Funding Proposal

FP165: Building Climate Resilient Safer Islands in the Maldives

Maldives | Japan International Cooperation Agency (JICA) | Decision B.29/02

1 July 2021

GREEN CLIMATE FUND

A. PROJECT/PROGRAMME SUMMARY

A.1. Project or programme	Project	**A.2. Public or private sector**	Public
A.3. Request for Proposals (RFP)	*If the funding proposal is being submitted in response to a specific GCF Request for Proposals, indicate which RFP it is targeted for. Please note that there is a separate template for the Simplified Approval Process and REDD+.* Not applicable		
A.4. Result area(s)	*Check the applicable GCF result area(s) that the overall proposed project/programme targets. For each checked result area(s), indicate the estimated percentage of GCF budget devoted to it. The total of the percentages when summed should be 100%.*		

Mitigation: Reduced emissions from:	GCF contribution:
☐ Energy access and power generation:	Enter number%
☐ Low-emission transport:	Enter number%
☐ Buildings, cities, industries, and appliances:	Enter number%
☐ Forestry and land use:	Enter number%
Adaptation: Increased resilience of:	
☒ Most vulnerable people, communities, and regions:	60%
☐ Health and well-being, and food and water security:	Enter number%
☒ Infrastructure and built environment:	30%
☒ Ecosystem and ecosystem services:	10%

A.5. Expected mitigation impact	*Indicate t CO2eq over lifespan*	**A.6. Expected adaptation impact**	**Direct:** 9,071 persons[1] (Male: 5,080, Female: 3,991) **Indirect:** 372,000 persons[2](Male: 210,000, Female: 162,000)
			Direct: 2.2 % of population in the Maldives **Indirect:** 91.2% of population in the Maldives
A.7. Total financing (GCF + co-finance)	66.0 million USD	**A.9. Project size**	Medium (Upto USD 250 million)
A.8. Total GCF funding requested	25.1 million USD *For multi-country proposals, please fill out annex 17.*		

A.10. Financial instrument(s) requested for the GCF funding	*Mark all that apply and provide total amounts. The sum of all total amounts should be consistent with A.8.*			
	☒ Grant	25.1 million	☐ Equity	Enter number
	☐ Loan	Enter number	☐ Results-based payment	Enter number
	☐ Guarantee	Enter number		

A.11. Implementation period	*6 years and 6 months*	**A.12. Total lifespan**	*50 years*
A.13. Expected date of AE internal approval	*This is the date that the Accredited Entity obtained/will obtain its own approval to implement the project/ programme, if available.* *1/23/2020*	**A.14. ESS category**	*Refer to the AE's safeguard policy and GCF ESS Standards to assess your FP category.* B

A.15. Has this FP been submitted as a CN before?	Yes ☒ No ☐	**A.16. Has Readiness or PPF support been used to prepare this FP?**	Yes ☐ No ☒
A.17. Is this FP included in the entity work programme?	Yes ☒ No ☐	**A.18. Is this FP included in the country programme?**	Yes ☒ No ☐
A.19. Complementarity and coherence	*Does the project/programme complement other climate finance funding (e.g. GEF, AF, CIF, etc.)? If yes, please elaborate in section B.1.* Yes ☐ No ☒		
A.20. Executing Entity information	*The Government of Maldives, acting through Ministry of Environment, Climate Change and Technology (ME, MEE)* *Japan International Cooperation Agency (JICA)*		

A.21. Executive summary (max. 750 words, approximately 1.5 pages)

1. Basic Information of the Maldives

The Republic of Maldives consists of 26 atolls and 1,192 islands within the range of around 90,000 km^2 in the Indian Ocean. The islands of the Maldives are classified into 1) inhabited islands, 2) resort islands, and 3) industrial islands. The number of these inhabited islands is 188. The total area of national land is 298 km^2, and the length of coastline is 644 km. Around 44% of residential areas and 47% of infrastructure facilities are located within 100 m of the coastline[1]. The population of the country is 407,660[2] with a population density of 1,359 per km^2. Mean elevation of these islands is 1.0 m to 1.5 m. As such, the Maldives has long coastlines and low-lying land area.

2. Climate Change Rationale

(1) Climate and Natural Hazard

Among major hazards in the Maldives, sea level rise (SLR) is the biggest concern that causes adverse impacts to the country with long coastlines and narrow and low-lying land. SLR may intensify the impact of other natural hazards such as swell waves and storm surges. Among the major natural hazards, these are hazards that cause massive damage and are most sensitive to climate change. In particular, swell waves occur more frequently than other hazards and it should be addressed with the highest priority. Southern regions in the Maldives tend to be more affected by swell waves and other climate hazards, which should be taken as the most important region to be addressed.

(2) Vulnerability to Related Sectors

The major climate change will impact to the various sectors and resources such as tourism, fisheries, agriculture and food security, human health, water resources, and coral reef biodiversity. Among major hazards, SLR will cause coastal erosion and intrusion of salt water to ground water. Furthermore, coastal erosion leads to loss of beach, land, and infrastructure along coasts. Coastal erosion will impact to tourism in which white sand beach attracts tourists and infrastructure sustains comfortable stay for the tourists. As well, coastal erosion will impact to agriculture and food security in which land is necessary for cultivation. Intrusion of salt water will impact directly to water resources especially ground water and indirectly to agriculture and food security in which cultivation needs freshwater.

(3) Vulnerability to Climate Hazard

The Maldives is vulnerable to high waves, storm surges and flooding. In the future, SLR due to climate change will accelerate natural hazards such as the increase of wave height, which will eventually reach the coast. The most serious problems that cause disasters in inhabited islands are coastal erosion and increased flooding due to high wave. The SLR and heightening of wave on coral reef due to SLR will accelerate coastal erosion and result in the loss of national lands. The concentration of humans and resources around the coastal areas in the inhabited islands and artificialization of the coastal lines including construction of harbors

[1] Based on Census 2014, Summation of five target islands' population for Component 2, Fonadhoo(2,266), Maamendhoo(896), Gan(3,080), Ishdoo(958) in Laamu Atoll and Meedhoo(1,871) in Addu Atoll with consideration of gender ratio from the same census.

[2] The proposed terrestrial broadcasting will cover 172 islands out of the 188 inhabitant islands. The coverage corresponds to 91.23% of the total population of the Maldives. Therefore, the number of beneficiaries of the coverage is estimated at 372,000, which is 91.23% of the total population (407,660 from the Census 2014) of the Maldives

cause the reduction of protection functions and drainage functions, which natural sandy beaches and coral reefs used to have, resulting in the acceleration of coastal erosion and increase of vulnerabilities in the future.

(4) Selection of Target Atolls

Under the above hazards and vulnerabilities, it is required to build national land resilience in order to conserve it and maintain a safe, secure and comfortable life for the local residents and to allow them to hand it over to the next generation. In order to achieve this, it is reasonable and realistic to consider the maintenance of the protection function of natural sandy beach and coral reef as “natural infrastructure” as much as possible, and supplementing the required or insufficient function with the implementation of climate adaptive measures. In this context, there are three points considered in the selection of the target atolls and islands: item 1) impact of climate hazard and vulnerability, item 2) project effects, and item 3) similarity of coastal conditions and coastal problems with other inhabited islands, and validity as model cases. From the results of the examination of items 1), 2), and 3), Fonadhoo Island of Laamu Atoll and Maamendhoo Island of Laamu Atoll were selected as the target islands for the proposed GCF financed projects. Also, Meedhoo island of Addu Atoll, and Gan and Ishdhoo islands in Laamu Atoll were selected as a sub-set of activity co-financed by the Government of the Maldives (GoM).

3. Theory of Change

(1) Goal

Project interventions aim to shift the paradigm away from current common understanding and action on coastal protection in the Maldives by modification of natural beaches artificially using hard structure measures without sufficient climate data and consideration for impact due to artificial modification towards a new paradigm to maintain the natural resilience of sandy beach and coral reef that the islands of the Maldives originally owned and has a potential to adapt to uncertain climate impact by realization of Integrated Coastal Zone Management (ICZM) and to implement the coastal conservation measures at some of densely populated area together with delivery of disaster early warning/information, by transferring knowledge and expertise on the proper implementation of soft (nature based) measures for coastal zone and beach protection and long-term sustainable management, to alleviate the loss of national land and to maintain safe and secure livelihood. This approach should ensure the maximum mitigation of maladaptation cases experienced by the country.

(2) Key barriers

In order to effect this transformation, the key barriers to adaptation, 1) lack of regulatory system to pursue coexistence and co-prosperity of development and coastal conservation considering climate change impact, 2) insufficient technical expertise and experience to plan and formulate necessary intervention addressing climate change impact, 3) Insufficient expertise and skills to implement solutions (policies/measures) to support/facilitate formulation/implementation of projects that address climate change impact, will have to be overcome in the Maldives to achieve the project goal, addressing on-going coastal erosion and climate related issues. These barriers are the major issues for the public sector, but how the private sector deal with the barriers will be referred for planning and designing the appropriate beach maintenance method in the project.

(3) Project results

To address these barriers, the proposed Project will establish and realize the integrated coastal zone management (ICZM) and implement and maintain the coastal conservation measures with delivery of disaster warning/information. This will be achieved through the following four inter-related Project Results: 1) institutional capacity building and policy support for realization and enforcement of ICZM, 2) protection of coastal communities and infrastructure exposed to coastal erosion, 3) strengthened multi hazard early warning system services, and 4) improved observations and monitoring of long-term wave, sea level, coastline, coral reef and land use. The Project Results also aim at creating enabling conditions for scaling up and replicating the Project impact beyond the immediate target area. The Project Results are based on the pillars of Ministry of Environment (ME) in the Government of Maldives and JICA (Japan International

Cooperation Agency) initiative coordinated with Maldives Metrological Services (MMS), Land & Survey, island governments, residents, NGOs.

Due to the negative experience of Maldives regarding the effectiveness of soft measures for coastal zone and beach protection, these measures are not popular at the current stage. Unpopularity of soft measures is mainly related to difficulties as shown in the above key barriers to be implemented effectively due their high sensitivity to the local environmental conditions such as geomorphology, hydrology and climate leading finally to maladaptation. In addition to knowledge and experience, the soft measures also require frequent and long-term commitment and significant financial resources to maintain their effectiveness.

AE submitting this funding proposal on behalf of Maldives' Government has successful experience in implementation of soft measures for coastal zone protection in the other countries and offers to the government of Maldives to transfer the technology related knowledge and provide on-the-job training of coastal zone engineering for sustainable and cost-effective management of coastal zone with soft measures.

4. Proposed Intervention

The proposed intervention aims at "strengthening the long-term and sustainable resilience of national land against climate change for enhancing economic development of the islands while maintaining the sustainable link between the residents and the beaches", and implementing appropriate management of coral reefs, and coastal side and shore side areas with physical measures at the coastal areas through combination of soft and hard components. The components will be studied "to maintain the natural protection function of coral reefs and sandy beaches" as a basic concept to build resilient islands.

(1) Component 1: Establishment of the Integrated Coastal Zone Management (ICZM)

In order to build climate-resilient safer islands, the natural protection functions of coastal areas and islands should be maintained on a long-term basis against developments and artificial modifications at the coastal area. To achieve this, integrated coastal zone management (ICZM) plan will be established based on accurate understanding the current state of the coast and the future climate risks, which is covered coral reef, coastal area and hinterland. Government officials from both the national and island levels will take action necessary intervention based on established policy and plan.

Activity 1.1: Inventory study for risk assessment on present coastal and coral reef conditions
Activity 1.2: Preparation of basic policy of ICZM at the national level
Activity 1.3: Preparation of concrete ICZM Plan at representative inhabitant island as case study
Activity 1.4: Capacity development and information sharing of the relevant organizations for establishment of the ICZM

(2) Component 2：Implementation of Coastal Conservation/Protection Measures against Coastal Disasters

Coastal conservation/protection measures will be implemented at selected areas in five inhabitant islands where coastal erosion has been already serious and coastal disaster risk due to SLR is exposed. Implemented coasts will be maintained sustainably by established community-based beach maintenance and management.

Activity 2.1: Detailed design of coastal conservation measures and capacity development of stakeholders
Activity 2.2: Implementation of coastal conservation/protection measures
Activity 2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders

(3) Component 3：Development of Disaster Warning and Information Dissemination

The system for dissemination of disaster warning/information covering nationwide will be built, and capacity development of government officials responsible for operating the system will be supported aiming at protecting residents' lives through appropriate evacuation activities to be taken by the residents themselves.

Activity 3.1: Installment of terrestrial digital broadcasting system

Activity 3.2: Establishment of Disaster Early Warning and Information Broadcasting System

(4) Component 4 ：Development of Basic Data Collection and Sharing System Related to Climate Change

In order to obtain basic climate related information such as waves, sea level, coastal and coral reef conditions for long term, and share the understanding of actual situation, climate impact and thereby to implement most appropriate measures for climate change, the monitoring system for wave and sea level, and beach, coral reef and land use will be established and necessary capacity development for operation will be conducted.

Activity 4.1: Development of wave and sea level monitoring system
Activity 4.2: Development of beach, coral reef and land use monitoring system

5. Climate Change Impacts/Benefits

The activities of each component shown in Section 2 are expected to contribute to building climate resilient and safer islands, and aid in the reduction of the USD 4.1 million (average annual benefit) of disaster damage caused by climate change. In addition, a total of about 4.2 km of the coasts facing immediate erosion will be conserved and protected, and the resilience of the coasts will increase at the protected hinterlands.

The implementation of the project is expected to demonstrate and promote the technology and expertise of beach nourishment, which retains the natural functions of the target coasts. The establishment of the Integrated Coastal Zone Management (ICZM), including environmental conservation and land use management of the surrounding areas, are also expected to be dispersed not only in the Maldives, but also in other island countries with similar geographical conditions.

6. Exit Strategy and Sustainability

The activities in the project are envisaged to have standard methodology for planning, designing, implementation, and maintenance of coastal conservation/protection in the Maldives. To realize this, the strategic activities are important for ensuring the sustainability of the project and to be taken in the project. The four strategies: 1) strategies for replication of the ICZM practices, 2) strategies for continued maintenance of nourished beaches, 3) strategies for continued operation of disaster warning system and the residents taking appropriate measures in the event of disaster, and 4) strategies for continued monitoring and accumulation of meteorological data, are executed during the project period. To execute the strategies and implement the preparatory activities for the strategies, capacity development of the concerned agencies and local consultants involved in the project is essential.

[1] State of Environment 2016, Ministry of Environment and Energy

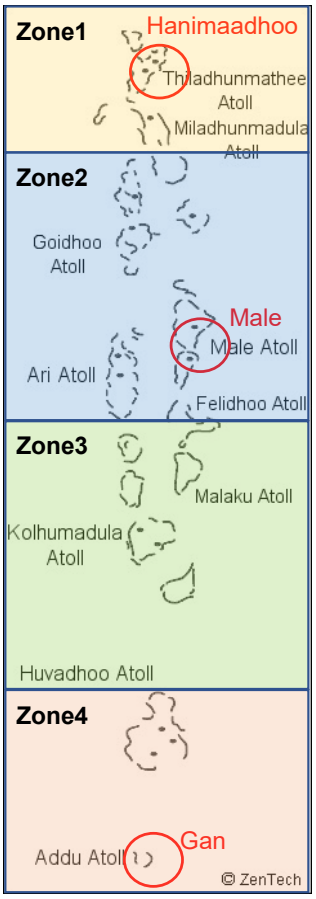
[2] Population & Housing Census 2014, Ministry of Finance & Treasury

B. PROJECT/PROGRAMME INFORMATION

B.1. Climate rationale and context (max. 1000 words, approximately 2 pages)

(1) Basic Information

The Republic of Maldives consists of 26 atolls and 1,192 islands within the range of around 90,000 km^2 in the Indian Ocean. The islands stretch 860km from latitude 7° 6'35"N, crossing the Equator to 0° 42'24"S, and lying between 72° 33'19"E and 73° 46'13"E longitude, and is demarcated into four zones in north-south direction as shown in Figure 1. The islands are very low-lying, with more than 80% having an elevation of less than 1m above mean sea level; none exceeds an elevation of 3m[1]. Coral reefs surrounding the islands protect the inhabitants from adverse impacts of strong waves. The islands of the Maldives are classified into 1) inhabited islands, 2) resort islands, and 3) industrial islands. The number of these inhabited islands is 188. The total area of national land is 298 km^2, and the length of coastline is 644 km. Around 44% of residential areas and 47% of infrastructure facilities are located within 100 m of the coastline[2]. The population of the country is 407,660[3] with a population density of 1,359 per km^2. The islands' geophysical characteristics predispose the country's propensity to natural hazards. Its geographic location near the equator in the Indian Ocean exposes Maldives to tropical storms and storm surges, swell waves, gale-force winds, heavy rainfall, drought, as well as tsunami and earthquakes. Floods occur from heavy rainfall, storm surges, or from swells generated by storms from the far south. The small size of the islands and their low elevation make human settlements defenseless against severe weather events, as well as tsunami, as retreat inland or to higher grounds would be impossible[4]. Also, accelerated sea level rise due to climate change will have devastating effects on the islands, and can threaten their very existence[1].

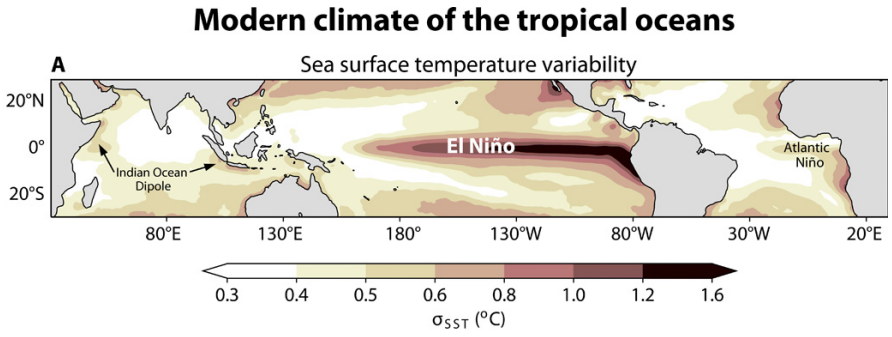


Source: Arranged by JICA based on Zen Tech

Figure 1 Geographical map of Maldives

(2) Regional Climate Overview[5]

Predicting changes in the pattern and magnitude of sea surface temperature (SST) fluctuations over the tropical oceans is critical for attributing changing climate variability and extreme weather over large parts of the world[6]. Observations show that the tropical Indian Ocean has been considered as a minor driver of climate variability relative to the Pacific or the Atlantic oceans for a long period[7].

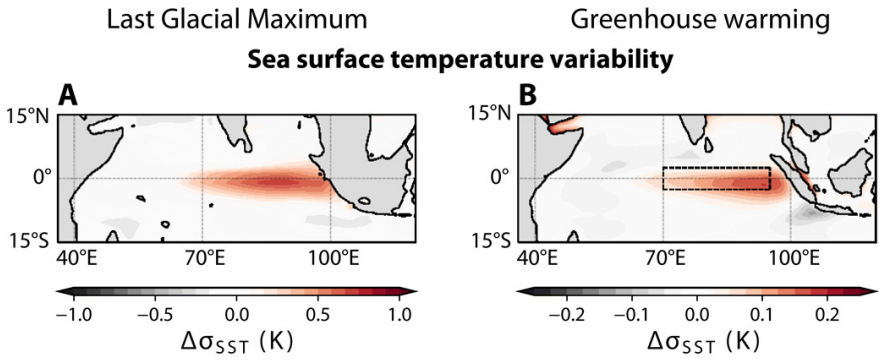


Source: Emergence of an equatorial mode of climate variability in the Indian Ocean (2020)[5]

Figure 2 Variability of Sea Surface Temperature

The tropical Indian Ocean exhibits much weaker SST variability than the tropical Pacific and Atlantic oceans as shown in Figure 2. Unlike these oceans, where the El Niño Southern Oscillation (ENSO) phenomenon and the Atlantic Niño drive pronounced basin-wide SST anomalies (SSTAs), variability in the Indian Ocean

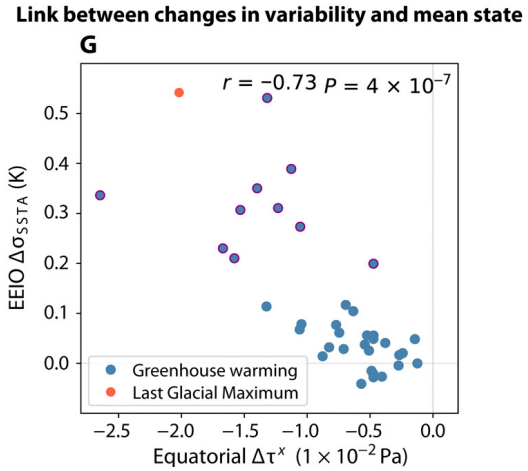
is restricted to the western side of the basin and along the coast of Sumatra and Java[8]. Large SSTAs spanning the equatorial Indian Ocean are extremely rare.



Source: Emergence of an equatorial mode of climate variability in the Indian Ocean (2020)[5]

Figure 3 Variability of Sea Surface Temperature in EEIO under GM and LGM Conditions

However, the model simulations of CMIP5 (Coupled Model Inter-comparison Project 5) show that continued greenhouse warming could alter these features, and the Indian Ocean could evolve into a mean state similar to the Pacific or Atlantic oceans[9,10,11]. The CMIP5 models show a direct link between the changes in mean climate and the increase in variability under greenhouse warming. Historical observations support this prediction, showing a tendency for easterly winds along the equator, an eastward shoaling thermocline, and a reversal of the east-west SST gradient since the 1950s [12, 13, 14, 15]. These changes should be accompanied by increased SST variability along the equatorial Indian Ocean[16].



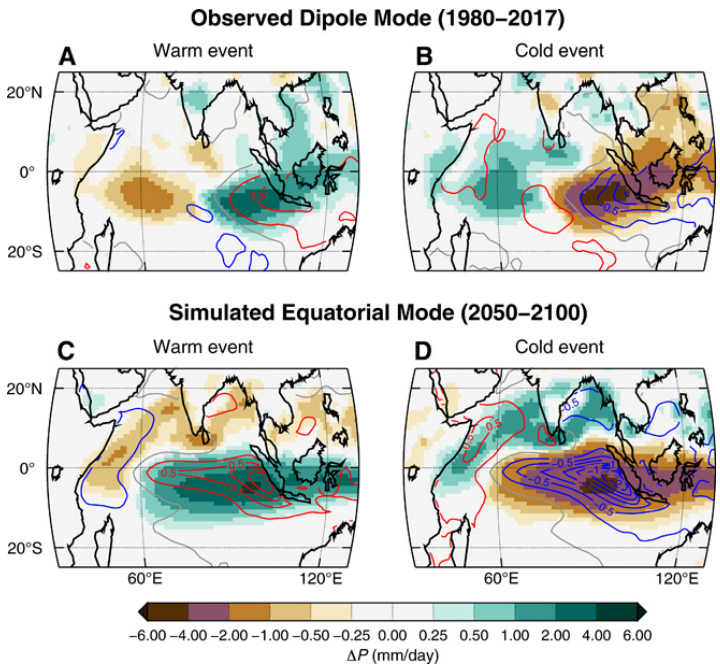
Source: Emergence of an equatorial mode of climate variability in the Indian Ocean (2020)[5]

Figure 4 Relation between Change in SD of SST and Zonal Wind Stress in the EIO

Eastern equatorial Indian ocean (EEIO) is one of the most climatically sensitive regions in the global ocean, which plays a vital role in modulating Indian ocean dipole (IOD) and El Niño southern oscillation (ENSO). The simulation results indicate that under greenhouse warming (GM) and Last Glacial Maximum (LGM) conditions, the Indian Ocean can exhibit increased SST variability in the eastern equatorial Indian Ocean (EEIO) as shown in Figure 3. The magnitude of the increase in SST variability, measured by the change in the Standard Deviation (SD) of SSTAs averaged over the EEIO, is strongly anti-correlated with the changes in zonal wind stress along the equator as shown in Figure 4. Most of CMIP5 models predict increases in variability and more easterly winds for the second half of the century. These seasonal variations are similar to those occurring in the modern Pacific and Atlantic oceans. The simulated changes in the Indian Ocean give rise to its own El Niño like variability.

Figure 5 shows the rainfall impacts of current and future modes of climate variability in the Indian Ocean. Composite rainfall anomalies (shading) during (A, B) observed Dipole Mode events and (C, D) simulated Equatorial Mode events active in the Indian Ocean under greenhouse warming. In both cases, warm (A, C) and cold (B, D) events are, respectively, characterized by positive or negative SST anomalies (contours) over the eastern Indian Ocean. The emergence of the equatorial mode could drive rainfall variability with stronger amplitude and altered patterns over the Indian Ocean and surrounding land masses relative to currently experienced. Warm vents, with their positive SSTAs spanning much of the equatorial Indian Ocean, could drive rainfall deficits over the Horn of Africa as well as over Southern India, in addition to increased rainfall over Indonesia and Northern Australia (Figure 5 C). On the other hand, cold events associated with the equatorial mode could drive rainfall anomalies with a similar spatial pattern and magnitude as the warm events, but with opposite polarity and subtle, yet important differences for terrestrial precipitation as shown in Figure 5 D.

In summary, it is demonstrated that the Indian Ocean can sustain an equatorial mode of climate variability under altered mean states predicted for the second half of the 21st century. This mode manifests as cold and warm interannual events with large-scale SSTAs spanning the central and EEIO. These events, particularly warm ones, represent a marked departure from current variability, characterized by weaker and more spatially confined warm Indian Ocean Dipole (IOD) events. Because of their basin wide and stronger SSTAs, future warm events could drive unprecedented hydrological extremes across the basin. They could bring more frequent droughts to East Africa and southern India, in addition to increased rainfall over Indonesia, exacerbating the effect of a warmer climate on these hydrological extremes[17]. A potential activation under greenhouse warming, however, could lead to record-breaking SST and rainfall fluctuations, rendering the emergence of the mode a main factor determining future climate risks, including more frequent and devastating wildfires, flooding, and droughts.



Source: Emergence of an equatorial mode of climate variability in the Indian Ocean (2020)[5]

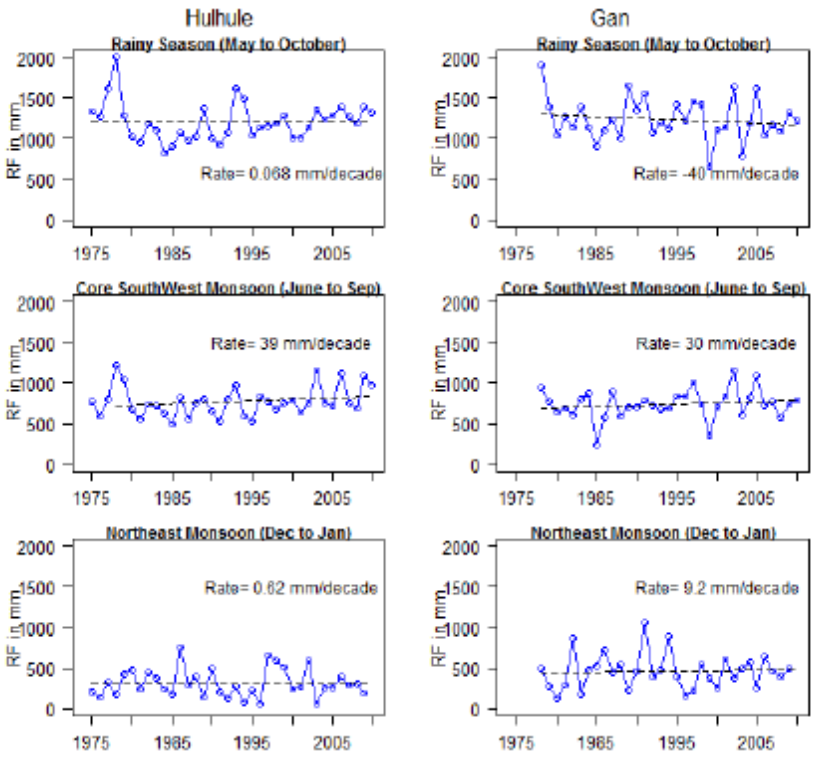
Figure 5 Rainfall impacts of current and future modes of climate variability in the IO

(3) Climate Trend of Maldives

a) Rainfall and Temperature

Annual and monthly climatology in Maldives for rainfall and temperatures have been presented using observed climate data by Maldives Meteorological Services for the period 1975 to 2010. The seasonal rainfall time series trend at Male' and Gan in Addu Atoll are presented in Figure 6[18].

From the present analysis of rainfall trends, indicates overall positive trend in all the seasons except rainy season in Gan (May to October). Rainfall during the core southwest monsoon months (JJAS) and northeast monsoon months (DJ) shows increasing trend for both the locations. The rainfall trend of Gan for rainy season is decreasing but has increasing trend during core southwest monsoon season. Annual Tropical Rainfall Measuring Mission (TRMM) rainfall analysis from 1998 to 2007 shows that zone4 receives more



Source: Climate change scenarios and their interpretation for Maldives (2012)[18]

Figure 6 Accumulated rainfall during various seasons for Male and Gan (1975 to 2010)

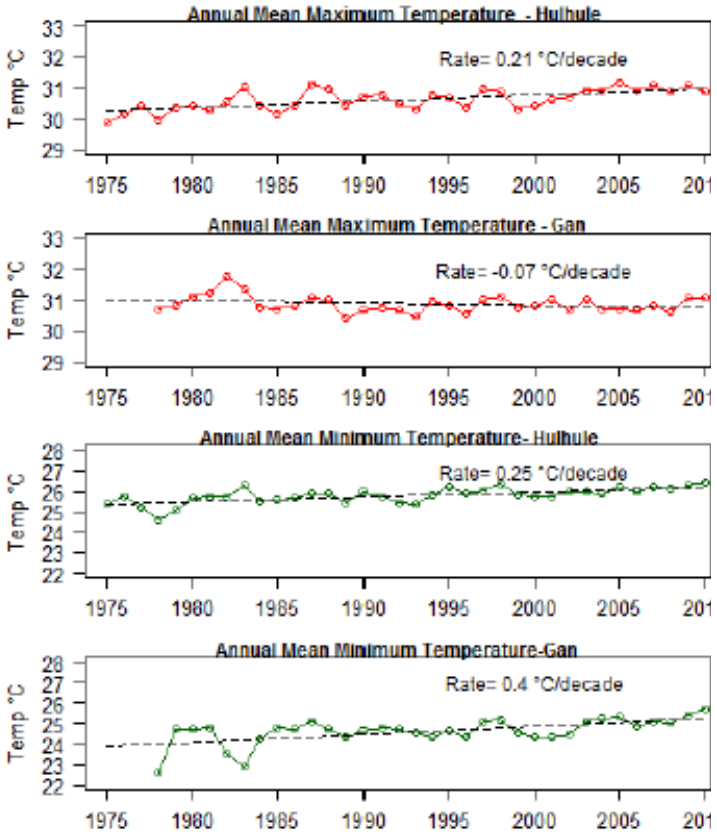
rainfall than other three zones (1, 2 & 3). Also, the fluctuation of annual rainfall is inferred between 1162 to 2503mm. It is observed that monthly rainfall amounts range from -200mm to 300mm, with very few anomalies that are greater than 400mm.

In terms of long-term annual maximum and minimum temperature analysis, the result shows rising trend for both Male and Gan station. Figure 7 shows trend plot of maximum and minimum temperatures in both northern (Hulhule) and southern (Gan) parts of the Maldives. Maximum temperature shows an increasing trend in the northern part of the Maldives (0.21°C/decade), but a decreasing trend in the southern part (- 0.06°C/). Looking at the minimum temperature, there is an increase trend observed in northern parts (0.25°C/) and steep increase in southern part (0.4°C/). However Gan's maximum temperature decreasing trend is overcome by higher rise of minimum temperature.

Monthly climatology from the observed datasets (1975 to 2010) has been shown in Figure 8. The main rainfall months as well as peaks are the months May and September. These peaks have been well marked in other stations also, illustrating the strong signal of the two monsoon seasons in the rainfall climatology of the islands. Rainfall in Maldives varies from north to south, with the amount of rainfall increasing towards the south. This difference in rainfall pattern is primarily due to the northeast monsoon, and April being much drier in the north than in the south[19].

