Funding Proposal

FP007: Support of Vulnerable Communities in Maldives to Manage Climate Change-Induced Water Shortages

Maldives | United Nations Development Programme (UNDP) | Decision B.11/11

15 October 2015

GREEN CLIMATE FUND

Funding Proposal

Version 1.0

The Green Climate Fund (GCF) is seeking high-quality funding proposals.

Accredited entities are expected to develop their funding proposals, in close consultation with the relevant national designated authority, with due consideration of the GCF's Investment Framework and Results Management Framework. The funding proposals should demonstrate how the proposed projects or programmes will perform against the investment criteria and achieve part or all of the strategic impact results.

GREEN CLIMATE FUND

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Note to accredited entities on the use of the funding proposal template

- Sections **A, B, D, E** and **H** of the funding proposal require detailed inputs from the accredited entity. For all other sections, including the Appraisal Summary in section F, accredited entities have discretion in how they wish to present the information. Accredited entities can either directly incorporate information into this proposal, or provide summary information in the proposal with cross-reference to other project documents such as project appraisal document.
- The total number of pages for the funding proposal (excluding annexes) is expected not to exceed 50.

Please submit the completed form to:

fundingproposal@gcfund.org

Please use the following name convention for the file name:
"[FP]-[Agency Short Name]-[Date]-[Serial Number]"

A.1. Brief Project / Programme Information		
A.1.1. Project / programme title		**Supporting vulnerable communities in Maldives to manage climate change-induced water shortages**
A.1.2. Project or programme		Project
A.1.3. Country (ies) / region		**Maldives**
A.1.4. National designated authority (ies)		**Amjad Abdulla** **Director General** **Ministry of Environment and Energy**
A.1.5. Accredited entity		**United Nations Development Programme (UNDP)**
A.1.5.a. Access modality		☐ Direct ☒ International
A.1.6. Executing entity / beneficiary		Executing Entity: Ministry of Environment and Energy # (total) of beneficiaries (people): • 32,000 people on 49 islands will benefit from uninterrupted and safe water supply (direct high intensity beneficiaries); • 73,000 people that are currently affected by annual water shortages will receive timely supplies during the dry season (direct, medium intensity beneficiaries).
A.1.7. Project size category (Total investment, million USD)		☐ Micro (≤10) ☒ Small (10<x≤50) ☐ Medium (50<x≤250) ☐ Large (>250)
A.1.8. Mitigation / adaptation focus		☐ Mitigation ☒ Adaptation ☐ Cross-cutting
A.1.9. Date of submission Date of resubmission		31/07/2015 21/09/2015
FA.1.10. Project contact details	Contact person, position	Ms. Keti Chachibaia, Regional Technical Adviser, Climate Change Adaptation Asia-Pacific
	Organization	UNDP
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A.1.11. Results areas *(mark all that apply)*

Reduced emissions from:

☐ Energy access and power generation
(E.g. on-grid, micro-grid or off-grid solar, wind, geothermal, etc.)

☐ Low emission transport
(E.g. on-grid, micro-grid or off-grid solar, wind, geothermal, etc.)

☐ Buildings, cities and industries and appliances
(E.g. new and retrofitted energy-efficient buildings, energy-efficient equipment for companies and supply chain management, etc.)

☐ Forestry and land use
(E.g. forest conservation and management, agroforestry, agricultural irrigation, water treatment and management, etc.)

Increased resilience of:

☐	Most vulnerable people and communities (E.g. mitigation of operational risk associated with climate change – diversification of supply sources and supply chain management, relocation of manufacturing facilities and warehouses, etc.)
☒	Health and well-being, and food and water security (E.g. climate-resilient crops, efficient irrigation systems, etc.)
☐	Infrastructure and built environment (E.g. sea walls, resilient road networks, etc.)
☐	Ecosystem and ecosystem services (E.g. ecosystem conservation and management, ecotourism, etc.)

A.2. Project / Programme Executive Summary (max 300 words)

1. The outer islands of the Maldives experiences drinking water shortages during the dry season. These shortages have had significant adverse human, environmental and social impacts on the outer island communities where 27% of population lives under the poverty line of US$2/per day. The key problems pertaining to freshwater security relate to the increasingly variable rainfall patterns induced by climate change and sea-level rise induced salinity of groundwater. As confirmed by the IPCC and RIMES reports, sea level rise of 3.1mm/year and decreasing rainfall amounts will considerably compound current water stress in the country. The Government faces constraints in responding to the challenge at hand without assistance, especially in the context of anticipated impacts of climate change. Firstly, the precarious fiscal status that confronts the Government limits the response options to this emerging crisis to largely reactive emergency measures. Longer-term solutions, without additional financial support, are out of reach. Secondly, a dispersed and small population on 193 islands prevents the possibility of economies of scale in providing water and sanitation services, including capital infrastructure.

2. In response to this climate challenge, the proposed 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. This will be achieved by delivering the following results:

a. Scaling up an integrated water supply system to provide safe water to vulnerable households;
b. Introduction of decentralized and cost-effective dry season water supply systems;
c. Groundwater quality improved to secure freshwater reserves for long term resilience.

3. The proposed adaptation solution is to maximize water production and scale up the use of an integrated water supply system that will bring three primary sources of water (rainwater, groundwater and desalinated water) into a least cost delivery system that is able to maintain service levels in the face of climate change related pressures. A paradigm shift will be achieved by addressing the main barriers to implementing integrated water supply systems (cost recovery; management capacity; and institutional mandates, coordination and policy direction). Replication potential is high considering the legislative mandate to provide clean water in the 2008 Constitution of the country. The project is based on national priorities and has been endorsed by the National Designated Authority for Maldives.

A.3. Project/Programme Milestone

Expected approval from accredited entity's Board (if applicable)	Not Applicable
Expected financial close (if applicable)	Not Applicable
Estimated implementation start and end date	Start: 15/02/2016 End: 14/02/2021
Project/programme lifespan	5 years

B.1. Description of Financial Elements of the Project / Programme

Component	Sub-component (if applicable)	Amount	Currency of disbursement	Amount	Local currency
Component 1 Climate resilient water supply system for population of outer islands of Maldives	Scaling up integrated water supply system to provide safe water to vulnerable households (at least 32,000 people, including 15,000 women)	19.004	million USD ($)	285.060	million Maldivian Rufiyaa
	Decentralized and cost-effective dry season water supply system introduced benefiting 73,000 people across the 7 northern atolls	1.588	million USD ($)	23.815	million Maldivian Rufiyaa
	Groundwater quality improved to secure freshwater reserves for long term resilience on 49 islands	3.044	million USD ($)	45.670	million Maldivian Rufiyaa
Total[1]		23.636	million USD ($)	354.545	million Maldivian Rufiyaa

** Please expand the table if needed.*

B.2. Project Financing Information

	Financial Instrument	Amount	Currency	Tenor	Pricing
(a) Total project financing	**(a) = (b) + (c)**	28.229	million USD ($)		
(b) Requested GCF amount	(i) Senior Loans	.....	Options	( ) years	( ) %
	(ii) Subordinated Loans	.....	Options	( ) years	( ) %
	(iii) Equity	.....	Options		( ) % IRR
	(iv) Guarantees	.....	Options		
	(v) Reimbursable grants *	.....	Options		
	(vi) Grants *	23.636	million USD ($)		

[1] The budget total includes project management costs of the executing entity.

	** Please provide economic and financial justification in section F.1 for the concessionality that GCF is expected to provide, particularly in the case of grants. Please specify difference in tenor and price between GCF financing and that of accredited entities. Please note that the level of concessionality should correspond to the level of the project/programme's expected performance against the investment criteria indicated in section E.*						
	Total requested (i+ii+iii+iv+v+vi)	23.636	million USD ($)				
(c) Co-financing	**Financial Instrument**	**Amount**	**Currency**	**Name of Institution**	**Tenor**	**Pricing**	**Seniority**
	Grant Options Grant Options	4.493[2] …… 0.1[3] ……	million USD ($) Options million USD ($) Options	Ministry of Environment and Energy (MEE) UNDP (core resources) ……	( ) years ( ) years	( ) % ( ) % ( ) % IRR	Options Options Options Options
	Lead financing institution: Not Applicable						
	** Please provide a confirmation letter or a letter of commitment in section I issued by the co-financing institution.*						

B.3. Fee Arrangement

4. While not included in this proposal as per the instructions of the GCF Secretariat, an additional cost of 10% of the value of the project will be necessary to cover quality assurance and oversight services performed by UNDP as a GCF Accredited Entity over all phases of the project cycle. This includes as follows: (i) oversight of proposal development; (ii) appraisal (pre and final) and oversight of project start-up; (iii) supervision and oversight of project implementation; and (iv) oversee project closure. UNDP awaits confirmation from the GCF Board on this matter and expect that the AE fee, over and above the project cost, will be approved by the GCF Board prior to commencement of implementation activities.

B.4. Financial Market Overview (if applicable)

Not Applicable.

[2] A total government co-financing in amount of US$ 4,493,940 includes US$ 4,193,940 for 10 years of operations and maintenance costs for both water system equipment and rainfall gauges. Additionally, US$300,000 is a contribution to 5 years of project implementation to cover government staff man-hour contributions and use of government premises to host the project staff.
[3] UNDP Country Office core funding in amount of US$100,000 will be directed towards project management unit and associated services.

C.1. Strategic Context

Context: Poverty, Growth and Vulnerability

5. The Maldives consists of 1,190 small, low-lying coral islands clustered in 26 ring-like atolls, spread over a North-South axis across 90,000 square kilometres, with a population of about 399,000 spread over 194 islands[4]. With high-end tourism as the main driver of economic growth, the country has made a significant development progress and graduated from being a Least Developed Country in 2011. However, national aggregate indicators of progress conceals underlying disparities. There is spatial disparity between the capital, Malé, and other atolls in human development indices[5]. The poverty headcount index, defined as the share of the population making less than MVR 18 (US$1.17) per person per day, for Malé has fallen from 23 % to less than 5 %; for the outer islands it has fallen at a lower rate, from 52 % to 25 % (UNDP, 2012). Spatial disparity is exacerbated by gender disparity; women in the atolls outside the capital are disproportionately affected by unequal opportunities.[6] On account of the spatial disparity, every 1 in 3 persons was living in the capital in 2014, where the most public services, including water supply are provided and their affordability is the most favourable.

6. The Maldives is a typical example of the "island paradox"[7]. Its relative prosperity through domestically generated income coexists with increasing vulnerability to external shocks[8] – including climate change, increases in global fuel prices or contractions of the tourism sector – and high structural costs due to its particular geographical characteristics. In large part, this is driven by the limits on land space and remoteness[9]. There are also high indivisible fixed costs on small island economies including policy and legislation formulation, regulatory activities, education, social services, justice, security, and foreign affairs. The Maldives is facing critical development challenges owing to a growing population and resource constraints. Longer-term impacts of urbanization are already happening including increasing water demand and pollution of naturally occurring, and very important, groundwater resources.

Context: Policies and Institutions

7. The legislative and policy basis for the provision of water supply and sanitation services in the Republic of Maldives is expressed though three main documents (*Constitution of the Republic of Maldives* (2008), the Manifesto of the Progressive Party of the Maldives (2013-2017) and the *Public Health Act* (2012). Legislation for the entire water sector (the Water Act) is forthcoming.

8. *The Constitution of the Republic of Maldives*, Article 23 states that every citizen has a right to "adequate and nutritious food and clean water", "the establishment of a sewage system of a reasonably adequate standard on every inhabited island" and that the "State undertakes to achieve the progressive realisation of these rights by reasonable measures within its ability and resources".

9. The Manifesto of the Progressive Party of the Maldives (2013-2017) outlines a number of policy areas, aims and solutions. Water and Sanitation fall in Section G of this Manifesto. The aim for water supply solutions is to ensure safe drinking water for all. The solutions include providing safe water to islands that face water shortages during the dry season, through desalination; increasing the storage capacity of water in all islands; establishing desalination plants in islands with large populations; and establishing a faster system to provide water to islands in emergencies through regional storage and desalination of water. The aim for establishing effective sewerage systems is to eliminate the contamination of water. The solutions for sewerage systems are threefold: i) plan and implement sewerage projects in the islands; ii) introduce environmentally suitable models of sewerage to the Maldives; and iii) establish a system for sustainable maintenance of sewerage.

[4] Preliminary results of 2014 Population and Housing Census - revised, March 2014.
[5] For instance, a person living in Malé is likely to complete three years more of schooling than someone living in the atolls. The average income of a person living in Malé is nearly twice as high as that of a person living in the atolls. (2014 NHDR)
[6] The Gender Inequality Index in Malé is the lowest in the Maldives at 0.232. The rest of the country has higher values, peaking at 0.741 in Thaa & Laamu atolls, where men hold all the seats in parliament and where only 15.5% of women have at least secondary education. (2014 NHDR)
[7] http://unctad.org/meetings/en/SessionalDocuments/td451_en.pdf
[8] The Maldives produces less than an estimated 10% of its food requirements, and it is almost fully dependent on fuel imports to meet its transport and energy needs. The geographic dispersion of the country means there is no national grid connecting one island to another. As a result, the country is highly vulnerable to international fuel price fluctuations. In 2012, the Maldives spent USD 474.6 million on fuel-based imports (excluding bunker fuels), accounting for about 35% of GDP. Source: 2014 Maldives National Human Development Report (NHDR)
[9] World Bank (2014) Maldives: country snapshot, < https://www.worldbank.org/content/dam/Worldbank/document/SAR/maldives-country-snapshot-spring-2014.pdf >

10. The *Public Health Act* contains sections related to water security, human rights obligations such as provision of essential water, quality assurance and regulations for implementing the Act (to be made by relevant institutions). It also has specific reference to rainwater tanks requiring protection from insects and animals. Although the Public Health Act addresses health concerns related to water quality, it is still in its infancy and the institutional arrangements for implementation of water quality monitoring to achieve stated health targets remain unclear.

11. In addition, recent restructuring of government towards decentralized authorities has implications for service delivery. The *Act on Decentralization of the Administrative Divisions of the Maldives, 2010* allows island communities to make their own decisions to improve living standards and to empower people by bringing the scope of services closer to them. There are 21 administrative divisions, including Malé City, each having its own council. Each outer island within each administrative division also has its own council of five elected members. The Act gives atoll and island councils wide powers, including:

a. Provision of water, electricity, and sewerage (S.24 e)
b. Collection of fees for services provided (S.8 i and S.78 a and b)
c. Supervision of the services provided by Divisions of Government Ministries (S.67)
d. Power to take on loans and issue securities (S.8 f and g)
e. Power to enter into service contracts for services to be provided under their authority (S.8 h)

12. The Government of Maldives (GoM) recently consolidated Utilities into 3 companies to serve the Maldives 193 inhabited islands. “FENAKA Corporation Limited” (FENAKA) is one of the Utilities (along with Maldives Water and Sanitation Company (MWSC) and STELCO) providing water, electricity, sewerage and solid waste services to the outer islands. FENAKA was formed in June 2012. GoM is also currently developing a comprehensive water policy – A Water Act – that will serve as an overarching national water policy to help the nation achieve the water and sanitation goals set forth in its constitution. The MEE spearheading an inclusive process of policy formulation to achieve consensus across various stakeholders, water-users and respective interests. It will embed the principles of integrated water resource management. It is therefore timely for the proposed GCF project to make conducive contributions in setting critical elements of the policy that will promote integrated approaches to water sector resilience.

C.2. Project / Programme Objective against Baseline

Baseline: Water security

13. Highly urbanized centres such as Malé are predominantly reliant on desalinated water. Water supply is managed by a partly State-Owned Enterprise. Piped water supply networks exist in Malé where a quarter of total population of the country resides. However, in ‘rural’ outer islands, individual households are largely responsible for harvesting rainwater and abstracting groundwater from privately dug wells at their own cost. Management of the limited water resources is complicated by the small catchment areas for rainfall, limited rainwater and groundwater storage capacity, long dry seasons and the susceptibility of groundwater aquifers to pollution from poor sanitation over many years and salinity intrusion through over-abstraction mainly. An annual urbanization rate of 4.2% results in high density communities on some islands (population densities of more than 300 per hectare are not uncommon in Maldives) with acute problems in groundwater pollution and water demand. Hence, one-size-fit-all solutions of water production and supply cannot be applied in a diverse context of atolls and islands. Difference in geography (land availability), hydro-climatic characteristics (rainfall amounts and distribution patterns) and socio-economic conditions (population size, density, growing trends and a type of customer base) suggests the need for decentralized and fully customized approaches to water production and distribution to achieve island and atoll level self-sufficiency.

14. The freshwater groundwater lens underlying each island has historically been the most important water source for islands. The thickness of the freshwater lens, which typically floats atop the denser sea water, is controlled by island width, rainfall rates and associated infiltration and recharge[10]. Depending on these factors, lens thickness range from less than a few meters to 25-30 meters. Knowledge regarding quantity of groundwater of the Maldives during average annual climatic variations is lacking, but recent modelling results indicate that many of the islands are expected to have a measurable freshwater lens although significant decreases (at least 50%) in thickness can occur during the dry season months. For small islands (less than 300 meters in width) complete depletion of the lens is likely to occur during the dry

[10] Rainwater that is not intercepted by vegetation, captured by roof-top catchment systems, evaporated or transpired by plants, percolates through the thin soil profile and recharges the freshwater lens at the water table.

season or after successive years of low annual rainfall. The freshwater lens are thicker for islands in the South of the country due to higher rainfall levels than the Central and Northern regions[11], with the North is particularly dry. Furthermore, excessive groundwater abstraction in relation to recharge has led to salt water intrusion and up-coning of saline water together with the preferential flow paths and reduction of the efficiency of natural recharge processes[12]. Thus, the concern is that during droughts, over-pumping can alter the size of the aquifer and limit recovery to its former size. Observation and anecdotal evidence points to ponding due to soil compaction and reduced infiltration capacity in areas of roads and built up areas, leading to evaporation losses[13].

15. Increases in the salinity of islands' freshwater lenses that immediately followed the 2004 tsunami and pollution of these lenses with sewage washed from overtopped septic tanks was a turning point in ground water use. Saltwater intrusion into fresh water lenses on almost all of the 1,200 islands resulted in vegetation browning and dieback. Since then, every year, government has provided emergency freshwater to many islands. The provision of emergency water is managed by the National Disaster Management Centre (NDMC), established after the tsunami. Also the impact of the tsunami was such that the pressure caused destruction to the septic tanks and toilets resulting in disposal of sewage onto the ground and contamination of water lens. Communities were advised that groundwater was contaminated and no longer fit for use. That message was so effective that the apparent general community perception now is that it is no longer safe to use local household wells for potable or secondary (bathing and washing) use. Although water quality monitoring is rarely conducted, anecdotal site specific reports of "bad smells" and high incidences of diarrhoeal disease indicate bacterial contamination of the groundwater. Women are particularly affected due to their family roles in cooking, washing, bathing children and house cleaning. Complaints of skin irritations and infections are also common[14]. These issues have reduced the use of historically important groundwater as a potable water source in the islands, though it is still used for non-potable uses such as bathing, clothes washing and toilet flushing. Unless this significant water resource is recovered for freshwater use the long term resilience of people in the outer islands, and the water sector is out of reach.

16. Due to the seasonality of the replenishment potential of the underground freshwater lenses, rainwater collection is another important source of water in the country. The national average rainwater storage per household is 2,900 litres. In a survey carried out in 2012[15], 141 islands out of the 202 surveyed reported that island rainwater tanks supplied water for only 8 months or less, indicating a major gap between supply and demand in the dry season. This is a particular issue in the northern atolls, characterized by longer dry periods and where almost two thirds of the outer island population is located. Even in the wetter south, maintaining rainwater supply in the dry season is a challenge for relatively large households. Yet, inter-annual variability means that an estimated 60% of flooding is caused by heavy rainfall events, highlighting a potential opportunity for better capture of water. Existing rainwater-harvesting systems are largely disconnected and sub-optimal in terms of their capacity, yield, and quality and hygiene. Typically, these tanks occupy more space per unit of water (only 2,500 litres) than required. A World Bank study estimated that in the Northern region of the Maldives alone, an additional 14,350 tanks of 7,500 litres volume are needed (World Bank, 2013). In some islands roof area is available for rainwater harvesting; however land may not be available for storage tanks. Therefore, despite obvious room for further maximizing the rainwater collection, especially from public buildings, availability of land on some of the outer islands is a limiting factor for increasing rainwater collection in islands.

17. Many of the Reverse Osmosis (RO) plants introduced during the post tsunami emergency operation currently stand idle as they had been introduced during emergency recovery without much consideration of adoptability and maintenance capabilities in terms of local engineering skills and capacities for operation and maintenance, operating costs (including fuel cost) of such plants or availability of spare parts at the local and regional markets. If these existing idled assets are to be sustainably redeployed, major rehabilitation, modernization, and suitable management and cost recovery systems (including pricing schemes) are required.

