



PACIFIC ADAPTATION TO CLIMATE CHANGE

REPUBLIC OF THE MARSHALL ISLANDS PROJECT PROPOSAL



Developed in collaboration with the Office of Environmental
Coordination Policy Coordination, Republic of the Marshall Islands

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PACC PROJECT SUMMARY

- I. Country – Republic of the Marshall Islands
- II. Title – MARSHALL ISLANDS PACC PROJECT: A Whole Island Approach to Climate Change Adaptation
- III. National Executing Body – The Office of Environmental Planning and Policy Coordination, Office of the President, Republic of the Marshall Islands
- IV. Cost of Project – USD 900,000 Co-Financing – USD 6,375,000
- V. Funding Agency – Global Environment Facility (GEF)
- VI. Implementing Agency – United Nations Development Programme (UNDP)
- VII. Background to the Consultation

The Republic of the Marshall Islands became the thirteenth country to be part of the Pacific Adaptation to Climate Change project on the 11th of December 2007. As a result of this development, an in-country consultation was carried out with government agencies, quasi-government organizations, and non-state actors as well as members of State governments of the Republic of the Marshall Islands on the 19th - 27th of February 2008.

This proposal is a result of discussions held at the national level and it details the PACC proposal for the Marshall Islands. Information on the climate change vulnerabilities faced by the Marshalls is provided with background information on current development efforts that are being undertaken at present. The consultation was facilitated by the Secretariat of the Pacific Regional Environment (SPREP), the implementation partner of the UNDP-GEF PACC project.

This proposal is divided into four main parts. Part I general introduction, Part II Background, Part III baseline scenario and PACC intervention and Part IV, PACC project details.

VIII. The Pacific Adaptation to Climate Change (PACC) project

The principal objective of the PACC is to facilitate the implementation of long-term adaptation measures to increase the resilience of a number of key development sectors in the Pacific island countries to the adverse impacts of climate change. A framework for PACC (PACC framework) will be developed through a consultative process involving all relevant stakeholders (including national governments and their respective agencies, institutions, departments and ministries, and non-government organizations, where appropriate, CROP agencies, donor partners, private sector, where appropriate, and others deemed necessary). The PACC framework will guide the implementation of the PACC at the national (including community and/or village) and regional levels.

For PACC Marshall Islands, the project will demonstrate the benefits of taking climate change into consideration in the water sector so as to better prepare for future climate change risks. The PACC project hopes to address the issue of high evaporation rates of current water storage facilities in the Marshall Islands. Unrestricted water utilization levels for Majuro have been estimated to be about 45 gallons per person per day, which equals 170 L/p/d. Past projects planned for Majuro have targeted 40 gallon/day (g/p/d) with an estimated current population 1994 of 25 000 results in a daily consumption of 1 million gallon. Hence, the storage provided by the existing reservoirs (23 Mega gallon) is less than a months supply in times of drought. This is a very vulnerable situation and if there are more El Nino like events in a future climate change scenario, serious socio-economic repercussion would come about for the island of Majuro. Overall, the PACC project promotes a broad based integrated intervention that takes into consideration policy issues related to water conservation particularly during droughts at the national and sectoral level. It also hopes to demonstrate a whole island approach to climate change adaptation that carefully considers water usage by other sectors particularly agriculture during droughts. A better understanding of the different vulnerabilities and risks for Majuro would provide valuable insight to improving the current and future adaptive capacity of Marshall Island people now and into the future.

IX. Eligibility to the GEF

The Marshall Islands will be part of 12 other Pacific Island countries that would be accessing the Special Climate Change Fund (SCCF) of the GEF. The Marshall Islands has ratified the United Nations Framework Convention on Climate Change (UNFCCC) in March 1992 and the Kyoto Protocol (KP) in March 2003. It is therefore, eligible under the guidance and procedures of the GEF to access GEF resources and financing for its adaptation programmes. The PACC project has been endorsed by the GEF operational focal point and a letter to that effect has been sent to the GEF and SPREP.

X. Linkages to regional/national sustainable development priorities

The PACC project is very closely aligned to the Marshall Islands Vision 2018, which details the policy direction for the Marshall Islands in terms of development. A key component of the plan is environment sustainability to ensure development is sustainable. At the regional level, the work of the PACC fits in very well with the Pacific Islands Framework Convention on Climate Change which is a regional document detailing priorities of Pacific Island countries on climate change.

At the national level, the proposed project will have strong linkages to a number of on-going UNDP-GEF enabling activities such as the National Capacity Self-Assessment (NCSA) activities, as well as with other UNDP funded activities in the area of sustainable energy including the UNDP-GEF funded Marshall Islands Renewable Energy (ADMIRE). There is also a clear complementarity between the PACC project and another GEF project to be implemented through UNDP in the Marshall Islands; the Integrated Water Resources Management (IWRM). IWRM hopes to demonstrate sustainable water resource and wastewater management in the Laura area, Majuro Atoll. The overall project purpose is to achieve improved water resources management, reduction in groundwater pollution from inadequate wastewater facilities, piggeries, cemeteries and landfills and improved water supply on and around the Laura area. This will be carried out with the provision of

infrastructure and improved management to protect the Laura groundwater lens, the largest natural water resource in Majuro which provides support to the public reservoirs for over 30,000 residents.

I. GENERAL INTRODUCTION

1.1 The need for adaptation to climate change

1. It is recognized by the International Panel on Climate Change (IPCC) that developing countries particularly Small Island Developing States are particularly vulnerable to climate change (IPCC AR4, 2007). The future of many of our island nations is being shaped by climate change events. The effects of climate change, and the need for concerted and coordinated action to address its effects, are no longer a matter of political debate. For some Pacific Island countries, it is a question of survival.

2. Pacific island countries are among the most vulnerable nations in the world to the impacts of extreme weather events. The most substantial impacts of climate change include losses of coastal infrastructure and land, more intense cyclones and droughts, failure of subsistence crops and coastal fisheries, losses of coral reefs and mangroves, and the spread of certain diseases. Climate change will affect the Pacific way of life and the sustainable development of our islands in profound ways unless we start to think about how we can adapt to the changes.

3. Generally for the Pacific region, climate changes are expected to include:

i) Increased average air and ocean temperatures – which will have impacts on precipitation, sea levels, winds, tides and other key climate conditions.

ii) Increases in sea-surface temperature – which has been linked to increases in the frequency and severity of tropical cyclones.

iii) Sea-level rise – as ocean temperatures rise, thermal expansion of ocean waters leads to a rise in sea levels causing loss of land, coastal erosion and increased salt intrusion.

iv) Greater climate extremes – e.g. droughts, storms and floods.

v) Changes in rainfall – the effect will vary across different island countries, and will impact on water resource management, particularly in areas dependent on shallow aquifers and rainwater harvesting.