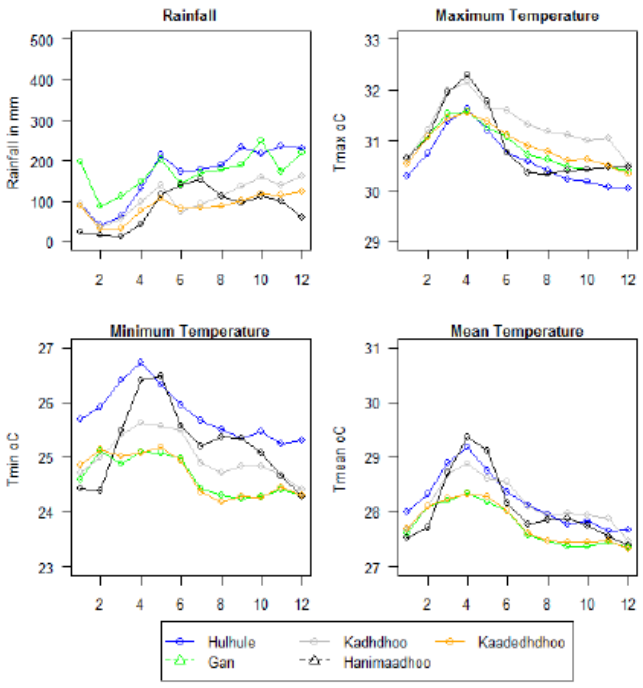
b) Sea Level

Figure 9 shows the observed sea level for the past 33 years from 1986 to 2018 which was observed in Gan, Addu Atoll. The blue and red lines in the figure show the maximum and average values for each year, respectively. Sea level was observed at 10.6 cm for 33 years (3.2 mm/year) for the average tide. On the other hand, the global average value for SLR, which was reported in the IPCC 5th Report 2013, was 19 cm from 1901 to 2010, or for 110 years (1.7 mm/year).



Source: Climate change scenarios and their interpretation for Maldives (2012)[18]

Figure 7 Variations in annual mean maximum and minimum temperature for Male and Gan (1975 to 2010)



Source: Climate change scenarios and their interpretation for Maldives (2012)[18]

Figure 8 Seasonal climate cycles

Sea Level Rise (SLR) is a type of hazard which affects all the coastal zones and contributes to intensifying impacts of other natural disasters. Therefore, SLR can be considered as the most dangerous disaster type for the future in the Maldives which consists of low-lying, narrow islands and long coastlines.

c) Sea Surface Temperature (SST)

SST is an important parameter because of its change might affect Maldives' coral reefs (coastal eco system) and fisheries sector. Understanding SST historical change and projection is, therefore, essential for coastal ecosystem impact assessment. NOAA Global Optimum Interpolation (OI) Sea Surface Temperature (SST) Analysis dataset is available for the period 1982 to 2010.

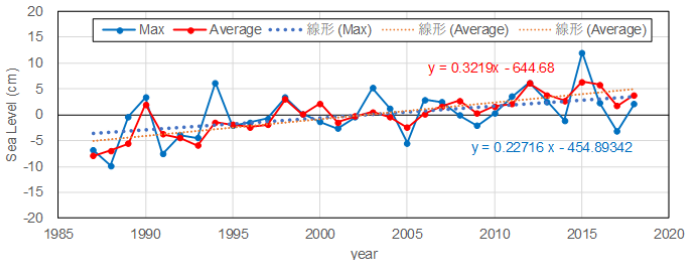
Figure 10 shows four different zones of Maldives. The SST has the same increasing tendency as that of the air temperature recorded at two meteorological stations of Maldives. Average monthly Sea Surface Temperature (SST) ranges from 28.2ºC to 29.3ºC.

d) Waves

i) Offshore Waves

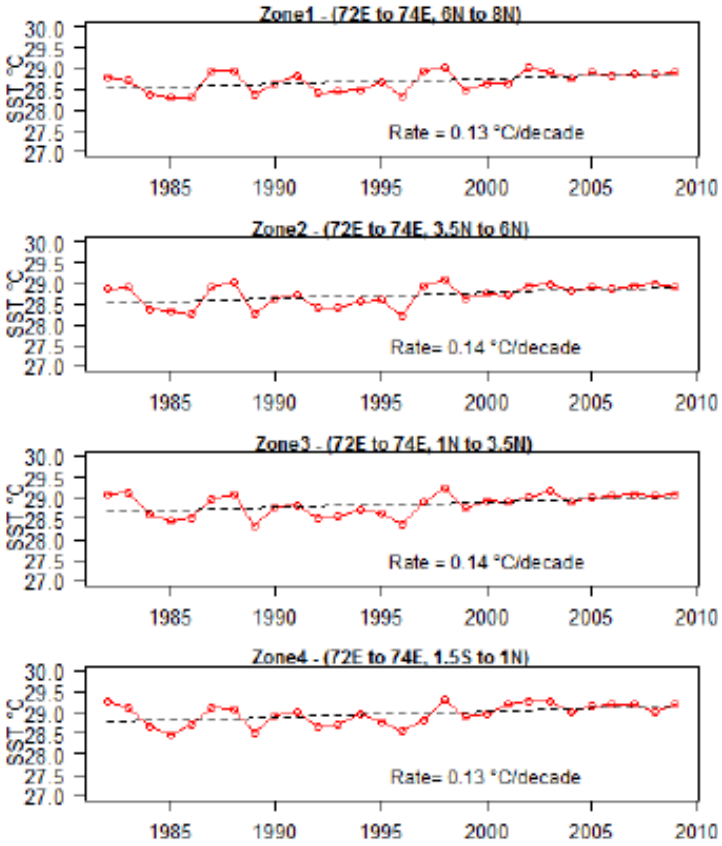
Characteristics of offshore waves are described by applying the reanalysis data base, WavewatchⅢ and ERA5, because no wave observation data for long periods can be available in the Maldives.

Figure 11 shows distribution and rose of significant wave by WavewatchⅢ from 1979 to 2008[20]. The significant wave height varies between 0.1 and 5 m, with the most frequently occurring value around 1.2 m. Most of the wave resource comes from the southeast. Figure 12 shows the variation of maximum value of monthly average wave height ($H_{1/3}$ and H_{max}) near the Addu atoll for about 40 years from 1978 to 2018 obtained from the reanalysis data of ERA5. This figure shows the increasing trend of $H_{1/3}$ and H_{max}. H_{max} increases by about 1 cm/yr, and $H_{1/3}$



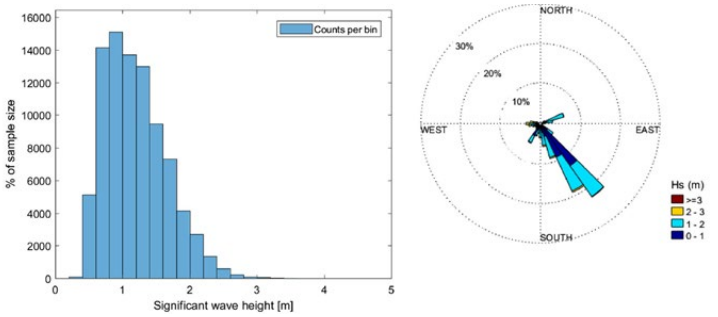
Source: Arranged by JICA Based on Data for Maldives Meteorological Service

Figure 9 Observed sea level in Gan, Addu Atoll for the past 33 years



Source: Climate change scenarios and their interpretation for Maldives (2012)[18]

Figure 10 Variation of annual mean sea surface temperature fluctuation for four zones in Maldives (1982 to 2009)



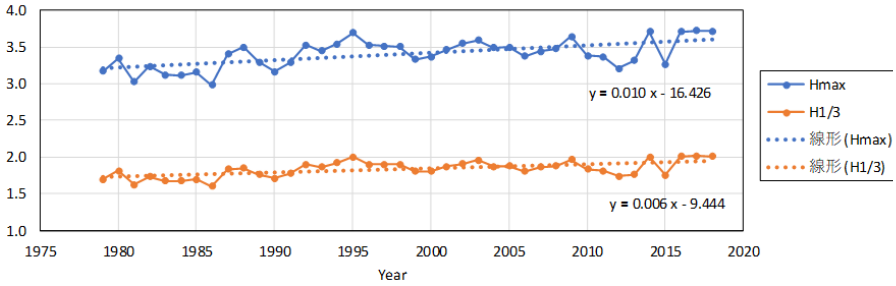
Source: Assessment of extreme and metocean conditions in the Maldives for OTEC applications (2019) [20]

Figure 11 Distribution and Rose for Significant Wave (1979-2008)

increases by about 0.6 cm/yr. However, the increasing rates are too small that their rates are less than 1 % of the both of monthly average wave height.

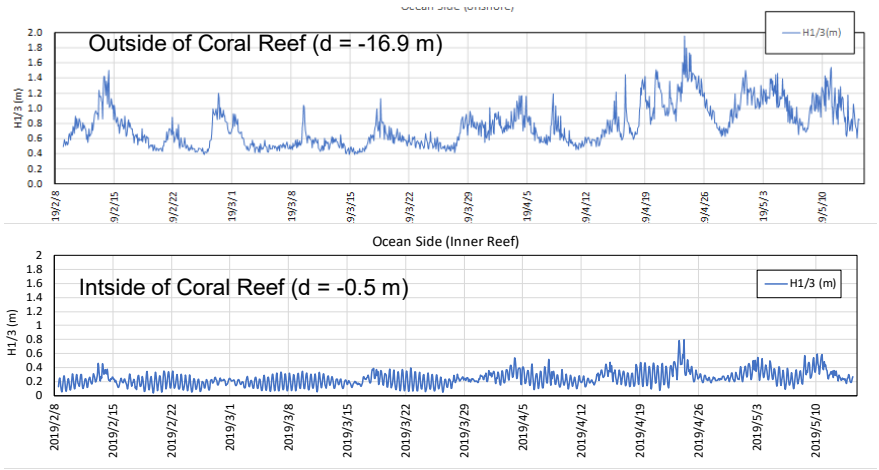
ii) Waves on Coral Reef

Coral reef enclosed the coastline in the Maldives and offshore waves propagate through coral reef. The propagate waves on coral reef is greatly influenced by wave deformation on coral reef such as wave breaking and split at reef edge, dissipation on reef flat, and wave set up on coral reef (Figure 13). Thus, it is important to know the characteristics of waves on coral reef to discuss vulnerability of coastal area. The characteristics of waves on coral reef are discussed based on the wave observation data, which was obtained by preliminary survey of JICA study in 2019. Figure 14 shows the relation between observed wave height and water level on coral reef observation at the two points at different distances from the reef edge. Significant decrease of wave height on the reef was observed, and it is identified the decrease of wave height is related to the water level on coral reef and distance from the reef edge. From the result, it is identified that waves to propagate to the shore for coral reef coast is greatly influenced by the water level and topography of coral reef, especially width of reef.



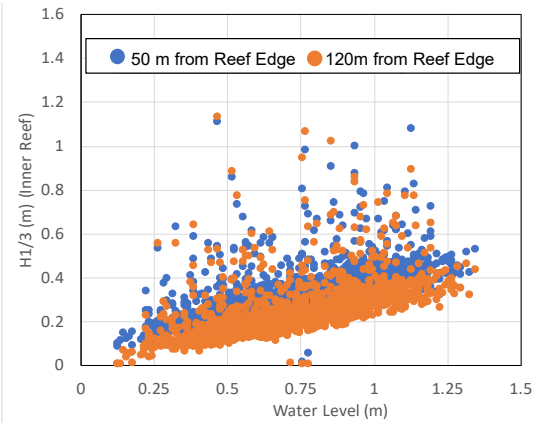
Source: JICA

Figure 12 Variation of Maximum Value of Monthly Average Wave Height ($H_{1/3}$ and H_{max}) (1978 - 2018) ($H_{1/3}$ and H_{max}) (1979-2008)



Source: JICA

Figure 13 Time series of $H_{1/3}$ at the inside and outside of coral reef (ocean side, Addu)



Source: JICA

Figure 14 Relation of wave height and water level at inside of coral reef (ocean side, Addu)

e) Summary of Observed Climate Trend

Climate of Maldives is largely dictated by the climate of the Indian Ocean, as the atoll clusters do not seem to produce a detectable land-sea contrast to create a clearly distinguishable island climatology. The existing long-term observational records show that the temperatures change closely correlate with the sea surface temperatures and the rainfall data at the daily scale is very noisy, which is indicative of a preponderance of sporadic convective phenomena. On a seasonal scale there is increasing trend that could perhaps be linked to the rising trends in temperature. Sea level is gradually increased with 3.2 mmm/year at Gan, Laamu Atoll in recent 33 years. Offshore wave height also has a tendency to increase gradually, but not so significant up to now. However, wave height on coral reef is greatly

influenced by water level on coral reef and SLR due to climate change will induce the increase of wave height propagated to coral coast.

(4) Future Projection of Maldives Climate

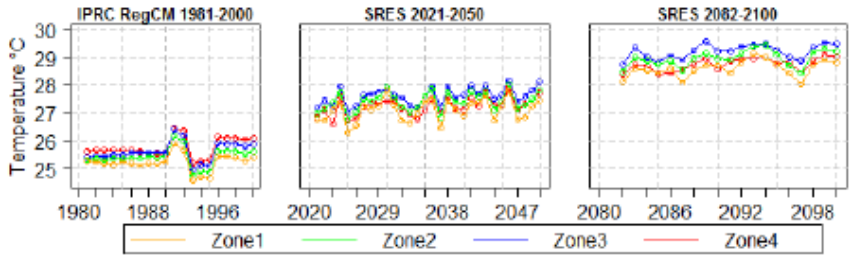
a) Rainfall and Temperature

Future projection of Maldives climate is described by using the regional dynamical downscaling climate model provided by the International Pacific Research Center (IPRC), University of Hawaii, which calls "IPRC RegCM".

Mean Temperature plot over Maldives for time slices 1981-2000, 2021-2050, 2082-2100 are presented in Figure 15. Surface temperature has an increasing trend as seen from the time slices experiments (2021- 2050) and (2082-2100) scenario over the different zones of Maldives.

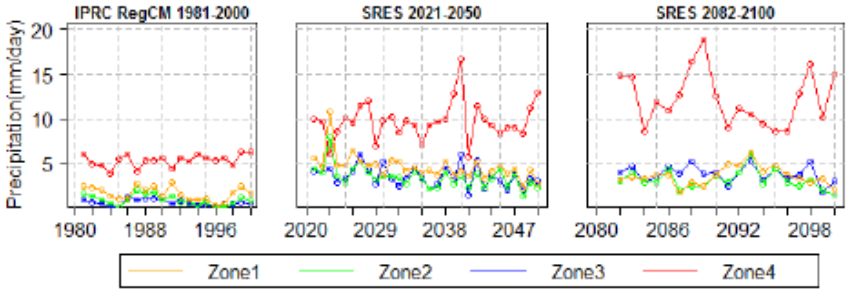
The regional model could simulate the rainfall characteristics over different zones as shown in Figure 16. These results show an increase in rainfall over most of the zones.

Figure 17 shows the simulated rainfall changes through the Special Report on Emission Scenarios, IPCC (SRES) A1B scenarios from 20th Century Climate in Coupled Models (20C3M) for the rainy season. The time slice of 2082-2100 shows increased rainfall overall. A greater increase in the rainfall from the north to south during the rainy season is observed encompassing zones 1, 2 and 3.



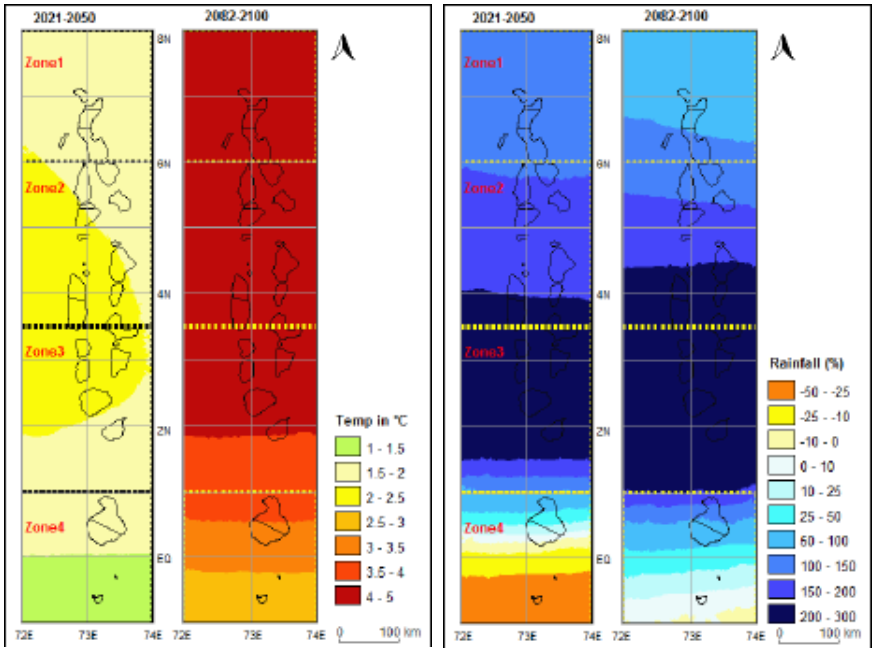
Source: Climate change scenarios and their interpretation for Maldives (2012)[18]

Figure 15 IPRC RegCM annual mean temperature projection for Maldives



Source: Climate change scenarios and their interpretation for Maldives (2012)[18]

Figure 16 IPRC RegCM annual daily rainfall projection for Maldives



Source: Climate change scenarios and their interpretation for Maldives (2012)[18]

Figure 17 Temperature and rainfall changes over Maldives domain from IPRC RegCM scenario time slices (2021-2050) and (2082-2100) from baseline (1980-2000)

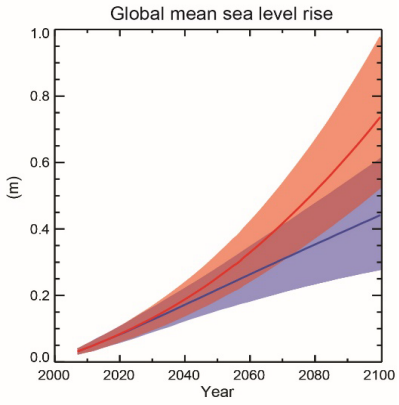
b) Sea Level Rise (SLR)

SLR is a type of hazard which affects all the coastal zones and contributes to intensifying impacts of other natural disasters. Therefore, SLR can be considered as the most serious hazard for the future in the Maldives which consists of low-lying, narrow islands and long coastlines. The range of the global mean SLR for each scenario is estimated as shown in Figure 18. The SLR up to 2100 is from 5.3 mm/year to 9.7 mm/year for RCP8.5 and from 2.8 mm/year to 6.3 mm/year for RCP2.6. The average SLR in the Maldives from 2001 to

2100 is predicted to be from 4.0 mm/year to 4.8 mm/year[2]. These values are higher compared with the SLR of 3.2 mm/year in the last 33 years in the Maldives.

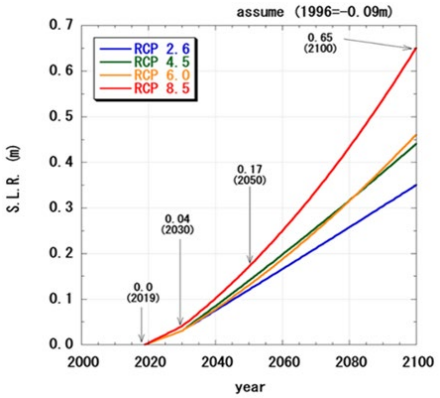
Since SLR has a large effect on the increase in wave height on the reef, the relationship between these two is explained below. The reef has a wave dissipation effect to decrease wave energy of the waves on the reef. Therefore, the wave height on the reef is much smaller than the wave height outside the reef. However, previous studies show that SLR weakens such effect while increasing wave height significantly. There is a concern that higher wave would reach the coast as the sea level continues to rise.

The future scenario of SLR is referred to as the scenario presented in the 5th report of IPCC[21]. Here, the base year for the future scenario presented in the 5th report was assumed around 1986 to 2005. In order to convert the base year to the present (2019), the value of 9 mm was deducted from the actual observed SLR from 1996 to now. Figure 19 shows the median values of future scenario of SLR in Maldives based on 2019.



Source: IPCC's fifth assessment report (2013)[21]

Figure 18 Estimated SRL by RCP scenarios (AR5)



Source: JICA

Figure 19 RCP scenarios in Maldives (based on 2019)

(5) Natural Hazard

The natural hazards in the Maldives are stated including the severity, frequency, and regional characteristics of the damage and also climate projection that have a high impact on each natural hazard. Following six natural hazards, which are storm surge, swell wave, heavy rainfall, drought and tsunami are discussed as main natural hazard in the Maldives.

a) Storm Surge

There are very few cases of cyclones occurring in the sea area near the Maldives. As shown in Figure 20, only 11 cyclones passed through the Maldives for 117 years from 1877 to 2004. Regarding the influence range of storm surge, the southern parts in the Maldives, as located near the equator, are off the pathways of cyclones and tropical depressions in general. Therefore, the impacts of storm surge are more significant in the northern side in Maldives. Moreover, SST rise is considered as a climate projection that has a large impact on storm surges. When the seawater temperature rises, cyclones and tropical cyclones become stronger and then the scale of storm surges becomes larger. In addition, when the sea level rises, the land ground height is relatively lowered and the water level reaching the coast becomes higher, but the external force of storm surge itself is hardly affected by the SLR.

Source: National Adaptation Plan of Action (NAPA) (2006)[23]

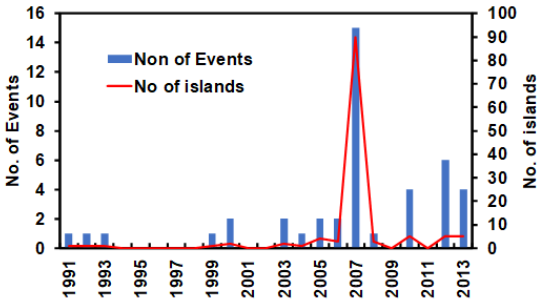
Figure 20 Cyclones pathways (1877-2004)

b) Swell Wave

Based on the frequency of flooding damage due to swell waves and the number of affected islands as shown in Figure 21, the flooding from swell waves occurred two to three times a year on average except in 2017. At the extreme event in recent years (May 15th – 18th, 2007), a tropical depression emerged in the southwest about 5,630 km off the Maldivian islands and brought swell waves to cause flooding in 68 islands in 18 atolls[22]. In some islands, flooding by swell waves reached 600

m inside from the coast. More serious damages were reported in the south, including Gaafu, Dhaalu, Thaa, and Laamu atolls.

Moreover, there are two climate projections that have a large impact on swell waves: SLR and SST rise. Regarding SLR, the depth of water inside the reef is shallower than that outside the reef, so the relative increase in water depth due to SLR is large. Since the wave height on the reef is defined by the water depth, if waves reaching the coast becomes large due to the effect of SLR, it is assumed that the scale of swell wave will increase. Meanwhile, when SST rises, it is assumed that the scale of the swell wave will increase as the monsoon intensifies.



Source: Second National Communication of Maldives (2016)[17]

Figure 21 Frequency of inundation caused by swell wave and number of islands affected

c) Heavy Rainfall

Flooding damage caused by heavy rain was not so large, but the frequency was relatively high due to the monsoon. Table 1 shows the maximum precipitation by island. It is noted that actual values of the maximum precipitation per day for southern regions are larger than those in the table. Therefore, it can be expected that flooding may cause more damages in the south. Moreover, increase in rainfall is considered as a climate projection that has a large impact on flooding by heavy rainfall. When rainfall increases, the scale of flooding is expected to increase.

Table 1 Maximum precipitation by Island

Island (from north to south)	Maximum Precipitation (mm/24hr)
H.Dh Kulhudhuffushi	176
Sh. Funadhoo	176
K. Thulusdhoo	176
Dh. Kudahuvadhoo	241
Th. Vilufushi	241
L. Gan	241
GA. Viligilli	248
G.dh Thinadhoo	248
S. Feydhoo	248
S. Hithadhoo	248

Source: Detailed Island Risk Assessment in Maldives (2008)[24]

d) Drought

In the Maldives, no significant drought damage has been reported in the past. According to the analysis of rainfall data, the number of consecutive days in the northern and central parts is larger than in the southern part. Even though, drought was not so significant in the past, it is expected to increase due to climate change based on the result of grovel climate model.

e) Tsunami

Tsunamis caused by earthquakes in the fault zone around the Maldives have been observed 80 times since 1816, and damages were not seen except for those caused by the Indian Ocean Tsunami that occurred in 2004. In the Indian Ocean Tsunami, 82 people were killed and 26 were missing, and 3,997 houses and buildings were damaged. About one-third of the population was severely affected. Based on the survey result for tsunami run-up height, it tends to be lower in the north and higher in the south due to the difference of height of coral ridge and grand level that is higher at northern area than that at southern area. Once huge tsunami attacks to the Maldives, it is caused serious damage to the Maldives because of low elevation and small area of land. However, the frequency of occurrence is very rare comparing to other natural hazard, and it is considered that there is no climate projection that has a large impact on tsunami.

(6) <u>Summary of Climate Projection and Natural Hazard</u>

Impact potentials and regional differences by natural hazard are summarized in Table 2 and Table 3, respectively.

a) Climate Projection

Major climate projections for the Maldives are precipitation increase, sea level rise (SLR), and atmospheric and sea surface temperature (SST) rise. Among this, SLR causes the biggest concern because it creates

adverse impact to countries that have long coastlines as well as narrow and low-lying land. Moreover, as shown in Table 2, SLR may intensify the impact of other natural hazards such as swell waves and storm surges, which should be addressed with the highest priority.

b) Natural Hazard

Among the major natural hazards shown in Table 2, 3) flooding and 4) drought are relatively small in terms of magnitude of disaster as previously described. 5) Tsunami brings massive damage but occurs quite rarely (once in 200 years or so), and with less impacts of climate change. Meanwhile, 1) storm surges and 2) swell waves are the hazards that give massive damage and are more sensitive to climate change. In particular, 2) swell waves occur more frequently than other hazards and should be addressed with the highest priority.

c) Focused Region

Looking at the hazards of swell waves as shown in Table 3, the southern regions in the Maldives, where swell waves are most developed, tend to be affected more than the others. From the natural hazard viewpoints, the islands in the south of the Maldives should be taken as the most important region to be addressed.

Table 2 Severity, frequency and impact potential of natural hazard by climate projection

	Natural Hazard				
	1) Storm Surge	2) Swell Wave	3) Flooding	4) Drought	1) Tsunami
Severity	High	High	Mod.	Mod.	Very High
Frequency	Rare	Often	Often	Often	Very Rare
Impact Potential of Climate Hazards					
1) Precipitation Increase	-	-	High	-	-
2) Sea Level Rise	-	High	-	-	-
3) Temperature Rise (SST)	High	High	-	-	-

Source: JICA

Table 3 Impact potential of natural hazard by region

	1) Storm Surge	2) Swell Wave	3) Flooding	4) Drought	5) Tsunami
Regional Trend	High	Mod.	Low	High	High
	High				
	Low	High	High	Mod.	High

Source: JICA

(7) Vulnerability to Related Sectors

a) Tourism

About 70 % of tourists visit the Maldives primarily for beach holidays, which would be severely disrupted because of the loss of beaches. Already 45 % of tourist resorts have reported varying degrees of beach erosion[23]. In addition to attracting tourists to its beaches, the Maldives is the “world’s leading dive destination” and the “Indian Ocean’s leading destination”[24]. The area’s coral reefs thrive in a narrow temperature range and are highly sensitive to changes in temperature. Given the current predictions for an increase in the sea surface temperature (SST) and the observed relatively more frequent or persistent El Niño episodes, coral bleaching is expected to rise rapidly and significantly.

The major climate change impacts on the Maldives tourism sector are identified as shown in Table 4.[25]

Table 4 Major climate change impacts on the Maldives tourism sector

Major Climate Change	Identified Impact
Increase in temperatures.	Change and unpredictability in seasons, increase in cooling costs, heat stress for tourists, infectious disease increases.
Increasing frequency and intensity of extreme events.	Increased insurance costs/loss of insurability, business interruption costs.
Sea level rise	Coastal erosion, loss of beach area, loss of coastal infrastructure, higher costs to protect and maintain beaches.
Sea surface temperatures rise	Increased coral bleaching and marine resource and aesthetics degradation in dive and snorkel destinations
Changes in marine biodiversity	Loss of natural marine attractions and species.

b) Fisheries

Predominant proportion of the fishery captures is tuna and tuna related species. Dynamics of marine fish stocks including tuna are linked to the climate variability. As the fishery of Maldives is entirely dependent on coral reef ecosystems, any impacts on these ecosystems will have a direct impact on fisheries sector. For example, tuna fishery is dependent on live bait which is caught from the reefs. In addition, a number of reef fish is extract for the export market and the resorts. The two main factors related to climate change that will impact fisheries are the changes in sea surface temperature and ocean pH.

c) Agriculture and Food Security

Agriculture is extremely important for the Maldives in terms of food security, nutrition, and income, which accounts for 1.2 % of its GDP in 2019[26]. Small size of coral islands with porous sand, makes production of agricultural products extremely challenging. According to Shabau[27] only 30 km^2 of cultivable land available throughout the archipelago. This is further exacerbated with limited fresh water available for irrigation on these small islands. Hence, agriculture is limited, making food availability a major concern for the Maldives.

Impacts of climate-induced hazards are huge and emerge in various ways: heat stress to plants, changes in moisture and temperature of soil, loss of fertile soil from surface erosion, water shortage for growing crops, changes in underground water level, water salination, land loss due to sea level rise, and so on. These impacts will worsen the current situation of the Maldives' agriculture which has already been under stress from poor soil, limited land area, and water shortage.

d) Human Health

There has not been an assessment done in the Maldives to find the exact relationship between climate change and health impacts. The anticipated climatic factors that have direct health impacts in Maldives are heat and extreme events. The climate model downscaling exercise predicts an increase of 1.67-3.72°C in temperature by the end of 21st century which could lead to an increase in frequency and intensity of heat waves in the future[28]. IPCC concludes heat-related mortality increases in countries with limited adaptive capacities and large exposed populations[29]. A semi-structured interview conducted under SNC in selected islands to outline their perception on climate change impacts. Table 5 summarizes the issues highlighted by the respondents as major concerns and emerging issues facing the islands. Participants raised concerns over increasing temperatures and related health impacts such as skin irritation and dehydration particularly among labors was also highlighted by many participants. Some participants believe that deaths in elderly populations may have been due to heat.

Table 5 Summary findings of health related impacts

Location (Atoll/Island)	Main Concerns
HDh. Kulhudhuffushi	hotter days dehydration skin irritation Urinary Tract Infections Eye irritation Respiratory diseases Increase in dust accumulation.
AA. Rasdhoo	Skin diseases (Itchiness, rashes), Hotter days
AA. Thoddoo	Respiratory diseases Dehydration.
Addu City	Hotter days Dehydration, Dryness due to loss of green vegetation is the reason.

There is an increase in the extreme events in Maldives. Future climate predictions indicate that frequency and intensity of these events will increase as mentioned earlier. The relation of health impacts, such as

physical injury and mortality from these events have not been studied in the Maldivian context. Lack of information on direct health impacts are hindering factors for such an analysis. In the qualitative survey, participants highlighted disruption of transport and reduced accessibility to health facilities due to extreme events.

e) Water Resources

Freshwater resources would be directly impacted by the predicted rise in global temperatures, sea level and also possible decrease in rainfall. For small islands like the Maldives, with limited fresh water it is important to realize the possible impacts on water resources from the impacts of climate change. This assessment, using a desk review and field work at selected islands looks at the vulnerability of water resources in the Maldives. Quality of groundwater and availability of rainwater are used as the main indicators for assessing the vulnerability of the case study islands to the impacts of climate change.

i) Groundwater

The groundwater, deposited in the freshwater lenses, located 1 m to 1.5 m underground, used to be the drinking water of the people in the past, and now around 90 % of people use rainwater for drinking and cooking. In addition to the over-pumping of water from the freshwater lenses, there will be possibilities for such water to be exhausted due to the prolonged dry seasons.

Saltwater intrusion to the freshwater lenses could occur due to the assumed floods caused by sea level rise and swell waves. Saltwater intrusion will affect the soil condition, vegetation and terrestrial ecosystem, resulting in severe losses in the agriculture sector.