18. Sewerage systems have been installed on an estimated 32 outer islands, around 16% of islands. Many (as much as 80% of sewerage systems by one estimate) of the current sewerage systems and wastewater treatment plants are reported to be not functioning or at least not functioning properly, partly because they are too expensive to operate for the local community and partly because the management and maintenance capacity is very weak[16]. The other main treatment method is septic tanks which can be as close as a meter from a domestic well. They usually leak because they

[11] Baily et al, 2014
[12] Arup, 2014.
[13] USAID, 2012
[14] WHO, 2015
[15] Beswick, In: WB study
[16] For example, the ARUP (2014) report reports that over-pumping has resulted in salinization and sewage contamination of groundwater even with a wastewater treatment plant. The water quality results show that little or no contaminants were being taken out of the waste water at the plant.

are not regularly cleaned out and the risk of polluting groundwater with island overtopping events is real. As the frequency of extreme events related to rainfall increases as climate change worsens, this risk will only become higher.

19. In 2004, an estimated 30 percent of the outer islands' population experienced water shortages, and since 2005 an average of 81 islands have requested emergency shipments of water to be delivered from Malé during the annual dry season. The calls for emergency shipments have intensified as the islands' stored rainwater reserves become depleted. Over the last 10 years, this has resulted on an average of 3,500 litres shipped out annually. During 2005-2012, the National Disaster Management Centre (NDMC) spent US$2.4 million (annual average of US$300,000) to provide desalinated water to over 90 islands. The average unit cost of water including production and distribution cost was US$77 per cubic meter. This is a recurrent pressure over already strained budgetary resources of the country. Furthermore, the cost of supplying bottled water is high and provides no economic rationale.

20. Currently, the water emergency distribution is fully centralized, with limitations for timely response. It is also highly vulnerable because of the reliance on one source of desalinated water in Malé. The emergency situation of 2014 highlights this vulnerability. The main RO plant that supplies the capital Malé and provides most water for emergency supply to the islands was burned down, which paralyzed the water supply and prompted a call for international support.

21. Incrementality of the proposed project lies into its core strategy of maximizing the water production capacity in response to discernable impacts of climate change. Projected impacts are mainly associated with changing rainfall patterns and sea level rise that are likely to result in growing water stress. In the absence of any surface water, rainfall and groundwater being the main water resources of the country.

22. Baseline Scenario: At the baseline, the government has supplied all households with the rainwater collection tanks of 2,900 liters of average storage capacity. At the same time, the government is heavily investing into the water sector by expanding the network of piped water supply and the sewerage (see section on baseline investment). Adequate sanitation infrastructure is critical for reversing the current pollution rates of the groundwater from the unpiped system of septic tanks. Thus, rainfall collection and a quality groundwater are fundamental ingredients to safe and reliable water supply. With a projected 60% increase in the number of households by 2033, the next 20 years will be critical for the water sector in the Maldives. Due to increasing demand and limited supply, it is projected that per capita groundwater availability for the Maldives will decline by 34 percent-- from the 2009 level of 103 litres/year to 77 litres/year by 2035[17]. Population growth will mean that sewage discharges will increase by approximately the same rate, and the rate of urbanization (4.2%) will result in higher density communities with knock-on impacts on pollution from waste disposal, particularly given the fragility of the freshwater lenses. Furthermore, higher urbanization will preclude the rainwater to permeate into the underground lenses unless a deliberative protection of catchment areas takes place. The baseline scenario of increasing water stress will be exacerbated by the climate change impacts. This calls for innovative and integrated solutions to water sector resilience.

23. Adaptation Scenario: According to IPPC and RIMES reports sea level rise of 3.1 mm/year will have a profound impact on saltwater intrusion into the groundwater lenses, jeopardizing the main freshwater source for the country. Overall aridity is projected over the Indian Ocean. This will likely translate into prolonged drier seasons. More variable spatial and temporal distribution of rainfall will likely pose significant threats both to the groundwater recharge and rainfall collection (see section on climate change). As water security is closely bound to rainfall and sea level rise in Maldives, the adaptation scenario will demand: (i) the rainfall collection capacity to increase at least threefold (from currently over 2,000literes to over 6,000liters): (ii) groundwater replenishment to keep water table levels high in order to buffer away salt water intrusion; and (iii) increased water production capacity through desalinization, as to secure sufficient back up resource during the extended dry periods for household supply and timely distribution. Therefore, the additional investment into the water production system is fully incremental as necessitated by climate change impacts.

Baseline investment

24. The government actively invests in the water sector, covering piped sewerage, water harvesting and RO plants. Ministry of Environment and Energy (MEE) has budgeted US$96.64 million of public expenditure in water and sanitation sector during 2015-2017. Out of this, US$77.69 million is budgeted for sanitation and US$18.96 million in water production and distribution. This investment covers the islands in the same atolls where the GCF grant investment is proposed and will serve as baseline finance, in parallel to the proposed GCF project (see Annex IV). MEE for the same period of time

[17] WB study, 2013

has successfully mobilized other sources of finance, a combination of loans and grants for the sector, the larger portion of which is being invested in the piped sewerage system. Expenditure of these funds will extend over the period of next 5-7 years and will provide an important funding at the baseline for the GCF incremental cost finance for climate change risks in the water sector. Despite the commitment and impressive capital investments in the sector, lingering fiscal deficits have constrained assistance to be extended to a considerable number of outer atoll island communities. Without any support, these communities, especially in the drier North, are incredibly vulnerable, and this will only worsen with climate change. Additionally, there are two highly relevant internationally funded projects that the GCF financed initiative will build on: (i) Adaptation Fund financed and project: "Increasing climate resilience through an Integrated Water Resource Management Programme" (US$8,285,000); and (ii) USAID financed: integrated water management project (US$ 7.3 million), designed to mobilize the communities it serves and work with provincial utilities to design, build, and operate seawater desalinization facilities to deliver clean drinking water to one island (further details in section C.3.).

Climate change

25. Small islands states, such as Maldives, have characteristics which make them especially vulnerable to the effects of climate change extreme events, rainfall distribution anomalies and sea level rise. An ensemble of 18 Global Calculation Models (GCMs) project the following with regards to climate change in the Maldives[18]. The observed trend for sea level rise is 3.3mm per year for Male'' (in the centre) and 3.1mm per year for Gan (in the South). Maximum sea surface heights increases within the range of 8.2 to 9.5 cm across the various atolls for 2080s. Mean annual temperature from 2021 to 2050 increases by 1.5°C to 1.85° C from the observed mean (RIMES 4 page 33). The surface air temperate change for the whole of Maldives for 2080s ranges between 1.6°C to 3.7°C (RIMES report 4 page 15). Sea surface temperature change for the Maldives for the same time period ranges between 1.27°C to 3.4°C (RIMES report 4 page 16). The intensity of tropical cyclones is expected to increase by 10% to 20% by 2050.

26. Average annual rainfall in Maldives is 2124 mm. per annum, ranging from 1799 mm in the North to 2321 mm. in the South. Future projections from the set of GCMs examined show a range of 1250 to 3185mm. Available historic rainfall records show annual and seasonal rainfalls are decreasing in the Maldives (MEE, 2011). Rainfall in Maldives varies from north to south with the amount of rainfall increasing towards the south. This difference in rainfall patterns is primarily due to the northeast monsoon period and April being much drier in the north than in the south. Greater extremes of dry periods and heavy rainfall are expected increasing the risks of droughts and floods, especially during El Nino events. A 180 mm/day rainfall event is currently a 100 year event but is expected to occur twice as often by 2050[19].

27. Groundwater is highly vulnerable to the impacts of climate change. Rising global temperatures may result in greater heat stress for people and ecosystems, thus, increasing water withdrawal[20]. In addition, sea-level rise, increased wave energy at the coast and increased frequency of tidal surges will increase island-overtopping events and coastal erosion which will increase saline intrusion into freshwater lenses. Two drought issues are especially risky for Maldives: i) extended dry seasons during which harvested rainwater runs out; and ii) reduced overall recharge during the wet season, affecting the availability of groundwater. Thus the patterns of rainfall are as important as average annual changes.

28. Observed experiences bear these risks out. Maldives has been experiencing high frequency, low impact hydro-meteorological disasters causing storm surges and often coastal flooding. Since 2007, more than 90 inhabited islands have been flooded at least once and 37 islands have been flooded regularly or at least once a year. More than 97% of inhabited islands reported beach erosion in 2004, of which 64% reported severe beach erosion. The 2004 Tsunami experience showed how extreme weather events such as cyclones and storm surge flooding can cause saline intrusion and overflow of septic tanks into freshwater lenses. Climate-sensitive illnesses such as diarrhea and vector borne diseases have shown increasing trends in recent years and there are marked seasonal patterns with peaks in diarrheal diseases in the wet season, which is consistent with polluted ground water especially following heavy rainfall events. In fact, national average rainfall, lagged by one month, is a significant predictor of the illness in every case[21].

Adaptation Solution

[18] RIMES Report 4 Climate Scenarios and Their Interpretations for Maldives, 2012
[19] MEE, (2001), First National Communication
[20] The current benchmark applied by GoM (as per MoH, 1996) is to provide access to 10 litres per person per day of safe water for drinking and cooking and in islands where groundwater is unfit for any potable use to provide 40 litres per day. Temperature increases expected with climate change may require this base level to increase to 12 litres per person per day (WB Study).
[21] Hales, 2015.

29. A practical adaptation solution to the above lies in developing a water supply system that integrates the three main sources of water (rainwater, groundwater and desalinated water) into a least cost delivery system and which is able to maintain service levels in the context of climate change, particularly greater rainfall variability and extended dry seasons. Early warning information, based on forecasted meteorological information, will also be required to feed into and guide system management. Standard Operating Procedures (SOPs) for water management will need to be developed and put into use. The system also needs to be based on least cost ways of delivering basic services through effective management of water resources, the use of renewable energy and locally appropriate energy efficient technologies. The system also needs the support and ownership from communities and their willingness to pay for the service necessary for financial sustainability of the system. Capacity development of the State Utilities to manage service delivery for many of the water stressed atoll islands, as well as the decentralized authorities and central government level is required to provide the appropriate enabling planning and institutional framework to ensure sustainable production and distribution of water resources. In order to achieve the above solution, there are a number of barriers (primarily institutional and financial) that need to be overcome.

Institutional barriers

30. Despite the current legislative environment including various national policies, clear directions are necessary to local agencies focusing on water resources, communities, as well as development partners supporting Maldives on the need to promote and support the diffusion of integrated water production and distribution systems in the most vulnerable outer islands. An overarching water policy is currently being formulated. However, there are no underpinning sub-laws and regulations to effectively protect water sources or regulate their use. Furthermore, the current water sector master plan does not take into account the implications of climate change.

31. Decentralization and community involvement in water management remains in its infancy. The Decentralization Act that covers water resources provides a mandate but no funding mechanisms to local communities. Current water supply systems are mainly developed through “supply-based planning,” in which local O&M capacity or ability to pay for the services is not fully taken into account during project planning. Meaningful steps to build awareness, sensitization and dialogue have yet to be put in place to ensure island communities are willing to pay for costly O&M. Mechanisms to involve local island councils and communities in project formulation or discussions on local water and sanitation requirements are needed, also to heighten ownership of completed investments. There is a low rate of cost recovery from households and thus there are no local funds to pay for basic operations and maintenance, In fact, over the past nine years the outer islands have become increasingly dependent on Malé based agencies to provide both public investment and basic water and sanitation management, such as the Ministry of Environment Energy as is mandated to provide water and sanitation to all islands.

32. There are various high-level government institutions involved in sector oversight, with multiple levels below them at central and local level. The wide array of agencies involved in the sector has led to fragmentation in key areas such as water and sanitation services, water quality monitoring, water resource protection and regulation of use and capital project assessment, design, and implementation. Different government agencies have overlapping responsibilities. For instance, National Disaster Management Centre is in charge of emergency water supplies while Ministry for Environment and Energy (MEE) oversees water and sanitation project design and construction as well as carrying the policy mandate while the utilities are the service providers. The Environmental Protection Agency (EPA) (which is institutionally housed within MEE) is the regulatory body and is responsible for water quality monitoring and approving water and sanitation tariff structures. The Ministry of Health (MoH) also has responsibility for water quality monitoring, though only peripherally involved in water resources management. There are, in effect, two separate regulators of water quality: EPA for public water, groundwater, and discharges of sewerage, and MoH for bottled water, acting under the Public Health Act. The public health basis for water and sanitation provision is not a large part of the current water supply and sanitation (WSS) implementation plan, headed by the Water and Sanitation Department (WSD) under the Ministry of Environmental and Energy (MEE). WSD’s core competency lies in infrastructure planning and development.

33. FENAKA and STELCO, the state owned utilities, have a primary focus on electricity generation and distribution. Water and sanitation services by these utilities have been a relatively new obligation. Therefore staff development and funding remains largely inadequate. Utilities have limited delegation of authority over the local system operators and are challenged by shortages in trained personnel in the islands. As a result, interruptions of services at the local level are frequent with little staff expertise to remedy the problems. The water and sewerage systems now under the purview of utilities serving outer islands are not profit making entities, often with unclear rates of equipment use or failure, and with few planned maintenance schedules and, importantly, with insufficient staff resources. Owing to their mandate to provide

water and sewerage services to the outer islands, FENAKA and STELCO are positioned in the national water and sewerage market with almost no potential for profit compared with the high population density (Malé and Malé islands) served by MWSC.

Financial barriers

34. GoM faces many constraints in investing in water supply service: (i) high and prolonged budget deficit and public debts lead to weak fiscal position; (ii) public service delivery is costly in the complex geographical context of broadly dispersed small islands where economies of scale is lacking; (iii) limited access to clean piped water in all islands is partly a result of current high tariff level that cannot attract sufficient investment as well as that of a small customer base in most islands; and (iv) electricity (which mostly requires imported expensive diesel fuel) is the major part of the operating cost of the water supply system, especially in the desalination process and pumping.

35. Appropriate levels of infrastructure and associated services that are economically feasible for islands of different population size and density is a considerable challenge to the financial viability of capital investment and a service that is provided based on a principle of cost-recovery. According to estimations (MWSC, 2011) the population level per island at which piped and household connected water service is relatively economically feasible is set at minimum 2,000 residents and above. This amounts to only 15% percent of the islands in the entire country, largely concentrated in the capital Malé and Malé region. These islands are already well served by the MWSC- the utility providing the service. Such high level of water supply with desalinated water is not economically feasible in the majority of outer islands of the Maldives. Economies of scale are lacking. Although utilities are expected to recover the cost of their service they are only able to do so through cross subsidization across the islands. Utilities often cross subsidize their services to small islands that are commercially unviable from their service to bigger islands with larger population where cost-recovery rates are relatively high. However, even if the utilities cannot fully recover the cost they are still obligated to provide the service as equitable access to freshwater is a constitutional right in the country.

36. Utilities serving the outer islands face significant constraints in their financial prospects. Their financial performance is adversely affected by the low rates of cost recovery for the services they provide. This is linked to the current gaps in policy or guidelines for water and sanitation tariffs, although the Water Act that is forthcoming includes that prices should be set for the provision of water. EPA as a regulatory body is responsible for approving tariff proposals submitted by service providers (utilities and / or island councils) and approval is done on a case by case basis. However, EPA needs a systematic criteria through which to evaluate proposals, and there is limited access to information or predictability on how the prices will be set. EPA as the environmental regulator lacks adequate expertise for the financial intricacies of tariff development, causing delays in approvals which in turn affects service delivery. At the same time, most utilities do not have adequate billing systems in place for water and sewerage systems, which is an additional challenge for utilities such as Fenaka. The maintenance programs of most utilities are often incomplete, resulting in equipment failure across the systems. Making utilities a viable business will require improved tariff policies, pricing and cost-recovery schemes in order to cover full operating costs for providing WSS in dispersed islands the majority of which have small population numbers.

37. Until now, the provision of water supply in the Maldives has been heavily subsidized by government. This is especially so on remote islands, but is also taking place in Male itself where water tariffs have not been increased since 1995 and where it is estimated that Government subsidizes 5 to 10% of the Male Water and Sewerage Company (MWSC). A recent USAID study concluded that: "It may be that a water tariff system required to achieve full cost recovery is simply not viable or sustainable and therefore that a central government tariff-subsidy mechanism is required." (USAID. 2012. Maldives Water and Sewer Tariffs: Current Framework and Policies. May 2012). Against this policy background is the recognition that climate change already has have significant impacts on water supply and in particular on the frequency and duration of water shortages. These changes are expected to continue to intensify in coming decades. Thus far, these shortages have been addressed with the transport of potable water from Male to islands experiencing water shortages. The Government of the Maldives is keenly aware that the existing tariff subsidization framework (or lack thereof) exerts a considerable fiscal burden on Government's budget. Government is also aware that the subsidization of water transport as a means of addressing water shortages proves to be increasingly costly and is fiscally unsustainable. The project aims to address both of the above issues by (1) reducing the costs of addressing water shortages on remote islands and (2) in collaboration with Government, developing a policy framework to facilitate the cost-recovery of water supply provision in the Maldives. As pointed out in the above USAID study, at least in the short-term and in the absence of a clear water tariff policy framework, water supply provision on remote islands of the Maldives cannot be provided on a commercial basis and aimed at full-cost recovery. Hence, without a significant grant component, water supply systems on remote

islands are not financially viable. These systems must however be put in place as a means to reduce the increasing fiscal cost of the current approach for addressing water shortages. However, an important objective of the project is that the development of a water policy and pricing framework will facilitate the recovery of operations and maintenance costs and ensure the financial and operational sustainability of water supply systems.

38. The **main goal** of the proposed project is to increase climate-resilient water security in Maldives. In particular, the proposed project will benefit 105,000 people from the year round access to reliable and safe water supply despite climate/weather shocks and stresses.

C.3. Project / Programme Description

39. 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.

40. The GCF project will help achieve three outputs:

a. Scaling up integrated water supply system to provide safe water to vulnerable households (at least 32,000 people, including15,000 women);
b. Decentralized and cost-effective dry season water supply system introduced benefiting 73,000 people across 7 Northern Atolls;
c. Groundwater quality improved to secure freshwater reserves for long term resilience on 49 islands.

41. The project will provide sufficient water to supply the potable water needs of island residents year round for a 35 year design period to 2050. Project finance will be used to establish an integrated water resources management system that integrates the three main sources of water (rainwater, groundwater and desalinated water) into a least cost delivery system and which is able to maintain service levels against a context of rainfall variability and sea level rise and also includes measures for groundwater quality recovery to secure freshwater reserves in the long term. Ultimately, the project will achieve an uninterrupted water supply on the islands that currently experience a 90 day chronic water shortage during dry season and depend on transported water from Malé, which is an extensive, overlong and costly operation. As a result of the project, 49 priority islands will have increased rainwater collection capacities, out of which, 4 bigger islands will additionally have water production systems of water desalination (Reverse Osmosis – RO water production plants), that will secure sufficient water production capacity enabling a decentralized and timely water distribution across all northern outer atolls during the extended dry periods, when shortages may occur. Early warning information based on forecasted meteorological information will feed into the Standard Operating Procedures (SOPs) for system management, thereby protecting lives and livelihoods from environmental risks associated with climate change. This will also feed into strengthening the MMS services on reaching out to the communities actionable early warning information, and preparing the communities to receive and act on such information. The system will achieve cost effectiveness in service provision through effective management of water resources and the use of renewable energy and locally appropriate technologies. Alongside the system design will be a capacity development workstream designed to obtain the support and ownership from communities, which is necessary for financial sustainability of the system, as well as the capacity development of the State Utilities (such as FENAKA and STELCO) to manage service delivery, and of the decentralized authorities and central government to provide an enabling environment for sustainability and scale up.

42. The project will improve on and scale up the integrated approach tested by the GoM with support from UNDP in the islands of Mahibadhoo (Alifu Dhaalu Atoll), Ihavandhoo (Haa Alifu Atoll) and Gadhdhoo (Gaaf Dhaal Atoll)[22]. That programme is in its final year of implementation. The investment to-date has significantly contributed to enhancing the resilience of freshwater supply through the integrated management of ground – and freshwater resources. With US$8,285,000 of grant investment approximately 7,000 inhabitants of these islands now will have safe and uninterrupted drinking water supply through combined sources of harvested and desalinated water. 4,250 m^3 of harvested water storage capacity and 200 m^3 of desalination capacity have enabled a minimum of 20 litre/day of safe water to be supplied per person. This is in line with the Maldivian EPA guidance, and is above the government minimum standard of 10 litres per day per person for drinking and cooking. An additional US$7.3 million grant from USAID is now replicating the investment with an improvement of having a component to address groundwater recharge and improved septic tanks so as to recover the groundwater reserves.

[22] This was possible with financial assistance from the Kyoto Protocol's Adaptation Fund which provided the GoM financial support to design and implement a project on "Increasing climate resilience through an Integrated Water Resource Management Programme", with technical support from UNDP.