4. The impact of climate change in the Pacific Islands region is likely to be more severe than in other areas because of the unique geographical, socio-cultural and economic characteristics of PICTs. These impacts are likely to include the following:

- *Agriculture sector* – Food insecurity concerns resulting from reduced food production due to salt-water intrusion and soil salinity; excessive rainfall; increased flooding; soil erosion; and shift of habitat for certain crops that will

grow only in cooler mountain environments, which will shift gardens further away from human settlements.

- *Fisheries sector* – Tuna Fisheries: While tuna are adaptable to climate variability, changing sea temperatures will influence total stocks and migratory patterns, shifting tuna away from current migratory routes. This will have serious consequences for tuna fisheries in most of the member PICTs. Coastal Fisheries: the combination of increasing sea-temperatures and sea-level rise will result in changes to coastal circulation patterns, thereby affecting nutrient supply, lagoon flushing, coastal erosion, and possibly ocean acidity and coral bleaching. These will affect both the reef building capacity of corals as well as the spawning cycles of reef fishes and invertebrates. Increased incidence of coral bleaching and ciguatera fish poisoning will also be seen.
- *Human settlements* – the majority of population settlement and critical infrastructure in most PICTs is located in coastal areas. Villages, towns, cities, and key infrastructure such as hospitals, schools, power plants and distribution systems, etc. are mostly located in coastal areas. In an increasingly urbanized Pacific, with many people residing in informal settlements, under very crowded conditions, poor housing and limited access to basic amenities, climate change is expected to place major burden on already stressed urban management.
- *Health sector* – climate change and environmental factors constitute a major determinant of health, either directly by causing an increasing incidence of vector-borne and environment-linked diseases, lack of available clean water or indirectly by preventing access to, or destroying, health facilities.
- *Potential extinction of sovereign states* – some of the Pacific’s most beautiful countries, in particular atoll countries, are at grave risk in the long term if the current trends observed in extreme weather conditions and sea-level rise continue along the projected path within the next century.

1.2 Objective of the PACC

2 Given the foregoing urgency for the need for adaptation to climate change in the Pacific island countries, a Pacific Adaptation to Climate Change (PACC) has been developed to assist with the implementation of adaptation measures in 13 countries of the region. The Marshall Islands, as one of the recipient countries will participate in the PACC to implement adaptation measures in their water sector to enhance resilience to current and future adverse impacts of climate change.

3 The principal objective of the PACC is to facilitate the implementation of long-term adaptation measures to increase the resilience of a number of key development sectors in the Pacific island countries to the adverse impacts of climate change. A framework for PACC (PACC framework) will be developed through a consultative process involving all relevant stakeholders (including national governments and their respective agencies,

institutions, departments and ministries, and non-government organizations, where appropriate, CROP agencies, donor partners, private sector, where appropriate, and others deemed necessary). The PACC framework will guide the implementation of the PACC at the national (including community and/or village) and regional levels.

1.3 Scope of proposal

2 As one the of the key outcomes of the in-country consultations is to determine detailed adaptation activities and baselines in each country, this report provides the outcomes of the Marshall Islands in-country consultations on PACC which were held from the 25th – 26th February, 2008. The report is divided into five sections: section I outlines the urgency for adaptation to climate change in SIDS, building on the IPCC fourth assessment report; section 2 provides a general overview of the climate change and development situation (situation analysis) in the Marshall Islands covering issues relating to assessment of impacts of climate change on the biophysical and human systems and stakeholder analysis; section 3 covers sectoral analysis with regard to a methodology and/or a criteria used to select a priority sector for adaptation intervention, institutional and development baselines within the priority sector as well as the analysis of the impacts of climate change within the priority sector; section 4 provides information of the delivery mechanism for full-sized project implementation of PACC-Republic of the Marshall Islands and section 5 covers the project goals, outcomes, outputs and activities. The letter of endorsement for co-financing and list of individuals/experts and their respective institutions consulted during the in-country consultation are appended as annexes in section 6.

II. SITUATION ANALYSIS

2.1 Geography

3 The Republic of the Marshall Islands is situated in the central Pacific, approximately mid-way between Hawaii and Australia. The country consists of 29 low-lying atolls and five low-elevation islands, and together land mass comprises only of 70 square miles. This is in contrast to the 700,000 square miles of ocean, which forms part of its Exclusive Economic Zone. Twenty-two of the atolls and four of the islands are inhabited. The atolls of the Marshall Islands are made up of calcareous remains of coral growth that have accumulated over millions of years on the peaks of submerged mid-oceanic volcanic islands (Wiens, 1962). The atoll and islands lie in two parallel chains: Ratak (Sunrise), to the East; and Ralik (Sunset), to the West. The two atoll chains are approximately 129 miles apart and are aligned diagonally northwest to southeast between 160° E - 173° E and 04° N - 15° N.

4 The capital is situated on Majuro atoll in the southeast, which has a land area of 3.56 square miles. The distance between Majuro and the furthest outlying atoll (Ujelang) is approximately 700 miles. Majuro lies some 2,300 miles southwest of Honolulu and nearly 2,000 miles southeast of Guam. Over two thirds of the population of the Marshall Islands is concentrated on Majuro and Kwajalein. There is a general conception that there

are three parts of the Marshall Islands, Majuro – capital, Kwajalein – second urban center and the outer islands – rural area.

5 Recent studies in the southern Pacific region show that the annual and seasonal ocean surface and island air temperatures have increased by 0.6 to 1.0oC since 1910 throughout a large part of the South Pacific, southwest of the South Pacific Convergence Zone (SPCZ) where as decadal increases of 0.3 to 0.5oC in annual temperatures are only widely seen since the 1970, preceded by some cooling after the 1940, which is the beginning of the record, to the northeast of the SPCZ (Salinger, 2001; Folland *et al.*, 2003).

2.2 Climate

6 Majuro has a tropical oceanic climate influenced by northeasterly trade winds that prevail from December to April. Periods of weaker winds and calms occur in the autumn (fall). The annual rainfall averages about 3560 mm (NOAA), but droughts are not uncommon. From June through November are normally the wettest months. Mean monthly temperatures vary within a range of one degree (27°C to 28°C) between the coolest and warmest month. Average daily temperatures are between 25°C and 30°C. Relative humidity is uniformly high throughout the year at about 80 %.

7 The mean annual temperature in the Marshall Islands is 28°C with temperature differences between the warmest and coolest months averaging less than 0.3 °C. This temperature regime coupled with abundant sunlight throughout the year generates favorable conditions for plant growth provided there is adequate water. Rainfall, on the other hand, is unevenly distributed across the archipelago with a distinct rainfall gradient running from north to south (Wiens, 1962).

8 Precipitation in the southern atolls averages threefold higher than in the northern atolls. On Enewetok atoll in the north-west, rainfall averages about 1440 mm annually (SRDC, 2005) increasing to 2540mm on centrally located Kwajalein (3D Research Corporation, 2005). The southern Marshall Islands are considerably wetter with annual precipitation on Majuro averaging 3300 mm (Marshall Islands Statistics, 2005). Available data indicate that rainfall can total as high as 4100 mm annually on Jaluit and is even higher on Ebon, the most southerly atoll (Spoehr, 1949).