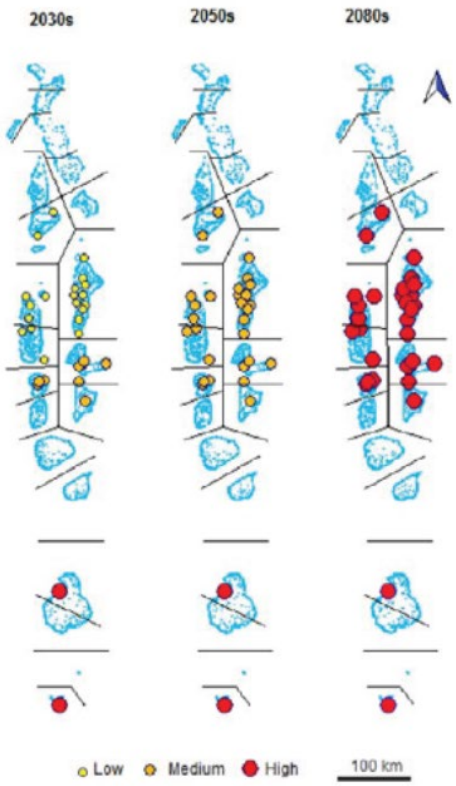
ii) Rainwater

Future regional climate change scenario shows that though the Maldives would experience high intensity monsoonal rainfall events, the number of rainy days is likely to decrease. This would have an impact on availability of rainwater for communities as a source of water.

f) Coral Reef Biodiversity

Corals are very sensitive to sea water temperature rise, and sea water temperature has already been higher than the threshold temperature that is optimal for the better growth of some coral species. The sea surface temperature (SST) anomalies cause coral bleaching. Coral reefs are also vulnerable to sea level rise, and the coral reefs found in the Maldives have already grown to reach the upper limit of the sea surface level, and there is no more room for the corals to grow further upward. Although the sea level rise may give opportunities to the corals to grow upward, it would be difficult for the corals to apply the sea level rise naturally, as the coral growth rate cannot keep up with the pace of sea level rise, accompanied with SST.

Future climate projections of the SST shows and increase over all regions of the Maldives as seen earlier. With the historic threshold of SST reaching 33°C for coral bleaching and using the baseline SST and the projected SST, it was found that the severity of bleaching will get higher with change of climate as seen in Figure 22 (MEE, 2015a)[30].



Source: Climate change scenarios and their interpretation for Maldives (2012)[d]

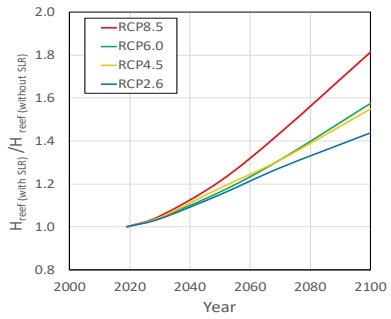
Figure 22 Projected impacts of coral bleaching

(8) Coastal Vulnerability

a) Natural Vulnerability

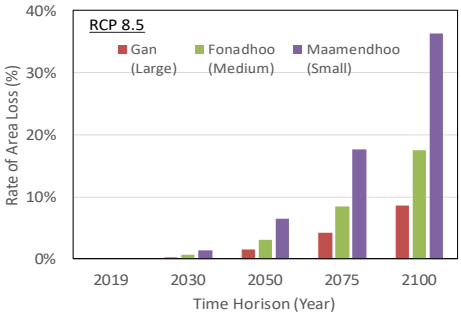
According to specific geological features, high exposure of residential areas, and important infrastructures located nearby the coasts, the Maldives is vulnerable to natural hazards such as high waves, storm surges, and flooding. In the future, SLR due to climate change will accelerate the occurrence of natural hazards such as the increase of wave height, which will eventually reach the coast.

The most serious problems that cause coastal disasters in inhabited islands in the Maldives are coastal erosion and increased flooding due to high waves. SLR and the increase of wave height on coral reef due to SLR (Figure 23) will accelerate coastal erosion and result in the loss of national lands (Figure 24), increasing the exposure of the coastal residential areas and important infrastructure, and making the damage due to high waves and flooding great and severe in terms of scale and frequency (Figure 25).



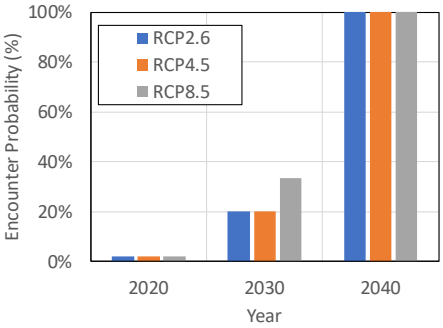
Source: JICA

Figure 23 Increase of Wave Height on Coral Reef due to SLR



Source: JICA

Figure 24 Rate of Area Loss by Coastal Erosion

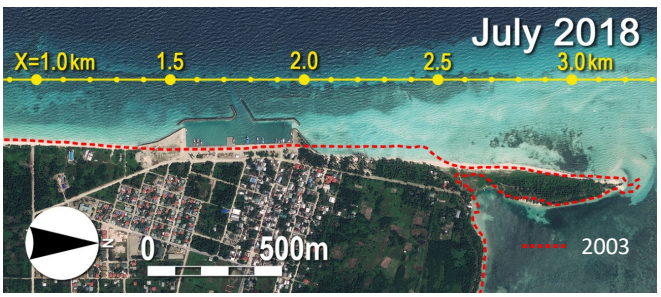


Source: JICA

Figure 25 Encounter Probability of Once Tide Level for each Scenario

b) Human-induced Vulnerability

The concentration of humans and resources around the coastal areas in the inhabited islands and artificialization of the coastal lines by the construction of harbors, reclamation, and other coastal protection facilities cause deterioration of protection functions and drainage functions, which natural sandy beaches and coral reefs in the Maldives originally to have, resulting in the acceleration of coastal line changes, coastal erosion, and increasing vulnerabilities against climate cha nge hazards in the future (Figure 26). Human-induced vulnerabilities also include the shortage of information sharing and mutual understanding among the relevant authorities, insufficiency in appropriate planning, designing, and management systems as well as these capacities, insufficiency in necessary measures to lead community-level actions. Disparity between men and women is also observed in terms of information acquisition, communication and evacuation means upon disaster event.



Source: JICA

Figure 26 Coastal Change after Port Construction (Gan Island, Red Line: Shoreline as of 2003)

(9) Selection of Target Atolls of the Project

Under the above hazards and vulnerabilities, it is required to build national land resilience in order to conserve it and maintain a safe, secure and comfortable life for the local residents and to allow them to hand it over to the next generation. In order to achieve this, it is reasonable and realistic to consider the maintenance of the protection function of natural sandy beach and coral reef as “natural infrastructure” as much as possible, and supplementing the required or insufficient function with the implementation of climate adaptive measures. In this context, there are three points considered in the selection of the target atolls and islands: item 1) impact of climate projection and vulnerability, item 2) project effects, and item 3) similarity of

coastal conditions and coastal problems with other inhabited islands, and validity as model cases. The results of examining each item are summarized as follows (see Appendix-2 Chap.5):

Item 1): The impacts of climate projection and vulnerability in the southern area are higher than in any other areas in the Maldives. The number of reported cases of coastal erosion, gender inequality index, human development index, and composite human vulnerability index show that Laamu Atoll has the highest climate impact and vulnerability among the southern atolls.

Item 2): Atolls in the southern part of the Maldives were compared in terms of socio-economic status. It includes the importance in the National Spatial Plan, the size of air passengers, current and future population, scale of tourism, scale of agriculture, and scale of fisheries. Addu Atoll is the most important in the southern area, followed by Laamu Atoll in terms of socio-economic activity.

Item 3): From the results of items 1) and 2), it was confirmed that Laamu Atoll and Addu Atoll have higher climate impact and vulnerability in the southern area, and project implementation effects can be expected. In the selected two atolls, the main inhabited islands were compared for selecting target islands in terms of 1) vulnerability, 2) current condition and future development plan for coral reef and natural coasts, and request by residents on coastal measures, and 3) the importance of the islands on both economic and development potential. Eight inhabited islands were listed for the comparison from each atoll, which were Gan, Fonadhoo, Maamendhoo, and Isdhoo in Laamu Atoll and Hithadhoo, Maradhoo/Maradhoo-feydhoo, Feydhoo and Meedhoo/Hulhudhoo in Addu Atoll. The priority of eight listed islands in total were evaluated by giving a score for each as shown in Table 6 and 7. Here, evaluation was basically examined by employing quantitative criteria for each item as shown in Table 8.

From the results of the examination of items 1), 2), and 3), Fonadhoo Island of Laamu Atoll and Maamendhoo Island of Laamu Atoll were selected as the target islands for the proposed GCF financed projects. Also, Meedhoo island of Addu Atoll, and Gan and Ishdhoo islands in Laamu Atoll were selected as a sub-set of activity co-financed by the Government of the Maldives (GoM).

Table 6 Evaluation Results of Main Islands in Laamu and Addu Atolls

Evaluation Category	Evaluation Items	Addu Atoll				Laamu Atoll			
		Hithadhoo	Maradhoo	Feydhoo	Meedhoo	Gan	Fonadhoo	Isdhoo	Maamendhoo
Vulnerability	Geographical features (elevation, areas, etc.)	High(small)	High(small)	High(small)	Medium (middle)	Low(large)	Medium (middle)	Medium (middle)	Very high (very small)
	Dense situation (infrastructure, residential areas,population	High	Very high	midium(after reclamation)	Low	Low	High	Low	Very high
	Exposure situations of resudential areas and infrastructure	High	High	midium(after reclamation)	Low	Low	High	Low	Very high
	Exposure situations of other elements, such as histrical and	Medium	Low	Low	High	High	Medium	High	Medium
	Current situations and severity of coastal erosion	High	Medium	–	High	Medium	High	Medium	High
	Current situations and severity of high wave and flooding dameges	Medium (partially)	Low	Low	High	Medium (partially)	High	Medium (partially)	Very high
	Awareness and gender gap	Medium	Medium	Medium	High	High	High	High	High
	Awareness and efforts of island councils	Medium	Medium	Medium	High	High	High	High	High
Coastal development, request on coastal protection	Current situations of the artification of the coasts and reefs, and future development plans	High	High	High	Low	Medium	Medium	Low	Low
	Requests from the local on the coastal protection measures	High	Medium	Low	High	High	High	High	High
Importance of the Island in terms of economy and future development	Future economy	High	High	High	Medium	High	High	Medium	High
	Future development	High	Medium	Medium	High	High	High	Medium	Medium

Source: JICA

Table 7 Results of Scoring and Prioritization

Evaluation Category	Evaluation Items	Addu Atoll				Laamu Atoll			
		Hithadhoo	Maradhoo	Feydhoo	Meedhoo	Gan	Fonadhoo	Isdhoo	Maamendhoo
Vulnerability	Geographical features (elevation, areas, etc.)	3	3	3	2	1	2	2	4
	Dense situation (infrastructure, residential areas,population	3	4	2	1	1	3	1	4
	Exposure situations of resudential areas and infrastructure	3	3	2	1	1	3	1	4
	Exposure situations of other elements, such as histrical and	2	1	1	3	3	2	3	2
	Current situations and severity of coastal erosion	3	2	0	3	2	3	2	3
	Current situations and severity of high wave and flooding dameges	2	1	1	3	2	3	2	4
	Awareness and gender gap	2	2	2	3	3	3	3	3
	Awareness and efforts of island councils	2	2	2	3	3	3	3	3
Coastal development, request on coastal protection	Current situations of the artification of the coasts and reefs, and future development plans*)	1	1	1	3	2	2	3	3
	Requests from the local on the coastal protection measures	3	2	1	3	3	3	3	3
Importance of the Island in terms of economy and future development	Future economy	3	3	3	2	3	3	2	3
	Future development	3	2	2	3	3	3	2	2
Overall ezaluation	Score	2.5	2.2	1.7	2.5	2.3	2.8	2.3	3.2
	Priority	3	7	8	3	5	2	5	1

Note: the scores range from 1: low, 2: medium, 3: high, and 4: very high, while for the items with *), the score will be vice versa.

Source: JICA

Table 8 Quantitative Criteria for Evaluation

Evaluation Category	Evaluation Items	Very High	High	Medium	Low	Remark
Vulnerability	Geographical features (elevation): E	E < 0.8 m	0.8 < E < 1.0 m	1.0 < E < 1.2 m	E > 1.2 m	
	Geographical features (area) : A	A < 50 ha	50 < A <100 ha	100 < A <500 ha	A > 500 ha	
	Dense situation (population density) : D	D > 40 person/ha	40 > D > 15 person/ha	15 > D > 10 person/ha	D < 10 person/ha	
	Exposure situations of resudential areas and infrastructure (Distance from shore) : L	L (Av.) < 5 ～10 m	L (Av.) < 10 ～15 m	L (Av.) < 15 ～20 m	L (Av.) > 20 m	
	Exposure situations of other elements (histrical and cultural heritages, inland ecosystems) :	Exist near shore and important	Exist near shore	Exist	Nothing	
	Severity of coastal erosion (Retreat width) : R	R > 20 m	10 < R < 20 m	5 < R < 10 m	R < 5 m	
	Current situations and severity of high wave and flooding dameges (Frequency/year) :F	F > 2	F > 1	F > 0	not observed	Based on interview result
	Awareness and gender gap	very high	high	medium	less interest	Based on interview result
	Awareness and efforts of island councils					
Coastal development, request on coastal protection	Current situations of the artification of the coasts (Rate of natural beach) : N	N > 80 %	50 < N < 80 %	20 < N < 50 %	N < 20 %	
	Requests from the local on the coastal protection measures	Very High	High	Medium	Low	Based on interview result
Importance of the Island in terms of economy and future development	Future economy					
	Future development					

Source: JICA

(10) Climate impact on Beach Erosion Which Has Been Already Observed at Target Area

1. Outline

Coastal erosion has been serious at inhabitant islands in the Maldives in recent several ten years. Coastal erosion at inhabitant island might be caused by both climate and anthropogenic impact. For the case of coastal erosion at down-drift side of port construction, anthropogenic impact is dominant for cause of coastal erosion as shown in Figure.27.

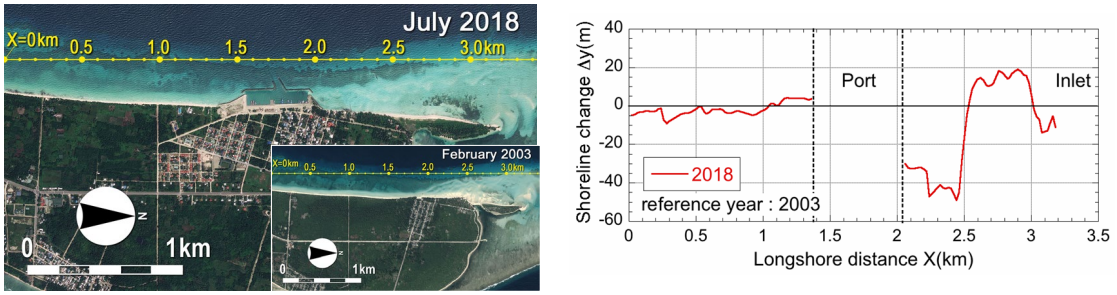
On the other hand, obvious anthropogenic impact was not identified at proposed target area of Maamendhoo and Fonadhoo Island in Laamu Atoll where coastal erosion has been serious. There is possibility that the coastal erosion at these areas has been caused by climate impact such as SLR, increase of waves, etc. to date. SLR is the most crucial climate hazard at the target area because of rare topographic condition with low elevation and existence of coral reef as described in Chapter 2 in Appendix 2. Thus, the climate impact on existing coastal erosion at target area was examined by applying newly proposed method to assess the impact of SLR on beach retreat (refer to section 6.2.3 in Chapter 6 in Appendix 2).

2. Analysis

(1) Erosion Level at Target Area

a) Maamendhoo

Based on the shoreline change analysis using satellite image since 1969, target area in Maamendhoo was set as shown in Figure 28, which is west side with approximately 600 m coastline (from x_W=0 to 600 m) and east side with approximately 300 m coastline (from x_E=300 to 600 m).



Source: JICA

Figure 27 Coastal Erosion at down-drift side of Port Construction

Width of beach retreat is the most common indicator to identify the coastal erosion. Figure 29 shows the shoreline change since 1969 up to 2019 for 50 years. Beach retreat at west side was observed about 20 m from X=0 to 250 m and 5 to 10 m from x=250 m to 500 m. Beach retreat at east side was observed about 10 to 15 m from x=350 m to 600 m.

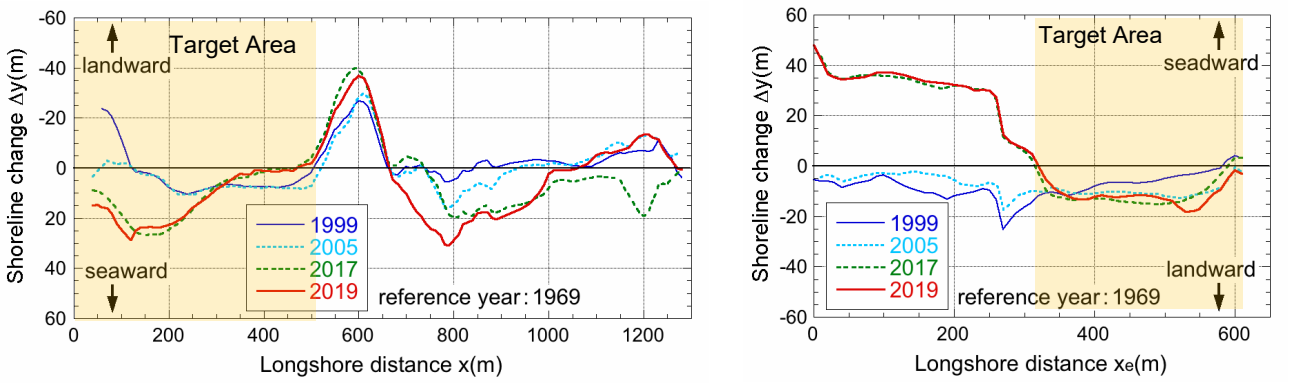
b) Fonadhoo

Target area was set as shown in Figure 30, which is ocean side with approximately 1000 m coastline (from x=2000 to 3000 m).

Figure 31 shows the shoreline change since 1969 up to 2019 for 50 years. Beach retreat at ocean side was observed about 5 to 10 m from x=2000 m to 3000 m.

Source: JICA

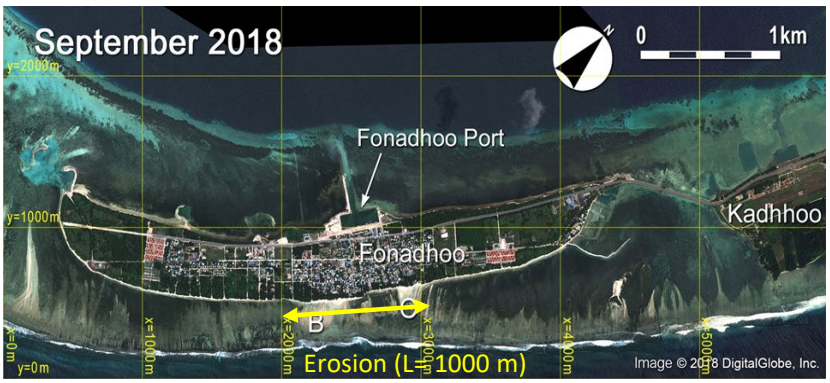
Figure 28 Target Area at Maamendhoo



(1) West Side (2) East Side

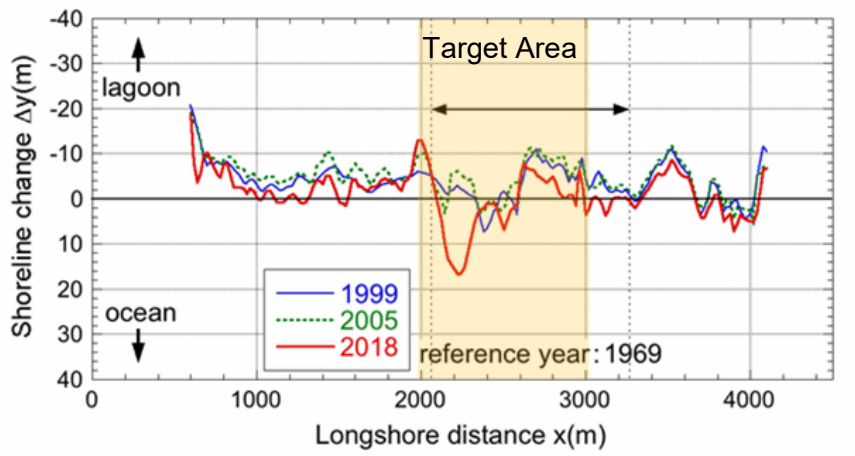
Source: JICA

Figure 29 Long-Term Shoreline Change at Maamendhoo from 1969



Source: JICA

Figure30 Target Area at Fonadhoo

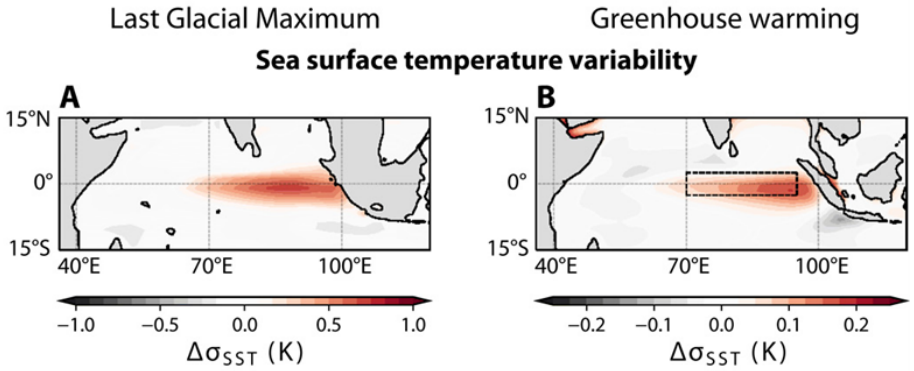


Source: JICA

Figure 31 Long-Term Shoreline Change at Fonadhoo from 1969

(2) Impact of Climate Change to Oceanographic Condition and Marine Ecosystem

Regional climate overview in the Indian Ocean was presented in Chapter 3.1 in Annex2. The tropical Indian Ocean has been considered as a minor driver of climate variability relative to the Pacific or the Atlantic oceans for a long period. However, the model simulations of CMIP5 (Coupled Model Inter-comparison Project 5) show that continued greenhouse warming could alter these features, and the Indian Ocean could evolve into a mean state similar to the Pacific or Atlantic oceans. The CMIP5 (Coupled Model Inter-comparison Project 5) show a direct link between the changes in mean climate and the increase in variability of sea surface temperature (SST) under greenhouse warming as shown in Figure 32. Historical observations support this prediction, showing a tendency for easterly winds along the equator, an eastward shoaling thermocline, and a reversal of the east-west SST (sea surface temperature) gradient since the 1950s. The increase in variability under greenhouse warming will drive increase of hydrological extreme events, such as increase of magnitude of swell waves, increase of peak value of SLR due to increase of variability of SLR. Also, increase of SST will drive the increase of average value of SLR, increase of magnitude and frequency of cyclone and tropical depression, storm surge, change in their track pattern. Furthermore, the increase of SST will correlate coral breaching and it results the decrease of coral sand which is source to formulate sandy beaches in Maldives.

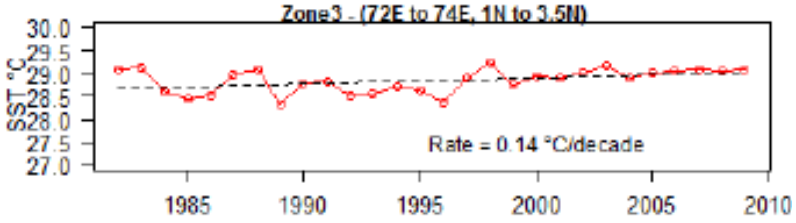


Source: Emergence of an equatorial mode of climate variability in the Indian Ocean (2020)[5]

Figure 32 Variability of Sea Surface Temperature in EEIO under GM and LGM Conditions

(3) Increment of SST since 1982

As presented in section 2.1 in Chapter 2, the dataset of SST, which is "NOAA Global Optimum Interpolation (OI) Sea Surface Temperature (SST) Analysis" is available for the period 1982 to 2010. Figure 33 shows the variation of annual mean sea surface temperature fluctuation for zone 3 (zone for Laamu Atoll) in the Maldives. The SST has the same increasing tendency as that of the air temperature recorded at two meteorological stations of Maldives. Monthly SST ranges from 28.2ºC to 29.3ºC and average increase of SST/decade is 0.14 °C.

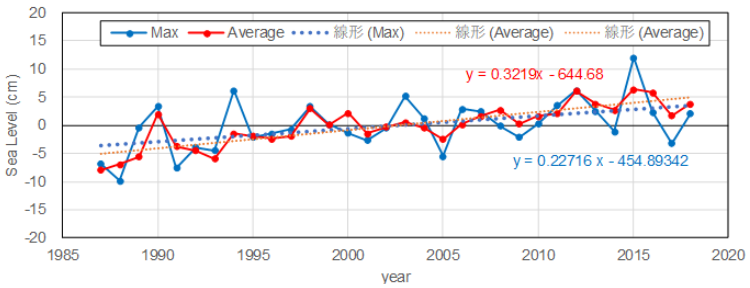


Source: Climate change scenarios and their interpretation for Maldives (2012)[4)]

Figure 33 Variation of annual mean sea surface temperature fluctuation for zone 3 in Maldives (1982 to 2009)

(4) Increment of SLR since 1969

Long term tide observation has been carried out at 3 stations in Maldives, which are Hanimaadhoo (zone 1), Male (Zone 2) and Gan in Addu Atoll (Zone 3). Tide observation data at Gan in Addu Atoll has been accumulated since 1986 as shown in Figure 34. Based on this observed data, increment of SLR was



Source: Arranged by JICA Based on Data for Maldives Meteorological Service

Figure 34 Observed sea level in Gan, Addu Atoll for the past 33 years

Table 9 Estimated SLR for the past 50 years since 1969

Period	Duration (year)	SLR(Av.) (cm)	Remark
1986-2018	33	10.6	observed data in Gan, Laamu
1969-2018	50	16.1	extrapolation from observed data

Source: JICA

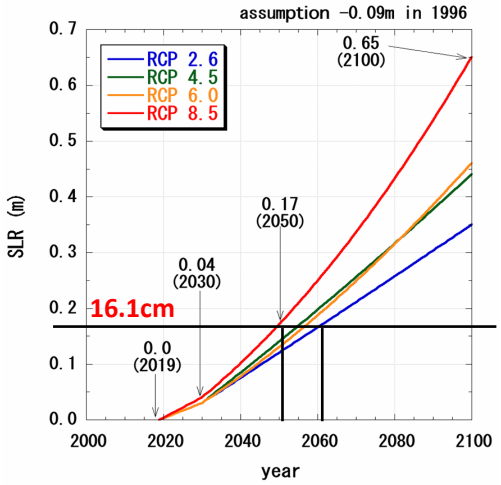
extrapolated from 1969 to 2018 for 50 year as shown in Table 9. From the result, SLR with 16.1 cm increment for 50 years since 1969 was obtained.

(5) Estimation of Beach Retreat for past 50 years

Beach retreat due to SLR for past 50 years was estimated by using proposed method for coral reef coast described in Chap. 6 of Annex 2.

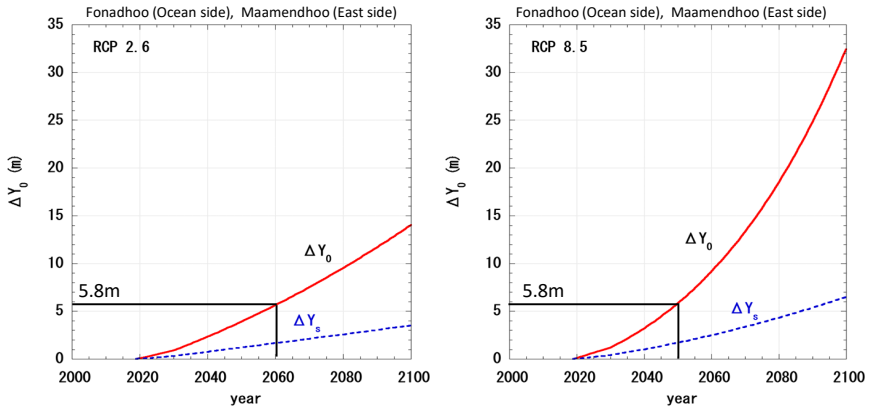
By applying the assumed SLR for each RCP scenario as shown in Figure 35, elapsed year to reach the increment of SLR for past 50 years (16.1 cm) was found. From the result, increment of SLR with 16.1 cm is found in 2060 for the case of RCP 2.6, or 2050 for the case of RCP 8.6.

The width of beach retreat due to SLR depends on site specific topography condition. Figure 36 shows the estimated beach retreat at Fonadhoo and east side of Maamendhoo due to each RCP scenario of SLR. And Figure 37 for west side of Maamendhoo. From the result, beach retreat with 5.8 m was estimated at Fonadhoo and east side of Maamendhoo, and 3.2 m was estimated at west side of Maamendhoo.



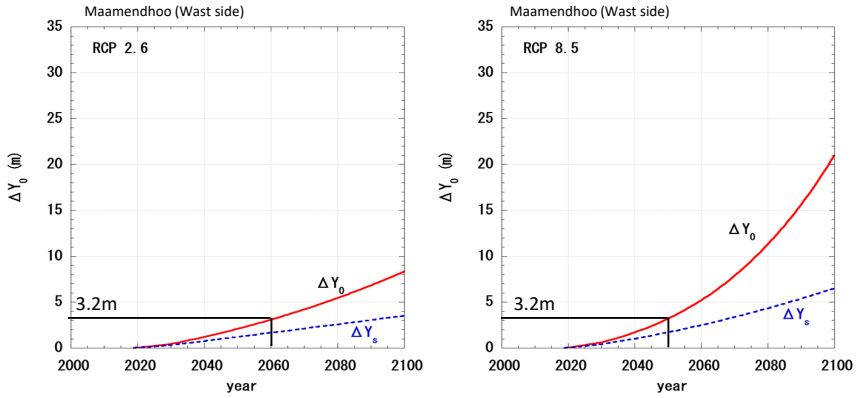
Source: JICA

Figure 35 SLR for each RCP Scenario



Source: JICA

Figure 36 Estimated Beach Retreat due to SLR at Fonadhoo and East Side of Maamendhoo



Source: JICA

Figure 37 Estimated Beach Retreat due to SLR at West Side of Maamendhoo

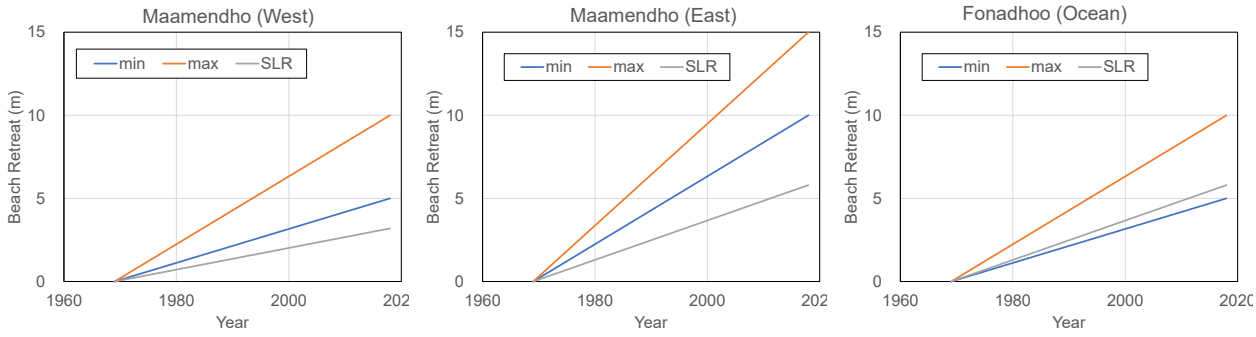
(6) Comparison between Observed and Estimated Beach Retreat due to Past SLR

Finally, the estimated beach retreat due to past SLR is compared with observed one as shown in Table 10. Figure 38 shows beach retreat since 1969 to 2018 for actual range (red line: maximum, blue line: minimum) and estimated one due to SLR (gray line) .

Table 10 Comparison of Beach Retreat between Observed and Estimated One due to Climate Impact

Island	Area	Period	Duration (year)	Retreat (m)		Portion
				Observed	Estimated	
Mamendhoo	West side	1969–2018	50	5～10	3.2	30～60 %
	East side			10～15	5.8	40～60 %
Fonadhoo	Ocean side			5～10	5.8	60～100%

Source: JICA



Source: JICA

Figure 38 Increment of SLR since 1969 to 2018 and Portion due to Climate

The portion of beach retreat due to past SLR is about 30 to 60 % at west side of Maamendhoo, 40 to 60 % at east side of Maamendhoo, and 60 to 100 % at Fonadoo.

(7) Conclusion

Based on the analysis to estimate the beach retreat due to past SLR, it is concluded as follows.

