ADAPTATION FUND

AFB/PPRC.18/24
7 March 2016

Adaptation Fund Board
Project and Programme Review Committee
Eighteenth Meeting
Bonn, Germany, 15-16 March 2016

Agenda Item 10

REQUEST FOR PROJECT REVISION AND BUDGET CHANGE: UNDP (MALDIVES)

Background

1. The Adaptation Fund Board (the Board) in its fourteenth meeting, approved the project "Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island" proposed by the United Nations Development Programme (UNDP) in Maldives (decision B.14/15). As mandated by the decision, an agreement was prepared and signed between the Board and UNDP. Following the Fund's standard legal agreement template the agreement states:

> *4.03. Any material change made in the original budget allocation for the Project by UNDP, in consultation with the Executing Entity, shall be communicated to the Board for its approval. "Material change" shall mean any change that involves ten per cent (10%) or more of the total budget.*

2. UNDP submitted to the Board, on 20 February 2015, through the secretariat, a request for budget revision. According to that request, the budget revision had taken place, and "[t]he revised financial figures, as presented by a sub-contractor (UNOPS) to the Government in their Project Implementation Document – PID were discussed and approved by the Project Board during its meeting on 22 October 2013". The request was complemented by the following documents:

a) The Project Implementation Document of the Govt's sub-contractor (United Nations Office for Processional Services, UNOPS) plus a Project Board letter of approval;

b) Revised budget lines under the component affected by the revisions (relating to only component 1); and

c) A table of the output-based budget comparing amounts allocated at the time of AF Board approval and following the revisions that have now taken place.

3. The Ethics and Finance Committee (EFC) of the Board discussed the above request at its sixteenth meeting on 7-8 April 2015. Several members of the Committee expressed the view that, rather than a shift of expenditures within the project, the changes proposed by UNDP had the effect of creating a completely new project that required further examination by the Project and Programme Review Committee (PPRC), and made a recommendation to the Board[1]. Having considered the comments and recommendation of the EFC, the Board decided to:

a) Request UNDP to provide the secretariat with the necessary information on the budget breakdown in order for the secretariat to conduct a full review of the revised project;

b) Request the Project and Programme Review Committee to review, intersessionally between the twenty-fifth and twenty-sixth meetings of the Board, the changes made to the project design and their impact in achievement of the project results;

c) Revert to the EFC with regard to the proposed changes in the budget with a view to making a decision at the twenty-sixth meeting of the Board; and

[1] AFB/EFC.16/8, Report of the Sixteenth Meeting of the Ethics and Finance Committee

d) Request the secretariat to communicate to UNDP that the Board expects that during the project design phase implementing entities will give due consideration to all the factors that may impact the project design and budget.

(Decision B.25/22)

4. The secretariat requested UNDP to provide the necessary information referred to in sub-paragraph a) of decision B.25/22, and also communicated to the UNDP the Board's expectation contained in sub-paragraph d) of the same decision.

5. UNDP submitted a revised project document and other information, and the secretariat conducted a review of the information provided by UNDP. When conducting the review, the secretariat applied the review criteria that were in place when the project was initially approved. On two occasions, the secretariat requested additional information. However, the secretariat did not receive all the requested information in time to make a recommendation to be discussed by the Board at its twenty-sixth meeting. Some of the necessary information was only received in January 2016. The review of the secretariat is presented below.

6. It should be recalled that at its twenty-sixth meeting, the Board decided to amend the Terms of Reference of the EFC and PPRC, so that the review of projects under implementation falls under the mandate of the PPRC, and not under that of the EFC as before. Therefore, the secretariat is submitting its review for consideration by the PPRC, with the understanding that the PPRC may consider all aspects of the request, and make a recommendation to the Board without reverting to the EFC with regard to the proposed changes in the budget as foreseen by decision B.25/22.

7. The secretariat has reviewed the formal request submitted by UNDP, as well as the following supporting documents:

a) The revised project document, dated 15 January 2016, with changes to the originally approved project document highlighted;

b) The Project Implementation Document of the government's sub-contractor (UNOPS) and a Project Board letter of approval, both submitted by UNDP;

c) Justification note, submitted by UNDP together with the request to approve the revised project document;

d) Revised budget lines under the component affected by the revisions as of 30 November 2015, submitted by UNDP;

e) A table of the output-based budget comparing amounts allocated at the time of AF Board approval and following the revisions that have now taken place, as of 30 November 2015, submitted by UNDP;

f) Memorandum of Agreement, between the Government of Maldives, represented by Ministry of Housing and Environment and the United Nations Office for Professional Services;

g) A response sheet to the technical review, dated 15 January 2016, submitted by UNDP.