9 The northern and centrally located atolls receive the bulk of their rainfall from June through November and are prone to drought during the winter and spring months. The atolls in the south, on the other hand, enjoy a moist climate throughout the year under normal conditions.

2.3 Population

10 The current population of the Marshall Islands is estimated at approximately 57,000 people. Despite having one of the highest birth rates in the Pacific, the annual population growth rate since the official census in 1988 was 1.2 %. While national population

growth is clearly moderated by a net positive rate of out-migration, of greater concern for planners is the rapid (and largely unregulated) growth of populations in urban centers due to internal migration. The Community and Household Survey of 2006, estimates the population in Majuro in excess of 28,000. This represents a seven-fold increase in population between 1958 and 1999 and a doubling of population density between 1980 and 1999. Population density in Majuro is in the order of 7,500 people per square mile. With a population approaching 10,000 and a land area of 0.12 square miles, population density on the islet of Ebeye (Kwajalein Atoll) is in the order of 83,000 people per square mile. Influenced by this growing trend in urbanization, overall population density in RMI has increased by a factor of five over the past half century. Overall population density in 2006 is estimated at approximately 800 people per square mile.

2.4 Majuro Population

11 Majuro and Kwajalein are the two most populated atolls, accounting for close to 70% of the total national population of 50,000 (1999 census).

Majuro	23,676
Kwajalein	10,902
Outer islands	16,262
TOTAL	50,840

(RMI 1999 Census)

12 Despite one of highest birth rates in Pacific, the annual population growth rate since the official census in 1988 is 1.2 %. While national population growth is clearly moderated by a net positive rate of out-migration, of greater concern for planners is the rapid (and largely unregulated) growth of populations in urban centers due to internal migration. The Community and Household Survey of 2006, estimates the population in Majuro in excess of 28,000. This represents a seven-fold increase in population between 1958 and 1999 and a doubling of population density between 1980 and 1999. Population density in Majuro in is in the order of 7,500 people per square mile. With a population approaching 10,000 and a land area of 0.12 square miles, population density on the islet of Ebeye (Kwajalein Atoll) is in the order of 83,000 people per square mile. Influenced by this growing trend in urbanization, overall population density in RMI has increased by a factor of five over the past half century. Overall population density in 2006 is estimated at approximately 800 people per square mile.

13 The rapid increase in population in Majuro (67 % since 1980) as a result of reduced infant death rates, increased fertility rates and immigration from outer islands has surpassed the capacity of existing water supplies, solid and sewage waste disposal facilities. Over 50 % of the registered deaths in 1991 were due to diseases commonly associated with lifestyle and poor living conditions (Barber, 1994). In a census in 1988, Majuro had a total population of 19 664 of which 1450 were residing in the Laura area (Anthony et.al., 1989). Estimates in a report on the rural and urban water supply and sanitation review in 1994 mention 25 000 residents in Majuro (Barber, 1994) and 30 000 in 1998 (Galbraith, Bendure and Friary, 2000) whereas the latest report mentions a Majuro population of 33 045 (Goodwin, Zheng and Mistry, 2000).

2.5 Economy

14 With its limited natural resources, the Marshall Islands has a small national economy that is primarily driven by public sector spending and contributions from the US Government. The latter takes place under the auspices of the Amended Compact of Free Association through which the US will continue to support the Marshall Islands through 2023, at which time a Trust Fund made up of US and Marshall Islands contributions will begin perpetual annual payouts. Commerce in the Marshall Islands is highly dependent on government expenditures and as of 2004, the government sector, including state-owned enterprises accounted for some 40% of GDP and 41% of formal employment. Ebeye and the U.S. Ronald Reagan Missile Test Site at Kwajalein Atoll are key components in the RMI economy and are estimated to provide about one-third of economic activity.

15 A continuing challenge for the Marshall Islands is achieving economic and fiscal stability in the face of a weakly developed private sector. This is because the economy is highly vulnerable to the negative repercussions of external market and other forces that disturb economic growth prospects and endanger living standards. Examples where this has happened in the past include: the decrease of tourism brought about by 9/11 and the Asian bird flu crisis in the 2001-2004 period; the migratory nature of the Marshall Island's fisheries for which decreases of fishing and associated revenue were experienced in 2003 and 2004. More recently, increases in fuel prices in 2004 and 2005 have reverberated throughout the entire economy. While the private sector has grown steadily over the past decade, the rate of growth is too slow to make significant inroads into the 31% unemployment rate. The tourist industry, now a small source of foreign exchange employing less than 10% of the labor force, remains the best hope for future added income.

16 The Marshall Islands has a GDP of approximately \$144 million and a per capita GDP of approximately \$2,900. Key sectors in the economy include:

- Agriculture and fisheries: 31.7%
- Industry: 14.9%
- Services: 53.4% (2004 est.)

17 Important export products include: copra cake, coconut oil, handicrafts, and fish. Important industries include: copra, tuna processing, tourism, craft items from seashells, wood, and pearls. As with most Small Island States, the value of imports (\$54.7 million) greatly exceeds the value of exports (\$9.1 million). Government downsizing, drought, a drop in construction, the decline in tourism, and less income from the renewal of fishing vessel licenses have held GDP growth to an average of 1% over the past decade.

18 With respect to government spending, the total budget of the Marshall Islands is in the region of \$150 million. Only 25% of the revenue raised to fund the budget is raised domestically. Over 60% of government revenue originates from Compact of Free Association funding, federal grants and nuclear compensation funding. The largest

contributors to government revenue are taxes (income tax and import tax), fishing licenses, ship registration fees, gross revenue tax and tourism.

19 Since 2004, the government has concentrated spending to its priority sectors: education, health, environment and infrastructure development and maintenance. The strategic approach to government spending includes: streamlining government and making public services more efficient and effective; creating an environment for private sector-led economic growth and employment generation; and improving the living standards for all Marshall Island citizens.

2.9 Government

20 After almost four decades under US administration, the Marshall Islands attained independence in 1986. Previously it was part of the Trust Territory of the Pacific Islands, a United Nations trusteeship administered by the United States Navy from 1947 to 1951 and by the United States Department of the Interior from 1951 to 1994. Elections are held every four years with each of the twenty-four constituencies electing a senator to the lower house of Marshall Islands bicameral legislature, the Nitijela. The upper house - the Council of Iroji - is an advisory body comprising twelve tribal chiefs. The Council of Iroji is consulted on all customary and land issues. The President, who is head of state as well as head of government, is elected by the Nitijela. The executive consists of the Presidential Cabinet - ten ministers appointed by the President with the approval of the Nitijela. The public service is headed by a Chief Secretary who is responsible to the Cabinet for the general direction of the work of all Departments and offices of government.