43. The main outputs and activities of the project will be as follows:

Output 1: Scaling up an integrated water supply systems to provide safe water to 32,000 people

44. The project will enable 49 targeted islands (across 13 atolls) to put in place an integrated water supply system. The system in each island will integrate locally appropriate combination of the three main sources of water that are currently largely disconnected (harvested rainwater, groundwater and desalinated water). Doing so will generate the necessary diversification and redundancy in the water supply system to ensure there is always a sufficient supply of safe freshwater for the local population at the selected atoll level. All three sources of water will be produced and distributed on the selected islands with large customer base, where desalinated water is necessary to serve as a back-up source, as the rainwater collection is not sufficient to satisfy the growing demands on water. Such an integrated system will be installed in four islands across four out of seven atolls of the northern, most vulnerable region. At the same time, these four target islands become the water production and distribution hubs for all seven northern atolls during the dry season, lifting their dependency on Malé. The islands of Nolhivaranfaru (Haa Dhaalu Atoll), Dharanvandhoo (Baa Atoll), Foakaidhoo (Shaviyani Atoll), and Maduvvavri (Raa Atoll) have been selected on the grounds of large populations, growing demands for water and vetting through extensive consultations with the government stakeholders and based on the selection criteria as presented in the Section E4.1. They are all located in the North, where the issues of aridity and water shortages are most prominent. These integrated systems will provide water supply for household consumption. Small and remote islands of the Maldives are not suitable for the conduct of industrial activities nor for an extensive agricultural sector. Agricultural activities (if any) would take place at the household level for household consumption.

45. Additionally 45 islands (20 islands across 4 atolls – out of the 7 - in the north and 25 islands across 7 atolls – out of the 9 – in the south) will benefit from improved rainwater collection infrastructure combined with ground water improvements. As the 45 islands are smaller islands with limited population, desalination on these islands will not be commercially viable. Consequently, each of the four islands will become a hub for producing and distributing water to the islands across all 7 northern atolls, as the need arises, in those particularly dry years when rains fail. This atoll-based system of water production and distribution will eliminate the need for additional emergency water supply during the dry seasons that is currently delivered through a Malé -based, centralized and ineffective, untimely, and costly distribution mechanism. Hence island and atoll-level water self-sufficiency is a main transformative achievement of the proposed project.

46. One of the indicators of success for this project is a year-round, uninterrupted supply of potable water that will be the main impact of the proposed project. The primary supply will be rainwater, complemented by groundwater, and the more expensive desalinated water as a backup supply when and if harvested water runs out at the more populated islands or growth centers. Treated rain water together with desalinated water will be combined in a clean water tank providing storage over two weeks. Collected from the roofs, the rainwater is collected in a tank, treated and transmitted to a mixing tank with desalinated water. The treated rainwater and desalinated water will be blended in varying proportions according to the season and the availability of rainwater. Purpose-designed drains will be put in place to enable excess rainwater from the communal system to infiltrate and recharge the groundwater (groundwater resource management is addressed more comprehensively under Output 3). In addition, consideration will be given to protecting critical infrastructure from island overtopping events by providing higher platform levels and dykes.

47. During the first quarter of the implementation the project will carry out island-level baseline assessments (to establish current quantities and quality of water supply, customer satisfaction and technical and management deficits) as a basis for performance monitoring as well as the community engagement strategy, and for identifying and delivering detailed training and management system needs.

Further details of the integrated design is as follows:

48. Rainwater harvesting: World Bank analysis of rainwater supply in the Northern, Central and Southern regions of the Maldives as well as the length of the dry season in the three regions led to findings that if rainwater tank capacity is increased where possible from 2,500 litres to 5,000 litres in south islands, 7,500 litres in central islands and 10,000 litres in northern islands, even large households with small roof catchment areas would have adequate drinking water supply through dry periods. Space limitations will dictate the extent to which it will be possible to supply all drinking water from harvested rainfall. A detailed island-specific assessment for rainfall harvesting (future water demands, geo-technical, roof area available, space available to install tanks, rainwater collection system, hydraulics, treatment design, land availability

etc) will be undertaken to determine the likely ranges of yields from rainwater, as well as the most cost-effective configuration of tanks, pipes, pumps, drains and storage facilities to cope with low rainfall years and high rainfall events.

49. Rainwater collection system is entirely gravitational and does not require energy inputs. Water goes through gutters and downpipes into the collection tank to be blended with desalinated water. As desalination technology is expensive per unit of water produced by increasing a share of harvested rainwater into the mix a total cost per litre of water delivered to the households will be reduced.

50. Desalinated water: Studies conducted in Maldives have shown that in larger islands with population of at least 2,000 people, rainwater collection and storage will be insufficient to satisfy the growing demand. Therefore, with currently depleted groundwater resources, desalination has become the only alternative means for providing freshwater. Water security in the four highly populated target islands therefore requires an RO plant as part of its integrated water resource management - IWRM system. The RO plants will be operated by a water utility that has been mandated to deliver, operate and maintain water services in the islands. The four selected islands for this project fall under the utility company Fenaka. The contracting company under the project will install and run the plants for 1 year after the installation. During this one year period the plants will be handed over to the designated utility and the staff will be trained for the operations and maintenance of the plants. Desalinated water production at these target islands will also serve as an atoll-based water production and distribution hub for the islands in the vicinity during dry seasons (further details provided in output 2). For the 4 larger islands a life-cycle cost analysis will be carried out to determine the optimal sizing for desalination plants to meet the required capacity in terms of the amount of desalinated water that needs to be produced per day, taking into account all energy efficiency design potentials as well as expected variation in rainfall quantities. Larger plants can produce a given amount of water in fewer hours but are more costly in initial capital cost. Benchmarks can be taken from feasibility assessments for other islands where comparable investments have taken place and proven successful. For example, in Hinnavaru island (supported by USAID), for a population of 5850 by 2050, two desalination plants of 50 m^3/day will be installed together with an existing 30 m^3/day plant. The other main expense involves the operating costs, of which energy is the main sub-component, even for the more efficient membrane technology (compared to thermal technology) that this project will enable the GoM to put into place. The Hinnavaru feasibility assessment shows that the solar PV option is the least expensive and coupled with a 24 hour RO operation, can produce a payback of 8 years. Based on calculations, cost of electricity produced using diesel fuel is about US$0.35 kwh, whereas with solar PV it is US$0.10 kwh. Hence electricity produced using solar PV is 70 percent cheaper than electricity produced using conventional fuel (MEE, 2015). This will result in significant reduction in operating costs, the savings from which could be utilized to cover O&M recurrent costs for next 20 years.

51. Based on the evidence from the Dhuvaafaru island and data submitted from the MWSC, the following assumptions can be made:

Total capacity	50 CBM
Total no. of operating days/ month	11 days
Monthly water production	355.7 CBM
Monthly running hours	211.5 hrs
Monthly electricity consumption	2195 kWh
Average no. of operating hours/ day	19.23 hrs

Table 1: Comparative cost estimation for three RO energy input options

Description	Grid connected system		Stand alone with battery		Conventional	
Solar PV installed capacity	20	kW	55	kW	NA	
Monthly electricity production from Solar	2400	kWh	6600	kWh	NA	
Battery	NA		26144	Ah	NA	
Investment cost	50,000	USD	157,000	USD	NA	
Tariff	0.10	USD	0.33	USD	0.35	USD

Source: MEE, Energy Department (2015)

52. Currently, conditions are conducive to achieve significant energy cost reductions in the RO desalinated water production systems. In this context, with financing from the Climate Investment Fund, the Maldives is one of the six pilot countries participating in the Scaling up Renewable Energy Program in Low Income Countries (SREP). This consists of two complementary investments:

(i) "Preparing Outer Islands for Sustainable Energy Development (POISED)". This program will be administered by Asian Development Bank (ADB). The total investment of this program is about US$120 million. The aim of the program is to upgrade existing energy generation and distribution systems and install solar PV by at least 30 percent of the day-time peak load in each inhabited island; and
(ii) "Accelerating Sustainable Private Investments in Renewable Energy (ASPIRE)". This program is administered by the World Bank (WB). The total expected investment is about US$60 million. The aim of this program is to create conducive environment for private investors and install up to 20MW of solar PV roof mounted systems in selected inhabited islands.

53. These investments target 192 islands. As a result of this investment, about 58GWh/year of electricity would be generated, and the share of RE would be increased by approximately 16%. However, in order to increase the percentage of RE installations and to reduce cost of energy requirement for RO water production, it is important to install additional RE electricity generating facilities targeting to meet energy demand for the RO water production. According to a forthcoming net metering regulation excess energy produced from RE installations will be fed directly into the grid and accordingly deducted from consumption. Alternatively, excess energy can be stored in batteries. Three options of electricity consumption are viable; from grid, grid tied and off grid with batteries.

54. Groundwater: A recent assessment of freshwater lenses in Maldives confirms that ground water, if properly protected from land-surface derived contamination, over-pumping and associated salinization, can be a valuable source of water for Maldives, especially the larger islands[23]. There have been many assessment in Maldives that have confirmed the importance of the island groundwater resource in building a resilient, integrated water supply system (Arup, 2014). The aquifer is an important facility to store water in times of excess for recovery in times of shortage; this storage will become all the more important considering the expected increased rainfall variability and intensity (see section B1 for details). Aquifer recharge will also limit and prevent salt water intrusion. The freshwater resource is highly dependent on rainfall, so conjunctive use of ground, rain and desalinated water will need to be a dynamically managed system taking into account forecasted rainfall.

55. There are two ways to restore the aquifer water balance: increase recharge or reduce abstraction rates. There are three ways the project will recharge the aquifer, based on detailed aquifer studies and related technical assessments on the target islands: i) management of storm water run-off (flooding) by installing drains soakaways and other features; ii) re-routing RWH 'first flush' and excess roof overflows to ground via soakaways and other recharge features (interceptor pits, trenches, infiltration galleries, filter drains etc); and iii) re-routing of greywater- separation of greywater at the household level would need to be assessed for feasibility. The integrated RWH – groundwater recharge design requires sufficient storage capacity in the RWH in order to better regulate and monitor flows, for example, to enable some delay in recharge when necessary due to a lack of aquifer space just after the rains. Fitting of automated cut-off valves would avoid overflow-induced flooding and issues related to clogging and maintenance. Recharge structures should make use of locally available materials for pre-filtration wherever possible. Detailed island level assessment of groundwater yields will need to be carried out considering also population densities[24].

56. The GoM has set aside a budget to install sewage systems in most of the selected atolls, which provides baseline financing for this investment. In fact, for the 45 islands selected for RWH, 12 islands have on-going or planned sewage projects either through Government investment or grants/loans. Overall, the Government has US$148.4 million financing towards sewerage for the period 2015-2017 through both grants and loans (as previously mentioned, government budget of US$77.69 is dedicated to sewerage networks). Therefore, the GCF investment is timely to complement into the water production and distribution systems that experiences major funding shortfalls.

57. The project will also enable the GoM to design transparent and consistent tariff evaluation criteria and tariff setting guidelines. The current increasing block tariff system applied in Malé provides a good example of workable tariff structure

[23] Bailey et al, 2014
[24] Population densities matter in the calculation of sustainable groundwater yields. A recent WB synthesis study of water resources in Maldives took the view that population densities of greater than 20 per hectare pose a risk to groundwater.

for the islands. This type of structure includes both a lifeline tier for poor households and a conservation incentive for large water users. Tariff policy that adheres to the principles of affordability, equity, and financial sustainability of the integrated water supply system in the long run will be introduced. Furthermore, the measures towards the reduction of production costs, as described above, the improvements in service provision and quality management systems set up at the utilities, will enable a conducive tariff structure to facilitate the recovery of operations and maintenance costs.

58. Management of the integrated water supply system (the government in Maldives has labelled it as IWRM) has to happen at various levels, most obviously by the public utilities (e.g. FENAKA and STELCO) who have responsibility to serve a number of Atoll islands. At the same time, communities in the islands and the regulatory authorities at the decentralized and central government levels also have a key role to play. Currently, the levels of disenfranchisement of the current service provisions is high and the capabilities to plan and manage service provision effectively is low. This downward cycle will be turned around through this initiative. Management capacities will be strengthened and optimized in order to ensure that investments made now and in the future are financially and operationally sustainable. Targeted capacity development will take place in three ways: i) Meaningful and well planned community engagement with households and island authorities to get their participation will be essential to making the integrated system work effectively, especially in the context of willingness to pay for the system; community engagement will be facilitated through the existing Island Council mechanism, including through such representative community groups as women's development committees that have mandate to provide inputs into the island development plans and individual projects; Women's development committees will be used to voice women's specific needs in water at the household level, use of their traditional methods of harvesting and promote their roles in household "willingness to pay" surveys and related decisions. Since water scarcity directly affects women by adding to their daily chores, they will more willingly secure family earnings for a reliable freshwater supply; Furthermore, a dedicated water task force (see output 3) at each Island Council will serve as a platform for participatory decision-making for an entire project duration and beyond; ii) Training programmes addressing the main management barriers together up-grading of management information systems will enable proper planning and financial management (targeted training and mentoring programmes, including a sustainable training facility at the Maldivian Polytechnic Training Institute will be established and rolled out); An equal number of female professionals will be trained alongside male peers and colleagues; and iii) Development of regulatory control through SOPs, quality standards and guidelines will enable the application of the principles enshrined in the legislation around safe water and sanitation for all. The capacity development and the development of regulatory control will enable replication to other islands and Atolls thereby multiplying the benefits of the investment over a larger population.

The following concrete results will be delivered under this output:

1.1. 11,502[3] rainwater harvesting systems for 26,000 residents in 45 islands installed;
1.2. Standard operating Procedures (SOPs) prepared and used by utilities, local councils and households;
1.3. 4 RO desalination water plants in 4 islands installed and made operational, using a grid-tied and / or off grid solar PV technology to provide backup capacity in times of water stress;
1.4. Groundwater recharge system installed for excess rainwater from the RWH collection system on 49 islands, including greywater recycling on selected islands;
1.5. Tariff evaluation criteria and tariff setting guidelines designed and introduced;
1.6. Training programmes in integrated water resource management, planning and budgeting, water economic modelling, expenditure management and performance monitoring developed and delivered for relevant atoll and island councils and the ministries (MEE, MoH); and
1.7. Certification courses for the utilities and sector specialists in the areas of water engineering, capital construction, operation, maintenance, financial management and planning introduced at the Maldivian Polytechnic training institute (MP).

Output 2: Dry Season water production and distribution

59. The quantities of emergency water are small as a proportion of rainwater available/harvested and could be accommodated at the island level through more widespread rainfall harvesting, as well as atoll-level desalination. Given the number of inhabited islands in Maldives (193), developing these integrated solutions across all Atolls and islands will be a longer-term prospect. In the shorter term, island level supplies will probably need to be supplemented by desalinated water supplies external to the island most preferably at a decentralized, atoll-level to reduce the transportation cost as well as to improve the timeliness of water delivery. The average cost over the last three years for emergency water costs has been US$93/m^3 (about 16% of average income in 2012 in the outer islands), compared to tariff rates that are closer to USD10/m^3, so this difference in price is a significant additional cost to GoM annually. A major portion of the cost is

transportation costs – around 10 times more than the amount spent on purchasing the water from suppliers in the capital island of Malé.

60. Currently, water is supplied based on the amount requested by the island councils, in batches. When a pledge is made, NDMC evaluates the request and prioritizes based on the most urgent need. The task is then outsourced to the lowest bidder through a competitive procurement process. The dry season water supply relies on the RO desalinated water produced in Malé atoll for collection and distribution to all affected islands (with few exceptional industrial islands where the water can be collected, sub-regionally). This is because water production is currently concentrated in Malé and larger Malé atoll islands with high population density and big customer base. Such centralized operation is not only costly but also and most importantly precludes timely delivery to the people in need. The timeliness is also hampered by current tender and contracting regulations that require separate tender process for each individual cluster of islands. In 2015 to date (June) NDMC has gone through 14 tender processes in order to supply the affected population. There are only handful companies that can bid and deliver for such services, therefore they push the prices high, leaving the NDMC with limited negotiation leverage.

61. If the regulation is adjusted to allow for a long term agreement for whole sale services, the companies with secure contracts will no longer inflate the price of water and transportation and cost of operation is expected to lower. Economic analysis shows that that If the collection points are decentralized across the atolls, especially in the dry North, it will significantly reduce the cost of operation at least by half. It is expected that Output 2 would improve the cost/m^3 of drinking water and the response times during dry seasons for Maldives as a whole. As an indication of the size of the beneficiary population, in 2014 emergency water was supplied to islands with a combined population of nearly 60,000, or 17.5% of the Maldives population.

62. The GCF funds will be used to improve regulatory frameworks and institutional set up governing the dry season water supply in the country (not just the 4 Atolls included in Output 1). Regulatory acts on water delivery tendering procedures and sub-laws on institutional coordination and accountability mechanisms will be devised and enacted. The decentralized, atoll-based water supply and distribution points developed under output 1 will serve as water production and distribution points for all 7 northern atolls. These new decentralised water production and distribution points will follow the existing mechanisms (logistical setup and infrastructure) for emergency water supply during the dry period, but with a considerable improvement by shifting from centrally operated to a decentralised system, closer to the beneficiary communities, thereby reducing costs drastically. With the establishment of integrated water resource management systems in the 4 regional atolls, the water production capacities will increase at the atoll level and make the water available for a timely distribution during the dry seasons. SOPs will be developed between the relevant institutions such as the utilities, councils, NDMC and MEE to establish a clear and streamlined water distribution operations.

63. In addition, a timely water alerts and forecasting will help to achieve effective water management planning decisions such as building up emergency stocks of desalinated water. The Maldives Meteorological Service (MMS) under the MEE will be involved in water alerts as well as long term projections and forecast to feed into the water sector SOPs. The project will improve the density of the rainfall observation network by procuring additional rainfall gauges. Four additional rainfall gauges – precipitation sensor "Rain(e)" with Data Logger - on pre-identified locations (HA, GA and Gdh atolls) of wide spread will considerably improve the granularity of the observations in the vulnerable outer islands. Currently, there are five rainfall gauges placed across the country. With the additional four gauges located strategically within the GCF project areas will expand the coverage and improve observation data collection. This in turn will improve accuracy of forecasting as well as seasonal water alerts. The data is collected at the main Meteorological Watch Office (located at the Ibrahim Nasir International Airport in Hulhule' island in Kaafu Atoll). The data from the additional rainfall gauges will supplement the hourly data collected from the five meteorological centres spread across the country. MMS staff will be trained in data analysis and forecasting methods. Observation data sharing between such relevant institutions as NDMC and MMS will result from an improved connectivity to MMS online database as well as systematic data sharing protocols. Finally, emphasis will be placed on timely water alerts to the grassroots level and dry season preparedness campaigns lead by women who are most acutely affected by the water shortages.

64. With climate change impacts accelerating, the effectiveness of dry season water distribution is a critical adaptation strategy in the water sector.

The following concrete results will be delivered under this output:

2.1. 4 sub-national water production and distribution locations to serve all Northern atolls established;

2.2. Institutional coordination and accountability mechanisms between the utilities, the NDMC, MEE and LGA/ councils to facilitate cost-effective and timely water supply during dry season;
2.3. Regulatory framework for competitive and wholesale water distribution services established;
2.4. Early warning system established on the basis of forecasted meteorological information for water emergency alerts and for effective operation of integrated water system.

Output 3: Aquifers recharged and protected

65. This output complements Output 1 in addressing the quantity and quality of the ground water, mainly from the perspective of land-use planning and water quality monitoring. Because of the hydrogeology of the island, the interrelated issues of groundwater quality and quantity can only be addressed by management approaches that encompass the entire recharge/catchment area, which can mean the whole island.

66. Firstly, an assessment of geological, hydrological and land-use information is needed to understand the aquifer vulnerability and the range of human activities which exert pressures over water resources. Groundwater is very poorly researched in Maldives; the project will be used to address this critical gap in knowledge. The results of the analysis, to be undertaken by GoM will help to unlock the resource potential critical for long term water security of the country. This field-based assessment will provide a direct contribution to the formulation of subsidiary mechanisms for the implementation of the upcoming Water Act that based on previews, will have a strong focus on groundwater protection and management.

67. Secondly, it will be necessary to undertake water quality monitoring and to set up and maintain an information inventory. Quality monitoring is critical for reviving the groundwater resource as a safe source of water that has been lost after the tsunami catastrophe of 2004. Monitoring is also critical for continuous SLR monitoring, based on the salinity levels. Groundwater monitoring protocols, equipment and training will be delivered. Measurements for both groundwater level and quality are equally important. Partnership between FENAKA and the health centres in the outer islands will be initiated. Protocols will include which parameters to be measured at which interval in time. It will also detail out how samples for measurement should be acquired and recorded. This will involve basic water testing equipment to check for contamination and minerals content. The professional training in groundwater statistics and monitoring compliance will be delivered to the professional personnel (equally to both women and men professionals) at the EPA, utilities and health centres. Trainings will be designed to help users without deep statistical expertise to understand the statistical techniques and methods related to groundwater management, including replenishment and cleanup and how to use them in all life cycle stages: release detection, site characterization, remediation and monitoring. A web-based technical and regulatory guidance will be provided to bring clarity to the planning, implementation, and communication of groundwater management through statistical methods to lead to greater confidence and transparency in the use of groundwater site management. The project will also enable the Government to examine in detail options for developing and introducing full or partial cost-recovery based models of water delivery and distribution in the future. That said, the island resident's willingness to pay for water and sewerage services depends on first seeing and experiencing obvious improvements in water quality and accessibility on the island. Communities realize that water quality is a problem and they have also emphasized the need for a system of monitoring and safeguards, demonstrating a willingness to cooperate[25]. Capitalizing on this momentum, the project will support institutional development such as establishing a water quality task force in each island under the leadership of the island council. The water quality task force will comprise of the members representing the relevant institutions at the island level such as, utilities, women's development committees, and health centres and will be a voluntary body, hosted by each island council, as part of the extended advisory body to ensure a full stakeholder engagement in local water access and safety decisions as well as serving as a mechanism for participatory monitoring of results delivered by water projects and investments. Role of women's development committees at Island Councils will be particularly prominent to empower women's role in stewarding groundwater protection and greywater collection for subsequent treatment and use for groundwater recharge. The community engagement detailed under Output 1 will also include discussion around land use controls and restriction of activities that negatively affect groundwater quality, as the basis of water safety plans on each island. A public information campaign will be designed and run.

