, Kosrae) could potentially avoid more than 25% of damages. Cost effectiveness has thus been viewed through the cost benefit analysis lens, aided by local community views, preferences and expert advice.

D. Describe how the project / programme 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.

Building on existing government institutions at the different levels, and working closely with key national institutions, the programme will foster inter-ministerial and cross-sectoral coordination on CCA and coastal management actions, in line with aim of the new Policy on Disaster Risk and Climate Change Adaptation (2013). Cross-sectoral climate change coordination mechanisms will be created and strengthened for climate change resiliency in all islands, with lessons learned in each island applied nation-wide and globally.

The proposal is fully compliant with the newly endorsed Policy on Disaster Risk Management and Climate Change Adaptation (2013). This supersedes the 2009 Climate Change Policy which needed updating to reflect the importance of DRM, as Micronesia is one of the nations' most vulnerable to climate change and sea-level rise. Scientific experts believe that the impacts of climate change have already begun with rising sea levels and more extreme weather events. These impacts have damaged and sometimes destroyed crops, homes, roads and other infrastructure. The FSM Government anticipates that these impacts of climate change will even require the sensitive consideration of having to relocate some Micronesian communities living on outer atoll islands. Further, through consultations during development of the State-wide Assessment and Resource Strategy 2010-2015, all four States identified climate change as posing a threat to coastal communities, especially as a result of sea level rise. However, the vulnerability of outer islands to sea level rise makes this a significant challenge to implement.

FSM approved the Hyogo Framework on 17 March 1998. FSM has, however, ratified the UN Framework Convention on Climate Change (UNFCCC) on 18 November 1993, and has submitted its Initial National Communication (INC) to the UNFCCC on 2 October 1997 and an addendum on 22 February 2000. The country has also initiated efforts to create an institutional set-up that seeks to mainstream climate change issues into the national legal frameworks. The project is fully aligned with FSM Strategic Development Plan, specifically to "protect, conserve, and sustainably manage a full and functional representation of marine, freshwater and terrestrial ecosystems". The FSM Government has also indicated to SPREP an interest in developing a Joint National Action Plan for climate change and disaster risk, using a model that has been developed in the region by SPREP, SPC and other partners (see http://www.sprep.org/Adaptation/current-programmes).

The Kosrae State Government has recently passed a Climate Change Act that seeks to address the issue in a long term manner. With regard to Kosrae, the work proposed in Component 3 is consistent with the States new Strategic Development Plan (2014-2023) and SMP (2014). In particular, Chapter 3 (Development Strategies) includes a specific sub section on the "Environment". Result 1 of that sub-section is that the "impact of coastal erosion is minimised". The objectively verifiable indicator (OVI) for that result is that *"By 2023, coastal erosion is adequately addressed, through promotion of community resilient and relocation strategies and with enhanced awareness of underlying issues and causes of increasing hazards*". A series of costed activities are presented, one of which states that *"climate proof measures integrated in the Coastal Management Plan are implemented"*. Is it understood that this is meant to refer to the Shoreline Management Plan for Kosrae. Component 3 addresses this issue specifically for Kosrae. The model adopted by Kosrae is being proposed throughout this proposal as the potential model for the remaining 3 States (reflected in the outputs assigned within Components 1 and 2).

The project is also well aligned with the GEF's Programme Framework Document for the regional programme "Pacific Islands Ridge-to-Reef National Priorities – Integrated Water, Land, Forest and Coastal Management to Preserve Ecosystem Services, Store Carbon, Improve Climate Resilience and Sustain Livelihoods". This project is to focus specifically on "high islands" whereas the "Living with the Sea" policy framework proposal coves national institutional improvements and pilot site interventions using soft low cost coastal engineering techniques (see Appendix E) on 6 low lying atoll islands.

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

The project reflects the strategic goals of the 2004 National Strategic Development Plan (SDP) with regards to the Environment namely to *"develop and implement integrated coastal environmental and resource management plans to enhance resilience of coastal and other ecosystems to extreme hazards exacerbated by climate variability and sea level rise"*. With the exception of Kosrae, other States have not yet adopted coastal resource management plans to assure coordination and successful resource management. The SDP states the requirement for *"coastal management plans developed for four state centres by 2008"*. This has not been achieved as yet, though this project shall help to deliver its expected output. In addition, the NSD Plan states the request to *"Integrate considerations of climate change and sea-level rise in strategic and operational (e.g. land use) planning for future development, including that related to structures, infrastructure, and critical assets supporting social and other services"*. The main focus of the project is to build resilience into national and State wide planning and development through "climate proofing" existing investment/infrastructures as stated in the SDP. The AF funds will be sought to implement the CC proofing investment required and its added cost.

National technical or engineering build standards for the coast are not established for FSM. However, the national commitment to climate change adaptation is declared through the supporting work of PACC on Kosrae which is planned to be up-scaled for the other 3 States in Component 2. Introducing a series of new building technical standards for FSM, coupled with a Coastal Development Guidance Manual and Environmental Policy Guidelines (EPG) is identified as a core activity in Component 1 (plus the recommendation for State specific Shoreline Management Plans to be produced for each State).

In order to address the above, each State shall take forward and be encouraged to replicate the procedures and standards set by Kosrae in terms of setting new climate resilient EIA regulations. This shall help to deliver (at a national level) the expectation to deliver and implement long-term plans for dealing with the impacts of climate change, including the development of integrated environmental and resource management objectives that enhance resilience of coastal and other ecosystems to natural hazards; identification of structures, infrastructure, and ecosystems at risk and explore opportunities to protect critical assets; "climate proofing". Outputs shall include existing facilities and infrastructure "climate-proofing" assessments and improvement plans developed for all States. There may be additional refinements required for each State however.

Through lessons learned from the PACC Kosrae initiative, this proposal shall be able to build on the leadership already demonstrated through the facilitation of new policy: following an intense 2-year process the Kosrae State Code was amended with ratification of the Kosrae Climate Change Act 2011, under which all new infrastructure developments, especially roads and buildings, are required by law to take climate change into consideration, in design and construction. Through the recently updated and "climate proofed" Shoreline Management Plan (2013), Kosrae intends to use this proposal to apply and implement the new State legislation in Kosrae; and also to use the Kosrae legislation as a "model" for the other three FSM States, and also more widely in the region. Also under the 2011 Act, Kosrae State, guided by the PACC project, has opted to regulate climate change adaptation by means of modifying their Environmental Impact Assessment (EIA) system. EIA experts from SPREP conducted workshops in FSM, in 2011 and 2012, for the SLM and PACC projects; with the objective of designing the EIA regulations.

The Kosrae State EIA process and approach shall be reviewed for relevance to other States (Output 1.1) and if appropriate, adhered to for the remaining 3 States. Updated EIA regulations shall then be used by all 4 States prior to any coastal intervention identified in Component 2 or 3 should this be requested by the appropriate environment regulatory body). Specific EIAs for each proposed intervention shall be undertaken in year 1 of the programme prior to the commencement of any engineering works (identified in Component 3). The EIA shall ensure compliance to the two new guidance standards for roads and coastal development measures (see Appendices C and D) and a clear report identifying the implications of different climate change scenarios for specific development purposes shall be included. It is therefore confirmed that, if requested by each States Environmental Department, then a full (or a preliminary) EIA shall be carried out. Should an EIA be required (based on revised FSM screening procedures to be put forward during Component 1 and the creation of the new Environmental Policy Guidelines being created), then these shall be undertaken prior to the commencement of Component 2 works (for Yap, Chuuk and Pohnpei) or the start of Component 3 (for Kosrae).

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Each EIA shall clearly provide the assurances (through clear mitigation strategies and the establishment of an enforceable Environmental Management Plan for each intervention project).The any potential negative impacts of the proposed infrastructure works have been adequately considered. Only upon receipt of a formal environmental permit (from KIRMA for Kosrae or equivalent from other States) will any pilot or formal intervention be carried out (as identified in Components 2 and 3).

The design and implementation of specific activities will pay particular attention to identifying and minimizing the gender-differentiated consequences of climate change, including those related to extreme events and disasters. Internationally recognized principles of gender equity will be applied, through use of gender analysis tools during design stage of the project and individual activities.

Nationally developed and applied tools and guidelines for assessments of coastal vulnerability and adaptation, will be used and refined during the course of the programme. Lessons learned and success factors will be documented for use during project evaluation, and subsequently in other projects. Participatory community-based consultation processes will ensure that specific interventions are accepted and owned by communities and clearly understood outputs or targets are established. All programme activities will be subjected to a SPREP appraisal process, which will ensure compliance with national standards and will be further confirmed or revised during project inception.

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

The recent ADB funded initiative entitled "Implementation of the Strategic Program for Climate Resilience: Pacific Region – SPCR" is a parallel initiative whereby Kosrae is selected as a pilot example of climate resilience. The Pacific has been invited as one of two vulnerable regions (the Caribbean being the other) to participate in the Pilot Program for Climate Resilience (PPCR) under the Strategic Climate Fund, a multi-donor trust fund within the Climate Investment Funds.

The PPCR aims to help countries transform to a climate-resilient development path, consistent with national poverty reduction and sustainable development goals. This regional capacity development technical assistance (TA) is intended to support implementation in FSM during 2014 onwards. The regional component of SPCR shall complement the work to be completed through the Living with the Sea project as it is comprises a pilot project to support the mainstreaming of climate change adaptation in national development plans. It is anticipated that the good work being proposed using AF resources shall feed directly into the regional mainstreaming work being taken forward under SPCR (i.e.: Guidance manuals – see Appendices C and D). Importantly, the Situation Analysis has already been completed and a short-list of initiatives is now being considered.

The Secretariat of the Pacific Regional Environment Programme (SPREP) has been engaged by ADB, through single source selection, to manage the program. As such, SPREP will have responsibility for the daily management of program implementation and for providing the required technical advice for CCA and DRR mainstreaming. With SPREP proposed as RIE for this AF project, the risk of duplication of effort is clearly mitigated against and the SPCR team at SPREP is integrated in the Climate Change Division of SPREP.

Component 1 of the PPCR is not planning to develop a substantial database or similar. The main thing being undertaken in this respect (i.e. relating to knowledge management) is developing knowledge product documents (which document activities, evaluate effectiveness, report lessons learned etc) which will likely be uploaded to the Climate Change Portal, Pacific Disaster Net, and hopefully some Kosrae/FSM websites.

Component 2 of the PPCR involves activities at two pilot sites; Kosrae and Kiritimati Island in Kiribati. The two pilot sites represent contrasting situations in terms of their geography (one a high island, one an atoll) and their state of preparations for climate and disaster resilience. The purpose of the Component is to provide models of successful resilience-building and produce material such as knowledge tools and techniques to enable scaling-up across the Pacific Islands region. In Kosrae activities focus on the recently adopted Kosrae SMP (2014) and aim to deliver a comprehensive set of activities across the sectors of agriculture, fisheries, water and coastal management. In addition to specific sector activities and products, the results will be brought together in an holistic guide or handbook to support 'repositioning for resilience', as set out in the SMP. These results will be disseminated to provide for scaling up of the actions modelled successfully in Kosrae (and Kiritimati Island). Component 2 will fund building roads and seawalls as proposed under this AF project (as appropriate). It is therefore proposed that the PPCR Kosrae Coastal component will seek to support the implementation of the Shoreline Management Plan as its primary focus, thus complementing those areas not being focused on within this AF proposal.

The Global Climate Change Alliance Pacific Small Islands States project (GCCA:PSIS funded by the EU) component "Increasing Coastal Food and Water Security for Climate Change in Selected FSM Islands is a key relevant project. This project has yet to start in earnest, though an initial workshop was held on 24 October 2013 to identify areas if intervention (finalise the log frame etc). In addition, one of the significant partnerships formed by the PACC project (through the Kosrae) Coordinator is with the SPC-GIZ CCCPIR project, with the objective of updating and up-grading Kosrae's 2000 Shoreline Management Plan, including advice and guidelines on coastal adaptation actions for Kosrae. This has been completed, and the lessons learned from that exercise shall be instilled into this project to help in the production of future SMPs for the remaining 3 States.

Under the Infrastructure Development Plan (2004-2023), prepared by the Dept. of Transport, Communications & Infrastructure, the Kosrae Circumferential Road was identified as a national priority and investment needs and options were presented. The Compact of Free Association provides for investment in road infrastructure under the Infrastructure Sector Grant. The State of Kosrae has identified the circumferential road as one of the projects to be funded under the Infrastructure Sector Grant. However, the Joint Economic Management Committee (JEMCO) consisting of three representatives of the US Government and two representatives of the FSM Government which overseas the management and utilization of sector grants under the Compact of Free Association prioritizes

education and health infrastructure projects. With the exception of the road project in Weno, Chuuk, which was prioritized because it includes replacing the aging water and sewer systems, other road infrastructure projects in the FSM that have been submitted for consideration by JEMCO have been placed on the "back burner". The current priority focus for JEMCO for the use of the Infrastructure Sector Grant is on education and health infrastructures such as schools, education centres, hospitals, community health centres, dispensaries, and anything related to social infrastructures

The UNDP are also in the preliminary stages of setting up a Project Preparation Grant (PPG) for the "Implementing an integrated 'Ridge to Reef' approach to enhance ecosystem services, to conserve globally important biodiversity and to sustain local livelihoods in FSM". The objective of this project is to strengthen local, State and National capacities and actions to implement an integrated ecosystems management through "ridge to reef" approach on the High Islands of the four States of the FSM. This is a multi-focal area proposal which is focused on biodiversity conservation initiatives commencing from FSM's ridge to its surrounding reef. It also cuts across the focal areas of sustainable land management (SLM) and international waters. The objective of the project is to conserve biodiversity, enhance ecosystem services, improve climate resilience and sustain livelihoods in the FSM using a ridge-to-reef approach. It has two components namely: (i) Integrated ecosystems management and rehabilitation on the High Islands of FSM to enhance ridge to reef connectivity; and (ii) Management Effectiveness enhanced within new and existing Protected Areas on the High Islands of FSM as part of R2R approach (both marine and terrestrial). This work will complement the work proposed in this AF proposal especially when considering ecosystem based shoreline management practices in the 4 States. This is important as marine and terrestrial biodiversity and ecosystem services underpin the economy of the Federated States of Micronesia and are vital to food security. However, these resources and services are currently being undermined by unsustainable resource use practices and overharvesting of resources, spread of invasive alien species and the impacts of climate change.

Other initiatives or programmes of relevance in FSM are included in Appendix G

All efforts have therefore been made to ensure that existing or pending project/programmes offer complementarity and additionality is offered through this proposal. The project will ensure coordination with the initiatives under the SPCR, PPCR, GCCA, PACC (due to be complete by end of 2014) and GEF-SPA projects. Given Kosrae was the pilot site for the current PACC project, the AF proposal will be complementary to other donor initiatives as it represents a State (Kosrae) initial baseline pilot which can then be used to replicate to the islands in FSM. SPCR PPCR Regional Track has recently (January 2014) concluded its Inception Meeting and a "Situation Analysis for Kosrae" assessment shall be undertaken from March 2014 onwards. The intention is to identify existing and planned CCA activities in Kosrae with the view to complementing and not duplicating those activities identified within this AF proposal. The format and content of the PPCR knowledge and information system shall be designed in tandem to this project in the development of the overall system (as part of Output 1.6).

SPCR and PPCR projects will be closely managed in light of this AF proposal to ensure that all projects are aware of the PACC and OEEM commitments. Synergies shall be apparent as members of each project will both be on the national steering committee for SPCR (hence close synergy between the projects ensured). There will thus be no overlap, but rather provide excellent opportunities to maximise synergies between the projects and also to help develop complementary additional activities..

The "Living with the Sea" project (this project) differs significantly from PPCR and SPCR in that it shall provide valuable coastal process related information and vulnerability analyses to help prioritise the precise locations for coastal protection intervention (Component 2 – Output 2.1). With regards to Components 2 and 3, the pilot intervention areas for this project shall align well with the outcomes of the PACC project which has focused primarily on seeking to put forward clear demonstrable climate change adaptation programmes, such as the Tafunsak road realignment programme on Kosrae (2011-2014). FSM shall make good use of AF funds to "climate proof" investments in infrastructure (i.e.: *full costs of adaptation as additional resources required to build climate change resilience)*, in a complementary way to that being adhered to within the existing PACC project for the State of Kosrae. It shall therefore be

used to fund the added cost of "climate proofing" infrastructures in the three remaining States of FSM in addition to the new proposed adaptation measures proposed in Component 3 (specific for Kosrae)..

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

Learning by doing and knowledge management is a crucial component of the proposed programme. The programme will help ensure that FSM States increase their understanding of climate change, including its likely impacts on the coastal communities within each State, and know about the range of measures to enhance resilience to maintain coastal systems, as well as be familiar with the importance of undertaking development and other planning that integrates climate risks.

The Nationwide Climate Change Policy (2009) (now superseded with the latest FSM 2013 Climate and Disaster Management Policy) sets out both mitigation and adaptation strategies. It commits to address adaptation needs through a framework in which *"all development activities in FSM take into account projected climatic changes in the design and implementation as stipulated in the FSM Strategic Development Plan/Infrastructure Development Plan."* It advocates use of an ecosystem-based approach where applicable; strengthening the application of traditional knowledge in conservation practices; and the development and implementation of appropriate strategies to improve food production. It also calls for the integration of climate change into other policies and strategies, including those related to disaster preparedness. Likewise, the State-wide Assessment and Resource Strategy 2010-2015 promotes food security through agroforestry, and coastal stabilisation as specific responses to climate change. It requires strategies be developed to address sea level rise in the outer islets.

The PACC project in Kosrae has completed a thorough knowledge management and learning programme to communicate the findings of the project thus far. Through a range of techniques, and presented clearly within the PACC Project Communications Plan, there has been success in raising the visibility of the PACC project to key supporting partners, key Gov., NGOs and CBOs in Kosrae and promoting the understanding of the role of PACC in Kosrae and the FSM. The communications plan has also:

1. Integrated PACC with other climate-related programs and projects in FSM;
2. Enhanced collaboration and partnerships with key stakeholders in Kosrae;
3. Raised interest of media in reporting on PACC-related issues (i.e. climate change issues);
4. Changed attitudes/behaviour toward use of resources and infrastructure planning (i.e. cutting of mangroves, placement of homes, building infrastructure) as it relates to climate change.

The programme proposes a series of complementary capacity building activities that help to improve knowledge management and to capture/disseminate lessons learned as follows:

a) Output 1.4: specific training support to help provide some programmatic training to national staff at OEEM on the implementation of the "Living with the Sea" guidance manuals produced (namely the Coastal Development Guidelines and the Environmental Policy Guidelines) which shall be adapted for relevance to each State. Particular focus of this training support lies on supporting the national support needed to help future implementers of environmental regulation/land use regulations in each State (see Appendix D).
b) Outputs 2.2 and 3.3: specific State relevant training support to help implement the new Coastal Development Guidelines and the Environmental Policy Guidelines (including the new proposed Roads Standard) within each State. Particular focus is placed on State specific engineers and contractors who are responsible for the delivery of climate resilient road schemes on the ground in addition to planners and decision makers within each State (see Appendix C)
c) Outputs 2.3 and 3.4: Education and awareness programmes on "Living with the Sea" principles for all 4 FSM States that will involve a more "community focused" series of awareness and training events that shall be focused on different gender and community aspects. Simple self help and support programmes shall be designed including localised monitoring approaches and "cash for work" support programmes as appropriate.

Recognizing the importance of knowledge management (KM) to enhance impacts and facilitate replication, this initiative integrates various KM related actions. Lessons will be documented by project staff with the support of the Chief Technical Advisor. These will be disseminated through a number of appropriate means to various target audiences and be guided by a project communication strategy. For example: 1) 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; 2) training modules generated from activity case studies and demonstrations will be used well after the first phase of the programme ends; the target groups will be primary and secondary school children and students undertaking tertiary studies; 3) guidelines and manuals for vulnerability, adaptation and coastal risk reduction assessments, land use planning and other programme-related activities will be made available to field workers, communities and other relevant parties; 4) a programme website will be established, with links targeting development professionals, teachers and school children; and 4) State and national level workshops will be held to facilitate peer-to-peer exchange of knowledge. Web-based platforms such as the Adaptation Learning Mechanism at www.adaptationlearning.net will be used to share information and also promote programme findings within the country. The capturing and analysing of experience, success factors, good practice and lessons learnt will be systematically applied throughout the programme cycle, for example from the detailed vulnerability assessment through the adaptation planning and implementation that will underpin the design of the project as articulated in the final project proposal.

The programme will also encourage members of other outer island communities in all 4 FSM States 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. Towards the end of the first phase of the programme a national workshop will be convened to review the new knowledge and technologies used, mainstreaming and coordination practices implemented and to develop a strategy for on-going replication and improvement for continuing use in similar future projects in FSM as well as elsewhere in the Pacific and beyond.

H. 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 programme builds on and serves to strengthen existing institutions and inter-ministerial coordination mechanisms. Consultations during the concept preparatory phase involved relevant national agencies and organizations among others.

The approach to consultation throughout the project shall mirror the effective consultative process already carried out and undertaken by the PACC team in Kosrae (for details see documents at https://www.sprep.org/pacc/fsm). In that project, regarding community engagement, a different approach has been taken. Rather than engaging people only in the immediate issues at the selected pilot site, the PACC Kosrae project team has organised briefings, seminars and activities for the whole of the island State community, targeting schools, leaders, men and women's groups, and covering the broader issue of Kosrae's climate change vulnerabilities and strategies for adaptation and building resilience. This approach seems to be working well and provides a good foundation for an inclusive longer-term adaptation & resilience program or campaign. To this end, it is proposed that this proposal undertakes a similar approach, designed clearly through a project specific Communications Plan that shall be prepared within the first month of the project. The experience from the PACC Kosrae coordinator is planned for this initiative to ensure continuity of message across all States of FSM.

Table 7 below outlines the names of key stakeholders consulted during December 2013 and throughout 2014 (see also Appendix A). The table also identifies their likely role in the implementation of the project.

Stakeholders	Project Implementation Role
Office of Environment and Emergency Management (OEEM)	This Office will facilitate functioning of the Project Implementation Unit (PIU), especially in regard to liaison with government authorities from different sectors.
Department of Resources and Development Division of Resource and Development, Agriculture Program and Marine Program	This department will take the lead coordinating role in the development of the Shoreline Management Plans in the 4 States ensuring standardization and quality. It will also take the lead in the coordination of the development of a standardized reporting and monitoring system, as well as in the development of a national Living with the Sea management information system.
State Government Departments including Chuuk State: Department of Agriculture, Department of Marine Resources; Pohnpei State: Department of Land and Natural Resources, Department of Public Safety; Kosrae State: Kosrae Island Resource Management Authority; and Yap State: Department of Resources and Development	These State Government Departments will take the lead developing the Shoreline Management Plans for the individual States. They will also be responsible for the establishment of land use planning areas and undertake, with the assistance of the NGOs, the consultations with the communities required in the process. The soft engineering Pilot Projects will be overseen by these departments and some pending availability of manpower even undertaken by the departments. These departments will participate in capacity development exercises, both in terms of developing the capacity in consultative processes. They will also play an important coordinating and implementing role in the monitoring and information gathering regarding sustainable coastal management practices
State Agencies responsible for Environmental Quality: Environmental Protection Agencies of Chuuk, Yap and Pohnpei and the Kosrae Island Resource Management Authority	These agencies have 4 main areas of responsibility: Pollution Control, Pesticides and hazardous chemicals, Public education and awareness; and Water Quality. Their involvement with the project includes interaction with the land owners, mainly through awareness raising and education of the coastal hazards caused by current practices and they will also be involved in the shoreline monitoring of lagoon water around the atoll islands.
Chuuk Conservation Society (CCS)	The mission of CCS is to 'preserve and protect Chuuk's natural resources to sustain community livelihoods by working with community partners'. It will participate in the capacity development for coordinated SMP actions on the outer atoll islands. The CCS will be involved in the community consultation in the selection and implementation of the soft coastal engineering techniques in Chuuk, partnering with communities and the Chuuk State, and undertaking ecosystem restoration activities on the main islands of Chuuk. CCS will also participate in the capacity development programme.
Conservation Society of Pohnpei (CSP)	The CSP was founded in 1998 by a group of concerned citizens and is the premier conservation organization in the FSM. CSP aims to increase community involvement in the conservation and management of Pohnpei natural resources; to build local capacity through public and private partnerships; to develop alternatives to unsustainable practices; and to promote law and policies that support these objectives. CSP will form part of the Multi-sector planning committee that will collaborate in developing the integrated land use plan for the main islands of Pohnpei. It will participate in the capacity development for coordinated SMP actions. CSP will be involved in the community consultation in the selection and implementation of the soft coastal engineering techniques in Pohnpei, partnering with communities and the Pohnpei State, and undertaking ecosystem restoration activities on the main islands of Pohnpei. CSP will also participate in the capacity development programme.
The Micronesia Conservation	The MCT is a regional organization chartered under FSM law to

Trust (MCT)	support biodiversity conservation and related sustainable development for the people of Micronesia. The MCT is set up as a private cooperation with a governing board of 9 members, including members from national, State, and municipal governments, NGOs, business, and academic institutions. The Board members represent the two major eco-regions of the Micronesia – the low islands (coral atolls) and the high islands (volcanic islands). The MCT is working to mobilise funding from a variety of public and private sources to build an endowment of US$ 20 million to provide long-term support for sustainable biodiversity resource management in Micronesia. The MCT will be involved in providing long-term grants and ensuring sustainability of funding for soft coastal engineering schemes and ecosystems restoration.
Yap Community Action Program (YapCAP)	The YapCAP helps ensure that development and infrastructure projects at the community level are consistent with the State's overall development goals and policies. Their power includes (i) promoting, encouraging and implementing development projects at the community level; (ii) adopting and enforcing rules and regulations; and (iii) receiving, coordinating and administrating grants and funds on behalf of the Yap State. YapCAP will form part of the Multi-sector planning committee that will collaborate in developing the integrated land use plan for the main islands of Yap. It will participate in the capacity development for coordinated SMP action. The YapCAP will be involved in the community consultation in soft coastal engineering scheme establishment, partnering with communities and the Yap State, and undertaking ecosystem restoration activities on the main islands of Yap. YapCAP will also participate in the capacity development programme.
Kosrae Conservation and Safety Organization (KCSO)	KCSO's mission is to sustainably manage and protect Kosrae's biodiversity and natural heritage through community engagement. KCSO will form part of the Multi-sector planning committee that will collaborate in developing the integrated land use plan for the Kosrae Island. It will participate in the capacity development for coordinated SLM action. The KCSO will be involved in the community consultation, partnering with communities and the Kosrae State, and undertaking ecosystem restoration activities on the Kosrae Island.
Local Community Groups	Local communities will be the primary agents to manage community protected areas and also in local agro-ecosystems management. Local leaders (both formal and traditionally) will play key roles in ensuring local protected area declaration, whilst local farmers groups/fishers groups, women's groups, youth groups etc. will also play key roles in different aspects of conservation planning, implementation and also in landscape management. Community Groups will form part of the Multi-sector planning committees that will collaborate in developing the integrated land use plans for the High Islands of the FSM. Local communities will be directly involved in the management and rehabilitation of critical habitats.

Table 7 Stakeholders Relevant to the Proposed Project

Given the community-based focus of the programme, a key message arising from the consultations is the need for assessment, planning and implementation of coastal adaptation measures to be carried out using participatory processes that engage community-governance structures, such as Island Councils, church groups/networks, and youth and women groups. Those consulted also urged that SMP implementation give particular attention be given to the role of women, recognizing their critical role in climate change adaptation work. The communication and knowledge sharing activities included in the

"Living with the Sea" approach will also help ensure that villagers learn directly from each other, through the good practices analysed and disseminated in conjunction with direct exchange visits, among other means. The approach is therefore designed to ensure that it takes on board the following basic assumptions and interpretations with regard to gender:

- Interventions shall be assessed based on an appreciation of the extent by which the livelihood of people working along the coastal strip (or watershed flood risk area) is negatively affected by the coastal erosion/accretion within the stipulated time horizon of the study shall be ascertained.
- Mitigating measures proposed shall be formulated and monitoring plans put in place only in those areas where people's livelihood is presently threatened now or during the next 20 years.

For the purpose of this proposal, the term "gender" shall focus on women and children living in and deriving an income from the strip of land along the coastal zone.

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

US$8,967,600 is requested for this proposal. This amount is justified for the following reasons.

Firstly, policies and related instruments in the coastal, water resource and land management sectors will be strengthened in ways that support climate change adaptation and shoreline management in all FSM States that is consistent with State Development Plans where these exist. Institutional coordination mechanisms at the national, sectoral and State levels will also be improved in ways that enhance decision making processes in the context of current and emerging climate risks. This will be further enhanced by policymakers and technical officers at the central and State level offices of government agencies represented on OEEM staff and State Government officials being trained in policies and strategies to manage coastal risks, and make good use of climate information services, climate risk assessments, and climate resilience management techniques. Educational and related initiatives will be undertaken under the guidance of a Learning and Teaching Advisor in Ministry of Education.

Secondly, the relevance and effectiveness of the current PACC project in Kosrae, whilst useful, have nevertheless been limited by the early decision to "climate proof" new sections of the island's coastal road, rather than develop a broader strategy to plan and demonstrate effective climate adaptation measures in coastal zone management. Consequently, the lessons learnt from Kosrae are clearly reflected in the design of the 3 project components for this "Living with the Sea" proposal. There is a strong incentive for the States of Pohnpei, Yap and Chuuk to adopted the model approach taken by Kosrae, to ensure that all necessary legislative and regulatory support work is undertaken, coupled with the production of a "climate proofed" Shoreline Management Plan for the State, prior to any major investment programmes. In Kosrae, "climate proofing" roads has taken place and some very useful experiences and capacities are being developed in the process. Road design is taking into consideration new meteorological data sets on climate precipitation and extreme flash flood expectations on Kosrae. This has required larger drainage culverts and a raised road base to be specified. Despite this, there now needs to be a period of "standard setting" as there is no overall design guidance manual for these works and no available documentation of how climate change modelling statistics and data can be applied, plus what engineering standards need to be used to determine culvert specifications, etc.

Thirdly, budgets are assigned (Component 3) for Kosrae to take forward key priority actions as defined in the SMP. This (importantly) defers the decisions originally considered in terms of constructing a complete circumferential road around Kosrae. Instead, focused attention is placed on providing improvements to road systems inland to help enable long term transition movements of coastal communities to higher ground. This reflects the requirements set out in the Kosrae SDP (2013-2024) and the updated SMP (2013). As no other State has similar documents in place, no budget is assigned to major schemes until such documents (supported by new State wide legislation is formulated and put into place). Despite this, the proposal does propose short term intervention advice for 6 outer island atoll communities in the States of Yap and Chuuk where immediate support and advice is needed to help

enable the “transition” from immediate self-help to long term relocation to higher islands. The proposal is very cognisant of the logistical challenges and costs associated with travel to outer islands (based on lessons learned from SPC and GCCA projects). Therefore, a suitable budget is allocated to Component 2 (which needs to include costs for travel to outer islands) that ensures that fall back measures (such as chartering survey ships in the region) could be used to help ensure delivery of the intended soft engineering projects proposed.

State Government administrators and technical officers will be provided with the opportunity and ability to participate in completing and updating SMPs for each State, and be involved in coastal risk assessment, management and in adaptation planning techniques. This will help facilitate the preparation of SMPs for each of the 4 States and also to identify agreed action interventions at 6 outer atoll islands split equally between Yap, Chuuk and Pohnpei States. To support implementation of these action plans, consistent with the SMPs set for each State, technical officers will provide advisory services to communities and community stakeholders while will in turn be trained in the use sector-tailored coastal information. This training will focus on implementation of climate-resilient coastal intervention practices.

Finally, whilst Kosrae now has its SMP (2014) officially endorsed, it now needs funds for it to be implemented, building on the approaches adopted by the PACC project where appropriate. The proposal is therefore designed to provide focused funds to help initiate intervention measures as set out as “priority” within the SMP. The outcome of this shall be to help communicate the experience and knowledge gained from to formulation of a comprehensive long-term climate adaptation strategy for FSM (each of the four States), as a framework within which multiple agencies and projects can work efficiently and effectively, subsidiary to the updated National Climate Change Policy (2013).

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

The project is designed with sustainability at the forefront of its implementation. For example, Component 1 focuses on developing the necessary Institutional Capacity for each FSM State to take forward the lessons learned from Kosrae (from the PACC project). Component 2 is designed to support the design of an appropriate shoreline management plan framework for taking for climate resilient coastal management, including the construction of 6 adaptation measures proposed for the most vulnerable atoll communities in 3 FSM states of Chuuk, Yap and Pohnpei. The lessons learned from these interventions (through workshops/conferences etc) shall be used to create a simple up-scaling strategy for other islands to follow (production of State specific Coastal Development Guidance Manual – Output 1.3). Component 3 is designed to support the Kosrae State Government to implement priority actions identified in the revised Shoreline Management Plan (2014) and to ensure the new Climate Change Act and the Kosrae State Development Plan (2014-2013) are implemented effectively with the preparation of suitable regulatory support, capacity building and on the ground engineering interventions.

The following provides some details on the sustainability of the approach.

Generic Sustainability

Sustainability is an integrated part of the project design, although it is not intended that the project, in and by itself will establish a sustainable climate resilient risk management framework. Regarding political and institutional sustainability, the project has strong government support at national and State levels. Various stakeholders from the government and civil society were involved in the initial consultation process and (see Appendix A), and several of those agencies are keen in carrying forward the implementation of the top identified priorities (i.e.: coastal erosion).

The long-term viability and sustainability of the project will also depend greatly on the extent to which national institutional capacities can be built through the implementation of the engineering pilot activities (Component 2). This will be achieved through capacity building at all levels (see Output 2.2 and 2.3) and climate resilient development rather than viewing the project as a short term activity. Institutional linkages will be strengthened (Component 1) and community based adaptation measures will include innovative

mechanisms for sustainable livelihoods, which in turn will enhance the sustainability of project outcomes (Output 2.1). The capacity building components of the project will empower stakeholders at all levels, from community members to State policymakers, all with a greater understanding of climate change risks, adaptation options and enhanced adaptive capacity. A number of measures are planned, to set the grounds for ensuring long-term institutional, political and financial sustainability. A phased approach will enable interventions to be scheduled within the absorptive capacities of existing institutions.

A key strategy of the project in engendering institutional sustainability is to create partnerships at State levels and between national institutions. The strategy is expected to greatly enhance prospects for assuring institutional sustainability, building on existing regional competencies. Training at the community level will be supplemented through participation in workshops, information exchange between communities and institutions, to be facilitated by the project management unit. The cultural sustainability of the project activities will also be ensured through community participation in the design and implementation of atoll island specific interventions bespoke coastal defence structures using local materials and other livelihood activities. During consultations with local FSM coastal communities, community members expressed strong interest in climate resilient livelihoods and measures to reduce vulnerability from increasingly frequent extreme climate events.

Institutional Sustainability

This is important at local, State and national levels. At local levels, the main measures in the project design to achieve this are: training for local island communities; supporting existing agencies and experts; empowering communities and decision-makers; and; strengthening existing consultation and decision-making structures. AF resources will build on existing organisations (local governments) and processes. At the national level, although the stakeholders and issues are different, the approach to assure institutional sustainability is the same. Awareness raising initiatives to secure political commitment, and the direct involvement of several Ministries can help ensure that commitment as will the dedication of the OEEM. The involvement of OEEM shall give the political robustness it deserves for successful implementation.

Financial/Economic Sustainability

This is a particular challenge. Although many coastal protection measures are low cost or no-cost, many others are high to medium cost. Moreover, many coastal protection measures require ongoing maintenance (funding from a combination of public and private sector partnership arrangements depending upon the purpose of the coastal protection scheme), which can only be achieved if there is sufficient local organisational capacity. The project takes many steps to achieve financial and economic sustainability. First, the measures to be demonstrated are to be achieved at costs which are largely affordable in FSM (and use local materials where possible). By building capacity to undertake all steps in constructing these measures locally, this will further lower the cost of these measures – all capacity will be available locally. Further, the project will build local organisational capacity to demonstrate that, in the complex FSM context, communities can maintain the physical constructions.

Another step taken by the project is to build capacity in FSM to mobilise financial resources to coastal protection. Elements of this include (i) strengthening data and information management capacity, so that future designs can be improved and better targeted; and (ii) developing capacity to prepare proposals and designs, notably economic analysis capacity. It is important to note that the 'demonstration' aspect of the project has implications for sustainability. In part, the project aims to demonstrate innovation, and to capture lessons learnt. Both of these are processes which require ongoing financing. Once something has been 'demonstrated', it does not require demonstrating again, so the costs associated with demonstration can be one-off (and do not need to be recovered).

K. 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
Compliance with the Law	X	The Project is in compliance with all applicable FSM and international law.
Access and Equity	X	Any new coastal protection scheme needs to ensure, through the EIA process, that it does not impede access to basic health services, clean water and sanitation, energy, education, housing, safe and decent working conditions, and land rights.
Marginalized and Vulnerable Groups	X	The interventions proposed shall ensure they avoid imposing any disproportionate impact on marginalized and vulnerable groups including children; women and girls; the elderly; disabled people.
Human Rights	X	The proposed interventions respect and where applicable, promote international human rights.
Gender Equity and Women's Empowerment	X	Training events are designed to ensure that both men and women shall equally be able to participate and be rewarded with equal benefits.
Core Labour Rights	X	Core labour standards shall be applied to when appropriate as identified by the International Labour Organization.
Indigenous Peoples	X	All applicable international instruments relating to indigenous peoples shall be adhered to with regard to any coastal protection scheme developed.
Involuntary Resettlement	X	Should coastal village relocation be implemented, displaced persons shall be informed of their rights, consulted on their options, and offered technically and economically feasible resettlement alternatives or fair and adequate compensation
Protection of Natural Habitats	X	Habitat protection is at the forefront of the programme (reef/seagrass/mangrove/wetland etc).
Conservation of Biological Diversity	X	The programme is designed to avoid any significant reduction or loss of biological diversity or the introduction of known invasive species.
Climate Change	X	The programme is designed to ensure there is no significant increase in greenhouse gas emissions or other drivers of climate change.
Pollution Prevention and Resource Efficiency	X	The programme is designed to ensure that it is designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use, the production of wastes, and the release of pollutants.
Public Health	X	The programme shall be designed to ensure it avoids significant negative impacts to public health.

Physical and Cultural Heritage	X	Compliance to the current EIA process shall 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 international level.
Lands and Soil Conservation	X	Compliance to the current EIA process shall ensure that the programme promotes soil conservation and avoids degradation or conversion of productive agricultural lands

Table 8: Checklist of Environmental and Social Principles as set by the Adaptation Fund ("X" denotes that no further assessment or management input required)

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project / programme implementation.

The Project implementation arrangements are set out in Figure 7 below.

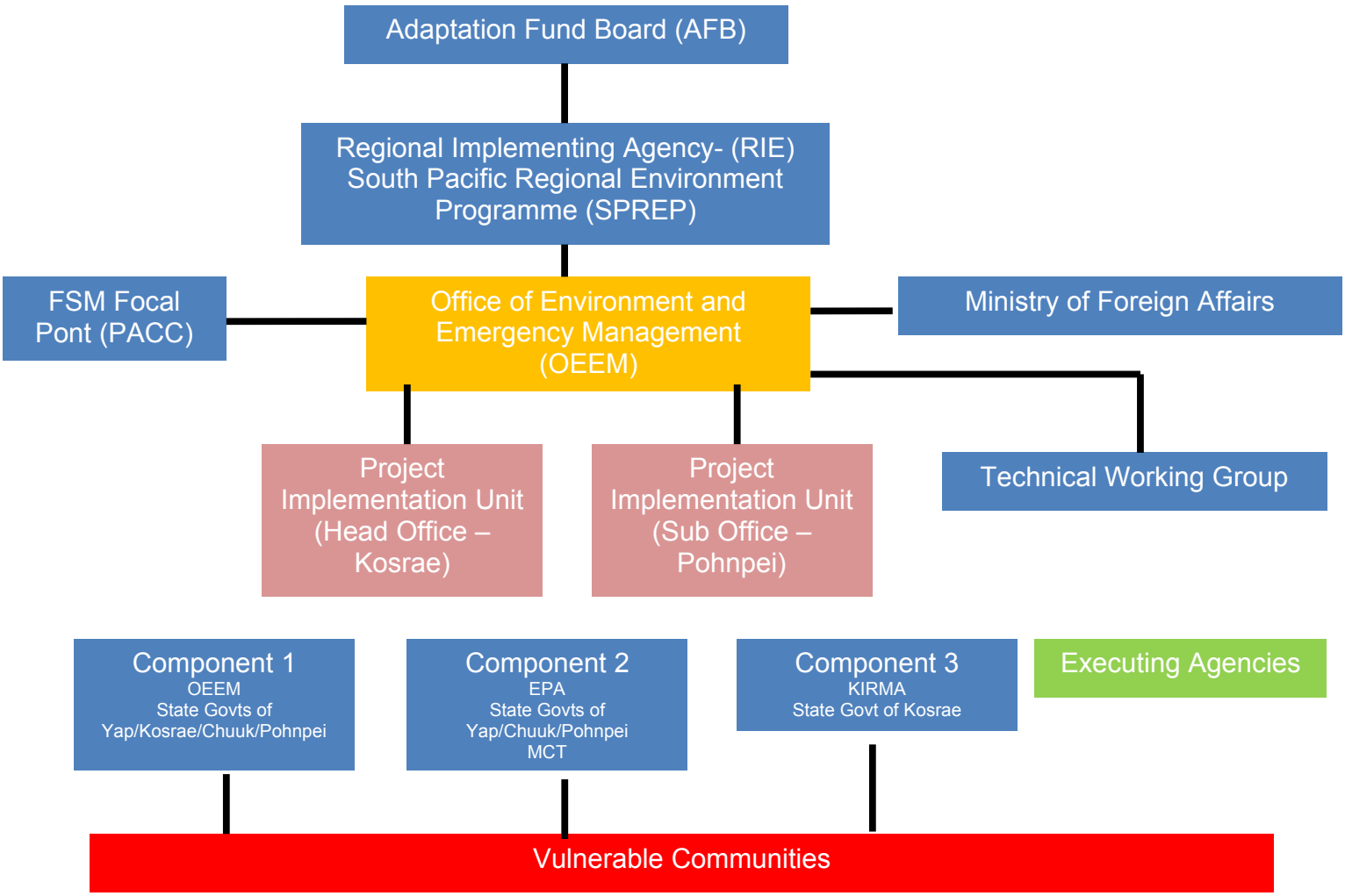

Figure 7: Indicative Organizational Outline

It will be implemented through SPREP (being a Regional Implementing Entity for AF), with the Office of Environment and Emergency Management (OEEM being the central coordinating body for climate change activities in FSM) serving as the designated national executing agency ("*Implementing Partner*") of the project. OEEM will have the technical and administrative responsibility for applying AF inputs in order to reach the expected Outcomes/Outputs as defined in this project document. OEEM is responsible for the timely delivery of project inputs and outputs, allocating resources in an effective and efficient manner, and in this context, for the coordination of all other responsible parties, including other line ministries, local government authorities and/or agencies.

Upon the request of the Government of FSM, SPREP will serve as the Regional Implementing Agency (RIE) for this project. Services that SPREP will provide to the Implementing Partner in support of achieving project Outcomes are outlined in Appendix G. SPREPs services will be provided by staff in the Multi-Country Office (Samoa).

A **Project Board** (PB), responsible for approving key management decisions of the project and will play a critical role in assuring the technical quality, financial transparency and overall development impact of the project, will be established as soon as this project is approved. The PB will be composed of designated senior-level representatives of the OEEM, State Government representatives and other key stakeholders as outlined in Part II/Section H of this project document. A complete list of PB members and their designated alternates will be provided in the initial project inception report.

The CEO of OEEM will be appointed as the **National Project Director (NPD)** and will be responsible for ensuring the overall smooth implementation of the project in line with planned project objectives and outcomes as identified in this project document. The NPD will provide strategic support as needed to the project, particularly to ensure strong engagement from key national and local stakeholders and ensure that members of National Environment Coordinating Committee (NECC), comprised of CEOs of line Ministries/Departments, are fully informed of the high-level policy objectives of the project. The costs of the NPD role will be borne by the Government of FSM as in-kind contribution to the project.

National Project Manager (NPM) will be a dedicated professional designated for the duration of the project and report to NPD. The NPM's prime responsibility is to ensure, under the overall guidance from the PB, that the project produces the results specified in the project document to the required standard of quality and within the specified constraints of time and cost.

The NPM will be supported by a core team of technical and support staff forming the **Project Implementation Unit** (PIU) located within the OEREM to execute project activities, including day-to-day operations of the project, and the overall operational and financial management and reporting. PMU will comprise a full-time island coordinator, initially based in Kosrae and an administrative/financial assistant. A "satellite" support office shall be set up within the office of SPC in Pohnpei with a separate administrative assistant based there for national coordination purposes. The PIU will work closely with the State Governments of all 4 States in FSM, to ensure that the coordination with other donor or publicly funded initiatives toward achieving national priorities is ensured (eg: direct links with the EU-GCCA and PPCR projects to be based in Pohnpei). A local coordinator will be recruited as a full time staff to oversee progress of technical project components under the guidance of the NPM. Following the project start in Pohnpei/Kosrae, a **Technical Working Group (TWG)** will be formulated for the duration of this project, comprising of national experts from different States and Departments (e.g.: Dept of Public Works and EPA), to assist the PIU on the technical dimensions of the project execution. The TWG shall be chaired by the NPM and shall meet on a fortnightly basis. The National Climate Change Committee (NCC) represented by State Governors and of key line ministries will be kept abreast of project progress and challenges through the representation of CEO in the NCC as well as vertical reporting from respective officers in TWG.

Project assurance: A Country Development Manager (CDM) located in Pohnpei, FSM and Multi-Country Office located in Pohnpei, will support project implementation by assisting in the monitoring of project budgets and expenditures, contracting project personnel and consultancy services, and subcontracting and procuring equipment at the request of the FSM Government. On the technical side, the CDM and SPREP will monitor progress of project implementation and achievement of project outcomes/outputs as per the endorsed project document. A designated Programme Officer will be assigned in the MCO to provide financial and technical monitoring and implementation support services.

The proposal seeks to be submitted through SPREP, who is now a Regional Implementing Entity (RIE) of the Adaptation Fund Board. .

The existing PACC Project Management Unit (PMU) shall be in operation up to the time of PACC funding termination (December 2014). It is proposed that the same structure of PMU is proposed for the project, adding to it with staffs as required.

The Government of the FSM has requested SPREP (now a RIE) assistance in designing and implementing this project, due to SPREPs track record in FSM through the recent PACC project whose funding expires in December 2014. SPREP has well-developed working relationships with the key stakeholders. It counts on the CDM exclusively dedicated to FSM's affairs. This officer is supported by other programme, operations and Senior Management staff at SPREPs Multi-country Coordinating Office's. Moreover, the project will benefit from the presence of a dedicated project officer currently in the new PACC offices in Kosrae plus also the SPC-GCCA offices in Pohnpei. SPREP also has extensive experience in integrated policy development, human resources development, institutional strengthening, and non-governmental and community participation.

SPREP will be engaged, through single source selection, to manage the program. As such, SPREP will have responsibility for the daily management of program implementation and for providing the required technical advice for the project. SPREP will also manage and administer studies and surveys, training programs, workshops, and conferences, including subcontracting service providers such as academic and training institutions, NGOs, and community-based organizations as necessary.

SPREP shall, early on in the project, decide on the need for engagement of specialist advice from CROP agencies (most likely as part of the inception work for the AF project).

The budget for Project Management (Execution) is shown on Table 9 below.

Items	Months	$/month	Total (US$)
6 core staff members (3 full time and 3 part time field officers per State)	See Table 14b	See Table 14b	248,000
Office Rent	50	370	18,500 (OEEM/KIRMA office support)
Equipment, supplies, misc	50	350	17,500
Vehicles and travel	48	1,000	48,000
Monitoring and evaluation			118,000
TOTAL			**450,000**

Table 9: Project Management (Execution) Costs

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

No	Type	Description	Comments/Mitigation Measures	Rating
1	Institutional	Lack of manpower within executing agencies cause delay or insufficient level of implementation	The project will be designed with a particular attention on the manpower constraints in State Government departments. The project will therefore place a strong emphasis on community, CSO and the private sector engagement to the extent possible and the implementation plan will be designed accordingly.	**Medium**
2	Environmental	Extreme natural disasters affect the implementation of climate change adaptation measures on the ground	Tropical cyclones are becoming more frequent and intense. In the last three decades, FSM received on average around 1.5 cyclones per year. If a large-scale tropical cyclone hits the country, some of the government functions will be diverted to emergency response measures. While the project cannot directly control the occurrence of cyclones, the project work plan is set to provide sufficient	**Medium**

			time buffer to catch up with potential delay. Further, the designs of equipment installed in the project will take into consideration intensifying natural disasters to withstand such events.	
3	Environmental / Social	Adaptation measures increase inequity	The project will ensure that the adaptation measures are gender sensitive and demonstration at the local level that they do not limit the participation of women and the disabled as beneficiaries. In addition, lessons learned from the three target islands will be accumulated and disseminated throughout the project cycle so that other islands that are not covered in this project will see benefits of learning from earlier experience.	**Low**
4	Financial	State Governments are not able to mobilize sufficient resources to replenish the small grant mechanism	SPREP will provide assistance in approaching potential donors, combining, sequencing and ultimately mobilizing additional climate change financing	**Low-Medium**
5	Social	Community acceptance of soft engineering shoreline protection measures proposed by the project	During the consultations that took place in FSM States in December 2013, the discussions resulted in high level political support if any help could be given to the outer island atoll communities of Yap, Chuuk and Pohnpei. Communities are acutely aware of both on-the-ground actions needed and of the financing constraints the government is facing. So it is likely that the acceptance by communities of concrete interventions proposed under Component 2 is high. The inception phase of the project will involve a series of awareness raising activities about proposed measures, which will also contribute to smooth acceptance of these measures for the selected States in FSM.	**Low**
6	Institutional	Weak coordination within and between State and national government and other stakeholder institutions responsible for land/coastal management; limited capacity (especially at lower levels) to interact with land users	The project will support and facilitate activities to ensure improved institutional coordination, capacity building and awareness-raising at the national, State and municipal levels. Where possible, formal agreements will be used to define roles and responsibilities. Training will be provided to stakeholders on conflict resolution. Activities will be designed and implemented in a win-win manner, beneficial to all, as far as possible. The sustainable development of the landscape will be emphasized with arguments that are supported with long-term economic forecasts.	**Medium**
7	Institutional	State run ships to outer islands are unreliable and very slow to get to many outer	A budget is included in Component 2 to ensure that the possibility of chartering a survey vessel is an option to ensure that the best possible opportunities are provided to set up and implement meaningful and tangible soft coastal engineering	**High**

		islands, and only stay on island for half a day (on average).	schemes on outer atoll islands.	

Table 10: Risk Management Measures

In addition to those identified in Table 10, the main risks for the implementation of the project are:(a) Conflict between stakeholder groups/land owners with different political agendas results in an inability of sectors and/or States to cooperate at the level needed to achieve results; (b) Pressing domestic economic and social issues such as poverty and human health issues imply that regional climate change and sea level rise impacts on coastal communities receive sub-optimal attention and investment; (c) There is sufficient numbers of regionally based experts (especially coastal engineers) to fulfil implementation needs of the project including building individual capacities in the region; (d) Participating communities in each State will not be able to agree on the mechanisms necessary to achieve sustainability; and(e) Important local level stakeholders (communities, planners, tourism industry stakeholders) will see ecosystem based management efforts as being detrimental or unaffordable given their interests.

In addition to this, and again in keeping with SPREP practice, a dedicated budget line exists for Monitoring and Evaluation (M&E), to ensure that the necessary resources are allocated to execute the M&E framework.

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

The key measures being proposed to address and manage environmental and social risk, in line with the AF Environmental and Social Policy include the following:

SPREP shall consider and manage environmental and social risks (as presented by the project) by integrating risk assessment procedures and management processes into day to day procedures. The initial screening for environmental and social risks shall therefore be included in the project/programme proposal document and Inception Report (the Work Plan). There will be particular attention towards ensuring that vulnerable groups, including gender considerations are inculcated into the working procedures of SPREP, OEEM and any supporting consultancy that the project requires."

The scope of any environmental and social assessment shall be commensurate with the scope and severity of potential risks (identified in "G" above). If an environmental and social assessment is required, the assessment shall assess all potential environmental and social risks and include a proposed risk management plan.