21 Local government is administered by the Ministry of Internal Affairs. Each inhabited island has a local council headed by a mayor. Funds are disbursed to the local councils on an annual basis in relation to the size of the population being served. Local council activities include: local police services, solid waste collection, and maintenance of local roads. Additional funding for capital projects is sometimes allocated from donor funding or US federal grants. Mayors report back to the Ministry of Internal Affairs every three months.

22 The Marshall Islands and the United States have a very strong relationship of mutual assistance as encapsulated under the Compact of Free Association, which came into effect in 1986. Certain provisions of the Compact, including economic assistance, expired in 2001 and have been subsequently renegotiated for an additional 20 years commencing in May 2004.

2.3 Climate change vulnerabilities

23 The Marshall Islands was heavily hit by the effects of variations of the El Niño weather pattern in 1997 and 1998, receiving almost no rainfall. Drought affected most of the country's population, particularly on Majuro and Ebeye. Such weather patterns have become more frequent since 1977, bringing an increase in rainfall in the Northeast Pacific

and a rainfall decrease in the Southwest. These more frequent El Niño events are believed to be associated with global warming, although there is no clear evidence that they are not part of a long-term natural cycle. Each El Niño event has resulted in water shortages and drought particularly in the northern atolls of the country where it is considered warmer than the southern atolls.

24 Like most low-lying atolls, groundwater is a critical resource for the Marshall Islands. Freshwater lenses are very shallow on coral atolls and borehole drilling is normally kept within 5-10 meters of the surface. The only alternative to groundwater in these circumstances is localized rainwater harvesting, which is not reliable in the long term and may not be adequate for current and future needs given the growth of the population, particularly on Majuro.

25 El Niño-related tropical cyclone activity that was anticipated in the Marshall Islands during the final months of 2006 into January 2007 did not occur. Only one tropical cyclone was a problem: in early October, the tropical disturbance that became Typhoon Soulik (TC 21W) tracked close to Majuro and Kwajalein. Gusty southerly winds associated with this tropical system produced high seas that topped the seawall on the southern boundary of the Majuro Airport. Saltwater contaminated 8 million gallons of fresh water. Some of the cloud systems in the Central Pacific looked as if they could become tropical cyclones that would affect the Marshall Islands, but no significant cyclone moved across the region. Paka (1997) was the last tropical cyclone of typhoon intensity to pass through the Marshall Islands.

26 During El Niño, the rainfall pattern in the Marshall Islands is very complex. Usually the northern islands of the Marshall Islands enter a prolonged dry spell for the first several months in the year that follows the El Niño year. The central parts of the Marshall Islands (this includes Majuro) often are quite dry and the southern part of the Marshall Islands and the islands of Kiribati can be wetter. Majuro had a severe dry spell lasting 4 or 5 months in early 1983, 1992 and 1998. Any atoll in the northern Marshall Islands may experience a month or two of abnormally dry weather at any time during the period February through May 2007.

III. Baseline Scenario and PACC Intervention

3.1 Current and Future Vulnerability

27 Vulnerability is a function of exposure to hazards, sensitivity and adaptive capacity. From the basis of exposure alone, 100% of the RMI population and infrastructure are located in the coastal areas/zones, rendering them highly vulnerable to climate change and sea-level rise (ADB 2005). Their vulnerability is exacerbated by their exposure to extreme events, such as high winds, high waves, typhoons, dry weather events, coastal erosions, salt water intrusions to waters and coral bleaching. Previous assessments (Initial National Communication, 2001) have pointed out that even though RMI is not directly in the typhoon corridor, it is exposed to a number of hazards and vulnerabilities that are linked both to its physical characteristics and unsustainable development processes. According to the National Action Plan for Disaster Risk Management (2008-2018), the risk posed by these socio-economic and physical conditions are compounded by weak management of various human activities and little consideration of the risk that is created through these development activities. All these climate and non-climate related exposures would seriously impact on already highly vulnerable sectors that are climate dependent such as water. Water is a major issue for Majuro and it is a growing problem given the high population density and the amount of space and resources available. If the water issue is not adequately addressed, it could undermine the development in other sectors particularly health and education.

28 According to the recently developed National Action Plan for Disaster Risk Management (2008-2018), factors that contribute to the RMI's high vulnerability include:

- Extremely high population densities on some islands, e.g. Ebeye, Majuro etc.;
- High levels of poverty – 20% of the population lives on less than \$1 per day. In addition to increasing incidence of poverty on the outer islands, pockets of deep poverty have taken hold in the urban centers of Majuro and Ebeye;
- Low elevation (the average elevation in the Marshall Islands is seven feet ASL);
- Wide dispersal of the country over a large area of ocean;
- A fragile island ecosystem – including the invaluable ecosystem services offered by coral reefs protecting the coastline;
- Limited and fragile fresh-water resources that are highly vulnerable to over-use and contamination;
- A weakly developed economy that is vulnerable to global influences.

29 The 4th IPCC Assessment Report (2007) is projecting warming of about 0.2°C per decade for a range of SRES emission scenarios. The best estimate for the low scenario (B1) is 1.8°C (likely range is 1.1°C to 2.9°C), and the best estimate for the high scenario (A1FI) is 4.0°C (likely range is 2.4°C to 6.4°C). This could mean an increase in El Nino and La Nina situations for Marshall Islands, which could exacerbate current vulnerabilities people are already facing. Observations also show that average temperature of the global ocean has also increased to depths of at least 3000 m and that

the ocean has been absorbing more than 80% of the heat added to the climate system. This means that the air temperature rise could lead to sea surface temperature rise. Such scenarios do not augur well for marine life, which the Marshall people depend on to eke out a living. Such additional stressors added onto the current vulnerable situations of Majuro, current development programmes particularly in the water sector would be seriously stressed.

3.2 Current Development Efforts in the Water Sector

The structure and climate of the atolls has restricted the quantity and quality of fresh water supply in the RMI. The source of drinking water varies from area to area, but for the country as a whole around 70 per cent of homes use rainwater for drinking (RMI Statistical Yearbook, 2003). To address shortcomings in water supply, the National Government distributed more than 3,000 water catchments to residents in both the urban centers and the Outer Islands. In addition, there are plans to construct another water reservoir to improve the security of water supply in Majuro Atoll.

The water supply on Majuro is from two main sources; the airport runway catchment area and the Laura groundwater lens. In the late 1970s and 1990s, the Government of the Marshall Islands in its effort to provide sanitized drinkable water to the general populace of Majuro managed to develop the airport runway also as a water catchment facility. Water from the runway is piped to a reservoir that is then linked to the main water supply system for Majuro. The reservoir near the runway is open and has a fairly significant evaporation rate. For better adaptation to future drought conditions, there is a need to address the issue of evaporation at the Majuro reservoir.