68. Thirdly, the recharge rate and water quality change in the vicinity of the recharge structure will be evaluated in each of the recharge areas. The quantity of water entering each recharge structure implemented in Output 1 would be

[25] WHO, 2015

monitored for flow rate and integrated volume. Water level in the well would be recorded using a water level logging device such as a pressure transducer. Aquifer recharge methods discussed above will be undertaken.

69. Fourthly, improved land use planning will also be guided by the protection of catchment areas (preservation of green zones etc.) to allow the rainwater to permeate into the underground lenses for natural replenishment process. Land-use planning guidelines will be updated in a fully consultative way with communities, island authorities and central government to include groundwater recharge requirements.

The following concrete results will be delivered under this output:

3.1. Baseline assessment (hazards inventory and catchment characterization) completed;
3.2. Groundwater monitoring protocols with associated equipment and training delivered;
3.3. Regulatory framework established for coastal land use, including zoning to protect coastal catchment areas and enable natural recharge of groundwater lenses.

More details about the activities and results are found under the section H.1.2. on Logframe.

C.4. Background Information on Project / Programme Sponsor

70. The Ministry of Environment and Energy has the institutional mandate to protect the environment of the Maldives, and develop strategic action plans to promote the sustainable development and implementation of all aspects of energy, water and sewerage, and meteorology. In doing so it is mandated to formulate policies, regulations and standards needed for the implementation of legislation related to environment, climate change, energy, water, sanitation, and meteorology as well as facilitate the execution and observance of the policies and regulations in these areas. There are a number of institutions that operate under the Ministry of Environment and Energy such as Maldives Meteorological Service (MMS); Environmental Protection Agency (EPA); Maldives Energy Authority (MEA); and Biosphere Reserve of Baa Atoll. The Ministry has long standing experience in engaging with international financial institutions and UN agencies to attract necessary financial resources and technical cooperation assistance towards achieving its aims within its institutional mandate. The current budget allocation to water related initiatives amounts to approximately US$15 million annually (see section C2 for more details).

C.5. Market Overview (if applicable)

71. The project delivers safe and reliable freshwater services to the most vulnerable communities in the outer islands of Maldives. The service will be delivered at the existing tariff. However, as a result of the project, considerable improvements in service quality and the reduction in production costs are assumed. This, together with other factors, such as increase in customer base and growing demand on water, will enable the possibilities for tariff restructuring, towards which the project provides technical criteria and detailed guidelines. The current block tariff sets a good example of progressive, increasing-block tariff. Socially differentiated tariff setting criteria will therefore be possible. As such, if water services are set with current tariff of US$9.7 / m^3, the revenues can cover over 60% of operating cost, but over the time, with an increase of customer base and an emergence of more private sector water users, increasing (but differentiated towards socially vulnerable groups, especially female headed households) block tariff can be set at a rate that secures a full cost recovery. According to the financial analysis this can be achieved at US$16.23 / m^3.

C.6. Regulation, Taxation and Insurance

72. The proposed project will be governed by the Environmental Protection Agency (EPA) Guideline for Integrated Water Resource Management Projects. The guidelines sets the design standards for such investments, and the minimum water supply targets that such systems must achieve. The proposed GCF investment will fully align with EPA guidelines as well as offer greater efficiency and optimization of the multiple sources of water so that it adheres to the EPA requirements that such system “shall be designed in a manner to provide sustained potable water to the consumers within the supply area on a continuous basis”. The Guidelines set specific standards and requirements for Conveyance system, water harvesting, storage standards, water transmission, desalinization, power supply, water treatment, disinfection, and groundwater recharge.

73. The project will also comply with site specific EIA requirements for the installation of such systems. The project builds on the ESIAs conducted for the prior UNDP’s Adaptation Fund financed investment in three islands, and for this comparable investment is fully guided by the relevant safeguards. For the purpose of this specific investment ESIAs will be conducted in all target islands as required by EPA regulations. Additionally, the project will follow the government’s tariff setting policies applying a block tariff principle. An upcoming Water Act will provide an overarching policy guidance to the project towards enforcing the principles of integrated water resource management and groundwater protection.

74. Additionally, UNDP's Programme and Operations Policies and Procedures which apply to the Project are publicly available here: https://info.undp.org/global/popp/Pages/default.aspx Furthermore, Section 7 of the Convention on the Privileges and Immunities of the United Nations provides, inter alia, that the United Nations, including its subsidiary organs, is exempt from all direct taxes, except charges for utilities services, and is exempt from customs duties and charges of a similar nature in respect of articles imported or exported for its official use.

C.7. Institutional / Implementation Arrangements

75. The project will be implemented following UNDP's National Implementation Modality (NIM), according to the Standard Basic Assistance Agreement between UNDP and the Government of Maldives, the Country Programme Action Plan (CPAP), and as policies and procedures outlined in the UNDP POPP (see https://info.undp.org/global/popp/ppm/Pages/Defining-a-Project.aspx). The National Implementation Modality is explicitly designed to ensure domestic actors and systems are used to strengthen national ownership, accountability and capacity development. The national implementing partner (i.e. the executing entity) will enter into a signed project document[26] with UNDP. The Project will also be governed by the Standard Basic Assistance Agreement which has been entered into with the Government of Maldives.

76. The **Implementing Partner** for this project is the Ministry of Environment and Energy (MEE). MEE is accountable to UNDP for managing the project, including the monitoring and evaluation of project interventions, achieving project outcomes, and for the effective use of resources. The national implementing partner (i.e. the executing entity) will enter into a signed project document with UNDP. The Project will also be governed by the Standard Basic Assistance Agreement which has been entered into with the Government of Maldives. The national implementing partner (i.e. the executing entity) will not receive any indirect operational fees. Eligible direct costs of the national implementing partner will be financed through the project budget.

77. A **Project Board** (PB), responsible to approve key management decisions of the project and to play a critical role in assuring the technical quality, financial transparency and overall development impact of the project, will be established as soon as this project is approved. The PB will be composed of designated senior-level representatives of the MEE, NDMC, Ministry of Housing and Infrastructure, Ministry of Finance and Treasury, Local Government Authority, National Designated Authority and other key stakeholders. A complete list of PB members and their designated alternates will be provided in the inception report.

78. **Project Support** will comprise of the following: (i) **technical groups** will serve as platforms for debate and contributions across the project outputs. Members of the Technical Group will include technical personnel from the Government agencies (MEE, MHI), NDMC, utilities companies (FENAKA, STELCO and MWSC) and independent water experts; (ii) **awareness and advocacy groups** will comprise community members and social groups, such as women's groups to facilitate full engagement of target households; and (iii) **private sector group** will provide a platform for private sector participation in the water sector. This includes the participation of sectors such as the tourism sector in providing water both in emergency situation as well as through CSR-related investment opportunities in local islands.

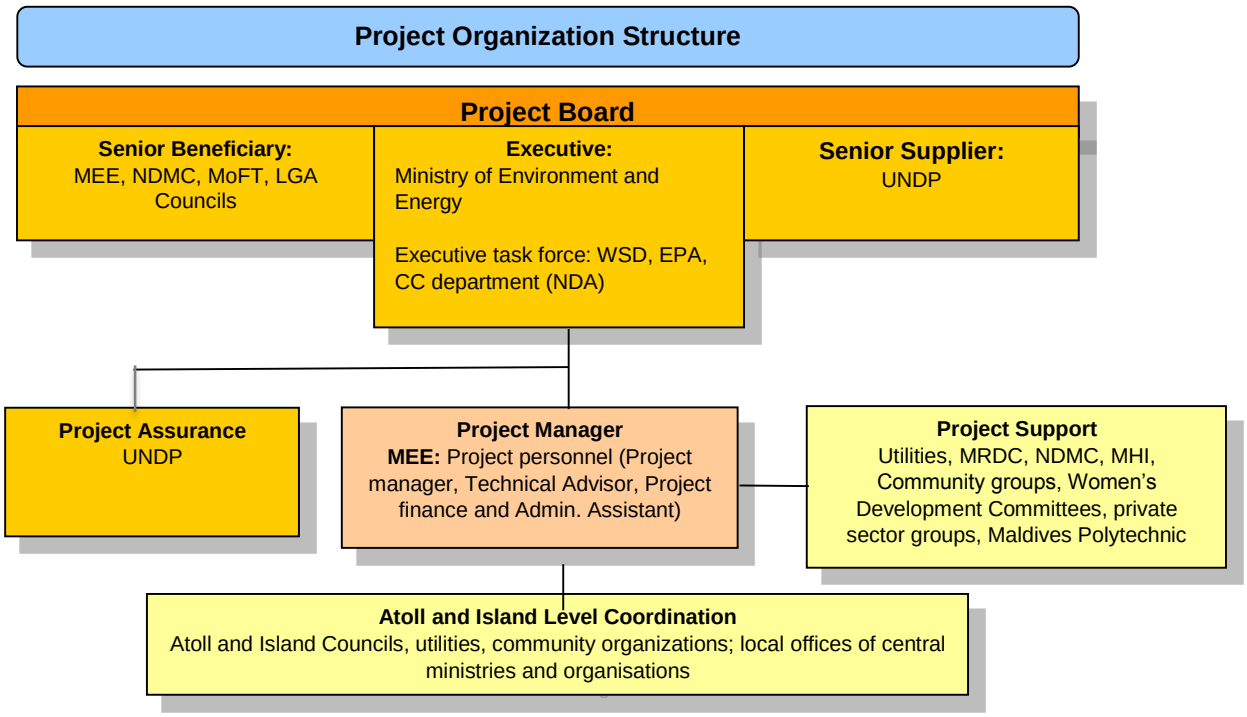
79. **UNDP's overall role** as an Accredited Entity is to provide oversight and quality assurance through its Headquarter and Country Office units. This role includes: (i) project preparation oversight; (ii) project implementation oversight and supervision, including financial management; and (iii) project completion and evaluation oversight. It also includes oversight roles in relation to reporting and knowledge-management. The '**project assurance**' function of UNDP is to support the Project Board by carrying out objective and independent project oversight and monitoring functions. This role ensures appropriate project management milestones are managed and completed. Project assurance has to be independent of the Project Manager; therefore, the Project Board cannot delegate any of its assurance responsibilities to the Project Manager. A UNDP Programme Officer, or M&E Officer, typically holds the Project Assurance role on behalf of UNDP. The '**senior supplier**' role of UNDP is to represent the interests of the parties which provide funding and/or technical expertise to the project (designing, developing, facilitating, procuring, implementing). The senior supplier's primary function within the Board is to provide guidance regarding the technical feasibility of the project. The senior supplier role must have the authority to commit or acquire supplier resources required. If necessary, more than one person may be required for this role. Typically, the implementing partner, UNDP and/or donor(s) would be represented under this role.

[26] UNDP prodoc template https://info.undp.org/global/popp/ppm/Pages/Defining-a-Project.aspx#TemplatesForms

80. The MEE will appoint a **National Project Director (NPD),** who will be designated over the course of the project inception phase. The costs of the NPD role will be borne by the Government of Maldives as an in-kind contribution to the project. Project Assurance is provided by UNDP. This role ensures appropriate project management milestones are managed and completed. The National Project Director is a senior Government staff who will provide quality assurance in terms of ensuring project management milestones are managed and completed. The cost of the National Project Director is borne by the Government and does not have a cost implication on the project.

81. **Project assurance**: UNDP Maldives will provide oversight of project implementation to ensure a steady delivery and compliance with committed results; more specifically to ensure a compliance with M&E requirements and annual result reporting across indicators, project risk management, including financial risk management (adherence to the principles of competitiveness, fairness and transparency); auditing, securing independent evaluations, quality control and peer reviews.

Figure 2: Management and oversight arrangements



82. The **Project Manager** (PM) will lead the Project Implementation Unit and run the project on a day-to-day basis on behalf of the Ministry of Environment and Energy within the constraints laid down by the Project Board. The Project Manager function will end when the final project terminal evaluation report, and other documentation required by the GCF and UNDP, has been completed and submitted to UNDP. The Project Manager is responsible for day-to-day management and decision-making for the project. The Project Manager's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specified constraints of time and cost. PM will be a local staff contracted by UNDP and located at MEE. The Project Manager will be contracted by UNDP and located at MEE. Matrix reporting to UNDP and MEE will be in effect. Both Project Manager and National Project Director will both be represented in the Project Board

83. **Project-Support:** The PM will be supported by a core team of technical and support staff forming the Project Implementation Unit (PIU) located at the MEE to execute project activities, including day-to-day operations of the project, and the overall operational and financial management and reporting. Members of the PIU will be located within MEE as well at the islands on-site.

C.8. Timetable of Project/Programme Implementation

The implementation schedule with detailed activity progress timeline and output completion is provided in Annex X.

D.1. Value Added for GCF Involvement

84. This project is fully in line with the GCF's focus of promoting transformational change in developing countries. The project will increase climate resilience of water security for 105,000 most vulnerable people in the outer islands of Maldives (mostly north, but also central and southern atolls) that have been facing water shortages for over 10 years since a devastating tsunami of 2004 that washed away and polluted groundwater. In contrast to previous efforts of temporary solutions, ad-hoc approaches which have been a drain on opportunities for so many in the outer islands, not to mention on scarce Government resources, the problems will be now addressed comprehensively and sustainably to achieve climate resilient water security in the country.

85. Importance of the GCF involvement is three fold: (i) climate change projections across the Indian ocean suggest greater rainfall variability and sea level rise, which will present significant threats to small island states such as Maldives. Uncertainties around the groundwater replenishment potential as well as salinization processes are high. This requires additional investments into the diversification of water resources in order to maximize the water production and distribution capabilities across multiple sources (including harvested rainwater, ground and desalinated water). The GCF funding, by covering the incremental cost of a climate resilient water production system will enable the government to resolve a long term water security issue for the outer islands; (ii) Climate finance resources are critical given the precarious fiscal situation that faces the Government of Maldives (see Section E.4.2 for details) which prevents the GoM from addressing the challenge faced by communities in the outer islands on its own; and (iii) the dispersed nature of a small population (around 400,000 people) on 193 islands does not lend itself to generating the kind of economies of scale required for the private sector to provide water and sanitation services, including making investments in the requisite capital-intensive infrastructure. Without such economies of scale, it is not realistic to expect that the private sector, on its own will play a role in stepping up to the challenge.

86. The investment made by this project will demonstrate how an integrated water management system can build resilience to sea swells, storms, floods and changing rainfall patterns. Early warning information based on forecasted meteorological information will feed into the standard operating procedures for system management. It will also show how barriers around cost recovery, management and institutional capacities can be addressed successfully. Engaging communities and creating incentives to pay for the service of year-round, safe and reliable water supply services, which the project will promote, will be key to achieving financial sustainability of the improved system (including O&M activities of the island level IWRM system). The project will also contribute to financial sustainability by reducing the cost of operations by (i) prioritizing cheapest source of water (rainwater harvesting), recovering traditional water sources (groundwater) and use of expensive RO water only for back-up supply; (ii) reducing energy cost at least by 50% by switching from diesel based fuel to solar PV and promoting energy efficient RO technology; and (iii) improving utility management and service around O&M planning and implementation. With successful demonstration of this, the investment could effectively build a market platform for private sector investors in water and sanitation service delivery in future.

D.2. Exit Strategy

87. Sustainability of the project lies in its barrier removal strategy that will be three-pronged, namely: i) financial sustainability by promoting an integrated system which is inexpensive to run through expanded use of cheapest water first (RWH), and the use of energy efficient and renewable energy technologies to reduce the cost of desalinated water production; ii) management capacity development to enable efficiency of service delivery by the target utilities into the longer-term; and iii) community engagement and decentralized options for a sustainable and effective integrated water supply system that supplies safe and reliable water at the island level and promotes island level self-sufficiency. Through these measures a cost-recovery and financing of well-defined O&M plans are possible. However, in the immediate and medium term the MEE steps in with the commitment to cover the O&M cost for the next 10 years to secure an uninterrupted and a quality service water supply service to the target households (See Annex XIII). The O&M was calculated in the "worst case" scenario of lowest cost-recovery capacity.

88. Developing simple and affordable technologies based on island specific water budget assessments will offer cost effective solutions to island self-sufficiency. This is the core to the project strategy. Rainwater harvesting is a viable solution to meet water production targets inexpensively. Thus, it is prioritized by the project to make households as self-sufficient as possible via combined rainwater and groundwater supply. Projections of increasing rainfall variability, combined with changes in groundwater reserves, suggest that even with increased rain storage capacity (during severe drought periods or other extreme weather events), water shortages will persist. Where desalination is found to be a

necessary backup solution for dry season supplies, adoption of sub-regional, atoll level water distribution is the most viable, accruing great social benefits of timely water delivery to vulnerable people in need, as opposed to centralized and costly operation from Malé atoll.

89. Community engagement and participatory planning processes will be undertaken as a key workstream running through all outputs in order to get their weight behind the principle of cost recovery, because the financial viability of the system will largely rest on the ability to recover at least some of the operating costs, with the GoM stepping in with a better targeted subsidy for the rest, especially in the context of outer islands. Community-based financing and solutions for O&M cost-recovery will be viable in the islands with small and medium populations. Furthermore, the current increasing block tariff system in place in Malé provides a good example of a workable tariff structure for the islands. This type of structure includes both a lifeline tier for poor households and a conservation incentive for larger water users. The experiential information that is generated by this investment will serve to input into the methodology being prepared, and subsequent reviews by EPA, tariff setting criteria, performance targets and comprehensive guidelines that will build the utility and potentially the private investor confidence in cost-recovery water sector investment options.

90. Institutional capacity development at the different institutional levels (Utility, decentralized authorities and Central Government) will include continuous certified professional trainings and management system investments in financial management, performance monitoring and planning; these are essential capacity development investments into the sustainable knowledge-base for adaptive water sector development.

E.1. Impact Potential

Potential of the project/programme to contribute to the achievement of the Fund's objectives and result areas

E.1.1. Mitigation / adaptation impact potential

91. The project will directly contribute to a Fund level impact of increased resilience of water security. 105,000 people, out of which over 50% women will have uninterrupted, a year round access to safe and secure water in the face of climate change. A 90 day of reserved clean water will be secured and the exposure to the health risks from untreated water will be avoided. This will particularly benefit women, as a recurrent water stress adds to their daily household chores. Women are responsible for cleaning, cooking and washing in their homes and are affected not only by severe shortages but also poor quality of water that is available to them from the polluted groundwater. The GCF resources will be used to upscale the technologies across atolls and islands that have been tested by the Government. 32,000 people, including over 15,000 women across 49 islands in the 13 Atolls will benefit from direct investments in water production, distribution and management. These qualify as direct **beneficiaries** of **high intensity**. In addition, 73,000 people, including 46,000 women, across all northern atolls will directly benefit from effective dry season water supply; these are **direct beneficiaries** of **medium intensity**. A decentralized system of water production and distribution hubs for northern atolls will be more effective and timely, than the current system of centralized emergency water supply and distribution. Number of beneficiaries has been calculated, based on the latest census statistics[27]. The table below explains the GCF investment direct beneficiaries more accurately.

Table: GCF direct beneficiaries[28]

Categories of direct beneficiaries		Description of water production and distribution methodology	Total population	Female	Number of islands
A		4 IWRM islands (all three sources of water)	5,375	2,362	4
B		45 RWH islands (one or two sources of water)	26,625	13,133	45
C	*C=A+B*	*TOTAL for 49 GCF islands*	***32,000***	*15,495*	*49*
D		Hub and spoke model of dry season water supply across all islands in North (7 atolls, 91 islands) that will benefit from the new water production hubs under the A category; but do not include the C beneficiaries of the North to avoid double counting.	**73,000**	46,656	91
E		GCF supported islands (Central and Southern atolls) NOT in the North (counted under C)	14,939	6,926	25
F	*F=C+D*	*TOTAL for ALL population benefitting from GCF*	***105,000***	*53,582*	*116*

92. Furthermore, 190,000 **indirect beneficiaries**, out of which over 50% women, represent the total population of the outer islands to whom FENAKA and STELCO provide water and sanitation services. As a result of this project, these utilities will have improved service provision capacities and hence will manage their service delivery for greater satisfaction of the target island populations. Ground water quality will be improved to a good drinking water standard (in accordance with EPA standards) which will add to system resilience against expected climate change impacts, especially during dry years, when the banked water can be accessed at a lower cost than desalinized water. Water security may be measured as the increase in months where households have rainwater available to them for consumption. Islands in targeted atolls will no longer request dry season supplementary water and will no longer experience water shortages during the prolonged dry seasons that will likely result from climate change impacts.