- Beach retreat due to past SLR for 50 years is the major part for observed beach retreat for both Fonadhoo and Maamendhoo.

As the other part for causing the past breach retreat, it might be pointed out the influence of anthropogenic impact which is port construction at surrounding coast even if the project site is not located at down-drift side from the port, and deterioration of coral condition due to increase of SST which will cause the decrease of sand source, etc.

(11) Related Projects/Interventions

Five related projects/interventions have been implemented in the Maldives, which are: 1) Climate Change Adaptation Project (CCAP) by the World Bank in 2015, 2) Coastal Protection Work in S. Hulhudhoo, Addu Atoll by GoM in 2017. 3) Supporting Vulnerable Communities in Maldives to Manage Climate Change-induced Water Shortages by GCF, which started from 2016 and will be completed in 2021, 4) Detailed Island Risk Assessment in Maldives by UNDP from 2007 to 2008 and 5) Integrating Climate Change Risks into Resilient Island Planning in the Maldives by Green Environment Facility (GEF) from 2008 to 2010. This proposed project makes difference through innovative approaches as shown in D.

1) Climate Change Adaptation Project (CCAP)/World Bank/2015	
Outline	The project comprises of five components, which are 1) Wetlands conservation in Hithadhoo island, and Fuvahmulah island, 2) Coral reef monitoring, 3) Development of an island level integrated solid waste management system, 4) Main streaming climate change into island development planning, and 5) Project management
Key Result	1. Training targeting island representatives on climate adaptive planning was imparted. 2. The project improved and extended data collection on coral reef health data with participation of the private sector. 3. The project supported students for a cohort of the Bachelors' degree course in Environmental Management.
Complementarity/ upscaling	1. The project was to demonstrate climate adaptive planning and management through the adoption of a multi-sectoral approach in Addu and Gnaviyani atolls. The project mainly focused to capacity development on wetland conservation, coral reef monitoring and solid waste management system at representative two island in Addu and Gnaviyani Atoll. Targeted project area was different from the proposed GCF project and main objective was not to enhance the resilience of coastal protection function. 2. Capacity development in the proposed project will be executed mainly by OJT and several activities in accordance with the progress of the project on field to be more effective and realistic.
2) Coastal Protection Work in S. Hulhudhoo, Addu Atoll/GoM/2017	
Outline	The objective of the Project was to provide a solution to the problem of coastal erosion on the eastern coast of Hulhudhoo in a sustainable manner by construction of rock boulder revetment and repairing the damaged areas of 450 m existing seawall on the south side of S. Hulhudhoo, Addu Atoll.
Key Result	The hinterland at eastern coast of Hulhudhoo was protected by hard structure measure using rock revetment against coastal erosion due to swell waves with 1.4 km coastline.
Complementarity/ upscaling	This project was also one of coastal adaptation measures against coastal erosion as same objective as the proposed project, however the concept for coastal protection is different. The proposed GCF project is to consider the multi-functions, "protection", "beach use" and "coastal environment", referring to the original natural function of sandy beach. Also, the proposed GCF project will establish the sustainable sediment budget control plan with less adverse effect to coats and marine environment, as one of sub-activities in component 1.
3) Supporting vulnerable communities in Maldives to manage climate change-induced water/GCF/2016-2021	
Outline	In response to climate change and sea-level rise induced salinity of groundwater, the project objective is to deliver safe and secure freshwater to 105,000 people in the islands of Maldives in the face of climate change risks.
Key Result	1. At least 6,400 households on 49 priority islands receive a year round safe freshwater supply. 2. At least 73,000 people receive dry season water 3 days ahead of need from decentralized, atoll-based water production and distribution hubs. Also, percentage of expected reduction in dry season water supply cost will be 40% at least. 3. Groundwater recharge rates maintained at a minimum of 30%. At least 20% increase in groundwater consumption by 50% of households on the full IWRM (Integrated Water Resources Management) islands as freshwater and/or in integrated water mix in target islands.
Complementarity/ upscaling	The project mainly focused to year round access to reliable and safe water supply despite climate shocks and stresses especially in dry season. Proposed project mainly focus to enhance the resilience of inhabitant islands against climate projection such as SLR, increase of wave action by strengthen of natural protection function of sandy beach and coral reef. The proposed project can

	complement the project by enhancing the resilience of water supply facilities designed in the project and by protecting groundwater quality through decrease in frequency of inundation and size of inundated area during swell wave.
4) Detailed Island Risk Assessment in Maldives UNDP/2007-2008	
Outline	A three-phase exercise was conducted as part of the study project: (1) Hazard Assessment of the 13 islands identified (2) Vulnerability Assessment (i.e. socio-economic, environmental, infrastructural and other vulnerabilities) (3) Composite Risk Assessment and Action Planning for prevention, mitigation, preparedness, response and recovery measures
Key Result	1. Each island has a maximum threshold level, especially for flood events, above which an event could flood the entire island regardless of its existing geophysical characteristics. 2. All islands are generally exposed to natural hazards, but some islands are comparatively less exposed due geophysical setup of the island. 3. It is possible to control the impact of hazards for existing events using engineering solutions. However, suitability of adopted solutions to slow onset hazards such as climate change is questionable especially in the coral island environment. 4. Safe Islands cannot be developed based on a standard set of designs such as a constant ridge height and artificial topography.
Complementarity/ upscaling	1. The objective of the project was to generate an elaborate disaster risk analysis of 13 islands identified. Targeted islands of the proposed project are not included in the 13 islands. However, hazards, vulnerability and risk profiles in Maldives summarized in the project will utilized for basic understanding of disaster risk in not only 13 islands identified but also the targeted islands or atoll in proposed project since it is highly possible that other islands in Maldives has potentially similar disaster risk. 2. The project discussed disaster risk from mainly the data of historical data acquired in department of Meteorology and there was a limitation of future projection data especially on climate change in those days. The proposed project can compensate the project by integrating the future climate change data from IPCC or other related agencies into risk assessment.
5) Integrating Climate Change Risks into Resilient Island Planning in the Maldives GEF/2008-2010	
Outline	The primary aim of the project is to increase resilience of the Maldives, reducing the vulnerability of the population to climate related natural disasters, through adequate planning and prioritization of climate change adaptation measures.
Key Result	1. The project enhanced capacity of national, provincial, atoll and island authorities and civil society leaders to integrate climate risk information into policy, planning and investment decisions 2. Climate risk planning integrated into key national policies that govern or impact land use planning, coastal protection and development 3. Appropriate adaptation options were locally prioritized that reduce exposure to climate change risks demonstrated
Complementarity/ upscaling	The project enabled Government of Maldives to develop the necessary institutional and individual capacity in the fields of land use planning and coastal protection at national, provincial, atoll and island levels. On the other hand, the proposed project aims to establish Integrated Coastal Zone Management (ICZM) with capacity development of government officials in component 1. ICZM in proposed project should cover not only coastal protection but also coastal conservation to sustainably maintain the natural features of the coral reefs and sandy beaches that have been maintained for many years.

B.2. Theory of change (max. 1000 words, approximately 2 pages plus diagram)

Project interventions aim to shift the paradigm away from current common understanding and action on coastal protection in the Maldives by modification of natural beaches artificially using hard structure measures without sufficient climate data and consideration for impact due to artificial modification towards a new paradigm to maintain the natural resilience of sandy beach and coral reef that the islands of the Maldives originally owned and has a potential to adapt to uncertain climate impact by realization of Integrated Coastal Zone Management (ICZM) and to implement the coastal conservation measures at some of densely populated area together with delivery of disaster early warning/information, by transferring knowledge and expertise on the proper implementation of soft (nature based) measures for coastal zone and beach protection and long-term sustainable management, to alleviate the loss of national land and to maintain safe and secure livelihood. This approach should ensure the maximum mitigation of maladaptation cases experienced by the country.

In order to effect this transformation, the following **key barriers to adaptation** will have to be overcome in the Maldives to achieve the project goal, addressing on-going coastal erosion and climate related issues:

(1) Lack of regulatory system to pursue coexistence and co-prosperity of development and coastal conservation considering climate change impact
- In circumstances where coastal development projects and conventional coastal measures proceed, establishment of inclusive regulatory systems with technical standards and conditions to minimize adverse effect on sustainability and resilience of the coastal environment coexisting with the preceding projects and measures

(2) Insufficient technical expertise and experience to plan and formulate necessary intervention addressing climate change impact:
- Best-mixed approach with selection of various physical (hard) measures and soft approaches, such as land use and beach maintenance from a long-term and multifaceted perspective
- Comprehensive coastal management plan based on individual local conditions, minimizing exposure of residential areas and critical infrastructure and maintaining natural protection functions

(3) Insufficient expertise and skills to implement solutions (policies/measures) to support/facilitate formulation/implementation of projects that address climate change impact such as:
- Adequate coastal conservation/protection measures considering climate change impact to coexist with coastal development.
- Plans of communication and dissemination of disaster information and evacuation means.
- Policy and outline of community-based beach maintenance
- Systems to continuously obtain basic information and data essential for having common understanding on the detailed picture, history, and factors of the phenomena, and system to share the information among the relevant government agencies

To address these barriers, the proposed Project will establish and realize the integrated coastal zone management (ICZM) and implement and maintain the coastal conservation measures with delivery of disaster warning/information. This will be achieved through the following four inter-related **Project Results,** which also aim at creating enabling conditions for scaling up and replicating the Project impact beyond the immediate target area. The Project Results are based on the pillars of Ministry of Environment (ME) in the Government of Maldives and JICA (Japan International Cooperation Agency) initiative coordinated with Maldives Metrological Services (MMS), Land & Survey, island governments, residents, NGOs.

These barriers are the major issues for the public sector, but how the private sector deal with the barriers will be referred for planning and designing the appropriate beach maintenance method in the project.

<Result 1> Institutional capacity building and policy support for realization and enforcement of ICZM

In order to build climate-resilient safer islands, the natural protection functions of coastal areas and islands should be maintained on a long-term basis against developments and artificial modifications at the coastal area. To achieve this, integrated coastal zone management (ICZM) plan will be established based on accurate understanding the current state of the coast and the future climate risks, which is covered coral reef, coastal area and hinterland. Government officials from both the national and island levels will take action necessary intervention based on established policy and plan. Since private sectors maintain only the coastal zone/beach which is under their property as seen in resort islands or in a part of inhabited islands in Maldives, community involvement will be stressed in maintenance of coastal zone/beach and possible private sector involvement in the maintenance including sharing special heavy equipment such as dredgers will be examined in ICZM.

Following four activities from Activity 1.1 to 1.4 will be conducted to achieve <Result 1>;

Activity 1.1: Inventory study for risk assessment on present coastal and coral reef conditions
Activity 1.2: Preparation of basic policy of ICZM at the national level
Activity 1.3: Preparation of concrete ICZM Plan at representative inhabitant island as case study
Activity 1.4: Capacity development and information sharing of the relevant organizations for establishment of the ICZM

<Result 2> Protection of coastal communities and infrastructure exposed to coastal erosion

Coastal conservation/protection measures will be implemented at selected areas in five inhabitant islands where coastal erosion has been already serious and coastal disaster risk due to SLR is exposed. Implemented coasts will be maintained sustainably by established community-based beach maintenance and management.

Following three activities from Activity 2.1 to 2.3 will be conducted to achieve <Result 2>;

Activity 2.1: Detailed design of coastal conservation measures and capacity development of stakeholders
Activity 2.2: Implementation of coastal conservation/protection measures
Activity 2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders

<Result 3> Strengthened multi hazard early warning system services

The system for dissemination of disaster warning/information covering nationwide will be built, and capacity development of government officials responsible for operating the system will be supported aiming at protecting residents' lives through appropriate evacuation activities to be taken by the residents themselves.

Following two activities Activity 3.1 and 3.2 will be conducted to achieve <Result 3>;

Activity 3.1: Installment of terrestrial digital broadcasting system
Activity 3.2: Establishment of Disaster Early Warning and Information Broadcasting System

<Result 4> Improved observations and monitoring of long-term wave, sea level, coastline, coral reef and land use

In order to obtain basic climate related information such as waves, sea level, coastal and coral reef conditions for long term, and share the understanding of actual situation, climate impact and thereby to implement most appropriate measures for climate change, the monitoring system for wave and sea level, and beach, coral reef and land use will be established and necessary capacity development for operation will be conducted.

Following two activities Activity 4.1 and 4.2 will be conducted to achieve <Result 4>;

Activity 4.1: Development of wave and sea level monitoring system

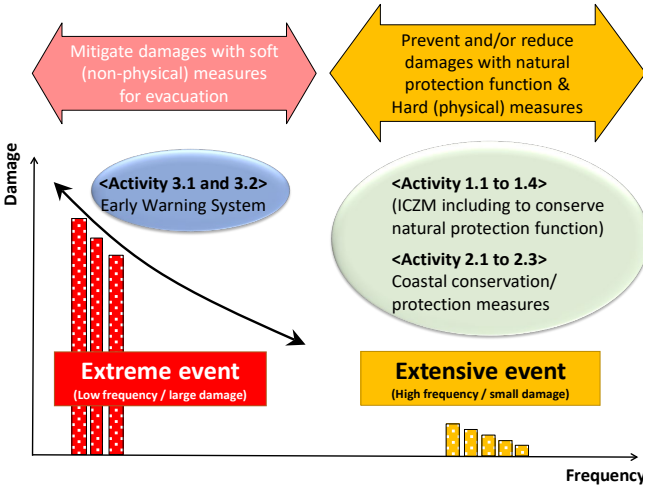
Activity 4.2: Development of beach, coral reef and land use monitoring system

The outcome 1 will see “Strengthened institutional and regulatory framework for climate responsive ICZM”, as a results of Result 1 and 4, which are “Institutional capacity building and policy support for realization and enforcement of ICZM” and “Improved observations and monitoring of long-term wave, sea level, coastline, coral reef and land use”.

The outcome 2 will see “Reduced exposure to coastal erosion for coastal communities and infrastructures”, as a results of Result 1and 2, which are “Institutional capacity building and policy support for realization and enforcement of ICZM” and “Protection of coastal communities and infrastructure exposed to coastal erosion caused by SLR”.

The outcome 3 will see “Integrated climate information and early warning systems able to instantly inform public to facilitate quick evacuation and protective actions”, as a results of Result 3 and 4, which are “ Strengthened multi hazard early warning system services” and “Improved observations and monitoring of long-term wave, sea level, coastline, coral reef and land use”.

Figure 39 shows the relation between Activity 1.1 to 1.4, Activity 2.1 to 2.3 and Activity 3.1 and 3.2 for the image of prevention measures against coastal disasters. Physical intervention utilizing natural protection function and coastal conservation/protection measures as required (Activity 1.1 to 1.4 and Activity 2.1 to 2.3) are expected to control low- to middle- intensity coastal disasters, which frequently occur and constantly require public expenditure for recovery and rehabilitation. Disasters of low frequency with high intensity, including distant tsunami, may exceed the design scale of those measures against disaster, but investment on physical measures to stand the level of extreme disaster is not financially viable for countries with small financial resource such as the Maldives. To address these remaining risks of rare but extreme disasters, promotion of appropriate evacuation by residents involving early warning (Activity 3.1 and 3.2) is essential for minimizing damages.



Source: JICA

Figure 39 Relation of Activities 1 to 3 against Coastal Disaster

Due to the negative experience of Maldives regarding the effectiveness of soft measures for coastal zone and beach protection, these measures are not popular at the current stage. Unpopularity of soft measures is mainly related to difficulties as shown in the above key barriers to be implemented effectively due their high sensitivity to the local environmental conditions such as geomorphology, hydrology and climate leading finally to maladaptation. In addition to knowledge and experience, the soft measures also require frequent and long-term commitment and significant financial resources to maintain their effectiveness.

AE submitting this funding proposal on behalf of Maldives’ Government have successful experience in implementation of soft measures for coastal zone protection in the other countries and offers to the government of Maldives to transfer the technology related knowledge and provide on-the-job training of coastal zone engineering for sustainable and cost-effective management of coastal zone with soft measures.

Detailed descriptions of these Results and activities they consist of, can be found in section B.3.

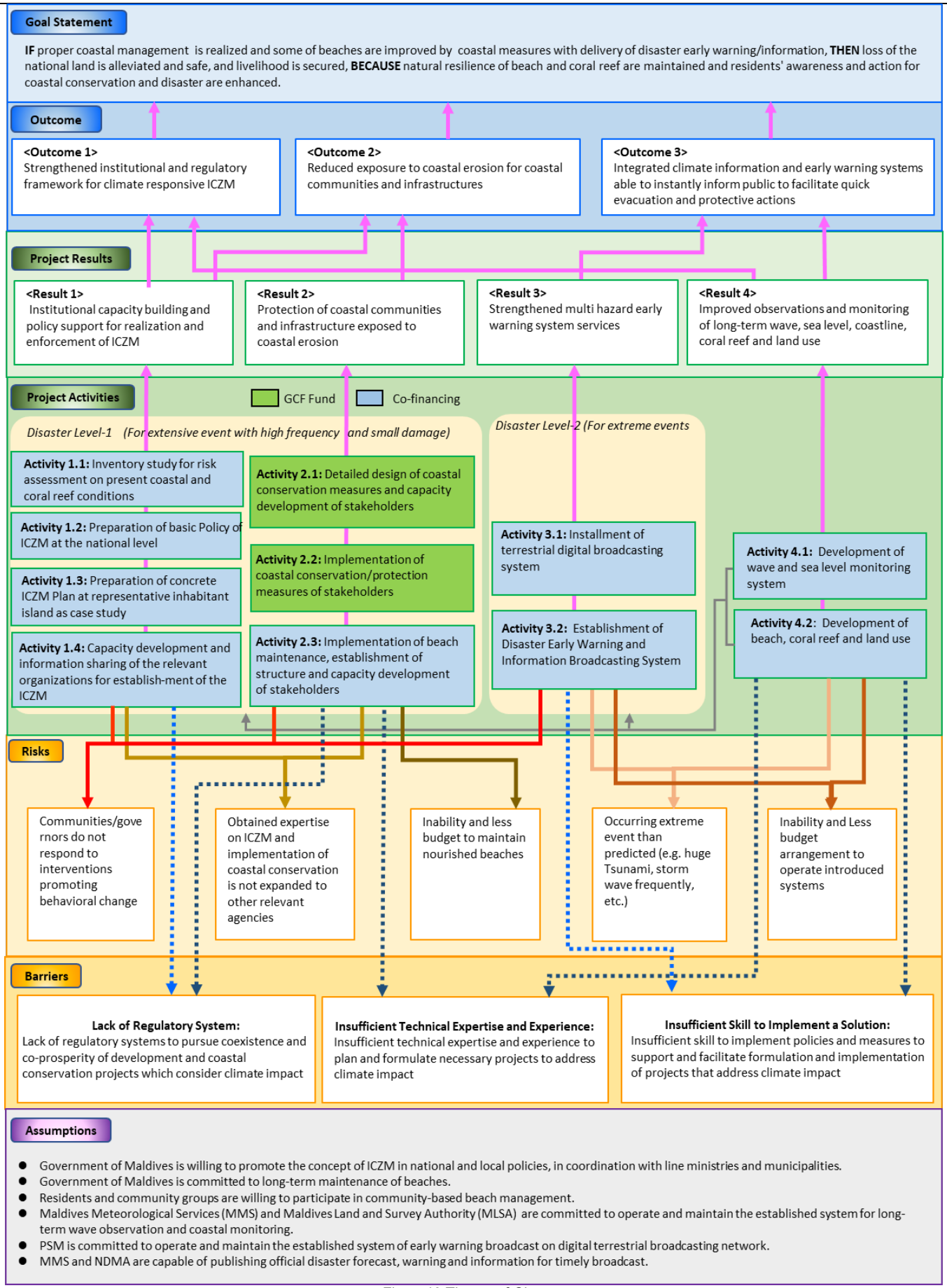


Figure40 Theory of Change

B.3. Project/programme description (max. 2000 words, approximately 4 pages)

The project aims at strengthening long-term and sustainable resilience of the national land against climate change in order to advance the economic development of the islands while maintaining the quality of life of residents linked with coastal environment. To accomplish this, the project components, consisting of the implementation of physical (hard) and non-physical (soft) measures and integrated management appropriate for coral reef, coastal areas and hinterland, are proposed:

Component 1: Establishment of the Integrated Coastal Zone Management (ICZM)

The coastal development on the inhabited islands in the Maldives has been made without sufficient understanding of its impact on the coastal environment, or rationale that harmonizes with it. In addition, there are no proper policies related to coastal zone management and institutional development necessary to sustainably maintain the natural features of the coral reefs and sandy beaches that have been maintained for many years. There are also no proper basic policies to build resilient hinterlands against coastal disasters. As of today, only the Guidelines for Land Use Planning of the Maldives (July 2005, Ministry of Housing and Urban Development) can be considered as relevant national framework for coastal zone and flood management. According to this Guideline, it is recommended to secure at least 20 m buffer zone made by the vegetation area between beach and developed area at foreshore side except a harbor, however, this rule is not clearly imposed at inhabitant islands. It is identified that houses and facilities are located within 20m buffer area, and the setback rule is entrusted by each opinion for island council.

In order to build climate-resilient safer islands, the natural protection functions of coastal areas and islands should be maintained on a long-term basis, against development and human activities, in addition to the implementation of resilient measures at the coastal area. To achieve this, government officials from both the national and island levels should formulate the ICZM plan covering coral reef, coastal area and hinterland, and implement necessary intervention based on the plan, based on accurate understanding the current state of the coast and the future climate risks.

Strategic Action Plan for 2019-2023 of the Maldives aims to strengthen legislative framework on environmental protection and disaster risk reduction to ensure vulnerable ecosystems are preserved and protected and the climate resilience of communities are enhanced, and this component contributes to the achievement of this goal.

This component, as a sub-set of activity financed by JICA, aims to establish ICZM along with the capacity development of government officials responsible for the enforcement of the ICZM:

Activity 1.1: Inventory study for risk assessment on present coastal and coral reef conditions

Some 200 inhabited islands are categorized by different topographical characteristics, hazard characteristics, socio-economic characteristics and living environment. Several islands are then selected from each categorized island for a field survey. The current problems, issues, and climate change risks in the different types of islands are sorted out.

Activity 1.2: Preparation of basic policy of ICZM at the national level

The basic policy for Integrated Coastal Zone Management (ICZM) at the national level will be examined, based on the current problems, issues, and climate change risks in the different types of islands, which are exposed as the results of activity 1.1. For the purpose of realization of coastal management based on the ICZM policy, basic plans for strengthening governance of coastal administration of the GoM and coastal management on each inhabited island will also be developed. Regulations and legal systems necessary for realization of ICZM are also examined, and the support for their enforcement is provided. The ICZM Guideline (Policy phase) will be prepared as the result of this activity.

Activity 1.3: Preparation of concrete ICZM Plan at representative Inhabitant Island as case study

To promote such concrete efforts based on the national ICZM concepts and plans, the concrete action for the island level of the ICZM will be examined based on the national level of the ICZM as a case study. The activity is included 1) Establishment of coastal and reef conservation plan, 2) Establishment and implementation of sediment budget control plan, 3) Study for strengthening measures on land use planning, 4) Study on coastal management system and its implementation, and 5) Study on regulation and law at island level. Gan and Fonadhoo islands in Laamu Atoll are assumed as the example of representative inhabited islands for case study. The ICZM Guideline (Practice phase) will be prepared as the result of this activity.

Activity 1.4: Capacity development and information sharing of the relevant organizations for establishment of the ICZM

For basic common understanding between the relevant agencies at the central and island levels on the above activities, as well as cooperation between the island councils and residents who are the main users of the coastal area. This activity will carry out capacity building, education and public relation programs for the practitioners of the relevant organizations of the central ministries and agencies and island councils, island community, NGO, schools and educational institutions, etc. Assumed related organization are Ministry of Environment (ME), Ministry of National Planning and Infrastructure (MNPI), Local Government Authority (LGA), National Disaster Management Authority (NDMA), Maldives Meteorological Service (MMS) as relevant agencies at central revel.

Capacity development at the relevant agencies will be conducted mainly through the on the job training (OJT) during the implementation period. To share and expand the understanding and knowledge to other inhabited islands, ICZM Guidelines, which are prepared as the results of Activity 1.2 and 1.3, will be utilized through conducting seminar and workshop in several times at other inhabited islands. The purpose of seminar and workshop is; 1) to share the outcomes of the Activity 1.2 and 1.3 examining the basic policy of ICZM in the Maldives and necessary planning for implementing the ICZM in other inhabited islands; and 2) to support the GoM to replicate it to other islands. Through these activities, the development impact on the coastal environment, the concept of development that harmonizes with the coastal environment, and its priority will be understood at the national as well as island level, facilitating multi-stakeholder engagement in monitoring and maintenance of the functional yet environmentally sustainable environment.

Component 2: Implementation of Coastal Conservation/Protection Measures against Coastal Disasters

The exposure of residential areas and critical infrastructure at nearshore area has been significant in the Maldives because the development activities associated with economic development have been executed near the coastal areas and coastal erosion has been serious in the inhabited islands. Artificial modifications of coast line due to construction of coastal infrastructures such as port construction, reclamation, etc., and some of hard structure coastal protection measures such as revetment, seawall, etc. have also accelerated the decline of natural protection function for original sandy beaches and coral reefs, and induced further coastal erosion. This component, as a sub-set of activity financed by GCF, partially by GoM in Activity 2.2 and by JICA in Activity 2.1 and 2.3, aims to implement the coastal conservation/protection measures and to maintain sustainably in order to protect the communities and infrastructures at hinterland exposed to coastal erosion. In this component, coastal conservation/protection measures, including environmental and social impact assessment (ESIA), will be implemented in the five selected coasts that have been already exposed to coastal disaster risk where another approach to enhance resilience at the hinterlands are difficult to implement and further increase of coastal disaster risk is expected due to climate impact.

Coastal conservation measures by applying beach nourishment will be implemented at three selected sites to protect the residential area at the hinterland considering the usage and current condition of the beach. And coastal protection measures with hard structure measures will be implemented at two sites to protect the historical heritage sites. In the planning and design for these coastal measures, it is essential that the related officers in the Maldives will obtain the required knowledge on coastal engineering, planning and design skills for future implementation of appropriate coastal measures by the Maldives autonomously

against predicted climate risks. Realization of appropriate beach maintenance and management at project beaches are also strongly required to maintain beaches with good condition and sustainability. Necessary activities on capacity development, public education and public relation will be also conducted in this component. Also, the countermeasures will be designed in line with the relevant existing regulations such as Land Use Planning of the Maldives.

Strategic Action Plan for 2019-2023 of the Maldives aims to develop localized coastal protection and flood mitigation mechanisms, and infrastructure in the islands identified as most vulnerable to disaster and climate risk, and this component is expected to contribute to the achievement of this goal.

Activity 2.1: Detailed design of coastal conservation measures and capacity development of stakeholders

This activity consists of two sub-activities, which are detailed design of coastal conservation/protection measures as described in Activity 2.2 (sub-activity 2.1.1) and capacity development of related officials on survey, planning and design of coastal project (sub-activity 2.1.2).

The detailed design includes the coastal conservation measures at two target islands in Laamu Atoll, namely, Maamendhoo and Fonadhoo islands, which are funded by GCF, as well as coastal conservation measures at Meedhoo Island in Addu Atoll, which are implemented as a sub-set of activity financed by the Government of the Maldives (GoM). It also includes the detailed design of coastal protection measures at Gan and Isdhoo islands in Laamu Atoll financed by the Government of the Maldives (GoM). The study items for this activity is as follows:

i) Conducting detailed survey

ii) Conducting detailed design (including construction plan and cost estimate)

iii) ESIA support

iv) Preparation of bid document and support for bidding

Capacity development for the related officers in the Maldives to obtain knowledge of coastal engineering, planning and design skills are required for the planning and design of appropriate coastal measures autonomously against future climate risks. The most effective way for the capacity development is for the related officers in the Maldives to work together with the consultant team under OJT. Therefore, the Maldivian engineers who will be engaged in the government coastal project in the future will be assigned into the consultant team.

The items of capacity development expected through this activity are as follows:

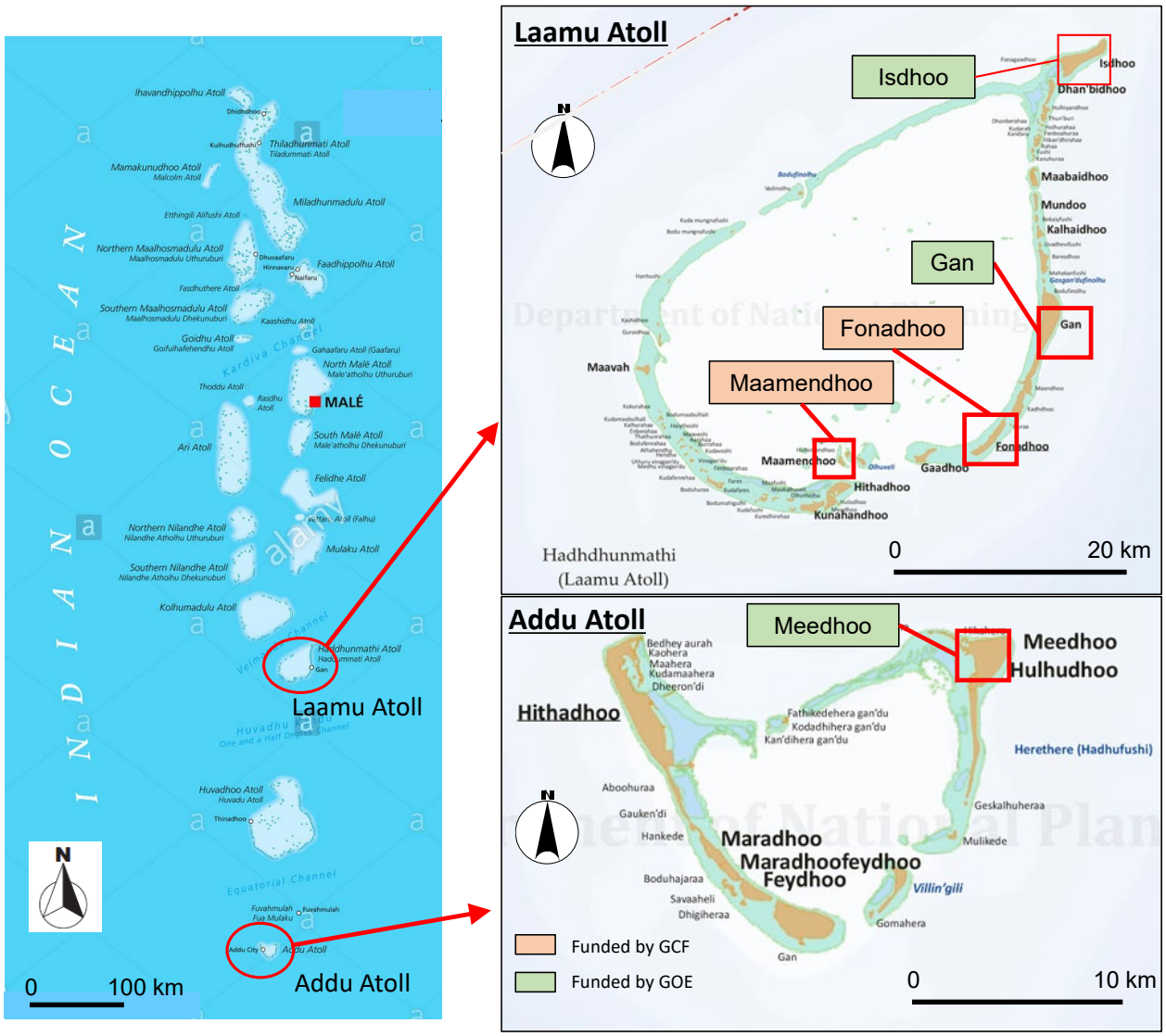
- Enhancement of the understanding of coastal process and characteristics including waves and littoral drift
- Acquisition of knowledge on each field survey method and analysis necessary to consider the above analysis
- Acquisition of techniques on planning, design and construction method related to coastal conservation and protection measures
- Acquisition of knowledge of international procurement rules and procedures

Activity 2.1 are founded by GCF except ESIA support, which is one of the study items in the detailed design funded by JICA.

Activity 2.2: Implementation of coastal conservation/protection measures

The coastal conservation measures at the two target islands of Maamendhoo and Fonadhoo islands in Laamu Atoll funded by GCF, and the coastal conservation measures at Meedhoo Island in Addu Atoll and the coastal protection measures at Gan and Isdhoo islands in Laamu Atoll funded by the GoM will be

implemented as shown in Figure 41. Proposed intervention for each site, its background, reason are summarized in Table 11.