Secretariat's review of the revised project document

8. The revised project document has the same total funding request as the document originally approved through decision B.14/15. The changes are only related to allocation of funds among outputs (budget) and the design of those outputs.

9. The main changes between the original and the revised project document have taken place between outputs 1.2 (rainwater harvesting schemes) and 1.3 (Production and distribution of desalinated water), with smaller changes to other outputs. As explained in the justification note (in annex) the proposed change in Output 1.2 from US$ 3,717,893 to US$ 1,392,481 relates to the removal of a household level rainwater harvesting component from the original design of an integrated water supply infrastructure. The note further explains: "The original plan of providing individual household rainwater harvesting tanks was excluded and the revised design now includes communal rainwater harvesting tanks that will capture the rain from the community / public buildings and adjacent private houses. This proposed change emerged from the post-tsunami evaluation, where individual household rainwater harvesting proved inefficient, operationally challenging, with difficulties of quality control as well as equity issues in terms of water access. In the initial design, it was anticipated that the water from the community rainwater storage tanks will be used only during the 90 day dry period and the storage capacity of the tanks were calculated for 90 day use. However, due to budget constraints and difficulty in obtaining land for construction of tanks of such size, local experts and project stakeholders advised to change the size of the tanks and water storage capacity. Hence, in the new design, the sizes of the tanks have been reduced and rainwater is to be mixed with desalinated water and pumped to the households throughout the year. With these new storage capacities, it is not sufficient to supply only rainwater for 90 days of the dry period, but these storage capacities will make water more affordable to the communities throughout the year and in the dry periods, the rainwater will last for the 90 days when mixed proportionately with the desalinated water."

10. The change in Output 1.3 from US$ 3,296,733 to US$ 5,645,653 correspond, according to the justification note, "primarily to the increased size of the centralized water distribution tanks ([Glass Fiber Reinforced Plastic] tanks installed in the central water distribution building – [Reverse Osmosis] Plant Building) which will collect the rainwater and the desalinated water before its mix for house-piped distribution, the inclusion of solar panels component from 1.2 to support the power system, and the inclusion of back-up generators that will ensure the reliability of the water supply system."

11. In addition to the main budget shifts above, the budget for Output 1.1 has been revised, so that a plan to construct and connect 700 groundwater recharging pits and 30 community recharge wells for the islands, after turning out not to be approved by the government stakeholders, has been changed to a plan to downscale the budget and use those resources to studies and design work. Further, in Output 1.4, the budget has been revised slightly upwards.

12. In addition to the budget changes an aspect of the project that was not clearly reflected in the original project document was the fact that the Component 1 had been

subcontracted to UNOPS. The need to outline the role of UNOPS was raised also by the technical review of the revised project document

13. The secretariat's review of the revised project document is included in an annex of this document.

Recommendation

14. The secretariat finds that UNDP has provided adequate reasoning for the changes made in the project design and budget.

15. Therefore the PPRC may consider and recommend to the Board, to: approve the revised project document for the project "Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island", as requested by the United Nations Development Programme (UNDP) including the budget changes made in that document.

Annexes:

1. The request to the Board to approve the revised project budget, dated 20 February 2015, submitted by UNDP through the secretariat.
2. The revised project document dated 15 January 2016, with changes to the originally approved project document highlighted.
3. The Project Implementation Document of the government's sub-contractor (UNOPS) and a Project Board letter of approval, both submitted by UNDP.
4. Justification note, submitted by UNDP together with the request to approve the revised project document.
5. Revised budget lines under the component affected by the revisions as of 30 November 2015, submitted by UNDP.
6. A table of the output-based budget comparing amounts allocated at the time of AF Board approval and following the revisions that have now taken place, as of 30 November 2015, submitted by UNDP.
7. Memorandum of Agreement, between the Government of Maldives, represented by Ministry of Housing and Environment and the United Nations Office for Professional Services.
8. The technical review of the revised project document conducted by the secretariat.
9. The response sheet, dated 15 January 2016, submitted by UNDP.