SPREP shall ensure that the latest AF Environmental and Social Policy document (approved in November 2013) shall be closely adhered to throughout. Screening exercises and policy delivery shall be important components of the project delivery mechanism. Environmental and Social Management Plans, clear monitoring, reporting and evaluation programmes coupled with appropriate grievance mechanisms and public disclosure consultations are key measures to ensure this happens.

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

A Technical Working Group (TWG) will be established that ensembles technical experts on climate change, coastal management and ecosystem conservation and all the related projects in FSM will be represented on this group. This shall use the structure already established as part of the PACC Project Management Unit currently based in Kosrae. Regular meetings will be held between the different projects to leverage synergies and ensure efficiency in implementing the projects. The studies conducted and

information gathered under the other projects will be integrated into project development and implementation.

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 **Error! Reference source not found.**. Technical guidance and oversight will be also provided from SPC (as a collaborative partner from its base in Pohnpei) and SPREP based in Samoa, as well as the Project Board (PB).

Project start: A Project Inception Workshop (IW) will be held within the first 2 months of project start with those with assigned roles in the project management, AF, SPREP and where appropriate/feasible, regional technical advisors as well as other stakeholders. The IW is crucial to building ownership for the project results and to plan the first year annual work plan.

Annual Progress Report. An Annual Progress Report (APR) shall be prepared by the National Project Manager, shared with the Project Board and submitted to the Donor. The APR will be prepared with progresses against set goals, objectives and targets, lessons learned, risk management and detailed financial disbursements.

Mid-term of the project cycle: The project will undergo an independent Mid-Term Evaluation (MTE) at the mid-point (24 months) of project implementation. The MTE will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. The findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term.

Periodic Monitoring through site visits: SPREP (or nominated collaborative parties) will conduct visits to project sites based on the agreed schedule in the project's Annual Work Plan to assess, at first hand, project progress. Other members of the PB may also join these visits.

Project Closure: An independent Final Evaluation will take place 3 months prior to the final PB meeting. The final evaluation will focus on the delivery of the project's results as initially planned and as corrected after the mid-term evaluation, if any such correction takes place. The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals.

The M&E plan outline is as follows (see Table 11):

Type of M&E activity	Responsible Parties	Budget US$	Time frame
Inception Workshop (IW)	▪ Project Manager ▪ SPREP	3,000	Within first four months of project start up
Inception Report	▪ Project Team ▪ SPREP	3,000	Within one month from IW
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by Project Manager ▪ Project team	n/a	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	▪ Project manager and team	0	Annually

	▪ SPREP ▪		
Periodic status/ progress reports	▪ Project manager and team	0	Quarterly/ Annually
Mid-term Evaluation	▪ Project manager and team ▪ SPREP ▪ External Consultants (i.e. evaluation team)	30,000	At the mid-point of project implementation.
Final Evaluation	▪ Project team, ▪ SPREP ▪ External Consultants (i.e. evaluation team)	30,000	At least one month before the end of project implementation
NEX Audit	▪ SPREP ▪ Project manager and team	2,000	Following SPREP finance regulations and rules
Visits to field sites (Travel)	▪ Project staff ▪ Government representatives	50,000	At all stages of project implementation
TOTAL indicative COST		**US$118,000**	

Table 11: M&E Plan outline and costs.

Components 2 and 3 both include a series of monitoring and evaluation programmes for each State, also training and capacity building activities on ecosystem based adaptation work and training for communities and State Officers to help implement the Coastal Development Guidance Manual, adapted to be specific for all FSM States.

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

A fully stakeholder endorsed results framework for the project proposal, including milestones, targets and indicators is presented in Table 12 below.

F Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund

Project Objective(s)[2]	Project Objective Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
Prepare the necessary institutional and regulatory frameworks, policies, guidance and "tools" to help deliver the "Living with the Sea" climate resilient approach for all FSM States.	Number of new institutional, regulatory and planning policies, frameworks and tools introduced to implement climate resiliency for all FSM States	1.1 Capacity developed for efficient and effective support at national level to deliver climate resilient policies and enforce regulations for the coastal zones of all FSM states.	Capacity to implement climate risk management in national institutions and target State Governments is increased.	785,000

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

Implement the "Living with the Sea" approach through the effective mainstreaming of climate resiliency and long term coastal planning into State wide development plans.	Number of communities with improved resilience through the mainstreaming of new climate-related planning and policy frameworks that are in place	1.1 Capacity developed for efficient and effective support at national level to deliver climate resilient policies and enforce regulations for the coastal zones of all FSM states.	25 Technicians trained in total (10 technical staff drawn from national departments; 20 extension staff drawn from relevant State engineering, planning and fisheries organisations.	600,000
Introduce "transitional planning" livelihood security measures to help 6 outer atoll islands implement the long term delivery of the "Living with the Sea" approach within the States of Yap, Chuuk and Pohnpei.	Number of risk-exposed coastal communities in Yap, Pohnpei and Chuuk protected through adaptation measures.	2.1 Vulnerability of coastal communities and infrastructure investments to climate risks is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.	6 atoll coastal adaptation schemes are designed and constructed within budget by the end of the project 1,500 households in all 4 FSM States will directly benefit directly from coastal protection planning measures proposed in the various SMPs.	3,075,000
Implement priority "Living with the Sea" transitional planning projects on Kosrae to help contribute towards the delivery of the Kosrae SDP and adopted Shoreline Management Plan (SMP2014) and to provide communities with the necessary infrastructure to help relocate from high risk coastal inundation sites.	Number of risk-exposed coastal communities in Kosrae protected through adaptation measures	3.1 Increased climate resilience of coastal communities (Malem, Utwe, Pal, Mosral and Walung) through the effective delivery of priority engineering "climate proof intervention measures" as set out in the Kosrae SDP (2014-2023) and Kosrae Shoreline Management Plan (SMP).	Successful construction of all proposed schemes (using AF funding support) on the island of Kosrae on time and within budget.	3,145,000
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
Outcome 1: Capacity developed for efficient and effective support at national level to deliver climate resilient policies and enforce regulations for the coastal zones of all FSM states.	Implementable law and regulatory enforcement support for climate resilient coastal and marine management for each FSM State. Institutional reform and capacity development to improve coordination for future Living with the Sea policy compliance (for each FSM State)	Tangible new legislation, regulation and guidance that is managed and enforced via robust policy as set by national Government (OEEM) for each State (Output 1.1). Shoreline Management Plans (SMPs) for each state and SMP identified coastal defence maintenance targets and recurrent and capital expenditures are integrated into national fiscal budgets (Output 1.2) Appropriate Guides, Manuals and Protocols to deliver "Living with the Sea" policies for all FSM States (Outputs 1.3 and 1.4). State Government "Living with the Sea" "performance measure procedures for key staff/departments are established (Output 1.5)	Coastal Development and Environmental Policy Guidelines for each State prepared and linked to new regulatory coastal planning policy for the each State. Road and building standards and protocols for the each FSM State ratified and inculcated into policy. National knowledge and information system for "Living with the Sea" is set up and working at national and State levels to help monitor and evaluate policy progress.	1,385,000

Outcome 2: Vulnerability of coastal communities and infrastructure investments to climate risks (in Yap, Chuuk and Pohnpei) is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.	Training programmes on the implementation of coastal development and environmental policy guidance and the State specific Roads and Building standard for each 3 States. Education and awareness programmes on "Living with the Sea" principles for all 4 FSM States	Pilot sustainable "low cost" soft coastal adaptation pilot intervention options (incorporating food security and water /marine resource management) on 6 atoll islands in Yap, Chuuk and Pohnpei States are implemented (Output 2.1). Education and awareness programmes are run and executed to over 100 FSM island individuals (Output 2.2 and 2.3).	6 pilot schemes (soft engineering) are designed and constructed on 6 islands on time and within budget.	3,075,000
Outcome 3: Vulnerability of coastal communities and infrastructure investments to climate risks (in priority locations on Kosrae) is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.	Maintenance coastal protection projects (as defined in the SMP for Kosrae and SDP 2013-2014). Education and awareness of climate resilience is improved on Kosrae	New road section construction (Malem to Yeseng) plus access routes to the two villages (Output 3.1) New capital coast protection schemes (Mosral and Pal).(Output 3.2) Community engagement and flood resilience programmes for "at risk" Kosrae villages. (Output 3.4).	Over 6,000 inhabitants of Kosrae receive added value benefit from the AF budget intervention programme.	3,145,000

Table 13: Project alignment with Strategic Results Framework (SRF)

Table 12: Strategic Result Framework for the Project

Project Strategy	Indicator	Baseline	Target	Sources of Verification	Assumptions
Objective: Strengthen the ability of all FSM coastal communities, and State Governments (the public service), to make informed decisions and manage anticipated climate change driven pressures (including extreme events) in a pro-active, integrated and strategic manner.	Number of national policies and related coastal planning and regulatory instruments are enhanced in ways that support the effective delivery of sustainable coastal management for all 4 States.	Relevant national coastal policy instruments, coordination mechanisms and institutions do not address climate risks in an adequate manner. States (other than Kosrae) have no formal mechanism for addressing coastal risks in a pro-active, integrated and strategic manner.	By the end of the programme, at least 1500 households and 100 public officers, (collectively in all 4 FSM States) have increased their adaptive capacity and ability to embrace and implement the "Living with the Sea" policy framework at State and local levels.	Project implementation, technical and training workshop reports. Community consultations and surveys on perceived risk reduction. National and sectoral coastal policy documents and island level coastal adaptation plans.	Availability of necessary expertise and experience to undertake activities required to integrate coastal risk management into relevant policies and other instruments. Political will and commitment by senior government officials to integrate coastal risk management. Strong coordination amongst coastal stakeholders in all FSM States. Strong community leadership and support for, and engagement in project activities in all 4 FSM States.
Outcome 1: Capacity developed for efficient and effective support at national level to deliver climate resilient policies and enforce regulations for the coastal zones of all FSM states**.**	Number of national policies and related instruments enhanced in ways that support the "Living with the Sea" Policy Framework. Number of State Government staff with job descriptions that make reference to climate and coastal risk management and who have received relevant training.	Relevant national policy instruments, coordination mechanisms and institutions do not address coastal risks in an adequate manner. Climate and coastal risk management are seen as the sole responsibility of the OEEM and of respective State wide Departments *(such as KIRMA in Kosrae etc).*	At least four different and relevant national level policy instruments (guides/standards/plans or procedures), and coordination mechanisms are set up to help implement integrated coastal zone management that is applicable for all FSM States. At least 100 State wide government staffs (with responsibilities for sustainable development in the Outer Islands) have job descriptions that make reference to ICZM and the "Living with the Sea" Policy Framework. By the end of the 2nd year, 3 additional State wide SMP action plans are approved by each State Governor, and harmonized with State Development Plans in Yap, Chuuk and Pohnpei. By the end of the programme at least four training packages receive	National policy documents Ministry Corporate, new SMPs and updates to State wide Strategic Plans; Annual reports of ministries and other government agencies; Project reports; Project monitoring and evaluation reports; Annual reports of ministries and other government agencies.	Political will and commitment to ensure plans and planning "tools" are prepared in a fully participatory manner. Strong community leadership and support for, and engagement in project activities in all 4 States. Availability of staff to be trained on delivery of the "Living with the Sea" Policy Framework and associate planning tools.

			positive evaluations in independent assessments.		
Outcome 2: Vulnerability of coastal communities and infrastructure investments to climate risks (in Yap, Chuuk and Pohnpei) is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.	Prepare 6"soft" coastal adaptation risk reduction measures on outer Islands within Yap, Chuuk and Pohnpei States. Island stakeholders and key players trained in soft coastal engineering coastal adaptation measures construction, maintenance and monitoring as well as delivery of the regulatory mechanisms linked to the "Living with the Sea" policy framework. No of local tourism / business enterprises on Outer Islands applying climate resilient coastal management techniques. Number of knowledge materials generated on lessons learned and best practices.	Only a few "pilot soft engineering" projects and ad-hoc coping measures have been undertaken by communities and have failed due to poor advice and technique. As a result communities lack adequate capacity to adapt to climate-induced impacts coastal ecosystems, and related livelihood activities and to introduce shoreline protection measures in a planned and systematic way. There are no individuals in the Outer Islands who have formal responsibilities for, and oversight of, coastal risk management in the context of sustainable island development. There is a critical lack of training materials for enhancing the capacity of island stakeholders in coastal risk management, adaptation planning, and in implementing of climate-resilient coastal management practices.	By the end of the 3rd year , at least 100 government staff with responsibilities for sustainable development in the Outer Islands will have received formal training in "Living with the Sea" policy framework delivery and coastal adaptation maintenance and monitoring techniques involving both men and women in an equitable manner. By the end of year 1 of the programme, Ste specific "Living with the Sea" Focal Points appointed and fully operational (within each State Government). By the end of the programme 6 soft engineering schemes are constructed on 6 separate Outer Islands within the States of Yap, Chuuk and Pohnpei, increasing the resilience to climate change to at least 1200 households (on 6 islands). By the end of the programme at least four training packages receive positive evaluations in independent assessments.	Reports of island councils, and secretaries. Site/field visits and surveys. Project reports Project monitoring and evaluation reports. Training evaluation reports	Strong island and community interest in, support for, and engagement in capacity building activities in the Outer Islands of each State. State Governors can identify the need for, and oversee implementation of interventions that address coastal adaptation in a pro-active, integrated and strategic manner. Strong island and community interest in, support for, and engagement in the design and construction of soft coastal adaptation measures that will not only enhance island and community resilience, but is designed with attention to "planning for" future climate risks. State Governments of Yap, Chuuk and Pohnpei can oversee implementation of infrastructure projects that will enhance island and community resilience.
Outcome 3: Vulnerability of coastal communities and infrastructure investments to climate risks (in priority locations on	Km of coastline with climate resilient shoreline protection or inland road reconstruction measures introduced on Kosrae.	Kosrae stakeholders and key players have little practical understanding of coastal adaptation and practical risk implementation and how this understanding	By the completion of the programme climate resilient coastal adaptation measures are introduced in at least 20 Km of coastline on Kosrae. By the end of the programme at least 6000 inhabitants of Kosrae	Documents on lessons learned, best practices and case studies Project reports E-mail exchanges with	Local capacity exists to produce training materials that are of a high standard. Island stakeholders and key players (e.g.: Kosrae State Government) have a high interest

Kosrae) is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.	Number of knowledge materials generated on lessons learned and best practices. Training materials prepared and evaluated.	can contribute to sustainable island development. There is a critical lack of training materials for enhancing the capacity of island stakeholders in coastal risk management, adaptation planning, and in implementing of climate-resilient coastal management practices.	have increased coastal resilience to inundation and erosion. At least 5 knowledge materials (experience notes, case studies, photo stories, videos, etc,) are generated per year starting from year 1 of the programme. By the end of the programme at least four training packages receive positive evaluations in independent assessments.	other countries Project monitoring and evaluation reports Independent evaluation reports Training evaluation reports Reports of State Governors.	in, support for, and engagement in capacity building activities in Kosrae. Locally available printing, video and audio production firms have the ability to engage with the “Living with the Sea” Programme

G 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.

A detailed budget is set out in Table 14a. Table 14b outlines the FSM project execution costs. Table 14c outlines the key budget note explanations. Table 14d demonstrates the division between Local (FSM) and International Consultant technical support services that are costed for.

Detailed Project Budget		
No.	**Outputs**	**Cost Est USD**
COMPONENT 1. STRENGTHENING NATIONAL INSTITUTIONAL AND CAPACITY DEVELOPMENT MEASURES TO SUPPORT DELIVERY OF CLIMATE RESILIENT COASTAL MANAGEMENT IN FSM ("LIVING WITH THE SEA")		
1.1	Output 1.1: Legislative and policy support to help improve regulatory enforcement of climate resilient coastal and marine management for each FSM State;	150,000
1.2	Output 1.2 Preparation of Shoreline Management Plans for Yap, Chuuk and Pohnpei States with each defining sets of maintenance targets and integrate recurrent and capital expenditures.	600,000
1.3	Output 1.3: Prepare Coastal Development and Environmental Policy Guidelines for each State to help deliver the "Living with the Sea" approach (i.e.: linking R2R and SMP policy direction).	150,000
1.4	Output 1.4 Establish climate resilient engineering and construction (building) standards and protocols for future coastal infrastructure construction within each FSM State.	175,000
1.5	Output 1.5 Capacity development to improve coordination for future Living with the Sea policy compliance (for each FSM State) including "performance measure" procedures for key staff/departments.	110,000
1.6	Output 1.6 Establish a national knowledge and information system for "Living with the Sea" delivery.	200,000
SUBTOTAL FOR COMPONENT 1		**1,385,000**
COMPONENT 2. PRACTICAL INTERVENTION SUPPORT FOR THE STATES OF YAP, CHUUK AND POHNPEI ON TO IMPLEMENT CLIMATE RESILIENT COASTAL MANAGEMENT ("LIVING WITH THE SEA")		
2.1	Output 2.1 Six (6) sustainable "Pilot soft coastal adaptation interventions" (incorporating food security and water /marine resource management where possible) on 6 atoll islands within the States of in Yap, Chuuk and Pohnpei.	2,600,000
2.2	Output 2.2 Training programmes for State Government and island specific technical on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the States of in Yap, Chuuk and Pohnpei (linking to Output 2.1).	275,000
2.3	Output 2.3 Education and awareness programmes for the wider community on "Living with the Sea" principles for the 3 FSM States.	200,000
SUBTOTAL FOR COMPONENT 2		**3,075,000**
COMPONENT 3. KOSRAE SHORELINE MANAGEMENT PLAN (2014): PRIORITY INTERVENTION MEASURES		
3.1	Output 3.1 Intervention A: New road section construction (Malem to Yeseng) plus access routes to the two villages.	2,100,000
3.2	Output 3.2 Intervention B: Transitional coast protection schemes (Mosral and Pal)	750,000
3.3	Output 3.3 Training programmes for the Kosrae State Government on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the State of Kosrae.	150,000
3.4	Output 3.4 Education and awareness programmes for the wider community engagement on "Living with the Sea" principles for Kosraen villages.	145,000
SUBTOTAL FOR COMPONENT 3		**3,145,000**
PROJECT MANAGEMENT (Project/Programme Executive Agency Costs (including M&E)		
Project Staff costs (6 staffs - see Table 14b below)		248,000
Office Rent (including OEEM/KIRMA office support)		18,500
Equipment, supplies, miscellaneous		17,500
Vehicles and travel		48,000
Monitoring and evaluation		118,000
SUB TOTAL		**450,000**
Implementing Entity Management fee (8.5% of Total Project Cost)		646,425
Project Cycle Management Fee charged by National Govt		266,175
TOTAL PROJECT COST		**$8,967,600**

Table 14a: Total Costs (excluding Implementing Agency Fee).

The Programme FSM Executing Agency Staff Costs are presented below in Table 14b.

	Year 1	Year 2	Year 3	Year 4	TOTAL (US$)
Project Coordinator Salary (Kosrae Based)	18,000	18,000	18,000	18,000	**72,000**
Project Admin/Finance Officer	16,000	16,000	16,000	16,000	**64,000**
Project Procurement Office salary	16,000	16,000	16,000	16,000	**64,000**
Field coordinators part time salary (Yap)	4,000	4,000	4,000	4,000	**16,000**
Field coordinators part time salary (Pohnpei)	4,000	4,000	4,000	4,000	**16,000**
Field coordinators part time salary (Chuuk)	4,000	4,000	4,000	4,000**62,000**	**16,000**
TOTAL	**62,000**	**62,000**	**62,000**		**248,000**

Table 14b: Total FSM Executive Agency Staff Costs.

The budget notes are set out in Table 14c.

Budget Note Number	Supporting Note Explanations
a	Local Consultant are based on monthly rates and be calculated per local expert for each agreed Outcome (see Table 14d).
b	Local Travel shall be estimated based on fuel/flight/car/transport costs for local and international staff around FSM (estimates per outcome using current local transport costs (2014).
c	Int. Consultants - (see breakdown in Table 14d below for monthly rates and calculated inputs per international expert for each Outcome)
d	Inter. Travel estimated based on airline transport costs for local and international staff to travel to FSM or from FSM on project business (economy class fares only) based on 2014 airfare rates (average USD1000/air fare).
e	Contract. Services (survey/engineering design and construction etc). Including services for staff training on engineering monitoring and design (etc) equipment; Expert studies to advisory support group.
f	Office Supplies - estimate for office equipment as required (Pohnpei and in State offices).
g	Project Equipment - Printing of awareness raising and training tools, Project Vehicles (eg: USD5000/motorcycle)
h	Miscellaneous / contingency - (1) Contingency is higher than other Outcomes as this represents international best practice with respect to engineering bill of quantity estimations. Full time Secretary at USD10,000/year if required. Vehicle for Project Manager, maintenance of vehicles + fuel; production of communication material etc.
i	Implementing Entity Fee will be utilised by SPREP to cover its indirect costs in the provision of general management support and specialised technical support services. Appendix F provides an indicative breakdown of the estimated costs of providing these services.

Table 14c – Budget Notes

INTERNATIONAL CONSULTANTS	*MONTHLY RATE (US$)*	*PROPOSED BUDGET (US$)*	*COMPONENT 1*	*COMPONENT 2)*	*COMPONENT 3*
Climate Change Adaptation Expert (18mm)	*13,000*	*234,000*	*93,600 (40%)*	*93,600 (40%)*	*46,800 (20%)*
Coastal Engineering Expert (18mm)	*15,000*	*180,000*	*18,000 (10%)*	*36,000 (20%)*	*126,000 (70%)*
Coastal Zone Planner/land Use Zoning Expert (12mm);	*15,000*	*180,000*	*18,000 (10%)*	*162,000 (90%)*	*0*
Monitoring and Evaluation Expert (12mm);	*13,000*	*156,000*	*52,000 (33.3%)*	*52,000 (33.3%)*	*52,000 (33.3%)*
TOTALS		***750,000***	***181,600***	***343,600***	***224,800***

LOCAL CONSULTANTS	*MONTHLY RATE (US$)*	*PROPOSED BUDGET (US$)*	*COMPONENT 1*	*COMPONENT 2)*	*COMPONENT 3*
Climate Resilient Livelihood Expert (12mm)	*6500*	*78,000*	*15,600 (20%)*	*31,200 (40%)*	*31,200 (40%)*
Policy and Institutional Expert (8mm)	*6500*	*52,000*	*36,400 (70%)*	*0*	*15,600 (30%)*
Communication & Gender Specialist(8mm)	*6500*	*52,000*	*5,200 (10%)*	*23,400 (45%)*	*23,400 (45%)*
State Community Liaison Advisors (x4; Kosrae, Yap, Chuuk and Pohnpei - 24 months each.	*5000*	*480,000*	*0*	*312,000 (65%)*	*168,000 (35%)*
TOTALS		***662,000***	***57,200***	***366,600***	***238,200***

Table 14d – Proposed Consultant Inputs (international and local)

H Include a disbursement schedule with time-bound milestones.

Table 15 presents the proposed disbursement matrix for the project. A simple 20% split of funds is allocated per year (plus upon agreement signature). This shall be reviewed and potentially updated during the inception phase of the project.

	Upon Agreement signature	One Year after Project Start	Year 2[b/]	Year 3	Year 4[c/]	Total
Scheduled Date	May 2015	May 2016	May 2017	May 2018	June 2019	N/A
Project Funds	1,664,235	1,664,235	1,664,235	1,664,235	1,664,235	**US$8,321,175**
Implementing Entity Fee	129,285	129,285	129,285	129,285	129,285	**646,425**
Total	**1,793,520**	**1,793,520**	**1,793,520**	**1,793,520**	**1,793,520**	**US$8,967,600**

Table 15 (based on initial figures presented on Table 4 financial figures)

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

A. Record of endorsement on behalf of the government

Lorin S. Robert, Secretary, Department of Foreign Affairs, FSM (see also appendix for State Governors' letters of endorsement)	Date: *14 August , 2014*

B. Implementing Entity certification

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, namely the 2004 National Strategic Development Plan, 2013 National Policy on Disaster Risk Management and Climate Change Adaptation, 2011 Kosrae State Climate Change Act, 2013 Kosrae State 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.
David Sheppard Implementing Entity Coordinator
Date: 14 *August 2014* — Tel. and email:+685-21-929 davids@sprep.org
Project Contact Person: Espen Ronneberg
Tel. And Email: +685-21-929 espenr@sprep.org

ADAPTATION FUND

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

LIST OF APPENDICES

- Appendix A:– Stakeholders Consulted and Support Letters
- Appendix B: Structure and Purpose of each FSM State Shoreline Management Plan (SMP)
- Appendix C: Terms of Reference – Climate Resilient Road Standards Team for FSM
- Appendix D: Terms of Reference: Consultancy for formulation of Coastal Development Guideline Manual for the Federated States of Micronesia (FSM)
- Appendix E: Detailed Description of “Living with the Sea” Soft Engineering Approaches
- Appendix F: Fees for Support to Adaptation Fund Project
- Appendix G: Climate Change Initiatives of Relevance to FSM
- Appendix H: Proposed Project Areas
- Appendix I: Implementation Schedule/Gantt Chart

Appendix A: Stakeholders Consulted and Support Letters

Key stakeholders initially consulted individually in FSM: December 2013.

NB: the findings of the consultation process are presented and embedded within the main Concept AF proposal.

Name	Ministry/Organization	State
Lyndon Jackson	State Governor	Kosrae
Simpson Abraham	PACC Coordinator	Kosrae
Emily Gibson	KIRMA (environmental regulations officer)	Kosrae
Lt. Anthony Tareg	Lt. State Governor	Yap
Ted Rutun	Vice Speaker, Eighth Legislature of Yap State	Yap
James Sarmog	Chief, Dept of Public Works	Yap
Christina Fillmed	Environmental Protection Agency	Yap
Johnson Elimo	State Governor	Chuuk
Ismael Mikel/Brad Mori	Chuuk EPA	Chuuk
Marcelo Peterson	Lt State Governor	Pohnpei
Pasha Carruthers	SPC Climate Change Advisor	Pohnpei
Gerald Zackios	SPC Director	Pohnpei
Andrew Yatilman	Office of Environment and Emergency Management	Pohnpei
Henry Susaia	EPA Pohnpei Office	Pohnpei
Willie Kostka	Micronesian Conservation Trust	Pohnpei
Lorin Robert Shanty Asher	Secretary and deputy Assistant Secretary Dept of Foreign Affairs (National Govt FSM)	National Government of FSM

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

July 15, 2014

Mr. David Sheppard
Director General
Secretariat of the Pacific Regional Environment Programme
P.O Box 240
Apia, Samoa

Subject: **Endorsement for "Enhancing the resilience vulnerable island atoll Communities in FSM to climate change risks through a "Living with the Sea" National Risk Management Framework" Project Proposal**

Dear Director Sheppard,

It is indeed my pleasure to convey herein, on behalf of the people of the state of Kosrae, our utmost appreciation of the efforts undertaken to date with regards to the application for Adaptation Fund support. This letter therefore reflects our full support towards submitting this proposal and we look forward to a positive outcome that shall help us address future climate resilience for our State and the coastal communities of our Outer Islands. The State of Kosrae is prone and vulnerable to the impacts of climate change, hence this proposal is beneficial to increase community resilience, improve coastal planning and to help us introduce cost effective adaptation options for our people.

This project is essential to help us to inform and communicate to our coastal communities in Kosrae hence, the most appropriate planning and engineering solutions available to us to address livelihood security for all. It also shall be valuable for us to introduce, where possible, ecosystem based adaptation approaches in an attempt to reduce community vulnerability to sea-level rise impacts.

I as the Governor of the State of Kosrae confirm that the proposed "Living with the Sea" National Risk Management Framework" would be in accordance with our own State wide priorities towards implementing adaptation activities to reduce the predicted adverse impacts and risks that are posed by climate change.

Sincerely,

Lyndon H. Jackson
Governor
Kosrae State

Cc: Dr. Netatua Pelesiko Director, Climate Change Division

OFFICE OF THE GOVERNOR
STATE OF CHUUK
Federated States of Micronesia

Johnson S. Elimo
Governor

Marius J. Akapito
Lt. Governor

Mr. David Sheppard
Director General
Secretariat of the Pacific Regional Environment Programme
P.O Box 240
Apia, Samoa

Subject: Endorsement for "Enhancing the resilience vulnerable island atoll Communities in FSM to climate change risks through a "Living with the Sea" National Risk Management Framework" Project Proposal

Dear Director Sheppard,

It is indeed my pleasure to convey herein, on behalf of the people of the state of Chuuk, our utmost appreciation of the efforts undertaken to date with regards to the application for Adaptation Fund support. This letter therefore reflects our full support towards submitting this proposal and we look forward to a positive outcome that shall help us address future climate resilience for our State and the coastal communities of our Outer Islands. The State of Chuuk is prone and vulnerable to the impacts of climate change, hence this proposal is beneficial to increase community resilience, improve coastal planning and to help us introduce cost effective adaptation options for our people.

This project is essential to help us to inform and communicate to our coastal communities in Chuuk (and outer islands) the most appropriate planning and engineering solutions available to us to address livelihood security for all. It also shall be valuable for us to introduce, where possible, ecosystem based adaptation approaches in an attempt to reduce community vulnerability to sea-level rise impacts.

I as the Governor of the State of Chuuk confirm that the proposed "Living with the Sea" National Risk Management Framework" would be in accordance with our own State wide priorities towards implementing adaptation activities to reduce the predicted adverse impacts and risks that are posed by climate change.

Sincerely,

7/11/14

Johnson Elimo
Governor
Chuuk State

Cc: Dr. Netatua Pelesiko — Director, Climate Change Division
Mr. Simpson Abraham — FSM PACC Coordinator
Mr. Andrew Yatilman — Director, OEEM

P.O. Box 189 Weno, Chuuk State, FM 96942 Tel: (691) 330-2234/2231 Fax: (691) 330-2234

THE LIEUTENANT GOVERNOR
STATE OF YAP

August 15th 2014

Dr. David Sheppard
Director General
Secretariat of the Pacific Regional Environment Programme
P.O Box 240
Apia, Samoa

Subject: Endorsement for "Enhancing the resilience vulnerable island atoll communities in FSM to climate change risks through a "Living with the Sea" National Risk Management Framework" Project Proposal

Dear Director Sheppard,

It is indeed my pleasure to convey herein, on behalf of the people of the state of Yap, our utmost appreciation of the efforts undertaken to date with regards to the application for Adaptation Fund support. This letter therefore reflects our full support towards submitting this proposal and we look forward to a positive outcome that shall help us address future climate resilience for our State and the coastal communities of our Outer Islands. Yap is prone and vulnerable to the impacts of climate change, hence this proposal is beneficial to increase community resilience, improve coastal planning and to help us introduce cost effective adaptation options for our people.

This project is essential to help us to inform and communicate to our coastal communities in Yap (and outer islands) the most appropriate planning and engineering solutions available to us to address livelihood security for all. It also shall be valuable for us to introduce, where possible, ecosystem based adaptation approaches in an attempt to reduce community vulnerability to sea-level rise impacts.

I as the Governor of the State of Yap confirm that the proposed "Living with the Sea" National Risk Management Framework" would be in accordance with our own State wide priorities towards implementing adaptation activities to reduce the predicted adverse impacts and risks that are posed by climate change.

Sincerely,

for Sebastian Anafel
Governor

Cc: Dr. Netatua Pelesiko — Director, Climate Change Division
Mr. Simpson Abraham — FSM PACC Coordinator
Mr. Andrew Yatilman — Director, OEEM

Colonia, Yap FM 96943
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OFFICE OF THE GOVERNOR

STATE OF POHNPEI
KOLONIA, POHNPEI FM 96941
TEL:(691) 320-2235/2204 FAX:(691) 320-2505

July 23, 2014

Mr. David Sheppard
Director General
Secretariat of the Pacific Regional Environment Programme
P.O Box 240
Apia, Samoa

Subject: Endorsement for "Enhancing the resilience vulnerable island atoll Communities in FSM to climate change risks through a "Living with the Sea" National Risk Management Framework" Project Proposal

Dear Director Sheppard,

It is indeed my pleasure to convey herein, on behalf of the people of the state of Pohnpei, our utmost appreciation of the efforts undertaken to date with regards to the application for Adaptation Fund support. This letter therefore reflects our full support towards submitting this proposal and we look forward to a positive outcome that shall help us address future climate resilience for our State and the coastal communities of our Outer Islands. Pohnpei is prone and vulnerable to the impacts of climate change, hence this proposal is beneficial to increase community resilience, improve coastal planning and to help us introduce cost effective adaptation options for our people.

This project is essential to help us to inform and communicate to our coastal communities in Pohnpei (and outer islands) the most appropriate planning and engineering solutions available to us to address livelihood security for all. It also shall be valuable for us to introduce, where possible, ecosystem based adaptation approaches in an attempt to reduce community vulnerability to sea-level rise impacts.

I as the Lt. Governor of the State of Pohnpei confirm that the proposed "Living with the Sea" National Risk Management Framework" would be in accordance with our own State wide priorities towards implementing adaptation activities to reduce the predicted adverse impacts and risks that are posed by climate change.

Sincerely,

Marcelo K. Peterson
Lt. Governor

Cc: Dr. Netatua Pelesiko — Director, Climate Change Division
Mr. Simpson Abraham — FSM PACC Coordinator
Mr. Andrew Yatilman — Director, OEEM

Appendix B: Structure and Purpose of each FSM State Shoreline Management Plan (SMP)

B1: The Aim of each SMP

A Shoreline Management Plan (SMP) is proposed for each FSM State. Each SMP shall cover "High Islands" and low lying atoll islands together in an integrated manner. Each SMP shall represent important Key Performance Indicator (KPI) which should be prepared as part of the FSM Governments "Living with the Sea" Risk Management framework. Each SMP is seen as one of the primary means of implementing the Living with the Sea Programme which was hoped to be formally approved by national government as providing the strategic direction for the management of infrastructure (both public and private) within the coastal area of all FSM States.

Each SMP shall relate and abide to existing national climate change policy and also relate to the other key documents in place (such as the Kosrae Strategic Development Plan 2013-2014). They should provide vision and "signposts" to practical tools with which each State Government can implement the programme efficiently and effectively.

The aim of each State SMP is to help the State Government to show a transparent process towards setting priority intervention measures that are auditable and based on sound and sustainable engineering best practice. They are also the key communication tool for State Governments to convey coastal hazards and from this to improve coastal resilience for local communities by identifying clear actions and solutions. Not all the proposed solutions presented in each SMP may be actioned immediately, and so it is for this reason that each SMP shall present investment opportunities over a range of time periods (0-3yrs, 3-10 yrs, 10-20 years) which shall be updated on an annual basis using new condition assessment information (stored within a new Living with the Sea Information Management System) to review, monitor and evaluate SMP recommendations being presented for long-term improvement in resilience of both infrastructure and communities.

Each SMP will:

1. Set priority intervention measures that are auditable and based on sound and sustainable engineering best practice;

2. Improve the coastal community's awareness (for each State) of coastal and watershed related hazard risks (through improved map production and clear presentation of risks to "non-experts");

3. Provide advice on techniques to reduce coastal hazard risks in coastal settlements (i.e: road relocation inland etc);

4. Provide "self-help" advice to community and infrastructure providers to better adapt, respond and recover from typhoon/storm events.

B2: Duration of each SMP

Each States SMP should be reviewed at five-yearly intervals (note: for Kosrae it was updated 13years after initial production). During the Plan period, the solutions implemented will be monitored by the State Governments designated authority organisation – KIRMA in the case of Kosrae) to ensure that they are effective in improving climate proofing and resilience. Some solutions are likely to take longer than five years to implement and the review will take the progress of these into account.

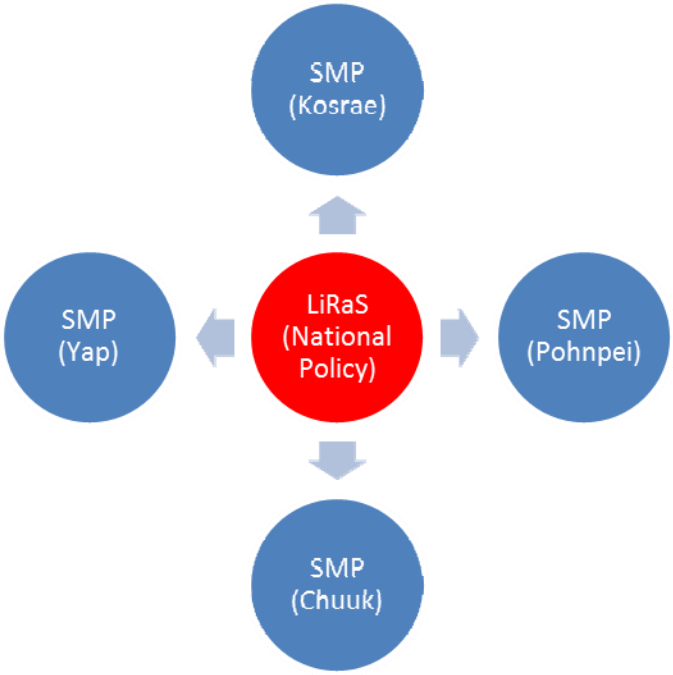


Figure B1 – National to State links for SMP delivery

B3: Structure of each SMP

(NB: the following text is prepared for guidance, and does not reflect eh structure of the Draft SMP for Kosrae recently produced).
Each SMP should consist of two parts each serving a separate and distinct purpose.

Part 1 - Plan Development, which describes the process undertaken in preparing the SMP in conjunction with representatives of the Communities involved and the State Government and other stakeholders with interests in the Plan area.

Part 2 - Implementation Guidelines, which describes the Plans and Actions recommended as outcomes of the process, together with the partner responsible for implementing these outcomes. The participants of the SMP preparation process are to be acknowledged in the ***Implementation Guidelines***. These Implementation Guidelines describe the solutions proposed that will increase the resilience of coastal settlements in each State and the ways these solutions can be implemented. The solutions shall be presented for each infrastructure aspect that is recorded (within the proposed Living with the Sea Information Management System) as being of moderate to low resilience (i.e.: defence or “feature” residual life of <5 years).

The review of the ***Implementation Guidelines*** and the solutions proposed will be undertaken:

1. As part of the Five-yearly SMP review programme.

2. Once implemented, the solutions will be monitored on either an annual or five-yearly basis to check the effectiveness of the solution. Detailed implementation of the solution will then determine the monitoring requirements and hence enable Key Performance Indicators (KPIs) to be set for each State Government to deliver against.

The following outlines the basic structure of each SMP. It is recommended that a Procedural Guidance document is also produced at a national level that elaborates on the following and provides

the actual expected requirements and details of each SMP (separate Technical Assistance exercise included in Component 1).

B4: Specific Aspects of each State Government SMP
Section 1 – Introduction

- Aim of the SMP
- Participants in the SMP production (including State Government, key departments contractors, land owners, community reps, NGOs etc)
- Process of preparing the SMP (consultation process etc)
- Review process of the SMP (by whom and when)

Section 2 – Description of the Shoreline Environment

- Description of the States coastal zone and shoreline, key features, hazard risks and identification / location of key settlements/features at risk;
- Baseline presentation / identification of resources present (economic, social and natural);
- Identification and description of significant infrastructure (location and scale);
- Description of the environment where the infrastructure is located;

Section 3 – Summary of States Coastal Community Resilience

- Identification and mapping of "hazard risk zones" to derive the risk to and resilience of the infrastructure and communities mentioned in Section 2.

Section 4 – Land and Resource Use Issues

- Identification of land uses/resources that are exacerbating or influencing sea or river hazard risk within the State (e.g.: areas of sand mining etc where erosion is occurring as a result and where the activity (or defence works) is increasing coastal hazard risks.

Section 5 – Appraisal and Option Selection

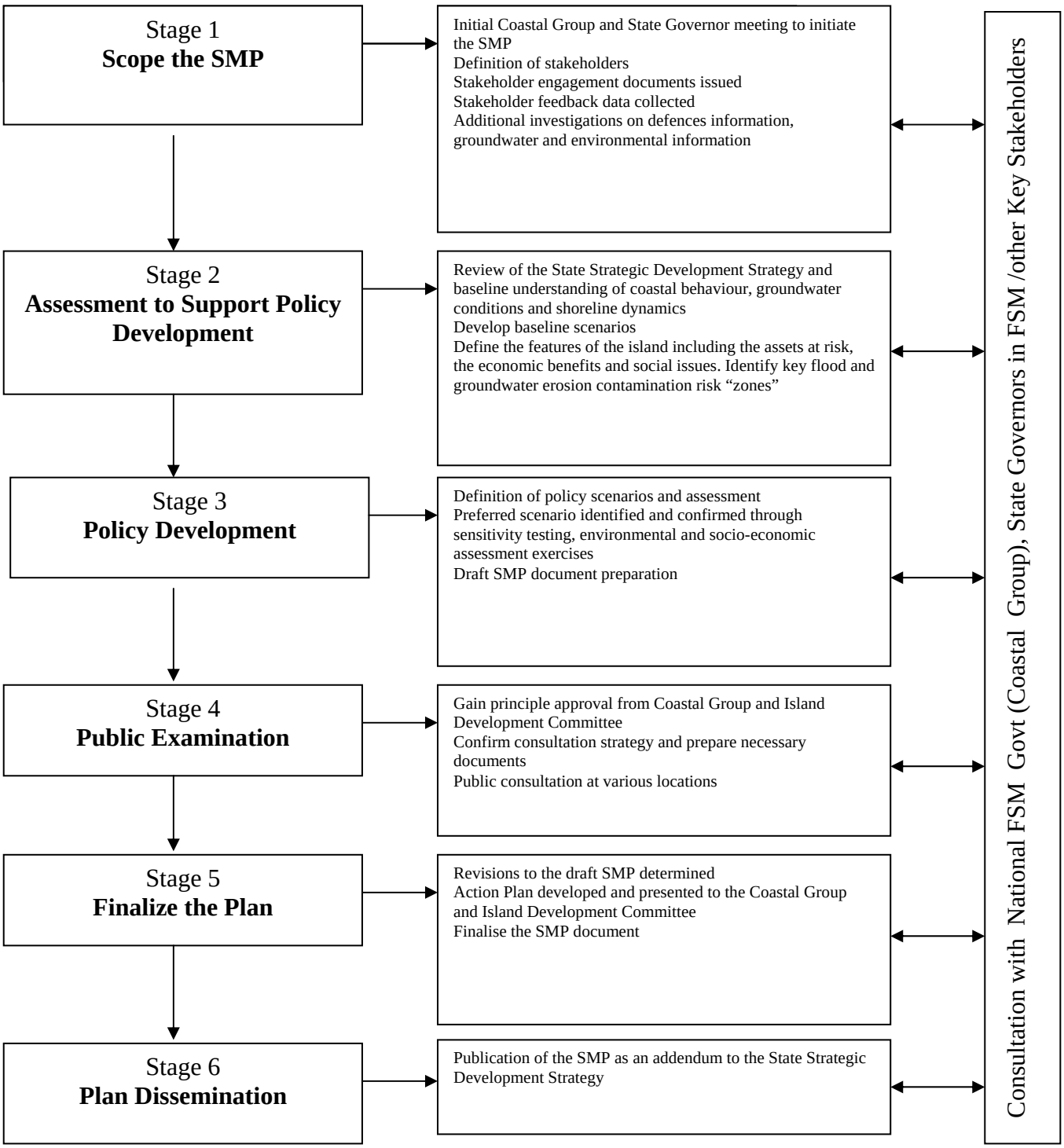
- Defences and Works Options –identify the defence works options over 3 timescales (0-3yrs, 3-10yrs and 10-20 years) including any recommendation to remove/relocate structures.

Section 6 – Programme

- Identify the defence works preferred programme over 3 timescales (0-3yrs, 3-10yrs and 10-20 years) including any recommendation to remove/relocate structures. Physical work plans can be included.
- Responsibilities – if required, identify who will be responsible for the implementation of the recommended defence plan of actions.

Section 7 – Review and Monitoring

Figure B1


Stage 1
Scope the SMP
Initial Coastal Group and State Governor meeting to initiate the SMP
Definition of stakeholders
Stakeholder engagement documents issued
Stakeholder feedback data collected
Additional investigations on defences information, groundwater and environmental information
Stage 2
Assessment to Support Policy Development
Review of the State Strategic Development Strategy and baseline understanding of coastal behaviour, groundwater conditions and shoreline dynamics
Develop baseline scenarios
Define the features of the island including the assets at risk, the economic benefits and social issues. Identify key flood and groundwater erosion contamination risk "zones"
Stage 3
Policy Development
Definition of policy scenarios and assessment
Preferred scenario identified and confirmed through sensitivity testing, environmental and socio-economic assessment exercises
Draft SMP document preparation
Stage 4
Public Examination
Gain principle approval from Coastal Group and Island Development Committee
Confirm consultation strategy and prepare necessary documents
Public consultation at various locations
Stage 5
Finalize the Plan
Revisions to the draft SMP determined
Action Plan developed and presented to the Coastal Group and Island Development Committee
Finalise the SMP document
Stage 6
Plan Dissemination
Publication of the SMP as an addendum to the State Strategic Development Strategy
Consultation with National FSM Govt (Coastal Group), State Governors in FSM /other Key Stakeholders

Appendix C: Terms of Reference – Climate Resilient Road Standards Project for FSM

Project Goal
Improve the climate resilience of road transport sector development in FSM

Project Outcome
To build the capacity of each FSM State to incorporate climate risk analysis into road transport infrastructure project identification, formulation and execution based on the latest climate change science and risk information tools available.

A. Activities / Outputs

Working within State Government structures for each State, the project team will:

1. Execute a review of the current **legal and institutional framework** for road construction in FSM (existing laws/codes, construction designs, policy/plans, and projects) and identify a regulatory avenue to incorporate climate change adaptation and disaster risk reduction measures as standard practice for future road construction.

2. Review the most up-to-date climate risk information and tools available in FSM and methodologies used in previous projects to formulate **a practical climate risk screening methodology for road transport** infrastructure in FSM, with respect to the following design parameters:

    a. Road pavement surface types (low volume, locally available materials), depth /elevation and construction standards

    b. Drainage structures / bio-engineering to control water flow (eg culverts, cross-road drainage, vegetated erosion control)

    c. Coastal protection measures (eg. levee banks, realignment)

    d. Bridge design (materials, clearance heights, protective embankments) / construction of fords

    e. Ongoing maintenance costs and scheduling

3. At the national level, utilise a practical climate risk screening methodology developed with key stakeholders to assess, identify and map **priority risk areas** of the national road infrastructure network at a State scale, in relation to both current and future climate for 2030 and 2055 time periods. Worst case and most likely future climate scenarios will be examined for the following variables:

    - change in onset and intensity of seasonal rains;
    - changes in very hot days and heat waves;
    - expected sea level rise;
    - changes in intensity and frequency of precipitation events (extremes in particular) and associated flood patterns and risk of erosion;
    - changes in cyclone intensity, frequency and duration, and associated wind speeds, storm surges and wave actions; and

    Other factors contributing to road infrastructure vulnerability will be examined including slope stability, topography, hydrology, significant lagoon or wetland/river crossings etc

To the extent possible, develop a set of State wide climate risk profiles detailing expected changes in key variables most relevant for transport infrastructure design and planning (eg return periods for extreme rainfall intensity, maximum daily rainfall and maximum wind speeds).

4. **Identify up to eight target sites** across the four FSM States islands **and formulate a work plan** to undertake detailed site specific climate risk and adaptation assessments in line with the national FSM climate change policy and other donor investments. Target sites will be determined on the basis of the following criteria:

    - Climate and disaster hazard risks (from activity 3)
    - Available data
    - Ongoing / planned physical works in the area
    - Potential to scale up (ie focus on different design parameters / environmental factors)
    - Potential for community involvement in climate resilience activities, including bioengineering, the involvement of women's groups or ecosystem-based adaptation.

5. Undertake **detailed site-specific climate risk assessment and design adaptation measures** for planned road improvements at up to eight sites across four States using the best available science, cost-benefit considerations and community engagement techniques, drawing on local knowledge where possible. Specific costed climate resilient design recommendations (both engineering and non-engineering) will be made as compared to standard construction, for 2030 and 2055 design horizons considering incremental cost/benefits over the life of the asset, including construction, maintenance and repair costs. The following design parameters will be considered:

    - Road pavement surface types (low volume, locally available materials), depth /elevation and construction standards
    - Drainage structures / bio-engineering to control water flow (eg culverts, cross-road drainage, vegetated erosion control)
    - Coastal protection measures (eg. levee banks, realignment)
    - Bridge design (materials, clearance heights, protective embankments) / construction of fords
    - Ongoing maintenance costs and scheduling with maximum community involvement where possible throughout the process

6. Present preliminary findings in a regional stakeholder workshop, to **share lessons learned** across selected partner countries to inform future sector wide adaptation strategies

7. Based on site specific assessment findings and identified risks at the national level, noting the differences between urban and rural roads, develop a **national road standards manual/guideline** that incorporates design guidelines for addressing climate risks in road project identification, formulation and execution (in relation to the aforementioned parameters), building on any standard engineering designs currently in use.

    a. Test manual on site in one of the target sites together with State specific staff incorporating feedback from stakeholders

b. Incorporate a decision support process to identify the level of risk, design and implementation of appropriate adaptation measures/minimum standards for climate resilient design, and cost-benefit estimates

8. **Develop the capacity and knowledge of State Government staff** in using and applying the climate resilient road standards and guidelines. The assigned support staff within each State working on the project should be exposed to on-the-job training and knowledge building
    a. Conduct at least three training seminars for each States staff during the project
9. Undertake **promotion and awareness raising** of the project outputs to both Government and non-Government stakeholders, including by demonstrating the guidelines and standards to staff at State Governmental Offices.
    a. Participate in a **national consultation** on the FSM national road standards manual
10. Prepare a **final technical report and summary for policy makers** with a recommendations on options for integrating the national road standards manual into relevant sub-sector plans or national legislation.

B. Key Deliverables

1. Climate Risk Screening methodology for road transport sector projects

- Documented methodology for application in future project feasibility studies

2. **Priority risk maps and sub-national climate profiles**

- A series of maps identifying high risk areas of the national road network for future climate in 2030 and 2055
- Sub-national climate risk profiles for expected changes in key climate variables

3. Detailed site specific climate risk and adaptation assessments completed for up to 8 selected sites

4. **Climate Resilient Road Standards and Construction Guidelines**

- A set of national climate resilient road standards and construction guidelines to ensure future road development addresses climate risks in project identification, planning and construction
- A technical document setting out a step-by-step process to apply minimum standards required for climate-resilient road design and construction, depending on the level of risk / geophysical features of a given project site and incremental cost benefits for specific adaptation measures over the life of the asset, specifying appropriate:
    i. Road pavement surface types;
    ii. Drainage standards, including potential for bio-engineering, ecosystem-based and community-based adaptation measures;
    iii. Coastal protection measures;
    iv. Bridge design (materials, clearance heights, protective embankments); and
    v. Ongoing maintenance and scheduling.

5. **A review of the legal and institutional framework for road sector development in FSM**

- **Policy recommendations** for regulatory/institutional reform for mainstreaming climate change adaptation and disaster risk reduction considerations into future road transport projects in FSM.

6. **Summary for Policy Makers**

- A knowledge product that can communicate to non technical users, the results of the project.

- The document should be short (20 pages), glossy, easy to read, with a synopsis of the practical tools, methods, and lessons learned for other governments/sectors to consider. For presentation at regional events

C. Required Expertise - Climate Resilient Road Standards Team

<u>International Technical Assistance:</u>

- Climate Risk Analysis Specialist / Team Leader (full time TA position up to 10 months)

  - Strong background in climate change and disaster risk analysis and at least 5 years experience in the application of environmental risk assessment on the design, operation and management of infrastructure projects

  - Relevant university degree and experience working in the Pacific / developing countries

  - Experience in team and project management in particular mentoring and capacity building in a diverse stakeholder environment

- Hydrologist (up to 3 person months)

  - Extensive experience in the identification, design and preparation of infrastructure projects, particularly in resource constrained environments

  - Relevant university degree

- Infrastructure economist (up to 2 person months)

  - Extensive experience in economic and financial analysis of infrastructure projects, least cost and cost-benefit analysis

  - Experience in developing prioritization methodology for future investments taking into account social, environmental and financial objectives including estimating whole-of-asset-life costs with climate change

- Legal specialist (up to 2 person months)

  - Extensive experience in policy and regulatory review, formulation and sector planning

  - Relevant work experience in Pacific island countries highly desirable

<u>State Government support teams (existing line positions):</u>

- 1 x Manager Projects (project counterpart)

- 1x Principal Engineer
- 1x Environment/Social Safeguards Officer
- 1 x Finance Officer

D. Responsibilities

- Climate Risk Analysis Specialist (Team Leader)

    - Establish contacts with key stakeholders within FSM and in close consultation develop a detailed work plan for the activity and roles and responsibilities of team members in coordination with individual State projects and operations managers.

    - Provide strategic oversight, direction and management of the project and deliverables, and act as key point of contact for all project stakeholders.