Source: JICA

Figure 41 Location of Proposed Intervention

Table11 Proposed intervention for each site, its background, reason

Project Site	Objective Coastline	Objective	Beach Topography	Land Use at Hinterland	Consideration on Planning	Proposed Measure
Maamendhoo	900 m	- To protect residential area against climate change - To maintain resident's livelihood and culture on beach use and environment	coral sandy beach	Residential area	-Protection -Beach use -Environment	Beach nourishment with supplementary groins (to reduce sand discharge)
Fonadhoo	850 m					
Meedhoo	1400 m			Residential and Agricultural area		
Gan	270 m	- To protect historical heritage	coral rock, gravel, slight sandy part	Natural empty area	-Protection	Rubble type revetment
Isdhoo	270 m					

Source: JICA

The Reason why beach nourishment method is proposed at above presented three sites as climate adaptation measures on coastal erosion is as follows.

1) Only the method to solve fundamentally for coastal erosion
   There are mainly two type of measures for coastal erosion, which are “hard structure measures such as revetment, seawall, groin, detached breakwater, etc., and “soft measures” such as beach nourishment. Basically, coastal erosion causes decrease of sand supply or unbalance of sediment transport. This means hard structure measures which is just protect land side and not to improve the decrease of sand supply. To solve coastal erosion problem fundamentally, improvement or recovery of sand supply is only the method to solve.
2) Multi-functions of sandy beach
   Beach nourishment has multi-functions not only “protection” (which is only function for structure measures), but also “beach use” and “environment”. Selection of method (hard or soft) is mainly depending on 1) what is original and current coastal topography, 2) what is condition of hinterland especially for the point of land use and 3) how is realization to maintain for long-term. For 1): originally sandy beach and still exists, for 2) residential area (for high consideration on beach use and environment) and for 3) expect not so significant sand discharge, are the basic requirements to select beach nourishment method.
   Natural sandy beach has been formed through several thousand years, however, once natural beach take place to artificial beach with hard structure measures, coastal protection using hard structure measures shall be maintained continuously instead of natural beaches which has been maintained for long centuries.
3) Similarity of formation, flexibility, and adaptability of sandy beach
   Impact of climate change will occur gradually year by year, and this is different phenomena such as big Tsunami which causes disasters destructively. Combination of coral reef and natural sandy beach has been formed through several thousand year and beach profile has been flexibly maintained by series historical wave action (e.g. berm height increases due to increase of wave action). Such flexibility is one of strong advantages of sandy beach, and which is not obtained by hard structure measures. This flexibility is expected to contribute to climate adaptation measures with uncertain factors. Also, appropriate measures can be considered adaptively depending to the actual future condition (not finalize the adaptation measures now for 50 or 100 advanced target year)
4) Applicability to coral reef coast
   Magnitude of littoral drift for coral reef coast is significantly smaller to order than that for general sandy beach which is facing to offshore waves directly. This means, sand movement and discharge of sand after beach nourishment will be also small and it is easy and low cost for sand replenishment as maintenance work.
5) Transformation of opinion in developed countries for coastal measures
   As coastal conservation/protection measures in developed countries, beach nourishment as soft measures have become mainstream as coastal protection/conservation measures, based on lessons and learnt for previous hard structure measures.
6) Experience of similar Projects by JICA
   JICA has experienced to execute several similar projects applying beach nourishment from pilot-scale to large-scale in tropical island countries with coral reef coasts. One of large-scale projects is “Bali Beach Conservation Project”, in which nourished beach has been maintained about 20 years with no sufficient periodical sand replenishment. As the other project, “Technical cooperation project on coastal conservation in Mauritius” is the one of success project to scale up the beach nourishment method by strong ownership of Mauritian Governments and communities after the pilot-scale Project.

Introduction of Similar Projects and Relation to this Project

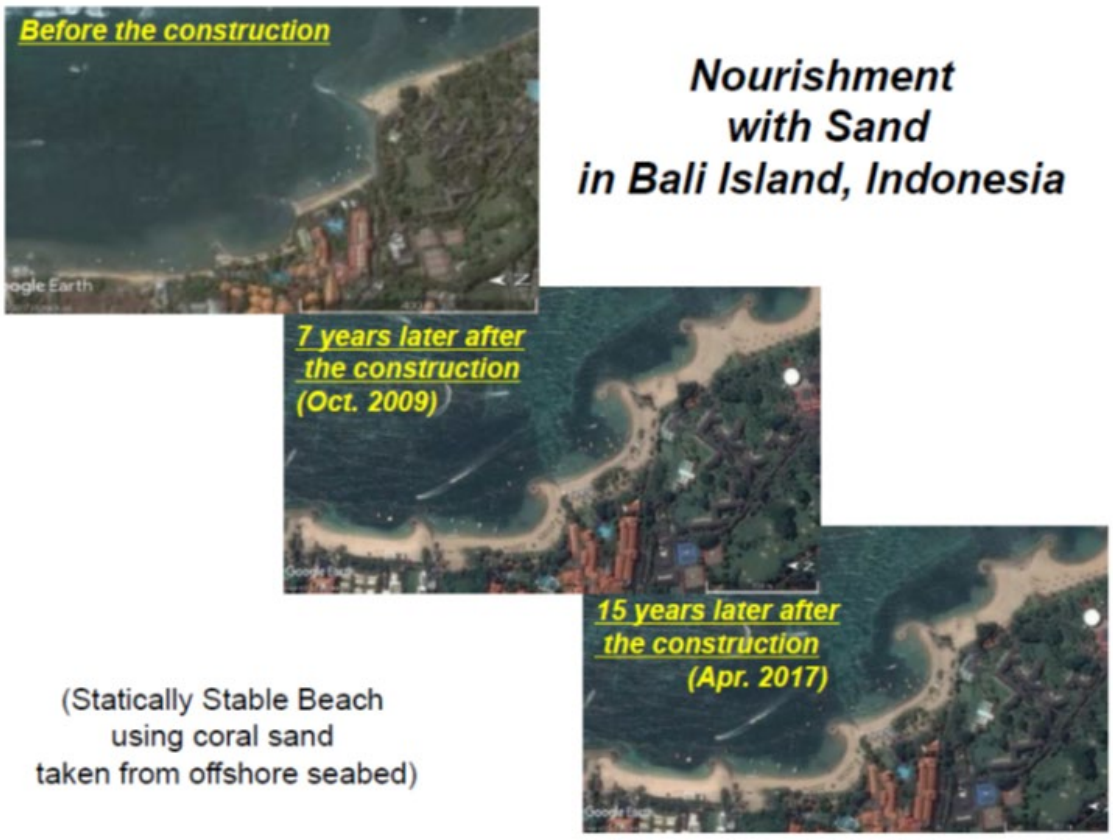
Here introduces Bali Beach Conservation Project (JICA Loan), in which nourished beach has been maintained about 20 years with no sufficient periodical sand replenishment, as one of the similar projects.

1) Outline

- Beach nourishment (with groins, headlands and detached breakwaters) was undertaken at three sites to recover the coral sandy beach against coastal erosion. Further, protection of sea cliff was carried out to protect the historical heritage temples faced on the sea.
- Quantity of sand for beach nourishment is about 300,000 m3 at Sanur, 340,000 m3 at Nusa Dua and 530, 000 m3 at Kuta Beach. Sand stock was also secured as sand for maintenance with 150,000 m3 in the stockpile.
- 20 years has already passed since initial beach nourishment at Sanur and Nusa Dua, and 14 years at Kuta.
- Discharge rate after the nourishment was taken as the index to evaluate the effectiveness of beach nourishment (about less than 20 %/ year was expected in planning and design stage, except extreme storm event).

2) Actual Condition after the Project

- Nourished beach has been well maintained for 20 years at Sanur and Nusa Dua without sufficient maintenance (periodical sand replenishment). This means it was proved that nourished sand could be well controlled by conducting appropriate planning and design.
- On the other hand, undesirable issues on coastal management has been currently observed, which are illegal construction of building on the beach, individual construction of revetment at the retreat



Source: JICA

Figure 42 Long-term Beach Change after the Project (Bali Beach Conservation Project)

area, etc. Now, Bali Beach Conservation Project has been ongoing since this year, and "establishment of coastal management system" is one of the project components.

3) Similarity to this Project, Reference Outcome

The similarity between BBCP and the proposed project for the Maldives in the funding proposal is as follows.

- BBCP was the first experience to employ beach nourishment method to wide public coastline as "coastal conservation" (not "commercial purpose for private sectors).
- Government of Indonesia as well as communities had no experience for maintaining of beach when the BBCP was completed. Thus, they were very worry about the possibility of significant sand discharge and increase of maintenance cost after the initial nourishment.
- There are two type of beach nourishment method, which are "dynamically stable beach" and "statically stable beach". Dynamically stable beach is just to replenish sand without any kinds of supplementary coastal structures and this method has been common to employ as coastal conservation measures in the United States or some of European countries. On the other hand, statically stable beach is to replenish sand with some supplementary coastal structures such as groins, headlands etc. in order to reduce the expected sand discharge after the initial nourishment. The method to be employed in BBCP was statically stable beach, and this method is also recommended in the proposed project for the Maldives in the funding proposal.
- As beach nourishment is to recover sandy beach like original natural beaches, it is not avoidable to expect some amount of sand discharge in post project period and periodical maintenance is required to maintain recovered sandy beach with good condition. If sand for maintenance is procured at every periodical maintenance period, it causes high cost (almost same cost of initial nourishment). To minimize the cost for maintenance, it is desirable to dredge and maintain sand stock for targeted certain period together. In BBCP, sand for future maintenance was stocked with about 150,000 m^3 at the sand stockpile. Same idea is employed to the proposed project for the Maldives in the funding proposal.
- Based on the monitoring result for about 20 years, most parts of sandy beaches recovered by the BBCP still well maintained. Sand replenishment using stocked sand has been carried out at some limited part of deteriorated area by the government once or twice for 20 years. This means the maintenance effort and its cost can be minimized by provision of proper planning and design of beach nourishment (especially layout design) with deep understanding of site-specific condition for beach process and mechanism of sand movement.
- After the BBCP, the government of Indonesia, communities, and related stakeholders have well understand that the contribution of recovered sandy beach on points not only for protection function but also for beach use (recovered beach has been highly used as tourism, recreation and cultural events are).
- To accelerate and achieve proper beach management by the government, communities and other stakeholders, the technical support has been continued through the second similar project (BBCP2).

Understanding of Beach Nourishment in Inhabitant Island of Maldives Described in Previous Report

The Second National Communication (SNC) Maldives updated in 2018 gives the following information. *Soft measures are difficult to implement effectively due its high sensitivity to the local environmental conditions such as geomorphology, hydrology and climate. The measures also require frequent and long-term commitment to maintain the effectiveness. These measures are not popular in inhabited islands due to low visibility but preferred by resorts in the Maldives that has high priority of maintaining a larger beach and to preserve the aesthetics of the natural coast*."

There are mainly two categories as coastal measures, which are "hard measures" and "soft measures". Concrete measures in each category are shown in Table-12.
There are several different categories for "soft measures" and "hard (structure) measures" for coastal conservation/protection measures. If we focus on coastal protection facilities, "hard (structure) measures" is to protect coasts by structures only, such as seawall, revetment, groins, breakwaters, submerged breakwaters (artificial reef). Other measures are basically categorized as "soft measures".

In other words, “soft measures” is to protect coasts by not only hard structures, but also by enhancement of nature protection function, such as beach nourishment (including combination of nourishment and supplementary structures), artificial sand dune recovery, sand engine (sand motor), coral reef restoration (coral transplantation), mangrove plantation, etc. or by other methods to reduce coastal vulnerability such as land use control (set-back, securing of buffer zone), evacuation system, etc. Some of measures categorized as soft measures in the SNC are different from above categorization, such as temporary seawalls/revetments, artificial reefs (same as submerged breakwater).

As beach nourishment method, there are mainly two methods, which are “dynamically stable beach” and “statically stable beach”. The former is just to replenish sand on beaches without any coastal structures. This method is common as coastal protection measures against coastal erosion mainly in the United States, Australia and some of European countries. On the other hand, “statically stable beach” is to replenish sand by combination of with some supplementary coastal structures such as groins, headlands, breakwaters, etc. in order to reduce sand discharge after initial beach nourishment. Private sectors not only in the Maldives but also in other countries have commonly applied “statically stable beach method” to maintain their beach locally in order to reduce sand discharge after the initial nourishment. On the other hand, in inhabitant islands in the Maldives, beach nourishment has not been common method as coastal protection measures. They have experiences only to dump by-product sand which was obtained from port (navigation channel) construction. This is almost same method as that for “dynamically stable beach”, just filling sand without any structures.

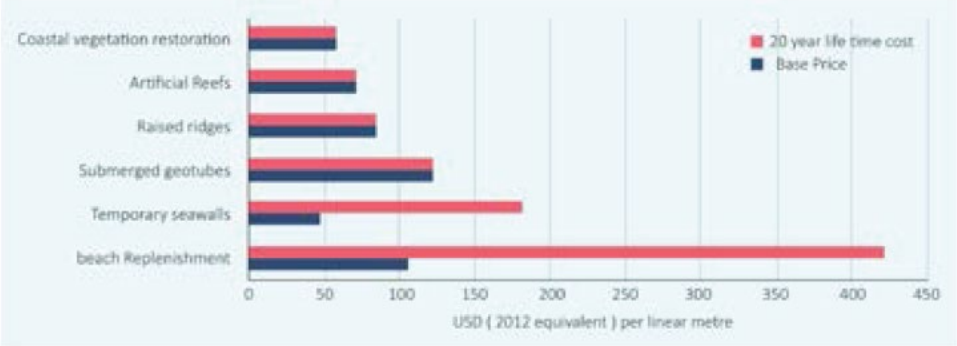
Table-12 Concrete Measures in Each Category

Hard (Structure) Measures	Soft Measures
− Seawall (mainly by concrete) − Revetment (by concrete, concrete block or rubble) − Groins (by concrete , concrete block or rubble) − Breakwaters (by concrete, concrete block or rubble) − Submerged breakwaters (artificial reef) (by concrete block or rubble), etc.	− Beach nourishment a) dynamically stable beach (only sand replenishment) b) statically stable beach (sand replenishment with supplementary facilities by groins, headlands, etc.) − Artificial sand dune (similar to nourishment) − Sand engine (sand motor) (similar to nourishment) − Coral reef restoration (coral transplantation) − Mangrove plantation − Land use control (setback, securing of buffer zone) − Evacuation system, EWS, etc.

Source: JICA

SNC mentioned that though the initial cost of beach nourishment is cheaper than other hard structure measures, the maintenance cost of beach nourishment for assumed 20 years is significantly high and about four times as much as initial cost (see Figure 43). This means all quantity of nourished sand will be disappeared in every 5 years and periodical sand replenishment with same quantity of initial beach nourishment is required in every 5 years. Even though the assumption or evidence for this estimation is unclear, our targeted sand discharge and required frequency and quantity of sand for maintenance will be less than this estimation by conducting proper planning and design and considering sand stock for future maintenance.

As



Source: Second National Communication of Maldives (2016)

Figure 43 Cost comparison of soft engineering solutions for coastal adaptation

explained below, we proposed to employ special dredger (Trailer Suction Hopper Dredger, TSHD) and dredge sand from offshore seabed with certain depth to minimize adverse effect to surrounding coastal topography.

There are mainly two items which is related to sand dredging using TSHD, which are 1) mobi- and demobilization cost for TSHD and 2) cost for sand dredging. TSHD with sufficient capacity is very special dredger, and source for procurement of TSHD is very limited, only from Europe. That is why, the item 1) costs about 3 million US$ more or less. Furthermore, the cost for item 2) is mainly for equipment ownership cost (equipment rental cost) during the mobilization duration. This means the cost for dredging work is greatly influenced by the scale merit (amount of sand). Thus, if we dredge and maintain sand stock for targeted certain period together, the total cost can be reduced.

Even though the amount of sand will be significantly increased, adverse effect on environment is not expected because we have already considered the expected impact to the beach (further coastal erosion due to sand dredging) and not recommended to take sand nearby coastal area, but from the appropriate borrowing sites, e.g. several km far from the coral reef at least more than 20 m in depth, sea bottom is manly composed of coral sand. That is why we need to employ such special dredger (TSHD) with sufficient capacity.

Regarding necessity of sand stockpile, if sand stock is not considered together with initial sand nourishment, it is very difficult for Maldives Gov. to obtain sand for maintenance from the appropriate borrowing sites by using special dredgers, TSHD, and this will cause the unsuccess of maintenance of projected beach with sustainability. That is why it is recommend to prepare the sand stock for first 25 to 30 years maintenance period. Another possibility for unsuccess maintenance might be by misunderstanding on beach conservation and environment, and this will cause to accelerate illegal sand mining, deterioration of coastal environment, etc.

As sand stockpile area, it is planned to keep certain area with about 1.5 – 2.0 ha with 1.5 to 2.0 m height for Fonadhoo and Meedhoo on land side because there are many un-used areas for both islands. On the other hand in Maamendhoo, as land area is very limited and no empty space in the island, it is planned to use newly constructed evacuation area as sand stockpile by increase of land elevation about +1 m from required grand elevation for evacuation.

Sand stockpile will be prepared by local government as “government property”, and just stock sand without maintenance (same as Bali Beach Project case). So, it will not cost for sand stock.

Reason why SNC Stated that Soft Measure (Beach Nourishment) was “Inappropriate” in the Maldives

1) Misunderstanding for image of beach nourishment method because of limited experiences of beach nourishment in inhabitant islands

   As mentioned above, there are several options for beach nourishment method. However, the understanding of beach nourishment stated in SNC seems just one pattern, maybe for dynamically

beach (Because beach replenishment at inhabitant island in the Maldives has been implemented to just replenish of dredged sand at some area, which was obtained as by-product material for construction of port/navigation channel). If proper method of beach nourishment is employed while taking into account of site-specific conditions, maintenance issues, etc., it becomes more realistic and easy method.

2) No consideration how to reduce maintenance activities and its cost
   Basically, there is no consideration to reduce maintenance activities and its cost (for example, preparation of sand stockpile in initial nourishment).
3) Lack of technical skill for coastal engineering, especially for understanding of coastal process, mechanism of sediment transport and experience for implementation of beach nourishment.
   In order to conduct proper planning and layout design for beach nourishment, sufficient understanding for site-specific coastal process, mechanism of sediment transport and know-how for beach nourishment based on actual implementation, etc. is strongly required. However, there is barrier for lack of technical skill, knowledge and experiences for executed officers of government of Maldives, related stakeholders.

Differences of Beach Nourishment between by the Government and by Private Sectors

- Purpose of beach nourishment is different between the government and private sectors. Government projects are for the purpose of coastal protection/conservation which is conducive to protect natural land, public property, and facilities, people's livelihood, culture etc. basically for whole coastal area in an island. On the other hand, projects by private sectors are implemented to maintain just their local private property for commercial purpose and coastal conservation point of view, which the government has, is not considered.
  Basically, private sectors do not have views on coastal conservation in which impact of the other islands and national land loss is taken into account. On the other hand, the government considers protecting natural land, public property, and facilities, people's livelihood, culture etc. basically for whole coastal area in an island.
  Commercial purpose for private sectors is for tourism contribution from foreign and domestic tourists. However, if we expand the meaning of "commercial purpose" more widely for inhabitant islands, there is possibility to contribute to bring income to local residents and local governments due to enhancing beach amenity using financial resources (for example, income from small shop for food and drinking, collection of entrance fee, etc.). Also, several kinds of beach activities can be promoted such as beach sport event (AE has an experience to promote and carry out such events using recovered sandy beach in the Tuvalu).
- Due to difference of above-mentioned purpose, private sectors dredge sand for maintenance from nearby project site (sometimes from foreshore area or coral reef) using sand pump and barge to minimize the maintenance cost. Due to this, there is possibility to cause adverse effect to surrounding coasts. On the other hand, from the coastal conservation point of view, it is required to take sand with high consideration not to cause adverse effect to surrounding beach. To achieve this, it is common understanding to dredge sand far from the coast with certain depth using special dredger (Trailer Suction Hopper Dredger, TSHD) even though cost is significantly higher than that for sand dredging using sand pump.

Applicability of Beach Nourishment in the Maldives

1) Proposed beach nourishment method

As beach nourishment method, we have proposed to employ "statically stable beach" using supplementary coastal structures such as groins together with beach nourishment to reduce the possibility of sand discharge after the initial nourishment. We understood that this method is realistic and appropriate method to apply to developing countries considering the reduction of maintenance period and its cost.

2) From the Point of Predicted Sand Discharge

- As mentioned in 2, the magnitude of littoral drift for coral reef coast is significantly smaller than that for common open sandy beach. Furthermore, proposed beach nourishment is not to apply the dynamically stable beach without any supplementary coastal structure such as groins, but the statically stable beach with combination of groins (same method of Bali Beach Conservation Project). Thus, it is expected to further reduce the sand discharge after the nourishment due to both effect of coral reef and planning of statistically stable beach.
- The estimated sand discharge (loss) for Bali Beach Project was 6,000 to 8,000 m3/year based on long-term satellite image analysis. On the other hand for proposed two beaches, Maamendhoo and Fonadhoo in the Maldives, estimated beach retreat with considering the effect of SLR was 0.6m/year at Maamendhoo and 0.67m/year at Fonadhoo in 2050 (as shown in Table 6.3.2 in Chapter 6, Appendix 2). Assuming 2 m as the height of sediment movement from the result of field survey, annual sand loss was estimated 720m3/year at west side coast in Maamendhoo with 600 m objective coastline, 360m3/year at east side coast with 300 m objective coastline. At Fonadhoo, 1160m3/year at 850 m objective coastline. This quantity for sand loss is quite smaller than that for Bali Beach.
- In the proposed design for intervention, 20 m is assumed as the nourished beach width as the result of analysis for flooding due to SLR and high waves. Also, it is proposed to prepare sand stock with same amount of initial volume of sand about 33,000 m3 for each island. From above mentioned result, this volume is equivalent to the volume of sand discharge for 30 years at Maamendhoo and 28 years at Fonadhoo. Furthermore, the proposed method can further reduce sand discharge due to the effect of supplementary structure such as groins to form statically stable beach.
- Actual phenomena depend on unpredictable wave condition. If unexpected extreme event (strong storm) occurs with high frequency, further sand replenishment will be required. However, based on rough analysis mentioned above, the applicability of beach nourishment in the Maldives coast seems high from the point of expected sand discharge after beach nourishment.

3) Consideration to reserve sand stock

To minimize the maintenance cost, it is recommended to reserve the sand for maintenance together with sand for initial nourishment at the same time. We propose to stock sand with the same amount of initial nourishment, which will be secured for 25 years maintenance work.

4) Planning and design based on sufficient analysis for the process of beach change and mechanism of sediment movement and capacity development for related governments officials

Detailed analysis for the process of beach change and mechanism of sediment movement will be conducted based on combination of satellite image analysis, field investigation and numerical approach to achieve appropriate planning and design of beach nourishment. Technology transfer and capacity development to related governments officials will be conducted through each activity by OJT.

5) Establishment of beach management system and capacity development for both government officers and communities

Through the sub-activity 2.3 of the proposed project, beach maintenance system will be established for both government officials (adaptive management to maintain project beaches) and community (dairy maintenance). In the sub-activity 2.3, it is also planned to promote and conduct several recreation events using recovered sandy beach area, such as beach sports event, open market, environment educational open school, etc. to increase the function of projected beach on commercialization point of view. Furthermore, possibility to increase the income of community or local governments will be examined, e.g. to collect entrance fee (or parking fee) to install attractive beach amenities, etc.

These events, program will be planned and executed local Gov. and community by AE support during the project period based on the experience from other projects by AE, and finally expect to conduct and manage by local Gov. and community in the Maldives.

Evaluation on Effect against Climate Change and Maladaptation Risk due to Intervention

The effect against climate change is evaluated as follows.

- Proposed intervention will have effect against climate change by reducing damage due to flooding and erosion.
- Magnitude of littoral drift due to intervention is small.
- Adverse effect of erosion and flooding at adjacent coast due to Intervention is not so significant.
- Regarding adverse effect by flooding, intervention was designed to minimize the adverse effect by flooding. The similar project by JICA in Tuvalu shows that no significant wave flooding and adverse effect was observed at beach and even around groin area.

Points to be addressed in the Detailed Design Stage

In detailed design, measures to mitigate out flow of sand will be elaborated by addressing the following two points.

1) Finalization of Detailed Layout Planning based on Appropriate Numerical Analysis

The layout plan will be finalized with accurate understanding and evaluation on expected sediment transport and beach changes after the implementation. In the detailed design stage, therefore, the numerical model needs to be developed to improve its repeatability of actual phenomenon of beach change then to be applied to optimize the detailed layout of beach nourishment and groins.

2) Improve Repeatability of Numerical Model at Detailed Design Stage

Wave data recorded in the site study was applied in order to improve the repeatability of the numerical model, however, it allows further improvement as the record period was only several months. Since the wave data will be accumulated for more than one year at the detailed design stage, these data should be analyzed in terms of annual variability (offshore wave height, wave height on reef, water level, wave direction, etc.) and be applied to improve the repeatability of numerical model.

Contribution of Paradigm Shift

Activity 2.2 Implementation of coastal conservation/protection measures is critical to realize enhancing resiliency against climate change by utilizing the natural protective functions of coasts and reefs. This activity is actual practice of implementing coastal conservation/protection measure and the central activities among the activities in the proposed project of all components. Through the implementation by organizing Project Management Unit, PMU will conduct monitoring and evaluation of the implementation and extract good practices and lessons learned which are conducive to bring the paradigm shift. The good practices and lessons learned will be obtained from the experiences of project management, procurement, construction, construction supervision. The impact is also high, since the stakeholders in Maldives would like to prevent coastal erosion and loss of beach.

“Activity 2.1 Detailed design of coastal conservation measures and capacity development of stakeholders” is necessary activity to prepare for Activity 2.2. “Activity 2.3 Implementation of beach maintenance, establishment of structure and capacity development of stakeholders” is also necessary activity to maintain the beach to be nourished in Activity 2.3. In Activities 2.1 and 2.3 as mentioned in C.3.2 of FP, capacity building and technology transfer through on-the-job training will be conducted. The trained personnel will be transferred to ME or MNPI, island councils to disseminate and share experience and knowledge learned through the activities in Component 2.

Activity 2.3 includes real maintenance activities by local community. Through the activity, the ownership by local community is fostered through deepening understating of local community on their maintenance and how the maintenance connects coastal environment and their benefits for community as mentioned in Support Document 1.

These activities in Component 2 will make the base of sustainable beach nourishment and contribute paradigm shift and impact of resilience in conjunction with the activities of other components.

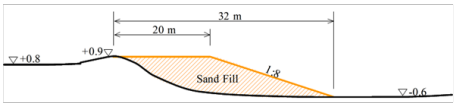
Proposed Intervention for Each Site

The following two adaptation measures will be implemented at Maamendhoo Island: 1) Coastal conservation measures by employing beach nourishment (L=900m) with supplementary groins; and 2) Creating evacuation area by partial reclamation (2.2ha). As coastal conservation measures at Fonadhoo and Meedhoo islands, beach nourishment (L=850m and 1400m, respectively) with supplementary groins is employed as the appropriate coastal conservation measure. The construction of rubble type revetment with L=270m each is proposed as coastal protection measures at Gan and Isdhoo islands to protect the historical heritage area at hinterland (Figure 44 and 45).

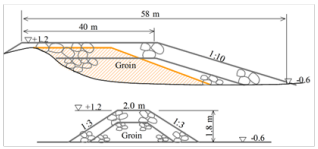
GoM will also make in-kind contribution for procurement of sand to be used for beach nourishment at three sites and for reclamation material in both GCF- and GoM-funded construction sites.

Maamendhoo Island in Laamu Atoll

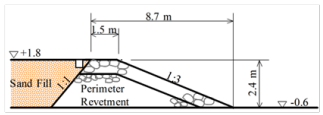
1. East Coast (300m) : Beach Nourishment + Groins
2. West Coast (600m) : Beach Nourishment + Groins
3. North Coast : Reclamation + Perimeter Revetment



Typical Cross-Section Image for Beach



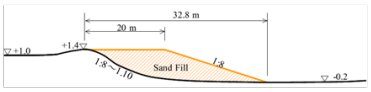
Typical Cross-Section Image for Groins



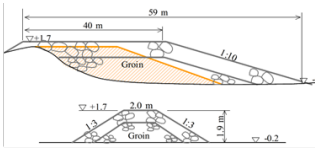
Typical Cross-Section Image for Reclamation Area

Fonadhoo Island in Laamu Atoll

1. East Coast (850m) : Beach Nourishment + Groins



(1) Typical Cross-Section Image for Beach (with refrained revetment)



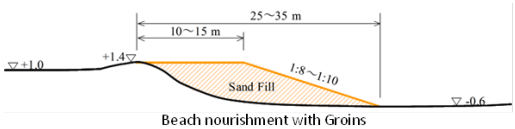
(2) Typical Cross-Section Image for Groins

Source: JICA

Figure 44 Proposed Intervention for Activity 2.2 funded by GCF

Meedhoo Island in Addu Atoll

North Coast (1400m) :
Beach Nourishment + Groins



Beach nourishment with Groins

Image of Proposed Beach Conservation Measure (Just Image)

Gan Island in Laamu Atoll

East Coast (270 m) :
Rubble Type Revetment

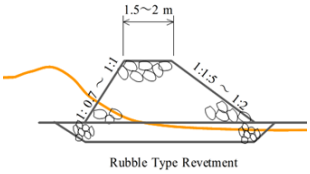
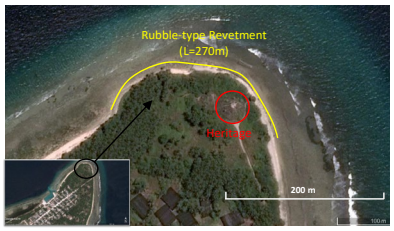


Image of Typical Cross Section

Isdhoo Island in Laamu Atoll

North Coast (270 m) :
Rubble Type Revetment



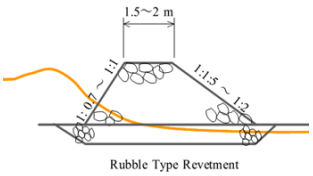


Image of Typical Cross Section

Source: JICA

Figure 45 Proposed Intervention for Activity 2.2 funded by GoM

Table 13 shows the role and responsibility of ME and JICA as Executing Entities (EE) for Activity 2.1.

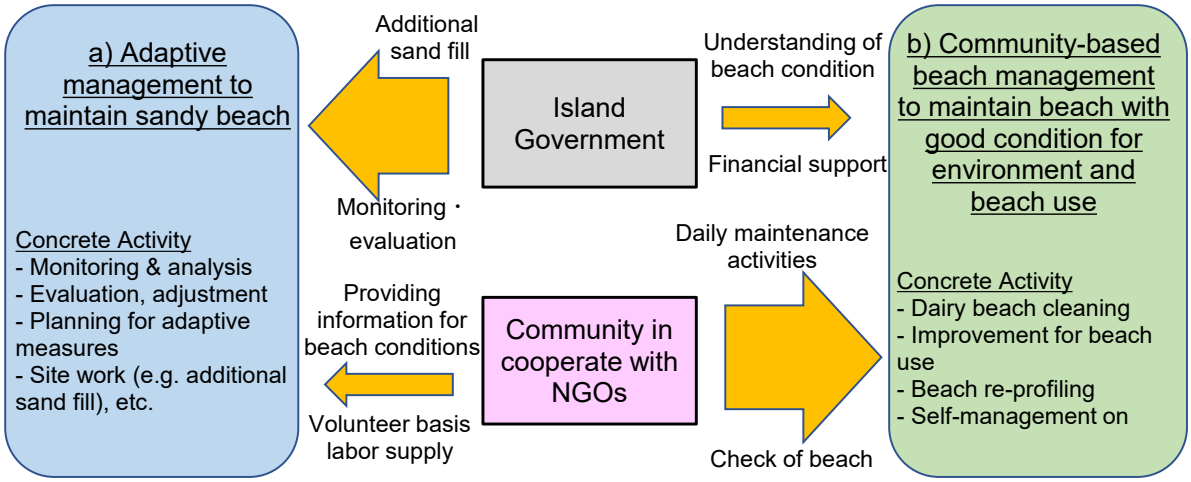
Sub-Activity		Roles and Responsibility of Executing Entities (EE)	
		ME	JICA
Sub-Activity 2.1.1	Detailed design of coastal conservation/protection measures	1) Conducting supplementary detailed survey 2) Conducting ESIA 2) Conducting of bidding	1) Conducting detailed survey 2) Conducting Basic design 3) Assistance in ESIA 4) Assistance for preparation of bid docment
Sub-Activity 2.1.2	Capacity development of related officials on survey, planning and design of coastal project	1) Facilitating OJT of capacity development for survey, planning and design of coastal project	1) Technical input for OJT of capacity development for survey, planning and design of coastal project

Activity 2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders

Appropriate coastal maintenance in accordance with actual changes in coastal conditions is essential in order to sustainably maintain the project beaches after the beach nourishment carried out in Activity 2.2. The required coastal maintenance after the beach nourishment is mainly divided into two items, which are 1) adaptive management aimed to maintain the beaches in accordance with the change of beach profile due to wave action, and 2) daily maintenance aimed to maintain the good condition of the beach for the beach use and environment as shown in Figure 46. As shown in this figure, cooperation between the island governments and communities in cooperate with NGOs is essential for the sustainable maintenance of the beach. Activity 2.3 is aimed to establish the beach maintenance system and develop the capacity of both island government officers and residents for beach maintenance by conducting the actual activities after the implementation of beach nourishment in Activity 2.2 in collaboration with the island government and residents.