United Nations Development Programme

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February 20, 2015

Ms. Marcia Levaggi
Adaptation Fund Manager
Adaptation Fund Board Secretariat
MSN P-P-400
1818 H Street NW
Washington DC 30433
USA

Re: Adaptation Fund financed 'Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Islands' (the 'Project'): Request for budget revision.

Dear Ms. Levaggi,

We refer to the above Project and the associated grant agreement entered into between the United Nations Development Programme ('UNDP') and the Adaptation Fund Board ('AFB'). As previously informed, the budget allocation between outputs have changed beyond the 10% permissible threshold which we are bringing to your attention.

On behalf of the Government of Maldives ('GoM'), UNDP is writing to request approval from the AFB at its 25rd meeting in April, 2015 for the budget revision that has taken place. The revised financial figures, as presented by a sub-contractor (UNOPS) to the Government in their Project Implementation Document – PID were discussed and approved by the Project Board during its meeting on 22 October 2013.

In order to facilitate the AFB approval, we submit for your review the following documents:

1. The Project Implementation Document of the Govt's sub-contractor (UNOPS) plus a Project Board letter of approval;
2. Revised budget lines under the component affected by the revisions (relating to only component 1); and
3. A table of the output-based budget comparing amounts allocated at the time of AF Board approval and following the revisions that have now taken place.

A description of the changes and the reasons that necessitated the budget revision under the project component 1, along with the above referenced support documents, is annexed to this letter. We kindly request that this request and the associated documents be transmitted to the AFB.

Thank you for your collaboration.

Yours sincerely

Adriana Dinu
Executive Coordinator,
UNDP-GEF

ADAPTATION FUND

DATE OF RECEIPT:
ADAPTATION FUND PROJECT ID:
(For Adaptation Fund Board Secretariat Use Only)

PROJECT/PROGRAMME PROPOSAL

PART I: PROJECT/PROGRAMME INFORMATION

PROJECT/PROGRAMME CATEGORY:	Regular
COUNTRY/IES	Maldives
TITLE OF PROJECT/PROGRAMME	Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island
TYPE OF IMPLEMENTING ENTITY	Multilateral Implementing Entity (MIE)
IMPLEMENTING ENTITY:	United Nations Development Programme (UNDP)
LEAD EXECUTING ENTITY:	Ministry of Housing and Environment
AMOUNT OF FINANCING REQUESTED:	US$ 8,989,225.-
CO-FINANCING	US$ 1,800,000.- (Government of Maldives, in kind)

PROJECT / PROGRAMME BACKGROUND AND CONTEXT:

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

Geographic, Environmental and Socioeconomic Context:

The Republic of Maldives is an archipelago of 26 natural atolls and 1,192 small, low-lying, coral islands distributed along a chain that extends over 860 km from north to south in the Indian Ocean. The country has a combined land and sea area of 115,300 km^2 and an Exclusive Economic Zone (EEZ) of 859,000 km^2.[1] With an area in excess of 21,000 km^2, the Maldivian atolls are the seventh largest reef system in the world, and the largest in the Indian Ocean. Administratively, the country is divided into 7 regions/provinces, 20 atolls, 192 inhabited islands[2] and the capital Malé. The total population in 2008 was estimated at 298,968 people[3], over a third of which live in Malé.

[1] Statistical Yearbook of Maldives, 2006, http://www.planning.gov.mv

[2] Inhabited islands are where the main population lives and distinguished from islands used for tourism and other purposes, of which there are a further 168. The capital Malé is always treated separately and is not included among the inhabited islands.

[3] MPND 2008. Maldives at a Glance. July 2008.

The Maldives has a tropical monsoon climate, dominated by two monsoon periods: the northeast monsoon from January to March and the southwest monsoon from May to November. The southwest monsoon is the wetter of the two monsoons and is typically the period when most severe weather events occur. Average annual rainfall is 2,124 mm, with a gradient of increasing rainfall from north to south that varies between 1,786 mm and 2,277 mm, respectively. Daily temperature varies between 23^{o}C and 31^{o}C, with a mean daily minimum temperature of 25.7^{o}C, and a mean daily maximum temperature of 30.4^{o}C. Humidity ranges between 73% and 85% (National Adaptation Program of Action, 2007).