    - Lead development and execution of the following:

        - a practical climate risk screening methodology for road transport infrastructure in FSM based on a review of the most up-to-date climate risk information and tools available

        - climate risk mapping for the national road network

        - undertake site-specific climate risk and adaptation assessments for identified sites and formulate appropriate adaptation design measures

        - national climate resilient road construction guidelines

    - Ensure timely delivery of project reporting as per the TOR

- Hydrologist

    - Under the direction of the Team Leader, advise on high risk areas of the national road network from a hydrological perspective and assist in the development of sub-national climate risk profiles and collection of data

    - Liaise with national FSM Govt and State Govt agencies and work with local engineers on technical design for climate resilient road drainage, surface types, coastal protection and bridge design

- Infrastructure economist

    - Under the direction of the Team Leader, review current road transport sector policy and investment programs to determine the application of prioritization criteria for transport sector investments, and the extent to which the incremental costs of climate change are incorporated in investment planning

    - Assist the team leader calculate the cost/benefits of identified adaptation measures for various road infrastructure design parameters over the life of the asset (including construction, maintenance and repair costs).

    - Assist the Team Leader develop decision criteria for the selection and implementation of adaptation measures as part of the national guideline

- Legal Specialist

- Under the direction of the Team Leader, lead review of the legal and institutional framework for road construction in FSM including collection and analysis of existing laws/codes, construction designs, policy/plans, and projects relevant for the integration of climate change and disaster risk reduction provisions
- Draft a policy note for FSM decision makers recommending a regulatory avenue to incorporate climate resilient design standards for future road development

E. Work Plan / Timeline

Indicative time line only (assuming AF funds are secured by October 2014).

Month	December '14			January '15				February				March				April				May				Jun	Jul	Aug	Sep	Oct	Nov	Dec
Action	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**							
1 Prepare and sign SA				X																										
2 Recruit contractor																														
3 Mobilise technical team (quarterly report)												X																		
4 Review policy settings																														
5 Climate risk screening methodology																X														
6 Priority climate risk maps and profiles																			X											
7 Identify 6 test-sites and formulate workplan (6 monthly report)																							X							
8 Detailed site-specific assessments and quarterly report																										X				
9 Regional workshop share lessons learnt																														
10 Draft national road standards																											X			
11 National consultations																														
12 Final national road standards manual																												X		
13 Draft technical report and Summary																													X	
14 Final technical report and summary																														X

Project Milestones - **X**

Appendix D - TERMS OF REFERENCE: Consultancy for formulation of Coastal Development Guidelines Manual for the Federated States of Micronesia (FSM)

I. INTRODUCTION AND BACKGROUND

Micronesia is a developing country vulnerable to tropical storms, typhoons and drought, effects which are presently modulated by the El Nino Southern Oscillation. Future climate change is expected to increase the intensity and frequency of extreme rainfall events. Sea level is observed to be rising at 28-36mm/decade exacerbating coastal erosion and placing at risk human communities in coastal areas of atoll islands and islets.

Currently there are no written guidelines on how to build climate change resilience into coastal erosion control, land reclamation or harbour/wharf development. Environmental Impact Assessment (EIA) requirements are generic on this issue though in Kosrae, efforts are being made to "climate proof" EIA regulations and approaches.

The consultant will work closely with the State Government and other relevant agencies to address gaps in technical knowledge and know-how on how best to plan and develop wharves, conduct land reclamation, other major developments and manage coastal erosion in a changing climate without increasing vulnerability. Current coastal zone management practices will be reviewed to assess their implications for strengthening or reducing climate resilience.

Comprehensive technical guidelines on climate change resilient coastal protection, with separate chapters on climate change resilient coastal development, land reclamation and coastal erosion control will be produced and finalized through stakeholder consultations with relevant national, and island authorities and sector specialists.

II. OBJECTIVE

To formulate an FSM specific set of guidelines for climate risk resilient coastal protection planning through a participatory approach and with recommended amendments to existing Land Use Planning and Environmental Impact Assessment (EIA) regulations of each FSM State, National Building Code, the Climate Change national policy as necessary to better address climate change adaptation and to provide pragmatic evidence based advocacy for high level political endorsement for the coastal protection guidelines document.

III. SCOPE OF WORK

- Source, define and obtain agreement for the development targets to be achieved with respect to climate change resilience and risk mitigation and the climate change risk scenarios to be considered in the coastal protection guideline document.
- Assess past and current development practices and coastal protection measures in FSM (per State) that have had negative impacts such as reduced natural resilience of the islands and increased vulnerability of the islands to climate change risks.
- Review the existing coastal development planning process, engineering designs and, construction implementation and monitoring processes and practices for high, medium and low impact coastal developments from a climate risk planning perspective. These include land reclamation, wharf/harbour development, erosion prevention and other coastal protection measures.

- Review the existing FSM EIA process (per State) and other policy and legal frameworks to determine possible regulatory improvements to implementing coastal development planning approaches.
- Formulate objectively verifiable, quantitative standards for coastal land use with respect to coastal development including safe setbacks, land reclamation, infrastructure etc. For example setting a minimum elevation with respect to the high wave energy zone.
- Provide an objective quantitative performance monitoring and evaluation framework for monitoring delivery of the proposed standards.
- Carry out stakeholder consultations to gather information and views on proposed guideline content.
- Prepare formal guideline document on climate risk resilient coastal protection and adaptation measures.
- Conduct high level stakeholder meeting to present and endorse the Guidelines for Climate Risk Resilient Coastal Protection in each FSM State.

IV. **INDICATIVE TASKS**

The consultant's work will include but not be limited to the following:

- Identify stakeholders and island communities most relevant for understanding, discussing and evaluating the situation with respect to integrating climate change risks into resilient island planning.
- Conduct field visits to discuss and analyse situation with respect to coastal protection, harbour development, land reclamation, flood and drainage control from the perspective of integrating climate change risks. Field visits will include visits to all 4 States (to be determined by the client). Travel costs (internal) will be borne by the client.
- Specify climate change resilience and risk assumptions requiring guidance support and seek agreement.
- Review of coastal protection and foreshore ownership issues in FSM.
- Review existing land use planning regulation, EIA regulation, EIA processes, land use planning regulations and any other building codes or guidelines to relate to climate change risks and adaptation planning perspectives.
- Review of reports from PACC, eg:cost benefit analysis and vulnerability assessments of key States visited.
- Identify existing land use practices that reduce natural resilience of the islands and increase vulnerabilities to climate change risks.
- Review, assess and analyze various coastal protection measures and practices including conventional adaptation, soft adaptation and traditional measures.
- Review and assess the costs and benefits of different options for reducing vulnerability of current and future climate change risks through land use planning measures such as maintaining and restoring natural buffers (e.g. coastal ridges, beach rock, coastal vegetation) and critical infrastructure based on projected patterns of flooding and beach and coastal erosion.
- Prepare a summary of findings and recommendations on the issues, identifying weaknesses and
- malpractices and social and economic costs and benefits associated with old and new coastal development and protection practices.
- Provide necessary amendments to the Land Use Planning Regulation by defining the environmental protection zone in the context of climate risk resilience in each FSM State.
- Provide guidance based on function, design and management of "environmental protection zone" or similar to increase climate risks resilience of communities along the coastal strip of each FSM state.

- Provide performance and engineering standards for defences (materials to be used in FSM etc).
- Produce a document on guidelines for climate risk resilient coastal protection in FSM that can be endorsed at highest political level and used to help preparation of each States SMP).

OUTPUTS

- A summary of findings and recommendations on the issues, identifying weaknesses and malpractices.
- An analysis of social and economic costs and benefits associated with old and new coastal development and protection practices.
- amendments to the Land Use Planning Regulation on the environmental protection zone
- Guidance and proposed amendments to land use planning and EIA regulation, EIA process etc.
- Standards for best practices in coastal development.
- Develop comprehensive guidelines on climate risk resilient coastal protection for high, medium and low impact coastal developments. This should include but not limited to the following:
  i) Infrastructure developments;
  ii) Land reclamation;
  iii) Beach replenishment;
  iv) Harbour development (dredging, quay wall and breakwater development);
  v) Coastal protection (erosion prevention measures);
  vi) Access improvement (reef entrance channels, jetties and quay walls);
  vii) Over-water structure development;
  viii) Any other significant coastal development or constructions;
  ix) A monitoring and evaluation framework for coastal protection standard.

- A final comprehensive document on Guidelines for Climate Risk Resilient Coastal Protection in FSM for high level political endorsement (State Governor)

Appendix E. Detailed Description of "Living with the Sea" Soft Engineering Approaches

The following presents a compendium of soft engineering adaptation options that could be used on outer atoll islands in FSM. Numerous gaps in information, weaknesses in existing measures and a major weakness in transfer of coastal adaptation technology across islands are identified.

Beach Recharge

Usage

The primary rationale for beach replenishment is to mitigate or compensate for erosion or loss of beach. Although beach replenishment itself does not address the causes of erosion, it provides natural buffer to attenuate the force of waves before they reach built infrastructure. In aesthetic terms, beach replenishment provides additional benefits for tourism development and recreation for local populations. Beach replenishment has not been commonly adopted as a procedure in FSM.

Design and construction

There are critical design aspects which must be considered in any beach replenishment projects. They include:

a. Estimation of maximum fill possible for a given sediment system;
b. Consideration of material size in relation to the existing sediment – replenished sediment needs to be coarser in nature to prevent suffocation of living organisms in the beach;
c. Proper sourcing and matching of sediment;
d. Proper beach profiling;
e. Timing of activities;
f. Environmental impact mitigation measures to minimize negative environmental impacts.

Beach replenishment is a temporary solution to the loss of beach and does not address the causes of erosion. The natural processes operating around the island dictates the stability of the fill material and beach profile in the post replenishment stage. Replenished profiles are rarely perfect and they may undergo rapid erosion in the first few months until a naturally adjusted or an 'equilibrium profile' for the cyclone period is reached. If an area has been replenished due to severe erosion, the area may continue to erode after replenishment, if the causes of erosion have not been addressed or if additional measures to reduce the loss of sediments are not in place (such as groynes).

A number of islands may benefit from possessing their own sand pumps and conduct regular or periodic replenishment. The basic design principle for such islands is to pump sand to wherever erosion in prevalent. The general method of beach replenishment construction is to deploy a sand pump on a floating barge within a distance that matches the technical limits of the sand pump and to pump sand directly onto the beach. Loaders are used to distribute the sand and manual labour is used to profile the beach. Smaller projects may be implemented by a group of 5-10 people. Sand may be sourced from a distant reef system and transported in barges to the destination beach.

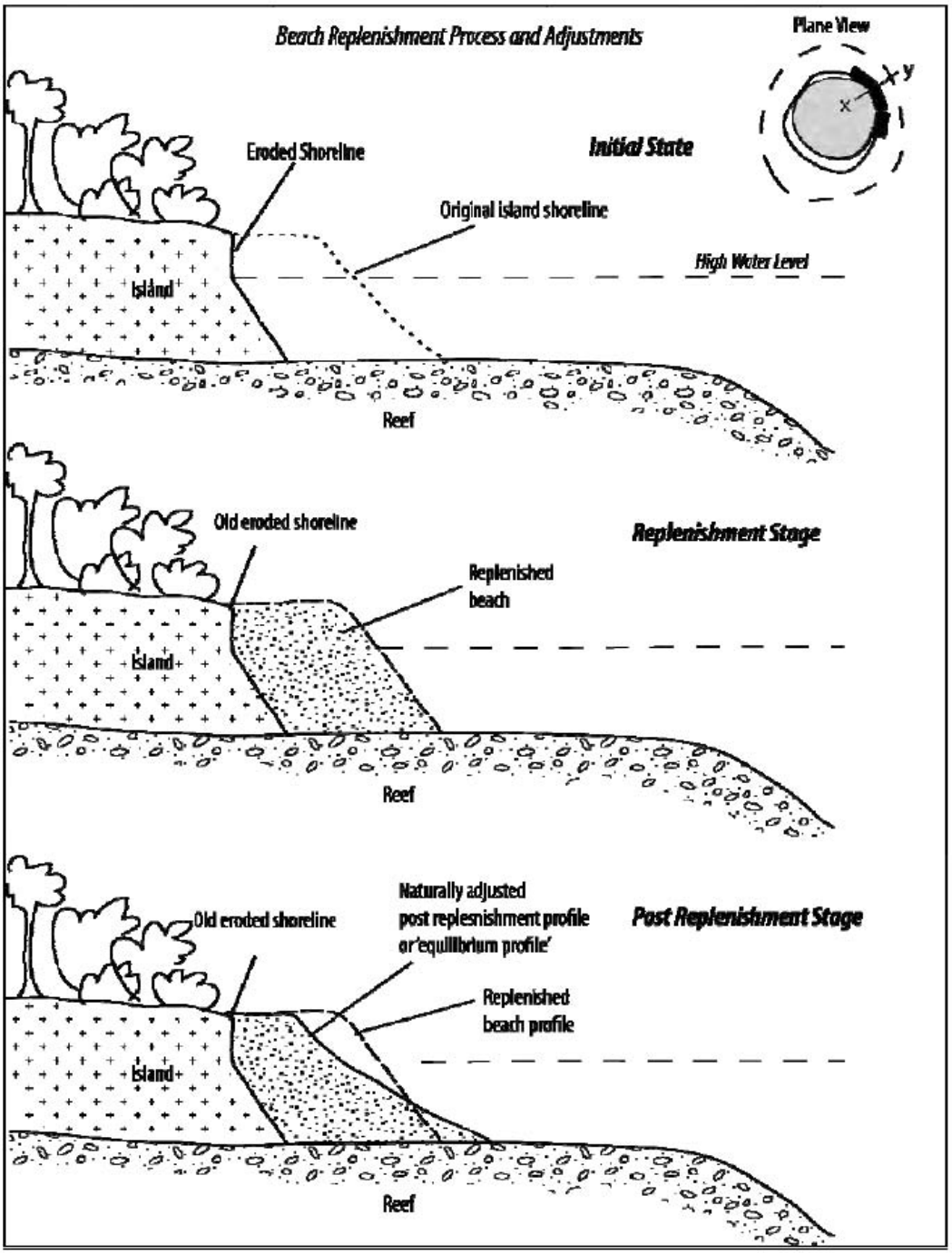
Best practice around the world suggests that newly pumped sand generally lasts from 2-10 seasons (i.e. about 5 years depending on storm frequency events) and is dependent on the previous extent of erosion and existing site conditions. Its effectiveness as a measure is often dependent on many factors particularly, the prevailing hydrodynamic conditions, pumped sediment size compared the existing sediment size, beach profiling, sediment source or burrow area, width of replenishment and project timing, among others.

Costs

a. The unit costs per linear meter of a replenished beach are estimated at US$100 per linear meter.

b. An indicative cost of a small-scale sand pump is US$30,000

c. Maintenance sand pumping is required at a minimum of 2 years and a maximum of 5 years after the initial replenishment. Follow up replenishment intervals generally increase over time to an average of once every 5 years. The total volume of sand required for maintenance replenishment is estimated at 50% of the total volume. The total cost over a 20 year time frame including maintenance sand pumping is estimated at US$350 per linear m of recharge.



Temporary Sand Groyne Structure

Usage
Temporary groynes are primarily used for emergency or seasonal erosion mitigation. The most important use of temporary groynes is to prevent the seasonal loss of beach in specific erosion hotspots. These structures are designed to arrest part of the sand migrating to other parts of the coastline. The structures are usually removed once the cyclone season reverts, but can be placed semi-permanently to reduce sedimentation loss after beach nourishment and reduce the maintenance costs into the future.

Design
There are no universally applied designs for temporary groynes. An island is likely to adopt a unique way of deploying, removing and arranging the structure. The most common material used for construction is nylon bags filled with sand. There are variations in the material ranging from coir weaved bags to geo-textile bags. The common features of these structures are that the individual modular units are small and can be easily transferred from one location to the other using manual labour.

Issues and challenges
In case of FSM, where loss of beaches is significant, the sandbags need to source sand from nearby lagoons. The use of poor quality bags is to be avoided as this can result in damaged empty bags being littered on to the reef or lagoon area.

Effectiveness
The most likely factors controlling effectiveness are hydrodynamic conditions of the lagoon or reef flat, structure height, depth, arrangement, bag size and type of material used for bags.

Costs
The unit costs per linear meter of temporary sandbag groyne are estimated at US$50 per linear meter. Maintenance is not required as new temporary seawall or groyne is placed every year.

Land-use Setback

Usage
Land use setbacks are used both as a voluntary adaptation measure and as a regulatory requirement (though currently this is not formally established in FSM within formal legislation). Similar small island nations (such as Maldives) have set a regulatory setback requirement as being a minimum of 20m from the vegetation line. Generally, there is a difference in the setbacks between oceanward side and lagoon ward side of atoll rim islands. Setbacks on the oceanward side are often wider, especially in locations where strong wave conditions are experienced and on islands with smaller distances between reef edge and oceanward shoreline.

Design
The design of setbacks is usually (or should be) incorporated into a States Strategic Development Strategy during the planning stage. In FSM, setbacks are most strictly applied to housing plots. Often, infrastructure developments such as power houses and communication facilities are allowed to get a lot closer to the vegetation line than housing plots.

Issues and challenges
Setbacks are difficult to implement when implemented without policy/regulatory backings, and there is a land shortage, especially if there is no land use plan. Setbacks are not equally applied to infrastructure development. The proposed project will first raise awareness among the Island Development Committee about the necessity and demonstrate in one location.

Effectiveness

The use of setbacks has been proven as an effective method of adaptation in most islands. However, this method is dependent on the commitment by island administrators and developers to implement the land use planning guidelines. On a number of occasions new plots are allocated with limited setbacks and in erosion prone areas. A Shoreline Management Framework, that establishes clear setback guidance, needs to be established within the coming years.

Retention and Replanting of Coastal Vegetation

Coastal vegetation is known to play a major role in reducing the exposure and impacts of natural hazards in FSM. In particular, mangrove plantation is one of the very few soft engineering shoreline management techniques that has been implemented in FSM – mainly in FSMtapu and Va'vau. In the face of predicted intensity and frequency of natural hazards due to climate change, and logistical challenges in implementing hard engineering solutions in many remote islands, coastal vegetation may have a crucial role to play in the adaptation of small islands, particularly to coastal flood impacts and strong wind.

Usage

Coastal vegetation has been retained in most islands as a traditional adaptation measure against strong wind, resulting salt spray and occasional coastal flooding. In general, good practice dictates the following approaches can be proposed.

a. The oceanward shoreline of islands, exposed to strong winds and salt spray during cyclones, should have a wider coastal vegetation system (see Figure below).
b. Similarly, the oceanward shoreline of islands, should have a wider coastal vegetation system. This could either be related to strong wave activity during NE monsoon or due the relatively large size of the islands.
c. Islands less exposed to regular strong wave activity, may have comparatively narrow coastal vegetation systems.

Coastal vegetation is generally retained as an adaptation measure in high exposure islands and where beach replenishment or reclamation, vegetation is replanted. Replanting is generally done using common coastal vegetation species present on the island. Coastal vegetation retention is strongly linked to other soft engineering measures such as land-use setbacks, artificial beach recharge and preservation of coastal measures.

Effectiveness

The use coastal vegetation preservation and coastal ridge maintenance is the most common method used against coastal flooding and to some extent against erosion. The effectiveness of ridges and vegetation belt are felt significantly in high flood exposure zones. Given the success of ridges and coastal vegetation in some FSM islands, artificial development of storm ridges are expected to be highly successful in FSM islands against potential storm and flood events. Based on past initiatives, the effectiveness of mangrove plantation largely depends on availability of fencing to prevent feral pigs from eating mangrove seedlings. Thus, the cost of mangrove plantation includes the necessary fencing costs.

Costs

a. Each seedling is about $0.5.
b. The costs of seedlings, labor, transport, materials for fencing, and tools for plantation of 1,000m^2 were $23,500 and $22,000 respectively.

Preservation of Coastal Ridges

Similar to coastal vegetation, coastal ridges are known to play a crucial role in the natural and planned adaptation to natural hazards in FSM.

Usage

Ridges are natural adaptation of island coastlines to prevailing wind and wave conditions at the site. They are generally left untouched, especially in islands with high wind and wave exposure. Ridges are treated as part of the coastal buffer zone and are usually used as an adaptation measure with land use setbacks and coastal vegetation retention. Not all islands have a well-defined coastal ridge. Figure E1 shows a graphical summary of ridge height variations across FSM. The use of artificial ridges as a soft engineering measure reduces the impacts of future coastal flooding from increasing abnormal climatic activity on certain islands. Artificial ridges have been used as an adaptation measure in the 'Safe Island' or 'resilient island' concepts in the Maldives. They can be constructed from lagoon sand and/or construction debris.

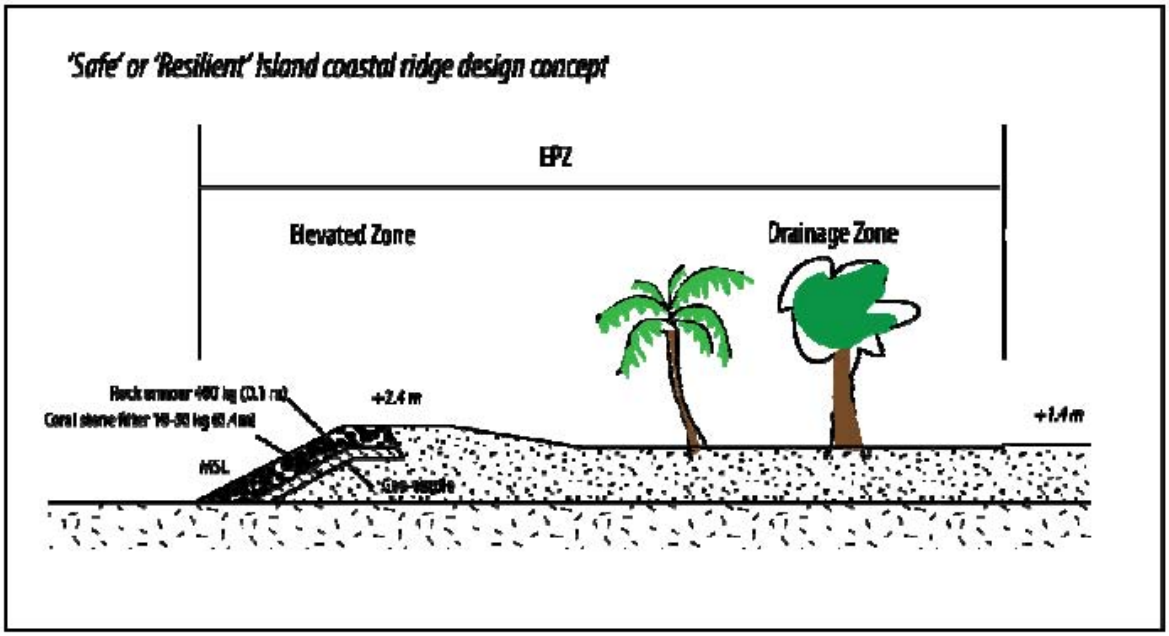


Figure E1 Coastal Ridge Design

Design aspects and natural patterns
Similar to coastal vegetation system, there is no specific design for the maintenance of coastal ridges. The basic components of a ridge are its height, width, slope and sediment composition. Soft engineering measures proposed under this project will involve the use of lagoon sand to enhance the existing ridge. The use of lagoon sand will require proper profiling of ridges and the use of sediments of larger or equal size. In addition, re-establishment of coastal vegetation is crucial to naturally stabilize the ridge.

Designs have been prepared for safe or resilient island ridges in countries such as the Maldives. The design incorporates artificial planting of coastal vegetation, drainage and construction setbacks as well, with a fixed width of 40 m. A specific assessment of FSM atoll islands has not been undertaken at this time.

Costs
The unit cost per linear meter of a raised ridge is estimated at US$100 per linear meter. Maintenance does not involve any additional costs once ridge is established.

Artificial Coral Reefs

Usage
Artificial reefs are sometimes used on small island states to act as a natural submerged breakwater structure to mitigate the force of wave actions. Applications can be observed in the Maldives, South

Pacific and Caribbean. Successful applications also enhance the reef as a tourism product as it provides habitats for fish population.

Artificial reef installations (either as commercial patented products such as EcoReef designs or simple rough surface concrete blocks) can create the ecological conditions that help young corals survive in otherwise hostile environments by providing:

- **Stabilization of loose sediments over the site**. Young corals are easily abraded or buried by moving sand and sediment. Reef installations can be engineered to efficiently cover large areas and slow the flow of water over the entire site, which helps reduce sediment movement. In addition, the installations (i.e. patented modules or simple concrete blocks) can be designed with settlement surfaces raised up off the seabed. This provides young corals and other invertebrates safe places to grow that are well-protected from sand scour.
- **Canopy habitat to protect small grazing fish.** Corals depend on the presence of small fish, especially grazers (herbivores), for their survival. Grazers are important because they eat fast-growing algae that would otherwise quickly overgrow and kill young corals. Installation modules create a dense, protective canopy of interlocking branches that provides high-quality habitat for large numbers of small fish.
- **Substrate for coral recruits**. Planktonic coral larvae can't settle on algae covered surfaces, instead they need clean, chemically inert surfaces. The grazing activity of small fish keeps any rough surface installations clean, and provides a steady supply of bare surfaces for settlement of planktonic coral larvae.
- **Complex habitat with high niche potential**. When deployed in large arrays, installations can create complex, naturalistic habitats that that mimic those of natural reefs. Such habitats offer a wide variety of shade, textures, micro-turbulence, and flow regimes needed by fish and invertebrates. Installations can be used alone or in conjunction with other environmentally-appropriate materials to further increase habitat complexity.

Artificial reefs installations often find that naturally-recruited young corals are visible within two years of installation, and that any transplanted corals will be well established in similar timeframe. Some of the faster growing species (*Acropora* spp.) can start to overtop the installation within 18 months of transplantation.

It is also recommended that any pilot project works within (or seek to establish) a marine conservation framework to limit potential uses that may negatively impact the site (e.g. fishing, anchoring, collecting, road building). Where traditional enforcement is not an option, it is advocated that the establishment of a community-based conservation programme is set up.

APPENDIX F: Fees for Support to Adaptation Fund Project

The implementing entity fee (8.5% of total project cost = US$646,425) will be utilized by SPREP to cover its indirect costs in the provision of general management support and specialized technical support services. The table below provides a breakdown of the estimated percentage fees for providing these services. Any additional Implementation Support Services (ISS) which have been requested by the national entity carrying out the project (OEEM) are reflected directly in the project budget.

Category	Services[1] Provided by SPREP[2]	Estimated % of Total Budget for Providing Services[3]
Identification, Sourcing and Screening of Ideas	Provide information on substantive issues in adaptation associated with the purpose of the Adaptation Fund (AF). Engage in upstream policy dialogue in FSM related to a potential application to the AF. Verify soundness & potential eligibility of identified idea for AF.	(5%) US$32,321
Feasibility Assessment / Due Diligence Review	Provide up-front guidance on converting general idea into a feasible project/programme. Source technical expertise in line with the scope of the project/ programme. Verify technical reports and project conceptualization. Provide detailed screening against technical, financial, social and risk criteria and provide statement of likely eligibility against AF requirements. Determination of execution modality and local capacity assessment of the national executing entity. Assist in identifying technical partners. Validate partner technical abilities. Obtain clearances from AF.	(15%) US$96,963
Development & Preparation	Provide technical support, backstopping and troubleshooting to convert the idea into a technically feasible and operationally viable project/programme. Source technical expertise in line with the scope of the project/ programme needs. Verify technical reports and project conceptualization.	(20%) US$129,285

[1] This is an indicative list only. Actual services provided may vary and may include additional services not listed here. The level and volume of services provided varies according to need.
[2] Services are delivered through SPREP's architecture and quality control, oversight and technical support system: local country offices; regional technical staff; and headquarters specialists.
[3] The breakdown of estimated costs is indicative only.

Category	Services[1] Provided by SPREP[2]	Estimated % of Total Budget for Providing Services[3]
	Verify technical soundness, quality of preparation, and match with AF expectations. Negotiate and obtain clearances by AF. Respond to information requests, arrange revisions etc.	
Implementation	Technical support in preparing TORs and verifying expertise for technical positions. Provide technical and operational guidance project teams. Verification of technical validity / match with AF expectations of inception report. Provide technical information as needed to facilitate implementation of the project activities. Provide advisory services as required. Provide technical support, participation as necessary during project activities. Provide troubleshooting support if needed. Provide support and oversight missions as necessary. Provide technical monitoring, progress monitoring, validation and quality assurance throughout. Allocate and monitor Annual Spending Limits based on agreed work plans. Receipt, allocation and reporting to the AFB of financial resources. Oversight and monitoring of AF funds. Return unspent funds to AF.	(45%) US$290,089
Evaluation and Reporting	Provide technical support in preparing TOR and verify expertise for technical positions involving evaluation and reporting. Participate in briefing / debriefing. Verify technical validity / match with AF expectations of all evaluation and other reports Undertake technical analysis, validate results, compile lessons. Disseminate technical findings	(15%) US$96,963
Total	*This is an indicative list only. Actual services provided may vary and may include additional services not listed here. The level and volume of services provided varies according to need.* *[1] Services are delivered through SPREP's architecture and quality control, oversight and technical support system: local country offices; regional technical staff; and headquarters specialists.* *[1] The percentage breakdown of estimated costs is indicative only.*	**100% (US$646,425)**

Category	Services[1] Provided by SPREP[2]	Estimated % of Total Budget for Providing Services[3]

Appendix G: On-going Climate Change Adaptation Activities

Title and Timeframe	Description, country focus and agencies responsible
Infrastructure Development Plan (2004-2023) prepared by the Dept. of Transport, Communications & Infrastructure	Under the Infrastructure Development Plan (2004-2023), the Kosrae Circumferential Road was identified as a national priority and investment needs and options were presented. The Compact of Free Association provides for investment in road infrastructure under the Infrastructure Sector Grant. The State of Kosrae has identified the circumferential road as one of the projects to be funded under the Infrastructure Sector Grant. However, the Joint Economic Management Committee (JEMCO) consisting of three representatives of the US Government and two representatives of the FSM Government which overseas the management and utilization of sector grants under the Compact of Free Association prioritizes education and health infrastructure projects. With the exception of the road project in Weno, Chuuk, which was prioritized because it includes replacing the aging water and sewer systems, other road infrastructure projects in the FSM that have been submitted for consideration by JEMCO have been placed on the "back burner". The current priority focus for JEMCO for the use of the Infrastructure Sector Grant is on education and health infrastructures such as schools, education centers, hospitals, community health centers, dispensaries, and anything related to social infrastructures.
The Nature Conservancy "Building the Resilience of Communities and their Ecosystems to the Impacts of Climate Change in Micronesia and Melanesia (International Climate Initiative – 2011)" **Proposal stage**	The Nature Conservancy (TNC) will lead the project and connect institutions and organizations across Micronesia and from Melanesia towards common goals and outputs. TNC will carry this task in close coordination with other lead organizations. TNC will provide and lead direct technical assistance relating to climate change adaptation assessments and planning, support learning and knowledge management for the project, and help mobilise and leverage project lessons through networks and platforms at regional and global levels. TNC will provide overall grant management, reporting and oversight for the partnership. ***Federated States of Micronesia**:* Department of Resources and Development, Ms. Alissa Takesy, Assistant Secretary Micronesia Challenge Focal Point, Federated States of Micronesia, P.O. Box PS-12, Palikir, Pohnpei FM 96941, Tel: (691) 320-2646/5133/2620; Fax: (691) 320-5854/2079 Email: alissa.takesy@fsmrd.fm
Micronesia Challenge (MC) ***2006 - ongoing***	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. The MC includes: Micronesians in Island Conservation Network (MIC); Pacific Islands Managed and Protected Area Community (PIMPAC); Locally Managed Marine Area Network – Micronesia Node (LMMA}; Micronesia Challenge Young Champions Agencies responsible: Micronesia Chief Executives (Guam, Mariana Islands, FSM, Palau and RMI); The Nature Conservancy (TNC); NOAA. Micronesia Conservation Trust (MCT)
Micronesia Conservation Trust (MCT) ***2002 - ongoing***	MCT was formally established by TNC in 2002 as 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." In 2006, MCT was selected as the financial mechanism for the MC and has since fully regionalized its Board and organizational structure and services. MCT is administered under FSM law, has a Board of Trustees.
Pacific Adaptation to Climate Change Project (PACC)	The PACC Project is designed to promote climate change adaptation as a key pre-requisite to sustainable development in Pacific Island countries. Its objective is to enhance the capacity of the participating countries to adapt to climate change and climate variability, in key development sectors.

2009 - 2013	Mainstreaming, demonstration and communications are implemented at the community and country levels. The project aims to assist FSM develop its food preservation and security needs, coastal management needs, and water management needs. Kosrae was chosen as pilot State focusing on coastal infrastructure e.g. roads that are already experiencing erosion from sea level rise and flooding. - Agencies responsible: UNDP (implementing agency); GEF, AUSAID (funding agencies); SPREP (implementing partner). FSM Kosrae Island Resource Management Authority (KIRMA)
International Climate Change Adaptation Initiative-Pacific Adaptation Strategy Assistance Program (ICCAI PASAP), ***2011-2013*:**	Aims to enhance the capacity of partner country to assess key vulnerabilities and risks, formulate adaptation strategies and plans and mainstream adaptation into decision making. The major output of the PASAP project is: Country (FSM)-led vulnerability assessment and adaptive strategies informed by best practice methods and improved knowledge. The project activities included community participatory surveys conducted in Yap which included Ulithi and Fais Atolls; evidence-based field research conducted on drought and salt tolerant varieties of sweet potatoes and sweet taro in Dinay and Wugeem, Yap; etc. Agencies responsible: Australian Department of Climate Change and Energy Efficiency (DCCEE), SPREP, SPC. COM-FSM CRE, State Departments of Agriculture, NGOs, and community members.
Geospatial Analysis for Food Security Adaptation **2013-2015**	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. funded by a three-year, $150,000 grant from the U.S. Forest Service Queens University of Charlotte, Yap State R&D
Pacific - Australia Climate Change Science and Adaptation Planning Program (PACCSAP) ***2011 - 2013***	PACCSAP: 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. Agencies responsible: AUSAID; Australian Department of Climate Change and Energy Efficiency (DCCEE); Australian Bureau of Meteorology, CSIRO, FSM OEEM
Implementing Sustainable Water Resources and Wastewater Management in Pacific Island Countries (Pacific IWRM) ***2008–2013 with Phase 2 (2013-2015) and 3 (2015-2018) being planned.***	Pacific IWRM is developing "Ridge to Reef – Community to Catchment" integrated water resource management (IWRM) activities in the 14 participating 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. Agencies responsible: GEF; SPC Applied Geosciences and Technology Division,FSM R&D
Water and Environmental Research Institute of the Western Pacific (WERI), *1985 ongoing*	Their mission is to seek solutions through research, teaching and outreach programs, to issues and problems associated with the location, 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. Agencies Responsible University of Guam, FSM? Island Research,
Global Climate Change Alliance: Pacific Small Island States (SPC-	The overall objective of the GCCA:PSIS is to support the governments of nine Pacific smaller island states, including FSM, in their efforts to tackle the adverse effects of climate change. Overall available funding is 11m EUR.

GCCA:PSIS) ***2011 – 2014***	In FSM the key adaptation activity focus of the project is addressing coastal water and food security in the outlying islands of Agencies responsible: European Union (EU); SPC (Implementation); SPREP. FSM OEEM
University of the South Pacific European Union Global Climate Change Alliance Project (USP-EU GCCA Project *2011 – 2014*	The USP-EU GCCA project addresses the challenges of climate change impacts in the 15 Pacific ACP countries, including FSM, through capacity building, community engagement, and applied research. The objective of this project is to develop and strengthen the Pacific ACP countries' capacity to adapt to the impacts of climate change. Overall available funding is € 8m. Agencies responsible: EU; USP,.FSM- MFA?
North Pacific ACP Renewable Energy and Energy Efficiency Project (North-REP) ***2010 – 2014***	The overall objective of North-REP is to improve the quality of life on the outer islands by increasing access to basic electricity and reducing dependency on fossil fuels through energy efficiency and increased penetration of matured renewable energy technologies in the North-REP countries (FSM, RMI and Palau). Overall available funding for FSM is 10m USD. Agencies responsible: EU; SPC (implementing agency); FSM R&D.
Coping with Climate Change in the Pacific Island Region (CCCPIR) ***2009 – 2015***	CCCPIR covers 12 Pacific Island Countries and 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. In FSM CCCPIR is undertaking mainstreaming climate change, and integrated land and marine resource management at the national and local level. Overall available funding is 17m EUR. FSM is eligible for up to 440,000 USD.depending on project design. Agencies responsible: German Ministry for Economic Cooperation and Development (BMZ, funding); German International Cooperation (GIZ, implementing agency); SPC (regional partner), FSM OEEM, R&D
ADAPT Asia – Pacific Annual Forum on Adaptation ***2012 onwards***	Designed to help Asia-Pacific country governments understand the technical and scientific demands required to apply for climate finance. Agency responsible: USAID, FSM OEEM
National Climate Change and Health Action Plan (NCCHAP) ***2010-2013***	Regional framework for action to protect human health from effects of climate change in the South East Asia and Pacific region. Agencies responsible: WHO,FSM DHSA, State EPAs, OEEM, WSO
Technical Assistance(TA) to the Federated States of Micronesia for Strengthening Infrastructure Planning and Implementation ***2011-2013***	TA will support state utilities within the FSM) in executing infrastructure projects more effectively by having an 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. The Government of FSM has requested ADB to finance $700,000 equivalent. Agencies responsible: ADB, Japan Fund for Poverty Reduction, FSM TC&I
Second National Communications to the UNFCCC ***2006-2012***	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. USD 425,000 Agencies Responsible, GEF, UNDP, FSM – OEEM, R&D, State Environmental Protection Agencies
$MAPCO_2$ Project ***2011 - ongoing***	A $MAPCO_2$ 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. Agencies responsible: NOAA's PMEL Carbon Group; Korea Ocean Research and Development Institute. FSM R&D
Pacific Islands Climate Education	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

Partnership (PCEP) ***2011–ongoing***	understandings of climate change and adapt to its impacts.US National Science Foundation (NSF); WestEd, FSM OEEM, National and State Departments of Education, Pacific Resources for Education and Learning (PREL)
Unite for Climate	Children's vulnerability to climate change and disaster impacts in East Asia and the Pacific. Agency responsible: UNICEF, FSM Department of Health and Social Affairs,
Pacific Regional Integrated Sciences and Assessments (Pacific RISA) ***1995 -ongoing***	Strives to enhance Pacific Island communities' abilities to understand, plan for, and respond to a changing climate. Emphasizing the engagement of 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 . Agencies Responsible National Oceanic and Atmospheric Administration (NOAA) WSO.
Schools of the Pacific Rainfall Climate Experiment (SPaRCE) ***1995–ongoing***	The SPaRCE programme seeks 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. Agencies Responsible: University of Oklahoma, FSM DoE, WSO
Climate Adaptation, Disaster Risk Reduction and Education (CADRE) ***2011 -2014***	Aims to build resilience of vulnerable communities to natural hazards particularly those that are climate induced. Will target approximately 10,000 school aged students at up to 50 schools with climate adaptation, disaster risk reduction and education program. Track 1 educational component, including capacity building of students, teachers, administrators and the local community; technical assessments of climate change impact and disaster risk on schools grounds, and the surrounding community. Track 2 roll out of adaptation measures stemming from the recommendations contained within the change impact assessments and exercising of the climate adaptation and disaster risk management plans Agencies responsible: USAID, AusAID, IOM, FSM OEEM, National and State Departments of Education
FSM Joint National Action Policy and State Action Plans for Climate Change Adaptation and Disaster Risk Management ***2013-2018***	Following a request by FSM in 2012, CROP agencies are providing assistance for the FSM and its States with the development of this policy and plans. Agencies Responsible: SPC, EU, SPREP, FSM OEEM
U.S. Peace Corps Small Project Assistance (SPA) for Adaptation, ***2013-2017***	This project will extend USAID's reach 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 demonstrate application of climate change and DRR principles. Implementing Organization: U.S. Peace Corps, USAID, FSM
Coastal Community Adaptation Project (C-CAP), ***2013-2017***	This project aims 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. The project has three components: (1) rehabilitating or constructing new, small-scale community infrastructure; (2) building capacity for community engagement for disaster prevention and preparedness; and (3) integrating climate resilient policies and practices into long-term land use plans and building standards. USAID Implementing Organization: Development Alternatives, Inc. (DAI), University of the South Pacific (USP); Kramer Ausenco Papua New Guinea Limited, FSM OEEM

Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) ***2007- 2015***	Aims 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. The initiative is part of the broader agenda on disaster risk management and climate change adaptation in the Pacific region. Responsible Agencies: SPC, WB and ADB, Japan, Pacific Disaster Centre, with technical inputs from GNS Science, Geoscience Australia, and AIR Worldwide

Appendix H - Project Target Islands

To complement the proposed LDCF contributions to FSM ("Ridge to Reef" project – R2R) whose approach focuses specifically on the main islands ("high islands") of each State, this proposal seeks to provide, in addition to national and State wide institutional, regulatory and legislative guidance work, a series of contributory support interventions for 6 (six) coastal communities in the **lower lying atoll islands of the 3 States of Yap, Chuuk and Pohnpei**. Component 3 (implementation of the Kosrae Shoreline Management Plan (SMP)) however focuses specifically on the main "high island" of Kosrae.

The following information provides a summary of each State and also indicative locations for soft coastal engineering intervention measures (which have been endorsed by each State Governor visited during December 2013).

NB: a rapid multi-criteria Analysis exercise was carried out to help prioritise intervention areas and technique proposals. A more detailed assessment is recommended to help finalise EXACT locations and EXACT intervention techniques per location.

Yap State: Yap's indigenous island cultures and traditions are still strong compared to neighbouring regions. The main district of Yap consists of four islands with geology that is non-volcanic in origin. The four are very close together and joined within a common coral reef and entirely formed from uplift of the Philippine Plate. The land is mostly rolling hills densely covered with vegetation. Mangrove forests line much of the shore although beaches are common in some areas. An outer barrier reef and lagoon surrounds the islands and their fringing reef. Colonia is the capital of Yap State. It administers both Yap proper and 14 atolls reaching to the east and south for some 800 kilometers, 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. The 2009 state wide population was 11,780. The state has a total land area of 102 km2. The tidal surges of 2007 and 2008 caused significant damage to coastal infrastructure, food resources, and housing. Yap is well developed and has a generally high quality of life.

The central business district of Yap is built around a harbour, the shoreline of which is armoured by well-designed and engineered walls and revetments. However, the top elevation of most of this coastal protection is only 30-60cm above high tide. By mid-century or earlier, these protections will need upward extension to protect the critical roads, fuel depots, buildings, and freight handling facilities lining the harbour. Over the next decade, climate risk management can focus on building a community-based adaptation program to improve climate risk management.

Proposed atoll islands for intervention within Yap State are identified in Table 3. The island of Fais is currently being piloted for a water resource management project (using funds from EU GCCA as part of the IWRM Project – see Part II). For this proposal, the atoll islands of Eauripik and Woleai are nominated for soft coastal engineering interventions based on clear advice from the State Government. The recent impacts caused by Typhoon Haiyan were felt very strongly at these islands and emergency assistance needed to be shipped to the communities there, where major tidal inundation occurred.

Chuuk State: The main population center of Chuuk State is the main Chuuk Lagoon, an archipelago with about 7 mountainous islands within it surrounded by a string of islets on a barrier reef. The two major geographical divisions of the Chuuk Lagoon are Faichuuk, the western islands, and Namoneas, the eastern islands. Chuuk State, population 53,106, also includes several additional sparsely populated outer island groups, including the Mortlock Islands to the southeast, the Hall Islands (Pafeng) to the north, Namonuito Atoll to the northwest, and the Pattiw Region to west. The Pattiw Region includes the islands of Pollap, Tamatam, Poluwat, and Houk.

Most of the roads and transportation systems are poor or in disrepair. These are regularly inundated by daily tides. No climate proofing of roads takes place. Potholes in the coastal road of the business district of Chuuk are often filled with either saltwater at high tide or runoff that cannot drain due to the low elevation. The tidal surges of 2007 and 2008 caused significant damage to coastal infrastructure, food

resources, and housing. On July 2, 2002, heavy rains from Tropical Storm Chataan caused more than 30 landslides that killed 47 people and injured dozens of others in the state's deadliest weather disaster. The landslides occurred throughout the day, some within just minutes of one another.

It is apparent that investment in Chuuk already scheduled to refurbish the main road and buried infrastructure is committed and planned for immediate ground breaking. Unfortunately, the pace of climate change has already made some design elements of these large infrastructure projects out of date. Adding to the elevation of the main road in Chuuk would likely permit avoidance of significant drainage problems related to sea-level rise for a period of years to decades depending on the amount of adjustment. The addition of 0.5 meters to the roadbed, and incorporation of enhanced drainage features, will likely pay dividends in flooding avoidance for a few decades.

Proposed atoll islands for intervention within Chuuk State are identified in Table 3. For this proposal, the island of Pis Panewu (northern edge of the Chuuk Lagoon) has been highlighted as a good example to help demonstrate soft coastal engineering techniques (e.g.: beach ridge rehabilitation and coastal vegetative planting). On outer atolls, the islands of Satawan and Lukanor are nominated for soft coastal engineering interventions based on clear advice from the State Governor.

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 kilometers 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. The indigenous makeup also includes people from the outer islands within the State, which comprise multiple regional ethnicities. Outer islands in Pohnpei include Pingelap, Mokil, Ant, Pakin, Ngatik, Nukuoro, and Kapingamarangi. These are atoll islets that suffered extreme hardship during the marine inundation events of 2007 and 2008.Typhoons rarely hit Pohnpei; more often they are spawned in Micronesia and move on to Guam and the Commonwealth of the Northern Marianas Islands. Every several years or so (on average), a mildly damaging tropical storm or depression will affect Pohnpei. Strong El Niño events can cause prolonged drought of many weeks or even months, as was seen in 1997-1998. The tidal surges of 2007 and 2008 caused significant damage to coastal infrastructure in low-lying areas. Without a specific plan to manage coastal problems, Pohnpei shoreline areas will lack a degree of resiliency, resources will be exposed to depletion, and improvements through investment may be outpaced by the scale of climate change unless a specific plan is developed.

Proposed atoll islands for intervention within Pohnpei State are identified in Table 3. On outer atoll, the islands of Nukuoro, and Kapingamarangi are nominated for soft coastal engineering interventions based on clear advice from the State Governor and the EPA. These islands were the focus of the Sustainable Land Management (SLM) project and hence a degree of continuity can be established on these islands (only circa US$25,000 per island received hence minimal intervention taken place to date).

Kosrae State: The island of Kosrae is the easternmost island in FSM. Kosrae is a 112 km2 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 population of approximately 8,247 is largely dependent upon fishing and farming for their livelihood. Kosrae has unique needs with regard to climate risk management and adaptation. The majority of the coastline is experiencing chronic erosion, in places related to engineering projects that have

caused down-drift sediment deficiencies over the past four decades. Additional causes of erosion include offshore mining of the reef flat for construction materials, beach mining for sand and gravel resources, and interruptions to alongshore sediment transport by engineering projects; in some areas erosion is occurring for reasons that are not entirely known but are probably, in part, related to sea-level rise. The widespread "telescoping" of erosion along the coast by armouring, and beach loss in front of seawalls and revetments, has produced a chronic deficiency in sand that formerly constituted beautiful beaches ringing the island. These beaches lent protection to coastal communities, ambience to tourism and a quality of life to residents that is at risk. The maximum overwash elevation of the recent tide surges is likely to be reached in future events with greater frequency. Generally, designing structures such that overwash may run beneath the structure increases community resilience. Buildings with their lowest horizontal structural component set above the maximum elevation of the December 2008 overwash plus 1 meter will be less prone to damage and more resilient to recovery. The maximum overwash elevation, plus 1 meter, represents a base flood elevation (BFE) for new construction and for renovation of existing buildings. Some key data from the 2010 FSM Census for Kosrae (to help with justifying Component 3 interventions) are presented below:

Kosrae 2010 census data

Malem population – 1300

- Male – 663
- Female - 637
- No of houses - 238

Utwe population – 983

- Male – 458
- Female – 525
- 23% of population high school age – need daily access to High school in Tofol
- No of houses – 161
- On pro-rata basis probably about 90 people in Utwe employed by National Government requiring daily access

Walung

- No census data for Walung (< 100 people?) as lumped with Tafunsak.
- Theoretically only road from Walung to rest of Kosrae is via Utwe (however, everyone at present uses boat to Tafunsak). But ultimately this will be the only road to Walung as road south from Tafunsak now suspended due to the Yela area being protected.

- So essentially 2 of the five villages reliant on the road access as the only connection to the rest of Kosrae and the main administrative centre at Tofol, medical facilities etc, and airport.
- Boat access from Utwe to Lelu not an option (as occurs from Walung to Tafunsak) as would be travelling on the windward (rough) side of the island

Tourism (reliant on access to Utwe)

- One dive operator (Kosrae village Resort) operates primarily out of Utwe, other operators on occasion.
- Tourism activities include Menke ruins hike, Mt Finkol hike, Sipian and other waterfalls, Utwe-Walung Marine Park

Access to traditional lands

Malem village was traditionally located at Kupluh (SW of Malem) on the volcanic part of the island prior to Missionaries arriving and moving everyone closer to the coast. Long desire by Malem local administration to upgrade, and develop the inland road to improve access to people's land which has limited vehicular access at present.

Desire to relocate inland

- Strong realisation that relocation will need to occur over time and best way to do this is in a staged approach over 1-2 generations as people come to build/rebuild houses etc
- Major barrier is lack on infrastructure (roads, power) around edge of volcanic part of the island.

Infrastructure location a major driver of where populations relocate on Kosrae.

State	Atoll Island for intervention	Indicative population to benefit	Google Earth Image
Yap	Eauripik Woleai	450 275	
Chuuk	Satawan Island Lukanor Island	250 150	
Pohnpei	Nukuoro, and Kapingamarangi	Circa 675 (combined)	

Table 3: Proposed "Soft Coastal Engineering" Living with the Sea Intervention Islands for Yap, Chuuk and Pohnpei

Appendix I – Implementation/Gantt Chart

Particulars	Schedule															
Years	**Year 1**				**Year 2**				**Year 3**				**Year 4**			
Quarters	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**1**	**3**	**4**
Project Inception																
Project Inception Workshop	x															
Outcome 1 - Capacity developed for efficient and effective support at national level to deliver climate resilient policies and enforce regulations for the coastal zones of all FSM states																
Output 1.1: Legislative and policy support to help improve regulatory enforcement of climate resilient coastal and marine management for each FSM State																
a) Strengthen national policies and related instruments (analysis; workshops)		x														
b) Strengthen institutional coordination mechanisms (analysis; workshops)		x	x													
c) Appoint and Support Learning and Teaching Advisor with ICZM focus			x													
Output 1.2 Preparation of Shoreline Management Plans for Yap, Chuuk and Pohnpei States with each defining sets of maintenance targets and integrate recurrent and capital expenditures																
a) Initial Data collection studies		x														
b) SMP preparation (per State)			x	x	x	x										
c) SMP Draft Consultation (per State)						x	x	x								
d) SMP endorsement (per State)								x								
Output 1.3: Prepare Coastal Development and Environmental Policy Guidelines for each State to help deliver the "Living with the Sea" approach (i.e.: linking R2R and SMP policy direction).																
a) Production of CDG									x	x						
b) Production of EPG									x	x						
Output 1.4 Establish climate resilient engineering and construction (building) standards and protocols for future coastal infrastructure construction within each FSM State																
a) Drafting of updated building/construction standards in coastal zone			x	x	x	x										
b) Drafting of new climate resilient roads standard			x	x	x	x										
Output 1.5 Capacity developed to improve coordination for future Living with the Sea policy compliance (for each FSM State) including "performance measure" procedures for key staff/departments																
a) Training of policymakers, technical officers and leaders of relevant NGOs								x	x	x						
b) Build capacities of national institutions			x	x	x	x	x	x	x	x						
Output 1.6 Establish a national knowledge and information system for "Living with the Sea" delivery																
a) Establishment of a framework and regular updates to a monitoring and surveillance system		x		x		x		x		x		x		x		x

b) Appoint and train "Living with the Sea" Focal Points for State		x														
Outcome 2 - Vulnerability of coastal communities and infrastructure investments to climate risks is reduced through construction of risk reduction adaptation measures and associated training and awareness programmes.																
Output 2.1 Six (6) sustainable "Pilot soft coastal adaptation interventions" (incorporating food security and water /marine resource management where possible) on 6 atoll islands within the States of in Yap, Chuuk and Pohnpei																
a) State Governor agreements on outer island pilot locations								x								
b) Baseline Assessment and concept design								x	x							
c) Detailed engineering design										x	x					
d) EIA and regulatory acceptance of pilot interventions											x	x				
e) Site construction and works												x	x	x	x	
Output 2.2 Training programmes for State Government and island specific technical on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the States of in Yap, Chuuk and Pohnpei (linking to Output 2.1).																
a) Train technical officers providing advisory services to communities, and other players												x	x	x	x	
b) Train farmers, fishers, households, and business owners on "Living with the Sea" techniques												x	x	x	x	
Output 2.3 Education and awareness programmes for the wider community on "Living with the Sea" principles for the 3 FSM States.																
a) Generate lessons learned and best practice training plans		x		x		x		x		x		x		x		x
b) Distribute educational materials			x		x		x		x		x		x		x	
Outcome 3 - Increased climate resilience of coastal communities (Malem, Utwe, Pal, Mosral and Walung) through the effective delivery of priority engineering "climate proof intervention measures" as set out in the Kosrae SDP (2014-2023) and Kosrae Shoreline Management Plan (SMP).																
Output 3.1 Intervention A: New road section construction (Malem to Yeseng) plus access routes to the two villages																
a) Baseline Assessment and concept design		x	x													
b) Detailed engineering design			x	x												
c) EIA and regulatory acceptance of pilot interventions					x	x										
d) Site construction and works							x	x	x							
Output 3.2 Intervention B: Transitional coast protection schemes (Mosral and Pal)																
a) Baseline Assessment and concept design					x	x										
b) Detailed engineering design						x	x									
c) EIA and regulatory acceptance of pilot interventions								x	x							
d) Site construction and works										x	x	x				
Output 3.3 Training programmes for the Kosrae State Government on the delivery and enforcement of the institutional and capacity development measures (Component 1) identified to support climate resilient coastal management for the State of Kosrae.																
a) Train technical officers providing advisory services to communities, and other players			x	x	x	x										
b) Train farmers, fishers, households, and business owners on "Living with the Sea" techniques			x	x	x	x										
Output 3.4 Education and awareness programmes for the wider community engagement on "Living with the Sea" principles for Kosraen																

villages																
a) Generate lessons learned and best practice training plans		x		x		x		x		x		x		x		x
b) Distribute educational materials			x		x		x		x		x		x		x	

Department of Foreign Affairs
Federated States of Micronesia

February 10, 2015

Letter of Endorsement by Government

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

Subject: **Endorsement for "Enhancing the resilience of vulnerable island atoll communities in FSM to climate change risks through a "Living with the Sea" National Risk Management Framework" Project Proposal**

In my capacity as designated authority for the Adaption Fund in the Federated States of Micronesia, I confirm that that the above national project 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 proposal with support from the Adaption Fund. If approved, the project will be implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) and executed by the FSM Office of Environment and Emergency Management (OEEM).