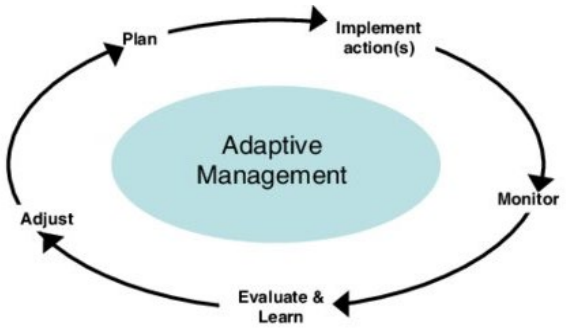
Cyclic management system, which includes monitoring, evaluation, adjustment, plan and action, is required to adaptive management for nourished beaches as shown in Figure 47. JICA will contribute to establish and take necessary action for capacity development of the adaptive management system, and public education, enlightenment, public relations for residents and capacity development for establishment of community-based beach maintenance, in cooperate with the consultant team procured by PMU.

Table 14 shows the role and responsibility of ME and JICA as Executing Entities (EE) for Activity 2.3.



Source JICA

Figure 46 Image of Required Beach Maintenance after the Beach Nourishment



Source：NOAA Coastal Services Center 2006[1)]

Figure 47 Image of Adaptation Management System to be applied to the maintenance work after the beach nourishment

Table 14 Role and responsibility of Executing Entities (EE) for Activity 2.3

Sub-Activity		Roles and Responsibility of Executing Entities (EE)	
		ME	JICA
Sub-Activity 2.3.1	Implementation and establishment of adaptive management	1) Monitoring survey after the construction 2) Implementation of adaptive measures 3) Coordination and followup of island government on operation of adaptive management	1) Technical evaluation based on monitoring results 2) Planning of adaptive measures 3) Support for capacity development for adaptive management system through each activity on site by OJT
Sub-Activity 2.3.2	Implementation of community-based beach maintenance for comfortable beach use and environment	1) Coordination and followup of community on operation of community-based beach maintenance 2) Coordination and followup of island government on operation of community-based beach maintenance	1) Support for capacity development for community-based beach maintenance through each activity on site byOJT
Sub-Activity 2.3.3	Public education, enlightenment, public relations to residents and capacity development on beach maintenance and management	1) Organizing coastal environmental education at elementary and junior high schools 2) Organizing of various educational events	1) Action for expanding knowledge (site tours, preparation of brochures, video for PR etc.) 2) Support for educational program and event

Source: JICA

Component 3: Development of Disaster Warning and Information Dissemination

Considering the remaining risk of extreme disasters that cannot be fully mitigated by structural measures along the coasts, countermeasures for coastal disaster in the Maldives requires appropriate official dissemination of disaster warning and information, in order for the general public to take preventive actions

in a timely manner. This component, co-financed by JICA, will build a system dissemination of disaster warning/information covering nationwide, and support capacity development of government officials responsible for operating the system, aiming at protecting residents' lives through appropriate evacuation activities to be taken by the residents themselves.

Early Warning Broadcast System (EWBS) will be set up on top of Integrated Services Digital Broadcasting-Terrestrial (ISDB-T) broadcasting system. This new transmission system will improve public access to up-to-date information and reduce information disparities among the scattered islands of the Maldives, which is critical with regards to disaster information. It enables the governmental agencies responsible for climate and other disaster forecast, warning and information, such as Maldives Meteorological Service (MMS) and National Disaster Management Authority (NDMA), to broadly and instantly inform public of the information based on their operational protocols to facilitate quick evacuation and protective actions.

This component is also expected to be in synergy with UNEP's project under planning 'Toward Risk-Aware and Climate-resilienT communities (TRACT) - Strengthening climate services and impact-based multi-hazard early warning in Maldives', in which information on EWBS may be included in developing last-mile early warning services, as well as community-based disaster risk reduction activities.

Since Maldivian households have a high rate of ownership of television, this media is expected to benefit public of broad profiles: in particular, it improves access to disaster information and warning by women staying at home during daytime as well as elders, children and people with disabilities, whom women tend to take care of in the Maldives and face higher risks of delay in evacuation in case of disaster.

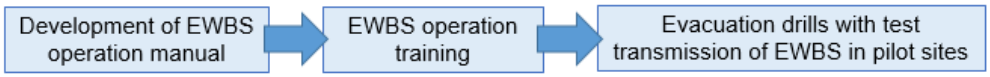
Activity 3.1: Installment of terrestrial digital broadcasting system

ISDB-T television network will be installed, with network operation center (in Male) and transmitting station equipment (in nationwide level), to allow broadcasting digital television broadcasts throughout the Maldives. Target atolls for installment of transmitting station can be referred in p.8-19, Annex2. Due to the installment of ISDB-T television network under the Project, the coverage corresponds to 91.23% of the total population of the Maldives, and this system, implemented through a co-financed grant aid project by JICA, will serve as a platform of EWBS.

Activity 3.2: Establishment of Disaster Early Warning and Information Broadcasting System (Figure 48)

EWBS, the nationwide disaster warning and information broadcasting services will be established through a co-financed technical cooperation project by JICA. Public Service Media (PSM), responsible for operation of public broadcasting services in the country, will develop operation manual for EWBS and implement operation training in collaboration with related organizations. Due to these activities, it is expected that PSM will obtain necessary techniques and equipment (such as digital signages) for operation and maintenance of EWBS.

Pilot evacuation drills with test transmission of EWBS will be organized in selected towns, with participation of municipalities and local residents so that they familiarize themselves with, as well as raise awareness of, the categories and contents of warning/information and appropriate responsive actions. When issuing an alarm through EWBS, real-time wave information obtained from wave observation system proposed in component 4 will be utilized.



As well as development of EWBS operation structure, PSM will obtain technology for O&M for ISDB-T so that EWBS will be effectively operated.

Source: JICA

Figure 48 Flow of activity 3.2 of component 3

Component 4: Development of Basic Data Collection and Sharing System Related to Climate Change

In the Maldives, recognition and understanding of the detailed impacts of hydraulic external forces and SLR due to climate change, and the detailed picture, history and factors of the phenomena, such as coastal erosion and deteriorating reef environment, are not sufficient. One of the main causes is that the concerned

stakeholders have had neither chance of understanding each phenomenon based on factual data, nor opportunities of examining evidence-based countermeasures.

In this sense, GoM is in need of basic observation of the climate change impact and the data of external force on wave and sea levels, which are the most relevant data on the increase of coastal disaster risk due to climate change impact; regular examination of their impact on the coastal area; analysis of the climate change impact based on quantitative information; and continuous study of the countermeasures against future climate change impact.

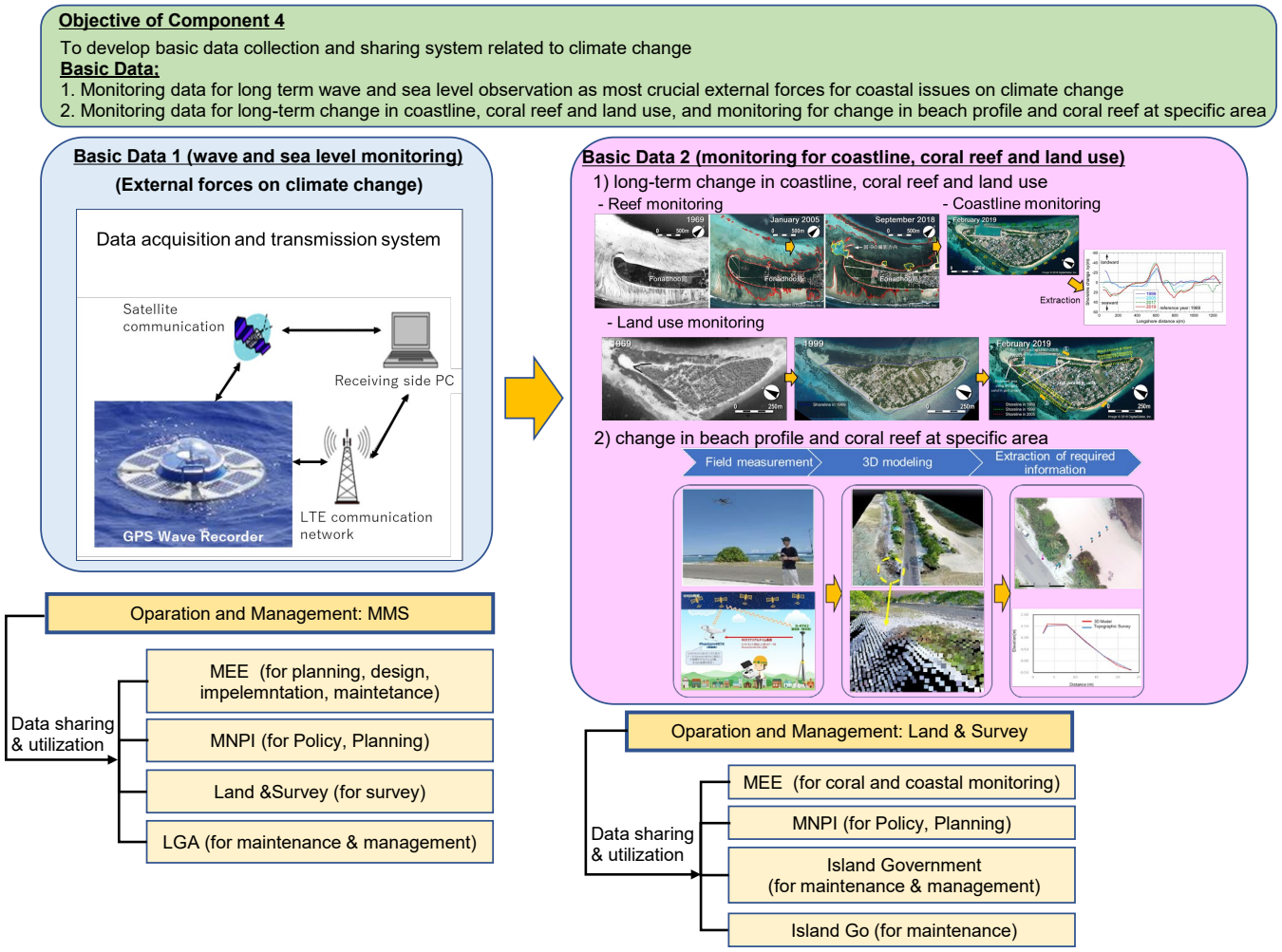
This component, financed by JICA, assists GoM with a system for obtaining and sharing basic data related to climate change, and capacity development of the government officials responsible for operating the system by transferring technical skills. The government agencies to sufficiently and commonly share the understanding of actual situation and impact of climate change and thereby to implement most appropriate measures" by implementing the following two Activities (see Figure 49).

Activity 4.1: Development of wave and sea level monitoring system

A long-term wave and sea level monitoring system will be developed and necessary technical transfer will be provided in order to obtain the long-term external forces related to climate change. Three representative sites, Hanimadhoo, Male, and Gan in Addu Atoll, are assumed as a fixed observation points, where MMS executes sea level observation.

Activity 4.2: Development of beach, coral reef and land use monitoring system

This component is divided into two types of monitoring systems: long-term monitoring for coastline, coral reef and land use for a wide area; and detailed monitoring for change in beach profile and coral reefs at a specific area. The monitoring system applying satellite images and GIS system will be developed in order to monitor the long-term change in coastline, coral reefs, and land use for wide areas. UAV technology will be applied in the examining visual changes of beach profile and coral reefs at specific areas which required detailed monitoring.



Source JICA

Figure 49 Image of Required Beach Maintenance after the Beach Nourishment

B.4. Implementation arrangements (max. 1500 words, approximately 3 pages plus diagrams)

Implementation Arrangement

In the project, the Maldives' technical and engineering foundation for mitigating negative impacts from climate change will be strengthened through Component 1 as non-physical measures and Component 2 as physical measures. Simultaneously, Component 3 will be implemented in light of extreme events that are not protected by the physical/non-physical measures. Further, Component 4 will be implemented to obtain essential basic data, as precondition for the planning and implementation of each of the measures and establish a sharing system of such data among relevant agencies. Project Steering Committee (PSC) will be established in order for concerned agencies to share the project information, effectively implement the project activities and cooperate in ensuring the project outcomes in a sustainable manner with project replications. Under PSC, Components 1, 3 and 4 will be implemented by JICA. Entire Component 2 will be managed by PMU on behalf of ME, while a part of Activity 2.1 (conducting detailed survey, basic design, assistance in ESIA and in preparation of bid document and technical input for OJT of capacity development for survey, planning and design of coastal project) and Activity 2.3 (the details are shown in table 14) will be implemented by JICA. The sub-set of activities financed by JICA are grouped into Components 1, 4, a part of Activity 2.1 and Activity 2.3, and Component 3, and an expert team under JICA funding will be formed for each group to implement the activities. Figure 50 shows the implementation arrangement of the project, in which the PMUs and JICA Expert Teams report to the Executing Entities (EEs), and then to PSC.

Project Steering Committee (PSC)

PSC is responsible for decision making on the project policy, regular monitoring of the project progress, coordinating conflicting interests among concerned agencies, and providing advice on problems that arise during the project implementation. The chairman of PSC is a senior official of ME, and as the members of PSC, representatives from National Designated Authority (NDA), ME, MNPI, Local Government Authority (LGA), Laamu Atoll Council, Addu City Council, NDMA, MMS, Environmental Protection Agency (EPA), Ministry of Finance (MoF) and JICA as EE, shall attend the regular meeting. The secretary of PSC will be ME to efficiently operate and effectively follow-up the issues to be raised and the decisions made at the meetings.

Executing Entity (EE)

ME: The activities of Component 2 will be implemented by the Environmental Department of ME in cooperation with MNPI, financed by GCF and the GoM, which is planning, evaluation and adjustment in implementation and establishment of adaptive management and community beach maintenance and sub activity 2.3.3 in support of JICA expert team. As the conventional coastal protection projects have been implemented by MNPI, information and construction methods of the Component 2 shall be shared with and discussed as necessary in order to mainstreaming the concept of coastal conservation/protection measures into the coastal projects in future. ME will be responsible for the oversight of the activities, reporting the progress to PSC, and reflecting the decisions and advices of PSC in the activities through PMU.

JICA: Components 1, 4, and Activity 2.3 will be implemented by JICA-1&4 in collaboration with MEE under PSC and Component 3 will be implemented by JICA-3 through a JICA Expert Team that will be formed for each of the component groups. JICA-1&4 and JICA-3 will be responsible for the oversight of the concerned activities, reporting the progress to PSC, and reflecting the decisions and advices of PSC in the concerned components.

Project Management Unit (PMU)

The PMU, established on behalf of ME for Component 2, is responsible for the day-to-day activity management, such as design, construction, monitoring during the defect liability period, and commencement of beach monitoring and management activities. The members of PMU are employed from external sources outside of ME. The function of PMU will end when the final performance report of the project is submitted

and the final administration of the project expenses is settled. The roles of major PMU members are listed as follows.

Project Manager: The leader of PMU. Responsible for the daily management of the project based on the project plan, to ensure that the project will be completed within the planned period and expenses and required quality.

Technical Adviser: Support PMU by providing technical expertise on coastal protection/conservation in reviewing and evaluating bidding documents, scrutinizing consultant's report regarding civil work and maintenance work and so on from the technical engineering aspect. Since the technical adviser works most closely on the project implementation and assures project quality, AE will procure the position and conclude the contract through the GCF funded project budget.

Social Environmental and Gender Officer: Coordinating with concerned agencies for the smooth implementation of the project according to the project plan, through the Stakeholder Engagement Plan (SEP) and Gender Action Plan (GAP); Reviewing the consultant's environmental, social and gender monitoring report and confirming that necessary measures are taken.

Knowledge Management Officer: Communicating project activities and promoting the project among stakeholders. Also collecting and organizing knowledge and lessons learned from the project activities to improve the activities and reflect to activities of other projects in Maldives and other countries.

Procurement/Contract Manager: Leading the procurement of consultants for the detailed design and construction supervision and contractor for civil works according to the procurement policy of JICA as AE); Reviewing the draft bidding documents prepared by ME for the selection of consultant and by the consultant for the selection of contractor; Finalizing and publicizing the bidding documents; Evaluating the bidders and preparing the evaluation report for the approval of PSC; Concluding the contracts and discussing contract matters during contract negotiation; and Filing the documents of procurement and contracts.

Senior Procurement Advisor: Confirming that the procurement activities lead by the procurement/contract manager comply with the procurement policy of AE, by providing technical expertise on AE's procurement system. Since the senior procurement advisor will have a double check function within the PMU, AE will procure the position and conclude the contract through the GCF funded project budget.

Accountant: Managing the GCF funded activity budget and Maldives co-financed activity budget including the management budget, preparing disbursement request, and filing of accounting records and documents throughout the project period under the supervision of the project manager.

Role of JICA

JICA also plays a role as AE, oversight the overall management, implementation and supervision of each component overseen by PSC such as the administration and management of the use of the GCF funds, monitoring and evaluation of the activities including the project effectiveness and environmental and social consideration, reporting to GCF, supporting PMUs as necessary, and quality assurance of the project. This will be implemented through reporting line from the Technical Advisor and Senior Procurement Advisor in PMU whom JICA will procure as well as the project's reporting line from PSC.

Fund Flow

The GCF fund will be used for Component 2 GCF funded activities, and disbursed to the designated account of JICA as AE based on the annual project cost estimation. After the second disbursement, the

timing will be decided based on the actual expenditure ratio. The disbursement from the AE to GoM will be made by disbursement request of ME via MoF.

The payment process for the consultant/contractor to be procured in the Component 2 GCF funded activities will start with the PMU scrutinizing the consultant/contractor issued invoice, preparing disbursement request, and submitting to JICA as AE. Upon confirmation of the arrival of JICA transferred fund at the designated account, the ME will process payment to the consultant/contractors through MoF, which manages the cash flow of the account. No GCF proceeds will be transferred through the Ministry of Finance in relation to the Funded Activity. The relevant documents, such as invoice, disbursement request, bank transfer instruction, bank remittance slip, and receipt will be filed by the PMU. Figure 51 shows the GCF fund flow. For the Component 2 Maldives co-financed activities, the fund disbursement requested by the PMU will be sent to ME according to the ME's funding scheme. For the sub-set of activity financed by JICA, the fund disbursement will be implemented in accordance with JICA's funding scheme. Since Component 2 will include GCF financed activities and Maldives co-financed activities, the funds will be disbursed simultaneously and depending on the procurement packages of consultant and contractors, proportionate funding from GCF and GoM may be expected.

Track Record of ME

Between 2014 and 2017, MEE commenced 105 climate change projects through the GoM's resources (average project cost is USD 1.22 million/project) and 13 climate change projects through external assistance. The project cost of 3 out of 13 projects exceeded USD 9 million and implemented by the Water and Sanitation Department or the Coastal Protection and Disaster Risk Reduction Unit of MEE or through the PMU established by MEE. One of them is the GCF project that UNDP oversees as AE (FP007), where MEE implements the project through a PMU in coordination with the concerned agencies such as NDMC, LGA, Ministry of Housing and Infrastructure and the island council. By utilizing MEE's experience, this project will be implemented effectively.

Track Record of JICA

JICA has been providing financial and technical support to developing countries as Official Development Assistance since 1954. In 2017, the numbers of ongoing climate change projects and programs are 137, of which six projects are for the island states. Especially, the coastal conservation/protection by beach nourishment and beach monitoring applied in the yen loan project in Indonesia, which commenced in 1996, obtained high reputation for its effectiveness and the implementation of the succeeding phase is planned. Also, a technical cooperation in Mauritius aimed at the formulation of a coastal conservation plan and capacity building of the concerned agencies through technology transfer. JICA assisted GoM through the yen loan project called "Maldives Tsunami Reconstruction Project", which commenced in 2006, to support the reconstruction of ports and sewerage damaged by the tsunami in the Indian Ocean.

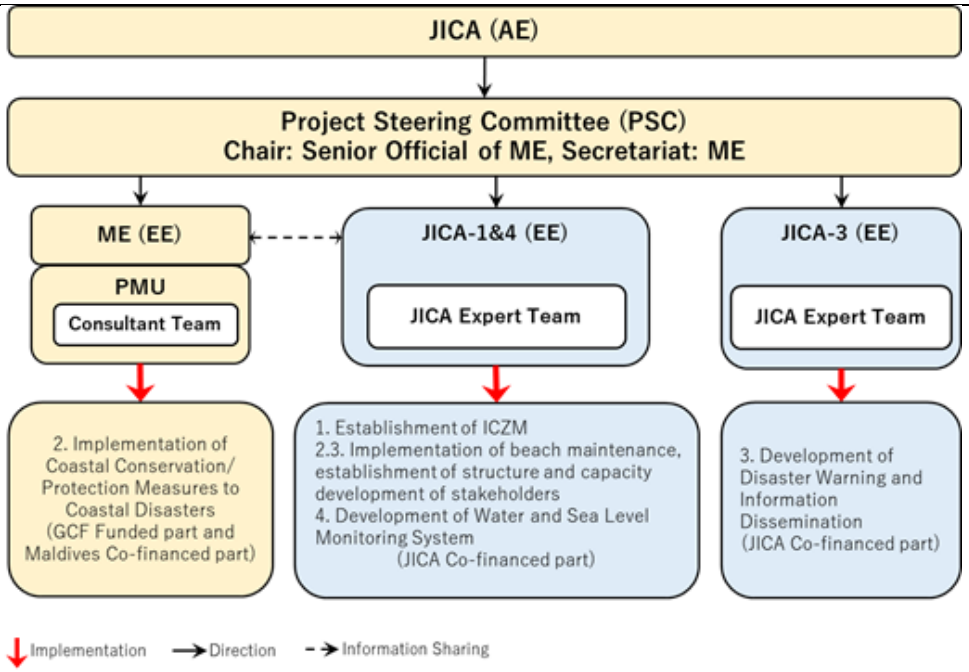


Figure 50 Implementation Arrangement of the GCF Project

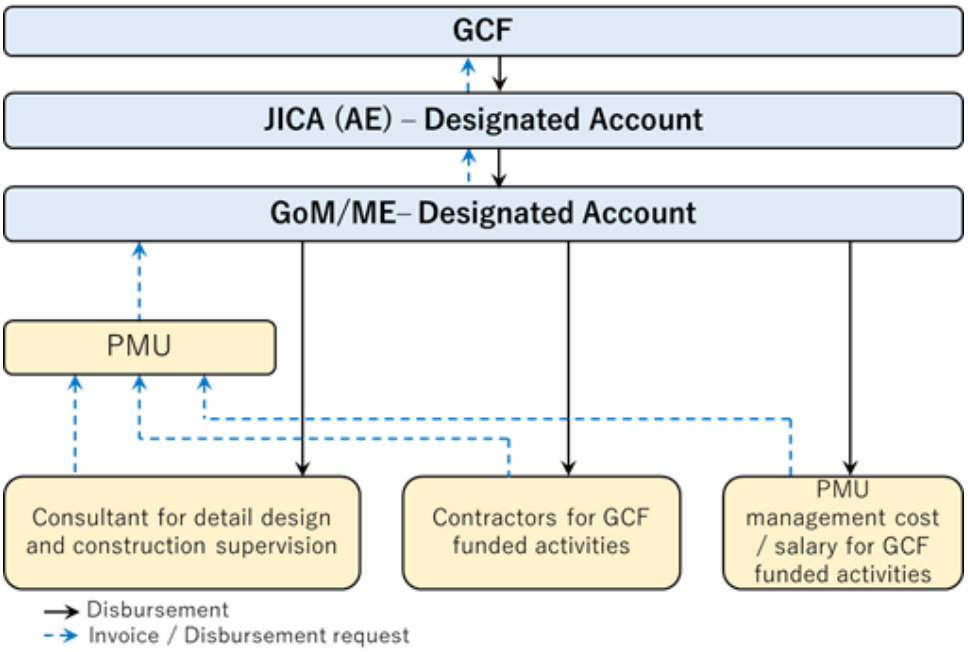


Figure 51 Fund Flow (GCF Funded Project)

B.5. Justification for GCF funding request (max. 1000 words, approximately 2 pages)

GoM has spent USD 30 million of government budget and USD 25 million from international aid agencies for coastal protection since 2013. However, 116 islands among the 188 inhabited islands in the country are facing coastal erosion, 38% of which are in an acute situation. Although GoM has allocated a budget of USD 0.65 million to USD 10 million annually for coastal protection measures on inhabited islands, the budget and external assistance are far from sufficient because of the expensive construction cost in the Maldives due to material import and transportation to the remote islands, which is necessary in the island states. Moreover, introduction of appropriate engineering technologies is essential for comprehensive and sustainable solutions with the effective use of limited resources against coastal erosion and coastal disaster accelerated by climate change. It is also a grave issue of sustainability of national environment, economy, society, and culture, which are all characterized by its fragile geography. The capacity of GoM is financially and technically insufficient.

To implement comprehensive coastal conservation/protection measures and for the residents to take appropriate measures in the event of disaster with a limited budget, the application of conventional measures such as the construction of coastal protection structures one after another would not be sustainable. Rather, it is necessary to place priority on the implementation of coastal conservation/protection measures in the high coastal disaster risk areas under the concept of medium to long term ICZM, which considers land management plan, coastal management plan, and sediment management plan. At the same time, it is also necessary to establish permanent systems to monitor meteorological phenomena and accumulate meteorological data for scientifically understanding the impact of climate change with evidence and for taking more appropriate measures. By jointly implementing these measures necessary for each of the short, medium and long term, the sustainability of the system, in which priority areas to implement coastal conservation/protection measures and develop disaster warning/dissemination, and specific measures and methods to take are identified and implemented, will be ensured.

The Government of Japan is preparing the Country Assistance Program for the Maldives, in which the basic policy is set out to provide assistances from a medium- to long-term point of view considering the vulnerability of the Maldives as a small island state while its national income per capita is relatively high. In the program, it is stated that the assistances shall be provided by focusing on the response to and measures against climate change and in the disaster risk reduction sector. Also, special attention is paid to the operation and maintenance system and capacity development of GoM. In the climate change cooperation policy of JICA, the comprehensive management of climate risk and improvement of climate change policy and system are set as the key issues, and it will provide cooperation in the integrated implementation of development and climate change measures by utilizing the accumulated experience of Japan. Following these, JICA sets out its GCF project formulation policy for a project likely to promote cooperation and synergistic effect with other ODA projects.

Based on the above policies of the Government of Japan and JICA, the area of JICA assistance in the project would be on the component that will consider the integrated implementation of development and climate change measures from a medium- to long-term point of view (Component 1), the component on disaster risk reduction sector (Component 3), and the component on comprehensive management of climate risk (Component 4), and these are proposed as the sub-set of activity financed by JICA. Because this is not a sector in which future commercialization is foreseen, mobilization of private funds is not appropriate. For the remaining fund gap, GoM will partly allocate its limited budget and implement as its co-financed project; the rest of the gap should be funded by GCF, which supports the adaptation of climate change impact.

In the Maldives, the importance of ICZM was pointed out in the past. Although studies and pilot projects were tried, the implementation plan lacks details and specifics so that there have been no cases where the concept of ICZM was put into practice. GoM published the Maldives's Intended Nationally Determined Contribution in 2015, raised coastal protection as one of the priority climate change adaptation measures, and requested for international assistance. However, the only assistance including structural measures

announced by international aid agency as of September 2018 is the Coastal Protection Project at Gn. Fuvahmulah (total project cost of USD 22 million) by the Netherlands (grant) and Kuwait Fund (loan). With this situation, expecting to obtain assistance from other international aid agencies would be difficult.

Because of climate change impact, coastal erosion in the Maldives is expected to accelerate and high wave flood damage will occur more frequently. Under these circumstances, the GCF fund in the project will be utilized for the implementation of coastal conservation/protection measures urgently required at the priority areas, based on appropriate land use and sediment management plans, which consider climate change impact. By utilizing the measures implemented by the GCF fund, this project will put the ICZM concept into practice and contribute to build climate resilient safer islands in the Maldives. It should be noted that because these coastal conservation/protection measures are not projects that will generate monetary profit and considering sustainable development and the current debt level of the Maldives, the grant of the GCF fund is the most appropriate.

B.6. Exit strategy and sustainability (max. 500 words, approximately 1 page)

The activities in the project are envisaged to have standard methodology for planning, designing, implementation, and maintenance of coastal conservation/protection in the Maldives. To realize this, the following strategic activities are important for ensuring the sustainability of the project:

1. For replication of the ICZM practices

The draft regulations developed in the target islands of the project, identified as necessary for practicing the ICZM through case studies, are submitted for approval of the mayors of the islands during the project period. To start the formulation process of the ICZM guidelines at the national level, a public office/department in charge of finalizing the ICZM guidelines shall be appointed. The trainings for concerned agencies include "cascade" training to enable the trained officials provide valuable advice during the replication stage. Further, the employment of the local consultants will be consulted in PSC, who will play an important role during the implementation of the case studies in the concerned agencies. With these activities, practicing the ICZM at the other islands is expected.

2. For continued maintenance of nourished beaches

GoM shows commitment in allocating budgets for maintenance of the nourished beaches. Maintenance manual will be prepared, which includes candidate sites for sand collection and its operation. The roles of the government and the communities will be clarified, and the implementation arrangement will be determined. Domestic contractors capable of the maintenance work will be identified and the required activities will be explained in advance. Sufficient amount of the sand stock for the maintenance will be secured and the management plan of the sand stock will be decided. The lessons learned from the private sector’s accumulated experiences in beach maintenance of their resort islands, in terms of the environmental considerations for the development plans and the knowhow to study, manage and replenish required quantity of sand at required timing, will be utilized where applicable. Collaboration with the private sector’s beach maintenance and the government large dredging project for the collection of required sand will be considered. With these activities, continued maintenance of the nourished beaches is expected.

3. For continued operation of disaster warning system and the residents taking appropriate measures in the event of disaster

Training on operation and maintenance of the system will be implemented, and manuals featuring the contents of the training will be prepared for future reference. The training involves personnel in charge of operation and maintenance at both the national and atoll levels. Operational exercise on a monthly basis will be set up during the implementation to ensure the continuity of skills and workflow gained through the activities.

4. For continued monitoring and accumulation of meteorological data

Manual for the monitoring equipment will be prepared and the training for operation and maintenance will be implemented. In the training program, information such as the purpose of monitoring and accumulation of data, the agency/department in charge, and the organizations to share the data will be included in addition to the technical knowledge and experience. It is expected that the utilization of accumulated data in GoM will be proposed at an appropriate time.

To implement the above preparatory activities, capacity development of the concerned agencies and local consultants involved in the project is essential.

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C. FINANCING INFORMATION

C.1. Total financing

(a) Requested GCF funding (i + ii + iii + iv + v + vi + vii)	Total amount	Currency
	25.1	million USD ($)

GCF financial instrument		Amount	Tenor	Grace period	Pricing
(i)	Senior loans		years	years	%
(ii)	Subordinated loans		years	years	%
(iii)	Equity				% equity return
(iv)	Guarantees		years		
(v)	Reimbursable grants				
(vi)	Grants	25.1			
(vii)	Result-based payments				

(b) Co-financing information	Total amount	Currency
	40.9	million USD ($)

Name of institution	Financial instrument	Amount	Currency	Tenor & grace	Pricing	Seniority
JICA	Grant	35.4	million USD ($)			
GoM	Grant	4.6	million USD ($)			
	In kind	0.9	million USD ($)			

(c) Total financing (c) = (a)+(b)	Amount	Currency
	66.0	million USD ($)

(d) Other financing arrangements and contributions (max 0.5 page)	*VAT exemption is agreed between MoF and JICA, and is to be officialized under the agreement with MoF and JICA.*

C.2. Financing by component

Please provide an estimate of the total cost per component and output as outlined in Section B.3. above and disaggregate by source of financing. More than one co-financing institution can fund a single component or output. Provide the summarised cost estimates in the table below and the detailed budget plan as Annex 4.