Other on-going efforts to address the issue of water and wastewater for Majuro include the development of toilet facilities and sewage disposal guidelines for the Marshall Islands by the Republic of the Marshall Islands Environmental Protection Agency (RMIEPA). The regulation has taken effect in 1994 but enforcement of these rules by RMIEPA has continuously been problematic. In Laura, the United States Environment Protection Agency (USEPA) provided a grant to install a wastewater system. The project, designed to protect the groundwater lens, consisted of a septic tank and leach field for every family in the immediate area from which water was withdrawn. The College of Micronesia has provided through its Cooperative Extension Program a Water Quality Extension Agent based in Majuro. The main objective of this program is raising awareness among communities on hygiene and sanitation, providing information on best practices, assisting in facilitation of regulations and organizing workshops and seminars in the urban and rural setting.

3.3. Gaps

Efforts to address the water issue particularly in drought conditions for Majuro continues to be of major concern to the government. A study by the Asian Development Bank in 2005 prioritized water in Majuro as one of the major areas that need assistance. Even though the Government of the Marshall Islands is well aware of the effects of the El Nino and the La Nina phenomenon on the water supply situation of the country, there is a need

to go beyond individual phenomenon to an integrated development of the whole water situation in Majuro, the capital of the RMI. This will better position Majuro to adapt to current and future drought conditions related to El Nino or otherwise. With a continuous influx of people from the rural to Majuro, population will continue to increase as well as the demand for quality water supply.

3.4 PACC Intervention

30 For PACC Marshall Islands, the project will demonstrate the benefits of taking climate change into consideration in the water sector so as to better prepare for future climate change risks. The PACC project hopes to address the issue of high evaporation rates of current water storage facilities in the Marshall Islands. Unrestricted water utilization levels for Majuro have been estimated to be about 45 gallons per person per day, which equals 170 L/p/d. Past projects planned for Majuro have targeted 40 gallon/day (g/p/d) with an estimated current population 1994 of 25 000 results in a daily consumption of 1 million gallon. Hence, the storage provided by the existing reservoirs (23 Mega gallon) is less than a months supply in times of drought. This is a very vulnerable situation and if there are more El Nino like events in a future climate change scenario, serious socio-economic repercussion would come about for the island of Majuro.

31 Overall, the PACC project would promote a broad based integrated intervention that takes into consideration policy issues related to water conservation and quality particularly during droughts at the national and sectoral level. It also hopes to demonstrate a whole island approach to climate change adaptation that carefully considers water usage by other sectors particularly agriculture during droughts. A better understanding of the different vulnerabilities and risks for Majuro would provide valuable insight to improving the current and future adaptive capacity of Marshall Island people now and into the future.

32 The efforts by the PACC project would help inform future initiatives of government that are in the pipeline such as the construction of a new water reservoir by the Majuro Water and Sanitation Corporation.

PART II. MARSHALL ISLANDS PACC PROJECT PROPOSAL

Introduction

The principal objective of the Pacific Adaptation to Climate Change [PACC] is to facilitate the implementation of long-term adaptation measures to increase the resilience of a number of key development sectors in the Pacific island countries to the adverse impacts of climate change. Marshall Islands became the twelfth country to be part of the PACC project on the 8th of December 2007. This development resulted in a country consultation carried out from the 19th to the 28th of February 2008 with government agencies, quasi-government organizations, and non-state actors.

Climate change impacts on several key sectors of a country. The key sectors are agriculture, water, infrastructure, health, and coastal zone. Impacts on these sectors are often magnified in small atoll island environments and have the potential to set-back development progress gained over the years. Key natural hazards that have the potential to negatively impact on these key sectors include: tropical storms and typhoons, high surf, and drought. All these hydro-meteorological events are expected to increase in intensity due to climate change.

Feedback from consultations carried out during the two weeks point to water as the critical sector that needs support from the PACC project. Even though there are several donors already supporting the sector over the years, the water vulnerability for Marshall Islands is in a critical situation warranting support particularly to adapt to the hydro-meteorological events listed above. This proposal is a result of the consultation and it details the activities that would be undertaken by the Marshall Islands to address current and future vulnerabilities they are facing in the water sector. PACC project resources will be used to compliment current development programmes in the water sector taking into consideration current and future changes in climate.

Conceptual Approach

A Whole Island Approach to Climate Change Adaptation: Reducing vulnerability of the water sector to climate change.

For atoll environments with limited landmass, people economize with space. Activities such as food production and food security, coastal developments, as well as other livelihood activities, which include water harvesting and storage, co-exist in a defined parcel of land. Rarely are there clear demarcations or zoning. In the case of Majuro, which is a proposed site for the PACC Project, this is largely the case, even though some may argue that food production activities are more concentrated in Laura than in any other part of the island. Given the above scenario for Majuro, it is worth considering the conceptual notion of a ‘whole island approach to climate change adaptation’. This ‘whole island approach’ takes into consideration several pertinent points:

- Water, food security and coastal management are closely integrated in atoll environments and are closely interconnected;
- Land area is severely limited thus a lot of activities co-exist in a parcel of land;
- Land and sea interface is one of the same coin therefore any development that is implemented in one affects another;

The conceptual approach described above will be tried out in the Majuro atoll, Marshall Islands under the PACC project. It is also the intention that even though water would be the main sector to be addressed by the Marshall Islands, linkages would be explored with the food production and food security sector, health, and other pertinent sectors such as the coastal management sector.

Pilot Area

The PACC project will be piloted in the capital of Marshall Islands, which is Majuro atoll and has a land area of 3.56 square miles. The distance between Majuro and the furthest outlying atoll (Ujelang) is approximately 700 miles. Majuro lies some 2,300 miles southwest of Honolulu and nearly 2,000 miles southeast of Guam. Over two thirds of the population of the Marshall Islands is concentrated on Majuro and Kwajalein.

**PROPOSED CONCEPT FOR MARSHALL ISLANDS
A WHOLE ISLAND APPROACH TO CLIMATE CHANGE ADAPTATION:
Reducing vulnerability of the water sector from climate change**

VISION 2018 – The Strategic
Development Plan Framework

Strengthening Marshall Islands institutional and procedural mechanisms to ensure that possible advantages of international and regional co-operation to minimize the adverse impact of global warming to climate change.

ENABLING
ENVIRONMENT
PROGRAMMES

First and Second National
Communication to the Conference
of the Parties of the United Nations
Convention on Climate Change

IMPLEMENTATION
PROGRAMMES

PACC

ADMIRE
PROJECT

**A WHOLE
ISLAND
APPROACH TO
CLIMATE
CHANGE
ADAPTATION**

WATER

Reducing water loss through minimizing the evaporation rates from current water storage facilities.

Reducing water usage from the main water source through provision of alternative source of water for drought resilience and food security.

Demonstrating alternative water source through reverse osmosis and alternative energy sources.