The only conventional water resources available on islands in Maldives are confined shallow groundwater aquifers, rainwater and small brackish/salt/fresh water ponds on some islands. The non conventional water resources include desalinated water, bottled water both from importation and local production. The main source of drinking water across Maldives still is rainwater and desalinated water especially on Male (capital of Maldives). In Villinigili and Hulhumale (two extended wards of Male), piped desalinated water is supplied to households on a 24hr basis and accounts for 25% coverage of safe secure water provision. In outer atolls, the main potable source of water is rainwater harvested on roof tops. However, the main concern is absence of water quality monitoring and assurance of water security measures on islands. Groundwater aquifers on islands from north to south are severely contaminated with untreated domestic wastewater discharged into ground due to absence of appropriate wastewater disposal systems on islands. For example, from 20 samples tested in north Ha.Dhidhoo, 30% of samples were identified with faecal coliforms; In tests from Ha.Nolhivaram, out of 17 samples 33% were found polluted by faecal coliforms.

The technology used in Maldives for water supply management includes low to high technology, ranging from roof top rainwater harvesting to seawater desalination. Water supply systems on outer islands are mainly from individual shallow hand dug groundwater wells, household and community rainwater tanks and water transportation on boats. Besides, there are no wastewater collections and treatment systems, except on a number of newly built resorts. Sewage treatment systems that are currently being designed and built are expected to minimize groundwater contamination. These schemes i are financed mainly from national budget (public sector investment-PSIP), loans, grants, development assistance and private sector investments.

Problem Statement: The Climate Change-induced Problem

The primary problem addressed by this project is climate change-induced decline of freshwater resources that is affecting the entire population of Maldives. Freshwater resources are scarce in the Maldives. As surface freshwater is generally lacking throughout the country (with the exception of a limited number of brackish water swampy areas in some of the islands), the key problems pertaining to freshwater security relate to the management of increasingly saline groundwater and increasingly variable rainfall patterns.
Groundwater is a scarce resource in Maldives, due to the hydrogeology of the country. The freshwater aquifer lying beneath the islands is a shallow lens, 1 to 1.5m

below the surface, and no more than a few meters thick. The thickness of the groundwater aquifer in the islands is determined by the size of the island and the permeability of the soil column. Adding to this is the critical determinant of **net rainfall recharge,** which is becoming more variable in a changing climate. Over the last few years the National Disaster Management Center has transported potable water to many islands facing acute water shortages due to prolonged dry periods costing over US$ 2 million every year.

Many freshwater aquifers are already stressed from over-extraction and face the risk of total depletion. This already precarious hydrological system is further aggravated by climate change-induced effects of sea level rise and flooding during extreme weather events, which increases saltwater intrusion into the freshwater lens. **Salinization of groundwater** is affecting the quality of life in the islands, as people depend on groundwater for washing, bathing and other non-potable uses. Saltwater intrusion is also affecting soil and vegetation, causing impacts on agriculture and terrestrial ecosystems. In addition, groundwater is stressed from the effects of flood-induced pollution, especially spillovers of septic tanks and spillage of human, animal and household waste during periods of heavy rainfall and inundation.