93. The project will enhance overall adaptive capacity of the water sector by improving technical and management capacity of the utilities servicing the vulnerable outer islands, constituting 61% of the total population of the country. More specifically, a detailed standard operating procedures (SOPs) for all integrated water production technologies will enhance

[27] According to population projections there will be much more beneficiaries. For example, only from the RWR investment (category B) it is about 39,068 people which will benefit from the system in 2040

[28] Number of beneficiaries has been calculated based on the latest population census data of 2014.

service provision, both reliability and safety of water supply. Overall regulatory framework, including the protection, recharge and monitoring protocols for the groundwater, the primary water resource for the country, will considerably enhance the quality and quantity of the resource for the benefit of vulnerable populations of the outer islands. Environmental health improvements are expected, as a result. Baseline data will be collected at the start of the implementation phase on current burden of illnesses such as diarrhea, gastroenteritis, salmonella and other water and vector borne diseases, specifically for the target islands. Water quality monitoring together with structures and processes to involve island communities will create a local level leadership for water quality improvements and safety. Change in these indices will be measured towards the end of the project, and results will be disseminated to island communities to reinforce their support for the integrated water supply service.

94. Section E.3.1 has the complete list of performance indicators that will be monitored. Section E.2.2. outlines the benefits expected in terms of adaptive capacity (technology provision, water resource management, financial sustainability, participatory development processes and regulatory management) and resilience (promoting agency, empowerment and self-organization; maximizing diversity; promoting flexibility in water solutions and upgrading skills and knowledge.

E.1.2. Key impact potential indicator

GCF core indicators	*Expected tonnes of carbon dioxide equivalent (t CO_2 eq) to be reduced or avoided (Mitigation only)*	*Annual*	
		Lifetime	
	Expected total number of direct and indirect beneficiaries (reduced vulnerability or increased resilience); number of beneficiaries relative to total population (adaptation only)	*Total*	105,000 people
		Percentage (%)	26% of Maldives population
Other relevant indicators	1. Year round access to safe, affordable and secure water supplies at the island level; 2. Groundwater quality improvements against Environmental Protection Agency (EPA) standard; 3. % increase in groundwater recharge rate; 4. % increase in groundwater use as freshwater; 5. # of islands receiving dry season water 3 days ahead of need from decentralized, atoll-based water production and distribution hubs; 6. % of reduction in dry season water supply cost; 7. Levels of customer satisfaction with service delivery improved to a minimum of 70% of households.		

95. The main methodology for indicators presented above is a calculation of the number of direct beneficiaries both of high and medium intensity. Approximately 100 islands have repeatedly requested for dry season emergency water supply at least once during past five years (e.g. in 2015 - 77 islands). This is indicative of persistent water shortages that will likely become more acute with effects of climate change and hence fall under the government priority to address water supply needs. Government's objective is to eliminate a need for dry season emergency water supply altogether and make most islands and atolls water self-sufficient. The principal strategy is to achieve all year round safe and reliable water supply by optimizing the production and supply of all sources of water in an integrated and cost-efficient system. The government services a number of vulnerable outer islands through ongoing and committed investments with total value of US$96 million for 2015-2017 period. The GCF resources will complement the government investment and cover the total of 32,000 direct beneficiaries of high intensity (where actual water production investments take place). Additionally, as a result of this investment, 4 target islands with full IWRM methodology will have the sufficient water production potential to serve as regional hubs and cover 7 Northern Atolls during the dry season. 73,000 direct beneficiaries of medium intensity across 91 islands of all northern Atolls will benefit from the decentralized and timely dry season water distribution. Therefore, number of direct beneficiaries for year round safe and reliable water supply is the most appropriate impact indicator for this investment. Additionally there will also be 190,000 indirect beneficiaries that will benefit from the service improvements provided by the target water utilities (FENAKA and STELCO) that are jointly serving most outer islands. There are also a sub-set of indicators (listed above) that will be used to track the impact (see logframe section).

E.2. Paradigm Shift Potential

Degree to which the proposed activity can catalyze impact beyond a one-off project/programme investment

E.2.1. Potential for scaling up and replication (Provide a numerical multiple and supporting rationale)

96. The solution as explained in Section C.3 is an integrated water supply deployed through an affordable technology to achieve island level self-sufficiency in water resources. The long term self-sufficiency is achieved by combining three sources to secure sufficient redundancy of water all year round and in the face of climate change. The project is to introduce

the integrated water production and distribution technologies, operation and service standards, and water management capacities and policies. Under output 1, an innovative integrated water production and distribution system will be introduced through accessible and affordable technologies, whereby three sources of water will be combined to deliver a year round safe and reliable water to the vulnerable outer island communities; under output 2: a decentralized, timely and cost-effective dry season water distribution, at the sub-regional and atoll level will be operationalized; and under output 3 a groundwater protection, recharge and monitoring protocols will secure critical water reserves for resilient water security.

97. The theory of change lies in the barrier removal strategy described below whereby the conditions are being created that lead to sustained impacts for replication and scale up with a potential for about three times the initial impact. Number of key barriers (financial and institutional) that prevent a sustainable water system from being implemented will be overcome. By addressing these barriers necessary enabling conditions will be created. In addition, a case will be made, with quantified performance metrics, to Central Government and the decentralized authorities for replication in other islands and Atolls in the Maldives, considering the legislative mandate to provide clean water in the 2008 Constitution of the Maldives. Thus a paradigm shift could be realized.

98. Recently implemented demonstration projects including those financed by the Adaptation Fund (through UNDP) and USAID provide a blueprint for the integrated system at the island level, notwithstanding that every island has a unique set of conditions that will need to factor into the system design. There are three main barriers to designing and implementing an integrated water supply system, including i) cost recovery for operation and maintenance into the water supply systems ii) management capacity both at the Utility level and at the regulatory levels; and ii) institutional mandates, coordination and policy direction.

Each of these three main barriers will be addressed as follows:

i) Cost recovery:

- A fair and affordable **tariff structure** should be established to improve service standards and investment in the system over time. The current increasing block tariff system in place in Malé provides a strong example of a workable tariff structure for the islands. This type of structure includes both a lifeline tier for poor households and a conservation incentive for large water users. Tariff setting criteria and guidelines developed by the project will enable transparent and predictable tariff policy. This will in turn enable setting up the progressive, block tariffs to provide cost-recovery streams for service providers;
- The island's residents' **willingness to pay** for water services depends on seeing and experiencing obvious improvements in water quality and accessibility on the island. Participatory planning processes with communities to shape the system design will be undertaken as a key workstream in order to get their weight behind the principle of cost recovery. As mentioned previously, the financial viability of the system will largely rest on the ability to recover at least some of the costs. This will be achieved in two ways: (i) by reducing water production costs. This will be possible by increasing rainwater collection capacities and a ratio of rainwater into a water mix of a supply system; and by energy switch from an imported and expensive diesel to a grid-tied solar; and (ii) by improving quality of water supply service. This will be addressed through quality control, SOPs and management systems (see below). As such, considerable improvements in service quality and a reduction in production costs, will enable the possibilities for tariff restructuring, towards which the project provides technical criteria and detailed guidelines. The project will provide support to the Government of the Maldives in the development of a tariff setting policy appropriate to the specific circumstances of the Maldives. The Government fully recognizes that the lack of such policy is a key impediment to addressing water supply challenges in the Maldives. It is thus projected that the development and adoption of such policy will then facilitate the financing of similar projects on other islands of the Maldives. To the extent that other SIDS experience similar socio-economic and geographical conditions as the Maldives, it is expected that such policy will be of interest to other SIDS.

ii) Management capacity:

- Developing **SOPs** and guidelines for the operation of an integrated system which includes rainwater harvesting, ground water and desalinated water will enable replication of the integrated system to other islands;
- Capacities and capabilities of FENAKA will be strengthened through **trainings and management system investment** to a good standard of service delivery;

- **Technical certification course** established at the Maldivian Polytechnic Institute for continuing skill development of water engineers and water management practitioners.

iii) Institutional capacity:

- Central government institutions' **ownership through skills development** will be developed through trainings and investments in management systems;
- Development of **regulation** in MEE to drive investments into cost effective resilient water supply and sanitation investments through, development of quality standards for various aspects of infrastructure design, installation and maintenance and the development of public-private partnership contract modalities for emergency water distribution;
- **Management capability** through development of Information on performance metrics (e.g. impacts on health and productivity from investments in water and sanitation systems; cost effectiveness, and resilience of the system against a dynamic climatic baseline), which will serve to strengthen the business case for replication;
- Enhancing **institutional coordination**, for example, working with Ministry of Health staff at the island level as well as making use of their capability on water quality testing could be a driver for effective institutional coordination. Better coordination will provide the conditions for improved understanding of total water sector costs in implementing integrated water and sanitation systems, which can then be compared to performance measures, as well as highlighting where institutional oversight and management efficiencies can be made;
- Influencing of the wider policy **enabling environment** regarding tariffs, groundwater management and associated land use and zoning safeguards, rationalizing policy mandates across numerous institutions responsible for water management, safety, production and distribution. Enhanced institutional coordination at different institutional levels should be able to demonstrate alternative and efficient ways of working driven by the needs and system design at the island level. The project will therefore help to develop policies, the enabling environment in terms of tariff setting and incentives for water service provision and reduce fragmentation of roles. The improved enabling environment will eventually serve to attract private sector provision of services.

Replication potential

99. There is good replication value both within Maldives and for other small island developing states with similar environmental conditions. This project will provide safe and secure water for 105,000 people, which is 26% of the Maldives population. Taking away Malé and its population of 150,000 which is already served by a piped water supply system, there is a replication value of more than three times this proposed investment. Over 61% of Maldivian population live in outer islands where the proposed model will successfully apply. Therefore the replication potential is significant. Furthermore, notwithstanding, that every island has a unique set of conditions that will need to factor into the system design, a multifaceted approach offered by the project that is adjusted to the local Island and atoll specific circumstances may well serve as a model for other small island states in Pacific and elsewhere.

Potential to scale up the solution

100. The investment will demonstrate how an integrated water and sewage management system can build resilience to sea swells, storms, floods and changing rainfall patterns. Through the integrated system whereby all sources of water are managed more effectively and brought into the unified island level water budget will inevitably create sufficient redundancy in the resources thus, making the target islands fully self-sufficient. Complemented by increased water production capacity as well as decentralized and hence timely and cost effective water distribution mechanisms during the extended dry periods, atoll level water self-sufficiency will be created. Early warning information based on forecasted meteorological information will feed into the SOP for system management. It will also show how barriers around cost recovery, management and institutional capacities can be addressed successfully, building on the UNDP supported Adaptation Fund financed project and USAID project experience. This investment will demonstrate the effectiveness of additional inputs that are required to adapt current systems into climate resilient systems through performance indicators set out in Section D6.5. A public awareness and communications campaign will disseminate messages and results to other islands with similar challenges. International foras will be actively used to present.

E.2.2. Contribution to the creation of an enabling environment

101. The proposed project takes a multi-faceted approach to creating enabling conditions for continuous investment into the climate resilient water supply. The following are the key enabling conditions:

(i) affordable and scalable water production and distribution **technology provision** to secure safe and secure water for 32,000 people in 49 islands (direct and high intensity beneficiaries);
(ii) improved **water resource management** that enables aquifer abstraction rates to match sustainable aquifer yields, recharge of natural water storage facilities, catchment protection, and forward looking management of water resources to reflect climate change impacts on rainfall, by substantively contributing to the EPA guidelines to groundwater management, especially parts on monitoring protocols and replenishment methods as well as by designing detailed SOPs for all sources of water – a direct contribution to the subsidiary legislation of an upcoming Water Act;
(iii) **financial sustainability** by reducing the cost of production by (i) promoting the use of the least expensive water source first (rainwater collection), (ii) introducing energy efficient RO technology as well as renewable energy for operation of RO and pumps; and (iii) through structuring tariffs with full consultation with communities and decentralized authorities so that a reasonable level of cost recovery is possible and thereby securing O&M and a satisfactory level of service delivery;
(iv) optimized **regulatory management** in the water sector that promotes decentralized approaches to island and atoll level solutions for self-sufficiency both for water production and dry season distribution. Enabling decentralized approaches through **participation** of households and decentralized authorities in decision-making around system design including maintenance requirements and tariff structure, can promote inclusive development and representative governance.

Additionally, the key ways through which this investment will promote resilience[29] of the water sector is as follows:

1. Promoting **empowerment and self-organisation** at the island level so that the integrated system established reflects local priorities and enables local solutions for self-sufficiency;
2. Maximizing **diversity** in the water budget at the island level;
3. Use of meteorological forecast information to promote **flexible and adaptable** management of IWRM strategies;
4. Upgrading of **skills and knowledge** and promoting performance-based management at the institutional level for improved learning about what works, which will also enable replication to other islands.

The above approach and resilience principles will create a comprehensive enabling environment for climate resilient water security in Maldives.

E.2.3. Contribution to regulatory framework and policies

102. Section E.2 explains how the investment will help to develop management, institutional and regulatory capacities to provide water supply service delivery in a cost effective and environmentally sustainable way. The key outputs will be: i) Development of SOPs and guidelines; ii) updated management information systems at the public utilities (e.g. FENAKA), the decentralized authorities and central government; iii) a tariff setting criteria and detailed guidelines formulated so as to secure transparency and predictability in tariff setting policies, including the wider tariff and subsidy schemes to achieve better economic efficiency; detailed regulatory mechanisms for willingness to pay surveys with direct engagement of communities and local authorities to facilitate cost recovery and financial sustainability of water infrastructure at an island level; iv) groundwater protection regulations, including the catchment area protection through land zoning regulations v) regulations to allow for long term, whole sale service agreements for effective water distribution operations during the dry season; and vi) institutional role definition and coordination mechanisms between the key Ministries, departments, agencies, and local authorities responsible for various aspects of water policy formulation or implementation.

E.2.4. Potential for knowledge and learning

103. Implementation of concrete adaptation actions on the ground will constitute the primary learning experience, which will feed into all awareness, training and knowledge management actions facilitated and conducted by the project. More specifically the project will design and deliver training programmes in water management, planning and budgeting, expenditure management and performance monitoring for relevant atoll and island councils and the ministries (MEE, MoH).

[29] Resilience is a concept taken from ecological and social system theory, which says that 'the capacity of a system to absorb disturbance and re-organize while undergoing change so as to still retain essentially the same function, structure, identity and feedback'.

Additionally, certified courses for the utilities and sector specialists in the areas of water engineering, capital construction, operation, maintenance, financial management and planning will be introduced at the Maldivian Polytechnic training institute. This will enable an iterative learning process that will support the sector by developing a cadre of professionals who can support the sector. Additionally, awareness raising and advocacy works will be an integral part of all island-level project activities.

E.3. Sustainable Development Potential

Wider benefits and priorities

E.3.1. Environmental, social and economic co-benefits, including gender-sensitive development impact

The investment is expected to deliver the following sustainable development benefits:

104. The main quantified economic benefit of the proposed project is avoided water production and transportation costs, while securing all year round safe water supply to the most vulnerable segments of population in Maldives. A 90 day of clean water supply will be secured for target population and exposure to untreated water for drinking and cooking purposes will be avoided. More specifically, the historical average duration of the dry-period in the Maldives is approximately 90 days. It is however important to note that historically, water shortages experienced by the islands included in the project have been for a period shorter than 90 days since at the onset of the dry period, all existing water storage capacity is filled and will provide water supply into that 90-days period. When water shortages are experienced, they are experienced in the second-half of the dry season for various numbers of days, varying across islands and across years. The design capacity of the water supply systems in the project is to provide water supply for a period of 90 days, beyond the average duration of water shortages. Hence, the project provides a significant buffer for projected climate impact.

105. The project has multiple social and environment benefits listed below:

1. Reduced level of water insecurity which in turn will raise environmental and social wellbeing and economic productivity;
2. Lowered burden of ill health from the use of contaminated water (avoided damage estimate/dose response function depends on the level of pathogens found in ground water which depends on population density of the island);
3. Reduced greenhouse gas emissions through reduction of transportation for water distribution during the dry season;
4. Reduced flood damages through improved rainfall capture and diversion capacity, including improved infiltration of flood water;
5. Increased capacity through education and training on water resource management;
6. Lowered overall economic and social costs of water provision.

106. The magnitude of co-benefits will be scoped out in detail at the start of the implementation phase for the 49 islands in the 13 Atolls.

107. Additionally, this scalable investment would effectively develop the market for water and sanitation service delivery with knock-on impacts on the demand for technical and technology provision services and the employment multiplier that this ‘green industry’ could have. Anecdotal evidence supports assumptions that addressing water shortages will be source of job and income generation. First, it is often noted that the likelihood of water shortages decreases the potential for commercial investment, particularly in the tourism sector. Second, while the proposal did not aim to quantify the health benefits of providing clean water supply to the selected islands (as existing records do not allow a reliable quantification of these benefits), addressing these health costs will undoubtedly be source of income generation. The other main co-benefit would be in terms of keeping populations stable in the outer islands, thereby creating alternative growth poles in the larger islands which would take pressure off Malé and spread the benefits of growth more evenly, which will help to improve adaptive capacity for the Maldives population in the longer term. These benefits are likely to manifest in the longer-term and will not be formally part of the results framework, though household surveys conducted for this investment will track trends.

108. A gender analysis carried out in 2010 on three islands reports three findings with relevance to this investment. Data reveals that 73% of women control the household budget, and over 95 % of the respondents reported that women have a say on the expenditure of the household. Responsibilities for fetching water from public taps and wells is more or less evenly split between men and women, but with slightly more responsibility falling on women. This has two implications:

First, piped water system will profoundly improve women's and men's lives by removing the drudgery of collecting water from wells and taps and freeing time for education, children and other economic, social and cultural activities. This supports the investment proposal for a piped water supply as part of the IWRM solution. Second, women, who are largely responsible for bringing up children and would experience firsthand the impacts of ill health from polluted ground water supplies could be important agents for change to support a safe and affordable service delivery system and associated tariffs. The household surveys conducted for this investment will track the effects of the IWRM system on health and productivity. As such, the project directly contributes to SDG agenda in Maldives, more concretely will help achieve Goal 6 fully by ensuring availability and sustainable management of water and sanitation for all. The project will considerably contribute towards climate change goal 13 as well as the goal 5 on gender equality.

E.4. Needs of the Recipient

Vulnerability and financing needs of the beneficiary country and population

E.4.1. Vulnerability of country and beneficiary groups (Adaptation only)

109. Climate change is expected to present a number of profound challenges to the Maldives, in particular sea level rise, rainfall, temperature and extreme events. The Maldives 2007 National Adaptation Plan of Action (NAPA) identified the following key trends:

- *Sea level* is predicted to rise under all IPCC scenarios. In the Maldives the observed trend is approximately 3.1 mm/year increase in mean sea level, with a 7mm/year rate for extreme sea level rise. This means that storm surge events are on the increase. For example, for Hulhule a 70cm surge is currently a 100-year event, but this is predicted to become an annual event by 2050. The safe yield of groundwater for islands is expected to decrease with rising sea levels;
- *Rainfall* is expected to decline throughout the Indian Ocean region. In the Maldives, projections indicate a possible increase in extreme events. For example, currently a 180mm daily rainfall event occurs 1 in every 17 years on average; this is expected to occur twice as often by 2050. Dry seasons can expect to be drier;
- *Temperature* is expected to increase between 2.1°C and 3.2°C by 2050 and 2080 respectively in the Indian Ocean region. In Maldives, projections indicate that a 1.5°C rise can be expected by 2100. Sea surface temperature changes are already being observed across seasons with relatively high rates of increase. This will increase the rate of ocean bleaching and the risk of coral die-off during the local ocean spikes that occur during El Nino events[30];
- *Extreme events* – cyclones in the region are expected to increase in intensity. Currently 60 knot winds are a 1 in 16-year event on average but this is predicted to become a 9-year event by 2025. Cyclonic storm surges, if coupled with high tide, are predicted to reach 2.3m and will cause regular flooding on most islands.

110. The main vulnerabilities of water supply to climate change include:

- Rising global temperatures may result in greater heat stress for people and ecosystems, thus, increasing water withdrawal;
- Sea level rise and associated erosion of land which will erode the size of the groundwater lens;
- Storm events and associated flooding with negative effects on groundwater due to saline water intrusion and sewage pollution from island over-topping;
- Reduced annual rainfall affecting water availability and quality, as well as recharge of groundwater lens;
- Two drought issues are especially risky for Maldives: i) extended dry seasons during which harvested rainwater runs out; and ii) reduced overall recharge during the wet season, affecting the availability of groundwater.

111. Over 61% of the Maldives population lives in the outer islands, approximately 250,000 people and 160,000 women among them. Income levels in the outer islands are twice as lower as a national average. For example, monthly earnings of a household in an outer island is approximately US$600, whereas a monthly national average for a household exceeds US$1,116 (WB, 2014). The population in these islands typically suffers drinking water shortages in the 90 days of dry season, posing a significant water insecurity. Island rainwater tanks supplied water for only 8 months or less, indicating a major gap between supply and demand in the dry season. In 2004, an estimated 30 percent of the outer islands' population experienced water shortages, and since 2005 an average of 81 islands have requested "emergency" shipments of water to be delivered from Malé during the annual dry season, as the islands' stored rainwater reserves ran out, with an average

[30] The severe 1998 El Nino event raised sea surface temperatures around the Maldives by as much as 5C (World Bank, 2014)

of 3,500,000 litres being shipped out annually. Currently, the water emergency distribution is highly vulnerable because of the reliance on one source of desalinated water in Malé.