Vision 2018

Marshall Islands have a Vision document titled Vision 2018 and it recognizes the importance of climate change as a global issue that has significant consequences locally. Goal 1 of the National Vision refers to Marshall Islands as a country within an interdependent world and this needs careful consideration and capitalization when opportunities arise. Programmes such as the GEF-UNDP-SPREP-PACC project contribute to the realization of the national vision. The National Vision reads:

'Become a country within an inter-dependent world, with an enhanced socio-economic self-reliance, an educated, healthy, productive, law-abiding and God loving people in which individual freedom and fundamental human rights are protected and culture and traditions are respected and development and environmental sustainability are in harmony'.

Master Plan

The Master Plans will be implemented by as many people as possible using existing institutions of government, the private sector, non-government organizations and civil society at large. Marshall Islands is especially vulnerable to the effects of climate change, sea-level rise, and extreme events, however, like most small island states, it lacks adequate baseline information for understanding the complex interplay between and within natural and human systems. There are gaps in information on likely changes in climate and human systems at the atoll-environment scale but this is no excuse not to act. The PACC project should be able to build on existing assessments as well as take a 'Whole Island Approach' to climate change adaptation using the top-down and bottom-up approach.

Project Objective

The purpose of this project is to demonstrate the benefits of taking climate change into consideration in current development programmes so as to better prepare for future climate change risks. The PACC project hopes to address the issue of high evaporation rates of current water storage facilities in the Marshall Islands. It is theorized that if adaptation measures were put in place, several millions of gallons of water would be saved and better position Majuro to minimize the effects of future droughts. The PACC project would promote a whole island approach to climate change adaptation that takes a holistic view of how water is being used so as to better address other risks such as overdrawn bore holes for agricultural purposes. A better understanding of the different vulnerabilities and the risk profile would provide valuable insight to improving the current and future adaptive capacity of Marshall Island people now and into the future.

Goal:

The main goal of this project is to enhance the capacity of the Republic of the Marshall Islands to adapt to climate change, including variability, in selected key development sectors.

Specific Outputs:

Output 1.1: Relevant plans and programmes incorporate climate risks in the coastal sector in the Republic of the Marshall Islands.

Output 2.1: Guidelines to integrate coastal climate risk management into relevant plans and programmes.

Output 2.2: Trained staff in key agencies to respond to impacts of salt-water intrusion and rises in sea surface temperatures on food production systems.

Below is a description of the outputs that would be delivered by the PACC project for Marshall Islands.

Output 1.1: Relevant plans and programmes incorporate climate risks in the coastal sector in the Republic of the Marshall Islands.

This will include integrating climate change into key development sectors that are highly vulnerable to climate change which include; agriculture, water, and coastal management. At the national level, work in climate variability and change is still the ‘domain’ of Meteorology Services, Environment Departments and National Disaster Agencies but the impacts are being felt by other agencies e.g. Fisheries, Agriculture, Forestry, Physical Planning, and Public Works. To mainstream key climate change issues into development plans of government sectors, a number of critical steps would be followed, which requires collaborative analytical and policy inputs from a number of different technical experts and domestic partners. Critical components of mainstreaming include: review of the NSDS and its role in national development; the identification of the strengths, weaknesses, gaps, responses to strengthen specific sectoral management (problem tree analysis and objective/ solution identification); the review of the link between sectoral plans and NSDS and the relationship between sectoral medium term budget and the medium term national fiscal expenditure and revenue budget; and strengthening of sector level budgeting that reflects outcome focused priorities and national development goals.

Specific activities to be undertaken would include:

- Promote and support dialogue, exchange of information and coordination amongst early warning, disaster risk reduction, disaster response, development and other relevant agencies and institutions at all levels, with the aim of fostering a holistic and multi-hazard approach towards disaster risk reduction.
- Development or customizing of a mainstreaming methodology that takes into consideration climate change technical and policy frameworks and issues;
- Forming of a Mainstreaming Team to work with key government sectors to mainstream climate change issues into key sectoral plans and policies;
- Countries to form V&A Teams comprising people in various agencies and institutions who can collaborate, integrate their work and be the main contact points in the various agencies to champion adaptation approaches and initiatives. Once the teams are formed a range of capacity building initiatives to be developed in the next component can be implemented.

- Mainstream climate change risk considerations into planning procedures, especially for major infrastructure projects, including the criteria for design, approval and implementation of such projects and considerations based on social, economic and environmental impact assessments.

Output 2.9.1a Guidelines for improving water retention through redesign and retrofit of existing water-holding tanks to enhance resilience to drought events.

Output 2.9.1b Demonstrating climate change risk management in water holding tanks in Majuro town (with co-financing support).

Activity 1: Reducing water loss through minimizing the evaporation rates from current water storage facilities.

This activity would address the issue of water loss from current water storage facilities in Majuro. It builds on previous and current efforts by Government to address the issue of water availability in times of extended dry periods or drought situations for Majuro. The Majuro runway was constructed in the early 1970s. A major part of the runway has been on the main water catchment for Majuro atoll. Rainwater is collected at the runway and pumped into nearby reservoir. The reservoir near the runway is open and this have a fairly significant evaporation rate. Installation of evaporation covers will increase the amount of water that is available for distribution to the public. The runway improvements will enable more efficient and effective collection of rainwater.

Drought associated with ENSO events have depleted rainfall collection supplies and the freshwater lenses and perched aquifers on many Pacific Island countries including Marshall Islands. For example, in 1998, 40 atolls of Micronesia ran out of water during an ENSO event, resulting in the declaration of a national emergency. The main capital of the Marshall Islands, Majuro only had access to drinking water for only seven hours every fourteen days. Climate change could result in an increased incidence of ENSO events, which in the past have been associated with massive decreases in rainfall in the western portion of the Pacific. This could substantially reduce freshwater supplies in nations such as Micronesia and the Marshall Islands, where rainwater is the primary source of supply.

Unrestricted utilization levels for Majuro have been estimated to be about 45 gallons per person per day, which equals 170 L/p/d. In effect 70 % of the population in Majuro has access to treated municipal drinking water and 25 % untreated well water in the Laura area. Past projects planned for Majuro have targeted 40 gallon/day (gpd) with an estimated current population in 1994 of 25 000 resulting in a daily consumption of 1 million gallon. Hence, the storage provided by the existing reservoirs (23 Mega gallon) is less than a months supply in times of drought. This is a very vulnerable situation and if there are more El Nino like events in a future climate change scenario, serious socio-economic repercussion would come about for the island of Majuro.

This component would deal with the vulnerability described above by addressing the issue of reducing water loss through minimizing the evaporation rates from current water storage facilities. Anti-evaporation covers could be investigated to see which is best to address the

situation on Majuro. Hopefully through such measures, evaporation rates at the reservoir would be reduced by about 3,000,000 gallons annually.

Proposed Tasks:

- i) Confirm rate of evaporation using current data and future scenarios;
- ii) Develop various adaptation scenarios to address the issue;
- iii) Evaluate the adaptation options; and
- iv) Implement the most appropriate adaptation measure.