Component	Output	Indicative cost million USD ($)	GCF financing		Co-financing		
			Amount million USD ($)	Financial Instrument	Amount million USD ($)	Financial Instrument	Name of Institutions
Component 1: Establishment of the Integrated Coastal Zone Management (ICZM)	Activity 1.1: Inventory study for risk assessment on present coastal and coral reef conditions	0.2			0.2	Grants	JICA
	Activity 1.2: Preparation of basic policy of ICZM at the national level	0.7			0.7	Grants	JICA
	Activity 1.3: Preparation of concrete ICZM Plan at	0.7			0.7	Grants	JICA

	representative inhabitant island as case study						
	Activity 1.4: Capacity development and information sharing of the relevant organizations for establishment of the ICZM	0.7			0.7	Grants	JICA
Component 2: Implementation of Coastal Conservation/Protection Measures against coastal disasters	Activity 2.1: Detailed design of coastal conservation measures and capacity development of stakeholders	1.6	1.4	Grants	0.3	Grants	JICA
	Activity 2.2: Implementation of coastal conservation/ protection measures	27.2	22.0	Grants	4.3	Grants	GoM
					0.9	In kind	GoM
	Activity 2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders	1.2	0.6	Grants	0.6	Grants	JICA
Component 3: Development of Disaster Warning and Information Dissemination	Activity 3.1: Installment of terrestrial digital broadcasting system	25.8			25.8	Grants	JICA
	Activity 3.2: Establishment of Disaster Early Warning and Information Broadcasting System	3.7			3.7	Grants	JICA
Component 4: Development of Basic Data Collection and Sharing System Related to Climate Change	Activity 4.1: Development of wave and sea level monitoring system	0.4			0.4	Grants	JICA
	Activity 4.2: Development of beach, coral reef, and land use monitoring system	0.4			0.4	Grants	JICA
Project Management Component		3.4	1.2	Grants	0.2	Grants	GoM
					2.0	Grants	JICA
Indicative total cost (USD)		66.0	25.1		40.9		

This table should match the one presented in the term sheet and be consistent with information presented in other annexes including the detailed budget plan and implementation timetable.

In case of a multi-country/region programme, specify indicative requested GCF funding amount for each country in Annex 17, if available.

C.3 Capacity building and technology development/transfer (max. 250 words, approximately 0.5 page)

C.3.1 Does GCF financing fund capacity building activities?	Yes ☒ No ☐
C.3.2. Does GCF financing fund technology development/transfer?	Yes ☒ No ☐

Capacity building and technology transfer are planned in Activity 2.1 and 2.3.

Activity 2.1: Detailed design of coastal conservation measures and capacity development of stakeholders

The consultant for detailed design and construction supervision, procured by PMU, will plan and design the beach nourishment and its maintenance plan after the construction in Activity 2.2. The co-team leader of the consultant team will learn by co-working with the international consultants through an on-the-job training style arrangement. The personnel will continue to work during the construction supervision stage and will be transferred to the ME or MNPI after completion of the project for them to disseminate and share the experience and knowledge learned through the project.

Activity 2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders

The same consultants above will prepare the plans for the adaptive management system and community-based daily maintenance based on the basic policy established in Activity 1.2: Preparation of basic policy of ICZM at the national level. The local consultants hired as site engineers of the consultant who will participate in the planning will be transferred to the island councils during the implementation stage to share their knowledge and experience and to support the island council together with the consultant. Through these activities, the capacity development of the island council will be planned.

The GCF financing fund to be used for these activities is the expenses for the consultant for detailed design and construction supervision, which is approximately USD 3.4 million.

D. EXPECTED PERFORMANCE AGAINST INVESTMENT CRITERIA

This section refers to the performance of the project/programme against the investment criteria as set out in the GCF's Initial Investment Framework.

D.1. Impact potential (max. 500 words, approximately 1 page)

The ICZM plans, to be developed under the project at the target inhabited islands, aim at enhanced resiliency against future climate change, utilizing the natural protective functions of coasts and reefs, while taking further coastal development into account. Upon observing and examining climate change-induced phenomena through basic monitoring systems set up under the project, the concept of ICZM shall be developed at the target islands, as well as introduced at the central level of the Maldives, which is expected to bring significant impacts as the foundation of effective and sustainable land and coastal management.

The case studies at the target islands of this component will enable the ICZM concept to be instrumental on ground, through the process of exercise and examination of concrete actions outlined in the ICZM plans.

Protection measures shall be implemented at the coasts facing acute coastal erosion and/or high risks of high tide and tsunami, in the areas with a) large population and economies, b) high potential of economic development, and/or c) high capacity of local and community governance. Unlike the conventional methods implemented in the Maldives and many other island countries, the measures to be adopted in the project will emphasize the linkage between humans and nature while retaining protective functions, in consideration of utility and environment for the citizens. The project shall also establish locally-oriented systems of coastal management for the sustainability of the structural measures once completed.

Implementation of these components shall involve relevant officials, public and private stakeholders, and the local population in order to transfer expertise in the planning, designing, technological application, and maintenance of coastal structures based on ICZM, taking further participation of women into consideration. These exercises are expected to promote technologically sound and effective coastal protection measures, which the Maldives largely needs, and broadly benefit the country in pursuit of adaptation to climate change.

The transmission systems for disaster warning and information by relevant government agencies will serve as a foundation of the citizen's timely and appropriate response when facing coastal disasters.

The beneficiaries of the project are expected as follows:
Direct beneficiaries of 9,000 persons (2.2% of total population in the Maldives)
Indirect beneficiaries of 372,000 persons (91.23% of total population in the Maldives)

D.2. Paradigm shift potential (max. 500 words, approximately 1 page)

According to Second National Communications of the Maldives in 2018, due to the negative experience of Maldives regarding the effectiveness of soft measures for coastal zone and beach protection, these measures are not popular at the current stage. Unpopularity of soft measures is mainly related to difficulties to be implemented effectively due their high sensitivity to the local environmental conditions such as geomorphology, hydrology and climate leading finally to maladaptation. In addition to knowledge and experience, the soft measures also require frequent and long-term commitment and significant financial resources to maintain their effectiveness.

Thus Project interventions aim to shift the paradigm away from current common understanding and action on coastal protection in the Maldives by modification of natural beaches artificially using hard structure measures without sufficient climate data and consideration for impact due to artificial modification towards a new paradigm to maintain the natural resilience of sandy beach and coral reef that the islands of the Maldives originally owned and has a potential to adapt to uncertain climate impact by realization of Integrated Coastal Zone Management (ICZM) and to implement the coastal conservation measures at some of densely populated area together with delivery of disaster early warning/information, by transferring knowledge and expertise on the proper implementation of soft (nature based) measures for

coastal zone and beach protection and long-term sustainable management, to alleviate the loss of national land and to maintain safe and secure livelihood. This approach should ensure the maximum mitigation of maladaptation cases experienced by the country.

Potential for scaling up and replication

The project outputs and outcomes appropriate ICZM planning and design for building resilience measures based on the plan, and strengthening of the disaster warning/information dissemination system in the project should be expanded in the other atolls and islands through collaboration among the executing agencies, stakeholders and residents. Specifically, the outputs that can be applied to other countries include the methods to build resilient islands by utilizing the original natural functions through both structural measures and non-structural measures, the observation networks and integrated observation information management systems at the island level, and the disaster warning and information systems. In addition, the beach nourishment method proposed in this project uses sand as the main material, which is the only material that can be procured in the country. This method can easily be applied to other island countries with similar geographical conditions, so the experience in this project is expected to be useful. Also it should be considered to reduce the implementation cost of physical adaptation measures for expansion to the other inhabitant islands, such as sharing of special heavy equipment with private sectors and ingenuity on implementation (the details are described in D.4). Such studies for scalability of the project will be also examined in Component 1 and 2.

AE has experienced to execute several similar projects applying beach nourishment from pilot-scale to large-scale in tropical island countries with coral reef coasts. These successful experience (mentioned in B3) in implementation of soft measures for coastal zone protection in other countries will be utilized to transfer the technology related knowledge and provide on-the-job training of coastal zone engineering for sustainable and cost-effective management of coastal zone with soft measures.

The scaling up of the intervention is also in line with their current strategies and policies. GOM put their priority for facilitating the mobilization of financing to reduce exposure of communities to coastal hazards, which is mentioned in the latest NDC, and the Project can contribute to the achievement of this goal since the output of the Project can be utilized for formulation of ICZM and technical transfer of the intervention. Also GOM mentions in their Strategic Action Plan 2019-2023 that they aim to strengthen legislative framework on environmental protection and disaster risk reduction to ensure vulnerable ecosystems are preserved and protected and the climate resilience of communities are enhanced, and the components also contribute to the achievement of this goal.

Potential for knowledge sharing and learning

One of the causes of coastal problems that have occurred in the Maldives is the difference in basic perceptions and the lack of information sharing among the concerned organizations involved in coastal zone development. It is expected that the ICZM and the observation system to be developed in this project will promote basic understanding and information sharing based on correct information among the concerned organizations. In addition, the concept of ICZM in the island countries, the process from survey to construction, and the method of regional-led coastal maintenance management are expected to be applied depending on the geographical characteristics and social context of each island.

For efficient knowledge sharing, during the planning and implementation period of the project, island councils, women's development committees and interested community based organizations will be given information through consultative meetings, progress briefings etc. Also after the Project, it will be also considered to organize knowledge sharing workshops/webinars to engineers and engineering students and other practitioners to broaden their knowledge on lessons learned from the project's improvements and design works, land use etc.

Contribution to the regulatory framework and policies

The ICZM plan will be formulated as a part of the comprehensive policy of the target island and as an output of the project. The national government is considering the creation of the policy documents for the national ICZM. In addition, it is expected that the target islands will develop necessary laws and regulations for regional development and land use based on the ICZM plan.

The plan and design for structural measures in this project and the introduction of appropriate construction methods are expected to contribute to the plan and design method for coastal structural measures to be continuously implemented as both public and private projects in the Maldives, and to the development of policies and systems for licensing and confirmation inspections.

Overall contribution to climate-resilient development pathways consistent with relevant national climate change adaptation strategies and plans

The ICZM plan to be formulated in this project and the policy document for the national ICZM will show the direction for the appropriate implementation of the specific actions for adaptation to climate change described in the National Adaptation Program of Action in the Maldives. It will also contribute to the achievement of the goal of “strengthening of climate change adaptation measures and developing a climate resilient infrastructure and community” under the National Climate Change Policy Framework.

D.3. Sustainable development (max. 500 words, approximately 1 page)

The project is composed of the establishment of ICZM, implementation of coastal conservation/protection, establishment of disaster alert/information system, and establishment of observation and monitoring systems, and is implemented by focusing on maintaining people’s interaction with the coast on the basis of the original protection function of the coast and proactively developing human resources. Therefore, it coincides with Goal 13 of the Sustainable Development Goals (SDGs), i.e., “take urgent action to combat climate change and its impacts” from the viewpoints of environment, society, and gender. The individual targets that match with this project are as follows:

13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries;
13.2: Integrate climate change measures into national policies, strategies, and planning;
13.3: Improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning; and
13.b: Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing states, including focusing on women, youth, and local and marginalized communities.

Especially, in the establishment of ICZM, land use plan will be considered, and community learning and publicizing activities will be implemented. Also, in the coastal conservation/protection, construction method using construction materials that are easy to collect locally, called beach nourishment, will be applied to recover natural beaches. Therefore, from the viewpoints of environment, society, gender, and economy, the project also coincides with Goal 5, i.e., “achieve gender equality and empower all women and girls”, Goal 11, i.e., “make cities and human settlements inclusive, safe, resilient, and sustainable”, Goal 12, i.e., “ensure sustainable consumption and production patterns”, and Goal 14, i.e., “conserve and sustainably use the oceans, seas, and marine resources for sustainable development”. The individual targets that match with this Project are as follows:

5.5: Ensure women’s full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life
5.b. Enhance the use of enabling technologies, in particular ICT, to promote women’s empowerment

11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities;
11.c: Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials;

12.2: By 2030, achieve the sustainable management and efficient use of natural resources;
12.8: By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature; and

14.2: By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

D.4. Needs of recipient (max. 500 words, approximately 1 page)

The Maldives, as a Small Island Developing State (SIDS), is highly vulnerable to climate change, and coastal erosion is identified as main cause for increase of coastal vulnerability.

The conventional coastal protection measures by applying hard structures has been common in the Maldives. However, the conventional coastal protection cannot be sustainable and efficient when considering the domestic needs for development. GoM cannot neglect the right of the island communities to preserve and maintain the lifestyle and culture of their islands with precious ecosystem. Providing ecosystem-based coastal protection works and preserving the important assets and beachline are vital to island communities as these are contributing to the island socio-economy. However, it is mentioned that the government cannot afford the high cost for technology development and engineering works in developing the ecosystem-based coastal protection technology. The overall cost for any coastal protection works in the Maldives is very high due to factors such as transport of materials and the accessibility of some islands. Thus, this project is highly needed to the Maldivian communities to release further coastal vulnerability due to climate change with maintaining their lifestyle and culture.

In each year, GoM allocates approximately USD 5 million to USD 11 million for coastal protection with a total expenditure of USD 30 million from 2013 to 2017. On the other hand, if it is assumed to implement the same scale of nature-based coastal adaptation measures applying beach nourishment at serious eroded inhabitant island (38% among total 188 inhabitant islands), total cost is estimated about USD 500 million. Estimated cost is quite huge comparing to current annual budget for coastal protection in the Maldives. Also, since the population is scattered across 188 inhabited islands, many of which have less than 1,000 inhabitants, the limited resources at the government's disposal are insufficient to provide a lasting solution to the coastal erosion issues that these islands face.

Based on above mentioned situation, it is unrealistic to implement same image of intervention to all of eroded inhabitant islands considering the scalability of the project to expand to other inhabitant islands.

Main objective to establish ICZM policy in national level and concrete plan for beach and coral reef conservation and sediment budget plan in island level in component 1 is to maintain and enhance the natural protection function of existing beach and coral reef as 1st priority of coastal conservation and adaption against climate change. Then, if it is expected to be insufficient and still remain serious coastal vulnerability, physical coastal adaption measures will be considered to implement as 2nd priority.

Furthermore, it should be considered to reduce the implementation cost of physical adaptation measures for expansion to the other inhabitant islands. Several ideas are possible, for example;

1) Sharing of necessary resources with private sectors

There is a possibility to collaborate each other between GoM and private sectors for sharing of special heavy equipment such as dredger, working vessels, etc. and manpower, which are required for physical

implementation. It is expected to reduce the implementation cost drastically, if the construction plan and schedule for both public and private project can be well-adjusted. However, it should be considered the difference of objective for development between the government and private sectors, which is "commercial purpose" and "enhancement of resilience purpose". Necessary systems for suitable arrangements would be included in the ICZM policy and planning.

2) Ingenuity on implementation

Major item in construction cost of coastal adaptation measures, which is affected to total construction cost in Component 2, is the cost for mobi- and demobilization of dredger (TSHD) and for sand mining from seabed. If sand to be used for beach nourishment and its maintenance has been already set prior to the project as securing of sand stockpile, it is also expected to reduce the implementation cost drastically.

Such studies for scalability of the project will be also examined in Component 1 and 2.

Further, it is essential to technically update the design method and applied method for structural measures for improving the cost benefit and sustainability of the structures, for which technical cooperation is enthusiastically requested by GoM.

On disaster warning and information dissemination, considering the increasing frequency of disasters, it is necessary to promptly develop a drastically sustainable management system suited for the Maldives, where many islands are scattered in a large area. Especially, GoM holds high expectations for the technical cooperation that will utilize Japanese experience on disaster prevention administration and risk reduction system.

D.5. Country ownership (max. 500 words, approximately 1 page)

Role of National Designated Authority (NDA)

ME acts as NDA of the project, in partnership with JICA as AE. Upon initial request for the project from GoM, the two parties worked on identifying the project needs and prepare the concept note with ME for submission in September 2018. During the course of JICA's study for project development commenced in January 2019, public consultation meetings and gender assessment were facilitated by ME and municipal governments to facilitate the understanding of the impact of climate change, and to confirm the willingness of the communities to participate in the proposed project.

Capacity of EE to deliver

ME has been successfully implementing a range of climate change projects, including large-scale ones with cost exceeding USD 9 million. Since climate change intervention is a multi-sector issue, ME is instrumental in closely coordinating with relevant national agencies, especially MNPI in charge of infrastructure construction, NDMA and MoF in implementation arrangements.

Existing GCF country programme

The country program developed by GoM includes the project as one of the most crucial activities for utilizing the GCF fund. Discussions have also been held between the NDA and the GCF Task Team, where it has been indicated that there is a strong country ownership of this project.

Existing national climate strategy and alignment with existing policies such as NDCs, NAMAs, and NAPs

GoM addresses the issues of climate change based on the following policies, programs, and documents, which the project is conducive to:

Intended Nationally Determined Contribution (2020): This is a basic policy document for climate change mitigation and adaptation in the Maldives. It features the resilience of infrastructure, coastal conservation, improvement of early warning system and observation system, and governance and capacity development as climate change adaptation measures.

National Adaptation Program of Action (NAPA) (2007): This program shows a framework for climate change adaptation and indicates prioritized adaptation measures which include the improvement of land use planning, enhancement of coastal protection and integrated coastal management capacities, coastal protection with both soft and hard measures, protection of critical infrastructure, and the preservation of coral reef diversity.

National Climate Change Policy Framework (2015): This framework intends to promote activities in NAPA and to strategically respond to the effects of climate change.

Jazeera Raajje (2018): This is a manifest of the current administration starting from November 2018, placing a high emphasis on preserving the traditional Maldivian island way of living.

Engagement with civil society organizations and other relevant stakeholders, including indigenous peoples, women, and other vulnerable groups

NGO and resident representatives, who also participated in the preparatory public consultation, mentioned above will be included as stakeholders of the community-based daily maintenance, and discussions and information sharing will continue during the project. The Maldives also launched its national gender equality policy in 2009, which aim to bolster the participation of women in decision-making and promote their economic empowerment. Public consultations and gender assessment will also assist in identifying and mainstreaming gender issues into the project.

D.6. Efficiency and effectiveness (max. 500 words, approximately 1 page)

Referring to page numbers 149-150 and Table 32 of the GCF Programming Manual (July 2020), assessment for the viability of the project including efficiency and effectiveness was conducted for each component. The results are summarized as follows and details can be found in Annex 3.

[Component 1] Establishment of the Integrated Coastal Zone Management (ICZM)

(1) Impact Potential/ Number of Direct and Indirect Beneficiaries

- Direct beneficiaries: 5,346 people
  The population of the two islands where the case studies for concrete ICZM Plan at island-level will be implemented.
  - 3,080(Gan Island) + 2,266 (Fonadhoo) = 5,346 people
- Indirect beneficiaries: 196,000 people
  Based on the State of Environment 2016, it was assumed that 52% of the national population lives either in reclaimed area or area with coastal protection measures implemented, which are already protected. The remaining population (i.e. 48% of total population of 407,660), therefore, was estimated as indirect, potent beneficiaries of ICZM concept.
  - 407,660 x 48% = 196,000 people

(2) Paradigm Shift Potential/ Scalability and Replicability/Transformation

- Scalability and replicability: High
  Practicing the ICZM at the other islands is expected through cascade training to enable the trained officials to provide valuable advice during the replication stage and the case studies implemented with concerned agencies for the purpose of capacity development.
- Transformation of the concept of coastal protection: High potential
  It is expected that the concept of coastal protection by GoM will be transformed from protection-oriented to environment-conscious through Component 1 in terms of, for example, the layout of coastal facilities and ports and the way to select coastal protection measures.

[Component 2] Implementation of Coastal Conservation/Protection Measures against Coastal Disasters

(1) Impact Potential/ Number of Direct Beneficiaries

- Direct beneficiaries: 9,071 people
  Summation of the islands' population where coastal conservation measures will be implemented (Maamnedhoo, Fonadhoo, Gan, Ishdhoo in Laamu Atoll and Meedhoo in Addu Atoll). Since the measure aims not only to protect hinterland but also restore recreational and cultural assets for island people, whole island population was considered as direct beneficiaries.
  - 896(Maamendhoo)+2,266(Fonadhoo)+3,080(Gan)+Ishdhoo(958)+Meedhoo(1,817)=9,071 people

(2) Needs of the Recipient/ Absence of Alternative Sources of Financing

- Insufficient budget for coastal conservation: GoM only can allocate USD 5 to 11 million for coastal protection for each year while total cost is estimated about USD 500 million, if it is assumed to implement the same scale of nature-based coastal adaptation measures applying beach nourishment at serious eroded inhabitant island (38% among total 188 inhabitant islands).
- Insufficient international assistance: As of 2019, only two international assistance for coastal protection had been announced despite of the publication of the Maldives's Intended Nationally Determined Contribution in 2015.

(3) Efficiency and Effectiveness/ Cost-effectiveness
Benefit expected due to Component 2 was evaluated as below and was incorporated with the following cost-benefit analysis (see Chap 2.2.3, Annex 3 for details).

	2019	2030	2050	2100
Expected Annual Benefit (1,000 USD)	1,397	1,833	5,196	3,414

[Component 3] Development of Disaster Warning and Information Dissemination

(1) Impact Potential/ Number of Beneficiaries of Coverage

- Beneficiaries of coverage: 372,000 people
  The proposed terrestrial broadcasting will cover 172 islands out of the 188 inhabitant islands. Summation of 172 islands' population is about 372,000 people, which equivalent to 91.23% of total population.

(2) Efficiency and Effectiveness/ Cost-effectiveness
The benefit expected through the implementation of Component 3 was indirectly evaluated as 3.395 (mil. USD/ year) referring to a case study in Samoa. This annual benefit was incorporated with the following cost-benefit analysis.

[Component 4] Development of Basic Data Collection and Sharing System Related to Climate Change

(1) Efficiency and Effectiveness/ Long-term Economic and Financial Viability

To make the wave monitoring system sustainable in terms of finance, maintenance items required in the long term (10 years) as well as the yearly maintenance plan of the wave recorder was analyzed and cost required for equipment and professional technicians are all included in budget plan for the Component 4.

[Result of Economic Analysis]

Table below shows the cost-benefit analysis for the whole Project (i.e. Component 1-4 and PM)

CBR (Cost-Benefit Ratio)	NPV (Net Present Value)	EIRR
1.58	31,958 (1,000 USD)	8.00%

E. LOGICAL FRAMEWORK

This section refers to the project/programme's logical framework in accordance with the GCF's Performance Measurement Frameworks under the Results Management Framework to which the project/programme contributes as a whole, including in respect of any co-financing.

E.1. Paradigm shift objectives

Please select the appropriated expected result. For cross-cutting proposals, tick both.

☐ Shift to low-emission sustainable development pathways

☐ Increased climate resilient sustainable development

E.2. Core indicator targets

Provide specific numerical values for the GCF core indicators to be achieved by the project/programme. Methodologies for the calculations should be provided. This should be consistent with the information provided in section A.

E.2.1. Expected tonnes of carbon dioxide equivalent (t CO_2 eq) to be reduced or avoided (mitigation only)	Annual	Click here to enter text. t CO_2 eq
	Lifetime	Click here to enter text. t CO_2 eq
E.2.2. Estimated cost per t CO_2 eq, defined as total investment cost / expected lifetime emission reductions (mitigation only)	(a) Total project financing	_____ Choose an item.
	(b) Requested GCF amount	_____ Choose an item.
	(c) Expected lifetime emission reductions	_____ t CO_2eq
	(d) Estimated cost per t CO_2eq (d = a / c)	_____ Choose an item. **/ t CO_2eq**
	(e) Estimated GCF cost per t CO_2eq removed (e = b / c)	_____ Choose an item. **/ t CO_2eq**
E.2.3. Expected volume of finance to be leveraged by the proposed project/programme as a result of the Fund's financing, disaggregated by public and private sources (mitigation only)	(f) Total finance leveraged	_____ Choose an item.
	(g) Public source co-financed	_____ Choose an item.
	(h) Private source finance leveraged	_____ Choose an item.
	(i) Total Leverage ratio (i = f / b)	_____
	(j) Public source co-financing ratio (j = g / b)	_____
	(k) Private source leverage ratio (k = h / b)	_____
E.2.4. Expected total number of direct and indirect beneficiaries, (disaggregated by sex)	Direct	9,071 persons[3] (Male: 5,080, Female: 3,991)
	Indirect	372,000 persons[4] (Male: 210,000, Female: 162,000)
	For a multi-country proposal, indicate the aggregate amount here and provide the data per country in annex 17.	
E.2.5. Number of beneficiaries relative to total population (disaggregated by sex)	Direct	2.2% of total population in country
	Indirect	91.2% of total population in country
	For a multi-country proposal, leave blank and provide the data per country in annex 17.	

E.3. Fund-level impacts

[3] Based on Census 2014, Summation of five target islands' population for Component 2, Fonadhoo(2,266), Maamendhoo(896), Gan(3,080), Ishdoo(958) in Laamu Atoll and Meedhoo(1,871) in Addu Atoll with consideration of gender ratio from the same census.

[4] The proposed terrestrial broadcasting will cover 172 islands out of the 188 inhabitant islands. The coverage corresponds to 91.23% of the total population of the Maldives. Therefore, the number of beneficiaries of the coverage is estimated at 372,000, which is 91.23% of the total population (407,660 from the Census 2014) of the Maldives

Select the appropriate impact(s) to be reported for the project/programme. Select key result areas and corresponding indicators from GCF RMF and PMFs as appropriate. Note that more than one indicator may be selected per expected impact result. The result areas indicated in this section should match those selected in section A.4 above. Add rows as needed.

Expected Results	Indicator	Means of Verification (MoV)	Baseline (2019)	Target		Assumptions
				Mid-term (2023)	Final (2028)	
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	*A1.1 Change in expected losses of lives and economic assets (US$) due to the impact of extreme climate-related disasters*	Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	Annual loss expected due to swell wave (10-year return period) and coastal erosion (million USD 2019):[5] Maamendhoo:0.83 Fonadhoo: 0.80 Meedhoo, Gan, Ishdhoo: N/A[6] No loss of lives expected for 5 Islands above	Same as the baseline[4]	Maamendhoo: 0 Fonadhoo: 0 Meedhoo, Gan, Ishdhoo: N/A	Annual loss due to flooding and erosion was evaluated as compound damage (See Chapter 6, Annex2.
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	*A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)*	Independent socioeconomic survey results, disaggregated by sex.	0 men 0 women	Same as the baseline[7]	9,071[8] persons Beach nourishment with groins: Males: 2,819 Females:2,215 (sum of population in Maamendhoo, Fonadhoo and Meedho benefitting from the measure) Rubble type revetment: Males: 2,261 Females:1,776 (sum of population in Maamendhoo, Fonadhoo and	- To be evaluated based on population of target islands where the implementation will be completed

[5] See P.6-43, Chapter 6, Annex2. Damage was evaluated as 832,384 USD for Maamendhoo in Table 6.3.11 and 797,709 USD for Fonadhoo in Table 6.3.12.

[6] The coastal conservation measures at these 3 Islands aims to protect cultural assets such as heritage site and graves behind and enhance beach access and environment. Due to difficulties to evaluate these effects in monetary values, baseline and target were not indicated.

[7] Construction work and coastal protection measures won't be completed at the Mid-term.

[8] See Caption 1 in E2.4.

					Meedho benefitting form the measure)	
A3.0 Increased resilience of intrastructur e and the built environment to climate change	*3.1 Number and value of physical assets made more resilient to climate variability and change, considering human benefits (reported where applicable)*	Government asset ledger	No shoreline distance directly protected 0 km 0 USD	Same as the baseline[5]	4.2 km[9] of shoreline distance protected with economic benefit of 1.4 million USD in 2019 (Maamendhoo 0.60+Fonadhoo 0.80) [10]	- Total shoreline distance directly conserved by the implementation - Political and economic stability is maintained in the Maldives - There are no conflicts that will disrupt the construction or supply chain required for the materials both within and outside the Maldives - Shoreline will be considered resilient if the beach is still accessible and suitable for community use despite increased wave overtopping and coastal erosion
A4.0 Improved resilience of ecosystems and ecosystem services	*A4.1 Coverage/s cale of ecosystems protected and stregnthene d in response to climate variability and change*	Government asset ledger	0 ha (Maamendhoo, Fonadhoo, Meedhoo)	Same as the baseline[5]	9.9 ha[11] - Maamendhoo: 2.9ha - Fonadhoo: 2.8 ha - Meedhoo: 4.2 ha	Total implementation area of beach nourishment

[9] Total coastal distance conserved by Component 2: Fonadhoo(850m by beach nourishment with groins), Maamendhoo(1,440m by beach nourishment with groins and revetment), Gan(270m by revetment), Ishdoo(270m by revetment) in Laamu Atoll and Meedhoo(1,400m by beach nourishment and groins) in Addu Atoll

[10] See Table 3.2.14 and 3.2.15, P.20, Annex 3 for damage reduction effect (i.e. economic benefit) estimated in 2019.

[11] See Figure 8.3.1 to 8.3.3 in P.8-11 to 8-12, Chapter 8, Annex2. Beach nourishment area calculated by multiplication of coastal distance by beach width: Fonadhoo(D850mxW32.8m=2.8ha), Maamendhoo(D900mx32m=2.9ha), Meedhoo(D1,400mxW30m=4.2ha)

E.4. Fund-level outcomes

Select the appropriate outcome(s) to be reported for the project/programme. Select key expected outcomes and corresponding indicators from GCF RMF and PMFs as appropriate. Note that more than one indicator may be selected per expected outcome. Add rows as needed.

Expected Outcomes	Indicator	Means of Verification (MoV)	Baseline (2019)	Target		Assumptions
				Mid-term(2023)	Final(2028)	
-	Number of technologies and innovative solutions transferred or licensed to support low-emission development as a result of Fund support.	Published ICZM Guideline, government plans, strategies and policies Coast Guard equipment ledger and MMS wave database	**0**	0	A total of 2 new measures and 1 technology Measures: •Beach monitoring plan ・ICZM plan Technology: • long-term wave observation technology at specific offshore locations	- Less frequent personnel shift in related organizations .
A5.0 Strengthened institutional and regulatory systems for climate-responsive planning and development	*A5.2 Number and level of effective coordination mechanisms*	Published policy of ICZM and ICZM Plan	Level 0[12] Number: 0	Level 1 Number: 0	Level 3 Number: 1 united coordination mechanism by central and local government and local communities.	- No policy reversal due to regime change in the Maldives' national or local governments . - Less frequent personnel shift in related organizations .
A6.0 Increased generation and use of climate information in decision-making	*A6.1 Use of climate information products/services in decision-making in climate sensitive sectors*	Completion report for technical transfer by consultant	3 offshore locations and 5 islands at Level 0[13]	3 offshore locations and 5 islands at Level 0.	3 offshore locations and 5 islands at Level 3.	- No policy reversal due to regime change in the Maldives' national or local governments .

[12] ICZM effectiveness level scorecards: Level 0 = No basic policy of ICZM and ICZM plan are prepared (number of coordination mechanisms is 0.). Level 1 = Outline of basic policy of ICZM is prepared (number of coordination mechanisms is 0.). Level 2 = Basic policy of ICZM Guideline is prepared (number of coordination mechanisms is 0.). Level 3 = ICZM Plan is prepared and it referred in the shoreline protection plan and coastal development plan consideration process (coordination mechanisms is established at final stage with a united mechanism consists of the central and local government and local communities.)

[13] Use of climate information product/services level indicators: Level 0 = No System for wave observation and coast, reef and land use monitoring system are installed. Level 1 = System for wave observation and coast, reef and land use monitoring system are installed. Level 2 = System for wave observation and coast, reef and land use monitoring system are operated. Level 3 = Collected data are integrated to the shoreline protection plan and coastal development plan consideration process.