112. Other baseline stresses are excessive groundwater abstraction in relation to recharge, particularly on islands with higher population densities has led to salt water intrusion. Due to increasing demand and limited supply, it is projected that per capita groundwater availability for the Maldives will decline by 34 percent from the 2009 level of 103,000 litres/year, to 77,000 litres/year by 2035[31].

113. Sewage pollution of groundwater resources is a major problem and challenge for resilience to climate change impacts on rainfall variability, again particularly in the islands of larger populations[32], as well as having significant impacts on health and wellbeing. Population growth will mean that sewage discharges will increase by approximately the same rate, and the rate of urbanization (4.2%) will result in higher density communities with knock-on impacts on pollution from waste disposal.

114. The main barrier to investment is finance, with cost recovery levels being low, mainly due to high operating costs and low population solvency, which prevent investments in maintenance and renewal necessary for well-functioning service delivery. The dispersed nature of the population poses a unique challenge to the equitable delivery of basic services, as the small population of most islands result in severe diseconomies of scale. Among the essential services that have not reached all the people of the Maldives are access to safe drinking water and proper sanitation. There are other barriers – mainly management and institutional capacities which are explained in Section D2. Measures to improve these management capacities are addressed across all outputs of the project (see Section B3 for details).

115. The islands selected for this project are among the most vulnerable. These following selection criteria were used to select the islands where the principal investment will be located, specifically islands that:

- habitually request emergency water supply during the dry season (at least during the past five or more years);
- do not have any on-going water projects;
- are medium to big with higher number of population and with high population growth rates; and also with high population density (that limit potential for rainwater collection and therefore RO back up production is simply inevitable);
- can fit the above criteria and can potentially serve as new sub-regional hubs for dry season water supply (by creating an atoll-based hub of distribution and back-up supplies during shortages);
- do not have RO production potential are medium to small in population (with population decline or no growth and low population density – low density means land availability to increase RWH potential through placement of bigger tanks) and remote that incur high transportation cost during the dry season; and preferably with potential to recover the groundwater (groundwater available and is of some use and can be recovered).

E.4.2. Financial, economic, social and institutional needs

116. Financial and economic needs: Maldives' macro-economic environment is significantly distressed. The current account deficit reached 27% in 2013. Public debt escalated to 86% of GDP in 2013 and is expected to reach 96% of GDP by 2015. Maldives is deemed to be at high risk of debt distress. Furthermore, coping with small economies of scale is very challenging in providing water and sanitation capital infrastructure in small island nations like Maldives. High operating costs and small and dispersed population across many islands makes commercial viability of the water supply service difficult for populations of less than 1500. Furthermore, without adequate water services, people tend to move to bigger islands, especially Malé, where already a quarter of the country's population resides. These are disrupting the demographic and social fabric on the islands and interrupting the prospects of economic development. Other constraints in investing in water supply services are noted in section B1.

117. With more than 80% of the land less than 1 meter above sea level and more than 75% of critical infrastructure and 45% of dwellings within 100 meters of the ocean, and for water security to be so closely bound to rainfall and sea level rise, the potential for climate change to impact adversely on Maldives makes it a highly vulnerable country. Thus, GoM can ill afford, under the current fiscal situation, to protect its population against climate change. Yet, its people are highly vulnerable. Population growth over the next 30 years will compound the numbers that are vulnerable.

[31] WB study
[32] See for example, Arup, 2014.

118. Social needs: Section D.4 summarizes the expected impacts on the people of Maldives. In addition, there is low participation of communities in their island's development, leaving communities disenfranchised. Island authorities have a mandate but no funding to be able to lead their island's development. Services and opportunities are concentrated in the Malé region, with many of the outer islands having limited access to basic service provision and job opportunities. This adds to the service delivery challenge.

119. Institutional needs: Addressing basic service needs and strengthening decentralized models of service delivery is an important strategy to generating broad-based growth that is responsive of local needs, which can from the basis for further investment in resilience to climate change. The current situation is one where there is little meaningful decentralization, little or no policy direction to substantiate the objectives enshrined in legislation; no long-term plans; extremely limited budgets and high institutional fragmentation which wastes valuable resources at the Centre. Current water and sewerage systems suffer from "supply-based planning," in which local O&M capacity or ability to pay for the services is not taken into account during project planning, and communities are not willing to pay for costly O&M.

E.5. Country Ownership

Beneficiary country (ies) ownership of, and capacity to implement, a funded project or programme

E.5.1. Existence of a national climate strategy and coherence with existing plans and policies, including NAMAs, NAPAs and NAPs

120. Section C.1 explains the legislative mandate provided the Country's Constitution to provide water and sanitation services for all of Maldives' citizens as their right. There are two sectoral pieces of legislation that also establish water and sanitation as priorities for the countries: the Public Health Act (2012) and the Water Act that is being drafted at the moment.

121. The country does have a NAPA (2008) and an Initial National Communications (2001) that outlines adaptation priorities. The project will directly contribute to the following country adaptation needs as outlined by the National Adaptation Programme of Action: (i) acquire appropriate sewage treatment and disposal technologies to protect water resources; (ii) increase safe rainwater harvesting; (iii) acquire desalination technologies appropriate for small islands; (iv) undertake recharging of aquifers to reduce salinization from saltwater intrusion and storm surge flooding; and (v) Protect and preserve natural water catchment and coastal areas.

122. Furthermore, the First National Communication of Maldives prioritizes the following adaptation measures in the water sector: (i) ground water protection and the introduction of appropriate technologies to sustainably extract water from the shallow groundwater lenses, including protection of water catchment areas and land allocation to facilitate groundwater replenishment processes; (ii) Increasing rainwater harvesting storage capacity; and (iii) Desalination. Desalination technologies that are currently used in the Maldives depend on fossil fuel. The introduction and use of alternative technologies, such as solar powered desalination, or desalination using waste heat from powerhouses, is an attractive option to mitigate the country's vulnerability to fluctuating oil prices.

E.5.2. Capacity of accredited entities and executing entities to deliver

Accredited Entity

123. UNDP is one of the world's largest brokers of climate change grants for developing countries, with a current portfolio of US$1.34 billion in mitigation and adaptation grant-financed projects in over 140 countries, supported by co-financing of US$6.7 billion. UNDP has a 3 tier quality assurance system. Services that UNDP will provide to the Implementing Partner in support of achieving project Outcomes includes undertaking all procurement for the Project. UNDP's services will be provided by staff in the UNDP Country Office (Malé), UNDP Asia Pacific Regional Hub (Bangkok), UNDP Procurement Support Centre (Malaysia) as well as UNDP Headquarters (New York). UNDP will act as the Quality Assurance partner for the project.

124. UNDP Maldives is currently the custodian of a portfolio that includes projects that have had significant footprints in the areas of biodiversity conservation, coastal adaptation, tourism sector resilience, integrated water resource management, data collection and management for climate change mitigation and adaptation, energy, waste management and disaster risk reduction, in collaboration with the Ministry of Environment and Energy.

125. UNDP Country Office is in the final year of its current Country Programme (2011-2015) with a resource envelope of US$29,200,000 (core: US$3,173,000 (10.9%) and non-core: US$26,020,000 (89.1%).

126. Between 2011 and 2014, UNDP invested US$22.4 million in the Maldives' development from both UNDP's own resources and bilateral/other donor contributions. UNDP Maldives mainly focuses on supporting the consolidation of democratic governance (33% of resource); poverty reduction/policy and inclusive growth (7%); and environmental sustainability, climate change mitigation and adaptation, and disaster resilience (60%).

127. The Adaptation Fund and GEF are the two largest donor partners of UNDP contributing to 39% and 29% of total donor partnerships respectively in the Maldives. The Adaptation Fund is supporting an Integrated Water Resource Management project in three islands across the country with a total budget of US$8,285,000. Under the new Country Programme (2016-20), UNDP will concentrate its support on the two out of four UNDAF (2016-20) outcomes: (A.) citizen expectations are met by stronger systems of democratic governance; and (B.) inclusive, sustainable and climate resilient growth and development, and focus on women and youth as target groups across the two outcome areas.

Executing Entity

128. The MEE is mandated to formulate policies, regulations and standards related to environment, climate change, energy, water, sanitation, sewerage, and meteorology as well as facilitate the execution and observance of the policies and regulations in these areas. The Ministry has a long standing experience in engaging with international financial institutions and UN agencies in technical cooperation assistance towards achieving its aims within its institutional mandate. A Micro-Assessment of financial management capacity of the Ministry of Housing and Environment was done in 2011. In 2012 the Ministry was split into Ministry of Environment and Energy and the Ministry of Housing and Infrastructure. The Mid-Term Evaluations and audits conducted through UNDP of existing projects with MEE shows clarity and improvements in procedures. A new micro-assessment is being undertaken for the Ministry of Environment and Energy now[33]

129. The Water and Sanitation Department within MEE is one of the key institutions responsible for the water and sanitation sector. Very broadly, it is responsible for (a) formulating policies, regulations, and standards relating to the environment, water, and sanitation; (b) implementation oversight of infrastructure projects related to water and sanitation, including preparing bidding documents, appraising tenders, and providing overall supervision; (c) protecting the environment and planning sustainable development in its spheres of influence; and (d) developing and implementing policies on climate change, biodiversity, coastal and coral reefs and sustainable development. The Department at the Ministry is spearheading all policy formulation work on the water sector and managing the portfolio of US$217.98 million over the course of 2015-2017 (largely invested in sanitation).

E.5.3. Engagement with civil society organizations and other relevant stakeholders

130. The proposed project is based on over 4 years of work in Maldives to address the issue of water shortages in the outer islands. Discussions have taken place in Malé with government officials and extensive consultations have been held with local authorities and the communities in several outer islands on finding effective solutions to the difficult challenge that confronts both communities and the government. Specifically, consultations and willingness to pay surveys have been conducted on the islands of Mahibadhoo (Alifu Dhaalu Atoll), Ihavandhoo (Haa Alifu Atoll) and Gadhdhoo (Gaaf Dhaal Atoll). These consultative and fact finding works have underpinned the design considerations of the proposed project.

131. More recently, a series of stakeholder consultations was held upon the request of the MEE and supported by the UNDP in its capacity of accredited agency to the GCF. Four dedicated field mission were organized preceding the project formulation process. The first of these were in February 2015 where a UNDP technical team led by the Head of the Climate Change Adaptation Programming division met with Minister of Environment and Energy and technical personnel at MEE, including NDA to discuss Government needs and priorities with regards to climate change adaptation. A second mission was led by the Regional Technical Specialist, UNDP – Global Environment Finance Unit during the week of 30 March 2015. Extensive consultations were held with the main stakeholders, including the different relevant departments of MEE, NDMC, Maldives Meteorological Services, Local Government Authority and local experts in the area of climate change and water. The major consultation was held on Tuesday 16th June 2015 during the National Stakeholder Consultation Meeting where all major stakeholders provided feedback to the Project Concept. A Project Validation Meeting was held on 13th July 2015 to appraise and provide feedback to the full proposal document (see Annex VII).

[33] Cap dev strategy needed: Within MEE, only eight staff members are allocated to water and sanitation activities. Only four of these, including one new staff member, hold university degrees. One is an engineer retained from an ongoing project. Only one of the four qualified staff members is available to oversee policy and sector oversight. That ministry should have a larger critical mass of skilled employees and with a greater capacity to absorb a large additional workload.

E.6. Efficiency and Effectiveness

Economic and, if appropriate, financial soundness of the project/programme

E.6.1. Cost-effectiveness and efficiency

132. Cost effectiveness will be ensured with the following factors:

- Use of solar PV for energy generation to reduce the costs of operation the RO plants and pumping;
- Design an integrated system for optimality of water resources consumption – use the cheapest water supply option first (i.e. RWH);
- Maintain option value of ground water resources through coastal protection – insurance against extreme events in the future.

133. Efficiency:

- Base it on good practice and locally tailored solutions so that services delivered are effective and affordable.
- A fair and affordable tariff structure should be established to improve service standards and investment in the system over time. Willingness to pay the tariffs will be promoted through dialogues and participatory planning processes with communities to shape the system design.

134. Improving and scaling up of proven, RE enabled Integrated Water Supply System options in Maldives that are well adjusted to local (island and atoll level) geographic, hydro-climatic and socio-economic conditions will offer the most effective and efficient solutions to climate change induced water stress. In order to grant sustainable operations and drive additional investments the water tariffs will be restructured that are set at maximum cost-recovery rate for operations and maintenance, affordable, flexible and indexed in major cost component such as energy. Results of preliminary financial analysis of a Grid-Tied Solar PV RO Desalination system and a typical RO desalination system using electricity from diesel grid have been undertaken.

Item	Value	Unit
Water demand	100	litre/person/day
Target Population Size	1,000	person per RE-WS System
RO System Capacity	100	cubic meter/day
RO System with Diesel Grid		
CAPEX: RO Plant	2,320	USD/m3/d
OPEX: Other than electricity	0.32	USD/m3
Electricity Tariff + Subsidy	0.31	USD/kWh
Electricity input	4.30	kWh/m3
Project Life Time	25	years
Levelized Water Cost	2.10	USD/m3
Grid-Tied Solar PV		
CAPEX	3,000	USD/kW
Cpacity Needed	20	kW
OPEX	3	% of CAPEX
Converter Overhual	15	% of CAPEX every 10 years
Panel inefficiency	1	% per year
Hour with Sunshine	7	hr per day
Project Life Time	25	years
Levelized Cost of Electricity	0.14	USD/kWh
Total Electricity Cost (PV+Grid)	0.26	USD/kWh
Grid-Tied Solar PV-RO System		
Levelized Water Cost	1.89	USD/m3
Cost Saving	0.21	USD/m3

135. Based on available data[34] for Maldives and assumptions taken from recent IRENA study[35] show that because of a lower Levelized Cost of Electricity (LCOE) from Solar PV (US$ 0.10/kWh versus US$0.35/kWh from diesel grid in Maldives), a 10 per cent reduction in a unit cost of water production can be achieved by adding a Grid-Tied Solar PV to a typical RO desalination system. It should be noted that the distribution and administration costs are not included in the analysis as these cost are the same for both water production systems. Promoting the energy efficient and renewable options for the Reverse Osmosis (RO) water production will also offer a positive change in cost-benefit equation by

[34] State Electricity Company Limited
[35] Koschikowski, J. et.al., 2015, Technology Options for Renewable Desalination on Islands Report, International Renewable Energy Agency

reducing lifecycle energy cost by adding a grid tied RE, especially solar PV, to the WS system. With 8 hours of sunlight, up to 30% energy cost reduction can be achieved. In a short term a mobile RO unit could be an effective option in providing necessary water during the dry season in an emergency case (see also Section C.3 for additional analysis conducted by the Energy Department of the MEE). Subsequently, the economic analysis demonstrates that the economic net present value is positive and that the economic rate of return is greater than 20%. However, financial analysis showed that financially the project is not viable without granting the capital cost. Therefore, cost-recovery is only possible on operations and maintenance costs, provided that capital investment is covered through the grant investment (See also sections E.6.3. F.1).

136. Furthermore, the decentralized, including the hub-and-spoke model of emergency water production and distribution will significantly (at least by half) reduce the cost of the operation, thus lifting the financial burden over already strained national budget and re-diverting the scarce development resource towards the country's development priorities, especially in the water sector.

E.6.2. Co-financing, leveraging and mobilized long-term investments (mitigation only)

137. The government of Maldives has committed a total amount of US$ 4,493,940 towards the proposed project. This includes US$ 4,193,940 for 10 years of operations and maintenance costs for both water system equipment and rainfall gauges as well as US$300,000 for project management and implementation support. Additionally, over the period of 2015-2017 the MEE budgeted and committed over US$96.0 million to invest in water and sanitation services across the atolls targeted by the GCF and constitutes important parallel finance at the baseline.

E.6.3. Financial viability

138. The GCF grant resources being sought for this project help remove the barriers to finance part of the investments into Maldives' water production and distribution sector, which is critical due the country's acute water shortage problems, particularly in the dry atolls in the North, and increasing risks due to climate change. Due to the primarily public good nature and the existing tariff recovery structure in Maldives, the capital costs of installing the proposed RWH and IWRM systems under output 1 of this programme do not entail recovery of capital costs during the project duration. Several financial, technical and institutional capacity barriers in Maldives prevent setting up of an enabling environment for sustainable, least-cost supply and distribution of clean fresh water by integrating all three primary sources of water – groundwater, rainwater and desalinated water - and strengthening regulatory framework for water sector. These barriers can only be eliminated by public investment financed by grant resources from international development institutions such as GCF. As such, the public goods nature of this project's outputs doesn't entail capital cost recovery from the project's direct and indirect beneficiaries during the project duration. Hence, a detailed financial analysis to compute financial returns to the project's executing entity isn't deemed pertinent.

139. However, the increasing-block tariff model implemented by Male' Water and Sewerage Company (MWSC) in its areas of operation and the relatively high tariffs being charged to consumers connected to the water supply system in a few other Northern islands present an opportunity to move towards a tariff structure that enables full recovery of operational costs of water supply systems in the Northern Atolls where the 4 IWRM systems are proposed to be setup. Hence, a financial assessment is conducted to assess the level of operational cost recovery that is feasible at these 4 IWRM installations, if an increasing-block tariff structure for household consumers is implemented in these atolls similar to that in Male'.

140. Based on this financial assessment, if an increasing-block based water tariff structure is introduced in these 4 IWRM systems, the revenues generated from households can cover 33.5% of operational costs of these systems in their first year of operation. Given the estimated increase in population (and hence water consumption), the revenues thus generated can cover 36% of operational costs in 10 years. If the weighted average tariff across all tariff blocks is increased to MVR 150 per CBM (US$ 9.74/CBM), which is the flat tariff being charged in Hinnavaru Island, the revenues can cover over 60% of operational costs in first year, going up to 65% in 10 years. If the weighted average tariff across all blocks is increased to about MVR 250 per CBM (US$ 16.23/CBM),[36] 100% recovery of operational costs can be achieved.

141. This assessment demonstrates that the increasing-block tariff structure offers an opportunity to the government to move towards full cost recovery based operations of IWRM systems in outer islands, while retaining a subsidized lifeline tariff tier for poor households. This is a highly favourable outcome considering the current expensive model of delivering potable water from Male' to outer islands during shortages. This will trigger private sector interest in co-investing in the

[36] It is to be noted that this tariff necessary to achieve 100% operational cost recovery is just about 6% of the cost of bottled water in Maldives

water sector together with the government, which is limited by the current regulatory and tariff setting framework. This in turn will enable a move towards public-private partnership in the country's water infrastructure.

142. Direct involvement of Maldives' private sector is limited by the current regulatory and tariff setting framework in the country, and hence, this project also aims to create and enabling environment for future participation of both public and private sector investors for wholesale and competitive water distribution services. This includes assessing willingness to pay among households, setting tariff evaluation criteria and setting guidelines, in addition to reviewing and obtaining procedural approvals for changes to the framework.

143. For example, the current tariff in Hinnavaru is a flat tariff of USD9.7/m^3. For peak consumption on this tariff, 5% of income would be spent on water considering the average monthly household income in the outer islands (USD550)[37]. Payment avoidance witnessed is as high as 40% in Hinnavaru so two things need to happen, the first is that costs have to be kept down and remain affordable, certainly no more than households are paying now during peak periods, and communities have to put their weight behind and commit to paying the tariffs for improved water supply services. Furthermore, the nature of the integrated system using the cheapest water first and extending this as far as possible during the dry periods, restoration of ground water as an additional cheaper source compared to desalinized water and solar energy for RO and pumps will help to keep costs down and as close to the current tariff as possible.

E.6.4. Application of best practices

144. UNDP's Integrated Water Resource Management Project financed by the Adaptation Fund offers a good practice model for the proposed grant investment. The final design report of 2013 that has been approved by the Government of Maldives serves as a feasibility study and the key design guide for a good practice of integrated water production and supply. The key good practice technology design includes: (i) groundwater recharge, including improved wastewater treatment, especially a greywater separation; (ii) redesigned rainwater harvesting schemes, interconnected and structurally improved; (iii) energy efficient Reverse Osmosis plants for production and distribution system for desalinated water; (iv) switch to renewable energy for RO operation and UV purification. Beyond the technological good practice standard, the project will apply the international good practice for the water resource management in the context of anticipated impacts of climate change. The main elements will include: (v) Operation and Management Plans for the water production and distribution infrastructure, and decentralized management systems; (vi) transparent tariff setting criteria and detailed guidelines for predictable tariff policy (as part of the investor confidence policy); (vii) meteorological, especially rainfall observation data feeding into the Standards of Operations procedures for water infrastructure and water management system at large; (viii) water management planning at multiple tiers of governance: local island, atoll, and central levels; and (ix) improved water policies and safeguards for maintaining quantity and quality for safe and reliable water supply.