Sincerely,

Lorin S. Robert
Secretary (Minister)

Loss & Damage

Loss and damage from coastal erosion in Kosrae, The Federated States of Micronesia

Iris Monnereau and Simpson Abraham

November 2013

CDKN
GERMANWATCH
ICCCAD International Centre for Climate Change and Development
MCII
UNITED NATIONS UNIVERSITY
UNU-EHS

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Table of Content

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Executive summary

Introduction

Small Island Developing States (SIDS) are expected to be disproportionately affected by climate change, sea-level rise and extreme weather events, due to their social, economic and geographical characteristics – for example, their limited size, proneness to natural hazards, low-lying areas and low adaptive capacity (Mimura et al., 2007). They are particularly vulnerable to sea-level rise, which is expected to increase in the near future and exacerbate coastal erosion, inundation, storm surges and other coastal hazards (Mimura et al., 2007). In SIDS, the projected sea-level rise of 5mm per year for the next 100 years would cause: increased coastal erosion, loss of land and property, dislocation of

Small Island Development States are particularly vulnerable to sea-level rise

people, increased risk from storm surges, reduced resilience of coastal ecosystems, saltwater intrusion into freshwater resources, and high resource costs for adaptation (Mirza, 2003). Coastal erosion is one of the expected consequences of climate change, particularly in the Pacific Ocean. Kosrae, one of the four states of the Federated States of Micronesia (FSM), has experienced severe coastal erosion over the past decades as a result of El Niño/La Niña Southern Oscillation (ENSO), sea-level rise and human activity. This is expected to increase as climate change impacts become more significant in the near future.

The research

The four main villages on Kosrae are all at significant risk from coastal erosion, as 70% of all households are located below or seaward of the 4m contour above sea level (NIWA, 2013). Coastal erosion, both gradual and that occurring as a result of high (king) tides, has already affected housing conditions on Kosrae. This is expected to worsen, as sea levels will continue to rise and

Coastal erosion already has severe impacts on Kosrae and is expected to worsen

extreme weather events are expected to become more frequent. Although many residents have adopted adaptation measures to deal with coastal erosion, these measures have, in most cases, not been enough to offset adverse impacts. Adaptation measures have their limitations and can also have negative consequences.

Loss and damage refers to the negative effects of extreme weather events and slow-onset climatic changes that people have not been able to cope with or adapt to

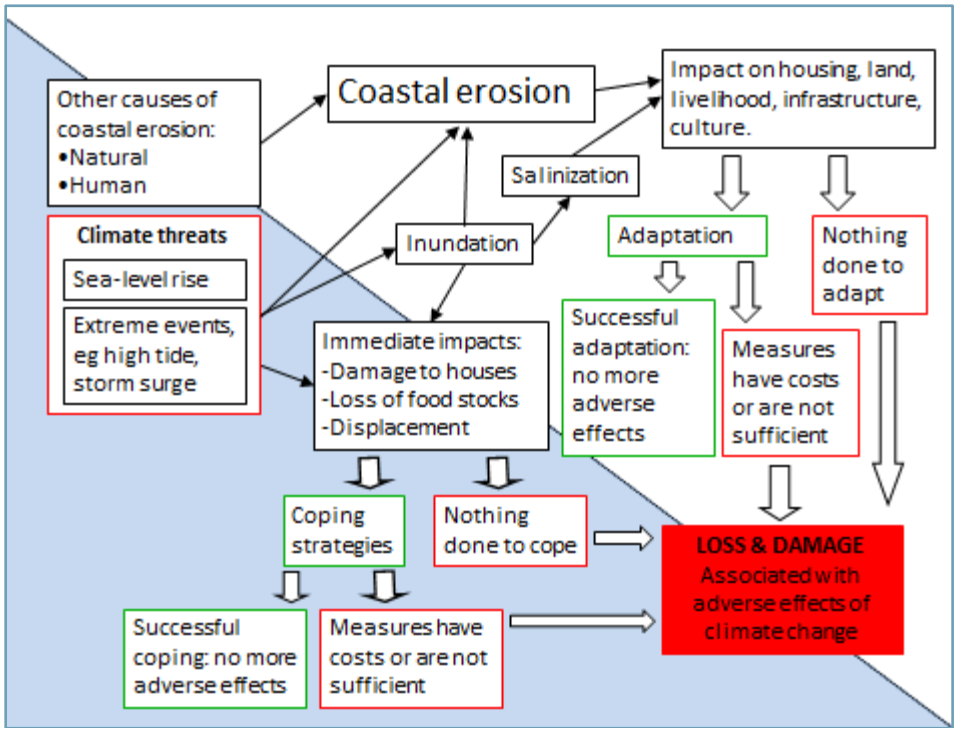


Figure 1: Framework of loss and damage project on Kosrae, Micronesia.

Note: The background colours divide the part of the study that looked at coping with extreme events (blue) and adaptation to slow-onset changes (white)

This research looks at loss and damage from climate change. 'Loss and damage' is defined here as the negative effects of extreme weather events and slow-onset climatic changes that people have not been able to cope with or adapt to. This case study focuses on the extent to which communities have been affected by sea-level rise and more extreme climate events, through coastal erosion and other impacts, the adaptation and coping strategies households have carried out, their limitations, and the loss and damage to housing on Kosrae. For this research, we administered 363 questionnaires, conducted six focus group discussions and 12 in-depth interviews during July 2012.

Figure 1 shows the framework of this study. Coastal erosion in this study is considered to be impacted by climate change variables such as sea-level rise and extreme weather events, as well as other factors such as human activity (eg reef dredging and sand mining) and natural causes (eg ENSO patterns). In this study we focus on the direct impacts of coastal erosion on housing and indirect impacts through inundation and salinization. Coastal erosion negatively affects residents through structural damage and loss to livelihoods, land, infrastructure, houses and culture.

87% of the surveyed households experienced adverse effects of coastal erosion and 51% adopted adaptation measures

Results

Slow onset changes: The majority of survey respondents (87%) on Kosrae have experienced adverse effects of coastal erosion over the past 20 years. The coastline has retreated, beaches have

disappeared, and people have suffered loss and damage to land, houses and livelihoods. Of those who experienced adverse effects of coastal erosion, 80% said this had directly affected their household economy, mostly as a result of loss and damage to crops, economic trees and housing. Of those who experienced negative impacts on their household economy, 53% reported damage to their house. The shoreline is often right alongside the house rather than ten metres away, as it was 15 years ago. Of those who said they suffered from coastal erosion, 51% said they carried out adaptation measures. The most popular measures were:

- building seawalls (29%)
- landfilling (29%)
- planting trees along the coastline (15%)
- elevating houses (11%).

For 92% of the adapting households, the measures were not enough to avoid negative effects of coastal erosion

However, 92% of those who had carried out adaptation measures said these measures were not enough to combat coastal erosion and its impacts. Respondents who did not carry out any adaptation measures indicated that this was mostly due to lack of financial means (71%), lack of know-how (41%) or skills (40%), or lack of other resources (18%). Only 3% of respondents who suffered from coastal erosion said they did not carry out any adaptation measures because it was not considered a priority; this very low percentage emphasises the fact that coastal erosion is perceived to be a very serious threat by many people on the island.

Extreme weather events: Of the households surveyed, 57% have also suffered the adverse effects of extreme weather events, specifically high (king) tides. These events have had short-term (eg damage to housing) and long-term impacts (eg salinisation of agricultural land and economic trees) on households. The loss of land and protective plants and trees along the shoreline further intensifies the problems. Of those who experienced these extreme events, only 25% said they carried out coping mechanisms, yet 96% felt the measures were insufficient. Measures undertaken were mainly building or repairing of temporary seawalls, repairing houses, with long-term coping strategies being adopted in a minority of cases.

Conclusion

Coastal erosion has severely impacted the livelihoods, housing and culture of the residents of Kosrae. Coastal erosion on the island has been caused by ongoing climate changes as well as other natural factors and human activity over the past 50 years. Dredging of the reef flat, sand

Coastal erorsion results from a combination of climatic stressors and human activities

mining, cutting trees and mangroves, and altering river outlets have all had a profound impact on

current coastal retreat. At the same time, climate change impacts such as sea-level rise and climate variability impacts such as ENSO events have exacerbated coastal vulnerability on the island. It has become clear that sea-level rise is greater in the FSM area in comparison to surrounding areas in the Pacific Ocean, and residents indicate that the extreme weather events of the past few years have been the worst they have seen in the last 20 years. Increasing coastal erosion will reinforce this cycle – that is, the more trees lost to coastal erosion, mangroves and the protective reef, the greater the impact of coastal erosion. This study has shown that despite their adaptation and coping measures, Kosraen households still suffer from loss and damage. Coastal erosion has a significant impact on their livelihoods, housing and culture. Some loss and damage can be repaired (eg to housing or infrastructure), while some, such as loss of income or culture, is much more difficult to restore.

This study has shown that despite their adaptation and coping measures, Kosraen households still suffer from loss and damage.

In order to improve future adaptation, collective collaboration and planned measures are necessary. Policy recommendations include:

- moving households to uphill areas;
- replanting of eroded coastal areas;
- protection of mangroves;
- maintaining coastal defences already in place;
- support infrastructure along inner roads and other infrastructure;
- support the elevation of houses.

Chapter 1: Introduction

"The storm came and broke the door and smashed the windows. The shoreline behind our house had already completely disappeared because of coastal erosion, so now the seawater quickly filled the house. Everything inside the house got wet – mattresses, clothes and furniture. The kitchen next to the house, built of bamboo and thatch, completely washed away. The only thing left was the cement floor. Our three dogs were washed away and disappeared in the dark. Water also entered the pigpen, but fortunately, the pigs survived. We had to stay with family for ten months while we rebuilt our home. We are building a new house in the hills, however, because the seawall and gabions we have built ourselves are no longer protecting us. The gabion nets are rusting and the waves are breaking down the seawall. The sea is almost reaching our house. Our grandson will not be able to grow old in this house." (Alokoa Jonithan, 55 years old, male, Tafunsak, Kosrae, Federated States of Micronesia)

Alokoa Jonithan's experience with the impacts of a storm on his housing and livelihood as a result of already pressing challenges of coastal erosion on Kosrae, Federated States of Micronesia (FSM), illustrates the impacts of climate change stressors on those living on small vulnerable islands. Small Island Developing States (SIDS) are already, and will continue to be, disproportionately affected by climate change, sea-level rise and extreme weather events (Mimura et al., 2007). This is due to their social, economic and geographical characteristics – such as their limited size, insular geography and remoteness, proneness to natural hazards, low-lying areas, and low adaptive capacity (Mimura et al., 2007; Nurse et al., 2001; Pelling and Uitto, 2001; Kelman, 2010; Douglas, 2006). SIDS are a grouping of 52 tropical island states, including FSM, that have been banded together under the United Nations to address common sustainability challenges (Mercer et al., 2012). Although SIDS produce only 0.6% [1] of global greenhouse gases, they will need to reallocate scarce resources away from economic development and poverty alleviation in order to adapt to the growing threats posed by global warming (Nurse and Moore, 2005).

SIDS produce only 0.6% of global greenhouse gases, but they need to use scarce resources to adapt to the growing threats posed by global warming

SIDS are particularly vulnerable to sea-level rise, which is expected to increase in the near future and exacerbate coastal erosion, inundation, storm surges and other coastal hazards (Mimura et al., 2007). Coastal erosion is considered to be one of the most serious climate change concerns for Pacific Ocean islands (Mimura, 1999; Mimura et

[1] This percentage is based on our calculations of SIDS' carbon production in 2009 from the Carbon Dioxide Information Analysis Center. See http://cdiac.ornl.gov/trends/emis/meth_reg.html (accessed July 23rd 2013). All SIDS are included in this analysis except for: American Samoa; Guam; Puerto Rico; Tuvalu; and the US Virgin Islands.

al., 2007; Fletcher and Richmond, 2010). Over the past few decades, FSM has experienced increasing coastal erosion and an escalating rate of shoreline retreat (Mimura, 1999; Fletcher and Richmond, 2010). The sea-level near the FSM, measured by satellite altimeters since 1993, has risen more than 10mm per year, significantly more than the global average of 3.2mm per year (Australian Bureau of Meteorology and CSIRO, 2011: 64) (see Figure 2). It is estimated that the mean global sea level will continue to rise over the course of the 21st century, with some studies suggesting faster global rates of sea-level rise (ibid).

At 10 mm per year, sea level rise in Micronesia is much higher than the global average of 3.2 mm

In the Pacific Ocean SIDS, more than 50% of the population lives within 1.5km of the coast (Mimura et al., 2007). This makes residents extremely vulnerable to sea-level rise. Moreover, most infrastructure, social services, tourism facilities, airports, seaport facilities, roads and vital utilities are located in low-lying areas (UNFCCC, 2005: 21). Coastal erosion can, and already is, causing losses and threats to land, communities and vital infrastructure, compromising the socio-economic well-being of those living on islands. Low-lying islands and atolls are the most vulnerable, as they can become totally inhabitable (Barnett and Adger, 2007). Nonetheless, even on islands with large land areas at higher elevations, such as on Kosrae, the majority of people and most of the infrastructure, are located on the narrow low-lying coastal strip. The higher areas are mostly characterised by steep, unstable slopes where development is difficult (Fletcher and Richmond, 2010). In Kosrae, 70% of households live below or seaward of the 4m contour (NIWA, 2013).

Low-lying islands are the most vulnerable, but even on 'high islands', such as on Kosrae, most people and infrastructure are located on the low-lying coastal strip.

Sea-level rise (SLR) is not the only cause of coastal erosion in the FSM, however, and coastal erosion should be seen in the light of multiple drivers. El Niño/La Niña Southern Oscillation (ENSO) climate patterns are considered to be an important factor. The predicted changes of ENSO inter-annual variability as a result of climate change differ among models and remain uncertain (Meehl et al., 2007). Human activities such as reef dredging and sand mining are other significant causes of coastal erosion (Development Review Commission (DRC), 2000). Environmental change is thus the result of multiple drivers and has indisputable human causes (Nelson et al., 2007). Yet, the rise in sea level over the past decades and the rise predicted for the coming decade (Australian Bureau of Meteorology and CSIRO, 2011: 64) are expected to exacerbate the already existing coastal erosion.

Adaptation measures are actions taken by individuals, groups and governments (Adger et al., 2005), to reduce the risk of climate change impact on what is valued (Adger et al., 2009). Over the past decade, there have been a growing number of studies on adaptation to climate change (eg Adger et al., 2003, 2005; Eakin and Patt, 2011; Moser and Ekstrom, 2010; Eriksen et al., 2010). In this article we follow Moser and Ekstrom's (2010: 1) definition of adaptation: "Adaptation involves changes in social-ecological systems in response to actual and expected impacts of climate change in the context of interacting non-climatic changes. Adaptation strategies and actions ... aim to meet more than climate change goals alone, and may or may not succeed in moderating harm or exploiting beneficial opportunities."

Adaptation involves changes in social-ecological systems in response to actual and expected impacts of climate change in the context of interacting non-climatic changes.

Adaptations can be either *autonomous* or *planned* and depending on their timing can be *reactive* or *anticipatory* (Smit and Wandel, 2006: 282; Smit et al., 2001). *Autonomous* adaptations are initiatives by private actors (eg individuals and households) rather than public actors (eg governments and non-governmental organisations (NGOs)) (Leary, 1999: 308; Smit et al., 2001). *Planned* adaptation measures are actions taken by public bodies (eg governments, NGOs) to protect citizens (Adger et al., 2005) and are the result of a deliberate policy decision by a public body (Smit et al., 2001). *Reactive* adaptation measures are triggered by past or current events after some impacts have been experienced (Füssel, 2007). *Anticipatory* measures are based on an assessment of future conditions and are taken before damages have occurred (Adger et al., 2005; Füssel, 2007). The latter distinction is not always definitive, however, as people base their adaptation strategies on their experiences of the present situation and recent past as well as on their expectations of the future.

Adaptation can be planned or autonomos, and reactive or anticipatory

The terms 'adaptation' and 'coping' are sometimes used interchangeably, leading to confusion about the similarities and differences between them. Coping relates to short-term reactions to an extreme-event. Coping strategies are therefore reactive rather than proactive, motivated by crisis and oriented towards survival (Van der Geest and Dietz, 2004; Dazé et al., 2009).

Within the adaptation debate over the past few years, increasing attention has been devoted to the limits of adaptation. Limits of adaptation refer to the point at which an actor's objective (or biophysical) needs cannot be safeguarded from intolerable risks despite adaptive actions (Dow et al., 2013). The debate concerning limits to adaptation relates to a growing awareness in

academic and policy circles that not all climate change impacts can be addressed by current and future mitigation and adaptation efforts, and that in many cases the impacts will exceed the adaptation capabilities of individuals, communities and countries.

Not all climate change impacts can be addressed by current and future mitigation and adaptation efforts; there are limits to the adaptive capacities of individuals, communities and countries

The IPCC Fourth Assessment Report concluded that some impacts of climate change may already be manifest. The impact of climate change *beyond adaptation* has come to be known as 'loss and damage'. Discussions started on the need for adaptation finance and action that would help countries (especially those most vulnerable to the negative impacts of climate change) to adapt and manage loss and damage incurred (Warner and Zakieldeen, 2011: 3). In 2008 at the United Nations Framework Convention on Climate Change (UNFCCC) 14th Conference of the Parties (COP14) in 2008 in Poland the debate on loss and damages intensified as the Small Island Developing States (SIDS) aligned with some of the Least Developed Countries (LDCs) to ask for more attention to be given to the loss and damage they were already experiencing. In 2010, at COP16 in Cancun, it was recognised that joint international efforts were needed to better understand and address such loss and damage.

Loss and damage results from the inability to respond adequately to climate stresses and the costs associated with existing measures

The concept of 'loss and damage' revolves around the question of the extent to which people in vulnerable countries are already suffering from the consequences of climate change, despite attempts to adapt (Warner and Zakieldeen, 2011). It is argued that there are limits to adaptation and that even if adaptation measures are implemented, there will still be residual loss and damage. In this study, which is part of the Loss and Damage in Vulnerable Countries Initiative,[2] 'loss and damage' is defined as "the negative effects of extreme weather events and slow-onset climatic changes that people have not been able to cope with or adapt to" (Warner et al., 2012: 20). This definition includes the inability to respond adequately to climate stresses and the costs associated with existing coping and adaptive strategies (cf. erosive coping strategies and mal-adaptation) (Warner and van der Geest, 2013).

In this review we use the concept of loss and damage to go beyond purely material losses, which is still over-represented in most literature,

[2] For more information on the Loss and Damage project, go to http://www.lossanddamage.net/

and incorporate social and cultural losses (Adger et al., 2013; Morrissey and Oliver-Smith, 2013).

This study addresses the impacts of coastal erosion on the island of Kosrae, the adaptation strategies households have adopted, and their limitations

This study addresses the degree to which households on the island of Kosrae are affected by coastal erosion, the adaptation measures and coping strategies they have implemented, and the limitations of such measures and strategies. Kosrae is one of four states of the FSM; as such, it is not an individual SIDS, but a state within a SIDS and thus shows characteristics in line with SIDS. This empirical case study contributes to the critical debate on the impacts of climate change beyond adaptation in general and within the context of vulnerability of SIDS in particular. This study is part of a series of case studies that empirically assesses climate-change related loss and damage in vulnerable countries. The case studies were undertaken in nine countries: Bangladesh, Bhutan, Burkina Faso, Ethiopia, Kenya, the Gambia, Micronesia, Mozambique and Nepal. Areas for the case studies were chosen on the basis of the diverse set of climate change impacts that have manifested themselves over the past decades; changes in rainfall patterns, droughts, floods, cyclones, sea-level rise and coastal erosion. The Kosrae case study focuses on the impacts of coastal erosion. While the coastal erosion that has occurred on Kosrae to date is due to a complex interaction of both natural and human factors, and not only due to climate change, it is an example of the impacts that coastal erosion can have on a small island state.

These case studies are part of the Loss and Damage in Vulnerable Countries Initiative, initiated by the government of Bangladesh and funded by the Climate and Development Knowledge Network (CDKN). The case studies are coordinated by the United Nations Institute for Environment and Human Security (UNU-EHS). Other partners in the consortium are German Watch, the International Centre for Climate Change and Development (ICCCAD) and Munich Climate Insurance Initiative (MCII). The African Climate Policy Centre (ACPC) of the United Nations Economic Commission for Africa (UNECA) funded the research in three African countries.

1.1 Climate change and loss and damage

Sea-level rise is considered to be an exacerbating factor causing coastal change in Pacific islands that are particularly vulnerable (Mimura et al., 2007). There are many other natural and human factors that also cause or contribute to coastal erosion, for example extreme climate events, the effects of climate variability such as ENSO on wave and water-level processes, and human activities such as coastal defence construction, sand mining and reef dredging (see for example DRC, 2000). In most cases, therefore, coastal erosion cannot be solely attributed to climate change yet it is often perceived to be a significant contributing factor both now and more so for the future (Mimura et al., 2007).

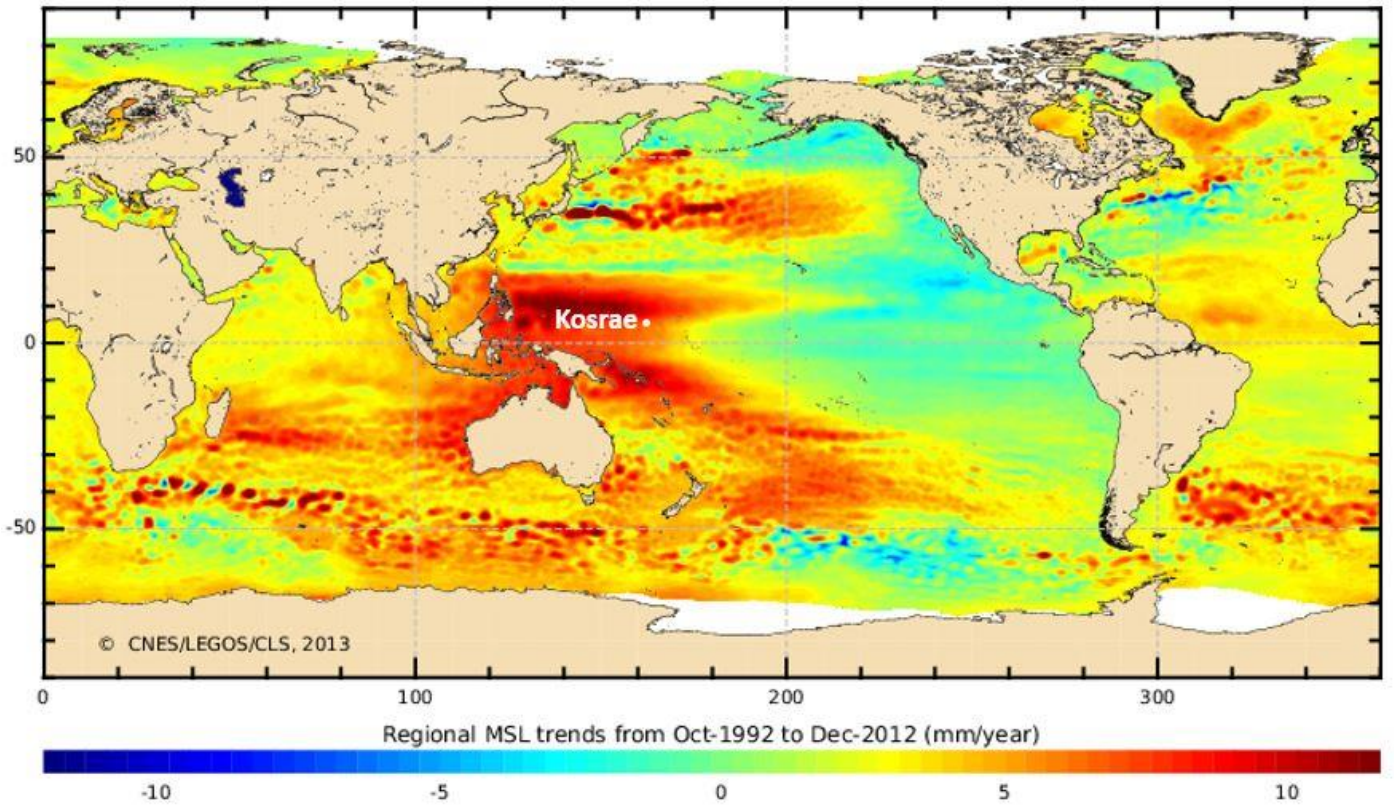


Figure 2: Global distribution of the rate of absolute sea-level rise between October 1992 and December 2012 (mm/year). Source: http://www.aviso.oceanobs.com/en/news/ocean-indicators/mean-sea-level/ in NIWA, 2013.

Coastal erosion is a major concern in relation to the effects of climate change in the region (Mimura, 1999; Mimura et al., 2007; Fletcher and Richmond, 2010). Islands in the region are often low-lying islands with the majority of residents living in areas that can easily be affected by coastal hazards. Narrow coastal plains have provided locations for human settlements and for infrastructure to support social and economic needs – eg social services, tourism facilities, airports, port facilities, roads and vital utilities (UNFCCC, 2005: 21). Coastal erosion therefore presents a considerable challenge to SIDS in terms of managing the effects of dynamic shoreline changes on fixed land boundaries, housing, schools, roads and other infrastructure.

SIDS, containing both high-island and low-lying coastal nations, are on the frontline of climate change. Global mean air temperatures have risen by approximately 0.7°C in the period 1906-2005 and for the next two decades projections are for approximately 0.2°C per decade (Nurse, 2011: 228). During the 20th century, global mean sea levels rose 0.17m ±0.05m (Bindoff et al., 2007), approximately ten times faster than the average rate for the previous 3,000 years (Nurse, 2011: 228). Some regions in the world are, however, more prone to sea-level rise than others and show significantly higher levels of increase in millimetres per year.

Small Island Developing States are on the frontlines of climate change

Figure 2 shows that sea-level rise near the FSM measured by satellite altimeters since 1992 is significantly more than the observed sea-level rise in the surrounding areas. The Australian Bureau of Meteorology (ABM) and CSIRO report of 2011 also indicates that the observed rise in sea level in this region since 1993 is over 10mm per year, and significantly more than the global average of 3.2 ± 0.4mm per year (ABM and CSIRO, 2011: 64). The underlying causes of this do not, however, point solely to the impacts of climate change. This spatial variability is argued to be largely due to trade wind and oceanographic influences and is likely to be predominantly attributable to inter-decadal variability rather than to a higher rate of long-term mean sea-level rise in this region (Meyssignac et al., 2012).

The above average rise in sea level and a higher frequency and intensity of extreme weather can have severe impacts on coastline and population

The fact that sea-level rise is significantly higher in this area than in other areas of the Pacific Ocean gives rise to concern. The rise in sea level and potential increase in frequency and intensity of extreme weather events could significantly affect the already vulnerable coastline and population along the coastline. Relatively small changes in mean temperature can also result in a disproportionate increase in the frequency of extreme weather events (Rosenzweig et al., 2001). Extreme weather events include spells of very high temperatures, extreme rains, and droughts. Under an increasing greenhouse effect, change can occur in both the main climate parameters and the frequency of extreme meteorological events (Rosenzweig et al., 2001; Mirza, 2003). The southwest Pacific Ocean region where Kosrae is located is severely influenced by ENSO climate conditions. The ENSO phenomenon is quasi-regular, tending to recur every two to nine years with varying intensity. The predicted changes in ENSO inter-annual variability as a result of climate change differ from model to model (Meehl et al., 2007), yet analysis of El Niño records shows that events have been stronger and more frequent since the 1980s, a pattern possibly linked to global warming (Rosenzweig et al., 2001). Seasonal sea levels are significantly lower during El Niño conditions and higher during La Niña conditions (± 15 cm) during October-February. Over the past years, there have been high solstitial tides with seasonal water levels from October to February in La Niña years (ABM and CSIRO, 2011: 65). On Kosrae this results in high (king) tides. 'King tide' is a popular name referring to any high tide or sea level that is well above an average height. Over the past ten years, local people perceive that high king tides have become more frequent. This is likely the result of a combination of La Niña events (compared to the period prior to 2000), which has pushed sea levels up, and sea-level rise (NIWA, 2013). Long-term sea-level rises will result in high tide levels increasingly exceeding what is currently considered a king-tide level.

People on Kosrae perceive that the frequency of high 'king tides' has increased

It was beyond the scope of this study to focus on establishing a link between increased flooding and king tides and climate change. Doug Ramsey of the National Institute of Water and Atmospheric Research in New Zealand argues that increased flooding is purely the result of La Niña phenomena over the past decade (personal communication). Kosrae is out of the natural hurricane range in the southwest Pacific, yet the impacts of hurricanes in the region are directly experienced in Kosrae. In both Indian and southwest Pacific Oceans there has been a significant increase in the number of hurricanes reaching categories 4 and 5 over the past 35 years (Webster et al., 2005; Hay and Mimura, 2006). Increased impacts on Kosrae can therefore be expected. In this study, we have examined the perceptions of residents in relation to the extreme high tides (king tides) and the coping measures they have carried out. Extreme events mostly occur as a combination of a severe storm with a very high tide (eg as a result of the season and moon) and solstitial tides.[3] Combined with La Niña year, which results in significantly higher seasonal sea level water, these events occur frequently on Kosrae.

Extreme weather events result from severe storm combined with high tide

As loss and damage is a new concept in climate change research, no commonly accepted definition is available yet. However, to inform our research questions and methods, we used the following definition: loss and damage refers to adverse effects of climate extremes, variability and climate change that people have not been able to cope with or adapt to. This definition includes the inability to respond to climate stresses (ie the costs of inaction) and the costs associated with existing coping and adaptive strategies. Such costs can be economic or monetary, but also social and cultural loss and damage.

This study goes beyond purely economic and material losses and damages, and uses qualitative as well as quantitative data

The concept of loss and damage in this study thus goes beyond the narrow interpretation of loss and damage as being purely economic and related to material loss. The case studies make use of quantitative as well as qualitative data, allowing for large-scale comparisons between different impacts as well as providing detailed information on the real impacts of climate change on people's livelihoods. Loss and damage from climate change varies across households, communities and societies according to their level of vulnerability and resilience. The case studies illustrate that loss and damage is also related to mitigation, as the potential costs of future climate change depend to a large extent on the intensity

[3] Solstitial tides are caused by the astrological event of the sun's relative position changing

of climatic disruptions, which in turn depend on mitigation efforts globally.

1.2 Research focus and objectives

Kosrae, one of four states of the FSM, has experienced severe coastal erosion over much of the last 30 to 50 years. Over the last century, and particularly since the end of the Second World War, the four main villages on Kosrae have developed on a narrow coastal strip. Currently, 70% of households live on land that is less than 4m above mean sea level (NIWA, 2013). All are at significant risk from coastal erosion and inundation.

70% of households on Kosrae live at less than 4m abouve sea level

Coastal erosion on Kosrae is the result of complex factors related to natural events around the 1890s and subsequent shoreline changes and to developments along the shoreline, particularly over the past 60-70 years. Ongoing coastal erosion and sporadic inundation have affected homes on Kosrae, primarily due to poor management of coastal development and human impacts on the natural environment. Human activity since the end of the Second World War – such as sand mining of beaches and dredging of the reef flats to build three airstrips, roads, houses, schools and other government buildings – has been a significant cause of the coastal erosion and habitat loss that has occurred (DCR, 2000). Continued building along the shoreline exposes the community to coastal hazards (Fletcher and Richmond, 2010). Both coastal erosion and inundation impacts are expected to increase as a result of climate change (Mimura et al., 2007).

Besides climate stressors, sand mining and dredging of the reef flats for infrastructure have also been significant causes of coastal erosion

This research aimed to investigate the impacts on the homes of Kosrae residents of coastal erosion caused by gradual change as well as by more extreme events such as king tides. In this research, 'loss and damage' also incorporates the negative effects of extreme weather. This study addresses the question: *to what degree do households on Kosrae, Federated States of Micronesia, suffer from coastal erosion, have they carried out adaptation measures, what are the limitations of such measures, and what is the resulting loss and damage.* In this study, loss and damage relates to both monetary and non-monetary values and to gradual changes caused by extreme weather events. Although we acknowledge that coastal erosion affects not only households but also infrastructure such as roads, electricity and government buildings such as schools, this study focuses exclusively on households. Having detailed empirical data to show the actual loss and damage already taking place, and the adaptation and coping measures households have or have not been able to undertake, is crucial for guiding future

policymaking and helping those vulnerable in the region.

The central research question will be answered through a set of sub-questions:

- What is the extent of coastal erosion on Kosrae?
- What is the impact of coastal erosion on Kosrae?
- How vulnerable are different villages on Kosrae to the impact of coastal erosion?
- How vulnerable are different households to the impact of coastal erosion?
- How do households adapt to coastal erosion impacts?
- What long-term adaptations are made in relation to more gradual changes (sea-level rise and associated gradual erosion)?
- What short-term coping strategies do households carry out in response to king tides?
- What type of loss and damage (costs) is incurred as a result of adverse effects of coastal erosion that people have not been able to offset through coping and adapting?
- What is the loss and damage (costs) associated with inability to deal with this impact?
- What is the loss and damage (costs) associated with current ways of dealing with this impact?
- What can be done to reduce loss and damage from coastal erosion?

What losses and damages result from the adverse effects of coastal erosion that people have not been able to avoid with coping and adaption measures?

In order to better understand patterns of loss and damage in Kosrae, this case study will gather data and information in four research domains:

Climate variable: In this study we investigate the impact of coastal erosion on Kosrae. Coastal erosion is primarily the result of non-climatic factors such as natural (eg ENSO events) and human actions (eg reef dredging) but is becoming increasingly strengthened by significant sea-level rise in the region. This study does not aim to investigate the relation between climate change and coastal erosion but rather focuses on the societal impact of coastal erosion. We acknowledge that coastal erosion is also related to non-climatic factors.

Societal impact: We investigate the adverse impacts of coastal erosion on housing, yet wider livelihood impacts also receive attention.

Coping and adaptation: What is done to cope with and adapt to the impacts of coastal erosion? The adaptation measures relate to long-term responses to coastal erosion, whereas coping relates to short-term coping measures in response to extreme weather events.

Loss and damage: What are the limits to coping and adapting to coastal erosion? What loss and damage occurs when a household cannot adapt further (ie when the limits of coping and adaptation are exceeded)? What impacts of coastal erosion have people not (yet) been able to avoid? This includes inability to cope or adapt and the consequences or costs associated with the inability of existing coping mechanisms.

Chapter 2: Methodology

This chapter provides information on the location and methods chosen to answer the research questions raised in section 1.3. Both qualitative methods (in-depth interviews and focus group discussions) and quantitative methods (a questionnaire survey) were used in this research. We administered 363 household questionnaires, conducted six focus group discussions with a variety of stakeholders and 12 in-depth interviews during July 2012. Eight in-depth interviews were conducted with residents who have been affected by coastal erosion and four were carried out with key experts; quotes in this article have been extracted from those interviews.

Figure 3: Location of Kosrae, Micronesia

The research team consisted of 14 people and was led by international researcher Iris Monnereau and project leader Simpson Abraham. Iris carried out ten in-depth interviews, Simpson Abraham two. The 363 surveys were carried out by ten enumerators dispersed over the four different villages. The six focus group discussions were carried out by Simpson and Iris. Ginny Jose and Carlos Cianchini provided ongoing practical support during the duration of the fieldwork (4–31 July). Carlos Cianchini took several photographs for the project; Ginny acted as note-taker and supervised the data entry, which he carried out with support from several of the enumerators. The research location and methods used (questionnaire, in-depth interviews and focus group discussion) are discussed in more detail below. This is followed by a brief examination of the limitations of this research.

2.1 Research location

Kosrae is one of the four states of the Federated States of Micronesia (FSM). The FSM is located in the western north Pacific Ocean. The total land area of the 607 islands of the FSM is approximately 702km². The small land area contrasts with the size of the Exclusive Economic Zone (EEZ), which totals over 2.98 million km² (ABM and CSIRO, 2011). In comparison to the other states of the FSM that consist of more than one island, the state of Kosrae consists of only one island, Kosrae, and a very small near-shore island called Lelu, connected to Kosrae via a causeway. Lelu is only 2km² in area, but has a population of around 1,500. Kosrae is located approximately 600km north of the equator, between Guam and the Hawaiian islands.

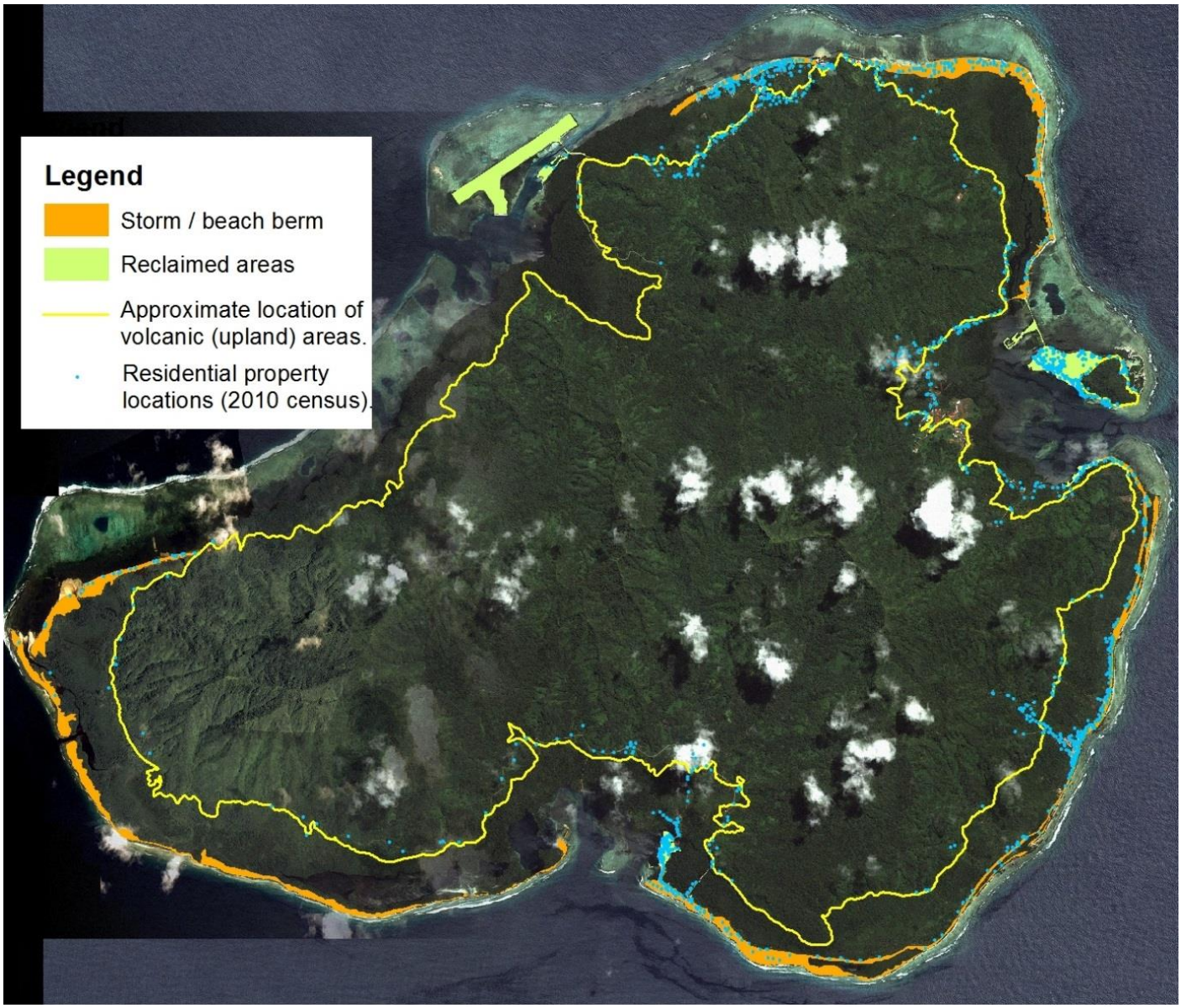


Figure 4: Location of residential development on Kosrae. Source: NIWA, 2013

Kosrae is a small volcanic island of 110km² covered with a dense vegetation. Basaltic mountains rise to a maximum elevation of 628 metres, and deep valleys characterise the slopes. There is a large outer-ring of low lying coastal area. Although Kosrae is thought to be safe from rising sea level because of its elevation in comparison to low-lying atolls with no or hardly any elevation, the majority of residents on Kosrae live in the low-lying coastal area. The population is 6,616 (2010 census) and 70% of all households are within 4m above sea level (NIWA, 2013) – nearly all of them within the low-lying coastal area of 4m above sea level (DRC, 2000). Figure 4 shows household locations with blue spots. The majority are located close to the shoreline. Much community and infrastructure development such as roads, electricity and telecommunication on Kosrae over the last 60 years has occurred along the coastal margins. These low-lying coastal areas are prone to long-term shoreline change and occasional coastal inundation (particularly during

times of king tides). Kosraeans have also built in some areas such as Lelu (island) and Malem on reclaimed land.

Houses built on reclaimed land, Lelu.
Photo: Iris Monnereau

Over the past century, Kosrae has been ruled by several countries, which have left their legacy on the island. The Germans entered Kosrae after the Spanish-American war in 1898 and ruled for 15 years. The island came under control of the

Empire of Japan after World War I until 1945. With the peace agreement at the end of World War II, the United Nations put the United States in charge of the social, economic and political development of the former Japanese colonies of the Western Pacific, including Kosrae, and a slow process of Americanisation in the region began.[4]

The FSM is currently one of the Freely Associated States with the political relationship (Compact of Free Association) with the United States. In 1979, the FSM became a UN Trust Territory under US administration. On 3 November 1986 independence was attained under a Compact of Free Association with the US. The UN formally ended the trusteeship in 1990 and the FSM became a member of the UN. The Compact was renewed in 2004, implying that Kosraeans can work, study and live in the US.

In terms of development, the FSM ranks much higher on the Human Development Index than the other case study areas in the Loss and Damage project.[5] The FSM ranks number 116 (out of 187 countries) and is thus considered a country at medium level on the human development index. Bhutan is the first country to follow Micronesia at the 141th place, falling also in the medium level category (albeit as the last one). The other six countries are all ranked in the low human development category: Kenya (143), Bangladesh (146), Nepal (157), The Gambia (168), Ethiopia (174), Burkina Faso (181) and Mozambique (184). The last implies Mozambique is the fourth last country in the world.

Typhoons events are rare on Kosrae, but they have played a significant role in the shoreline

[4] http://www.kosrae.com/History.aspx Accessed 4-11-2012

[5] The HDI is a single statistic to show both social and economic development of a country. The scoring is an aggregate of life expectancy, level of education, GDP per capita (adjusted for inequality). see http://hdr.undp.org/en/statistics/ihdi/ for more information as well as ranking of countries.

changes experienced around the coastline of Kosrae. The last cyclone to have significantly affected Kosrae was in 1905. Yet, it was a typhoon in 1891 that was of particular importance. Despite the fact this typhoon caused a lot of damage, it did deposit a large bank of coral rubble onto the reef flat along much of the eastern coastline as well as sand and coral rubble onto the beaches (Development Review Commission (DRC), 2000). The coral rubble bank provided a sheltered environment from wave action in its lee, allowing mangroves to establish and the shoreline to build out along the eastern coast. Over time, this rubble bank has worn down, accelerated by the removal of large amounts of coral rubble for construction in the decades following World War II. The progressive loss of the sheltering effect of the bank has increasingly allowed more wave energy to reach the shoreline, resulting in a loss of mangrove habitat and a landward retreat of the east-facing shoreline (DRC, 2000; Doug Ramsey, personal communication).

Gradual coastal erosion threatens housing along the coastline in Malem, July 2012 (Source: Doug Ramsey)

December 2008, king tide inundating coastal communities along the north and northeast side of Kosrae.
Source: Kosrae Island Resource Management Agency staff)

2.2 Household questionnaire

The 363 households were chosen on the basis of a 100% sample of 374 households living within approximately the first 60 metres of coastline and in one river-mouth area. Eleven households were unavailable to complete in the questionnaire. The total number of households on Kosrae is 1,170, with a total population of 6,616 (census 2010). Ten enumerators interviewed the households. Two to three enumerators were allocated to each village, typically in the villages where they themselves lived. Towards the end of the research, enumerators in the villages of Malem, Utwe and Tafunsak helped conduct the surveys in Lelu. Two enumerators travelled to the village of Walung, which is only accessible by sea. The questionnaire (Appendix A) contained both open and closed questions and usually took between 30–70 minutes to complete. Table 2.1 summarises the number of household questionnaires completed in each village.

Village	Number of questionnaires
Utwe	82
Lelu	230
Tafunsak	63
Walung	31
Malem	57

Table 2.1 Number of questionnaires per village on Kosrae

In 86% of the cases, it was the household head or their spouse who was interviewed. In the remaining cases it was usually a son or daughter of the household head (older than 16 years). The survey consisted of four sections and consisted of both open ended as well as closed questions. In the survey, we first gathered basic demographic and socio-economic information of the household. Then we inquired about the impacts of gradual changes in coastal erosion over time, the adaptation measures people adopted and the effectiveness of these measures. Adaptation is defined and explained to respondents as longer-term responses to more gradual changes, while coping strategies were defined as short-term responses to the impacts of sudden events and thus refer to more temporary, ad hoc, responses (Warner et al., 2012). Finally, we asked about impacts of more extreme events like storms and coastal floods over the past 20 years and households' coping strategies. Sections 2 and 3 of the questionnaire started with open-ended questions to gather people's own perceptions of the climate stressor as well as potential changes, impacts, and adaptation or coping strategies. This was followed by closed question gathering, *inter alia*, information about impacts on crops, livestock, fishing, trade and housing and frequent adaptation strategies, that is, in relation to agriculture, livelihood diversification and human mobility. The closed questions enabled a quantitative analysis of results.

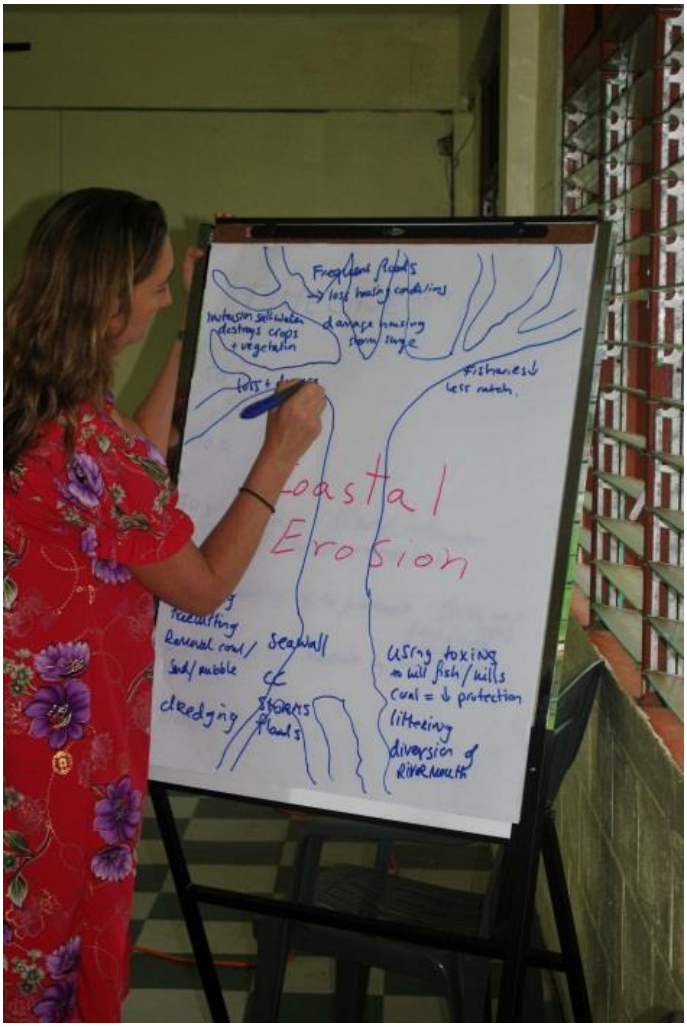
2.3 In-depth and group interviews

We conducted 12 in-depth interviews during July 2012. Nine in-depth interviews were conducted with residents who have been affected by coastal erosion. Enumerators identified the people for interview after they had conducted a survey with them or they were brought to our attention through focus groups discussions. Three in-depth interviews were carried out with key experts (a state senator; a staff member of the Kosrae Conservation Safety Organisation (KCSO), an NGO; and a government employee working for the Kosrae Island Resource Management Authority). (see Appendix B).

2.4 Focus group discussions

Three different focus group discussions were held with stakeholders, the Senate of Kosrae, and the Kosrae Island Resource Management Authority (KIRMA) (a semi-autonomous government agency) (see Appendix C for a list of the focus group discussions). These three focus groups were attended by both young and old citizens but not women (except for Iris Monnereau). During these meetings, Iris Monnereau presented an overview of the loss and damage project, and Simpson Abraham further explained the details of the project and acted as facilitator. This was followed by a discussion on the project and coastal erosion on Kosrae. See Appendix C for the dates of each focus group discussion and the minutes of each meeting.

Focus group discussion with Lelu senior citizens. Photo: Carlos Cianchini



Research drawing 'problem tree' during a focus group discussion. Photo: Carlos Cianchini

Three further focus group discussion were held with the senior citizens of Malem, Lelu and Utwe. These involved both men and women and were well attended. Focus group discussion were not carried out in Tafunsak or Walung due to time constraints, which also limited the potential for other focus group discussion – eg with young people or women's groups. Given the time limitations, it was decided that the senior citizens were best suited to provide a clear picture on the developments and changes that had taken place along the coastal margins over the past 50 years.

A 'problem-tree' approach was used, focusing on the causes and impacts of coastal erosion. The problem tree was filled in with comments from participants and their views on causes, impacts and solutions to coastal erosion in their village. In addition, Iris and Simpson established, with the focus group, a timeline of events that had led to the current problem of coastal erosion in their village.