Proposed Budget – USD350,000

Co-Financing –

Primary Agency - MWSC

Secondary Agencies – MEC, National Weather Service, EPA,

Activity Indicators

- i) Increased level of water from current baseline;
- ii) Increase of water days/hours
- iii) Reports

Activity 2: Reducing water usage from the main water source through provision of alternative source of water for drought resilience and food security.

Description

Proposed Activities:

- i) Assess current and future climate change precipitation scenarios;
- ii) Carry out participatory assessments (CV&A);
- iii) Develop alternative source of water
- iv) Evaluate the adaptation options; and
- v) Implement the most appropriate adaptation measure.

Proposed Budget – USD200,000

Co-Financing –

Primary Agency: R & D and Land Grant

Secondary Agencies: National Weather Service, EPA, MWSC

Activity Indicators

- i) Increased level of water from current baseline;

- ii) Less draw from the Laura water lens
- iii) Increased alternative water sources
- iv) Increased production of staple crops

Output 3: Demonstrating alternative water source through reverse osmosis and alternative energy sources.

Description

Proposed Tasks:

- i) Assess current and future climate change precipitation scenarios;
- ii) Assess current supply

Proposed Budget – USD 130,000

Co-Financing –

Primary Agency: CMI

Secondary Agencies: National Weather Service, EPA

Activity Indicators

i).

Primary agency:

Secondary agency:

Possible Activity Indicators:

- i) Confirm rate of evaporation using current data and future scenarios;
- ii) Develop various adaptation scenarios to address the issue;
- iii) Evaluate the adaptation options; and

Activity 4: National water conservation/adaptation policy developed.

Description

- Businesses/government houses/hospitals etc. should have their own water supply systems in place;

- Autonomous institutional

Tasks

- i) Develop a policy for installing alternative water sources and storage in all new public buildings;
- ii) Develop a policy for installing alternative water sources and storage in all new private buildings

Proposed Budget – US60,000

Co-Financing –

Primary Agency: EPA/OEPPC

Secondary Agencies: EPPSO, Local government, Internal Affairs,

Activity Indicators

1. Policy developed and endorsed by Cabinet in 2010
2. Increased number of buildings that are in compliance with the policy
3. Decreased usage of public water during dry season (January-March)

Output Two: Increased public awareness on climate change and water quality

Description

- This output will complement National Action Plan Disaster Risk Management, which aims to conduct public awareness activities and linkages between water, pollution and public health;
- Under this output the level of public awareness about water related risks and climate will be addressed
-

Activity

- iii) Develop a communications strategy on climate change
- iv) Conduct an awareness raising campaign of linkages between climate change, water, pollution and public health;
- v) Equip community with knowledge and means to purify water from climate related risks;
- vi) Facilitated regular consultation meetings between landowners, private sector and regulatory agencies

Proposed Budget – USD 60,000

Co-Financing –

Primary Agency: OEPPC

Secondary Agencies: EPA, CMI Land Grant, OEPPC, Internal Affairs, MWSC

Activity Indicators

1. Increased knowledge (Pre and post surveys);
2. Improved health and lifestyle (decreased number of cases water borne diseases);
3. Increased users of safe water (pre and post survey results);

Long form of Acronyms used above:

MWSC - Majuro Water Sewer Company

MEC - Marshalls Energy Company

WSO - National Weather Service

EPA - Environmental Protection Authority

R&D - Resource & Development

Land Grant - CMI Land Grant

CMI - College of the Marshall Islands

OEPPC - Office of Environmental Planning & Policy Coordination

MALGov - Majuro Atoll Local Government

IA - Internal Affairs

EPPSO - Economic Policy Planning & Statistic Office

PACC Budget:

The PACC budget as agreed in the two days workshop at the Marshall Islands Hotel on the 26th and the 27th of February 08 is presented below.

OUTPUTS	<u>BUDGET</u>	<u>COFINANCING</u> <u>USD</u>
Output 1.1	350,000	4,000,000 (Airport Runway works) 400,000 – (MWSC)
Output 1.2	210,000	140,000 (CMI) 450,000 R&D Budget 250,000 – ROC 300,000 (National Weather Service)
Output 1.3	130,000	375,000 (CMI)
Output 2.1	60,000	200,000 EPA
Output 2.2	60,000	100,000 (CMI)
Project Management	90,000	160,000 OEPPC
TOTAL	800,000	6,375,000