						- Less frequent personnel shift in related organizations .
A7.0 Strengthened adaptive capacity and reduced exposure to climate risks	*A7.2 Number of males and females reached by [or total geogrpahic coverage of] climate-related early warning systems and other risk reduction measures established/strengthened*	Implementation progress report by contractor	Maamendhoo: -Male: 0 -Female:0 Fonadhoo -Male:0 -Female: 0 Meedhoo: -Male: 0 -Female:0 Gan: -Male:0 -Female:0 Isdhoo: -Male:0 -Female:0	Maamendhoo: -Male: 0 -Female:0 Fonadhoo -Male:0 -Female: 0 Meedhoo: -Male: 0 -Female:0 Gan: -Male:0 -Female:0 Isdhoo: -Male:0 -Female:0	372,000 persons[14] (Male: 210,000, Female: 162,000) Maamendhoo: -Male:472 -Female:424 Fonadhoo -Male:1210 -Female: 1056 Meedhoo: -Male: 950 -Female:921 Gan: -Male:1657 -Female:1423 Isdhoo: -Male:469 -Female:489	- Assuming that the transmission ratio of disaster information will reach to 91% of population

E.5. Project/programme performance indicators

The performance indicators for progress reporting during implementation should seek to measure pre-existing conditions, progress and results at the most relevant level for ease of GCF monitoring and AE reporting. Add rows as needed.

Expected Results	Indicator	Means of Verification (MoV)	Baseline (2019)	Target		Assumptions
				Mid-term(2023)	Final(2028)	
Result 1:. Institutional capacity building and policy support for realization and enforcement of ICZM	1. Level of ICZM integration	Published government plans, strategies and policies	Level 0[15]	Level 1	Level 3	- No policy reversal due to regime change in the Maldives' national or local governments. - Less frequent personnel shift in

[14] The proposed terrestrial broadcasting will cover 172 islands out of the 188 inhabitant islands. The coverage corresponds to 91.23% of the total population of the Maldives. Therefore, the number of beneficiaries of the coverage is estimated at 372,000, which is 91.23% of the total population (407,660 from the Census 2014) of the Maldives

[15] ICZM integration level indicators: Level 0 = No knowledge about ICZM implementation and no plans where ICZM has been integrated, Level 1 = Governments get knowledge about ICZM plan but no plans where ICZM has been integrated, Level 2: Governments use knowledge about ICZM plan in development plans in 2 islands, Level 3: Governments use knowledge about ICZM plan in development plans in 3 islands.

						related organizations.
Result 2:[16] Protection of coastal communities and infrastructure exposed to coastal erosion	2. evacuation area created and number of people saved	Government asset ledger	0 ha, 0 people	0 ha, 0 people	2.2ha[17] 896 people (Males:502 Females: 394, Maamendhoo)	- No policy reversal due to regime change in the Maldives's national or local governments. - No unexpected event occurs to obtain materials necessary for littoral nourishment.
	3. Remaining width of beach (m)	Monitoring report to be prepared by Consultant	Meedhoo: 5-10, Gan: 0, Fonadhoo: 5-15, Ishdhoo: 0, Maamendhoo: 0-10	Meedhoo: 5-10, Gan: 0, Fonadhoo: 5-15, Ishdhoo: 0, Maamendhoo: 0-10	Meedhoo: 29, Gan: 0, Fonadhoo: 31, Ishdhoo: 0, Maamendhoo: 27	Baseline: observed from site investigation Final: beach width after beach nourishment above mean sea level (M.S.L)
	4. Erosion Area (m^2)	Monitoring report to be prepared by Consultant	Meedhoo: 7,000, Gan: -, Fonadhoo: 6,400, Ishdhoo: -, Maamendhoo: 11,300	Meedhoo: 7,000, Gan: -, Fonadhoo: 6,400, Ishdhoo: -, Maamendhoo: 11,300	Meedhoo: 0, Gan: -, Fonadhoo: 0, Ishdhoo: -, Maamendhoo: 0	Baseline, midterm: shoreline distance(m) x observed retreat(m) Final: No erosion from baseline expected
	5. Coral coverage on reef	Monitoring report to be prepared by Contractor	Meedhoo: Level 2 Gan: Level 1 Fonadhoo: Level 1 Ishdhoo: Level 1 Maamendhoo: Level 2	Meedhoo: Level 2 Gan: Level 1 Fonadhoo: Level 1 Ishdhoo: Level 1 Maamendhoo: Level 2	Meedhoo: Level 2 Gan: Level 1 Fonadhoo: Level 1 Ishdhoo: Level 1 Maamendhoo: Level 2	Coverage level from line-transect survey in 2019 and reports on coral bleaching event in Maldives: Level 1: 0-9% (extremely poor), 2: 10-24% (poor), 3: 25-49% (rather poor), 4. 50-74% (rich), and 5: 75-100% (especially rich)
Result 3: Strengthened multi hazard early warning system services	6. Coverage of population with reception of ISDB-T digital broadcasting services, and avoided economic loss	PSM technical data / baseline and endline surveys on sample households	0%, 0 USD	91.2[18]%, 0 USD	91.2%, 3.4 mil USD/year	No policy reversal due to regime change in the Maldives' national or local governments.

[16] See Annex 11 for additional performance indicators
[17] See P9-7 and Figure 9.2.1, Annex 2 for evacuation area and number of people saved
[18] See PP.5-6, Ch.2.3, Annex 3 for the coverage ratio and the avoided economic loss (i.e. benefit due to intervention)

Result 4: Improved observations and monitoring of long-term wave, sea level, coastline, coral reef and land use	7. Proficiency in Monitoring	Completion Report for technical transfer by Consultant	Level 0[19]	Level 1	Level 3	No policy reversal due to regime change in the Maldives' national or local governments.

E.6. Activities

All project activities should be listed here with a description and sub-activities. Significant deliverables should be reflected in the implementation timetable. Add rows as needed.

Activity	Description	Sub-activities	Deliverables
1.1 Inventory study for risk assessment on present coastal and coral reef conditions	Research activities on current state of coast to identify problems and issues.	1.1.1: Conducting inventory study 1.1.2: Identification of issues 1.1.3: Summary of results	Current situation, risks, problems, and issues in each island investigated are compiled as an "inventory survey report".
1.2 Preparation of basic policy of ICZM at national level	Preparation of basic policy of ICZM at a national level for categorized inhabited islands	1.2.1: Establishment of basic policy for coastal management 1.2.2: Study on regulation and law related to the ICZM 1.2.3: Summary of results	Basic policy of ICZM (including coastal and reef conservation plan, sediment budget control plan, land-use plan) is prepared at the national level as the basis for mid- to long-term management in accordance with the characteristics of each island as classified by pattern, which is compiled as the "Basic policy of ICZM" and a visual material such as a map to promote understanding.
1.3 Preparation of concrete ICZM Plan at representative inhabitant island as case study	Preparation of concrete ICZM Plan in Gan and Fonadhoo islands in	1.3.1: Establishment of coastal and reef conservation plan at the target islands 1.3.2: Establishment and implementation of sediment budget control plan at the target islands 1.3.3: Study for strengthening measures on land use planning at the target islands	Through conducting case studies, the results of the sub-activities 1) to 5) for implementing concrete ICZM actions by the island government are compiled as the "ICZM Plan" and visual material such as a

[19] Proficiency of monitoring indicators: Level 0 = Stakeholders (MEE, MMS, atoll and Island councils and communities in 5 islands) have no/ insufficient knowledge on monitoring. Level 1= Stakeholders will acquire sufficient knowledge on monitoring methods. Level 2 = Stakeholders will be able to implement monitoring by themselves, Level 3 = Stakeholders will be able to accumulate monitoring data in proper manner so that the data can be directly applied for coastal planning.

	Laamu Atoll.	1.3.4: Study on coastal management at inhabited island 1.3.5: Study on regulation and law at island level 1.3.6: Summary of results	map to promote understanding. In order to horizontally spread to other inhabited islands that have the same problems and to share the information with related organizations in other islands, workshops and site visits will be conducted regularly during the implementation period.
1.4 Capacity development and information sharing of the relevant organizations for establishment of the ICZM	Conduct of activities for capacity building and information sharing regarding Activities 1.1, 1.2 and 1.3	1.4.1: Capacity development of practitioners of central and island governments 1.4.2: Holding periodical seminars and workshops on the ICZM 1.4.3: Creation of opportunities for trainings and study abroad on coastal planning and management for junior officials	Conducting the abovementioned activities (inventory study, ICZM, and case studies) through OJT, which involves related agencies, will benefit the Maldivian government with experiences from establishing to implementing ICZM. Through seminars and workshops, such achievement can be shared within the Maldives, presenting reference case for lateral spread in the future. Opportunities to be created allow young officers to participate in external training sessions and seminars, while providing information and making presentation.
2.1 Detailed design of coastal conservation measures and capacity development of stakeholders	Conduct of detailed design regarding coastal conservation and protection, through	2.1.1: Detailed design of coastal conservation/protection measures 2.1.2: Capacity development of related officials on survey, planning and design of coastal project	Outcomes of detailed study and planning for implementation of coastal conservation and protection are compiled as the “Report on study and planning for coastal conservation and protection programs”.

	which planning and design functions in related agencies are improved		The detailed planning and designs for areas in urgent need of coastal conservation and protection conducted through OJT, which involves related agencies, will be accumulated as certain experience in line with the concept of ICZM in the Maldivian government. Through seminars and workshops, such achievement can be shared within the Maldives, presenting reference case for lateral spread in the future.
2.2 Implementation of coastal conservation/ protection measures	Implementation of coastal conservation measures in three coastal areas, while conducting coastal protection measures for another two coastal areas.	2.2.1: Coastal conservation measures and creating evacuation area at Maamendhoo Island in Laamu Atoll 2.2.2: Coastal conservation measures at ocean side of Fonadhoo Island in Laamu Atoll 2.2.3: Coastal conservation measures at Meedhoo Island in Addu Atoll 2.2.4: Coastal protection measure at Gan Island in Laamu Atoll 2.2.5: Coastal protection measure at Ishdhoo Island in Laamu Atoll	Measures regarding coastal conservation and protection are implemented.
2.3 Implementation of beach maintenance, establishment of structure and capacity development of stakeholders	Implementation of beach maintenance for nourished beach in the project Implementation of local education, awareness-	2.3.1: Implementation and establishment of adaptive management 2.3.2: Implementation of community-based beach maintenance for comfortable beach use and environment 2.3.3: Public education, enlightenment, public relations to residents and capacity development on beach maintenance and management	Beach maintenance consisting of adaptive management and daily maintenance for nourished beach in the project is implemented by the concerned stakeholders such as island government, residents, NGOs. Local education, awareness-raising, and

	raising, advertisement, and activities of beach management		public relations are implemented.
3.1: Installment of terrestrial digital broadcasting system	Installment of digital terrestrial broadcasting system	3.1.1: Standardization of disaster warning and information dissemination system 3.1.2: Awareness raising on disaster warning and information dissemination	Facilities and equipment for digital terrestrial broadcasting services Improved capacities of PSM and other related organizations in operation of the system
3.2 Establishment of Disaster Early Warning and Information Broadcasting System	Establishment of early warning broadcasting system (EWBS) Assistance in operation and maintenance of EWBS Evacuation drills with warning messages through EWBS	3.2.1: Examination of operational system for disaster warning and information dissemination 3.2.2: Establishment of the structure to operate disaster warning and information dissemination through the terrestrial digital broadcasting system	Manual(s) for data broadcasting programing Guideline(s) and manual(s) for EWBS operation Improved capacities of related organizations in the operation of the system Procedure of evacuation drills with test transmission of EWBS
4.1 Development of wave and sea level monitoring system	Development of wave and sea level observation system and conduct of technology transfer for wave	4.1.1: Development of wave and sea level monitoring system (three representative locations) 4.1.2: Technical transfer on data processing, analysis, and operation	Establish stationary observation system for wave, sea level, and water temperature. Through technological transfer regarding data analysis and system operation to related agency

	observation system		(MMS), real-time data is used as the source of early emergency warning. Through technological transfer regarding data accumulation and system operation, data is continuously and regularly accumulated.
4.2 Development of beach, coral reef and land use monitoring system	Establishment of monitoring system for beach, coral reef, and land use and conduct of capacity building for monitoring	4.2.1: Development of wide-area monitoring system applying satellite images and GIS system, and capacity development 4.2.2: Development of monitoring system utilizing the UAV technology at specific area, and capacity development	Establish wide-area monitoring system by using satellite images and GIS, with technological transfer regarding system operation to related agency (Land and Survey), which will help understand the long-term change in national territory. Establish monitoring system in specific area by applying UAV technology, with technological transfer regarding system operation to related agency (Land and Survey), which will help understand changes in the relevant area.

E.7. Monitoring, reporting and evaluation arrangements (max. 500 words, 1 page)

The project will be monitored and evaluated based on the key indicators described from E.4 to E.6. The baseline for these indicators has been established on the best available data but will in some cases be refined by reviewing the detailed design over the first two years of implementation. Results indicators will be disaggregated by gender when feasible.

The progress of the objective and outcome of the project will be monitored and evaluated by the EE of each component. The component to be implemented by GCF fund will be monitored and evaluated on a semi-annual basis through the activities of PMU and the consultant for detailed design and construction supervision.

Interim evaluation will be implemented within three years and three months from the commencement of the project by an independent evaluator selected by JICA as AE by using the GCF funded project management expenses of the project. Final evaluation will be implemented within nine months from the completion of the project by an independent evaluator selected by JICA as AE by using the AE fee. The evaluation reports will include necessary corrective measures (only for interim evaluation), assessment of performance as part of the efficiency and effectiveness criterion of the GCF fund, sustainability and scalability of results, and impacts and lessons learned (only for final evaluation).

The corrective measures proposed by the interim evaluation report will be discussed at the PSC meeting to decide the measures to be applied for the rest of the project period. The lessons learned obtained by the final evaluation report will be utilized for the GoM discussions on future replication of the project.

F. RISK ASSESSMENT AND MANAGEMENT

F.1. Risk factors and mitigations measures (max. 3 pages)

Please describe financial, technical, operational, macroeconomic/political, money laundering/terrorist financing (ML/TF), sanctions, prohibited practices, and other risks that might prevent the project/programme objectives from being achieved. Also describe the proposed risk mitigation measures. Insert additional rows if necessary.

For probability: High has significant probability, Medium has moderate probability, Low has negligible probability
For impact: High has significant impact, Medium has moderate impact, Low has negligible impact
Prohibited practices include abuse, conflict of interest, corruption, retaliation against whistleblowers or witnesses, as well as fraudulent, coercive, collusive, and obstructive practices

Selected Risk Factor 1

Category	Probability	Impact
Technical and operational	Medium	Medium

Description

Expected outcome may not be obtained from capacity development activities such as OJT.

Mitigation Measure(s)

By taking the following measures, recover the outcome level to the originally expected level: carrying out capacity evaluation of each trainee and confirming their need of OJT and Off-JT after commencement of the project; periodically monitoring the progress of individual capacity development during the project implementation; and when the achievement level of expected outcome is low, improved capacity development activities are discussed and implemented.

Selected Risk Factor 2

Category	Probability	Impact
Governance	Low	Medium

Description

Sufficient involvement in ICZM activities from the concerned communities to promote behavioral change might not be obtained, though involvement from main concerned agencies including ME, MNPI, NDMA, Laamu atoll council is sufficient since the involvement of these agencies will be regulated by GOM.

Mitigation Measure(s)

Through the public consultation meetings and gender assessment consultation meetings, AE explained that proposed intervention (beach nourishment) requires communities' involvement and confirmed their willingness to join beach cleaning activities to maintain the Project beach in good environment. Furthermore, by taking the following measures, involvement of communities can be increased: clarifying the roles of concerned government agencies and communities, island government will be responsible for maintaining the beach to be nourished, while the local communities will conduct daily beach cleaning, self-control on beach use, etc.; ME and the concerned atoll/island councils explain the necessity of sufficient involvement of the communities for their understanding, together with the expected benefits due to maintenance such as securing the place for recreation and improving their livelihood; periodically holding a meeting with the communities for the common understanding of the progress and issues of the project; linking with communities' cultural and common activities such as beach cleaning as roles of community, since in general beach cleaning is a common activity in Maldives.

Selected Risk Factor 3

Category	Probability	Impact
Technical and operational	Medium	Medium

Description

The construction schedule may be delayed due to natural phenomena and contractors' performance in project management.

Mitigation Measure(s)		
By taking the following measures, the risk of schedule delay is mitigated: procuring a high-quality consultant for construction supervision, which prepares/checks construction schedule by considering meteorological and oceanographic characteristics and manages the project based on the schedule; and including a bidding condition in which the construction capacity of the contractors, such as construction of beach nourishment, track records, and past experiences in the Maldives, is evaluated.		
Selected Risk Factor 4		
Category	Probability	Impact
Technical and operational	Medium	Medium
Description		
The required quality of sand (granularity and color) for beach nourishment may not be secured nearby the project site. The meaning of “quality” here is mainly for granularity. Sand for beach nourishment will be dredged from seabed at lagoon side with sufficient depth and distance from the shore to avoid negative impact to the beach due to dredging activity. Also, it is desirable to take sand nearby the project site considering reducing of construction cost. So, this risk is not countrywide but locally. However, even if sand with specified quality is difficult to obtain, we can adjust the quality (granularity), even though there is possibility to increase sand discharge after the nourishment.		
Mitigation Measure(s)		
By taking the following measures, sand availability is ensured: carrying out a site survey during the detailed design stage on the quality of sand for beach nourishment to have some options; and based on the survey results, including a bidding condition in which the contractor is required to procure an appropriate special dredging boat to collect the required sand.		
Selected Risk Factor 5		
Category	Probability	Impact
Technical and operational	Low	Medium
Description		
Materials for beach nourishment may be unexpectedly swept away or coastal deformation due to unusual weather (such as waves) may occur after implementation of the project.		
Mitigation Measure(s)		
By taking the following measures, unexpected run off of the materials of beach nourishment or coastal deformation is mitigated: periodical replenishment of sand (periodical replenishment of sand is required. Frequency of the replenishment is quite site specific and needs to be evaluated based on monitoring after the initial implementation as “adaptive management”. Based on similar type of the Project, here we assumed that replenishment with 20% volume of initial sand volume is required at every 5 years.) and implementing wave observation and coastal monitoring required for post analysis of the unexpected phenomena from the beginning of the project.		
Selected Risk Factor 6		
Category	Probability	Impact
Technical and operational	Low	Low
Description		
Involvement of community for beach monitoring and management during the operation and maintenance stage may not be obtained as originally expected.		
Mitigation Measure(s)		
By taking the following measure, involvement of community is increased: implementing consultations with the communities from the detailed design stage for them to understand the importance of community-based beach monitoring and management.		

Selected Risk Factor 7		
Category	Probability	Impact
Technical and operational	Low	Low
Description		
Monitoring and maintenance by GoM after completion of the project may not be implemented and it may deteriorate the coastal form.		
Mitigation Measure(s)		
By taking the following measure, non-implementation risk of monitoring, operation and maintenance by GoM after completion of the project is lowered: explaining to GoM before commencing the project that their monitoring, operation, and maintenance as well as the budget for the activities are essential to maintain the coasts in good condition to obtain their understanding.		
Selected Risk Factor 8		
Category	Probability	Impact
Technical and operational	Low	Low
Description		
Trouble or breakdown of the wave and sea level observation equipment may occur after the completion of the project.		
Mitigation Measure(s)		
By taking the following measure, GoM is able to respond to the troubles and breakdown of the equipment: thoroughly transferring the technology on operation and maintenance method of the equipment by examining the sustainable method from the detailed design stage.		
Selected Risk Factor 9		
Category	Probability	Impact
Technical and operational	Low	Low
Description		
Coastal management may not be applied as a policy after completion of the project as committed by GoM.		
Mitigation Measure(s)		
By taking the following measure, GoM will apply coastal management as a policy: explaining the scenario in case the ICZM is not applied as part of the coastal management policies and the merit in case it is applied before commencing the project.		
Selected Risk Factor 10		
Category	Probability	Impact
Governance	Medium	High
Description		
The project account may be used for money laundering to make fraudulent transactions.		
Mitigation Measure(s)		
By taking the following measure, the risk of the project account being used for money laundering is lowered: establishing the fund flow system in which disbursement requests and payment instructions will be sent via MoF, while the actual receipt and payment process will be implemented from/to the ME's project account. Also, ME to comply with JICA's Anti-Corruption Guidance for due diligence of the contractors, account monitoring and recording the transactions.		

G. GCF POLICIES AND STANDARDS

G.1. Environmental and social risk assessment (max. 750 words, approximately 1.5 pages)

Environmental and Social Management Framework (ESMF) was conducted under which each project component are screened to prove all project components proposed in this Funding Proposal are aligned with the Environmental and Social Consideration Guidelines of both JICA and GoM. The JICA guideline was already reviewed by the GCF Accreditation Panel and deemed sufficient to accredit JICA to submit low (Category C), medium (Category B), and high-risk (Category A) projects.

Based on initial assessment, the overall social and environmental risk category for this project is Moderate, with very low possibility of medium- to long-term and/or irreversible impacts. Potentially moderate risks associated with the proposed construction of coastal protection structures and dredging of materials under Component 2 and of buildings and facilities under Component 3 can be sufficiently managed during the implementation stage in conformity with relevant national regulations.

As one of the proposed physical measures under Component 2, beach nourishment is proposed to be implemented along both the lagoon side and ocean side. As the beach nourishments are planned to be constructed within the range of 40 m from the coastal lines, the adverse environmental impacts are estimated to be quite low for the ecological, biological and physical environment, such as corals inhabiting inside/outside of the reef areas.

None of the project sites for Components 2 and 3 are located in proximity to important archaeological, sensitive or other types of cultural heritage site, and some activities under Component 2 will be implemented to protect those important archaeological or other types of cultural heritage sites.

For Component 3, GoM conducted environmental screening, in which only nine out of 22 sites are required to conduct EIA before the project works begin on the sites. Based on the decision statement issued on the environmental screening by EPA, the EIA studies for the nine sites initially screened and additional three sites were conducted in 2017 and 2018. None of the sites for Component 3 are located in proximity to important and sensitive or protection sites.

<u>Natural Environmental Considerations</u>

The physical measures are expected to have low or moderate environmental impacts, which are likely to be only as a result of beach nourishment under Component 2 and buildings and facilities for Component 3.

All the soil materials to be used for beach nourishment will be dredged a few kilometres away from coastlines, by using special dredging boats. In order to select the adequate borrow areas, Dredging and Reclamation regulation (2013/R-15) and its Amendment (2014) shall be followed to protect and preserve natural environment, biodiversity, resources and scenic beauty, and necessary measures to avoid and mitigate such adverse impacts shall be taken.

The physical measures may include sediment placement and earth excavation works which will be undertaken by heavy machinery and/or manually. These activities may result in deleterious short-term and spatially restricted impacts including dust, traffic and noise, pollution of land, water, and air from vehicle exhausts, and so on. The ESMF includes measures that will be implemented to control these adverse impacts.

The ESMF also requires the contractor(s) to adhere to environmentally sound site management practices, by planning and implementing the physical measures in a way to reduce traffic, strictly keeping the site boundaries/limits, not carrying out earth and construction works during rainy days, and installing soil erosion control structures. Further, it is necessary to implement site rehabilitation measures, including re-vegetation at some sites after completion of construction works. Necessary measures have to be taken to avoid over-surface runoff and drainage of soil and turbid water into natural water bodies by avoiding construction works during rainy days.

Social Considerations

All the proposed components seek to reducing vulnerability of the communities against natural disaster and climate change, hence long-term positive social impacts expected. Adverse social impact induced from the planned coastal protection measures is quite limited.

The proposed components do not require involuntary resettlement or acquisition of private lands although they may have temporary impacts on land during construction activities under Component 2 and 3. Any land issues will not occur in the project implementation because all the project sites along the coasts are national lands and not located in sensitive areas.

To ensure there is limited impact on communities, consultations will be undertaken to ensure that dredging for the beach nourishment does not impact on important fishery areas. Where available, local people, regardless of gender, will be employed as casual laborers for construction works to improve their livelihood and increase their commitment to the constructed facilities. Information dissemination and trainings to the communities will be undertaken for sustainable monitoring and maintenance of the coastal protection facilities by the communities.

G.2. Gender assessment and action plan (max. 500 words, approximately 1 page)

The proposed project addresses gender dimensions within the project design and implementation in order to identify and integrate interventions to provide gender responsive and transformative results. As women are key players in managing basic household resources as well as participants in undertaking the project, the design of the proposed project addresses the cultural, the physical, as well as the capacity-related obstacles preventing women from being actively engaged. Therefore, the project needs to undertake mitigation measures to reduce such obstacles, to increase awareness and understanding of the project and mitigation measures through prior consultation and dissemination, and to secure commitment and accountabilities on all project-related activities. Specifically, the following components are included in the project for mainstreaming gender into the project activities:

- Conduct of community-level consultations ensuring that all segments of the population, including women, youth, the elderly, and the disabled are equitably represented during the construction stage, as planned in the Stakeholder Engagement Plan (SEP) and Gender Action Plan (GAP).
- Setting of explicit rules in the tendering process to ensure gender equality and equal participation of women in the contracting schemes.
- Establishment of grievance mechanisms, accessible for both women and men, to be able to voice complaints during the project construction stage.
- Development and implementation of capacity building trainings, processes on information dissemination and awareness raising in relation to gender and social inclusion mechanisms.
- Involvement of national gender-based institutions and organizations as main stakeholders of the project.
- Development and revision of SEP, as well as gender assessment and GAP, and ensuring equitable representation of women and men in the development of the ICZM plan.
- Ensuring empowerment of women through women-led community organizations, such as Women Development Committees, tasked with shoreline protection and stabilization, cleaning of coasts, creation of coastal green buffer zones, and maintenance of beach and beach vegetation.
- Implementation, during project implementation, of monitoring activities for the GAP to evaluate qualitatively and quantitatively the gender-specific benefits that can be directly associated with the project. The results of such monitoring will be incorporated into the Annual Performance Report, Interim Evaluation Report, and Final Evaluation Report.
- Development of qualitative and quantitative indicators to evaluate the achievement of the project objectives in relation to gender equality. These will include, but not to be limited to: i) equal accessibility between men and women to the project targets (nourished beach, coastal protection measures, etc.), ii) number of men and women employed from the jobs created by the project and number of women and

men who were trained through the project, and iii) knowledge management and information dissemination.

G.3. Financial management and procurement (max. 500 words, approximately 1 page)

The financial management and procurement activities carried out in the project will be in compliance with JICA policies as the AE in the project. JICA, in its roles as AE, has overall responsibility and oversight for the project, including project preparation and implementation, financial management and procurement. JICA as AE will ensure that project will comply with international accounting standards and that all documents and reports will be prepared accordingly.

Budgeting Arrangements

GoM will prepare the budget estimation a year before the financial year of the commence of the project, in which the costs of the GoM co-financed activities, GCF funded activities, and project management expenses are estimated and submitted to MoF. At the same time, the forecasted cost of the GCF funded activities and project management expenses will be informed to MoF.

Accounting Arrangements

An online accounting system in GOM is available only for small-scale projects. For the scale of this project, ME will open a designated account (*Imprest Account*) in response to the request of AE, to receive the disbursement from AE and process payment to consultant/contractors. Relevant documents such as invoices, disbursement requests, bank transfer instructions, bank remittance slips, and receipts will be obtained and filed by PMU.

Internal Controls

In GoM, the Auditor General's Office is established independently and is responsible for risk management by verifying the reliability of financial statements, bank account, and operation of public funds submitted by the Financial Unit of each public office and scrutinizing that the operation of public properties and monies, accounting records, and supporting documents are administered according to the Public Finance Regulation (https://www.finance.gov.mv/public-finance-regulation (unofficial translation in English)). The fund of the projects implemented by EE shall also be audited internally by the Auditor General's Office.

The fixed assets GoM received in the project shall be recorded and maintained in Fixed Asset Registry of State by the recipient public offices. Each of the recipient public offices is responsible for annual physical count and inspection, which also verifies if measures had been taken for the durability of such assets in accordance with the Public Finance Regulation (Chapter 11 Public Property).

To respond to the complaints and allegations of impropriety and wrong-doing in terms of appropriate handling of public monies, properties and bidding procedures, investigation of the complaints, the procedure, actions to be taken, penalties imposed are stipulated in the Public Finance Regulation (Chapter 17).

Fund Flow

Component 2 will be implemented by ME using the GCF fund. The fund will be disbursed to the designated account of JICA, as AE, based on the annual project cost estimation. The timing from the second disbursement will be decided based on the actual expenditure ratio of the disbursed amount. The disbursement of the GCF fund from AE to GoM will be done based on the quarterly estimate of the project expenses submitted by ME. The replenishment will be disbursed depending on the progress of the project. The payment of the work implemented by the consultant/contractor(s) for the GCF funded project will be processed by MoF.

External Audit

An external auditor will be procured by JICA; the audit will be implemented for the unaudited accounting information within three months after the submission of the Annual Performance Report (APR) to GCF and the audited accounting information within two months after the submission of the final APR to GCF.

Procurement Guideline

Fairness, transparency, and accountability shall be ensured for all procurement that uses the GCF fund. In the project, the procurement done by JICA will be implemented in accordance with the procurement guideline of JICA as AE, and the policy will be applied to the procurement by the PMU, by utilizing the appropriate procurement rule of GoM, which basically conforms with JICA's procurement guideline. The senior procurement adviser of the PMU will confirm that the procurement by the PMU complies with the JICA's procurement policy. The procurement rule of GoM is shown in the MoF website: http://www.finance.gov.mv/public-procurement/procurement-regulation (unofficial translation in English of the Public Financial Regulations, in which Chapter 10 describes the public procurement system).

G.4. Disclosure of funding proposal

Note: The Information Disclosure Policy (IDP) provides that the GCF will apply a presumption in favour of disclosure for all information and documents relating to the GCF and its funding activities. Under the IDP, project and programme funding proposals will be disclosed on the GCF website, simultaneous with the submission to the Board, subject to the redaction of any information that may not be disclosed pursuant to the IDP. Information provided in confidence is one of the exceptions, but this exception should not be applied broadly to an entire document if the document contains specific, segregable portions that can be disclosed without prejudice or harm.

Indicate below whether or not the funding proposal includes confidential information.

☐ No confidential information: The accredited entity confirms that the funding proposal, including its annexes, may be disclosed in full by the GCF, as no information is being provided in confidence.

☒ With confidential information: The accredited entity declares that the funding proposal, including its annexes, may not be disclosed in full by the GCF, as certain information is being provided in confidence. Accordingly, the accredited entity is providing to the Secretariat the following two copies of the funding proposal, including all annexes:

- ☐ full copy for internal use of the GCF in which the confidential portions are marked accordingly, together with an explanatory note regarding the said portions and the corresponding reason for confidentiality under the accredited entity's disclosure policy, and
- ☐ redacted copy for disclosure on the GCF website.

The funding proposal can only be processed upon receipt of the two copies above, if containing confidential information.

H. ANNEXES

H.1. Mandatory annexes

☒	Annex 1	NDA No-objection letter(s) **(template provided)**
☒	Annex 2	Feasibility study - and a market study, if applicable
☒	Annex 3	Economic and/or financial analyses in spreadsheet format
☒	Annex 4	Detailed budget plan **(template provided)**
☒	Annex 5	Implementation timetable including key project/programme milestones **(template provided)**
☒	Annex 6	E&S document corresponding to the E&S category (A, B or C; or I1, I2 or I3): **(ESS disclosure template provided)** ☐ Environmental and Social Impact Assessment (ESIA) or ☒ Environmental and Social Management Plan (ESMP) or ☐ Environmental and Social Management System (ESMS) ☐ Others (please specify – e.g. Resettlement Action Plan, Resettlement Policy Framework, Indigenous People's Plan, Land Acquisition Plan, etc.)
☒	Annex 7	Summary of consultations and stakeholder engagement plan
☒	Annex 8	Gender assessment and project/programme-level action plan **(template provided)**
☒	Annex 9	Legal due diligence (regulation, taxation and insurance)
☒	Annex 10	Procurement plan **(template provided)**
☒	Annex 11	Monitoring and evaluation plans **(template provided)**
☒	Annex 12	AE fee request **(template provided)**
☒	Annex 13	Co-financing commitment letter, if applicable **(template provided)**
☒	Annex 14	Term sheet including a detailed disbursement schedule and, if applicable, repayment schedule

H.2. Other annexes as applicable

☐	Annex 15	Evidence of internal approval **(template provided)**
☒	Annex 16	Map(s) indicating the location of proposed interventions
☐	Annex 17	Multi-country project/programme information **(template provided)**
☐	Annex 18	Appraisal, due diligence or evaluation report for proposals based on up-scaling or replicating a pilot project
☐	Annex 19	Procedures for controlling procurement by third parties or executing entities undertaking projects financed by the entity
☐	Annex 20	First level AML/CFT (KYC) assessment
☐	Annex 21	Operations manual (Operations and maintenance)
☒	Annex 22	Temporary Annex on co-financing

** Please note that a funding proposal will be considered complete only upon receipt of all the applicable supporting documents.*