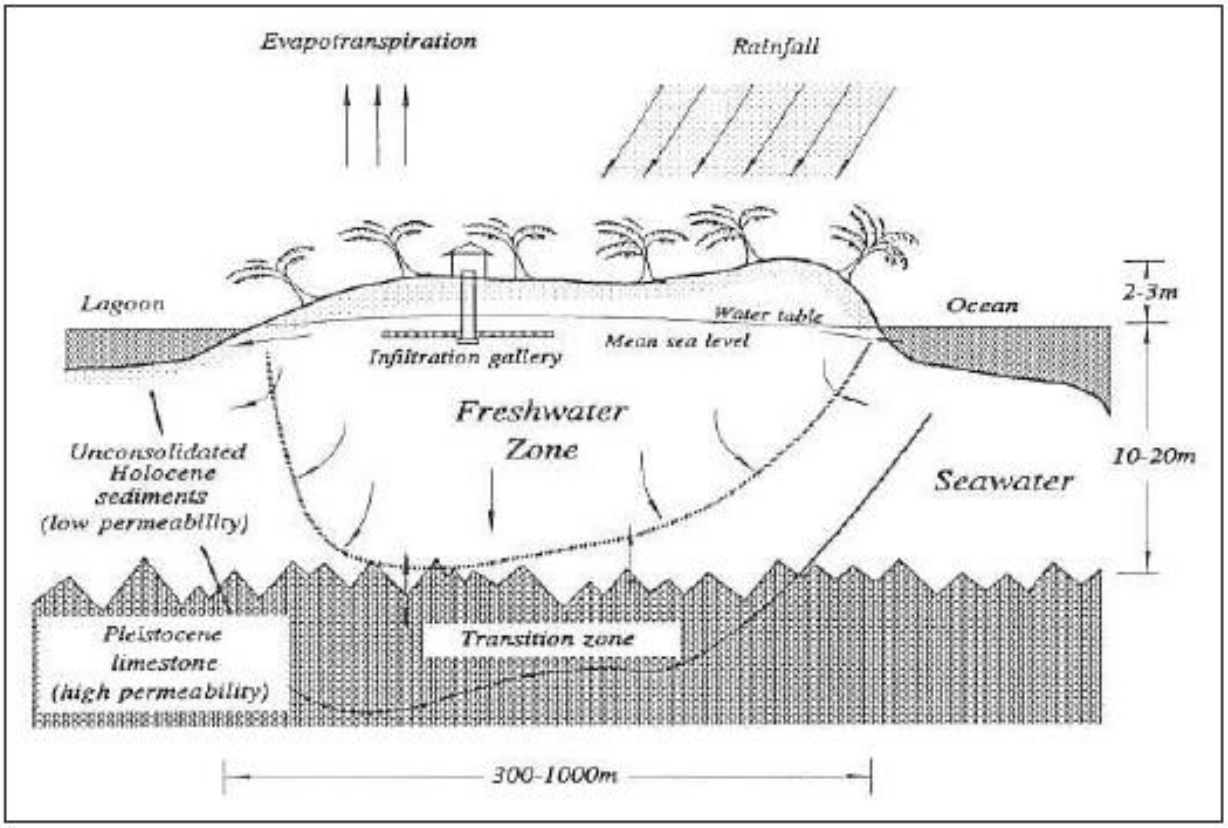


Fig.1: Typical groundwater lens on a small coral island, prone to salinization (Falkland et.al., 2007)

Roof top harvested rainwater is the main source of drinking water available on islands across Maldives. Overall, 77% of people in Maldives and more than 92% of households in outer atolls use rainwater for drinking (MPND 2006). However, due to limited storage capacity within house plots, householders can collect and store only

a small quantity of water (the average household storage capacity on islands across Maldives is 2500 liters). In dry periods, many householders experience a shortage of drinking water, which is due to shifting weather patterns and prolonged dry periods. In such instances, the government is called upon to transport potable water to the affected islands. Apart from water scarcity in dry periods, another major concern associated with rooftop harvested rainwater on islands is the absence of means to check water quality and employ biological or chemical water security measures: At present, no facilities are available on islands to test rainwater quality. In addition, the setup and design of existing rainwater storage facilities on many islands has proven to be vulnerable to loss and damage from flooding and high wave incidences, as demonstrated during events witnessed in 1987, 1991 and 1993.

Although the global average precipitation is projected to increase during the 21st century, a marginal decline in precipitation is projected for the Indian Ocean region (Nurse and Sem 2001). The predicted changes in precipitation have the potential to impact on rainwater harvesting across all the atolls. Drinking water shortages during dry periods will therefore prove to be a significant challenge for the atoll population.

Information derived from Climate Scenarios:

The adaptation rationale of the proposed project is confirmed by a number of climate change scenarios which are discussed in different sources:

- The First National Communication of Maldives to the UNFCCC (Ministry of Home Affairs, Housing and Environment, 2001);
- The Climate Risk Profile for Maldives, which was developed as input to the formulation of a National Adaptation Programme of Action (University of Waikato, 2006);
- A number of scientific publications about regional climate projections, which have contributed to the 4th Assessment report of the IPCC (e.g. Mitchell, 2002; Christensen et.al., 2007)