2.5 Research limitations

The household surveys were conducted with 65% male and 35% female respondents. In principle, interviews could be carried out with either female or male household heads, yet when both household heads were present, it tended to be the man who completed the survey. Furthermore, in a number of cases when only the female was present in the household they would tell the enumerators to come back later when their husband would be at home. The surveys thus have a small bias towards a male perspective. As mentioned in Section 2.4 during the three different focus group discussions with the senate, policymakers and KIRMA there were no female participants, again meaning there is a bias towards a male perspective.

The ten enumerators were fluent in Kosraean and conducted the surveys in Kosraean, yet they struggled to read or write Kosraean. They would conduct the verbal part of the survey in Kosraean, but write it up in English. Using one language might have been easier for the enumerators and less time consuming but would have limited responses in some cases.

Another constraint was the short time available for the research. The fieldwork period was very short (4–31 July). The team completed nearly all surveys in the sample, yet it would have been good to have more time for in-depth interviews with key experts and focus group discussions with different age groups. If more time had been available we would have had more time to test the survey and make improvements before carrying out all 363 surveys.

In this study, we do not differentiate (and, indeed, it is not possible to do so) between ongoing natural and human-related influences on coastal changes on Kosrae and any exacerbating effects due to climate change. We realise that making a distinction is difficult and this will have influenced the answers respondents gave.

Islands in the Pacific Ocean report not only erosion and loss of land but also accretion of land (Webb and Kench, 2010). Although accretion might take place on Kosrae, we have not investigated this or incorporated questions on accretion of land in Kosrae in the survey.

Chapter 3: Livelihoods, employment and housing in Kosrae

3.1 Main sources of livelihood and vulnerability

This chapter describes the main characteristics, sources of livelihood and housing characteristics of the respondents to the survey. The household surveys were conducted among the households living in close proximity (< 60m) to the coastline and, in Malem, the river banks. Table 3.1 shows the characteristics of the respondents. The average age of respondents was 49.9 years; only three people interviewed were under 20 years of age, four were over 80. On average, there were 6.7 people per household, with 1.8 economically active people per household. Respondents had an average of 5.1 children per household (2.6 sons and 2.5 daughters). Most respondents were male (65%), compared to females (35%) (see Section 2.5 for more on this division). Christianity is the sole religion on the island, although many different Christian denominations are practised. The first missionary post was established by Protestant missionaries in 1852, and virtually the whole island converted to Christianity within a few decades. Religion still plays a very important and central role in Kosraean society.

All respondents were of Kosraean nationality with the exception of two. The average number of years of education among Kosraeans is relatively high at 12 years, which means the majority of respondents attended school until they were, on average, 18 years of age. This high level of education is in line with general statistics from Micronesia, which has a primary-secondary gross enrolment rate of 98% (United Nations Statistical Division, 2010). English is the official language of the FSM. Kosraeans mostly speak to one another in Kosraean although they are less proficient at reading and writing in Kosraean. The US dollar is the official currency.

Characteristics of respondents	% / Years
Male	65%
Female	35%
Single-headed household	12%
Christian	100%
Average years of schooling	12 years
Average age of respondent	50 years

Table 3.1 Characteristic of respondents

Category of non-farming income	%
White collar	48
Blue collar	23
Petty trade	20
Processing of natural resources	3
Crafts	3
Large business	3
Total	100

Table 3.2 Categories of non-farm activities

Table 3.2 shows the main sources of paid income of households. The main source of income comes from non-farm activities (59.1%) (see Table 3.3). On average one person per household was involved in non-farm income (NFI) activities. The main categories of NFI income are white collar

work (48%), blue collar (23%) and petty trade (20%). White collar jobs include teachers, nurses, bank clerks, computer technicians and sales assistants. Blue collar work includes plumbers, electricians, cooks and construction workers.

Remittances are the second largest source of household income (in both money and goods), with 64% of respondents indicating that their household received remittances. As the FSM has a constitutional government in free association with the United States, Kosraeans are able to freely work, study and live in the US. Remittances are typically sent by Kosraean family members living on either the US mainland or the islands of Guam and Hawaii. Only four respondents out of the 234 who indicated they received remittances, received them from outside US territories (China (2), Japan and Germany). Most remittances were sent by sons, followed by daughters, brothers, sisters and other relatives (eg cousins). The remittances are a significant component of household income, with the average amount sent per household being US$1,087. In addition, a further 137 households received products from relatives abroad (often in addition to the money sent). The average value of products sent to Kosrae was US$450 per household. Together this amounts to US$1,537 per household and represents 20.9% of total income (see Table 3.3). Other sources of income (23%) mostly relate to retirement pensions.

Kosrae households engage in agricultural activities such as cultivating crops (71%), growing fruit trees (74%), fishing (70%) and raising livestock (71%) (see Table 3.3). The produce of these activities is mainly used for household purposes, however, and does not comprise more than 3% in terms of income generation (see Table 3.3). The main sources of income on Kosrae thus come from non-farm activities (59%), including white collar work, blue collar work and petty trade.

Category	% of households	N=	% of income
Non-farm activities	68	247	59.1
Remittances (money and goods)	64	234	21
Other sources	23	85	9.2
Crop cultivation	71	256	3.1
Tree crops	74	269	2.5
Fishing	70	252	2.1
Livestock	71	256	1.6
Farm labour	4	15	1.5

Table 3.3 Employment of respondents (not exclusive)

Crop production and tree crops mostly consist of taro (a root vegetable), bananas, breadfruit, papayas and coconuts. Respondents were also growing cabbage, mango trees, tangerines, cucumber and eggplants. Some grew kava roots (used to make the alcoholic drink Sakau) and betel nuts. Betel nuts, also known as areca nuts, from the areca palm (Areca Catechu) are chewed by many inhabitants of Kosrae and are considered to be a mild stimulant.

Only four respondents used animals or tractors to plough their land. Irrigation is used by 18% of all respondents (this is low-key irrigation, ie watering crops), and by 42% of those engaged in farming. Crop cultivation is mainly carried out for

household consumption; only 3.3% of respondents stated the main purpose of production was for sale. The total average sales of agricultural produce is US$226 per year per household. Crops grown mostly consisted of bananas, cabbage, taro and sugar cane. Twenty-five per cent of respondents said crop yields were decreasing a lot, and 15% said they were decreasing a little. The main reason given for this decrease was saltwater intrusion. No direct distinction was made in the survey, yet most answers related particularly to banana and taro production being affected by saltwater intrusion.[6] Approximately 47% of the households indicated that crop yields remained the same, whereas 11% indicated crops were increasing a little, and 2% indicated they were increasing a lot. The main reasons given for the increase was increased farming activities (planting or more land).

Crop cultivation is carried out in the coastal areas where the household lives but primarily in the uphill areas where families often own land. No estimate was made of the split between produce grown at the household and that grown on upland farms. However, a considerable amount of farming is conducted in the uphill areas where there is no saltwater intrusion or coastal inundation.

Seventy-four per cent of the households own a number of tree crops, such as oranges, lemons, breadfruit and coconuts. Of those, 91% indicated that tree crops provided an average income of US$187.

Seventy per cent of the respondents were engaged in fishing. Considering Kosrae is located in the middle of the Pacific Ocean and has a large and healthy coral reef (ABM and CSIRO, 2011) this is no surprise. National fish consumption is estimated to be 69kg per person per year, which is considerable considering the average for Oceania is 24.6 and for the world 18.8kg (FAO, 2012). In 99% of the households that fished, fishing involved marine capture, whereas fish farming is limited. Of those engaged in fishing, 93% indicated this was mainly for household consumption, with the remaining 7% indicating fish capture was mainly used for sale. Average income per household from fishing is US$158.

Livestock raising is carried out by nearly 71% of the households interviewed, with respondents raising pigs, fowl and dogs. Pig rearing was the main livestock activity; 67% of all households own pigs, with an average number of four pigs per household. Approximately 15% of the households surveyed owned fowls, with an average of nine fowl per household. Only 18 households, equivalent to 5%, said they raised dogs, with an average number of three dogs per household. Of those who owned livestock, 93% said the main purpose was household consumption; only 5% said livestock were intended for sale; the remaining percentage was fowl used for cockfights. The average income of livestock rearing was US$112.

[6] The survey template did not make a distinction between annual and perennial crops.

Respondents estimated that the total income at their disposal is US$7,370. The average GDP per capita for the FSM was considerably lower in 2010 and valued at US$2,434 (UN Statistical Division, 2010). Although this study covered only 363 households on Kosrae and did not cover households living further from the shoreline, the survey results indicate that compared to GDP per capita of the FSM as a whole, the income of Kosrae households is most likely higher than in other FSM states. Yet the majority of respondents (65%) believed their income was average; 23% believed their household income was below average and 12% believed it to be more than average. As an indication of their relative high income in comparison to other countries, most households owned TVs, a fridge, phones and cars (see Table 3.4). The main assets owned by households were TVs (73%), fridges (71%), cars (60%) and phones (58%). Computers were also quite common (41%); 27% owned a bicycle and 3% a motorcycle.

Assets	Percentage of house-holds that own this asset
TV	73
Fridge	71
Car	60
Phone	58
Computer	41
Bicycle	27
Motorcycle	3

Table 3.4 Household assets

3.2 Housing and household property

On Kosrae most households own the property where they live (91.2%); 88.1%[7] own the house they lived in. The average land size on which respondents lived was 2,089m²; the average size of the farmland was 1,428m².[8] Sixteen per cent of respondents owned another house as well. Houses on Kosrae are typically built with iron sheet roofs and cement walls. Iron sheets for roofing is used by 70% of households, followed by concrete roofs (33.2%) and roofs made of natural product (8%). Some houses have roofs made of more than one material of the three above. Cement walls are used by 85%, followed by wood (32%). Only in a few cases is natural material used for the walls. Some households use cement for the first 80cm of the walls to make the house more resistant to flooding. Floors are typically of concrete (94%), with 9% timber. A number of households have both types of floor in their house. On average, houses have 2.4 bedrooms. The majority of houses have electricity (93.4%), leaving only a small number of houses (6.6%) with no electricity; 99% have a WC or latrine.

3.3 Food and food security

As described in Section 3.1, the majority of households engage in crop cultivation, livestock raising, fishing and growing economic trees to supply the household with food. This is in line with the findings that over 60% of the households

[7] N=363

[8] N= 248 (of a total of N=256 respondents who indicated they engaged in farming).

indicated that only half or less than half of the food they consumed was bought; 37% bought more than half of their food. Commonly, families eat 3.1 meals a day, with children eating the same number of meals as parents. Although food appears to be abundant due to families engaging in many farming activities, 21% of the households had suffered from food shortages over the past 12 months; 29% had suffered from food shortages over the past ten years. The main reason given for food shortages was financial difficulties.

A house made of traditional woven mats made of natural material. Photo: Iris Monnereau

A common Kosrae house with cement walls and iron sheet roofing. Photo: Iris Monnereau

Chapter 4: Loss and damage from slow onset climate changes

4.1 Slow-onset climate changes

Kosrae has experienced severe coastal erosion over the past decades (DRC, 2000; Fletcher and Richmond, 2010). The entire coastline of the island has experienced a rapid change, primarily caused by an insufficient amount of sediment on the beaches and a reduction in the protection of waves provided by coral rubble deposits on the outer reef flat. The resulting coastal erosion can be attributed to natural factors; however, human activity has significantly exacerbated the rate of erosion (DRC, 2000). During the second half of the last century, demographic changes, development needs and changes in construction practices exacerbated coastal erosion. Dredging of the reef flat, sand mining, cutting trees and mangroves, building inappropriate coastal defences, land reclamation and altering river outlets all significantly increased beach retreat (NIWA, 2013). The most significant of these activities was the removal of coral rubble from the outer reef flat for use in road and airstrip construction and other development projects (DRC, 2000).

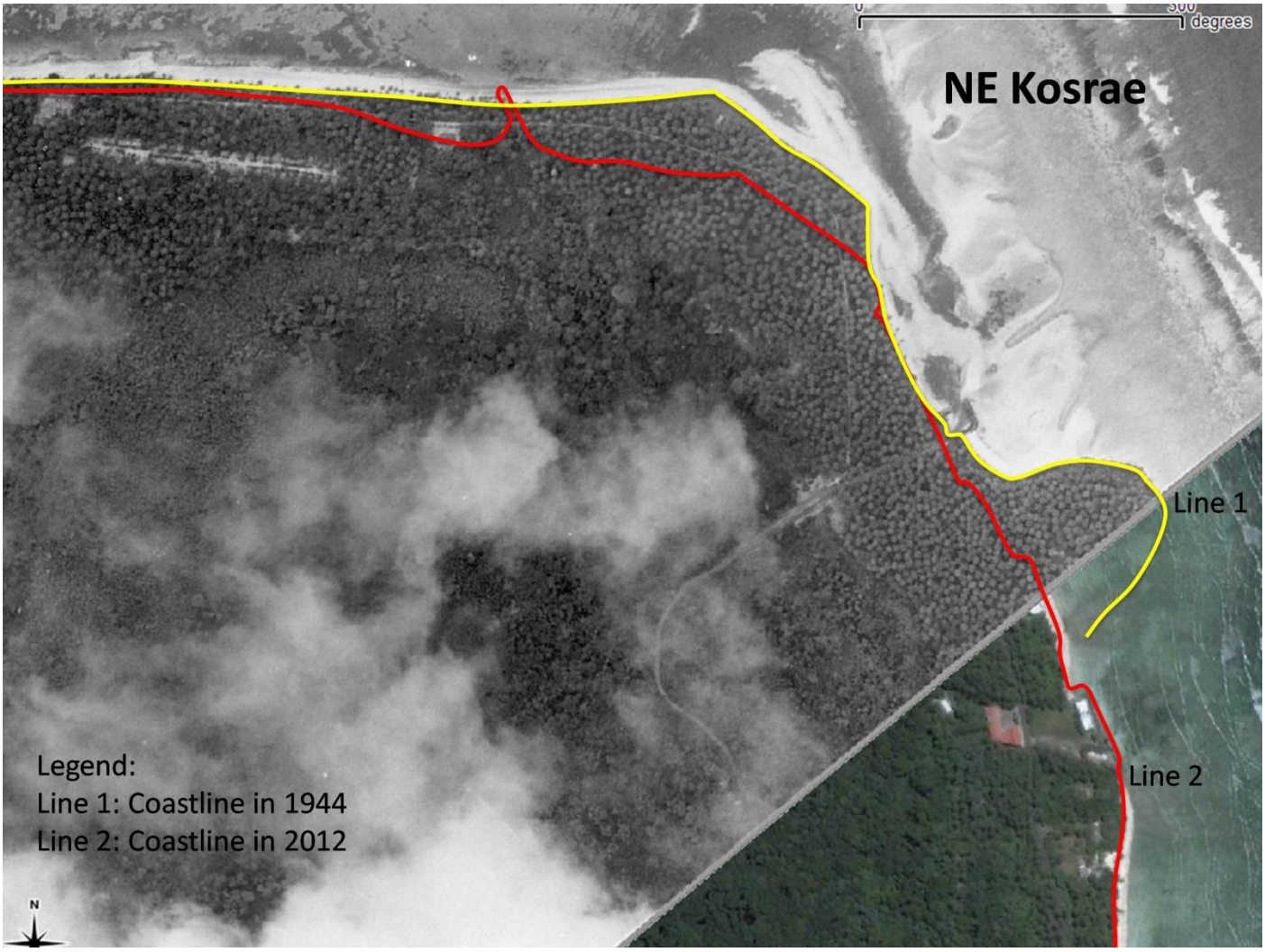


Figure 5: Change in coastline on the north-east corner of Kosrae between 1944 and 2012. Source: Webb, 2012

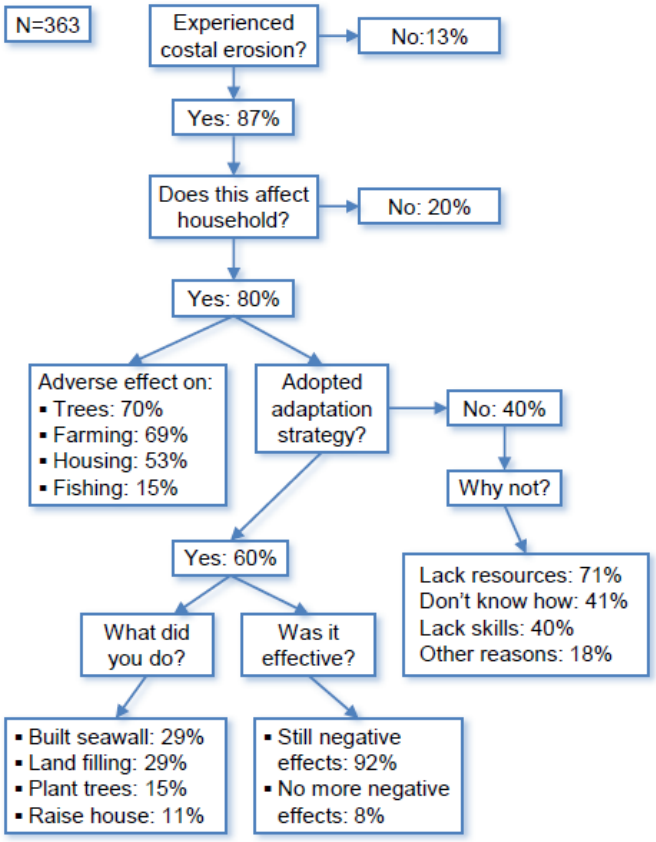


Figure 6: Tree diagram of experience and impacts of coastal erosion on Kosrae

The volume of coastal aggregate necessary to build an airstrip is enormous and while this aggregate can be easily extracted within a few months or years, its replacement in natural carbonate systems will take hundreds of year (Maharaj, 1998). Three different airstrips have been built over the past 40 years, requiring a substantial amount of aggregate, a large part of which was taken from coral reefs surrounding the island. The removal of this large amount of aggregate on other smaller islands in the FSM showed that it causes an increase in near-shore water depths and removes natural coral breakwaters, thereby reducing the amount of natural protection and wave-breaker protection (Maharaj, 1998).

Removal of aggregate in the area of Tafunsak for construction of an airstrip resulted in severe coastal erosion on this part of the island. The devastating effects were so great that the US company responsible for the removal has had to pay residents in the area for their lost land. Although these activities took place decades ago, the impacts are still noticeable. This coastal vulnerability is further exacerbated by the impacts of climate change. Figure 5 shows the loss of coastline between 1944 and 2012.

The picture in Figure 5 is an overlay of two images, one an aerial photograph taken in 1944, the second a satellite image of the same area in 2012. Line 1 shows the coastline in 1944, line 2 the coastline in July 2012, clearly showing the significant loss of coastline. We did not investigate the possible accretion of land on Kosrae. Land accretion has taken place on a large number of islands in the Pacific (Webb and Kench, 2010) so it is possible that similar developments have taken place on Kosrae. The most recent NIWA report on coastal erosion on Kosrae does not state any areas where accretion has taken place (NIWA, 2013).

The majority of survey respondents (87%) have experienced adverse effects of coastal erosion over the past 20 years (see Figure 6). This is in line with reports on coastal erosion on Kosrae (DCR, 2000; Fletcher and Richmond, 2010; NIWA, 2013). Within this group, 60% indicated that this has affected their household, with main impacts on commercial trees (70%), farming (69%) and housing (53%). In relation to damages to their

homes, respondents said, for example: "The shoreline has gotten closer to our house, which increases the risk of water intrusion and flood";[9] "My farm and garden were eroded and I can't do any farming anymore";[10] and, "A large portion of our private land is lost and several of our tree crops are gone."[11] Nearly all the respondents said the reduction in crops and economic trees was due to saltwater intrusion; a few cited decreasing land size.

Fishing has been affected by coastal erosion, sea-level rise and increasing sea temperatures, according to 15% of the respondents, who believe fish catches have been affected because "fish living in shallow areas have died due to high water temperature". They also indicated that there are fewer fish than before and their catches have declined as a result. Rooston Abraham, former fisheries officer of Kosrae, explains the impacts of coastal erosion on fishing activities in the village of Utwe, on the south coast of Kosrae (see Box 4.3). Utwe has a river mouth that serves as a spawning ground for fisheries.

Nine per cent of respondents believe that trade had also been affected. Katarina Adams, a hotel-owner on Kosrae told us how her livelihood has been affected by increasing coastal erosion (see Box 4.4). She moved to Kosrae 17 years ago and built ten beachside cabins made of natural material.

Box 4.1 "I have seen the changes on the coast very well (...) here on Lelu Island (...). There used to be a little island in front of our house, called Rabbit Island. As long as the island was there it was protecting our backyard. Over the last ten years the island has been disappearing slowly and now the sea just slams into our yard. When the tide is high the water comes right up to the road. We have built seawalls to protect us but it's getting worse." (Marston Weston Luckymis, male, 33 years, Lelu, 26 July 2012).

Box 4.2: Hotel owner Katrina Adams describes her experience: "Only six years ago I finally accepted coastal erosion was really destroying our place. At first I was in denial, I just didn't want to see it. When a scientist was here eight years ago I would keep on showing him places where new sand had been deposited as I just didn't want to see what was happening to my home. But six years ago I couldn't deny it any longer. The log of the tree you can see in the water now is the tree we used to sit on in the evening after a day's work. Now more than ten metres of our beach have been destroyed since we moved here and the cabins we have for our hotel in the front have washed away entirely." (Katrina Adams, female, 64, Lelu, 18 July 2012)

[9] Alek Alokoa, Male, 63, Malem, 8 July 2012

[10] Sadako Sanney, Female, 36, Tafunsak, 13 July 2012

[11] Jacob Palik, Male, 63, Walung, 25 July 2012

Box 4.3: "We all depend on fish for our food, but the fishing in Utwe has declined because the river flow has changed. As a result of coastal erosion the little island in front of the village has disappeared, and all the protection of the river mouth disappeared. Now the saltwater is coming straight into the river and affecting the spawning areas of the fish. The lack of brackish water is thus affecting the fish stocks and the fish catch has gone down." (Rooston Abraham, male, 60 years, Lelu, 20 July 2012)

One of the cabins at Katrina's hotel by the beach and the gabion that she placed in front of it filled with rocks and dead coral (box 4.2 and 4.4). Photo: Carlos Cianchini

Box 4.4: Katrina explains how coastal erosion has affected their business: "We are the first hotel on Kosrae and have built cabins right by the shore. As a result of the erosion we have had to abandon two cabins because the water comes right up to them now. The erosion causes the roots of the trees to disappear. When the trees fall down, the wind hits the cabins directly. Changes used to be gradual but over the past months it has become increasingly bad. In December, a European couple stayed here in the hotel for their honeymoon. The entire place was flooded so they had to wade to get out of the hotel, inside their cabin or to the restaurant. Then one night during a storm their roof was blown off because the erosion had damaged the trees, which usually break the wind. They came to us with big eyes and told us their roof had simply blown off. We gave them a new cabin but the next night the giant tree standing next to the cabin simply fell down because the saltwater intrusion had caused the roots to die. Thankfully it fell between two cabins and no one was hurt. I am sure they will never forget their honeymoon." (Katrina Adams, female, 64, Lelu, 18 July 2012)

4.2 Adaptation measures

The following section explores the adaptation measures that households have carried out in response to the challenges of coastal erosion over the past decades. As explained in the introduction of this report, adaptations can be either *autonomous* or *planned* and depending on their timing they can be *reactive* or *anticipatory* (Smit and Wandel, 2006: 282; Smit et al., 2001).

Our survey showed that 60% of households that were affected by coastal erosion said they had carried out adaptation measures (see Figure 6). Building seawalls, gabions and landfilling were the most popular measures, although they were commonly carried out in a haphazard manner. Few were planned, designed or carried out in a collective manner. The most popular adaptation measures were (N=140):

- building seawalls (29%)
- landfilling (29%)
- planting trees (15%)
- elevating housing (11%)
- relocation (6%).

Seawalls are made of rocks, logs, car tyres or other material built to protect houses from inundation and coastal erosion. Gabions are cages of net or metal wire filled with rocks or other types of material (including, for instance, fuel or paint drums filled with cement). Gabions are used to stabilise shorelines and slopes against erosion. Landfilling is carried out by building a small wall (eg of cement) or dam then filling it with dirt, rocks and earth to create more land or to reclaim lost land. Material resources to carry out adaptation measures are scarce, so households have to make do with whatever material they can put their hands on. Respondents described their efforts in the following ways:

- *"I built a 5-foot high 80cm-thick sea wall"* (Nena Likiak, male, 66, Malem, 16 July 2012)
- "I planted coconut trees near shoreline to hold the soil" (Kemela Palik, female, 59, Lelu, 18 July 2012)
- "I used logs, rocks and other debris to fill in the eroded areas" (Kenye Nena, female, 42, Walung, 27 July 2012)
- "I filled the land with rocks, and then poured cement on top of the rocks" (Daniel Thomson, male, 66, Lelu, 11 July 2012)

In addition, 2% of respondents referred to planned adaptation measures: ie collective and state efforts to build seawalls. In the back, is a small lower seawall that was planned and carried out by the Tafunsak restoration project. This is a good example of the variety of seawalls found on Kosrae.

Seawall covered with cement to protect a house in Lelu, Kosrae. Photo: Iris Monnereau

Box 4.5: "In 1971 we built the first seawall from coral reef rocks. Only 15 years later we had to build a new seawall as the water just kept on rising. Groups of men built these two walls as a community. In 2004, the last seawall was built by the government. Large trucks delivered the rocks. But the seawall changed the current and we lost all of our beaches. We used to have a very large beach – this has now disappeared. The seawall we have is not enough and when it floods the water still comes right up to the house. Our bakery floods every year and it wasn't like that in the past. To improve the situation, my wife and I decided to use our own money to make the seawall in our backyard higher. I bought 150 bags of cement. Not all at once – every month I would buy a few bags and cement the area in the back. It cost 500 US dollars – as much as we make in the bakery in three months. But now we feel safe for a while."
(Kilafwasru Kilafwasru, male, 64 years, Malem)

The seawall behind the house and bakery of Kilafwasru Kilafwasru and Sepe Kilafwasru in Malem (box 4.5). Photo: Iris Monnereau

Kilafwasru Kilafwasru and Sepe Kilafwasru in Malem (box 4.5). Photo: Iris Monnereau

The example in Box 4.5 shows how an adaption measure can be autonomous and planned, as well as reactive and precautionary. The first two walls were built collectively by residents, the third was built by the state and the fourth adaptation measure (raising up and fortifying a small part of the existing seawall) – was an individual initiative. It is both reactive and precautionary as it aims to protect from current coastal erosion as well as from future erosion and flooding.

In addition to the autonomous measures that householders have undertaken, several planned adaptation measures have been carried out. The planned measures were mostly carried out

between 2002 and 2005. The state of Kosrae organised and paid for the building of seawalls, mostly of armoured rock, although on occasion the state was supported by external agencies. These seawalls not only have high investment costs, they also typically have high maintenance requirements and have a limited time-span of around 20-30 years (NIWA, 2013). Building new coastal defences will further burden the state and individual municipalities, which are already responsible for funding the upkeep of existing seawalls (NIWA, 2013).

Stone wall in Tafunsak. Photo: Iris Monnereau

A self-built gabion (metal frame filled with rocks) in Malem: Photo: Iris Monnereau

Seawall of cement bags in Lelu. Photo: Iris Monnereau

Residents undertake a variety of adaptation measures and meet the costs themselves. One resident showed us the metal gabion in his backyard that he has filled with various kinds of rubbish (gasoline drums, bottles, rocks, etc) in order to protect his house. Planting trees along the shoreline is considered to be another viable option to protect the coast and stem coastal erosion. Fifteen per cent of residents planted trees as an adaptation measure: for example, "I planted coconut trees near the shoreline to hold the soil" and "We (and the neighbours) planted trees along the beach to hold the soil." Another said, "We had to remove the kitchen and plant strong, special trees near the coastline." Currently, the state, with funding from the USA, is helping residents to buy seedlings for replanting.

Only two respondents said they had moved to higher ground. This does not mean that moving to uphill areas has not been used as an adaptation measure but is most likely the result of our sampling method. The household questionnaire sample was administered to those

living along the first 60 metres of the coast; therefore, the sample may not have captured those households who have already moved uphill. As a solution to the problem of coastal erosion, moving uphill was, however, mentioned by 7% of respondents.

4.3 Loss and damage to housing and properties

The previous section has shown that the majority of respondents affected by coastal erosion carried out adaptation measures. Yet, 92% of those who had carried out adaptation measures indicated that these measures were insufficient (see Figure 6). Household adaptation measures (seawalls, gabions, tree planting and landfilling) were limited by ecological physical limits, economic limits, and technical limits of adaptation. They are often only temporarily effective and protect only the segment of coastline behind the structure. If one household along the coastline builds a seawall but the neighbours fail to do so, the seawall will only have a limited effect. This limitation is thus not only physical and financial but also social. The island is very remote and the material used often inadequate to build adequate protection. The majority of households (56%) felt that the most effective solution to coastal erosion would be large-scale seawalls supported by the state as well as communal action in the form of landfilling (11%), moving to higher ground (7%) and planting trees (6%). Yet building seawalls, both autonomous as well as planned, requires large-scale financial inputs that cannot easily be met by residents or their governments.

Household adaptation measures, such as seawalls, gabions, tree planting and landfilling, are constrained by physical, economic and technical limits

In line with these findings, survey respondents who did not carry out any adaptation measures at household level indicated that this was mostly due to lack of financial means (71%), lack of the necessary knowledge (41%) or skills (40%), or lack of other resources (18%) (see Figure 6) According to one respondent, "It is not very easy to think of a solution or anything that could deal with the impact."[12] Our data clearly revealed that lack of the necessary knowledge on materials to use and the lack of technical capacity to know how to build adequate adaptation measures was a significant limitation in carrying out adaptation measures. Coastal erosion is perceived to be a very serious threat by many on the island, and only 3% of the affected respondents did not adopt any adaptation measures because they did not consider it a priority.

Non-adaptation resulted from lack of money, knowledge, skills or other resources. In only 3% of the households, adaptation was 'not a priority'

[12]Lucy Killin, female, 69, Utwe, 21 July 2012

At state level there are also limitations to adaptation. The state has acknowledged the increasing negative impacts of climate change and various recent policy documents highlight this, most notably the Nationwide Climate Change Policy (NCCP) in 2009, the National Energy Policy and State Action Plans (NEP) in 2010, the National Action Plan to Combat Land Degradation (NAP) in 2011, and the UNFCCC FSM National Communication (2012). The state has declared policies to reduce the human causes of coastal erosion, such as the prohibition of sand mining and climate change awareness programmes. The Climate Change Bill passed by the state of Kosrae requires that all new initiatives or developments on the island must be climate proof (eg when a new road is built it has to be at a higher elevation to withstand sea level rise).[13] However, the Bill has not been implemented due to lack of material and financial resources, and is being incorporated into the Environmental Impact Assessment regulations currently being formulated.

Adaptation measures provide only temporary relief and some have negative side-effects

Adaptation measures can also cause other environmental problems (Eriksen et al., 2010). The autonomous adaptation measures residents have carried out provide only temporary relief at best. Gabions filled with paint drums and other waste can cause environmental hazards. Planned sea walls have also had unforeseen and undesired environmental consequences. They have caused changes in currents and beach loss, and caused coastal erosion at the edges of the wall (Maharaj, 1998). Data from our in-depth interviews and focus group discussions shows that, in most cases, planned sea walls resulted in intensified erosion at the edges of the construction and caused changes in currents. This is in line with the findings by NIWA (2013). NIWA also describes the *develop-defend-develop cycle*. This process involves residents living in vulnerable locations. After a storm or other extreme event, either residents feel the need to protect themselves or the state wants to protect its residents. After the defence has been erected people feel more secure and 'protected' leading to even further development. When a new storm occurs, and/or the coastal defence breaks down, there is even larger demand for better or larger coastal defences.

The study also found social and cultural constraints to adaptation, such as resistance to move to higher ground

Limits to adaptation were also found in endogenous factors including social and cultural limiting factors (Adger et al., 2009). These limitations on Kosrae can, for instance, be found in relocation to higher grounds and the cultural practice of burying loved ones close to their house, and thus often by the sea. Low-lying reef islands in the Pacific Ocean are perceived to be

[13] See e.g. http://www.kpress.info/index.php/climate-change/576-kosrae-pacc-a-shining-example-of-climate-change-adaptation-measures

particularly vulnerable to the impacts of sea-level rise. On a number of low-lying atoll islands there are no uphill areas to which residents can move. Kosrae has steep, uphill areas but only two respondents had moved to higher grounds. This does not necessarily mean that moving to uphill areas has not been used as an adaptation measure, but results partly from our sampling method. We interviewed all households living within 60 metres of the coastline. However, when asked about solutions to coastal erosion, 'moving uphill' was only mentioned by 7% of respondents. Not only is access to the area difficult, it also lacks access to drinking water, electricity and telecommunications. Not all residents have land in uphill areas. Those who do will have to invest in building new homes and relocating. Those who do not have land in uphill areas will depend on the state to give them land. As most land is privately owned, the state would have to buy land from private owners before it can redistribute it. Furthermore, land distribution could change social relations and create potential conflict. Residents would also have to change their culture of living very close to the sea with a culture of living in the higher, elevated and hilly areas.

Box 4.6: *"We bury our loved ones right next to our house. We want to have our loved ones close to us. But now sea-level rise and floods cause problems with the burial of our loved ones while we want our loved ones to rest in peace. We can't go on burying them like this and maybe we have to think of other ways to bury them."*
(Alik Sigrah, male, 67, Lelu, 24 July 2012)

Coastal erosion is also affecting burial culture on Kosrae. In Micronesian culture, burial plays a major role (Spennemann, 2006). While burial patterns have changed with the arrival of Christianity, the land claims derived from burials remain strong (Spennemann, 2006). Many loved ones are still buried next to present day houses and family property. As most residents live right along the coastline, these graves are often close to the sea. With increasing loss of beach front, traditional burial practices are now being threatened.

Grave next to the sea in Kosrae. Photo: Carlos Cianchini

Remnants of the Lelu ruins. Photo: Iris Monnereau

On Lelu island, resources to build seawalls and fill land are particularly limited as there are no large hills and rocks. In former times it was used as the residence of chiefs, while the main island Kosrae was for commoners. In the six centuries before European contact, the people erected an island city on Lelu island consisting of more than 100 compounds, paved roads and buildings with walls up to seven metres high (Morgan, 1988). Residents have used the basalt rocks from their ancient heritage site to build seawalls. Although it is presently illegal to use the ancient stones, residents commented on the loss of cultural heritage.

Box 4.7: "The sea keeps on rising and the people need to protect themselves. They have used the stones from the ancient ruins on Lelu Island to build walls and fill the land. For centuries the commoners built a complete city for the chiefs with paved roads and large houses made of rocks coming from Kosrae. Huge rocks, weighing tonnes, had to be shipped from the main island of Kosrae to Lelu island by wooden canoe over the open ocean. Now, when I visit the ruins most of the walls that used to be there when I was young have disappeared." (Masayuki Skilling, male, 67 years, Lelu, 27 July 2012)

Chapter 5: Loss and damage from extreme weather events

5.1 Extreme weather event impacts

Seasonal sea levels are significantly lower during El Niño conditions and higher during La Niña conditions (± 15 cm). Over a year, tide levels on Kosrae tend to be higher between November and February. Over the past years there have been high solstitial tides with seasonal water levels during October to February in La Niña years (ABM and CSIRO, 2011: 65). It was beyond the scope of this study to establish a link between increased flooding and high king tides and climate change. Doug Ramsey of the National Institute of Water and Atmospheric Research in New Zealand (Personal communication; NIWA, 2013) argues increased flooding is purely the result of La Niña phenomena over the past decade and not a result of climate change. Kosrae is out of the natural hurricane range in the southwest Pacific, but the impacts of hurricanes in the region are directly felt in Kosrae. In both the Indian and southwest Pacific Oceans, a significant increase in the number and proportion of hurricanes reaching categories 4 and 5 has been observed over the past 35 years (Webster et al., 2005; Hay and Mimura, 2006). Kosrae is also located in one of the areas where NASA has shown sea-level rise to be most extreme (NASA, 2008). Increased impacts on Kosrae can therefore be expected.

We have examined the perceptions of residents in relation to extreme high tides, known as 'king tides' (not to be confused with daily high and low tides) and the coping measures they have carried out. These tides mostly occur as a combination of a severe storm with a very high tide (eg as a result of the season and moon) and solstitial tides [14] mostly from October to February. These events occur on Kosrae in combination with a period of La Niña years, when there is significantly higher seasonal sea level water. The surveys showed that 62% of the households have experienced such an extreme king tides (see Figure 7).

King tides cause flooding of the coastal zone, resulting in loss and damage to housing, crops and economic trees, and damage to other assets. Respondents first answered a number of open-ended questions regarding their experience of extreme weather events, then answered closed questions about how the event affected their livelihood and the estimated monetary value of any damage. Respondents reported that the king tides affected them profoundly, saying, for example: "The water got into the house, flooded the floor, broke the walls and continued its way into the road"[15], "Our roof was blown away and we had to gather our belongings and move to the higher ground until the wind settled."[16]

Figure 7 shows the impact of extreme weather events on the households surveyed. Of those who had been affected, 80% suffered moderately from the event, while 20% suffered severe impacts. The map (Figure 8) clearly shows that the villages of Tafunsak and Malem are most vulnerable to extreme weather events, most likely due to wind

[14] Solstitial tides are an effect of the astronomical event when the sun's relative position to the sun changes

[15] Joshua Albert, male, 46, Tafunsak, 24 July 2012

[16] Nena Abraham, female, 59, Lelu, 23 July 2012.

direction and lack of shoreline protection. The latter is due to a lack of mangroves in these areas (see Figure 9) and to the intense reef dredging and sand mining that has taken place in Tafunsak.

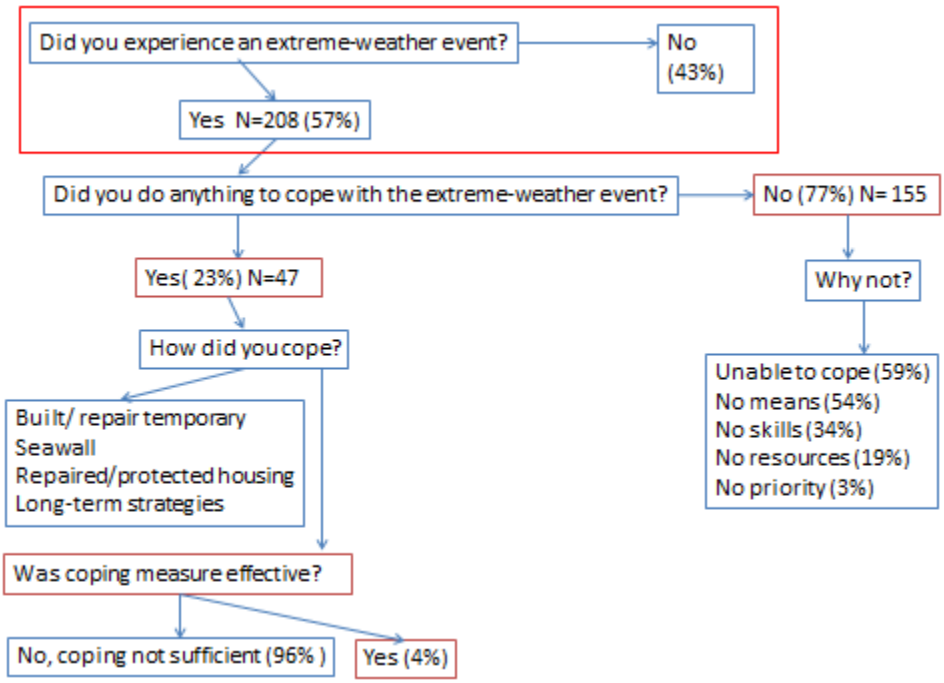


Figure 7: Experience of extreme weather event on Kosrae

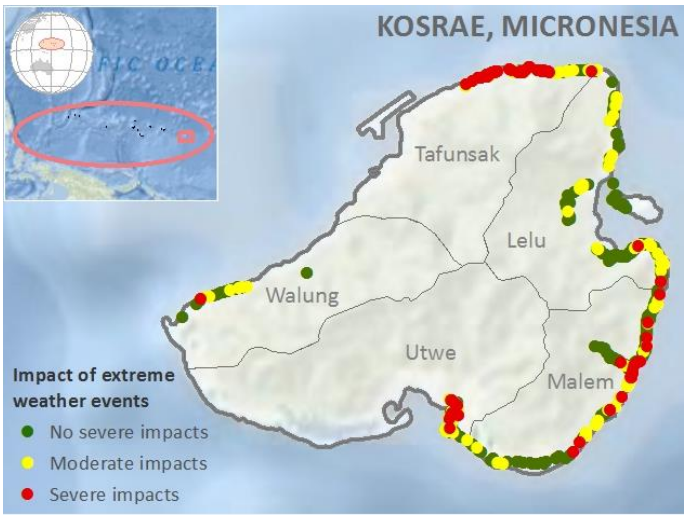


Figure 8 Map of Kosrae showing the households indicating they have suffered from an extreme-weather event.

Figure 9: Map of mangroves vegtation on the coast of Kosrae.

King tides can cause inundation and damage to housing, and can wash away outside built kitchens and livestock. Alokoa Jonithan and his wife, both from Tafunsak, recall what happened to their household in December 2008 when the storm hit their house (see Box 5.1).

The house of Alokoa Jonithan (taken from a tilted position), during the 2008 extreme event (box 5.2 and 5.4). Photo: Carlos Cianchini

Alokoa Jonithan, his wife and grandson in front of the house, July 2012 (box 5.2 and 5.4). Photo: Iris Monnereau

Box 5.1: "The storm came and broke the door and smashed the windows. The shoreline behind our house had already completely disappeared because of coastal erosion, so now the seawater quickly filled the house. Everything inside the house got wet – mattresses, clothes, and furniture. The kitchen next to the house, built of bamboo and thatch, completely washed away. The only thing left was the cement floor. Our three dogs were washed away and disappeared in the dark. Water also entered the pigpen, but fortunately, the pigs survived. We had to stay with family for ten months while we rebuilt our home. We are building a new house in the hills, however, because the seawall and gabions we have built ourselves are no longer protecting us. The gabion nets are rusting and the waves are breaking down the seawall. The sea is almost reaching our house. Our grandson will not be able to grow old in this house. (Alokoa Jonithan, 55 years, male, Tafunsak).

Line Mitcher, a 73-year old widow, recalls how she experienced the terrrifying moments of the 2008 storm surge (see Box 5.2).

Box 5.2: "In 2008 we experienced a king tide. All of a sudden we noticed a few waves starting coming strong towards our cooking house and pounding against the main house. A big surge followed and came right inside our sleeping house and the cooking house. It destroyed our cooking house and washed out our cooking supplies. I saw my washing machine floating away. I was so terrified that day, I could not believe what had happened." (Line Mitcher, female, 73 years, Tafunsak, 30 July 2012)

Line Mitcher in front of her affected house (box 5.2). Photo: Simpson Abraham

Example of the impact of the 2008 floods Photo: Carlos Cianchini. Photo: Carlos Cianchini

Respondents recalled 17 different years when they discussed the extreme weather event that had affected them between 1980 and 2012. Yet, when asked the year of the extreme weather event that caused them most damage, the six main events were between 2000 and 2011. The two years in which most residents affected were 2008 and 2011 (see Table 5.1). Of the 363 respondents, 208 had experienced an extreme weather event.

Box 5.3: "In December 2008 we were inside our house when the first storm came. Our house is made of concrete so at first we weren't scared. Than the storm broke all the windows and the door broke. The broken door disappeared in the waves. It scared us as the waves now were coming inside our house. The house quickly flooded and everything got wet – our clothes, our furniture, the mattresses on the floor. Our cooking area is outside and the storm took the whole kitchen away. All the pots and pans disappeared in the dark. As the storm got worse, and more and more water came in, the house turned into a swimming pool. We had to find refuge at my mom's house up in the hills." (Sepe Santos, female, 63, Tafunsak, 17 July 2012)

As shown in Table 5.1, the island was most affected by the extreme weather event of 2008. Towards the end of December that year, a major king tide flooded a large part of (mostly) the northern side of island. On 24 December, the governor of Kosrae, Robert Weichbacher, declared a state of emergency because of the damage the king tide had caused through flooding and the destruction of community, government and business structures. Thirty businesses were severely affected and also 31 households (15 of which sustained major damage), according to a damage survey carried out by PDA (2009). Even more importantly, roughly 30% of the land in the three main areas hit by the king tide was affected by saltwater intrusion. Many crops were lost or damaged – eg 80% of the bananas, 65% of the taro and 65-70% of breadfruit, the main household food staples farmed by householders (PDA, 2009).

Year	% (N= 208)	N
2000	7	14
2003	5	10
2004	13	26
2008	32	67
2010	5	10
2011	26	55

Table 5.1: The six years of most extreme weather events, as noted by respondents

There were no casualties among the 208 respondents affected by the extreme weather event, although around ten respondents or their household members had had minor injuries such as cuts to legs and arms and skin infections due to the high water. However, households did suffer damage to their housing (50%), economic trees (46%), crops (43%), fishing (11%) and livestock (7%). The most damage was to pigs, which either drowned or their pens were flooded. Fishing was impacted, as the number of fish had declined because of the storm and it was too dangerous to go out fishing during the storm.

Pig pen flooded during the 2008 king tide. Photo: Carlos Cianchini

N	Damage category	Average damage per affected hh (US$)	Total damage per category (US$)
59	House	3,679	217,061
40	Furniture/kitchen supplies, etc	2,025	81,000
25	Income lost	1,594	39,850
38	Clean-up	396	15,048
5	Vehicles	1,600	8,000
20	Other	321	6,420

Table 5.2: Damages resulting from the extreme event, in US$ (categories are not exclusive)

Of the 208 respondents who had suffered from an extreme weather event, 50% experienced loss and damage to their housing. Of these, 51% indicated

the impacts were moderate, whereas 49% said they were severe. Respondents mostly indicated their houses had been (partly) destroyed and flooded. Often their outside kitchens had disappeared and roofs were blown off (see Table 5.2). Table 5.2 shows householders' monetary losses. The damages were estimated by 71 households. Table 5.2 clearly shows that most damages was to houses and furniture (including mattresses, tables, beds, chairs, ovens, pots and pans, kitchen supplies, etc), followed by loss of income, clean-up and vehicles

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Box 5.4: "We had nowhere to cook and the inside of the house had to be redone completely. The Red Cross gave us new pots and pans and plastic containers. Our house took a long time to rebuild. During the day we would have a tent close to our house where we would cook but it took ten months before we could move back. We are building a new house in the hills, as the seawall we have built ourselves is not protecting us. We put rocks in metal nets, called gabions, and put them here behind our house to protect us from the sea but the nets are rusting. The waves are breaking down the stone walls in place. We have started building seawalls while waiting for monetary assistance. The sea almost reaches our house. Our grandson will not be able to grow old in this house so we are building another house in the hills. We will need to start a new life over there. We are lucky we have land there as many families do not have land in the hills." (Alokoa Jonithan, male, 55 years, Tafunsak, 17 July 2012)

5.2 Coping with extreme-weather events

The majority of respondents (75%) who had suffered from an extreme weather event did not adopt any short-term coping measures to deal with the impacts. For the 25% who did, the main coping strategies were temporary repair of seawalls, putting up rubbish, rocks or bags of cement to stop water from intruding, and repairing houses to stand the storm. Many respondents, however, referred to more long-term coping – that is, adaptation rather than coping – building seawalls or gabions or planting trees. Of those who carried out coping measures, 96% indicated this was not enough and that "The area is still experiencing water intrusions. The waves still go over the seawalls",[17] and "When there are strong, high tides the sea walls are no use. It reduces the impact, though, but there are still water coming in".[18]

5. 3 Loss and damage

As noted in Chapter 1, loss and damage refers to "*adverse effects of climate variability and climate change that people have not been able to cope with or adapt to".* Figure 7 shows that the majority of households (57%) have suffered from extreme weather events. Of these households, 25% had adopted coping measures. Yet, of the

[17] Joshua Albert, male, 46, Tafunsak, 24 July 2012

[18] Marcilyn Nulud, female, 38 years, Malem, 13-07-2012

respondents who had attempted to cope with the extreme event, 96% still suffered from the impacts, as their coping measures were not sufficient to deal with the rising sea level and increased frequency of storms.

Sepe Santos in her kitchen/store and the house that was destroyed (box 5.3). Photo: Iris Monnereau

The destroyed house of Sepe Santos (box 5.3). Photo: Iris Monnereau

As Sepe Santos from Tafunsak tells us, "We love this place right here by the sea. But we know we will have to move to higher ground in the future. There used to be so much beach in front of our house. Now I don't feel good when I see the beach in front of my house. Only when it is low tide we have beach now." (Female, 50 years, Tafunsak, 17 July 2012)

Of those who did not carry out any coping measures, which was the majority (77%) of those who suffered from an extreme event, this was mostly due to inability to cope (59%) or lack of means (54%) or skills (34%) (more than one answer was possible). Only 3% did not carry out coping measures because the problem was not a priority for them. Damage to housing led to temporary migration for 26% of those who experienced from an extreme-weather event. They mostly stayed with family who live on higher ground. A few had to live somewhere else for up to a year while they rebuilt their house, yet, most residents (96%) could return to their homes within two weeks.

The impacts of extreme weather events reinforce the cycle of coastal erosion by breaking down protection such as seawalls, gabions and land filling. Houses are damaged and agricultural land becomes unsuitable. As crops and (commercial) trees die, as respondents indicated, there are no roots and plants to keep the soil together and coastal erosion is intensified. Loss and damage from king tides is thus very much related to the loss and damage caused by long-term coastal erosion.

Chapter 6: Discussion and conclusion

6.1 Summary

This study has demonstrated that households perceive high levels of coastal erosion, a finding in line with other reports indicating significant coastal erosion on Kosrae (Development Review Commission, 2000; Fletcher and Richmond, 2010). Kosrae has experienced significant levels of coastal erosion over the past decades, threatening communities and vital infrastructure in the most vulnerable low-lying areas. The majority of respondents (87%) have been affected by coastal erosion over the past two decades. The coastline has retreated, beaches have disappeared, and coastal roads are at risk of being washed away. As a consequence, 80% indicated their household economies have been affected – mostly crops, trees and housing. Respondents also suffered from a loss in culture.

The majority of respondents (87%) have been affected by coastal erosion over the past two decades.

Of those households who were affected by coastal erosion, 60% have carried out adaptation measures. They have tried to adapt by building seawalls, reinforcing their homes, and planting trees. The adaptation measures have mostly been autonomous and implemented at household level, although some community and government-planned seawalls have been built, although on a small scale. Adaptation measures were both reactive and anticipatory, as the measures that households adopted were in response to current and past experiences of coastal erosion and flooding as well as the expected threats of the future.

60% of affected households took measures to adaptation, such as building seawalls and planting trees along the coastline

This study has shown that despite adaptation measures, households still experience residual loss and damage; 92% of respondents still suffered from negative effects of climate change and were unable to counter the effects of coastal erosion. The ability to carry out adaptation measures was often curtailed by material, technical and financial limitations. The majority of those who did not carry out adaptation strategies indicated this was due to lack of resources, skills or knowledge.

For 92% of the 'adapting households' the measures were not enough to avoid loss and damage

In addition to gradual changes, 57% of the surveyed households have also suffered adverse effects of extreme weather events, in this case 'king tides'. These events have had short-term (eg damage to housing) and long-term impacts (eg severe damage to housing, salinization of agricultural land and economic trees) on

households. The loss of land and protecting plants and trees along the shoreline further intensifies the problems. Of those who experienced these extreme events, only 25% had carried out coping mechanisms, yet 96% said the measures were insufficient. The main coping mechanisms were building or repairing temporary seawalls and repairing houses; some longer-term coping measures were also undertaken. Those who did not carry out coping measures indicated this was mainly due to an inability to cope, lack of means or lack of skills. Only 3% did not prioritise coping mechanisms. As the impacts of climate change are expected to worsen in the region, the vulnerability of Kosrae residents to coastal erosion can be expected to increase as well. Support to counter coastal erosion on Kosrae, FSM, is therefore of great importance.

6.2 Reflections

In this study we have examined the impacts of coastal erosion on Kosrae, the various adaptation measures carried out by households and the limitations thereof. Studies suggest that rising sea levels, particularly in the Pacific Ocean, can lead to a reduction in island size. Coastal erosion is one of the most prominent concerns on Kosrae (Mimura, 1999; Fletcher and Richmond, 2010). This study has demonstrated that, in line with other reports, a large percentage of households in the survey have experienced coastal erosion. The coastline has retreated, beaches have disappeared, and coastal roads and other infrastructure are at risk of being washed away. For the large majority, this affects their household, for example with impacts on housing or crop cultivation. Of those households impacted, 60% had carried out autonomous adaptation measures such as building seawalls, reinforcing their homes, and planting trees.