E.6.5. Key efficiency and effectiveness indicators

GCF core indicators	Estimated cost per t CO_2 eq, defined as total investment cost / expected lifetime emission reductions (mitigation only)	
	(a) Total project financing	US$_____
	(b) Requested GCF amount	US$_____
	(c) Expected lifetime emission reductions overtime	_____ tCO_2eq
	(d) Estimated cost per tCO_2eq (d = a / c)	US$_____ **/ tCO_2eq**
	(e) Estimated GCF cost per tCO_2eq removed (e = b / c)	US$_____ **/ tCO_2eq**
	N/A	
	Expected volume of finance to be leveraged by the proposed project/programme and as a result of the Fund's financing, disaggregated by public and private sources (mitigation only)	
	Not applicable	
Other relevant indicators (e.g. estimated cost per co-benefit generated as a result of the project/programme)		Not applicable

[37] USAID, 2012

F.1. Economic and Financial Analysis

145. The proposed investment is founded on a cost-effective solution that involves expanding the rainwater collection capacities at both household and community level. The purpose of the rainwater harvesting system (RWH) is to ensure the continuous supply of potable water for the population of the 45 selected islands over a period of 90 days. The main benefit of the system is to avoid the transport of potable water from Malé or other locations to the islands currently experiencing water shortages during the dry season and expected to experience increasing water shortages as a result of climate change and as a result of an increasing contamination of groundwater from both improper sanitation and increasing salinity arising from sea-level rise. Important benefits of the investment include access to safe potable water during the annual shortage period of 90 days and thus avoiding the exposure to health risks. Benefits of the RWH system are at a minimum twofold. First, it is expected that with the RWH system, there will be no need to transport water to the islands (mostly from Malé desalination plant). Hence, avoided water production costs and transportation costs are important benefits of the investment. Access to safe water and avoided health hazards is another important benefit. More specifically price of bottled water that many communities have to purchase during the dry periods are indicative of their willingness to pay for safe and clean water. This willingness-to-pay may serve as a minimum proxy value for all benefits of consuming clean potable water, including the health benefits associated with such consumption and is uniformly set at US$0.2 per 1.5l of incremental clean potable water. Overall, the net present value of the RWH system amounts to approximately US$ 15 million for the selected 45 islands. The investment offers an economic internal rate of return of approximately 27.2%, larger than the discount rate.

146. In addition to RWH infrastructure, RO plants for the desalinated water production will be installed on 4 selected islands of four atolls of the most Northern part of the Maldives. The large population of these islands explain that a RWH approach only would not be sufficient to provide the 90-day potable water supply objective of the Government. The net present value of the entire IWRM component of the project amounts to approximately US$ 8.7 million with an economic rate of return of 20.1%. Key other benefits include health benefits associated with the consumption of treated potable water, and the security of adequate potable water supply. Hence, the quantified benefits of the investment project are expected to be a significant under-estimate of the true benefits of the project.

147. Putting in place additional water production capacities will help meet growing water demands in the country. In the long term, when the groundwater reserves are recovered for potable water use, as a result of a direct contribution of the proposed project, the RO-based water production might be scaled down across the country, assuming that rainfall amounts will sustain rainwater collection and groundwater replenishment at a sustainable levels to meet water demands of growing population and economic development.

148. The purpose of the economic analysis is to assess the feasibility of the project strictly from a point of view of economic efficiency. In this analysis, the following parameters were used:

- The RWH and IWRM systems were assumed to have a life time of 25 years with no salvage value at the end of the assumed life time;
- Financial prices were adjusted to economic prices by removing taxes and other forms of government duties;
- Given existing labor conditions in the Maldives, the economic cost of labor (shadow wage rate) was assumed to be the market price of labor;
- A discount rate of 10% was used in the analysis. Please note that, in the absence of guidance in the proposal template on the selection of a specific economic discount rate to use in the economic analysis, all proposals supported by UNDP have opted to use a 10% discount rate, in line with the existing practice of multilateral development banks. Should the GCF request that all proposals submitted for review use the same discount rate and that this rate be other than 10%, we will be happy to revise the economic analysis accordingly.

The benefits of the RWH system are at a minimum twofold.

149. **First**, it is expected that with the RWH system, there will be no need to transport water to the islands (from Male desalination plant). Hence, avoided water production costs (at the Male desalination plant) and water transport costs (from Male to the islands experiencing water shortages) will provide an estimate of the economic benefit of the RWH investment.

150. **Second**, populations of the islands are regularly exposed to untreated water (collected from household roofs) for drinking and cooking purposes. Anecdotal evidence suggests high frequency of gastro-intestinal diseases and skin diseases associated with exposure to untreated water. However, an initial assessment on a limited number of islands indicates that empirical evidence is not sufficiently adequate to provide an estimate of the economic benefits from avoided health costs which the system would allow. For purpose of estimating the economic benefit of accessing clean potable water, an adjusted price of a bottled water is used as a measure of the willingness-to-pay to consume clean potable water.

151. In addition to the above two benefits, the IWRM system provides a **third** benefit as the IWRM system installed in the 4 islands will also serve as a center for providing emergency water to other nearby islands, thus avoiding transport costs from Male to these other islands.

152. The overall undertaking of the cost-benefit analysis includes the following key steps:

- **Step 1**: Establishing population projections over the period 2015-2040. Population projections will play a key factor in estimating the cost of the RWH and IWRM investments (the larger the population, the greater the needed capacity of the RWH), and in estimating their benefits (in the absence of the project, the larger the population, the greater the quantity of potable water has to be transported to the islands when shortages occur and the greater the cost of such activity).
- **Step 2**: For each island selected for investment, estimate the capital cost and O&M cost over the period 2015-2040.
- **Step 3**: For each island selected for investment, provide the best estimate possible of what could be water shortages over the period 2015-2040 and in so doing, estimate the total transport cost which would have to be incurred *in the absence of the project* to supply potable water to the islands.
- **Step 4**: Estimate the benefits of both avoided transport costs and of the incremental quantity of clear potable water.

153. The net present value of the RWH component of the project amounts to approximately $ 15 million with an economic rate of return of 27.2% (Table 1). Sensitivity analysis reveals the investment to be robust to significant increase in cost (20%) and/or decrease in benefits (20%).

Table 1: Base Case and Sensitivity Analysis for RWH Component

Scenarios	NPV ($ millions)	IRR
Base case	15.01	27.2
Cost +20%	11.1	22.6
Benefits -20%	8.5	21.7
Cost +20% and Benefits -20%	6.8	18.0

154. The net present value of the entire IWRM component of the project is lower than for the RWH component but positive and amounts to approximately $ 8.7 million with an economic rate of return of 20.1% (Table 2). Sensitivity analysis reveals the investment to be robust to significant increase in cost (20%) and/or decrease in benefits (20%).

Table 2: Sensitivity Analysis for IWRM Component

Scenarios	NPV ($ millions)	IRR
Base case	8.7	20.1
Cost +20%	5.9	15.8
Benefits -20%	4.2	15.0
Cost +20% and Benefits -20%	1.4	11.4

155. (See further details of economic analysis in Annex XII).

F.2. Technical Evaluation

156. The project is targeted to increase access to safe water and demonstrate climate-smart freshwater management schemes in the target islands and replicate practices across the country. In the proposed project, complying with the IWRM Principle of conjunctive use of water resources, potable water is provided by a combination of groundwater, rainwater and desalinated water, which is a new and unique project for the Maldives that has been tested successfully on a smaller scale in the context of three islands with AF funding. And with the GCF funding a greater geographic scope as well as broader improvements in enabling environment for conclusive solution to climate change driven water stress can be achieved. The proposed IWRM project has been designed to cover the selected 49 island communities.

157. The system has been proposed to incorporate rainwater as the primary source of water supplemented by desalinated water during the dry period. In addition, recharge wells have been proposed, expected to improve filtration of rainwater into the water lens. The need to develop, protect, monitor and conserve ground water as a primary source of water as the long term climate resilient sustainable supply to the community needs and the socioeconomic development, cannot be overemphasized. A Managed Aquifer Recharge (MAR) system is planned to be developed as one of the results and existing wastewater management system with a view to prevent any further pollution of the groundwater. In consideration of the Maldivian context, the nature and magnitude of municipal infrastructure that constitutes a significant component of electromechanical equipment with limited lifespan of not more than 20 years has to be planned meticulously. Thus, it is appropriate to design a water supply system for a mid-term period of about 20-25 years with the option to expand it in the future. Based on this consideration the design horizon for the proposed water supply system has been set at year 2030 that effectively complies with local requirement of minimum 15 years.

158. The existing technically feasible options for producing a quality potable water supply to the inhabitants of the project area are outlined below: 1. Community based rainwater harvesting system; 2. Desalination Plant to secure minimum water requirement in all situations; and 3. Groundwater recharge. Potable water produced from the two independent sources (rainwater and seawater) would be directly connected to the household to realize the ultimate goal of safe and sustained pipe-borne water supply system. The proposed integrated water supply system should essentially embrace the non-climate reliance desalination option due to unpredictable climate-induced rainfall pattern and the polluted ground water. Desalinated water is considered necessary during extreme climatic conditions as well as to supplement potable water from other inexpensive sources. This economically viable approach shall be environmental friendly and involve cost-effectively sound capital investment and minimum affordable production cost (operation and maintenance) to the end users. In view of the contaminated ground water source, the larger section of the population within the supply area needs to be provided with potable water from the proposed water supply systems and thus coverage area shall be 100% and the minimum per capita consumption would be limited to 20litres/day during extreme climatic conditions and emergency situations. This objective would be realized with combined community based rainwater harvesting systems and sea water desalination through reverse osmosis. The designs have been approved by the government of Maldives (MEE and EPA in 2013). These approved designs, feasibility studies are presented as part of this submission (see annex II).

F.3. Environmental, Social Assessment, including Gender Considerations

159. This project has completed the UNDP social and environmental screening procedure (see SESP attached as Annex VIa). It includes a summary of considerations as well as SESP results. This screening was undertaken to ensure this project complies with UNDP's Social and Environmental Standards. UNDP's Social and Environmental Standards were reviewed by the GCF accreditation panel and deemed sufficient to accredit UNDP to submit low and medium risk projects. The overall social and environmental risk category for this project is moderate. Specific project risks are listed in Section G below, together with appropriate mitigation measures.

F.4. Financial Management and Procurement

160. The financial management and procurement of this project will be guided by UNDP financial rules and regulations available here: https://info.undp.org/global/documents/frm/Financial-Rules-and-Regulations_E.pdf

161. Further guidance is outlined in the financial resources management section of the UNDP Programme and Operations Policies and Procedures available at https://info.undp.org/global/popp/frm/Pages/introduction.aspx

162. UNDP has comprehensive procurement policies in place as outlined in the 'Contracts and Procurement' section of UNDP's Programme and Operations Policies and Procedures (POPP). The policies outline formal procurement standards and guidelines across each phase of the procurement process, and they apply to all procurements in UNDP. See here: https://info.undp.org/global/popp/cap/Pages/Introduction.aspx

163. The project will be implemented following the National Implementation Modality (NIM) following NIM guidelines available here: https://info.undp.org/global/documents/_layouts/WopiFrame.aspx?sourcedoc=/global/documents/frm/National%20Implementation%20by%20the%20Government%20of%20UNDP%20Projects.docx&action=default&DefaultItemOpen=1 The NIM Guidelines are a formal part of UNDP's policies and procedures, as set out in the UNDP Programme and Operations Policies and Procedures (POPP). The NIM Guidelines were corporately developed and adopted by UNDP, and are fully compliant with UNDP's procurement and financial management rules and regulations. The national executing entity - also referred to as the national 'Implementing Partner' in UNDP terminology - is required to implement the project in compliance with UNDP rules and regulations, policies and procedures (including the NIM Guidelines). In legal terms, this is ensured through the national Government's signature of the UNDP Standard Basic Assistance Agreement (SBAA), together with a UNDP project document which will be signed by the Implementing Partner to govern the use of the funds. Both of these documents require compliance. The project will be audited in accordance with UNDP policies and procedures on audits, informed by and together with any specific requirements agreed in the AMA currently being negotiated with the GCF. According to the current audit policies, UNDP will be appointing the auditors. In UNDP scheduled audits are performed during the programme cycle as per UNDP assurance/audit plans, on the basis of the implementing partner's risk rating and UNDP's guidelines. A scheduled audit is used to determine whether the funds transferred to the implementing partner were used for the appropriate purpose and in accordance with the work plan. A scheduled audit can consist of a financial audit or an internal control audit. All GCF resources will be provided to the implementing partner, less any agreed cost recovery amount. Under UNDP's national implementation modality, UNDP advances cash funds on a quarterly basis to the implementing partner (executing entity) for the implementation of agreed and approved programme activities, in accordance with UNDP standard policies and the NIM Guidelines. The implementing partner reports back expenditure via a financial report on quarterly basis to UNDP. UNDP provides a variety of assurance activities which will comprise of (but not be limited to): (1) *Periodic on-site reviews (spot checks)* of the IP's financial records of cash transfers. These may be performed by qualified UNDP staff or third party service providers; (2) *Programmatic monitoring* of activities supported by cash transfers, which provides evidence regarding the state of programme implementation and use of the GCF resources; and (3) *Scheduled and special audits (financial or internal control)* of the IP's financial records and financial management systems of internal controls related to the programme. All details are available here: https://info.undp.org/global/popp/frm/Pages/Harmonized-Approach-to-Cash-Transfers.aspx UNDP prepares and reports financial statements in full accordance with the International Public Sector Accounting Standards (IPSAS). Full compliance with IPSAS was achieved effective January 2012. IPSAS was mandated by General Assembly Resolution 60/283 and is considered best practice in accounting for public sector and not-for-profit organizations. The National Implementing Partner will have contractual obligations to ensure compliance with UNDP's financial regulations and rules, including procurement policies. Procurements performed by the Government implementing partner will follow Government procurement rules provided they are assessed as not being inconsistent with UNDP procurement rules. Oversight will be performed by UNDP. Procurements performed by UNDP will follow UNDP procurement procedures. More specifically, UNDP has established three procurement review committees, each responsible for reviewing procurements within different monetary thresholds. Further details can be found in the contracts and procurement section of the POPP.

164. UNDP will ascertain the national capacities of the implementing partner by undertaking an evaluation of capacity following the Framework for Cash Transfers to Implementing Partners (part of the Harmonized Approach to Cash Transfers - HACT). The Harmonized Approach to Cash Transfer (HACT) framework consists of four processes: (1) macro assessments; (2) micro assessments; (3) cash transfers and disbursements; and (4) assurance activities. Assurance activities include planning, periodic on-site reviews (spot checks), programmatic monitoring, scheduled audits and special audits. During micro-assessment, there can weaknesses identified for which actions are required to addresses the gaps. When a spot check finds that the gaps are not addressed it will mean that the level of assurance activities will have to

remain higher and modalities of engaging with that implementing partner will have to be reviewed if necessary. All details are available here: https://undg.org/wp-content/uploads/2015/02/2014-UNDG-HACT-Framework-English-FINAL.pdf
All projects will be audited following the UNDP financial rules and regulations noted above and applicable audit guidelines and policies.

G.1. Risk Assessment Summary

165. As identified above, the project has a number of environmental and social risks associated primarily with the desalination plants and groundwater recharge. The risks associated with the installation of rain harvesting systems will be limited to erosion and sediment control. Given the elevation of the atolls, this is unlikely to be a risk. The main risks associated with the rain water harvesting is not securing the foundations of the system, thereby giving rise to the possibility of the tank shifting and potential creating water flow. The risk of this occurring is extremely low.

166. The risks associated with the desalination plants include impact on marine ecosystems with both the intake and outfall, including on important fishing grounds. By undertaking the relevant studies and community consultation, these risks will be reduced significantly. Given the size of the desalination plants, it is unlikely that, in comparison to much larger projects internationally, they will have short to long term significant impacts. The relevant mitigation measures are identified in Section F.3 of the proposal.

167. The risks associated with groundwater recharge are both environmental and social in nature. Environmentally, the risks include changing the biophysical and chemical characteristics that could result in the loss of an important ecosystem. However, without action, the ecosystems are likely to collapse as a result of past over use and extraction and the impacts of saline impacts through seawater inundation. With respect to social risks, recharging of untreated greywater can give rise to infectious diseases and moreover make the groundwater unusable. With the recommended mitigation measures as described in Section F.3 of the proposal undertaken, the risks of any short to long term significant impacts are greatly reduced.

168. Additionally, since water security is the main adaptation priority expressed in national communication, NAPA and other strategic documents, stability of political commitment is assumed, therefore no political risks are detected. Furthermore, the government has committed a co-financing towards the O&M that is confirmed in the letter of co-financing, hence O&M related risk has not been identified by the project proponents.

G.2. Risk Factors and Mitigation Measures

Selected Risk Factor 1

Description	Risk category	Level of risk	Probability of risk occurring
Activity: Mobilization *Spillage of construction materials.* The transport and supply of material, barges, excavator, truck and any other machinery may have impacts that may arise from accidental spillage of construction materials (e.g. cement); oils and other chemical spills. Further, there may be the release of actual construction material including but not limited to tanks etc	Social and environmental	Low (<5% of project value)	Low
Mitigation Measure(s)			
Precautionary measures, such as a site enclosure to be in place while loading and unloading of such materials and machineries at work sites under supervision at all times throughout the cycle of the process. The mitigation measure further reduces the Low level of risk.			

Selected Risk Factor 2

Description	Risk category	Level of risk	Probability of risk occurring
Activity: Mobilization *Accidental grounding of large vessels such as barges.* Propellers' wake can break fragile corals. Anchor	Social and environmental	Low (<5% of project value)	Low

damage from the vessels; Hazards of transport of material and machinery to site including overtopping of barges.			
Mitigation Measure(s)			
There are no Marine Protected Areas (MPAs) in the vicinity of any of the project sites. EPA approved vessel transportation routes will be fully complied with.			
Selected Risk Factor 3			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Machinery In addition to unlikely accidental damage caused to corals from barges and other machinery, these machines run on diesel fuel, which will have fuel management and handling issues in addition to carbon emissions and oil spill safety management plans. Poor handling and management of diesel and other fuel as in many islands, often lead to contamination of the aquifer. Degradation of the marine environment is unlikely for this component of the project.	Social and environmental	Medium (5.1-20% of project value)	Low
Mitigation Measure(s)			
Machines must be clean at all times and operated by experienced operators. Care must be taken when disposing of cleaning materials and changing oils. The mitigation measure further reduces the level of risk to Low.			
Selected Risk Factor 4			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Borehole construction *Salinizationn of the aquifer.* Failure of the borehole to enter the groundwater lens. Should this occur, groundwater is drawn into the system. The same applies to ocean intake pipelines, the failure of which could cause salinization of the aquifer	Social and environmental	Low (<5% of project value)	Low
Mitigation Measure(s)			
In order to mitigate the impacts of borehole construction, the borehole will be made using drilling equipment that can drill through hard bedrock. The borehole will be constructed using drilling equipment that is able to drill through sand and hard rock to penetrate to a depth of 30 to 40m. Also, a casing will be fitted and a bentonite sealant will be applied to protect saltwater interference and to protect contamination of the aquifer. The casing will be fitted as the drilling takes place and a bentonite sealant will be laid between the groundwater and the saltwater interface to ensure groundwater lens is not affected. The drilling of the borehole will have minimal impact on the aquifer. Boreholes have the advantage that sedimentation tanks are not required. The mitigation measure further reduces the Low level of risk.			
Selected Risk Factor 5			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Borehole construction *Contamination of the aquifer.* It may be necessary to watch for anaerobic conditions at such depths giving rise to ammonia in the water, which could lead to the formation of chloramines after treatment with hypochlorite.	Social and environmental	Low (<5% of project value)	Low

Mitigation Measure(s)			
Reports of ammoniac smell in raw water in systems where boreholes have been used are rare In the Maldives. Prior tests will be undertaken to avoid the risk.			
Selected Risk Factor 6			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Desalination Location construction, commissioning and operation Impact on Marine Environment as a result of the location on intake	Social and environmental	Low (<5% of project value)	Low
Mitigation Measure(s)			
Prior to the design and site selection on the desalination plants, relevant studies will be undertaken to ensure that the preferred location will not have environmental and social impacts. The mitigation measure further reduces the Low level of risk.			
Selected Risk Factor 7			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Impingement and entrainment *Marine environmental damage.* Marine environmental damage is a risk of desalination plants with potential marine damage to both the marine habitat and marine life. Seawater intake has a negative effect on marine life through both impingement and entrainment. Impingement involves the loss of marine life such as juvenile fish being killed during the intake process. The marine organisms that are small enough to pass through the intake screen such as larvae and plankton are killed through entrainment (salt water processing).	Social and environmental	Low (<5% of project value)	Low
Mitigation Measure(s)			
Impingement can be reduced through open surface intakes. Prior to the design and site selection on the desalination plants, relevant studies will be undertaken to ensure that the preferred location will not have environmental and social impacts. Using footvalves or filters can ensure impingement and entrainment are avoided. The risk of loss to larger organisms can be reduced through low intake of saltwater in addition to appropriate screens. Both boreholes and ocean intakes are recommended, however boreholes are preferred due to the prolonged life of RO membranes. In addition, no pipeline installation disturbances occur on reef areas, which is the case with seawater intake. The mitigation measure further reduces the Low level of risk.			
Selected Risk Factor 8			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Installation to brine outfalls *Damage to coral reef due to sedimentation and loss of habitat during installation.* Damage to the marine environment due to impacts on the marine environment through the intake and outfalls with associated brine (salinity), increased temperature and density of brine water being released; The potential release of chemicals used in the desalination process	Social and environmental	Low (<5% of project value)	Low

into the surrounding marine environment. Example chemicals used during the reverse osmosis process include but are not limited to chlorine, sodium hypochlorite, sodium bisulphate, heavy metals, anti-scalants; coagulants like ferric- or aluminum chloride; antifoaming agents like polyglycols; biocides; and cleaning chemicals. These chemicals can, if released incorrectly, have significant impacts on the environmental both spatially and temporally and over the medium term; and the impacts on marine and terrestrial systems as a result of increased pH (eg high alkalinity as a consequence of increasing the calcium carbonate, calcium sulfate and other elements in the brine water to almost double that of normal seawater and loss of habitat during installation. Marine habitats including reef and rocky outcrops affected by the installation and construction of the plant may be adversely impacted by laying of pipe work.			
Mitigation Measure(s)			
Prior to the design and site selection on the desalination plants, relevant studies will be undertaken to ensure that the preferred location will not have environmental and social impacts. The mitigation measure further reduces the Low level of risk.			
Selected Risk Factor 9			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Installation to brine outfalls *Impact on local fisheries.* The concentrated brine returned to the ocean as a waste product of desalination impacts and the location of infrastructure could impact on important fishing grounds for local communities.	Social and environmental	Low (<5% of project value)	Low
Mitigation Measure(s)			
EPA regulations will be followed and site specific studies will guide the selection of island specific locations as to minimize the impact on fishing grounds. Local community engagement mechanisms will be actively used to identify the fishing areas.			
Selected Risk Factor 10			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Use of recharge wells *Flooding.* If excess water from roof catchment is directed to recharge wells on roads, during heavy rain, the recharge wells may contribute to flooding.	Social and environmental	Medium (5.1-20% of project value)	Low
Mitigation Measure(s)			
One of the objectives of the recharge wells is to minimize flooding of roads with hardened road surfaces and other effects of urbanization contributing to flooding. Recharge wells may help to minimize such flooding by assisting drainage in flood prone areas, in which case the wells should be designed as part of a storm water drainage system and not for groundwater recharge. This impact shall be taken into consideration in designing recharge wells and shut-off mechanisms shall be incorporated as a mitigation measure. It is also recommended to consider skimming wells instead of recharge wells to			

minimize the effect of drawdown on the aquifer and subsequent coning effect. This is considered to help in the sustainable management of the water lens better than proposed recharge wells and would be more cost-effective. The mitigation measure further reduces the level of risk to Low.			
Selected Risk Factor 12			
Description	Risk category	Level of risk	Probability of risk occurring
Activity: Health and safety *Accidents and falls*	Social and environmental	Low (<5% of project value)	Low
Mitigation Measure(s)			
Health and safety training for all personnel will be undertaken.			