The First National Communication analyzes IPCC emission scenarios IS92a and IS92e to develop climate change scenarios using MAGICC and SCENGEN modeling software for the years 2025, 2050 and 2100. The models project that by the end of this century, the average mean temperature in Maldives will have increased between 2.0ºC and 3.8ºC, accompanied by sea level rise of 48cm to 95cm. The connection between increasing temperature, rising sea levels and declining freshwater resources was clearly made: The summary report highlighted that inundation of land and associated saltwater intrusion due to the predicted sea level rise will reduce the size of freshwater lenses and thus reduce fresh groundwater available in Maldives in the future. In addition, increasing temperatures have been related to greater heat stress of people and ecosystems, resulting in growing withdrawal of freshwater from aquifers and surface storage facilities. While the climate models interpreted by the National Communications project were not conclusive with regards to an overall decline or increase in rainfall, analysis of observational rainfall data for Malé between 1969 and 1998 has shown increasing variability and an average slight decrease in rainfall of 2.7 mm every year. Total annual rainfall for the meteorological station in Gan (southern Maldives) shows an average decrease of 7.6 mm of rainfall per year. The National Communication report concluded that “overall, local long term climate

recordings for the Maldives show that there is an increase in atmospheric temperatures and sea level while a decrease in rainfall is observed."

The Climate Risk Profile (CRP) for Maldives, which was developed as scientific input to the formulation of a National Adaptation Programme of Action (Hay, 2006) confirms the findings from the First National Communication. The CRP's analysis of future climate risk is based on output from 4 global climate models (GCMs) and 6 different IPCC greenhouse gas (GHG) emission scenarios for an approximately 3.75 by 3.75 degree grid square, which covers a large portion of the Maldives. The climate hazards that were analyzed are: 1) high sea levels; 2) extreme rainfall events (both 3-hourly and daily); 3) drought; 4) extreme winds; and 5) extreme high air temperatures. Combining observational data from Male atoll (Hulhule) with the output from 4 GCMs, the CRP established a best estimate projection of the maximum and minimum rates of change in future risk levels. In summary, the CRP found that all evaluated climate risks, including sea level rise, extreme high air temperatures, extreme rainfall events, and drought, are expected to increase over time as a result of global warming. The CRP found relatively high confidence in projections of maximum temperature, with annual maximum daily temperature projected to increase by at least 1.5ºC by 2100. A maximum temperature of 33.5ºC is currently a 20-year event in Maldives, but will likely have a return period of just three years by 2025. With regards to sea level, the CRP found that the observed long-term trend in sea level rise of 1.7 mm/yr (based on data for Hulhulé from 1989-2005) confirms projections by climate models. Even more extreme high sea levels are evident in the mean hourly sea level data, which show that maximum hourly sea level is increasing by approximately 7 mm/yr, a rate far in excess of the observed local and global trends in mean sea level. The CRP concluded that such exceptionally high sea levels are associated with greater short-term flooding, accelerated coastal erosion and salt water intrusion into groundwater. With regards to rainfall, the CRP confirmed high variability in observed daily, monthly and annual rainfall, including maximum rainfall, and no significant long-term trends. While climate models produce inconclusive rainfall projections, observational data from weather stations indicated considerable inter-annual and inter-decadal variability.

A number of recent scientific publications which have contributed analysis of regional climate change models and scenarios to the 4th assessment report of the IPCC highlight the effects of rising temperatures and sea level rise on the hydrological cycle in Maldives. A synthesis of 9 GCMs from Tyndall Center (Mitchell, 2002) confirms projections in temperature between 2ºC and 3ºC, and divergent rainfall projections (ranging between -20% and +20%) by the end of the century. The regional projections for precipitation developed by Christensen et al. (2007) highlight that annual precipitation changes across climate models for Maldives average out at a median of a slight 4% increase, but that most models perform poorly in the simulation of monsoon dynamics (which are the most relevant factor influencing rainfall intensity and distribution in Maldives).

Ultimately, all analytical work on climate change models and scenarios for Maldives to date has concluded that:

a) Temperatures will increase
b) Sea level will rise

c) Hydroclimatic variability and extremes will increase, and
d) Climate models are no reliable source of information to project rainfall trends.

While long-term observational data from hydro-meteorological stations across Maldives confirm increasing rainfall variability, there is agreement among climate change scenarios that increasing temperatures are causing a number of follow-on effects on freshwater resources:

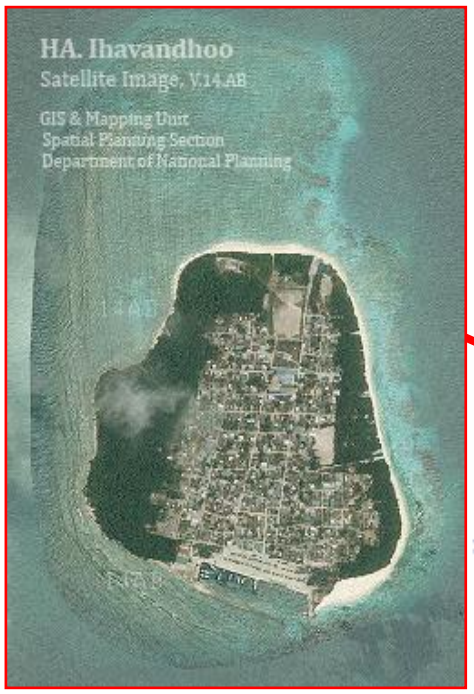
- Increasing temperatures result in greater heat stress of people and ecosystems, and consequently in increasing water withdrawal from groundwater aquifers and surface storage facilities.
- Increasing temperatures result in thermal expansion of sea water, which causes sea levels to rise and more saline water to infiltrate into groundwater aquifers.
- Increasing temperatures offset a portion of rainfall-induced groundwater recharge through effects of evapotranspiration (Jung, 2010; Wild, 2008). If future precipitation remains the same as today, freshwater recharge is expected to decrease due to an increase in evapotranspiration. Even if rainfall would increase slightly (as indicated by some climate change models at a low level of confidence), such gains would be offset by evapotranspiration in warmer temperatures.

Project Target Area:

The proposed initiative will increase the resilience of freshwater resources through an integrated management of ground- and freshwater resources in the islands of Mahibadhoo (Alifu Dhaalu Atoll), Ihavandhoo (Haa Alifu Atoll) and Gadhdhoo (Gaaf Dhaal Atoll). These three islands represent different geographical locations across the country, are densely populated and have a flat topography varying between 0-0.5m MSL. The geographical location and island settings are depicted in the following table:

	Longitude	Latitude	No. of families	Population (2011)*
ADh. Mahibadhoo	72.969066	3.75722	361	2038
HA. Ihavandhoo	72.926103	6.953145	360	2640
GdDh. Gadhdhoo	73.456435	0.289472	543	2023
			1264	**6701**

*Extrapolated from census data 2006, based on annual growth rates



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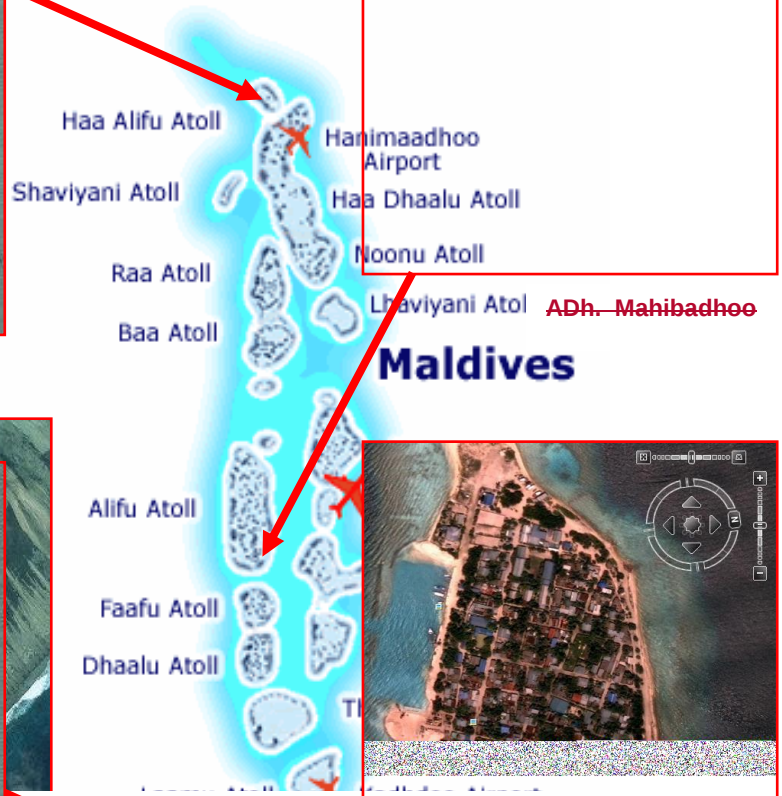