The coastline has retreated, beaches have disappeared, and coastal roads are at risk of being washed away.

Over half of the households interviewed suffered from extreme weather events. These reinforced the cycle of coastal erosion and coping strategies thus consisted of both long-term and short-term strategies. Long-term strategies overlap with adaptation strategies, such as building and reinforcing seawalls and gabions, repairing housing, landfilling and planting trees. In line with Adger and colleagues (2007), and Füssel (2007), our findings show that the theoretical distinction between reactive and proactive adaptation measures is fuzzy in reality. Household decisions to undertake adaptation measures were often triggered by an extreme weather event, but were largely made in anticipation of future risk changes.

Our findings show that the theoretical distinction between reactive and proactive adaptation is fuzzy in reality

Adaptation measures on Kosrae illustrate the resilience of people and their aspiration to protect their housing and culture. As the island is very

remote, residents have used rocks, coral and sand to build seawalls and have filled gabions with whatever material they could find. This study argues that the adaptation measures adopted by most households are only partly successful in avoiding adverse effects of coastal erosion and that there are limits to adaptation. This study reveals that the limits faced by households to adaptation have physical, economic and technical dimensions as well as social and cultural aspects (Adger et al., 2007, 2009, 2013). The ability of an individual household to build a seawall and halt coastal erosion is limited both by their financial means, the physical limitations of small seawalls constructed by one household but perhaps not by his or her neighbours, and the lack of technical material and knowledge to build adequate adaptation measures.

adaptation measures are only partly successful in avoiding adverse effects of coastal erosion; there are limits to adaptation

In addition to the autonomous adaptation measures at household level, several planned adaptation measures have been carried out. These mostly relate to the state-funded building of seawalls. These have been only partly effective and often caused further coastal erosion in other locations. The seawalls were effective at reducing the impact of coastal erosion where the seawall was situated, but created negative environmental consequences at its outer edges. Building more, and/or, improper seawalls could negatively affect the coral reefs around the island, affecting both biodiversity and fishing activities.

The study also found social and cultural adaptation limits and constraints

Outside of these more exogenous limits to adaptation we also found a number of more endogenous limits that relate to social and cultural factors (Adger et al., 2009). Relocation to uphill areas comes with social consequences and limitations, as it would affect current land tenure systems. Traditionally, nearly all infrastructure and population are located in the narrow strip bordering the sea. As communities move uphill, new infrastructure and basic facilities will be needed in those areas. Cultural changes will also result from people's move away from the sea. Kosraeans are also accustomed to living close to where their loved ones are buried, and increased coastal erosion is affecting burial practices. The loss of culture as people have to change burial practices and the ongoing loss of land and homes have far-reaching consequences that cannot be reversed, and adaptation measures need to incorporate these cultural values.

This study showed that measures households adopted to deal with impacts of coastal erosion are not enough to avoid loss and damage due to limits in household adaptive capacity. As a consequence, these measures have economic, social, and cultural costs that are not regained. Despite adaptation measures, households still incur residual loss and damage; 92% of

respondents still suffered from negative effects of coastal erosion and were unable to counter its effects. In the working definition used in this study, loss and damage refers to the negative effects of extreme weather events and slow-onset climatic changes that people have not been able to cope with or adapt to (Warner et al., 2012: 20).

loss and damage goes beyond material losses and touches on people's culture and identity

This research links loss and damage explicitly with the literature about limits to adaptation and non-economic losses (Adger et al., 2005, 2007; Warner et al., 2013). We have seen loss and damage that goes beyond material losses and touches on people's culture and identity values which contribute to the functioning of society as a whole. Implementation of new adaptation strategies requires significant institutional and political reform, technical support, social changes and financial support from donors. In order to improve future adaptation measures, collective collaboration and planned adaptation measures are necessary, for example relocation and advanced technological coastal defences adapted to local circumstances. These adaptation measures, however, need to be sustainable (Eriksen et al., 2010) and contribute to socially and environmentally sustainable development pathways.

6.3 Significance of findings

This case study can serve as an example of similar challenges faced by many other islands and the limitations and constraints SIDS face in dealing with climate change. Although Kosrae is an island that, in comparison with low-lying atolls in the Pacific Island region, has a larger area of uphill areas, it nevertheless faces similar challenges. This study is an example of limits to adaptation and the loss and damage that other islands in the region will face equally, if not more so. Kosrae's vulnerability is characterised by: predicted severe impacts of climate change, sea-level rise and extreme events; its relative isolation; the concentration of population, socio-economic activities and infrastructure along the low-lying coastal zone; and its insufficient financial, technical and institutional capacities. This extreme vulnerability seriously limits the capacity of Kosrae, and SIDS in general, to adapt to adverse impacts of climate change.

Enhancing adaptive capacity is critical to meet the challenges of climate change and sea-level rise

Enhancing adaptive capacity is thus critical for SIDS if they are to meet the challenges of projected climate change and sea-level rise. Yet, climate change is just one of the pressing problems that most SIDS face. Other socio-economic concerns, such as poverty alleviation, high unemployment, improving housing and education, all compete for scant resources. Adaptation measures must therefore be framed within the larger development goals of SIDS.

Coastal erosion has severely impacted the livelihoods, housing and culture of the residents of Kosrae, both as a result of ongoing climate changes as well as other natural factors and human activity over the past 50 years. Dredging of the reef flat, sand mining, cutting trees and mangroves and altering river outlets have all had a profound impact on current beach retreat. At the same time, current climate change has been exacerbating this vulnerability as it has become clear that sea-level rise is more than average in the FSM in comparison to surrounding areas in the Pacific Ocean and residents indicate that the impacts of extreme weather events over the past few years have been the worst of the last 20 years. Increasing coastal erosion will also enforce this cycle – that is, the more trees lost to coastal erosion, mangroves and the protective reef, the greater the impact of coastal erosion. This study has shown that despite adaptation and coping measures, households still suffer from loss and damage. The limits to Kosrae's ability to implement adaptation measures are in line with the vulnerability of SIDS in general.

Chapter 7: Reflections for policymakers

The recommendations we propose below are based on the in-depth interviews, the open-ended questions regarding policies in the questionnaire, focus group discussions, the DRC report (2000) and the NIWA report (2013).

International donors are needed to support:

- improvements to the inner roads on the island to improve access for people living in uphill areas (the most appropriate roads to be enhanced are set out in NIWA, 2013)
- State and church awareness and outreach programmes on replanting and on harmful practices such as sand mining and mangrove destruction
- state purchases of land in uphill areas to help residents without land to move to uphill areas

Preventive measures should be taken by the state and by Kosrae housing agency so that all new development (eg houses, infrastructure):

- is located away from areas at risk from current and future coastal hazards
- is 'climate proofed' in design to incorporate weather and climate extremes (eg building roads at high elevations to withstand flooding in future)

The state should:

- continue to prohibit and enforce legislation on sand mining or coastal rubble removal by residents
- stop the breakdown of natural buffers by prohibiting the removal of vegetation behind beaches, landfilling, and reclaiming of mangrove areas
- maintain existing coastal defences
- limit new coastal defences and only build with permission

Awareness raising by KIRMA, KCSO and the church should help to:

- continue and enhance current replanting efforts
- build residents' knowledge on topics such as sand mining, coral rubble removal, the importance of mangrove areas and other beach protection areas, as well as inappropriate building of coastal defences
- relocate residents to uphill areas; this can be insured only by improving inner roads and prohibiting construction of new houses in low-lying areas.

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Appendix A: Loss and Damage Case Study Questionnaire:

1. Questionnaire number:
2. Date of interview: _ _ / _ _ / _ _
3. Name of village or town:
4. Name of interviewer:
5. Date of data entry: _ _ / _ _ / _ _
6. Name of data entry officer:

Section 1: Respondent, household, livelihood and vulnerability

1.1 Respondent and household information

7. Name:_____
8. Birth year [YYYY][write age (YY) if easier]:_____
9. Sex: 1=Male | 2=Female
10. Relation to household head: 1=Household head | 2=Spouse | 3=Other, specify_____
11. Marital status: 1=Single | 2=Monogamous marriage| 3=Polygamous marriage |4='Consensual union' |5=Widowed |6=Separated/divorced |7=Other, specify _____
12. Number of children: Sons ____Daughters _____
13. Place of birth: 1=This village or town | 2=Elsewhere in the region | 3=Elsewhere in the country, specify region _____| 4=Abroad, specify country _____
14. Education level: _____
15. Ethnicity/mother tongue:_____
16. Religion: 1=Christian | 2=Muslim | 3=Buddhist | 4=Hindu | 5=Other, specify _____
17. Occupation (multiple options): 1=Farming | 2=Livestock raising | 3=Fishing | 4=Trading | 5=Salary work ('white collar'), specify _____ | 6=Other non-farm income, specify _____ | 7=Farm labour | 8=Other labour, specify _____ | 9=Housework | 10=Student | 11=Unemployed | 12=Other, specify _____

18. Household composition: Adult men (aged 18-65) ___ | Adult women (aged 18-65) ___ | Boys (<18) ___ | Girls (<18) ___ | Elderly men (>65) ___ | Elderly women (>65) ___
19. How many members of your household are involved in activities that provide food or income? __

1.2 Land and farm

20. Do you (or does your household) 'own' land? 1=Yes | 2=No
    a. If yes, for what do you use your land (multiple options)? 1=House | 2=Crop cultivation | 3=Livestock raising | 4=Renting out | 5=Fallowing | 6=Nothing | 7=Other, specify _____
    b. If yes, please estimate the total land size? Number _____ Unit _____
21. Do you farm? 1=Yes | 2=No (if no, go to next section)
22. What is the size of the land that you cultivate this year? Number _____ Unit _____
23. Do you own the land you farm? 1=Yes, all | 2=No, none | 3=Partly
    a. If 2 or 3, how do you get access to this land (multiple options)? 1=Renting | 2=Sharecropping | 3=Borrow | 4=Community land | 5=Other, specify _____
24. Is some of the land you farm irrigated? 1=Yes | 2=No
    a. If yes, how much? Number _____ Unit _____
25. Which crops did you cultivate last year? [in order of importance] (1) _____ (2) _____ (3) _____ (4) _____ (5) _____ (6) _____
26. Do you use animal traction or a tractor to cultivate your land? 1=Yes | 2=No
    a. If yes, do you own, hire or borrow these implements (multiple options)? 1=Own | 2=Hire | 3=Borrow | 4=Other, specify _____
27. Do you employ people to work on your land? 1=Yes | 2=No
    a. If yes, please estimate the total number of 'person days' per year _____
28. What is the main purpose of your crop production (choose one)? 1=Household consumption | 2=Sale | 3=Other, specify _____

29. How much of your crop production do you usually sell? 1=Everything | 2=More than half | 3=Approximately half | 4=Less than half | 5=Hardly anything| 6=Nothing
30. How much income did your household derive from crop sales in the last 12 months? _____
31. In the last 10 years, did your crop production... 1=Decrease a lot | 2=Decrease a little | 3=Remain the same | 4=Increase a little | 5=Increase a lot
    a. If decreased or increased, please indicate the cause(s):

1.3 Livestock, fishing and economic trees

32. Do you or other household members own livestock? Please indicate the number of (1) Cows ___ | (2) Donkeys ___ | (3) Goats and sheep ___ | (4) Pigs ___ | (5) Fowls ___ (5) Others, specify ___
    a. If yes, what is the main purpose of your livestock (choose one)? 1=Household consumption | 2=Sale | 3=Traction | 4=Other, specify _____
    b. Please estimate the income you derived from livestock raising in the last 12 months? _____
33. Do you or any other household members engage in fishing or fish raising? 1=Yes | 2=No
    a. If yes, please specify: 1=Fishing | 2=Fish raising | 3=Both
    b. What is the main purpose of your fishing / fish raising (choose one)? 1=Household consumption | 2=Sale | 3=Other, specify _____
    c. Please estimate the income your household derived from fishing / fish raising in the last 12 months? _____
34. Does your household own economic trees (fruit, timber, etc)? 1=Yes | 2=No
    a. If yes, what is the main purpose of your economic trees (choose one)? 1=Household consumption | 2=Sale | 3=Other, specify _____
    b. Please indicate the number of economic trees:(1) <10 | (2) 10-50 | (3) 50-100 | (4) >100
    c. Please estimate the income your household got from economic trees in the last 12 months___

1.4 Other income generating activities

35. Do you or any household members derive income from non-farm activities? 1=Yes | 2=No
    a. If yes, how many household members engage in such activities? _____
    b. In which activities do they engage (multiple options)? 1=Petty trading | 2=Larger business | 3='White collar' salary work, specify _____ | 4='Blue collar' salary work, specify_____ | 5=Crafts, specify _____6=Processing natural resources, specify_____ 7=Other non-farm income, specify _____
    c. Please estimate the total income derived from non-farm activities in last 12 months? _____
36. Does your household receive remittances from migrant relatives or friends? 1=Yes | 2=No
    a. If yes, from whom [relation to HH-H] (multiple options)? 1=Daughter | 2=Son | 3=Brother | 4=Sister | 5=Parents | 6=Other, specify _____
    b. Where do they live (multiple options)? 1=Within the region | 2=Other region, specify _____ | 3=Abroad, specify_____
    c. Please estimate the total amount of money you received in the last 12 months_____
    d. And the value of other things (food, goods) you received in the last 12 months _____
37. Do you or household members sometimes labour on other people's farms? 1=Yes | 2=No
    a. If yes, how many household members? _____
    b. Please estimate: the total number of 'person days' in the last 12 months _____
    c. Please estimate the total annual income derived in the last 12 months_____
38. Do you have any other sources of income besides the ones you mentioned? 1=Yes | 2=No
    a. If yes, please specify source _____
    b. Please specify the total annual income derived in the last 12 months ____
39. Please estimate the amount of money your household usually has to its disposal:

    Amount_____ Currency _____ per (time unit): week / month / year

40. Compared to other households in your village/town, would you say that your monthly income is (1) Less than most others | (2) Average | (3) More than most others

1.5 Housing and other assets

41. Do you 'own' the house you live in? 1=Yes | 2=No
42. Do you own any other houses? 1=Yes, specify how many _____ 2=No
43. Please indicate the building materials of the house you live in:
    a. Roof (multiple options): 1=Roofing tiles | 2=Iron sheets | 3=Concrete | 4=Natural materials, e.g. thatch or earth | 5=Other, specify_____
    b. Walls (multiple options): 1=Cement blocks/concrete| 2=Baked bricks | 3=Sun-dried bricks | 4=Wood | 5= Iron sheets | 6=Other natural materials, specify_____ 6=Other, specify ___
    c. Floor (multiple options): 1=Cement | 2=Earth | 3=Wood | 4=Other, specify _____
44. How many bedrooms does the house you live in have? _____
45. Compared to the other houses in your village/town, would you say that the house you live in is (1) Of better quality | (2) Average or | (3) Worse quality?
46. Does your house have electricity? 1=Yes | 2=No
47. What is the source of your drinking water (multiple options)? 1=Surface water | 2=Well | 3=Borehole/Pump | 4=Pipe | 5=Other, specify ____
48. Does your house have a private latrine or WC? 1=Yes | 2=No
49. Please indicate whether your household owns the following assets [and how many]: (a) TV __ (b) (Mobile) phone __ (c) Bicycle __ (d) Motorbike __ (e) Car __ (f) Fridge __ (g) Computer __

1.6 Food security

50. How many meals a day do adults in your household eat on a 'regular day'? _____
51. How many meals a day do children in your household eat on a 'regular day'? _____
52. In the past year, have there been months that you had to eat less? 1=Yes | 2=No

a. If yes, in which months did this happen (multiple options)? 1=Jan | 2=Feb | 3=Mar | 4=Apr | 5=May | 6=Jun | 7= Jul | 8=Aug | 9=Sep | 10=Oct | 11=Nov | 12=Dec

b. What was/were the cause(s) of this food shortage?

53. In the past ten years, has your household experienced any food shortages? 1=Yes | 2=No

a. If yes, in how many out of ten years?

b. What was/were usually the cause(s) of such shortages?

54. How much of the food your household consumes is bought (i.e. not produced by household itself)? 1=Everything | 2=More than half | 3=Approximately half | 4=Less than half | 5=Hardly anything | 6=Nothing

Section 2: Impact of and adaptation to slow onset climatic changes

55. In the past twenty years, how many years have you lived in this [district, area or province]? ____

2.1 Open questions

56. What changes have you experienced in coastal erosion in your village over the last twenty years?

57. How has this (changes in) coastal erosion affected your housing situation??

58. How does your household adapt to the impact of coastal erosion on your housing situation? (if nothing done, please explain why not)

59. If yes, do you feel that despite these measures your household still experiences negative effects from (changes in) coastal erosion (multiple options)? 1=No | 2=Yes, measures not enough |3=Yes, measures have costs/negative effects | 4=Yes, other reason, specify _____

a. Please explain:

60. If no, why not (multiple options)? 1=Don't know what to do | 2=Lack of financial resources (to do what?) | 3=Lack of skills/knowledge (to do what?) |4=Lack of other resources (to do what?) | 5=It's not a priority/not very important to us | 6=Not my task/responsibility | 7=Other, specify

a. Please explain

2.2 Closed questions: slow onset climatic changes (impact + adaptation)

61. Have you experienced (more/any changes in)coastal erosion over the past twenty years? 1=Yes, a lot | 2=Yes, but only a little | 3=About the same | 4=No, less than before | 5=Not existed at all
62. If 1 or 2, does this adversely affect (the economic situation of) your household? 1=Yes, a lot | 2=Yes, but only a little | 3=No, it doesn't affect us at all
63. If yes, how does it affect your household?
    a. Negative effect on crops: 1=None | 2=Moderate | 3=Severe | 4=Not applicable (NA)
       If 2 or 3, explain: _____
    b. Negative effect on livestock: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain: _____
    c. Negative effect on fishing: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain: _____
    d. Negative effect on tree crops: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain: _____
    e. Negative effect on trade/business: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain: _____
    f. Effect on food prices: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain: _____
    g. Damage to house/properties: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain: _____
    h. Other negative effects, specify _____1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain: _____

Questions about what households do/did to adapt to (impacts of) climatic changes:

64. Did you modify agricultural production/fishing to deal with coastal erosion?

1=No | 2=Yes, shift to other crops/livestock/fish, specify_____| 3=Shift from rain-fed to irrigated agriculture | 4=Modify production techniques/inputs, specify _____5=Other, specify_____

65. Did you engage (more) in non-farm activities to deal with coastal erosion?

    1=No | 2=Yes, switch to new economic activities, specify _____ | 3=More household members engaged in economic activities | 4=Expand existing non-farm activities | 5=Other, specify _____

66. Did you or household members migrate (more) to deal with coastal erosion? 1=No | 2=Yes, I migrated | 3=Yes, other household member(s) migrated | 4=Yes, whole household migrated

    a. If yes, for what periods? 1=Short-term (<6 months) | 2=Longer-term (>6 months)

    b. If yes, where to? 1=Within region | 2=Other region, specify _____ | 3=Abroad, specify ____

    c. Was migration destination rural or urban? 1=Rural | 2=Urban

67. Did you do anything else to deal with coastal erosion? 1=No | 2=Yes, specify _____

68. (Only ask if measures were taken): Are these things you did to deal with coastal erosion enough to avoid negative effects on the living standard and well-being of your household? 1=No, still severe negative effects | 2=No, still moderate negative effects | 3=Yes, it allows us to carry on | 4=Yes, it has even improved our situation

    a. Please explain:

Section 3: Impact of and coping with weather-related extreme events

3.1 Open questions

69. Choose a storm surge that affected your household (the most severe one or the most recent one). Please mention the year [_ _ _ _] and reconstruct what happened:

70. How did this storm surge affect housing?

71. Did your household do anything to deal with (the impact of) [storm surge] on [housing]? 1=Yes | 2=No (if no, skip next two questions)

72. If yes, what did you do?
73. If yes, do you feel that despite these measures your household still experienced negative effects from [storm surge] (multiple options)? 1=No | 2=Yes, measures are not enough |3=Yes, measures have costs/negative effects | 4=Yes, other reason
    a. Please explain:
74. If no, why not (multiple options)? 1=Didn't know what to do | 2=Lack of financial resources (to do what?) | 3=Lack of skills/knowledge (to do what?) | 4=Lack of other resources (to do what?) | 5=It's not a priority/not very important to us | 6=Not my task/responsibility | 7=Other, specify
    a. Please explain:
75. If no, what negative effects (loss, damage, costs) did your household experience from storm surge because no measures were taken?

3.2 Closed questions: extreme events (impact and coping)

76. Has your household (ever) been affected by a storm surge?
    1=No | 2=Yes, but not severely | 3=Yes, severely
77. How many times has your household been affected by a weather-related extreme event over the past 10 years?
78. Did your or any other household member suffer an injury or illness due to a storm surge? (specify by minor injuries and major injuries)
79. If yes, how does it affect your household (multiple options)?
    a. Negative effect on crops: 1=No | 2=Moderate | 3=Severe | 4=Not applicable (NA)
       If 2 or 3, explain/estimate costs: _____
    b. Negative effect on livestock: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain/estimate costs: _____
    c. Negative effect on fishing: 1=None | 2=Moderate | 3=Severe | 4=NA
       If 2 or 3, explain/estimate costs: _____

d. Negative effect on tree crops: 1=None | 2=Moderate | 3=Severe | 4=NA

   If 2 or 3, explain/estimate costs: _____

e. Negative effect on trade/business/tourism: 1=None | 2=Moderate | 3=Severe | 4=NA

   If 2 or 3, explain/estimate costs: _____

f. Effect on food prices: 1=None | 2=Moderate | 3=Severe | 4=NA

   If 2 or 3, explain/estimate costs: _____

g. Damage to house/properties: 1=None | 2=Moderate | 3=Severe | 4=NA

   If 2 or 3, explain/estimate costs: _____

h. Other negative effects, specify _____1=None | 2=Moderate | 3=Severe | 4=NA

   If 2 or 3, explain/estimate costs: _____

80. If your housing was affected by the event were you forced to live somewhere else (due to the damage, repairs, and cleaning up)? 1= Yes/ 2= No

81. For how many days?

82. Was the house flooded? 1= Yes/ 2= No

83. Did the extreme event cause structural damage to your house?

84. If yes, estimate the amount of damage caused (in US$):

    Building:
    Contents:
    Vehicles:
    Lost income:
    Clean-up:
    Other:

Questions about what people did to cope with (impacts of) extreme events:

85. Did you ask for food or money from other people to deal with storm surge? 1=No | 2=Yes, from a relative | 3=Neighbour | 4=Friend | 5=Other, specify _____

86. Did you receive support from an organisation to deal with storm surge? 1=No |2=Yes, government agency, specify _____ | 2=NGO, specify_____ | 3=Religious organisation, specify _____ | Other, specify_____
87. Did you or household members try to earn extra income to deal with storm surge? 1=No | 2=Yes, intensified existing activities, specify_____ | 3=Engaged in new activities, specify_____
88. Did you or household members migrate (move) to deal with storm surge? 1=No | 2=Yes, I migrated | 3=Yes, other household member(s) migrated | 4=Yes, whole household migrated
    a. If yes, for what periods? 1=Short-term (<6 months) | 2=Longer-term (>6 months)
    b. If yes, where to? 1=Within Kosrae | 2=FSM, specify _____ | 3=Abroad, specify ____
    c. Was migration destination rural or urban? 1=Rural | 2=Urban
89. Did you sell capital to deal with storm surge? 1=No | 2=Yes, land | 3=Livestock | 4=House | 5=Productive assets, specify _____ 6=Means of transport, specify _____ | 7=Luxury items, specify _____ 8| Other, specify _____
90. Did you try to spend less money to deal with storm surge? 1=No | 2=Yes, spent less on food items | 2=On school fees | 3=On healthcare | 4=On productive investments, specify_____ | 5=On house maintenance | 6=Other, specify_____
91. Did you modify food consumption to deal with storm surge? 1=No | 2=Yes, bought less expensive foods | 3=Limit portion sizes | 4=Reduce number of meals per day |5=Adults ate less so children could eat | 6=Less people eating at home | 7=Other, specify_____
92. Did you do anything else to deal with storm surge? 1=No | 2=Yes, specify _____
93. If measures were taken, were these things you did to deal with coastal erosion enough to avoid negative effects on the living standard and well-being of your household? 1=No, still severe negative effects | 2=No, still moderate negative effects | 3=Yes, it allows us to carry on | 4=Yes, it has even improved our situation

a. Please explain:

4. Vulnerability, gender and policy

94. Do you feel that your household is more or less likely to suffer from the impacts of coastal erosion than other households in your community? 1=More | 2=Average | 3=Less
    a. Why?
95. Do you think that the impacts of these climate threats affect men and women differently? Please explain.
96. Do you think men and women play different roles in dealing with these climate threats? Please explain.
97. What are currently the biggest threats to your housing condition?
98. What do you think government agencies or other organisations could do to reduce the impacts of coastal erosion?
99. What should islanders do to reduce the impacts of coastal erosion/storm surges?
100. What would be your recommendations to help prepare for, prevent and protect your household from the impacts of sea-level rise?

Appendix B: List of in-depth interviews

Village	Date	Interviewer	Name of interviewee
Tafunsak	17-7-2012	Iris Monnereau	Sepe Santos
Tafunsak	17-7-2012	Iris Monnereau	Alokoa Jonithan
Lelu	20-7-2012	Iris Monnereau	Rooston Abraham
Lelu	18-7-2012	Iris Monnereau	Katrina Adams
Lelu	20-7-2012	Iris Monnereau	Josaiah Wagun / Senator
Leu	26-7-2012	Iris Monnereau	KCSO / Marston Weston Luckymis
Lelu	26-7-2012	Iris Monnereau	KCSO / Marston Weston Luckymis
Lelu	26-7-2012	Iris Monnereau	Ruthey Luckymis / KIRMA
Lelu	27-7-2012	Iris Monnereau	Masayuki Skilling
Lelu	24-7-2012	meeting	Alik Sigrah
Lelu	17-7-2012	Iris Monnereau	Ilai Abraham
Malem	18-7-2012	Iris Monnereau	Kilafwasru Kilafwasru
Utwe	18-7-2012	Iris Monnereau	Moses Alik
Lelu	30-7-2012	Simpson Abraham	Kiubu Luey
Lelu	31-7-2012	Simpson Abraham	Dorothy Edwin
Tafunsak	30-7-2012	Simpson Abraham	Line Mitcher

Appendix C: Focus group discussions

Focus group	Name of meeting	Date	Number of attendees
1	Policy and executive stakeholders	9 July 2012	27
2	Board of KIRMA[19]	19 July 2012	12
3	Senior citizens, Lelu	24 July 2012	18
4	Senior citizens, Malem	25 July 2012	15
5	Kosrae Senate	26 July 2012	11
6	Senior citizens, Utwe	31 July 2012	24

[19] KIRMA is a semi-autonomous government agency.

4.1 Climate Summary

4.1.1 Current Climate

- Warming trends are evident in annual and half-year mean air temperatures for Pohnpei since 1951. The Yap mean air temperature trend shows little change for the same period.
- Extreme temperatures such as Warm Days and Warm Nights have been increasing at Pohnpei consistent with global warming trends. Trends in minimum temperatures at Yap are not consistent with Pohnpei or global warming trends and may be due to unresolved inhomogeneities in the record.
- At Pohnpei, there has been a decreasing trend in May–October rainfall since 1950. This implies either a shift in the mean location of the Inter-Tropical Convergence Zone (ITCZ) away from Pohnpei and/or a change in the intensity of rainfall associated with the ITCZ.
- There has also been a decreasing trend in Very Wet Day rainfall at Pohnpei and Consecutive Dry Days at Yap since 1952. The remaining annual, half-year and extreme daily rainfall trends show little change at both sites.
- Tropical cyclones (typhoons) affect the Federated States of Micronesia mainly between June and November. An average of 71 cyclones per decade developed within or crossed the Federated States of Micronesia's Exclusive Economic Zone (EEZ) between the 1977 and 2011 seasons. Tropical cyclones were most frequent in El Niño years (88 cyclones per decade) and least frequent in La Niña years (38 cyclones per decade). The neutral season average is 84 cyclones per decade. Thirty-seven of the 212 tropical cyclones (17%) between the 1981 and 2011 seasons became severe events (Category 3 or stronger) in the Federated States of Micronesia's EEZ. Available data are not suitable for assessing long-term trends.
- Wind-waves in the Federated States of Micronesia are dominated by north-easterly trade winds and westerly monsoon winds seasonally, and the El Niño–Southern Oscillation (ENSO) interannually. There is little variation in wave climate between the eastern and western parts of the country; however Yap, in the west, has a more marked dependence on the El Niño–Southern Oscillation in June–September than Pohnpei, in the east. Available data are not suitable for assessing long-term trends (see Section 1.3).

4.1.2 Climate Projections

For the period to 2100, the latest global climate model (GCM) projections and climate science findings indicate:

- 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;
- Annual mean temperatures and extremely high daily temperatures will continue to rise (*very high confidence*);
- 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 the June–September *(low confidence)*.

4.2 Data Availability

There are 23 operational meteorological stations in the Federated States of Micronesia. Multiple observations within a 24-hour period are taken at five stations in Chuuk State, six in Pohnpei State (including Kosrae State) and three in Yap State. In addition, there are two single-observation-a-day climate stations in Pohnpei and seven single-observation-a-day rainfall stations in Yap. Rainfall data for Pohnpei are available from 1949 and Yap from 1951. Air temperature data are available from 1950 for Pohnpei and 1951 for Yap.

The complete historical rainfall and air temperature records for Pohnpei and Yap have been used in this report. These records are considered homogeneous given the available metadata, however low confidence is given to Yap's minimum air temperature data that remain inconsistent with temperature records in the region, likely due to remaining inhomogeneities in the record. Additional information on historical climate trends in the Federated States of Micronesia region can be found in the Pacific Climate Change Data Portal www.bom.gov.au/climate/pccsp/.

Wind-wave data from buoys are particularly sparse in the Pacific region, with very short records. Model and reanalysis data are therefore required to detail the wind-wave climate of the region. Reanalysis surface wind data have been used to drive a wave model over the period 1979–2009 to generate a hindcast of the historical wind-wave climate.

4.3 Seasonal Cycles

Information on temperature and rainfall seasonal cycles can be found in Australian Bureau of Meteorology and CSIRO (2011).

4.3.1 Wind-driven Waves

Surface wind-wave driven processes can impact on many aspects of Pacific Island coastal environments, including: coastal flooding during storm wave events; coastal erosion, both during episodic storm events and due to long-term changes in integrated wave climate; characterisation of reef morphology and marine habitat/species distribution; flushing and circulation of lagoons; and potential shipping and renewable wave energy solutions. The surface offshore wind wave climate can be described by characteristic wave heights, lengths (wave period) and directions.

In the eastern Federated States of Micronesia (e.g. on the north coast of Pohnpei), waves are predominantly directed from the north-east throughout the year, but display strong seasonal variability of direction with increased variability in direction during June–September (Figure 4.1). Wave heights and periods also vary seasonally, reaching a maximum in December–March (mean wave height 7'1" (2.2 m) and period 8.7 s), with minima around the start of the wetter season (June–September) (seasonal mean wave height 3'9" (1.1 m) and period 7.8 s) (Table 4.1). The wave climate is characterised by trade wind generated waves from the north-east and east. During December–March swell is propagated from storm events in the north-west from monsoons and North Pacific extra-tropical storms. In June–September swell waves are generated from Southern Hemisphere storms and occasionally from the south-east from trade winds. Waves larger than 10'2" (3.1 m) (99th percentile) to the north of Pohnpei occur predominantly between November and April and have longer than average periods, usually directed from the north-east to north-west, associated with typhoons and extra-tropical storms. The height of a 1-in-50 year wave event on the north coast of Pohnpei is calculated to be 19'2" (5.8 m).

In the western Federated States of Micronesia (e.g. on the south coast of Yap), waves are characterised by variability of the Northern Hemisphere trade winds and westerly monsoon winds. During the northern trade wind season, December–March, waves at Yap are east-northeasterly and have a larger height and slightly longer period than in other months (mean height around 5'1" (1.5 m) and period around 7.5 s), with some north-westerly swell from extra-tropical storms (Figure 4.2). In the wetter months of June–September, waves have a slightly shorter period (mean around 7.2 s) and lower height (mean around 3'6" (1.1 m) than December–March (Table 4.1). These waves consist of locally generated trade wind waves from the east and north-east, as well as locally generated westerly monsoon waves and easterly trade wind swell. Waves larger than 9'6" (2.9 m) (99th percentile) occur from the south-west in the wetter months due to monsoon systems and typhoons, and from the west, east, and varying directions in November–March from extra-tropical storms. The height of a 1-in-50 year wave event on the south coast of Yap is calculated to be 31'3" (9.5 m).

No suitable dataset is available to assess long-term historical trends in wave climate for the Federated States of Micronesia. However, interannual variability may be assessed in the hindcast record. The wind-wave climate displays strong interannual variability at both Pohnpei and Yap, varying with the El Niño–Southern Oscillation (ENSO) in June–September. During La Niña years, mean wave power at Pohnpei is greater than during El Niño years in June–September, and waves are more strongly directed from the east, associated with increased trade wind speeds. At Yap, wave power does not vary substantially between in El Niño and La Niña years in December–March, but in June–September much weaker waves are directed from the east in La Niña years but stronger and from the west in El Niño years, associated with movement of the Inter-Tropical Convergence Zone (ITCZ) influencing changes in the trade winds and monsoon systems.

Table 4.1: Mean wave height, period and direction from which the waves are travelling around the Federated States of Micronesia in December–March and June–September. Observation (hindcast) and climate model simulation mean values are given with the 5–95th percentile range (in brackets). Projections are made for eastern and western area averages of the Federated States of Micronesia, so historical model simulation values are given for these areas for comparison (see Section 4.5.6 – Wind driven waves, and Tables 4.8 and 4.9). A compass relating number of degrees to cardinal points (direction) is shown.

		Hindcast Reference Data (1979–2009), north Pohnpei	Climate Model Simulations (1986–2005) – Eastern Federated States of Micronesia	Hindcast Reference Data (1979–2009), south Yap	Climate Model Simulations (1986–2005) – Western Federated States of Micronesia
Wave Height (metres)	December–March	2.2 (1.5–2.9)	2.0 (1.7–2.4)	1.5 (1.0–2.2)	1.8 (1.5–2.2)
	June–September	1.1 (0.7–1.6)	1.1 (0.9–1.4)	1.1 (0.6–2.1)	1.0 (0.8–1.3)
Mean wave height (feet)	December–March	7.1 (5.0–9.5)	6.7 (5.5–7.8)	5.1 (3.1–7.4)	6.0 (4.8–7.2)
	June–September	3.7 (2.4–5.4)	3.7 (3.1–4.4)	3.5 (1.9–7.0)	3.2 (2.5–4.4)
Wave Period (seconds)	December–March	8.7 (7.3–10.7)	8.0 (7.4–8.8)	7.5 (6.3–9.3)	7.6 (7.0–8.2)
	June–September	7.8 (6.3–9.7)	7.2 (6.5–7.9)	7.2 (5.7–8.8)	6.6 (6.0–7.1)
Wave direction (degrees clockwise from North)	December–March	40 (10–60)	50 (40–60)	70 (60–90)	50 (40–60)
	June–September	40 (310–80)	110 (80–160)	130 (70–270)	100 (50–150)

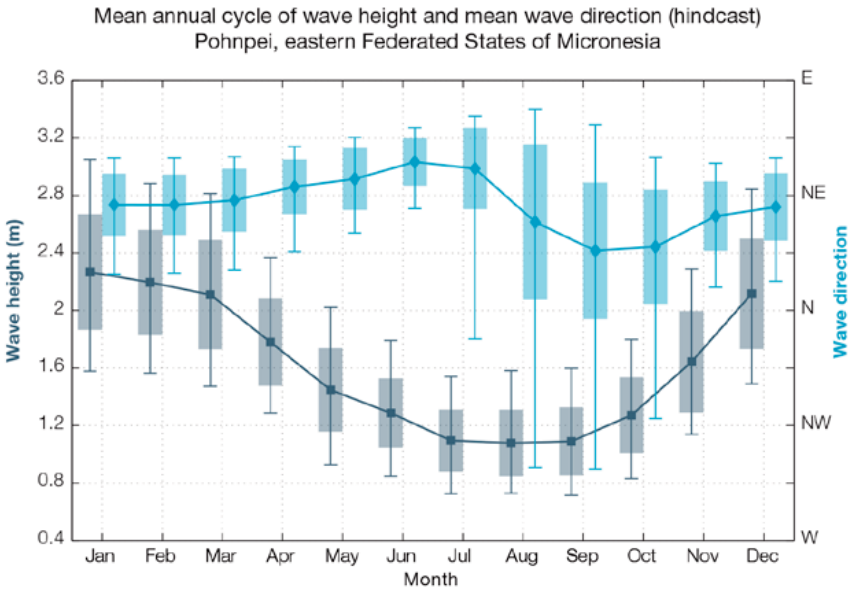

Figure 4.1: Mean annual cycle of wave height (grey) and mean wave direction (blue) at Pohnpei (eastern Federated States of Micronesia) in hindcast data (1979–2009). To give an indication of interannual variability of the monthly means of the hindcast data, shaded boxes show 1 standard deviation around the monthly means, and error bars show the 5–95% range. The direction from which the waves are travelling is shown (not the direction towards which they are travelling).

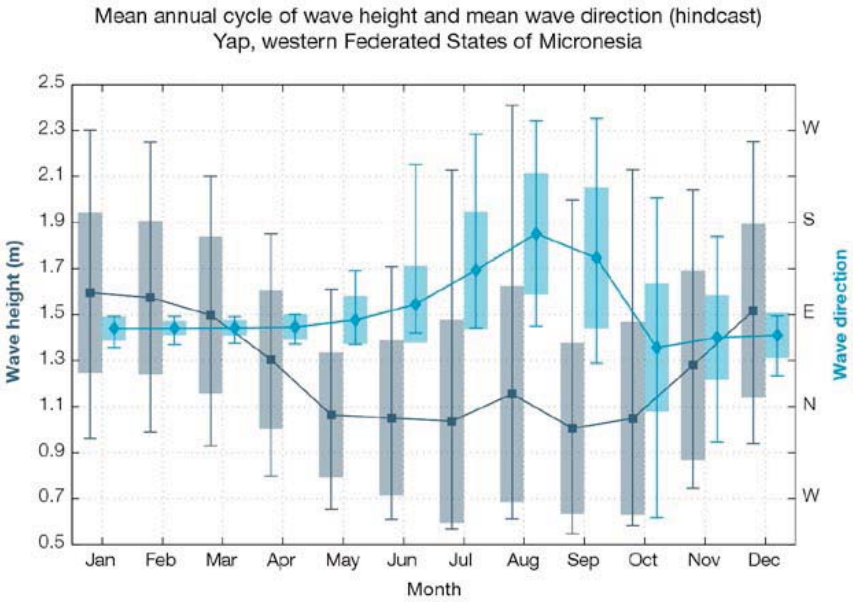

Figure 4.2: Mean annual cycle of wave height (grey) and mean wave direction (blue) at Yap (western Federated States of Micronesia) in hindcast data (1979–2009). To give an indication of interannual variability of the monthly means of the hindcast data, shaded boxes show 1 standard deviation around the monthly means, and error bars show the 5–95% range. The direction from which the waves are travelling is shown (not the direction towards which they are travelling).

4.4 Observed Trends

4.4.1 Air Temperature

Annual and Half-year Mean Air Temperature

Trends for annual and half-year mean temperatures are positive at Pohnpei with little change observed at Yap (Figure 4.3, Figure 4.4 and Table 4.2). At Pohnpei and Yap the warming trends in maximum annual and half-year air temperatures are statistically significant at the 5% level and consistent with regional and global warming trends. Minimum temperatures show significant positive trends at Pohnpei over November–April and May–October. Also at Pohnpei, annual and half-year trends in maximum air temperature are greater than those observed in minimum air temperature. The cooling trends in Yap annual and half-year minimum temperatures are inconsistent with regional and global trends. This could potentially be due to remaining inhomogeneities in record which cannot be resolved due to lack of metadata. Strong cooling trends in the minimum air temperature are responsible for no significant trends in the mean air temperatures at Yap.

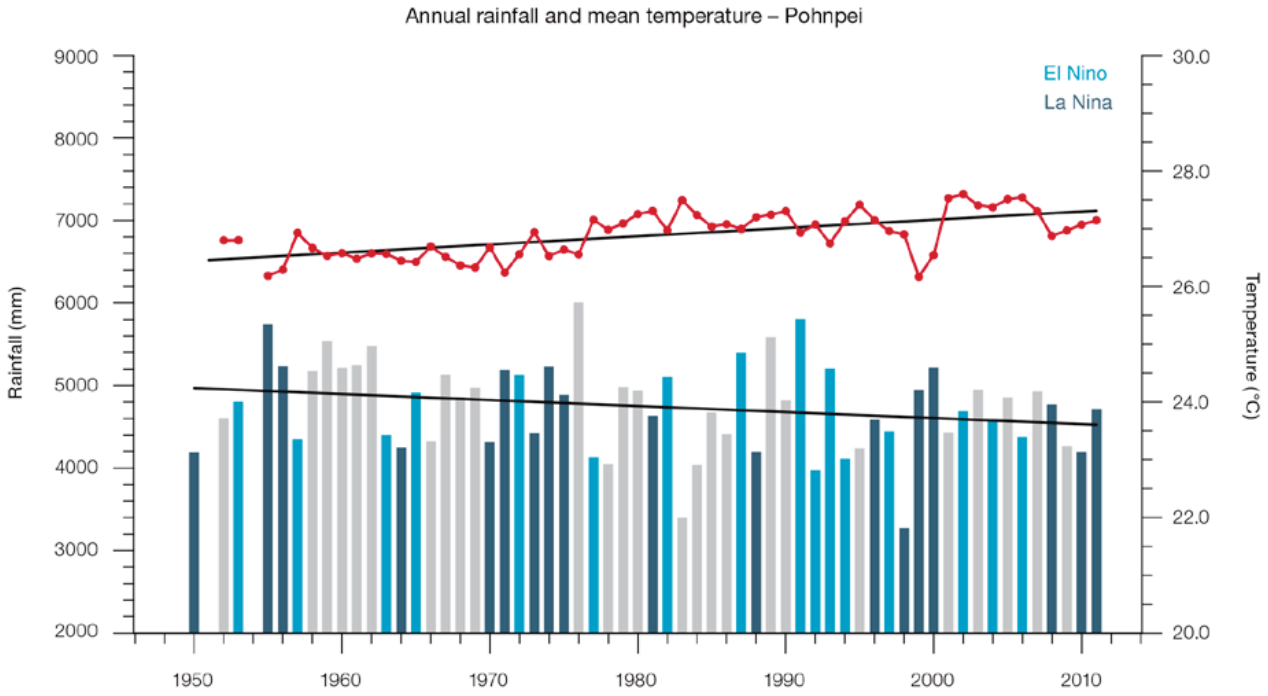

Figure 4.3: Observed time series of annual average values of mean air temperature (red dots and line) and total rainfall (bars) at Pohnpei. Light blue, dark blue and grey bars denote El Niño, La Niña and neutral years respectively. Solid black trend lines indicate a least squares fit.

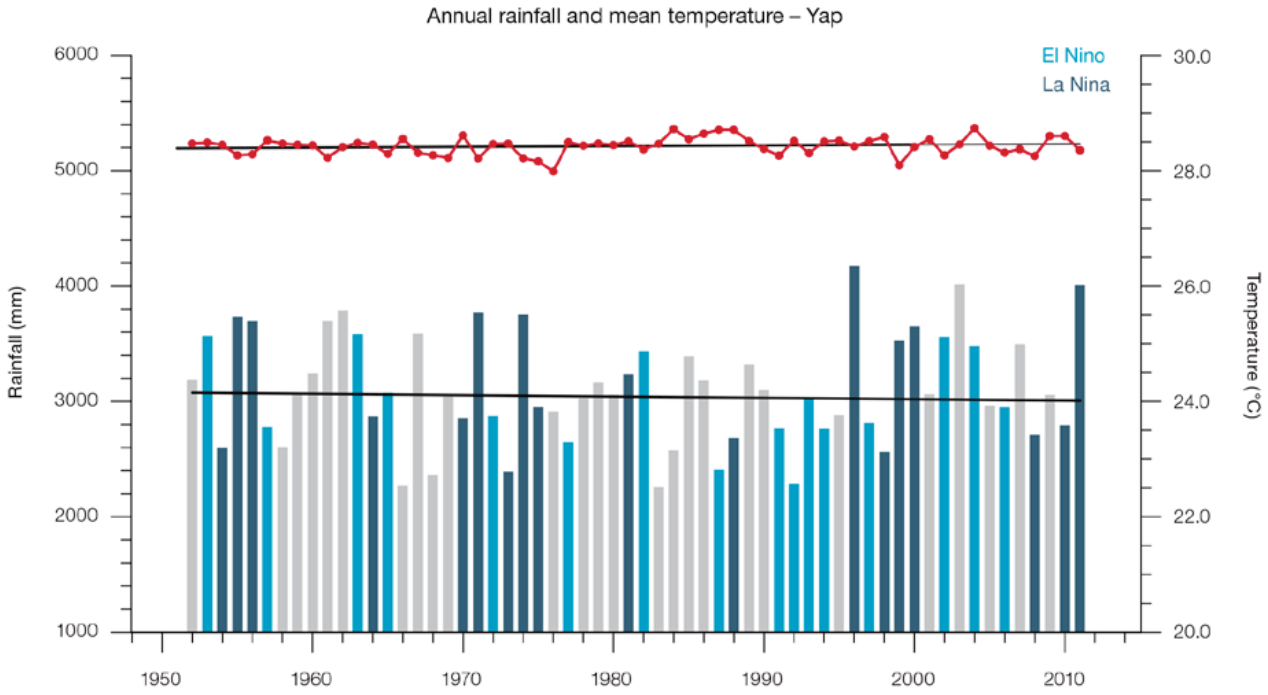

Figure 4.4: Observed time series of annual average values of mean air temperature (red dots and line) and total rainfall (bars) at Yap. Light blue, dark blue and grey bars denote El Niño, La Niña and neutral years respectively. Solid black trend lines indicate a least squares fit.

Table 4.2: Annual and half-year trends in air temperature (Tmax, Tmin, Tmean) and rainfall at Pohnpei (top) and Yap (bottom). The 95% confidence intervals are shown in parentheses. Values for trends significant at the 5% level are shown in **boldface**.

Pohnpei	Tmax °F/10yrs [°C/10yrs]	Tmin °F/10yrs [°C/10yrs] 1951–2011	Tmean °F/10yrs [°C/10yrs]	Total Rain inches/10yrs [mm/10yrs] 1950–2011
Annual	**+0.32** (+0.19, +0.46) [**+0.18** (+0.10, +0.26)]	+0.16 (-0.02, +0.35) [+0.09 (-0.01, +0.20)]	**+0.27** (+0.12, +0.38) [**+0.15** (+0.07, +0.21)]	-2.26 (-5.32, +0.61) [-57.3 (-135.1, +15.5)]
Nov–Apr	**+0.31** (+0.17, +0.48) [**+0.17** (+0.09,+0.27)]	**+0.25** (+0.03, +0.42) [**+0.14** (+0.02, +0.23)]	**+0.29** (+0.11, +0.44) [**+0.16** (+0.06, +0.25)]	-1.80 (-4.60, +1.64) [-45.8 (-116.7, +41.8)]
May–Oct	**+0.32** (+0.16, +0.46) [**+0.18** (+0.09, +0.26)]	**+0.19** (+0.03, +0.37) [**+0.11** (+0.02, +0.21)]	**+0.27** (+0.13, +0.39) [**+0.15** (+0.07, +0.22)]	**-2.23** (-4.52, -0.12) [**-56.6** (-114.9, -3.1)]

Yap	Tmax °F/10yrs (°C/10yrs)	Tmin °F/10yrs (°C/10yrs) 1951–2011	Tmean °F/10yrs (°C/10yrs)	Total Rain inches/10yrs (mm/10yrs) 1952–2011
Annual	**+0.41** (+0.36, +0.48) [**+0.23** (+0.20, +0.26)]	**-0.36** (-0.43, -0.27) [**-0.20** (-0.24, -0.15)]	+0.03 (-0.02, +0.07) [+0.01 (-0.01, +0.04)]	0.00 (-2.85, +3.22) [-0.1 (-72.5, +81.8)]
Nov–Apr	**+0.39** (+0.34, +0.44) [**+0.22** (+0.19, +0.25)	**-0.27** (-0.37, -0.18) [**-0.15** (-0.21, -0.10)]	+0.04 (-0.02, +0.11) [+0.02 (-0.01, +0.06)]	+0.86 (-2.87, +1.44) [-21.9 (-72.8, +36.6)]
May–Oct	**+0.44** (+0.37, +0.51) [**+0.24** (+0.20, +0.28)]	**-0.40** (-0.48, -0.33) [**-0.22** (-0.27, +0.18)]	+0.01 (-0.04, +0.05) [0.00 (-0.02, +0.03)]	+0.93 (-1.27, +3.10) [+23.6 (-32.1,+78.8)]

Extreme Daily Air Temperature

Warming trends are present in the extreme indices (Table 4.3 and Figure 4.5) at Pohnpei. The annual number of Warm Days and Warm Nights has increased with Cool Days decreasing. These trends were found to be statistically significant. At Yap, Warm Days are increasing with Cool Days decreasing consistent with day-time temperature trends at Pohnpei. However, extreme minimum temperature trends show opposite trends; Cool Nights are increasing and Warm Nights decreasing – a trend that is inconsistent with mean and extreme global warming trends. This is likely due to remaining inhomogeneities in the record which could not be resolved given the metadata available at Yap.

Table 4.3: Annual trends in air temperature and rainfall extremes at Pohnpei (top) and Yap (bottom). The 95% confidence intervals are shown in parentheses. Values for trends significant at the 5% level are shown in **boldface**.