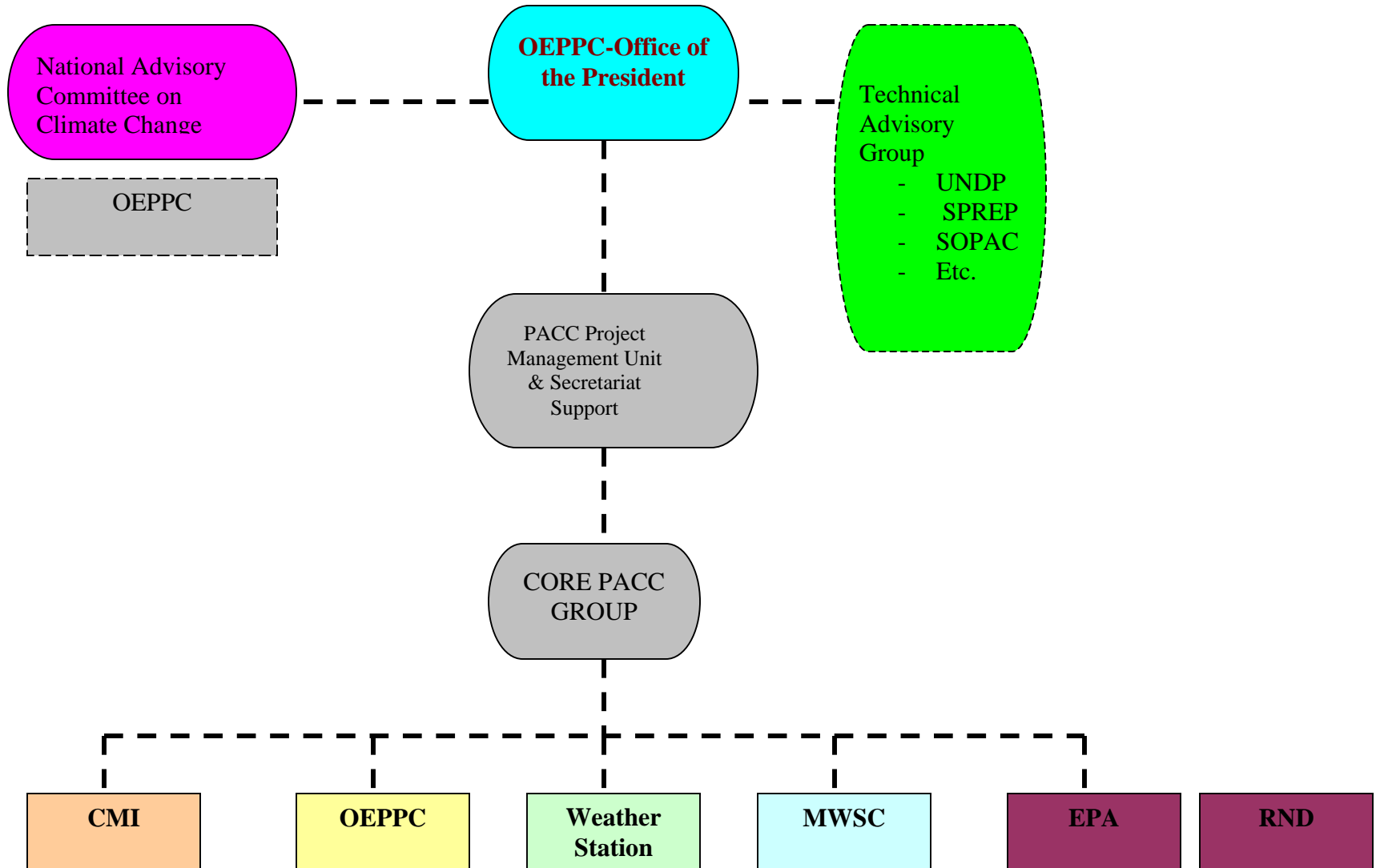
Institutional Arrangement

The PACC project will be coordinated at the national level by the Marshall Islands National Advisory Committee on Climate Change (NACCC). The NACCC will provide policy and technical oversight to the project. The NACCC comprises various ministries and departments, as well as representatives from the private sector, local communities and NGOs. The NACCC will ensure that the PACC project is clearly in line and contributing to the overall national development goals and the Vision 2018 of the Government of Marshall Islands.

A PACC project Management Unit will be established at OEPPC and a Coordinator appointed to coordinate the day-to-day execution of activities to be carried out. Figure 1 shows the institutional framework and project management structure. The PACC project will be executed by the OEPPC, with the support of various government ministries: Resources and Development, Foreign Affairs, Health, EPPSO, RMIEPA Public Works, Internal Affairs and Non-governmental Partners.

The NACCC will meet every two months to review project implementation and provide scientific, technical, policy and strategic guidance. The minutes of these meetings will be shared with all participating institutions.

National Advisory Committee on Climate Change NACCC



PROJECT LOG FRAMES AND INDICATORS

Project Log Frame and indicators for Marshall Islands would be finalized during the inception meeting of the PACC project.

Budget

Responsible	ERP/Atlas	Budget Description							
	Budget Code								Total
				Year 1/08	Year 2/09	Year 3/10	Year 4/11	Year 5/12	Budget
Outcome 1	71200	International Consultants (including national regional staffing)	10,000	10,000	0	0	0	0	10,000
	71300	Local Consultants (including national staffing)	30,000	5,000	5,000	10,000	5,000	5,000	30,000
	71400	Contractual Services - Ind	20,000	5,000	5,000	5,000	5,000	0	20,000
	71600	Travel	20,000	0	5,000	5,000	5,000	5,000	20,000
	72100	Contractual Services - Co	40,000	10,000	10,000	10,000	10,000	0	40,000
	72200	Equipment & Furniture	10,000	5,000	1,000	3,000	1,000	0	10,000
	72400	Communication & Audio Visual equipment	4,000	2,000	500	500	500	500	4,000
	72500	Supplies	1,000	500	100	100	200	100	1,000
	72800	Information technology and Outreach	3,000	500	1,000	500	1,000	0	3,000
	74200	Printing, Publishing & Production	2,000	0	500	500	500	500	2,000
Subtotal			140,000	38,000	28,100	34,600	28,200	11,100	140,000
Outcome 2									
	71200	International Consultation	10,000	10,000	0	0	0	0	10,000
	71300	Local Consultants	60,000	10,000	20,000	20,000	5,000	5,000	60,000
	71400	Service Contracts - Ind	150,000	30,000	50,000	50,000	10,000	10,000	150,000
	71600	Travel	20,000	2,000	5,000	5,000	5,000	3,000	20,000
	72100	Contractual services - Co	320,000	55,000	105,000	55,000	55,000	50,000	320,000
	72200	Equipment & Furniture	10,000	0	5,000	5,000	0	0	10,000
	72500	Supplies	50,000	10,000	10,000	10,000	10,000	10,000	50,000
	72400	Audio Visual Equipment and Communication	20,000	5,000	5,000	5,000	2,500	2,500	20,000
	72800	Information Technology Equipment and Outreach	15,000	5,000	4,000	3,000	2,000	1,000	15,000
	74200	Printing and Publications	15,000	5,000	4,000	3,000	2,000	1,000	15,000
Subtotal			670,000	132,000	208,000	156,000	91,500	82,500	670,000
Outcome 3									
	71200	International Consultants							

	71300	Local Consultants							0
	71600	Travel	20,000	4000	4000	4000	4000	4000	20,000
	72100	Contractual Services - Co							0
Subtotal			20,000	4000	4000	4000	4000	4000	20,000
Outcome 4			88,758	17752	17752	17752	17752	17750	88,758
Subtotal			88,758	17752	17752	17752	17752	17750	88,758
Total			918,758	191,752	257,852	212,352	141,452	115,350	918,758

ANNEX 2 – DESCRIPTIONS OF CO-FINANCING

National Training Council

Output 2.2

To educate outer island populations on how to address vulnerabilities related to climate change.

CMI

The CMI facilities Master Plan calls for increasing levels of independence from municipal water and energy supplies. Within the context of this plan, \$375,000 is available from a U.S. Dept. of Interior approved capital improvement project to create an Alternative Energy Center for the campus. Matching funding is assured from USDOJ sources, but other sources of funds may be substituted.

CMI Land Grant

The money CMI-Land Grant is co-financing is currently used to conduct our extension activities and research projects to address the water quality and agriculture issues of the Marshall Islands. The staff works closely with the farmers and community in the rural villages of Majuro and in the outer islands.

MWSC

4 Staff / 1.1 @ 40% per year over four years

2 staff / 1.2 @ 20% per year (Research) over 4 years

1 staff @ 20% per year (Policy develop) over 4 years

Runway Works – RMI Ports Authority

The Majuro runway was constructed in the early 1970s. A major --- of the runway has been on the main water catchment for Majuro atoll. Rainwater is collected at the runway and pumped into nearby reservoir. The reservoir near the runway are open and this have a fairly significant evaporation rate. Installation of evaporation covers will increase the amount of water that is available for distribution to the public. The runway improvements will enable more efficient and effective collection of rainwater.

Weather

Data acquisition, analysis and dissemination

Drought ---

Marshall Energy Company

MEC can contribute technical skills and expertise to the design and construction of house size solar water distilling equipment

R&D

Salaries for 5 staff – 137,000

Fuel – 35,000

Training – 33,000

Reporting – 27,000

Equipment/supplies – 90,000

Communications – 40,000

Public awareness – 90,000

Travel – 50,000

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