** Please expand this sub-section when needed to address all potential material and relevant risks.*

H.1. Logic Framework.

H.1.1 Paradigm Shift Objectives, Impacts and Outcomes at the Fund level[38]						
Paradigm Shift Objectives						
Increased climate-resilient sustainable development	The proposed project contributes to climate-resilient development pathways in Maldives specifically in the water sector. A year round self-sufficiency at the target atoll and island level is the main transformative achievement of the project. Such water self-sufficiency will be achieved on the outer islands where the most vulnerable parts of population reside. The sustained impact of project measures will have high potential for replicability and scale potentially covering at least to 61% of total population of the Maldives population.					
Expected Result	**Indicator**	**Means of Verification (MoV)**	**Baseline**	**Target**		**Assumptions**
				Mid-term	Final	
Fund-level Impacts[39]						
A2.0 Increased resilience of health and well-being, and food and water security	2.3 Number of males and females with year round access to reliable and safe water supply despite climate shocks and stresses.	Gender-sensitive Household (hh) surveys.	Currently no residents (male or female) in the target 49 outer islands have a reliable source of freshwater.	50% of target hh have year round drinking water security. (26,791 female and 25,709 male residents)	100% of hh in 49 islands have year round drinking water security. 105, 000 residents (53,582 female and 51,418 male residents)	Sufficient rainfall can be collected to help achieve water security.
Additional outcomes (if applicable)						
Core indicators/cross-cutting indicators						
H.1.2 Outcomes, Outputs, Activities and Inputs at Project/Programme level						
Outcomes						
A7.0 Strengthened adaptive capacity and reduced exposure to climate risks	Use by vulnerable households, communities, businesses and public-sector services of Fund-supported tools, instruments, strategies and activities to respond to climate	Gender-sensitive Household surveys. Water quality readings. Recharge and aquifer	No households are currently benefiting from the piped water supply services in the target islands; Groundwater quality does not meet freshwater quality requirements (and	8,000 households on target islands	20,000 households on target islands	Communities will be willing to pay for a good level of service delivery. Sufficient rainfall can be collected to help achieve water security.

[38] Information on the Fund's expected results and indicators can be found in its Performance Measurement Frameworks available at the following link (Please note that some indicators are under refinement): http://www.gcfund.org/fileadmin/00_customer/documents/Operations/5.3_Initial_PMF.pdf

[39] Please link the project/programme objective to one or more of the Fund-level impacts.

	change and variability. # of households using water supply service delivered. % increase in groundwater consumption (quality improvements) % of groundwater recharge rate increase	measurement tests	used for secondary or tertiary use). Groundwater quality and recharge rates will be established during the first six months of project implementation.			Groundwater can be recharged and the quality can be improved.
Expected Result	**Indicator**	**Means of Verification (MoV)**	**Baseline**	**Target**		**Assumptions**
				Mid-term	**Final**	
Project/Programme Outputs[40]						
Scaling up integrated water supply system to provide safe water to vulnerable households (at least 32,000)	# of hh on target 49 islands receive a year round safe and affordable freshwater supply (disaggregated by gender)	HH surveys Utility reports Island Council Water requests NDMC emergency water supply database.	Target island population do not have a reliable and functional water production and supply system, qualifying for annual water emergency supply.	At least 4,000 hhs (of which 50% women) on 49 islands receive a year round safe freshwater supply.	At least 6,400 hhs (of which 50% women) on 49 islands receive a year round safe freshwater supply.	Utilities fully adopt new management systems to improve service delivery, including O&M planning. Communities' willingness to pay rates are high and conducive for O&M cost-recovery.
Decentralized and cost-effective dry season water supply system introduced benefiting 73,000 people across the 7 northern atolls	# of people receiving dry season water 3 days ahead of need from decentralized, atoll-based water production and distribution hubs. % of expected reduction in dry season water supply cost	NDMC reports Atoll Council and Island Council water information records Utility reports	A total annual cost of emergency operation ranges between US$300,000-500,000, depending on number of islands serviced as well as a distance from the central supplier - Male'.	At least 40,000 people (of which 50% women, across 4 atolls) At least 20% reduction in dry season distribution cost.	At least 73,000 people (of which 50% women, across 7 atolls) At least 40% reduction in dry season water distribution cost	Performance results will influence policies and strategies at central government level towards meaningful decentralisation of water and sanitation service delivery.
Groundwater quality improved to secure freshwater reserves	% increase in Groundwater recharge rate	MoH reports HH surveys	Groundwater quality does not meet freshwater quality	Ground water recharge rates	Groundwater recharge rates maintained	Results of groundwater recharge and quality

[40] Outputs, Activities and Inputs at the project/programme level follow a cause-effect relationship (theory of change). For example, the Activities numbered 1.1 and 1.2 contribute to the achievement of Output 1. Inputs 1.1.1 and 1.1.2 contribute to Activity 1.1.

	% of use of groundwater as freshwater (Groundwater quality improvements against EPA standards)	EPA reports	requirements and only used for secondary or tertiary use and current recharge rates in target islands are 0%. EPA standards for groundwater quality are not met. Groundwater quality and recharge rates will be established during the first six months of project implementation.	increase by 30% At least 10% of increase in groundwater consumption by 20% of households as in integrated water mix in target islands.	at a minimum of 30%. At least 20% increase in groundwater consumption by 50% of households on the full IWRM islands as freshwater and / or in integrated water mix in target islands.	monitoring are communicated effectively to recover the trust into the resource.

Activities	Description	Inputs	Description
1.1. 11,502m^3 rainwater harvesting systems for 26,625 people installed in 45 islands	Detailed 49 island-level assessments and necessary engineering parameter calculations completed, including siting decisions; Community, especially women's engagement mechanisms established for system design in all target island, using island council structures; Tender documents formulated and all review and approval procedures completed.	Technical consultancy Construction company service Equipment procurement notice	Consultation processes Procurement and installation of water collection tanks
1.2. Standard operating Procedures (SOPs) prepared and used by utilities, local councils and households	Based on the AF, USAID and other good practice investments, apply and modify SOP procedures for users and suppliers, for all 3 sources of water; Series of 10 sensitization and training workshops organized combined with site-based demonstrations with at least 50% of female participation; SOP approval procedures undertaken at the relevant organisations.	TA consultancy Consultation Workshops Field missions	Broad-based consultation processes to facilitate technical inputs Community outreach and series of engagement workshops Institutionalization of SOPs
1.3. 4 RO desalination water plants in 4 islands installed and made operational, using a grid-tied and / or off grid solar PV technology to provide	Review and modify the design of the AF and USAID investments to adjust to 4 target island specific conditions and water production requirements; Formulate tender and procurement documents;	Construction company service Equipment procurement notice	Installations of RO plants and off grid PV panels (in places, if necessary, in case of absence of on-grid solar options)

backup capacity in times of water stress	Undertake 4 detailed assessments for 4 island specific RE powered RO infrastructure installation approval procedures.		
1.4 Ground water recharge system installed for excess rainwater collection from RWH systems and greywater recycling.	Review and modify the design of the AF and USAID investments to adjust to 49 target island specific conditions and water production requirements; Formulate tender and procurement documents; Undertake a detailed assessment for island specific systems.	TA consultancy Consultation Workshops Field missions	Installation of recharge facilities, including quality control and monitoring units
1.5. Tariff evaluation criteria and tariff setting guidelines designed and introduced	Undertake 4 household surveys (willingness to pay) and 4 financial assessments for 4 island specific water infrastructure investment; Based on existing UNDP, USAID and WB review reports, undertake consultations and a financial assessment for tariff setting criteria and detailed guidelines; Undertake all government approval procedures and 2 required training for tariff setting criteria and use of guidelines.	TA consultancy Consultation Workshops Field missions.	Broad-based consultations for consensus-based design and adoption of new tariff criteria and guidelines (to constitute new water tariff policy)
1.6. Training programmes in integrated water resource management, planning and budgeting, expenditure management and performance monitoring developed and delivered for relevant atoll and island councils and the ministries (MEE, MoH)	Undertake detailed skill profile surveys and institutional functional analysis to establish critical gaps and capacity requirements at the key water sector stakeholders; Design and deliver training programmers at least two a year in the course of the project implementation with at least 50% of female participation; At least 100 water sector practitioners both at national and island level will be trained.	TA consultancy Consultation Workshops Field missions	Targeted series of trainings with training of trainers (ToT) methodologies and client feedback mechanisms for further improvements
1.7. Certification courses for the utilities and sector specialists in the areas of water engineering, capital construction, operation, maintenance, financial management and planning introduced at the	Undertake curricular design and implement 5 professional training and mentoring for trainers, with at least 50% of female participation; Undertake procedures for certifications and approvals or associated budgets for the new training courses.	TA consultancy Consultation Workshops Field missions	Design and budgeting of certification courses, with international mentoring and / or partnership arrangement

Maldivian Polytechnic training institute (MP)			
2.1 Decentralized, sub-national water production and distribution hubs across five target atolls (both in the north and south) established	Undertake atoll level estimations to design water collection and distribution schemes during the dry season, at the atoll level; Design and implement improved piping systems to transfer water from jetties to island water kiosks at the atoll level.	Construction company service Equipment procurement notice TA consultancy Consultation Workshops Field missions	Design and approvals of new decentralized, atoll level water distribution mechanisms and protocols for 7 northern atolls. This includes monitoring against cost (transportation / diesel cost) and timeliness indicators.
2.2 Institutional coordination and accountability mechanisms between the utilities, the NDMC, MEE and LGA/ councils to facilitate cost-effective and timely water supply during dry season	Undertake legislation reviews to identify critical functional gaps and functional overlaps to optimize dry season water distribution operation; Formulate 3 regulations and 6 sub-laws to address the current institutional disconnect between the key government organizations playing a role in water supply system; Undertake 10 consultations, advocacy and approval procedures through the project Implementing Partner and Responsible Parties.	TA consultancy Consultation Workshops Field missions	Streamlining roles and responsibilities across all institutions in the water sector Institutionalization of the coordination mechanisms, including coordinated planning and budgeting procedures
2.3 Regulatory framework for competitive and wholesale water distribution services established	Undertake procedural review and consultations to formulate 2 enabling regulations for long term agreements for whole sale services for dry season water distribution; Undertake necessary procedural approvals to implement the new arrangement and set up a monitoring mechanism detect a change both in terms of timeliness of service delivery and cost.	TA consultancy Consultation Workshops Field missions	Broad-based consultations to establish a feasible and enforceable public and private partnership arrangement (whole sale service provision for dry season water supply)
2.4 Early warning system established on the basis of forecasted meteorological information for water emergency alerts and for effective operation of integrated water system	Improve coverage for rainfall observation network by procuring additional early gauges; Prepare tender and procurement documents with detailed specifications of rainfall gauges and siting; Undertake measures to connect with MMS online database for rainfall data and other indices.	TA consultancy Consultation Workshops Field missions Equipment procurement and installation service	Procurement and installation of rainfall gauges to ensure seamless data transmission and processing for early warning system
3.1 Baseline assessments (hazards inventory and catchment characterization) completed	Building on AF financed ground water assessments and other studies undertake the 4 target island specific aquifer assessments; Baseline assessment (hazards inventory and catchment characterization) and detailed	TA consultancy Consultation Workshops Field missions	Technical, filed-based studies arranged with participation of all responsible agencies (EPA, MOH, MEE)

	feasibility assessment for managed aquifer recharge for each island completed.		
3.2 Groundwater monitoring protocols with associated equipment and training delivered	Set up information inventory and feed into FENAKA information management system; Community dialogue on participatory management arrangements, including a water quality task force; In consultation with MoH and its local laboratories device and implement a groundwater monitoring protocol; Design and deliver 3 trainings for groundwater monitoring and quality testing with at least 50% of female participation; Monitor and evaluate groundwater recharge rates and water quality change.	TA consultancy Consultation Workshops Field missions Tender specifications for procurement	Procurement and a series of user training for the monitoring equipment
3.3 Regulatory framework established for coastal land use, including zoning to protect coastal catchment areas and enable natural recharge of groundwater lenses	Review land use policies and formulate regulatory framework for land use to protect groundwater catchment areas (maintenance of green zones, such as park, stadiums and other areas to allow natural replenishment); Implementation of recharge methods, especially flood water diversions; Consultations, led by island authorities, with communities Review 3 pieces of groundwater protection legislation, guidelines and standards and make necessary adjustments for greater protection and recovery.	TA consultancy Consultation Workshops Field missions	Formulation and approval of new groundwater protection policies Installation of recharge galleries to divert flood waters

H.2. Arrangements for Monitoring, Reporting and Evaluation

169. Project-level monitoring and evaluation will be undertaken in compliance with the UNDP POPP and the UNDP Evaluation Policy.

170. The primary responsibility for day-to-day project monitoring and implementation rests with the Project Manager. The Project Manager will develop annual work plans to ensure the efficient implementation of the project. The Project Manager will inform the Project Board and the UNDP Country Office of any delays or difficulties during implementation, including the implementation of the M&E plan, so that the appropriate support and corrective measures can be adopted. The Project Manager will also ensure that all project staff maintain a high level of transparency, responsibility and accountability in monitoring and reporting project results.

171. The UNDP Country Office will support the Project Manager as needed, including through annual supervision missions. The UNDP Country Office is responsible for complying with UNDP project-level M&E requirements as outlined

in the UNDP POPP. Additional M&E and implementation quality assurance and troubleshooting support will be provided by the UNDP Regional Technical Advisor as needed. The project target groups and stakeholders including the NDA Focal Point will be involved as much as possible in project-level M&E.

172. A project inception workshop will be held after the UNDP project document has been signed by all relevant parties to: a) re-orient project stakeholders to the project strategy and discuss any changes in the overall context that influence project implementation; b) discuss the roles and responsibilities of the project team, including reporting and communication lines and conflict resolution mechanisms; c) review the results framework and discuss reporting, monitoring and evaluation roles and responsibilities and finalize the M&E plan; d) review financial reporting procedures and mandatory requirements, and agree on the arrangements for the annual audit; and e) plan and schedule Project Board meetings and finalize the first year annual work plan. The Project Manager will prepare the inception report no later than one month after the inception workshop. The final inception report will be cleared by the UNDP Country Office and the UNDP Regional Technical Adviser, and will be approved by the Project Board.

173. A project implementation report will be prepared for each year of project implementation. The Project Manager, the UNDP Country Office, and the UNDP Regional Technical Advisor will provide objective input to the annual Project Implementation Report (PIR). The Project Manager will ensure that the indicators included in the project results framework are monitored annually well in advance of the PIR submission deadline and will objectively report progress in the Development Objective tab of the PIR. The annual PIR will be shared with the Project Board and other stakeholders. The UNDP Country Office will coordinate the input of the NDA Focal Point and other stakeholders to the PIR. The quality rating of the previous year's PIR will be used to inform the preparation of the next PIR. The final project PIR, along with the terminal evaluation report and corresponding management response, will serve as the final project report package.

174. An independent mid-term review process will be undertaken and the findings and responses outlined in the management response will be incorporated as recommendations for enhanced implementation during the final half of the project's duration. The terms of reference, the review process and the final Mid-Term Review (MTR) report will follow the standard templates and guidance available on the UNDP Evaluation Resource Center. The final MTR report will be cleared by the UNDP Country Office and the UNDP Regional Technical Adviser, and will be approved by the Project Board. The final MTR report will be available in English.

175. An independent final evaluation (FE) will take place no later than three months prior to operational closure of the project. The terms of reference, the review process and the final TE report will follow the standard templates and guidance available on the UNDP Evaluation Resource Center. The final TE report will be cleared by the UNDP Country Office and the UNDP Regional Technical Adviser, and will be approved by the Project Board. The TE report will be available in English. The UNDP Country Office will include the planned project terminal evaluation in the UNDP Country Office evaluation plan, and will upload the final terminal evaluation report in English and the management response to the public UNDP Evaluation Resource Centre (ERC) (http://erc.undp.org).

176. The UNDP Country Office will retain all M&E records for this project for up to seven years after project financial closure in order to support ex-post evaluations. UNDP will perform monitoring and reporting throughout the Reporting Period, including semi-annual reporting, in accordance with the AMA and Funded Activity Agreement (FAA). UNDP has country presence and capacity to perform such functions. In the event of any additional post-implementation obligations over and above the AMA, UNDP will discuss and agree these with the GCF Secretariat in in the final year of the project and will prepare a post-implementation monitoring plan and budget for approval by the GCF Board as necessary.

177. A detailed M&E budget, monitoring plan and evaluation plan will be included in the UNDP project document.

SECTION I

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

I. SUPPORTING DOCUMENTS FOR FUNDING PROPOSAL

- ☐ NDA No-objection Letter **Annex I**
- ☐ Feasibility Study **Annex II**
- ☐ Integrated Financial Model that provides sensitivity analysis of critical elements **Annex IIIa**
- ☐ Integrated Financial Model that provides sensitivity analysis of critical elements (xls format) **Annex IIIb**

Information is provided under the section E.6.3.

- ☐ Confirmation letter or letter of commitment for co-financing commitment **Annex IV**
- ☐ Term Sheet / Confirmation (as per AMA) **Annex Va**
- ☐ Term Sheet / Confirmation (as per AMA) **Annex Vb**
- ☐ Environmental and Social Impact Assessment (ESIA) **Annex VIa**
- ☐ Environmental and Social Management Plan (ESMP) **Annex VIb**
- ☐ Appraisal Report or Due Diligence Report with recommendations **Annex VII**
- ☐ Evaluation Report of the baseline project **Annex VIII**

Not applicable. *Evaluation Report is not available.*

- ☐ Map indicating the location of the project/programme **Annex IX**
- ☐ Timetable of project/programme implementation **Annex X**
- ☐ Project/Programme confirmation **Annex XI**

Additional Information

- ☐ Economic Analysis - Summary **Annex XIIa**
- ☐ Economic Analysis - IWRM (xls format) **Annex XIIb**
- ☐ Economic Analysis – RWH (xls format) **Annex XIIc**
- ☐ Additional Background Details **Annex XIII**
- ☐ Response to GCF Comments on Proposal **Annex XIV**
- ☐ Additional Supporting Documents **Annex XV**