		Pohnpei	Yap
TEMPERATURE		**1952–2011**	**1952–2011**
Warm Days (days/decade)		**7.86** (+3.65, 11.70)	**12.23** (+4.60, +19.80)
Warm Nights (days/decade)		**5.12** (+1.22, +9.05)	**-16.68** (-21.57, -10.24)
Cool Days (days/decade)		**-3.98** (-5.53, -2.52)	**-8.50** (-13.66, -2.67)
Cool Nights (days/decade)		-2.73 (-8.21, +3.68)	**+8.70** (+3.71, +14.90)
RAINFALL			
Rain Days ≥ 1 mm	(days/decade)	-0.21 (-2.79, +2.48)	-1.01 (-4.20, +1.82)
Very Wet Day rainfall	(inches/decade)	**-2.63** (-5.15, -0.12)	+0.22 (-1.39, +1.97)
	(mm/decade)	**-66.88** (-130.81, -3.05)	+5.55 (-35.30, +49.95)
Consecutive Dry Days (days/decade)		0.00 (-0.43, +0.20)	**-0.37** (-0.77, 0.00)
Max 1-day rainfall	(inches/decade)	-0.015 (-0.29, 0.27)	-0.04 (-0.30, +0.21)
	(mm/decade)	-0.38 (-7.29, +6.84)	-0.88 (-7.62, +5.41)

Warm Days: Number of days with maximum temperature greater than the 90th percentile for the base period 1971–2000
Warm Nights: Number of days with minimum temperature greater than the 90th percentile for the base period 1971–2000
Cool Days: Number of days with maximum temperature less than the 10th percentile for the base period 1971–2000
Cool Nights: Number of days with minimum temperature less than the 10th percentile for the base period 1971–2000
Rain Days ≥ 1mm: Annual count of days where rainfall is greater or equal to 1mm (0.039 inches)
Very Wet Day rainfall: Amount of rain in a year where daily rainfall is greater than the 95th percentile for the reference period 1971–2000
Consecutive Dry Days: Maximum number of consecutive days in a year with rainfall less than 1mm (0.039 inches)
Max 1-day rainfall: Annual maximum 1-day rainfall

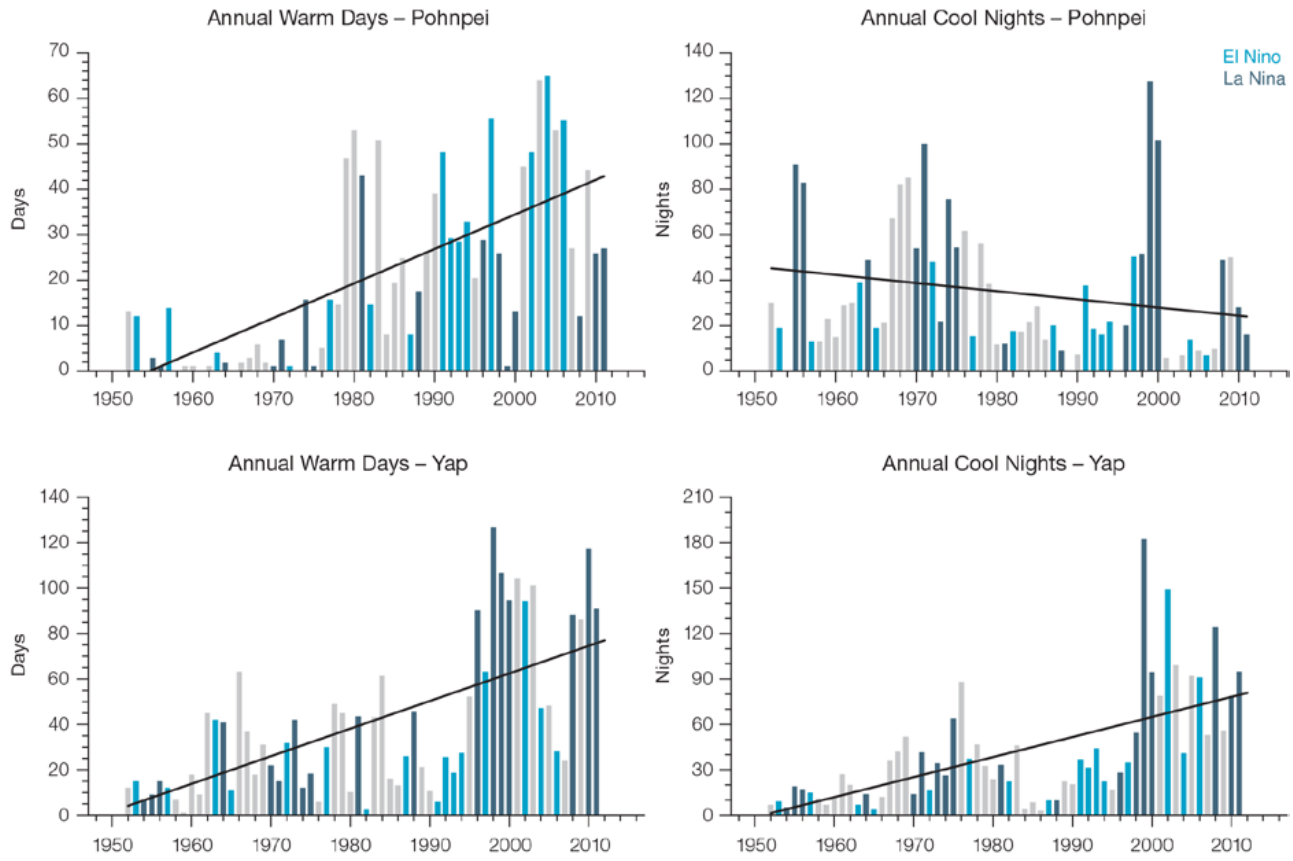

Figure 4.5: Observed time series of annual total number of Warm Days at Pohnpei (top left panel) and Yap (bottom left panel). Annual total number of Cool Nights at Pohnpei (top right panel) and Yap (bottom right panel). Solid black line indicates least squares fit.

4.4.2 Rainfall

Annual and Half-year Total Rainfall

Notable interannual variability associated with the ENSO is evident in the observed rainfall records for Pohnpei since 1950 (Figure 4.3) and Yap since 1952 (Figure 4.4). The negative trend in Pohnpei rainfall from May–October is statistically significant at the 5% level (Table 4.2). This implies either a shift in the mean location of the ITCZ away from Pohnpei and/or a change in the intensity of rainfall associated with the ITCZ. The ITCZ is closest to the equator in March–May, and furthest north during September–November, when it becomes broader, expanding both to the north and south.

The other total rainfall trends presented in Table 4.2, Figure 4.3 and Figure 4.4 are not statistically significant. In other words, excluding Pohnpei May–October rainfall, there has been little change in rainfall at Pohnpei and Yap.

Daily Rainfall

Daily rainfall trends for Pohnpei and Yap are presented in Table 4.3. Figure 4.6 shows trends in annual Very Wet Days and Consecutive Dry Days at Pohnpei and Yap. The negative trends in annual Very Wet Day rainfall at Pohnpei and annual Consecutive Dry Days at Yap are statistically significant. The decrease in annual Consecutive Dry Days at Yap does not coincide with an increase in the number of rain days. The other extreme rainfall trends in Table 4.3 are not statistically significant.

4.4.3 Tropical Cyclones

When tropical cyclones (typhoons) affect the Federated States of Micronesia they tend to do so between June and November. The tropical cyclone archive of the Northern Hemisphere indicates that between the 1977 and 2011 seasons, 248 tropical cyclones developed within or crossed the Federated States of Micronesia's EEZ. This represents an average of 71 cyclones per decade. Refer to Chapter 1, Section 1.4.2 (Tropical Cyclones) for an explanation of the difference in the number of tropical cyclones occurring in the Federated States of Micronesia in this report (Australian Bureau of Meteorology and CSIRO, 2014) compared to Australian Bureau of Meteorology and CSIRO (2011).

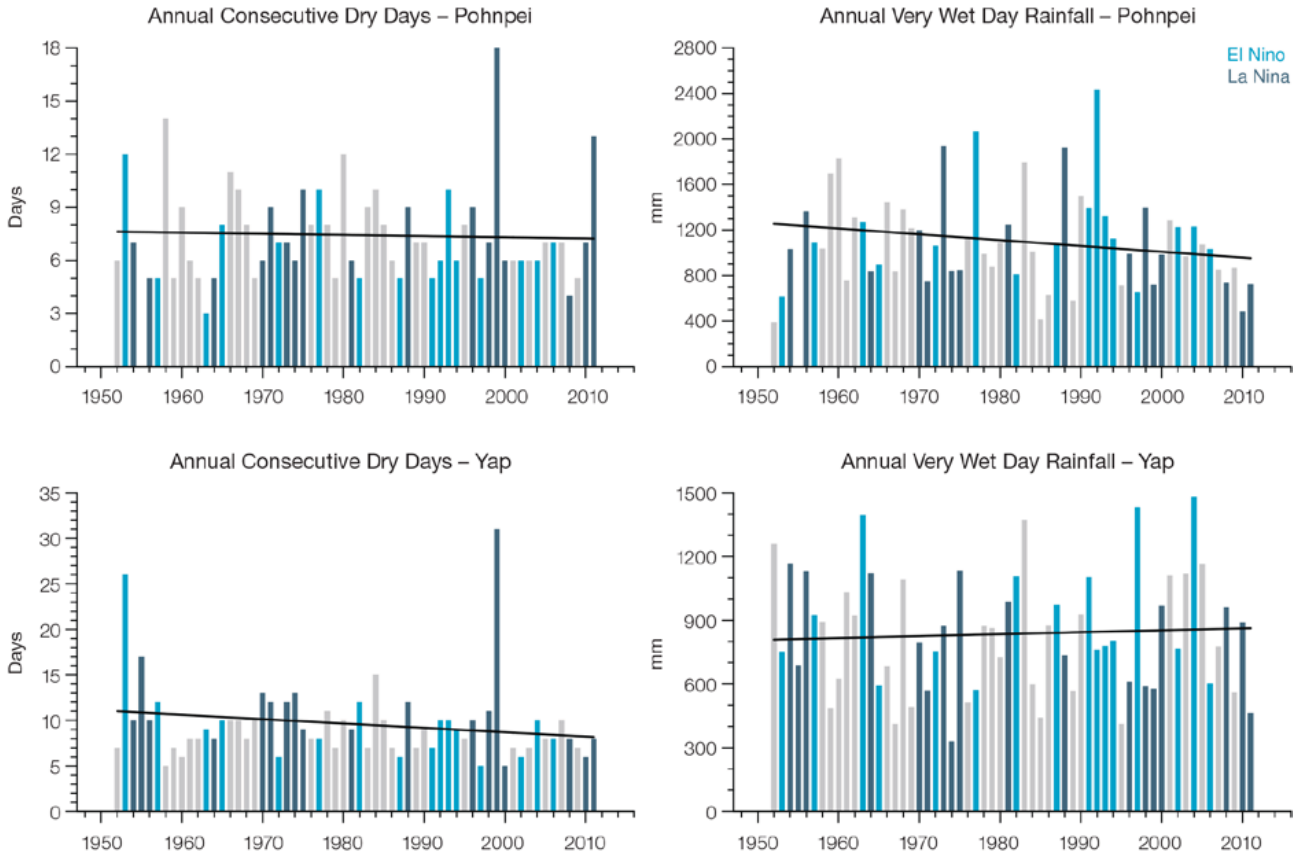

Figure 4.6: Observed time series of annual Consecutive Dry Days at Pohnpei (top left panel) and Yap (bottom left panel), and annual Very Wet Days at Pohnpei (top right panel) and Yap (bottom right panel). Solid black line indicates least squares fit.

Interannual variability in the number of tropical cyclones in the Federated States of Micronesia's EEZ is large, ranging from zero in 1999 to 12 in 1979 and 1987 (Figure 4.7). Tropical cyclones were most frequent in El Niño and neutral years, and least frequent in La Niña years. The neutral season average is 84 cyclones per decade. Thirty-seven of the 212 tropical cyclones (17%) between the 1981 and 2011 seasons became severe events (Category 3 or higher) within the Federated States of Micronesia's EEZ.

Long term trends in frequency and intensity have not been presented as country scale assessment is not recommended. Some tropical cyclone tracks analysed in this subsection include the tropical depression stage (sustained winds less than or equal to 34 knots) before and/or after tropical cyclone formation.

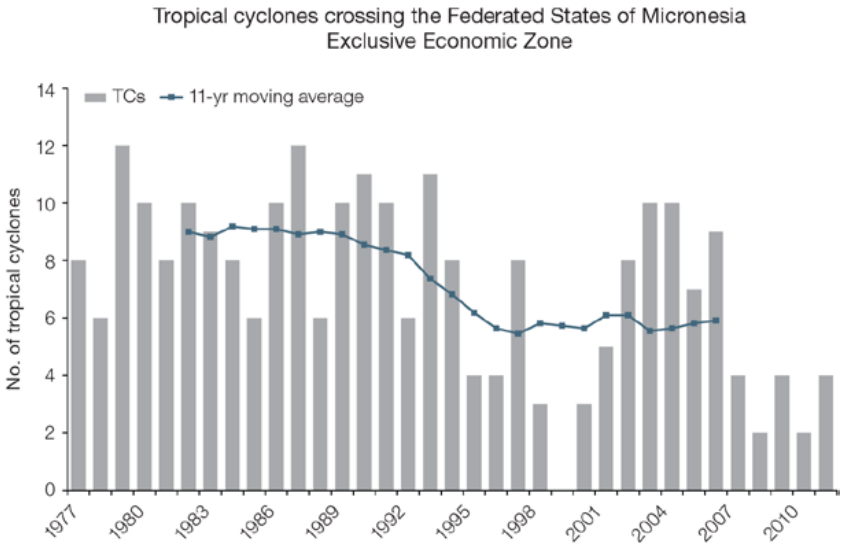

Figure 4.7: Time series of the observed number of tropical cyclones developing within and crossing the Federated States of Micronesia EEZ per season. The 11-year moving average is in blue.

4.5 Climate Projections

The performance of the available Coupled Model Intercomparison Project (Phase 5) (CMIP5) climate models over the Pacific has been rigorously assessed (Brown et al., 2013a, b; Grose et al., 2014; Widlansky et al., 2013). The simulation of the key processes and features for the Federated States of Micronesia region is similar to the previous generation of CMIP3 models, with all the same strengths and many of the same weaknesses. The best-performing CMIP5 models used here have lower biases (differences between the simulated and observed climate data) than the best CMIP3 models, and there are fewer poorly-performing models. For the Federated States of Micronesia, the most important model bias is that the simulated rainfall in the ITCZ and the West Pacific Monsoon (WPM) is too wet in November–April in the present climate, but March–October rainfall is within observed uncertainty. This affects the confidence in the model projections. Out of 27 models assessed, one model was rejected for use in these projections due to biases in the mean climate. Climate projections have been derived from up to 26 new GCMs in the CMIP5 database (the exact number is different for each scenario, Appendix A), compared with up to 18 models in the CMIP3 database reported in Australian Bureau of Meteorology and CSIRO (2011).

It is important to realise that the models used give different projections under the same scenario. This means there is not a single projected future for the Federated States of Micronesia, but rather a range of possible futures for each emission scenario. This range is described below.

4.5.1 Temperature

Further warming is expected over the Federated States of Micronesia (Figure 4.8, Tables 4.6 and 4.7). Under all RCPs, the warming is up to 1.1°C by 2030, relative to 1995, but after 2030 there is a growing difference between each RCP. For example, in the eastern Federated States of Micronesia by 2090, a warming of 2.1 to 4.1°C is projected for RCP8.5 (very high emissions) while a warming of 0.5 to 1.2°C is projected for RCP2.6 (very low emissions), with a very similar change in Western Federated States of Micronesia. The total range of projected temperatures is broader than that presented in Australian Bureau of Meteorology and CSIRO (2011) because a wider range of emissions scenarios is considered. While relatively warm and cool years and decades will still occur due to natural variability, there is projected to be more warm years and decades on average in a warmer climate.

There is *very high confidence* that temperatures will rise because:

- It is known from theory and observations that an increase in greenhouse gases will lead to a warming of the atmosphere; and
- Climate models agree that the long-term average temperature will rise.

There is *high confidence* in the model average temperature change shown in Tables 4.6 and 4.7 because:

- The new models do a good job of simulating the rate of temperature change of the recent past; and
- There are no large model biases in sea-surface temperatures in the region.

4.5.2 Rainfall

The long-term average rainfall over the Federated States of Micronesia is projected by almost all models to increase (Figure 4.9, Table 4.6 and 4.7). Models consistently project a greater increase in rainfall in May–October rainfall than in November–April rainfall. However, the year-to-year rainfall variability over the Federated States of Micronesia is still the same or larger than the projected change, even in the highest emission scenario by 2090. Mean rainfall increased markedly in the western Federated States of Micronesia between 1979 and 2006 (Figure 4.8, bottom panel), but the models do not project this will continue at this rate into the future. This indicates that the recent increase may be caused partly by natural variability and not caused by global warming. It is also possible that the models do not simulate a key process driving the recent change. However, the recent change is not particularly large (<10%) and the observed record shown is not particularly long (28 years), so it is difficult to determine the importance of this difference, and its cause. There will still be wet and dry years and decades due to natural variability, but models show that the long-term average may be wetter in the Federated States of Micronesia by the end of the century. The effect of climate change on average rainfall may not be obvious in the short or medium term due to natural variability.

These results are similar to those from Australian Bureau of Meteorology and CSIRO (2011), however the confidence rating has been reduced from *high confidence* to *medium confidence*. The new model results and new research into drivers of climate change have there is revealed greater complexity than was found previously.

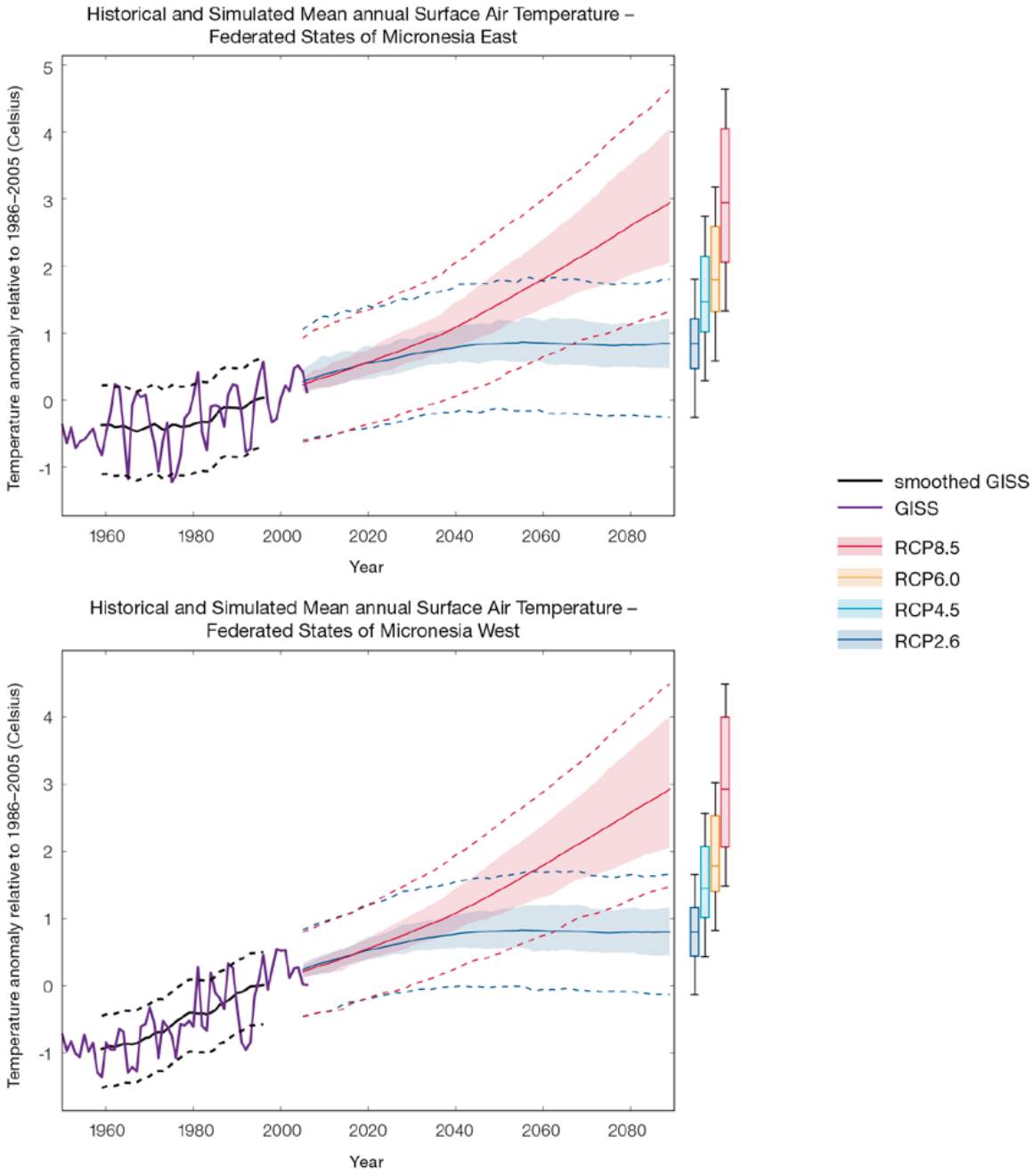

Figure 4.8: Historical and simulated surface air temperature time series for the region surrounding the eastern (top) and western (bottom) Federated States of Micronesia. The graph shows the anomaly (from the base period 1986–2005) in surface air temperature from observations (the GISS dataset, in purple), and for the CMIP5 models under the very high (RCP8.5, in red) and very low (RCP2.6, in blue) emissions scenarios. The solid red and blue lines show the smoothed (20-year running average) multi-model mean anomaly in surface air temperature, while shading represents the spread of model values (5–95th percentile). The dashed lines show the 5–95th percentile of the observed interannual variability for the observed period (in black) and added to the projections as a visual guide (in red and blue). This indicates that future surface air temperature could be above or below the projected long-term averages due to interannual variability. The ranges of projections for a 20-year period centred on 2090 are shown by the bars on the right for RCP8.5, 6.0, 4.5 and 2.6.

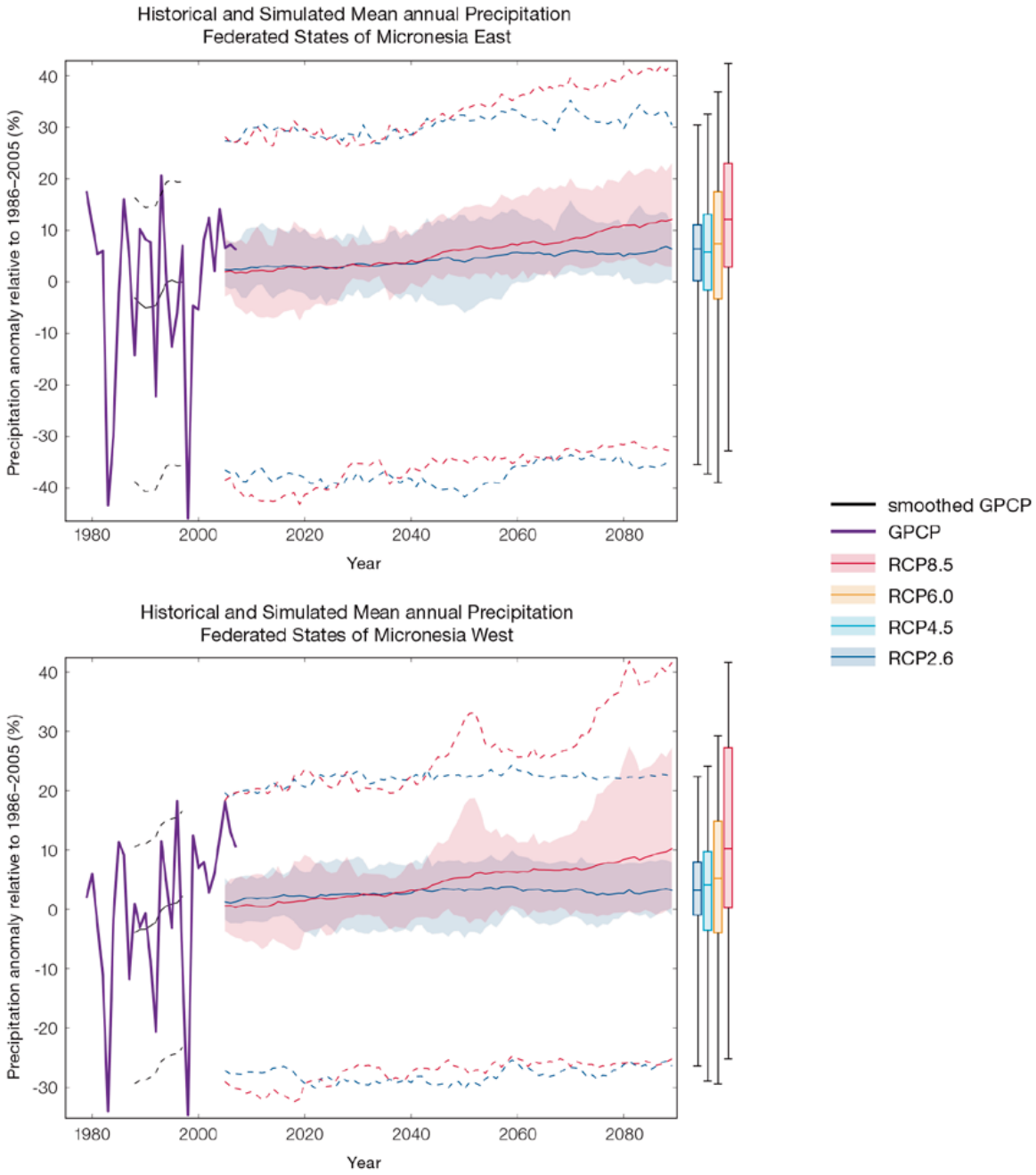

Figure 4.9: Historical and simulated annual average rainfall time series for the region surrounding the eastern (top) and western (bottom) Federated States of Micronesia. The graph shows the anomaly (from the base period 1986–2005) in rainfall from observations (the GPCP dataset, in purple), and for the CMIP5 models under the very high (RCP8.5, in red) and very low (RCP2.6, in blue) emissions scenarios. The solid red and blue lines show the smoothed (20-year running average) multi-model mean anomaly in rainfall, while shading represents the spread of model values (5–95th percentile). The dashed lines show the 5–95th percentile of the observed interannual variability for the observed period (in black) and added to the projections as a visual guide (in red and blue). This indicates that future rainfall could be above or below the projected long-term averages due to interannual variability. The ranges of projections for a 20-year period centred on 2090 are shown by the bars on the right for RCP8.5, 6.0, 4.5 and 2.6.

There is general agreement between models that rainfall will increase, and this increase is larger later in the century and for the higher emissions scenarios. There are some biases in the models in the region that lower the confidence in the amount of projected change. The 5–95th percentile range of projected values from CMIP5 climate models is moderate, e.g. for the eastern Federated States of Micronesia RCP8.5 (very high emissions) the range is 1 to +9% by 2030 and 3 to +23% by 2090.

There is *medium confidence* that the long-term rainfall over the Federated States of Micronesia will increase because:

- The majority of CMIP3 and CMIP5 models agree that the rainfall in the ITCZ and WPM will increase under a warmer climate (only two of the 27 models used showed a rainfall decrease); and
- There are well understood physical reasons why a warmer climate will lead to increased rainfall in the ITCZ region.

There is *medium confidence* in the model average rainfall change shown in Tables 4.6 and 4.7 because:

- The complex set of processes involved in tropical rainfall is challenging to simulate in models. This means that the confidence in the projection of rainfall is generally lower than for other variables such as temperature;
- Many models have a bias in November–April rainfall in the current climate; and
- The future behaviour of the El Niño–Southern Oscillation is unclear, and the El Niño–Southern Oscillation strongly influences year-to-year rainfall variability.

4.5.3 Extremes

Extreme Temperature

The temperature on extremely hot days is projected to increase by about the same amount as average temperature. This conclusion is based on analysis of daily temperature data from a subset of CMIP5 models (Chapter 1). The frequency of extremely hot days is also expected to increase.

For the eastern Federated States of Micronesia the temperature of the 1-in-20-year hot day is projected to increase by approximately 1.1°F (0.6°C) by 2030 under the RCP2.6 (very low) scenario and by 1.4°F (0.8°C) under the RCP8.5 (very high) scenario. By 2090 the projected increase is 1.4°F (0.8°C) for RCP2.6 (very low) and 5.4°F (3°C) for RCP8.5 (very high).

For the western Federated States of Micronesia the temperature of the 1-in-20-year hot day is projected to increase by approximately 1.1°F (0.6°C) by 2030 under the RCP2.6 (very low) scenario and by 1.4°F (0.8°C) under the RCP8.5 (very high) scenario. By 2090 the projected increase is 1.4°F (0.8°C) for RCP2.6 (very low) and 5.8°F (3.2°C) for RCP8.5 (very high).

There is *very high confidence* that the temperature of extremely hot days and extremely cool days will increase, because:

- A change in the range of temperatures, including the extremes, is physically consistent with rising greenhouse gas concentrations;
- This is consistent with observed changes in extreme temperatures around the world over recent decades; and
- All the CMIP5 models agree on an increase in the frequency and intensity of extremely hot days and a decrease in the frequency and intensity of cool days.

There is *low confidence* in the magnitude of projected change in extreme temperature because models generally underestimate the current intensity and frequency of extreme events. Changes to the particular driver of extreme temperatures affect whether the change to extremes is more or less than the change in the average temperature, and the changes to the drivers of extreme temperatures in the Federated States of Micronesia are currently unclear.

Extreme Rainfall

The frequency and intensity of extreme rainfall events are projected to increase. This conclusion is based on analysis of daily rainfall data from a subset of CMIP5 models using a similar method to that in Australian Bureau of Meteorology and CSIRO (2011) with some improvements (Chapter 1), so the results are slightly different to those in Australian Bureau of Meteorology and CSIRO (2011).

For the eastern Federated States of Micronesia the current 1-in-20-year daily rainfall amount is projected to increase by approximately 0.4 in (11 mm) by 2030 for RCP2.6 and by 0.6 in (15 mm) by 2030 for RCP8.5 (very high emissions). By 2090, it is projected to increase by approximately 0.8 in (20 mm) for RCP2.6 and by 1.5 in (38 mm) for RCP8.5 (very high emissions).The majority of models project the current 1-in-20-year daily rainfall event will become, on average, a 1-in-7-year event for RCP2.6 and a 1-in-6-year event for RCP8.5 (very high emissions) by 2090.

For the western Federated States of Micronesia the current 1-in-20-year daily rainfall amount is projected to increase by approximately 0.6 in (14 mm) by 2030 for RCP2.6 and by 0.7 in (18 mm) by 2030 for RCP8.5 (very high emissions). By 2090, it is projected to increase by approximately 0.75 in (19 mm) for RCP2.6 and by 1.9 in (47 mm) for RCP8.5 (very high emissions).The majority of models project the current 1-in-20-year daily rainfall event will become, on average, a 1-in-8-year event for RCP2.6 and a 1-in-4-year event for RCP8.5 (very high emissions) by 2090. These results are different to those found in Australian Bureau of Meteorology and CSIRO (2011) because of different methods used (Chapter 1).

There is *high confidence* that the frequency and intensity of extreme rainfall events will increase because:

- A warmer atmosphere can hold more moisture, so there is greater potential for extreme rainfall (IPCC, 2012); and
- Increases in extreme rainfall in the Pacific are projected in all available climate models.

There is *low confidence* in the magnitude of projected change in extreme rainfall because:

- Models generally underestimate the current intensity of local extreme events, especially in this area due to the 'cold-tongue bias' (Chapter 1);
- Changes in extreme rainfall projected by models may be underestimated because models seem to underestimate the observed increase in heavy rainfall with warming (Min et al., 2011);
- GCMs have a coarse spatial resolution, so they do not adequately capture some of the processes involved in extreme rainfall events; and
- The Conformal Cubic Atmospheric Model (CCAM) downscaling model has finer spatial resolution and the CCAM results presented in Australian Bureau of Meteorology and CSIRO (2011) indicates a smaller increase in the number of extreme rainfall days, and there is no clear reason to accept one set of models over another.

Drought

Drought projections (defined in Chapter 1) are described in terms of changes in proportion of time in drought, frequency and duration by 2090 for very low and very high emissions (RCP2.6 and 8.5).

For both the eastern and western Federated States of Micronesia the overall proportion of time spent in drought is expected to decrease under all scenarios. Under RCP8.5 the frequency of drought in all categories is projected to decrease slightly while the duration of events is projected to stay approximately the same (Figure 4.10). Under RCP2.6 (very low emissions) the frequency of severe drought is projected to decrease slightly while the frequency of drought in all other categories is projected to remain the same. The duration of events in all drought categories is projected to stay approximately the same under RCP2.6 (very low emissions).

There is *medium confidence* in this direction of change because:

- There is *high confidence* in the direction of mean rainfall change;
- These drought projections are based upon a subset of models; and
- Like the CMIP3 models, the majority of the CMIP5 models agree on this direction of change.

There is *medium confidence* in the projections of drought frequency and duration because there is *medium confidence* in the magnitude of rainfall projections, and no consensus about projected changes in the ENSO, which directly influence the projection of drought.

Tropical Cyclones

Global Picture

There is a growing level of agreement among models that on a global basis the frequency of tropical cyclones is likely to decrease by the end of the 21st century. The magnitude of the decrease varies from 6%–35% depending on the modelling study. There is also a general agreement between models that there will be an increase in the mean maximum wind speed of cyclones by between 2% and 11% globally, and an increase in rainfall rates of the order of 20% within 100 km of the cyclone centre (Knutson et al., 2010). Thus, the scientific community has a *medium* level of confidence in these global projections.

Federated States of Micronesia

The projection is for a decrease in tropical cyclone genesis (formation) frequency for the northern basin (Figure 4.11 and Table 4.4). However the confidence level for this projection is low.

The GCMs show inconsistent results across models for changes in tropical cyclone frequency for the northern basin, using either the direct detection methodologies (CVP or CDD) or the empirical methods described in Chapter 1. The direct detection methodologies tend to indicate a decrease in formation with almost half of results suggesting decreases of between 20 and 50%. The empirical techniques assess changes in the main atmospheric ingredients known to be necessary for tropical cyclone formation. About four-fifths of results suggest the conditions for tropical cyclone formation will become more favourable in this region. However, when only the models for which direct detection and empirical methods are available are considered, the assessment is for a decrease in tropical cyclone formation. These projections are consistent with those of Australian Bureau of Meteorology and CSIRO (2011).

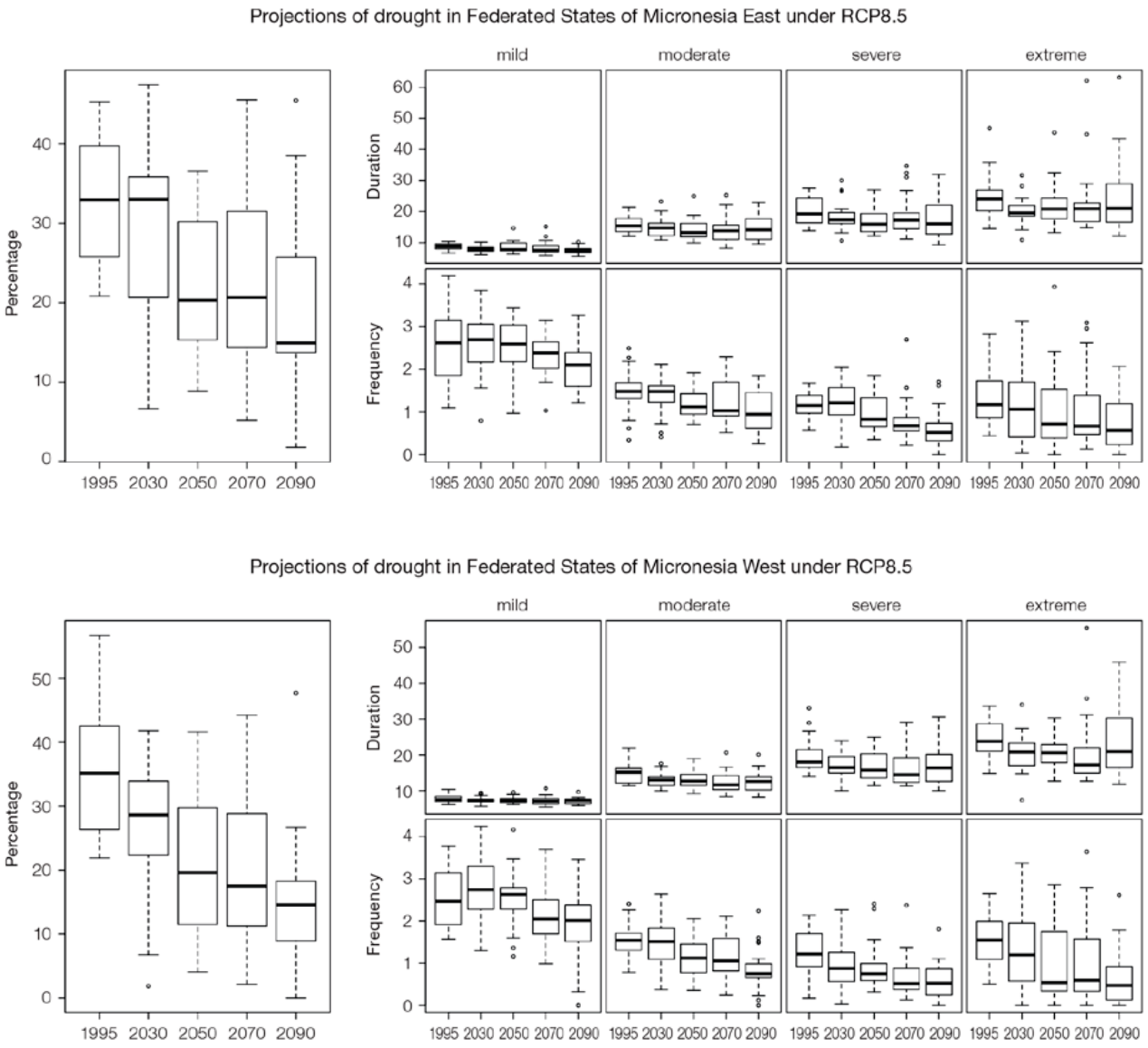

Figure 4.10: Box-plots showing percent of time in moderate, severe or extreme drought (left hand side), and average drought duration and frequency for the different categories of drought (mild, moderate, severe and extreme) for the eastern (top) and western (bottom) Federated States of Micronesia. These are shown for 20-year periods centred on 1995, 2030, 2050, 2070 and 2090 for the RCP8.5 (very high emissions) scenario. The thick dark lines show the median of all models, the box shows the interquartile (25–75%) range, the dashed lines show 1.5 times the interquartile range and circles show outlier results.

Table 4.4: Projected percentage change in cyclone frequency in the northern basin (0–15°N; 130–180°E) for 22 CMIP5 climate models, based on five methods, for 2080–2099 relative to 1980–1999 for RCP8.5 (very high emissions). The 22 CMIP5 climate models were selected based upon the availability of data or on their ability to reproduce a current-climate tropical cyclone climatology (See Section 1.5.3 – Detailed Projection Methods, Tropical Cyclones). Blue numbers indicate projected decreases in tropical cyclone frequency, red numbers an increase. MMM is the multi-model mean change. N increase is the proportion of models (for the individual projection method) projecting an increase in cyclone formation.

Model	GPI change	GPI-M change	Tippett	CDD	OWZ
access10	71	22	-54	71	
access13	55	48	-33	107	
bcccsm11	13	11	-22		2
canesm2	34	22	-47	24	
ccsm4				-81	-12
cnrm_cm5	0	-2	-25	-1	-23
csiro_mk36	7	-1	-30	8	15
fgoals_g2	-5	-15	-10		
fgoals_s2	-3	-3	-35		
gfdl-esm2m				-2	-8
gfdl_cm3	15	5	-17		-40
gfdl-esm2g				-33	-37
gisse2r	14	9	-17		
hadgem2_es	13	1	-57		
inm	25	26	-5		
ipslcm5alr	19	9	-17		
ipslcm5blr				-49	
miroc5				-52	-50
mirocesm	17	2	26		
mpim	19	17	-45		
mricgcm3	1	-3	-34		
noresm1m	-11	-17	-19	-42	
MMM	17	8	-26	-5	-19
N increase	0.8	0.7	0.1	0.4	0.3

4.5.4 Coral Reefs and Ocean Acidification

As atmospheric CO_2 concentrations continue to rise, oceans will warm and continue to acidify. These changes will impact the health and viability of marine ecosystems, including coral reefs that provide many key ecosystem services (*high confidence*). These impacts are also likely to be compounded by other stressors such as storm damage, fishing pressure and other human impacts.

The projections for future ocean acidification and coral bleaching use three RCPs (2.6, 4.5, and 8.5).

Ocean acidification

In the Federated States of Micronesia, the aragonite saturation state has declined from about 4.5 in the late 18th century to an observed value of about 3.9±0.1 by 2000 (Kuchinke et al., 2014). All models show that the aragonite saturation state, a proxy for coral reef growth rate, will continue to decrease as atmospheric CO_2 concentrations increase (*very high confidence*). Projections from CMIP5 models indicate that under RCPs 8.5 (very high emissions) and 4.5 (low emissions) the median aragonite saturation state will transition to marginal conditions (3.5) around 2030.

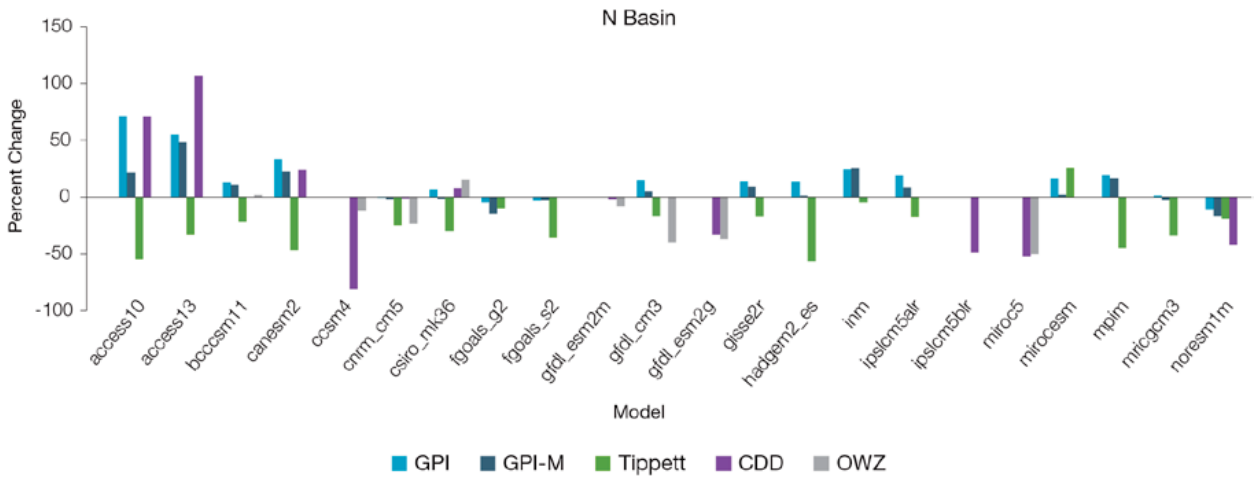

Figure 4.11: Projected percentage change in cyclone frequency in the northern basin (data from Table 4.4).

In RCP8.5 (very high emissions) the aragonite saturation state continues to strongly decline thereafter to values where coral reefs have not historically been found (< 3.0). Under RCP4.5 (low emissions) the aragonite saturation plateaus around 3.2 i.e. marginal conditions for healthy coral reefs. While under RCP2.6 (very low emissions) the median aragonite saturation state never falls below 3.5, and increases slightly toward the end of the century (Figure 4.12) suggesting that the conditions remains adequate for healthy corals reefs. There is *medium confidence* in this range and distribution of possible futures because the projections are based on climate models that do not resolve the reef scale that can play a role in modulating large-scale changes. The impacts of ocean acidification are also likely to affect the entire marine ecosystem impacting the key ecosystem services provided by reefs.

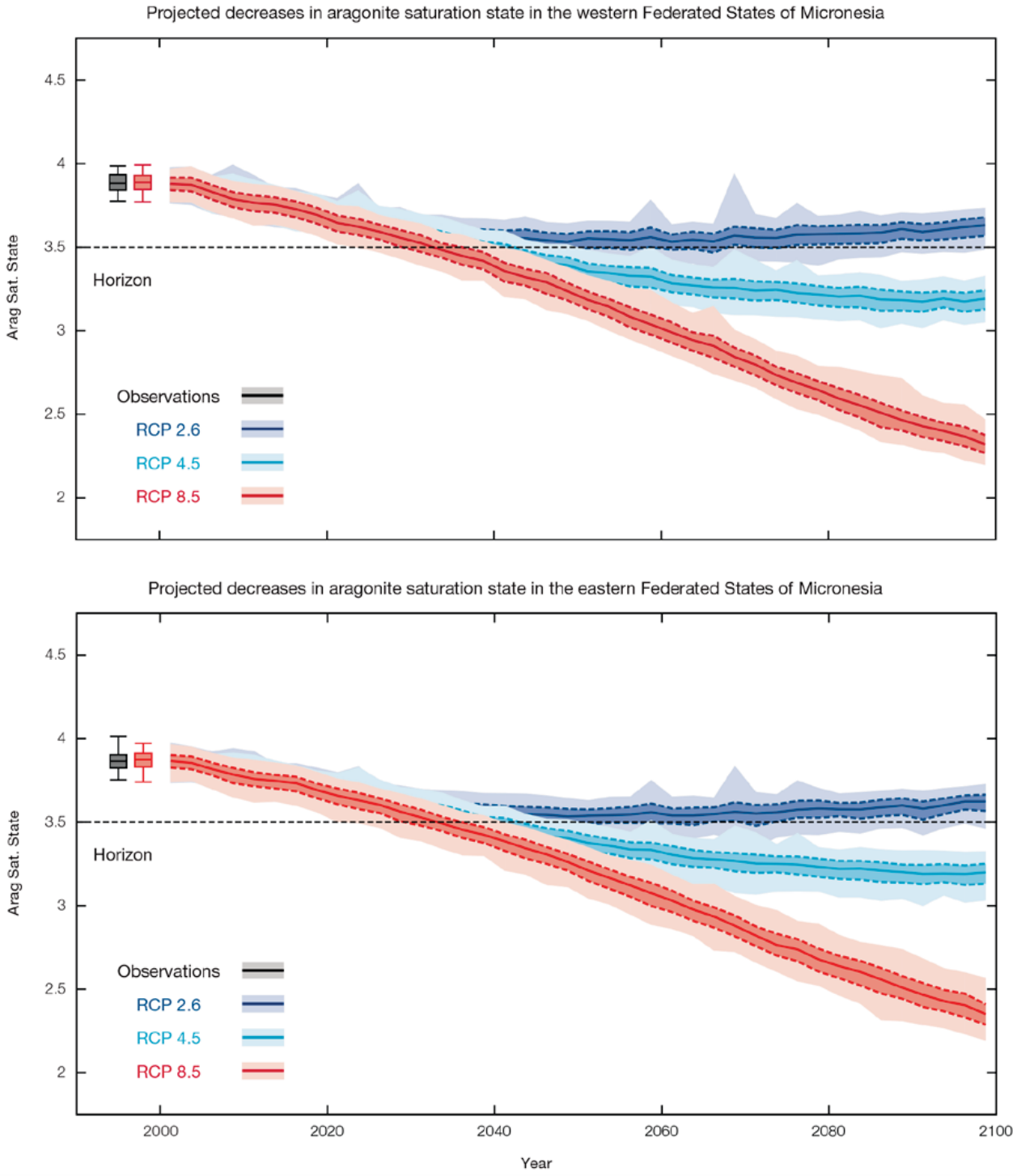

Figure 4.12: Projected decreases in aragonite saturation state in western (upper) and eastern (lower) Federated States of Micronesia from CMIP5 under RCPs 2.6, 4.5 and 8.5. Shown on this plots are the median values, the interquartile range (the dashed line), and 5% and 95% percentiles. The horizontal line represents the transition to marginal conditions for coral reef health (from Guinotte et al., 2003).

Coral Bleaching Risk

As the ocean warms, the risk of coral bleaching increases (*very high confidence).* There is *medium confidence* in the projected rate of change for the Federated States of Micronesia because there is *medium confidence* in the rate of change of SST, and the changes at the reef scale (which can play a role in modulating large-scale changes) are not adequately resolved. Importantly, the coral bleaching risk calculation does not account the impact of other potential stressors (Chapter 1).

The changes in the frequency (or recurrence) and duration of severe bleaching risk are quantified for different projected SST changes (Table 4.5). Overall there is a decrease in the time between two periods of elevated risk and an increase in the duration of the elevated risk. For example, under a long-term mean increase of 1°C (relative to 1982–1999 period), the average period of severe bleaching risk (referred to as a risk event) will last 9.4 weeks (with a minimum duration of 1.7 weeks and a maximum duration of 6.3 months) and the average time between two risks will be 1.9 years (with the minimum recurrence of 3.2 months and a maximum recurrence of 6.0 years). If severe bleaching events occur more often than once every five years, the long-term viability of coral reef ecosystems becomes threatened.

4.5.5 Sea Level

Mean sea level is projected to continue to rise over the course of the 21st century. There is *very high confidence* in the direction of change. The CMIP5 models simulate a rise of between approximately 7–18 cm by 2030 (very similar values for different RCPs), with increases of 41–90 cm by 2090 under the RCP8.5 (Figure 4.13 and Table 4.6). There is *medium confidence* in the range mainly because there is still uncertainty associated with projections of the Antarctic ice sheet contribution. Interannual variability of sea level will lead to periods of lower and higher regional sea levels. In the past, this interannual variability has been about 26 cm (5–95% range, after removal of the seasonal signal, see dashed lines in Figure 4.13 (a) and it is likely that a similar range will continue through the 21st century.

Table 4.5: Projected changes in severe coral bleaching risk for the Federated States of Micronesia EEZ for increases in SST relative to 1982–1999.

Temperature change [1]	Recurrence interval [2]	Duration of the risk event [3]
Change in observed mean	30 years	5.7 weeks
+0.25°C	26.9 years (25.4 years – 29.1 years)	5.2 weeks (4.9 weeks – 5.7 weeks)
+0.5°C	20.6 years (18.3 years – 23.3 years)	6.2 weeks (4.8 weeks – 8.8 weeks)
+0.75°C	7.4 years (2.9 years – 14.0 years)	7.2 weeks (2.7 weeks – 3.6 months)
+1°C	1.9 years (3.2 months – 6.0 years)	9.4 weeks (1.7 weeks – 6.3 months)
+1.5°C	5.4 months (1.1 months – 1.4 years)	4.6 months (1.8 weeks – 1.5 years)
+2°C	3.2 months (1.1 months – 5.4 months)	1.1 years (3.0 months – 5.1 years)

[1] This refers to projected SST anomalies above the mean for 1982–1999.
[2] Recurrence is the mean time between severe coral bleaching risk events. Range (min – max) shown in brackets.
[3] Duration refers to the period of time where coral are exposed to the risk of severe bleaching. Range (min – max) shown in brackets.

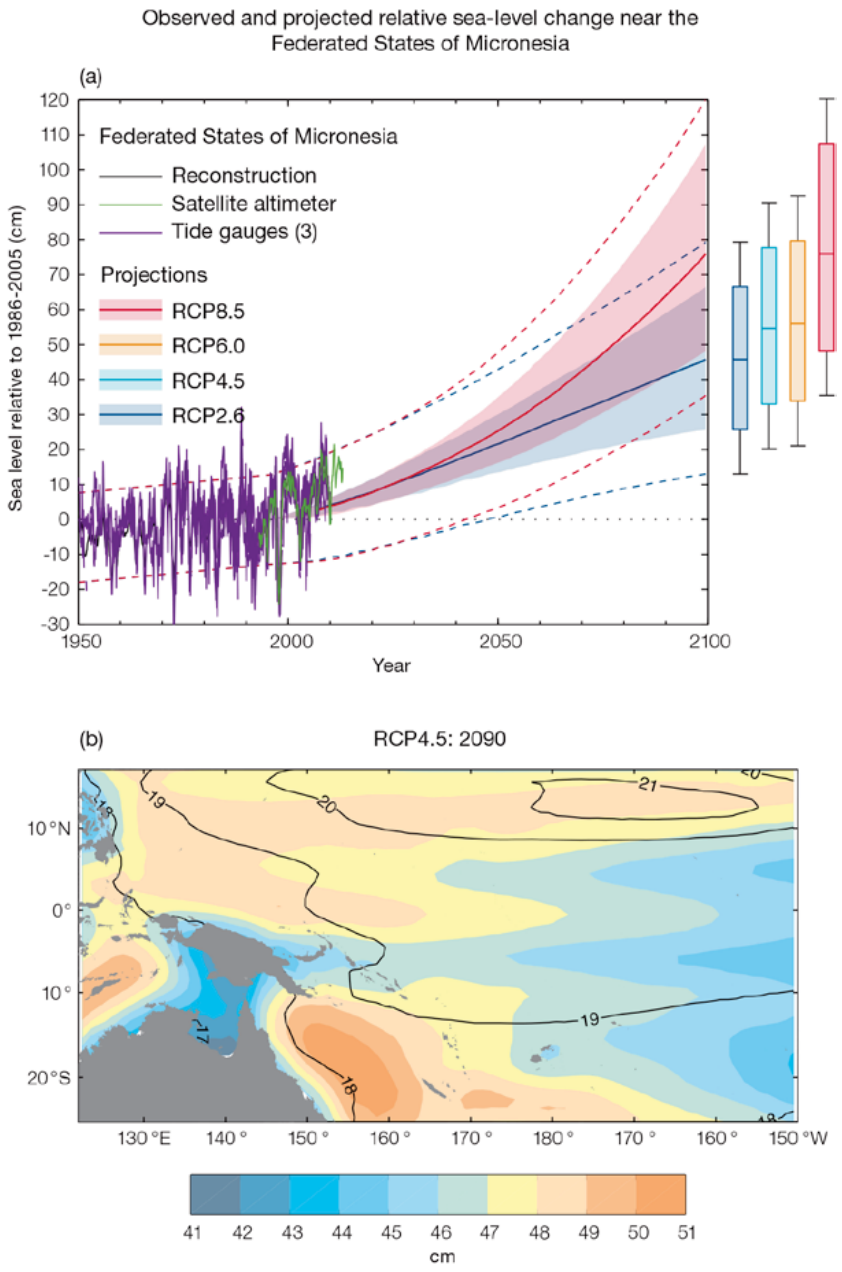

Figure 4.13: (a) The observed tide-gauge records of relative sea-level (since the late 1970s) are indicated in purple, and the satellite record (since 1993) in green. The gridded (reconstructed) sea level data at the Federated States of Micronesia (since 1950) is shown in black. Multi-model mean projections from 1995–2100 are given for the RCP8.5 (red solid line) and RCP2.6 emissions scenarios (blue solid line), with the 5–95% uncertainty range shown by the red and blue shaded regions. The ranges of projections for four emission scenarios (RCPs 2.6, 4.5, 6.0 and 8.5) 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% uncertainty range about the projections) and indicate that individual monthly averages of sea level can be above or below longer-term averages.

(b) The regional distribution of projected sea level rise under the RCP4.5 emissions scenario for 2081–2100 relative to 1986–2005. Mean projected changes are indicated by the shading, and the estimated uncertainty in the projections is indicated by the contours (in cm).

4.5.6 Wind-driven Waves

The projected changes in wave climate are spatially consistent across the Federated States of Micronesia.

In the western region, there is a projected decrease in December–March wave height and period (significant under RCP8.5, very high emissions in 2090) (Figure 4.14) with no change in direction *(low confidence)* (Table 4.8). In June–September there is no projected change in wave height, a small decrease in period is suggested, with a clockwise rotation toward the south implied, particularly under RCP8.5 (very high emissions) in 2090 *(low confidence)*. A decrease in the height of storm waves is suggested in December–March (*low confidence)*.

In the eastern region, projected changes in wave properties include a small decrease in wave height (significant under RCP8.5 very high emissions, by 2090) (Figure 4.15), with no change in wave period or direction during December–March (*low confidence)* (Table 4.9). During June–September, otherwise no significant changes are projected to occur in wave climate *(low confidence)*, with a suggestion of less variable wave directions. An increase in the height of storm waves is suggested in June–September *(low confidence)*.

There is *low confidence* in projected changes in the Federated States of Micronesia wind-wave climate because:

- Projected changes in wave climate are dependent on confidence in projected changes in the ENSO, which is low. and
- The differences between simulated and observed (hindcast) wave data can be larger than the projected wave changes, which further reduces our confidence in projections.

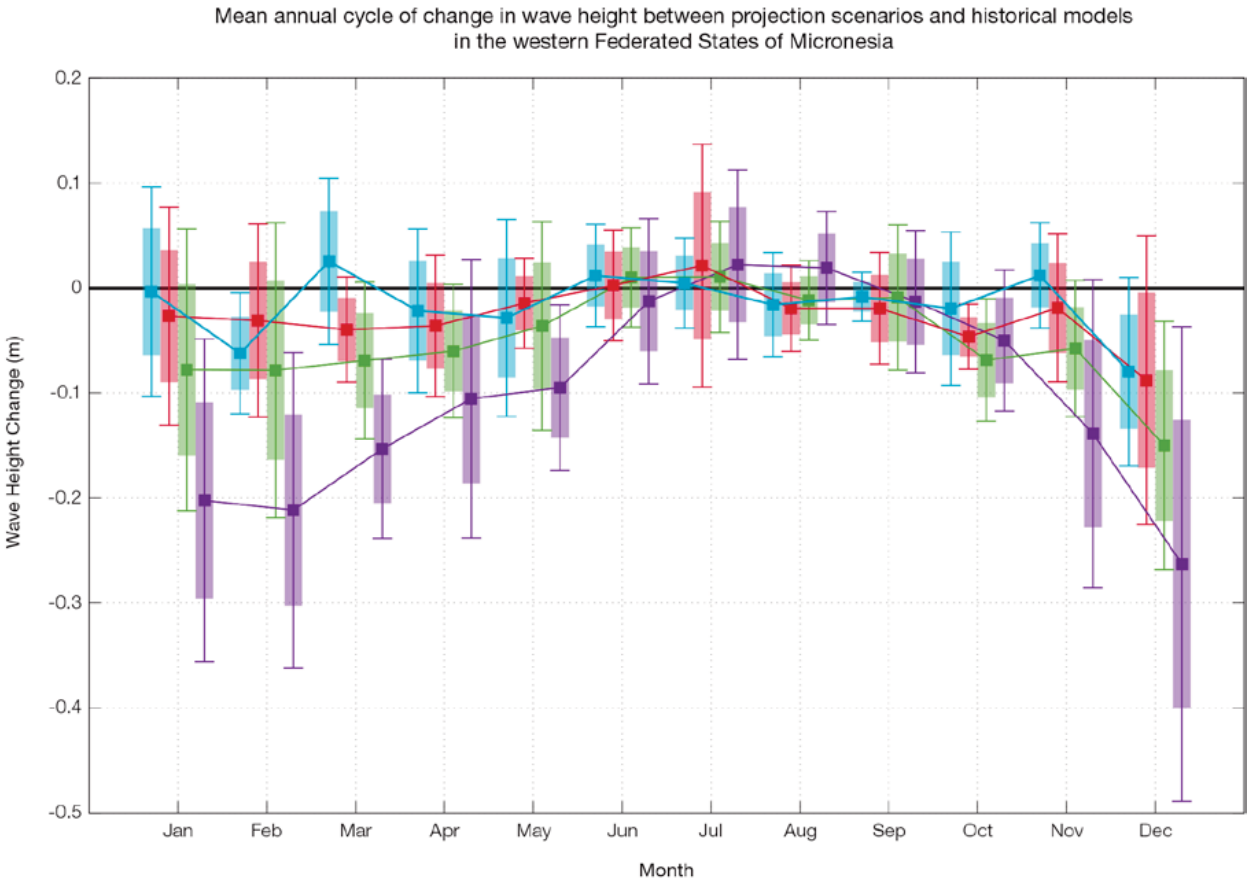

Figure 4.14: Mean annual cycle of change in wave height between projection scenarios and historical models in the western Federated States of Micronesia. This plot shows a decrease in wave heights in the dry season months (significant under RCP8.5, very high emissions by 2090), and no change in the wet season months. Shaded boxes show 1 standard deviation of models' means around the ensemble means, and error bars show the 5–95% range inferred from the standard deviation. Colours represent RCP scenarios and time periods: blue 2035 RCP4.5 (low emissions), red 2035 RCP8.5 (very high emissions), green 2090 RCP4.5 (low emissions), purple 2090 RCP8.5 (very high emissions).

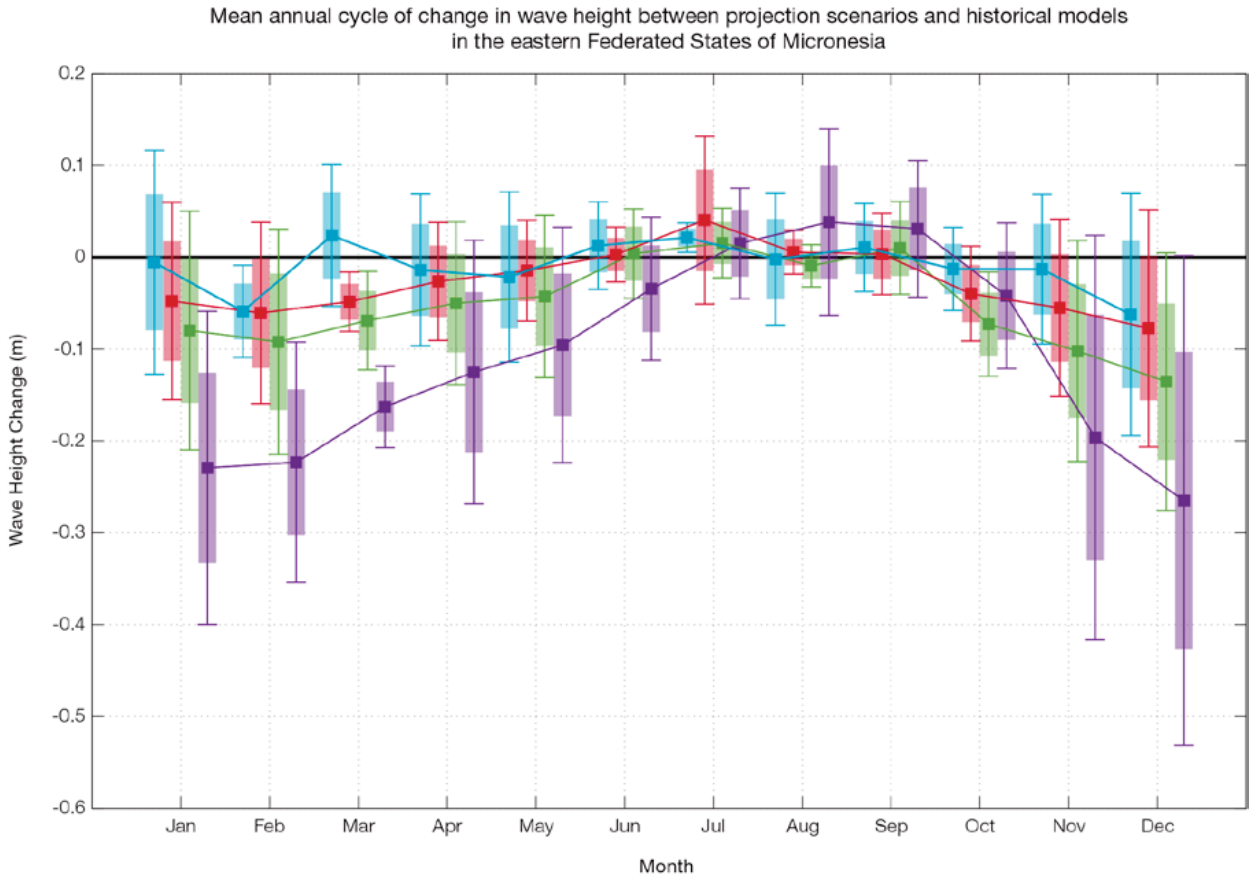

Figure 4.15: Mean annual cycle of change in wave height between projection scenarios and historical models in the eastern Federated States of Micronesia. This plot shows a decrease in wave heights in December–March (significant under RCP8.5, very high emissions, in 2090, as well as RCP4.5 2090 and RCP8.5, very high emissions, 2035 in March), and no significant change in June–September. Shaded boxes show 1 standard deviation of models' means around the ensemble means, and error bars show the 5–95% range inferred from the standard deviation. Colours represent RCP scenarios and time periods: blue 2035 RCP4.5 (low emissions), red 2035 RCP8.5 (very high emissions), green 2090 RCP4.5 (low emissions), purple 2090 RCP8.5 (very high emissions).

4.5.7 Projections Summary

There is *very high confidence* in the direction of long-term change in a number of key climate variables, namely an increase in mean and extremely high temperatures, sea level and ocean acidification. There is *high confidence* that mean annual rainfall and the frequency and intensity of extreme rainfall will increase. There is *medium confidence* that mean rainfall will increase and drought frequency will decrease.

Tables 4.6–4.9 quantify the mean changes and ranges of uncertainty for a number of variables, years and emissions scenarios. A number of factors are considered in assessing confidence, i.e. the type, amount, quality and consistency of evidence (e.g. mechanistic understanding, theory, data, models, expert judgment) and the degree of agreement, following the IPCC guidelines (Mastrandrea et al., 2010). Confidence ratings in the projected magnitude of mean change are generally lower than those for the direction of change (see paragraph above) because magnitude of change is more difficult to assess. For example, there is *very high confidence* that temperature will increase, but *medium confidence* in the magnitude of mean change.

Table 4.6: Projected changes in the annual and seasonal mean climate for the eastern Federated States of Micronesia under four emissions scenarios; RCP2.6 (very low emissions, in dark blue), RCP4.5 (low emissions, in light blue), RCP6 (medium emissions, in orange) and RCP8.5 (very high emissions, in red). Projected changes are given for four 20-year periods centred on 2030, 2050, 2070 and 2090, relative to a 20-year period centred on 1995. Values represent the multi-model mean change, with the 5–95% range of uncertainty in brackets. Confidence in the magnitude of change is expressed as *high*, *medium* or *low*. Surface air temperatures in the Pacific are closely related to sea-surface temperatures (SST), so the projected changes to air temperature given in this table can be used as a guide to the expected changes to SST. (See also Section 1.5.2). 'NA' indicates where data are not available.

Variable	Season	2030	2050	2070	2090	Confidence (magnitude of change)
Surface air temperature (°C)	Annual	0.7 (0.4–0.9)	0.8 (0.6–1.2)	0.8 (0.5–1.2)	0.8 (0.5–1.2)	*High*
		0.7 (0.5–1)	1.1 (0.8–1.4)	1.4 (1–1.9)	1.5 (1–2.1)	
		0.6 (0.4–0.9)	1 (0.7–1.4)	1.4 (1–2)	1.8 (1.3–2.6)	
		0.8 (0.6–1.1)	1.4 (1–1.9)	2.2 (1.6–3.1)	3 (2.1–4.1)	
Maximum temperature (°C)	1-in-20 year event	0.6 (0.1–1.1)	0.7 (0.3–1.2)	0.7 (0.3–1.1)	0.8 (0.3–1.1)	*Medium*
		0.6 (0.2–0.9)	0.9 (0.5–1.4)	1.2 (0.7–1.6)	1.3 (0.9–2.1)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		0.8 (0.3–1.1)	1.4 (0.8–2.2)	2.3 (1.4–3.4)	3.1 (2–4.3)	
Minimum temperature (°C)	1-in-20 year event	0.6 (0.4–0.9)	0.8 (0.5–1.3)	0.8 (0.4–1)	0.8 (0.3–1.1)	*Medium*
		0.7 (0.4–0.9)	1 (0.7–1.3)	1.3 (0.9–1.8)	1.4 (1–1.8)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		0.8 (0.5–1.1)	1.5 (1–2.1)	2.3 (1.7–3.2)	3.2 (2.3–4.3)	
Total rainfall (%)	Annual	3 (-3–9)	4 (-5–13)	6 (2–14)	6 (0–11)	*Medium*
		3 (-5–12)	5 (-1–12)	7 (1–20)	6 (-2–13)	
		3 (-3–9)	4 (-2–9)	5 (-5–12)	7 (-3–17)	
		3 (1–9)	6 (1–14)	8 (3–18)	12 (3–23)	
Total rainfall (%)	Nov-Apr	2 (-7–10)	3 (-7–10)	4 (-3–16)	6 (-2–15)	*Medium*
		1 (-12–15)	3 (-4–13)	5 (-5–16)	2 (-8–12)	
		2 (-6–10)	2 (-7–7)	4 (-8–18)	5 (-10–16)	
		1 (-5–6)	3 (-7–15)	4 (-8–13)	7 (-10–21)	
Total rainfall (%)	May-Oct	4 (-1–10)	5 (-3–15)	7 (1–13)	7 (1–14)	*Medium*
		4 (-3–10)	7 (1–14)	9 (-1–18)	9 (2–17)	
		3 (-3–12)	6 (-2–16)	7 (-1–13)	10 (-2–21)	
		5 (-1–12)	9 (2–16)	12 (-1–23)	18 (2–29)	
Aragonite saturation state (Ωar)	Annual	-0.3 (-0.6–0.0)	-0.4 (-0.7–-0.1)	-0.4 (-0.6–-0.1)	-0.3 (-0.6–-0.1	*Medium*
		-0.3 (-0.6–-0.1)	-0.5 (-0.8–-0.3)	-0.7 (-0.9–-0.5)	-0.8 (-1.0–-0.5)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		-0.4 (-0.6–-0.1)	-0.7 (-1.0–-0.5)	-1.1 (-1.4–-0.9)	-1.5 (-1.7–-1.3)	
Mean sea level (cm)	Annual	13 (8–18)	22 (14–30)	32 (20–45)	42 (24–60)	*Medium*
		12 (8–17)	22 (14–31)	35 (22–49)	48 (30–68)	
		12 (7–17)	22 (14–30)	34 (22–48)	49 (31–69)	
		13 (8–18)	26 (17–35)	43 (28–59)	64 (41–90)	

Table 4.7: Projected changes in the annual and seasonal mean climate for the western Federated States of Micronesia under four emissions scenarios; RCP2.6 (very low emissions, in dark blue), RCP4.5 (low emissions, in light blue), RCP6 (medium emissions, in orange) and RCP8.5 (very high emissions, in red). Projected changes are given for four 20-year periods centred on 2030, 2050, 2070 and 2090, relative to a 20-year period centred on 1995. Values represent the multi-model mean change, with the 5–95% range of uncertainty in brackets. Confidence in the magnitude of change is expressed as *high*, *medium* or *low*. Surface air temperatures in the Pacific are closely related to sea-surface temperatures (SST), so the projected changes to air temperature given in this table can be used as a guide to the expected changes to SST. (See also Section 1.5.2). 'NA' indicates where data are not available.

Variable	Season	2030	2050	2070	2090	Confidence (magnitude of change)
Surface air temperature (°C)	Annual	0.7 (0.5–0.9)	0.8 (0.6–1.1)	0.8 (0.5–1.2)	0.8 (0.4–1.2)	*High*
		0.7 (0.5–1)	1 (0.8–1.4)	1.3 (1–1.8)	1.5 (1–2.1)	
		0.6 (0.4–0.9)	1 (0.7–1.4)	1.4 (1.1–1.9)	1.8 (1.4–2.6)	
		0.8 (0.6–1.1)	1.4 (1.1–1.9)	2.2 (1.6–3.1)	3 (2.1–4)	
Maximum temperature (°C)	1-in-20 year event	0.6 (0.4–1)	0.8 (0.4–1.1)	0.7 (0.3–1.1)	0.8 (0.2–1.1)	*Medium*
		0.7 (0.3–0.9)	1 (0.5–1.3)	1.3 (0.8–1.6)	1.3 (0.8–2)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		0.8 (0.4–1.1)	1.5 (0.9–2.1)	2.3 (1.5–3.2)	3.2 (2–4.3)	
Minimum temperature (°C)	1-in-20 year event	0.7 (0.4–0.8)	0.8 (0.5–1.1)	0.8 (0.4–1)	0.8 (0.4–1)	*Medium*
		0.7 (0.3–0.8)	1 (0.7–1.2)	1.2 (0.8–1.7)	1.4 (1–1.7)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		0.8 (0.5–1.1)	1.5 (1–2)	2.3 (1.7–3.2)	3.2 (2.2–4.1)	
Total rainfall (%)	Annual	3 (-3–8)	3 (-4–8)	3 (-1–8)	3 (-1–8)	*Medium*
		3 (-4–8)	4 (-3–12)	6 (-3–13)	4 (-4–10)	
		0 (-6–5)	3 (-1–8)	3 (-6–10)	5 (-4–15)	
		2 (-1–7)	5 (-1–15)	7 (0–12)	10 (0–27)	
Total rainfall (%)	Nov-Apr	3 (-4–10)	2 (-6–12)	2 (-6–9)	2 (-5–11)	*Medium*
		2 (-7–11)	3 (-9–12)	5 (-7–27)	3 (-8–13)	
		1 (-5–7)	2 (-4–6)	3 (-10–12)	4 (-11–17)	
		2 (-4–8)	4 (-6–20)	4 (-11–15)	7 (-10–28)	
Total rainfall (%)	May-Oct	3 (-2–7)	5 (-1–14)	5 (-3–13)	4 (0–10)	*Medium*
		3 (0–9)	5 (-2–13)	7 (-1–14)	6 (-1–13)	
		1 (-5–5)	5 (-2–17)	4 (-3–12)	7 (-3–17)	
		3 (0–6)	7 (-2–18)	10 (-3–22)	14 (-2–31)	
Aragonite saturation state (Ωar)	Annual	-0.3 (-0.6–0.0)	-0.4 (-0.7–-0.1)	-0.4 (-0.7–-0.1)	-0.3 (-0.6–-0.1)	*Medium*
		-0.3 (-0.6–0.0)	-0.5 (-0.8–-0.3)	-0.7 (-0.9–-0.4)	-0.7 (-1.0–-0.5)	
		NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	NA (NA–NA)	
		-0.4 (-0.6–-0.1)	-0.7 (-1.0–-0.4)	-1.1 (-1.3–-0.8)	-1.4 (-1.7–-1.2)	
Mean sea level (cm)	Annual	13 (8–18)	22 (14–30)	32 (20–45)	42 (24–60)	*Medium*
		12 (8–17)	22 (14–31)	35 (22–49)	48 (30–68)	
		12 (7–17)	22 (14–30)	34 (22–48)	49 (31–69)	
		13 (8–18)	26 (17–35)	43 (28–59)	64 (41–90)	

Waves Projections Summary

Table 4.8: Projected average changes in wave height, period and direction in the eastern Federated States of Micronesia for December–March and June–September for RCP4.5 (low emissions, in blue) and RCP8.5 (very high emissions, in red), for two 20-year periods (2026–2045 and 2081–2100), relative to a 1986–2005 historical period. The values in brackets represent the 5th to 95th percentile range of uncertainty.

Variable	Season	2035	2090	Confidence (range)
Wave height change (m)	December–March	-0.0 (-0.2–0.2) -0.1 (-0.3–0.2)	-0.1 (-0.3–0.1) -0.2 (-0.4–-0.0)	*Low*
	June–September	+0.0 (-0.2–0.2) +0.0 (-0.1–0.2)	0.0 (-0.2–0.2) +0.0 (-0.1–0.2)	*Low*
Wave height change (ft)	December–March	-0.1 (-0.8–0.7) -0.2 (-1.0–0.7)	-0.3 (-1.0–0.4) -0.7 (-1.2–-0.1)	*Low*
	June–September	+0.0 (-0.7–0.7) +0.0 (-0.4 to 0.6)	0.0 (-0.6 to 0.6) +0.0 (-0.5 to 0.8)	*Low*
Wave period change (s)	December–March	-0.1 (-0.6–0.4) -0.1 (-0.6–0.5)	-0.1 (-0.7–0.5) -0.2 (-0.9–0.4)	*Low*
	June–September	0.0 (-0.6–0.6) -0.0 (-0.6–0.5)	-0.0 (-0.7–0.6) -0.1 (-0.7–0.5)	*Low*
Wave direction change (° clockwise)	December–March	0 (-10–10) 0 (-10–10)	0 (-10–10) 0 (-10–10)	*Low*
	June–September	+0 (-20–40) 0 (-20–40)	+0 (-20–30) +10 (-20–60)	*Low*

Table 4.9: Projected average changes in wave height, period and direction in the western Federated States of Micronesia for December–March and June–September for RCP4.5 (low emissions, in blue) and RCP8.5 (very high emissions, in red), for two 20-year periods (2026–2045 and 2081–2100), relative to a 1986–2005 historical period. The values in brackets represent the 5th to 95th percentile range of uncertainty.

Variable	Season	2035	2090	Confidence (range)
Wave height change (m)	December–March	-0.0 (-0.3–0.2) -0.0 (-0.3–0.2)	-0.1 (-0.3–0.1) -0.2 (-0.4–0.0)	*Low*
	June–September	0.0 (-0.2–0.2) 0.0 (-0.2 to0.2)	0.0 (-0.2–0.2) 0.0 (-0.2–0.2)	*Low*
Wave height change (ft)	December–March	-0.1 (-0.8–0.7) -0.1 (-0.9–0.7)	-0.3 (-1.0–0.5) -0.7 (-1.3–0.0)	*Low*
	June–September	0.0 (-0.6–0.6) 0.0 (-0.4–0.7)	0.0 (-0.4–0.7) 0.0 (-0.3–0.8)	*Low*
Wave period change (s)	December–March	-0.1 (-0.4–0.3) -0.1 (-0.5–0.3)	-0.1 (-0.5–0.3) -0.3 (-0.7–0.2)	*Low*
	June–September	0.0 (-0.4–0.4) 0.0 (-0.4–0.4)	-0.0 (-0.5–0.4) -0.1 (-0.6–0.4)	*Low*
Wave direction change (° clockwise)	December–March	0 (-5–5) 0 (-5–5)	0 (-10–5) -0 (-10–5)	*Low*
	June–September	+0 (-40–40) 0 (-40–40)	+0 (-30–40) +10 (-30–50)	*Low*

Wind-wave variables parameters are calculated for a 20-year period centred on 2035.

Road Households and Users Interviews

Road next to mangrove

1) Marcelyn Hairens - 50's. Five adults, 5 kids. Fish and farm. Never experience flooding before or after climate proofing the road. They use the road daily, they live there. The road is better, faster to reach school, fishing grounds and home. Their yard gets flooded in very high tide (lower than road).

2) Richard Allen Mackelung- 50's . Two adults and 4 kids. Him and wife fishes and farm. No flooding before (close to the road border). Before the road was open, they had to walk to the main road. Before the road was climate proofed, the high tide reached the border of the road, now the road is higher. He just have a complaint, when first approached to build the road (over ten years ago), he asked for a bridge to let their boats to reach to their house, but it was never done. The project should be done in other roads (the culverts and drainage).

3) Carson Sigrah- 50's. Lt. Governor of Kosrae. Has his home and also farms. With the road, is easier to reach school and work. Before the sea level was at the border of the road, now the road is higher. He would like that future farm roads to be constructed, to have bigger culverts and good drainage to be more resilient.

Road next to the freshwater swamp

4) Mr. Nena Miosi- 50's. Works at the Hospital. Two families live in the house, 6 adults and 4 children. Before there were occasions that the road flooded during heavy rain. Now the road it does not flood, except for one culvert (next to their house), that still is 12" D. They use the road everyday to go to work and school. They claim they can reach their jobs, schools and home faster.

5) Mr. Ashley Jackson- No house, farmland. Road flooded before during heavy rains. Not now. Before had to walk to main road. Faster to reach farm, easier to transport produce to his house and market. Complains about lack of maintenance and now that the road is OK, people robs their produce.

6) Pastor Robert Jackson- 50's. He works as the Director of the Kosrae Island Resource Management Authority, KIRMA. Has a house, even there is no electricity. He gets water from a river nearby. Has a farmland there too. The road makes the trips faster to school and work. He recommends having well designed drainages and bigger culverts to reduce damage by flooding.

7) Pastor Soloman Monkeya- 60's. No house, only farmland. He did not experience flooding of the road on his land. Very happy with the road, easier and faster to reach his land to farm. Before road, they came thru a channel by canoe. He wants other roads in Kosrae to be climate proofed too. Plans to move to his land once there is electricity and water available.

Interviews were made during May and October 2014.
On two days during October, we saw three cars parked at the road, while the owners worked in their farms. Also the road is popular with people going to the Melo and Okat river to swim during weekends.

ADAPTATION FUND BOARD SECRETARIAT TECHNICAL REVIEW OF PROJECT/PROGRAMME PROPOSAL

PROJECT/PROGRAMME CATEGORY: Regular-sized Project Concept

Country/Region: Federal State of Micronesia
Project Title: "ENHANCING THE RESILIENCE OF VULNERABLE ISLAND ATOLL COMMUNITIES IN FSM TO CLIMATE CHANGE RISKS THROUGH A "LIVING WITH THE SEA" NATIONAL RISK MANAGEMENT FRAMEWORK"
AF Project ID: FSM/RIE/Coastal/2015/1
IE Project ID: Requested Financing from Adaptation Fund (US Dollars): **$ 8,967,600**

Reviewer and contact person: Hugo Remaury Co-reviewer(s): Daouda Ndiaye
IE Contact Person: Espen Ronneberg

Review Criteria	Questions	Comments	SPREP Response
Country Eligibility	1. Is the country party to the Kyoto Protocol?	Yes. Signature: 17 March 1998 Ratification : 21 June 1999 Entry into force : 16 February 2005	
	2. Is the country a developing country particularly vulnerable to the adverse effects of climate change?	Yes. **CR 1**: It would be useful to be further document the document by providing information on specific studies and climate change risks scenarios for FSM.	**CR1**: The most recent climate change science and risks scenarios is contained in the Pacific Australia Climate Change Science and Adaptation Planning Programme "Climate Variability, Extremes and Change in the Tropical Western Pacific: New Science and Updated Country Reports 2014", Australian Bureau of Meteorology and CSIRO. The relevant pages are attached as an annex and the information can be inserted in a revised prodoc. (see FSM latest science and projections.pdf)
Project Eligibility	1. Has the designated government authority for the Adaptation Fund	Yes, letter dated 10th of February 2015, signed by the DA (Hon. Lorin S. Robert,	

	endorsed the project/programme?	Secretary (Minister) of Foreign Affairs)	
	2. Does the project / programme support concrete adaptation actions to assist the country in addressing adaptive capacity to the adverse effects of climate change and build in climate resilience?	To a certain extent. **CR 2**: Please demonstrate how the project strategy will make sure that the proposed plans, policies, regulations, guidelines, standards and protocols will yield the expected outcomes and support, as best possible, in enforcing these rules and regulations. **CR 3**: Please demonstrate that the most vulnerable local communities have been consulted and have identified the road infrastructure proposed in component 3 as a priority intervention for providing their communities with adaptation benefits. **CR 4**: Please discuss how investments under output 3.1 and output 3.2 component 3 will provide resilience to future climate change, and how these investments themselves will be made resilient to future climate change. **CR 5**. Output 1.5: Could you provide additional information on the tasks that will be implemented to ensure that the main objective of this output is met?	**CR 2**: The project strategy includes the notion that during the life of the project that any new or revised plans, policies, regulations, guidelines, standards and protocols are approved at the highest level (i.e State Cabinet and State Legislature) to ensure the regulated provisions for enforcement are in place during and after the project. Within that context, capacity building will be an important component of this strategy. Capacity building will be based on a needs analysis and a tailored capacity programme to meet any capacity gaps. This will also be addressed and completed during the life of the project in parallel to plans, policy, regulations review, development or amendments. If capacity is available the strategy will be implemented, enforced and through improved understanding and awareness the outcomes will be achieved. For example the guidelines on mainstreaming will require all relevant Government job descriptions to include climate change considerations. **CR 3**: Land owners along the coast and the road are the most vulnerable as their land is not only affected by increasing salt content and loss of land due to erosion thus affecting agriculture but vital services like transportation from schools, market, town centre were also disrupted when there is a high

			surge. Land owners were consulted to identify the root causes of their vulnerability and key actions required. A series of consultations were expedited in the 4 communities in Kosrae. `The results are also evident in the Shoreline management plan supporting that clearly identified those highly vulnerable areas around the island. This was carried out by KIRMA (see attached report Road Households and Users Interviews) **CR4**: These investments are targeted at what is arguably the currently most vulnerable section of Kosrae, in that a relatively large community resides in a relatively low and highly exposed coastal environment. The villages are the marginally vulnerable especially women and children. The investments under 3.1 and 3.2 will provide resilience in the short to medium term by reducing significant exposure of the marginal population from storm surges, king tides and severe coastal erosion exaggerated by accelerated sea level rise projected to increase for FSM with very high confidence. Further in the long term, it will increase the adaptive capacity through natural relocation inland of communities and businesses. Other government investments will naturally follow as a result (electricity and water utilities). The investments under 3.2 are clearly stated as “buying

			time" for the worst case scenarios in terms of climate change, and will build resilience in the short to medium term, given the poor state of the existing protections. Following on from the successful cost benefit analysis demonstration of the PACC project, the ADB's PPCR project has taken on the urgent request to carry out the CBA for the Malem-Utwe road reconstruction, (Output 3.1 investment). This measure will, prior to any site intervention, justify and determine the resiliency of the investment itself to future climate change. The sensitivity analysis specifies options that include other investments and how these are made to last in the longer term. **CR5**: It is envisaged to be a combination of formal training, workshops and seminars, and eventual peer-to-peer exchanges with the objective of strengthening partnerships, networking that promote policy compliancy. Further is the development or strengthening of action plans at the corporate and individual level. These plans include agreed criteria and standards for achieving key result areas in which performances of departments and individuals are measured. For example, setting up organizational values in departments and codes of conduct into staff contracts. Criteria such as environmental leadership,

			service delivery, knowledge sharing, gender perspectives, valuing people and partnerships are examples. Monitoring and evaluation baseline, indicator and target information will be drawn from here to help the project measure and ensure progress towards achieving this output. This will follow experiences gained under the PACC project in all its 14 participating countries, and will build on a number of capacity development tools now available such as the regional Mainstreaming Guide, and the Pacific Gender & Climate Change Toolkit (available online at www.sprep.org/pacc and wwwpacificclimatechange.net. portal)..
	3. Does the project / programme provide economic, social and environmental benefits, particularly to vulnerable communities, including gender considerations, while avoiding or mitigating negative impacts, in compliance with the Environmental and Social Policy of the Fund?	Yes, the proposed project has the potential to provide benefits to vulnerable communities. However, some questions persist as for the potential impacts of the project on involuntary resettlements and protection of natural habitats, as highlighted in the CR in section 13.	
	4. Is the project / programme cost effective?	Somewhat. **CR 6**. Please clarify how the proposed infrastructural investments have been chosen amongst potential alternatives, and how the decision analysis have led to the prioritization of the proposed activities.	**CR 6**: The investments have largely been chosen based on vulnerability assessments and community consultations, as well as climate change projections. Prioritization has been a consultative process with government officials and experts.

			Results of the assessments and consultations show that these areas are priorities that must be addressed under the climate change adaptation programmes and projects.
	5. Is the project / programme consistent with national or sub-national sustainable development strategies, national or sub-national development plans, poverty reduction strategies, national communications and adaptation programs of action and other relevant instruments?	Yes, the project is consistent with the relevant legislation discussed in the proposal. The *Nationwide Climate Change Policy (2009)* includes a commitment to addressing climate change adaptation through a framework in which: "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." This has now been replaced by the *Nationwide Integrated Disaster Risk Management and Climate Change Policy (2013).*	
	6. Does the project / programme meet the relevant national technical standards, where applicable, in compliance with the Environmental and Social Policy of the Fund??	Yes, however more information are needed concerning the EIA legislation and technical standards that will apply. **CR 7**. Please demonstrate the extent to which the EIA will be enforced for the activities proposed, and provide an update on the EIA legislation in FSM highlighting how the relevant standards will be applied through the implementation of the proposed project. **CR 8**. Please clarify what relevant	**CR 7**: All FSM EIA guidelines and its legal requirements are mirrored to US EPA. They are applied at State level in the FSM. The update to Kosrae State's EIA legislation includes the recent amendments under the Regulations for Development Project 2013, carried out under the PACC project. The new regulation now requires development activities in Kosrae State to take into account projected climate change

		technical standards (can be internationals if nationals do not exist yet) will be used where applicable in the proposed project.	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 amendments also considered consistency 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. Therefore, EIA is enforced as one of the key standard procedures of the 2013 regulation - to formally review development projects in FSM. In response then in how the relevant standards will be applied through the implementation of the proposed project, the project will require factoring in its work plans the following regulation requirements that (a) the project is to integrate the EIA process into its early planning stages to ensure 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) - also required. EIS is a comprehensive and detailed document

			that describes 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. To demonstrate the extent to which the EIA will be enforced for the activities proposed, the project will adhere to the regulations, the 2013 EIA Guidelines revised by the PACC project and approved by legislature; and guided by the 2014 Kosrae Shoreline Management Plan. At the same time, The application of the EIA requirements will form part of the broader Environmental and Social Management Plan Process (discussed below) . **CR 8**: Technical standards are thus those referred to by the 2013 Regulations for Development Project; the 2013 EIA Guidelines; and principles and strategies of the 2014 Kosrae Shoreline Management Plan. The Adaptation Fund Environmental and Social Safeguard principles will also be instructive throughout the ongoing design, planning and implementation of the project.,
	7. Is there duplication of project / programme with other funding sources?	**CR. 9**. Please update information on the GCCA project and explain how the proposed project will seek synergies and avoid duplication and clarify how the project will avoid duplication of activities	**CR 9**: The PPCR Funded program being implemented by SPREP/ADB does not have the establishment of a National Knowledge and Information System as one of its outputs so there is

		related to the establishment of a knowledge and information system with the PPCR-funded programme.	no duplication of activities at all between this AF proposal and the PPCR work A Knowledge Management component may have been one of the outputs of the PPCR Component 2 administered by WBG and implemented by SPC. However WBG have decided not to carry out activities in FSM and have relayed this message to the FSM National Government. The SPREP/ADB components are focused on (1) Integrating (mainstreaming) CC/DRR into national/sector plans/policies. This work focuses on cost benefit analysis, M and E, logical Frameworks, ODA proposals factoring in CC/DRR considerations (2) Providing TA to 14 Pacific Island Countries through an expedited and dedicated support mechanism of experts. Perhaps a TA to assist with the design a Knowledge Information System for Kosrae could be funded under a TA but not the costs of the system itself across FSM (4 states) including infrastructure +system for storing and managing information that is the focus of the proposed AF intervention.

	8. Does the project / programme have a learning and knowledge management component to capture and feedback lessons?	Yes. **CR 10**. Can you please describe the process that will allow lessons to be systematically captured, before project staff document them with the support of the CTA?	**CR 10**: The project will follow the experiences and processes that have been captured in the PACC project, by using easy to use templates to capture and then store information and lessons learned. Examples can be found at https://www.sprep.org/pacc/experiences and https://www.sprep.org/pacc/publications Individuals, staff, communities, groups (technical, committees) are encouraged to report success stories, lessons, experiences from the project that has improved (efficient, effective), or made impact (sustainability, relevant) on the ground. These are often captured via quarterly progress reports, site visit reports, training seminars, consultations, workshops and learning sessions. The lessons are then elaborated on further (review, check facts, figures, revise) with the sources and the communications and KM team, either in country or with SPREP. The idea then is to capture, share online or in other meetings, conferences, as well as stored online. Lessons and practices are further reviewed by technical expertise in SPREP and edited by the publications and KM team in SPREP. Final KM products are published articles, peer-reviewed journals, and technical reports. These are shared

			widely through systematic networks of the country and SPREP.
	9. Has a consultative process taken place, and has it involved all key stakeholders, and vulnerable groups, including gender considerations?	Yes, however the scope of this process needs to be further described. **CR 11**. Please describe in what extent the following stakeholders have been consulted, including proof of gender considerations, and evidences about the extent to which they support the implementation of the proposed solutions: - direct beneficiaries and local communities of this project, notably marginally vulnerable groups living in the targeted areas; - stakeholders responsible for land/costal management; - land users and land owners; - private sectors (including construction sector); - Universities/research centres.	**CR 11**: As reflected in the terminal review for the PACC project, all the 4 municipalities and the leadership had been consulted thru workshops, site visits, survey (SEAPACC), CC legislation 10-2, Strategic Development Plan (SDP), JSAP (DRR/CCA), Gender policy now factoring climate resilience, the cc proofing of the shoreline management plan first in FSM, Loss & Damage case study assisted by United Nations University also address climate change impacts in Kosrae. (see attached UNU study on FSM)
	10. Is the requested financing justified on the basis of full cost of adaptation reasoning?	**CR 12**. As there are currently a wide range of initiatives that includes activities that have a close link with the proposed project, it seems relevant to outline how the project will deliver its outcomes and outputs, regardless of the success of	**CR 12**: The PPCR project in FSM is being coordinated by the PPCR Team based at SPREP. There are regular team meetings that include relevant staff from the Climate Change Division and this procedure will be stepped up

		these other projects.	once the FSM project is approved. Similarly the GCCA project that is operating in FSM also provides for a Climate Change Coordination Adviser based at SPREP in the Climate Change Division, who regularly provides briefs on activities in FSM – both to the PPCR team and the Division. Through such regular consultative processes SPREP will ensure that there are synergies with these project activities.
	11. Is the project / program aligned with AF's results framework?	No. **CR 13**. The alignment table is not properly completed as it does not include AF outcome or output indicators. Please update the document accordingly.	**CR 13**: SPREP notes this recommendation and requests that it provide an updated and fully aligned results framework in future version of the ProDoc.
	12. Has the sustainability of the project/programme outcomes been taken into account when designing the project?	Yes, but additional information are needed as for the rationality of the reasoning provided. **CR 14**. The proposal suggests that the local capacity that will be built will demonstrate "*that in the FSM context, communities can maintain the physical constructions*". Please describe in more details the rationale for this assumption, by for example providing examples of previously experiences, and highlight what capacity gaps had been overcome in such cases to allow community maintenance of infrastructure, and how the project sustainability strategy will	**CR 14**: The long-term sustainability of the project will depend greatly on the extent to which national institutional capacities can be built through the pilot activities and the notion that this is resilient development rather than a short term activity. As shown by the support letters the project has strong government support at the highest levels as well as with the communities. With this support as a foundation, the

		build upon these lessons learned.	capacity building components of the project will empower stakeholders at all levels, from community members to State policymakers, all with a greater understanding of climate change risks, adaptation options and enhanced adaptive capacity. A number of measures are planned, to set the grounds for ensuring long-term institutional, political and financial sustainability. A phased approach will enable interventions to be scheduled within the absorptive capacities of existing institutions. The nature of the interventions is also such that community and government support is intrinsic in their successful delivery, and in many cases lessons learned from previous projects will be applied to support longer term sustainability. For example: • Land-use setback is a voluntary adaptation measure that involves strategic and sustainability planning between government and targeted beneficiaries. It is acknowledged by the project team that the current legislative setting is not actively supporting of this intervention, and that is why the project's sustainability strategy is to ensure that regulations are strengthened, plans are

			developed and set up, awareness and advocacy campaigns that target community groups such as Island Development Committees in FSM are carried out. • Retention and replanting of coastal vegetation such as mangrove plantation is alow-cost community activity. Based on past initiatives, the effectiveness of mangrove plantation largely depends on availability of fencing to prevent feral pigs from eating mangrove seedlings. Thus, the cost of mangrove plantation includes the necessary fencing costs The project's sustainability strategy therefore also aims to capture experiences between States as well as from other islands (Maldives, Samoa, Vanuatu, Cook Islands) and tailor it to inform development processes and improve regulation and strengthen planning and the enabling environment. As with many of the activities in this proposal, this element will also build on the highly successful PACC project, its experiences and lessons learned which have been well documented. It will in

			part be underpinned by the local capacity that will be built, and the enhanced institutional capacity that will come through the mainstreaming activities. Based on a high level of community and government 'buy-in', including integration into development plans and regulation; practical and low cost maintenance; and practical application of lessons learned from other comparable projects in the region, the the project's long-term results are assured to the highest extent.
	13. Does the project / programme provide an overview of environmental and social impacts / risks identified?	No. **CR 15**. The risks table under section K (p. 49) concludes that for none of the 15 principles of the ESP further assessment or management inputs are required. This is inconsistent with the programme approach under which for each sub-project the environmental and social risks remain to be identified and assessed as needed. For example, the table states that no further assessment is required for compliance with the principle on involuntary resettlement but at the same time the possibility and modalities of coastal village relocation are discussed. Another example is on compliance with the principle on protection of natural habitats - no further	**CR 15/16**: The project contains a number of elements which will trigger consideration of the Adaptation Fund Environmental and Social Safeguards principles, in particular with regard to outcome area 3. SPREP requests that it provide an update against the 'Checklist of environmental and social principles' in an updated version of the ProDoc. SPREP anticipates developing a detailed Environmental and Social Management Plan that will analysis each outcome and associated outputs (as well as the underlying process) against each of the relevant environmental and social impact areas. Based on this assessment appropriate management strategies and / or

		assessment is said to be required since habitat protection is at the forefront of the programme. Yet, the largest programme activity that also already has been identified - the new road construction in Kosrae - is located in what appear to be forested areas and will have an impact on these natural habitats. Please demonstrate in a rational way the proposed project compliance with the environmental and social principles as outlined in the ESP, including how relevant standards will be applied through the project implementation, when applicable. Further assessment is notably required for principles on access and equity, marginalized and vulnerable groups, gender equity and women's empowerment, indigenous peoples (it doesn't state that there is none), involuntary resettlement, protection of natural habitats, physical and cultural heritage and land and soil conservation. As a number of EIAs (and/or ESIAs) are to be prepared during the project implementation, an ESMP will be requested at the full proposal stage. **CR 16**. Please categorize the proposed programme in line with the ESP (A, B or C).	modifications to project delivery will be undertaken. With regard to Outcome area 3 (delivery of new/upgraded road sections and sea wall construction) SPREP will apply (as part of the ESMP process described above) dedicated Environmental Impact Assessments, as required, consistent with the existing (and emerging) standards within FSM regulation. **CR 16**: SPREP requests that it provide a risk Category rating in an updated version of the Pro Doc.
Resource Availability	1. Is the requested project / programme funding within the cap of the country?	Yes.	
	2. Is the Implementing Entity	Yes.	

	Management Fee at or below 8.5 per cent of the total project/programme budget before the fee?	**CR 17**: Please clarify the reasoning behind the budget allocation to "Project Cycle Management Fee charged by the national government". According to the AF guidelines, only implementing entities can charge the budget with fees, not national governments.	**CR 17**: We note the comments from AF as well as compliance to the AF guidelines. SPREP will ensure this is rectified and Government notified accordingly. SPREP requests submission of revised budget. The revision will not have an impact on overall funding request nor at major component level.
	3. Are the Project/Programme Execution Costs at or below 9.5 per cent of the total project/programme budget (including the fee)?	Yes.	
Eligibility of IE	4. Is the project/programme submitted through an eligible Implementing Entity that has been accredited by the Board?	Yes.	
Implementation Arrangements	1. Is there adequate arrangement for project / programme management?	**CR 18**. Please clarify the following sentence: "SPREP will be engaged, through single source selection, to manage the program. As such, SPREP will have responsibility for the daily management of program implementation and for providing the required technical advice for the project. SPREP will also manage and administer studies and surveys, training programs, workshops, and conferences, including subcontracting service providers such as academic and training institutions, NGOs, and community-based organizations as necessary." It should be clarified whether SPREP will act only as an IE or if it will also act as an EE (hence using the $450,000 execution costs). The letter of	**CR 18**: SPREP would be the implementing entity, and is selected by FSM through single source selection, as there are no other RIEs in the Pacific which FSM could work with. The list of activities is an indicative list of possible services that SPREP may be requested to provide to FSM. These would be provided as part of the SPREP regular work program in delivering services upon request to Pacific Island States and Territories that are members of SPREP, and not related to SPREP's role as the RIE. SPREP will thus not have an EE role. **CR 19**: The services that SPREP MAY provide to OEEM will be listed in Annex

		endorsement does not refer to SPREP as an EE, but OEEM. As a reminder, and as per the AF operational policies and guidelines, when an entity intends to serve both as the implementing entity and the executing entity for a project/programme, the execution costs are capped at 1.5% of the total budget requested, before the implementing entity fees. **CR 19**. Please clarify the services that SPREP will provide to the OEEM, as they are not listed in annex G unlike stated. Similarly, please clarify what stakeholders will be part of the Project Board, as there is no mention of this in Part II/Section H, unlike stated. **CR 20**. Please confirm that the Project Implementation unit will be located within the OEEM, as there may be a typo in the document, paragraph 5, page 52.	G, and will inter alia include: management and administration of studies and surveys, training programs, workshops, and conferences, including subcontracting service providers such as academic and training institutions, NGOs, and community-based organizations as necessary. **CR 20**: We confirm that the Project Implementation Unit will be located within the OEEM.
	2. Are there measures for financial and project/programme risk management?	N/A	
	3. Are there measures in place for the management of for environmental and social risks, in line with the Environmental and Social Policy of the Fund? Proponents are encouraged to refer to the draft Guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social	N/A	

	Policy, for details.		
	4. Is a budget on the Implementing Entity Management Fee use included?	N/A	
	5. Is an explanation and a breakdown of the execution costs included?	N/A	
	6. Is a detailed budget including budget notes included?	N/A	
	7. Are arrangements for monitoring and evaluation clearly defined, including budgeted M&E plans and sex-disaggregated data, targets and indicators?	N/A	
	8. Does the M&E Framework include a break-down of how implementing entity IE fees will be utilized in the supervision of the M&E function?	N/A	
	9. Does the project/programme's results framework align with the AF's results framework? Does it include at least one core outcome indicator from the Fund's results framework?	See CR 13.	
	10. Is a disbursement schedule with time-bound milestones included?	N/A	

Technical Summary	The overall objective of the proposed programme is to support the four State governments in FSM in building an institution frameworks and development planning tools to help coastal communities to adapt to future higher sea levels. The proposed interventions are foreseen to bring the following benefits: 1. Developing the capacity of the FSM government to deliver climate resilient policies and enforce regulations for the coastal zones in all FSM states. 2. Reducing the vulnerabilities of coastal communities and infrastructure investments to climate risks through adaptation measures and capacity building efforts. 3. Increasing resilience of coastal communities through the delivery of engineering infrastructures in Kosrea.

	The project concept does not provide enough information in some sections of the proposal to fully evaluate the proposed project. As a result, the concept needs to be revised before it can be recommended for endorsement. The initial review made 20 Clarifications Requests (CR) where further information are requested, to allow a full review of the proposed project: **CR 1**: It would be useful to be further document the document by providing information on specific studies and climate change risks scenarios for FSM. **CR 2**: Please demonstrate how the project strategy will make sure that the proposed plans, policies, regulations, guidelines, standards and protocols will yield the expected outcomes and support, as best possible, in enforcing these rules and regulations. **CR 3**: Please demonstrate that the most vulnerable local communities have been consulted and have identified the road infrastructure proposed in component 3 as a priority intervention for providing their communities with adaptation benefits. **CR 4**: Please discuss how investments under output 3.1 and output 3.2 component 3 will provide resilience to future climate change, and how these investments themselves will be made resilient to future climate change. **CR 5**. Output 1.5: Could you provide additional information on the tasks that will be implemented to ensure that the main objective of this output is met? **CR 6**. Please clarify how the proposed infrastructural investments have been chosen amongst potential alternatives, and how the decision analysis have led to the prioritization of the proposed activities. **CR 7**. Please demonstrate the extent to which the EIA will be enforced for the activities proposed, and provide an update on the EIA legislation in FSM highlighting how the relevant standards will be applied through the implementation of the proposed project. **CR 8**. Please clarify what relevant technical standards (can be internationals if nationals do not exist yet) will be used where applicable in the proposed project. **CR. 9**. Please update information on the GCCA project and explain how the proposed project will seek synergies and avoid duplication and clarify how the project will avoid duplication of activities related to the establishment of a knowledge and information system with the PPCR-funded programme. **CR 10**. Can you please describe the process that will allow lessons to be systematically captured, before project staff document them with the support of the CTA? **CR 11**. Please describe in what extent the following stakeholders have been consulted, including proof of gender considerations, and evidences about the extent to which they support the implementation of the proposed solutions: - direct beneficiaries and local communities of this project, notably marginally vulnerable groups living in the targeted areas; - stakeholders responsible for land/costal management; - land users and land owners; - private sectors (including construction sector);

	- Universities/research centres. **CR 12**. As there are currently a wide range of initiatives that includes activities that have a close link with the proposed project, it seems relevant to outline how the project will deliver its outcomes and outputs, regardless of the success of these other projects. **CR 13**. The alignment table is not properly completed as it does not include AF outcome or output indicators. Please update the document accordingly. **CR 14**. The proposal suggests that the local capacity that will be built will demonstrate "*that in the FSM context, communities can maintain the physical constructions*". Please describe in more details the rationale for this assumption, by for example providing examples of previously experiences, and highlight what capacity gaps had been overcome in such cases to allow community maintenance of infrastructure, and how the project sustainability strategy will build upon these lessons learned. **CR 15**. The risks table under section K (p. 49) concludes that for none of the 15 principles of the ESP further assessment or management inputs are required. This is inconsistent with the programme approach under which for each sub-project the environmental and social risks remain to be identified and assessed as needed. For example, the table states that no further assessment is required for compliance with the principle on involuntary resettlement but at the same time the possibility and modalities of coastal village relocation are discussed. Another example is on compliance with the principle on protection of natural habitats - no further assessment is said to be required since habitat protection is at the forefront of the programme. Yet, the largest programme activity that also already has been identified - the new road construction in Kosrae - is located in what appear to be forested areas and will have an impact on these natural habitats. Please demonstrate in a rational way the proposed project compliance with the environmental and social principles as outlined in the ESP, including how relevant standards will be applied through the project implementation, when applicable. Further assessment is notably required for principles on access and equity, marginalized and vulnerable groups, gender equity and women's empowerment, indigenous peoples (it doesn't state that there is none), involuntary resettlement, protection of natural habitats, physical and cultural heritage and land and soil conservation. As a number of EIAs (and/or ESIAs) are to be prepared during the project implementation, an ESMP will be requested at the full proposal stage. **CR 16**. Please categorize the proposed programme in line with the ESP (A, B or C). **CR 17**: Please clarify the reasoning behind the budget allocation to "Project Cycle Management Fee charged by the national government". According to the AF guidelines, only implementing entities can charge the budget with fees, not national governments. **CR 18**. Please clarify the following sentence: "SPREP will be engaged, through single source selection, to manage the program. As such, SPREP will have responsibility for the daily management of program implementation and for providing the required technical advice for the project. SPREP will also manage and administer studies and surveys, training programs, workshops, and conferences, including subcontracting service providers such as academic and training institutions, NGOs, and community-based organizations as necessary."

	It should be clarified whether SPREP will act only as an IE or if it will also act as an EE (hence using the $450,000 execution costs). The letter of endorsement does not refer to SPREP as an EE, but OEEM. **CR 19**. Please clarify the services that SPREP will provide to the OEEM, as they are not listed in annex G unlike stated. Similarly, please clarify what stakeholders will be part of the Project Board, as there is no mention of this in Part II/Section H, unlike stated. **CR 20**. Please confirm that the Project Implementation unit will be located within the OEEM, as there may be a typo in the document, paragraph 5, page 52.
Date:	19 February 2015