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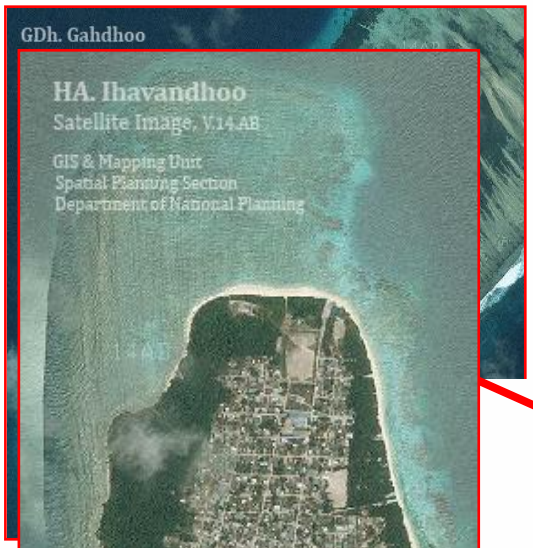
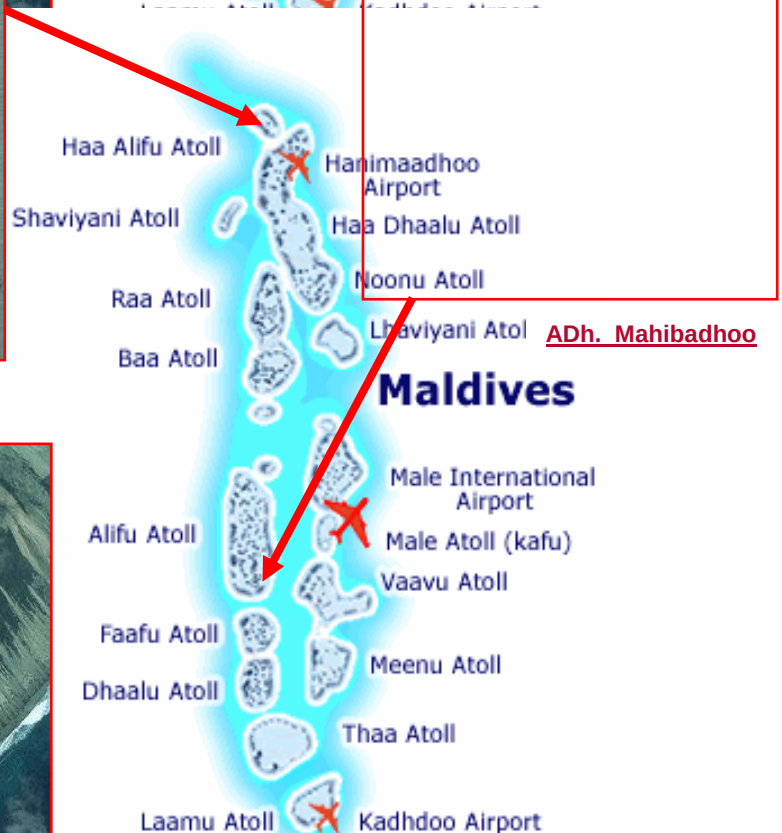


HA. Ihavandhoo



ADh. Mahibadhoo

Fig.2: Target sites of the proposed project

After approval of the AF concept, an assessment mission was conducted to the 3 target islands to verify the situation of communities with regards to freshwater supply (see Annex D). These assessments have confirmed that at present, the inhabitants of Mahibadhoo, Ihavandhoo and Gadhdhoo rely on rain water for their drinking water needs and on ground water for other purposes. However, due to shifting rainfall patterns, the available quality and quantity of drinking water has been declining. Ground water salinity is increasing markedly as an effect of reduced recharge/increased outtake, sea level rise and high wave impacts. In addition, poor sanitation facilities (especially unsecured septic tanks) have increased the contamination of ground water sources and rendered this source of water virtually unusable for domestic purposes. In consideration of these climate-related factors, the Government of Maldives is obliged to introduce a systematic approach to the integrated management of freshwater resources in a changing climate. The proposed project represents the first example of an integrated water management project which is based on principles of climate risk resilience and adaptive capacity.

Barriers to addressing the Climate Change-induced Problems:

In Maldives, similar to many other small island states, the limited natural water resources have not been properly managed. There is no appropriate mechanism at present for sustainable management of these resources. Freshwater undoubtedly is a scarce resource which requires planned and regulated management. One of the major issues that have continued for decades on islands is inappropriate wastewater disposal and inefficient rainwater harvesting practices. MWSA (2001) reported that there are significant problems with the currently used technologies used for waste water disposal and also with the robustness of rainwater harvesting practices.

With regards to adaptive, integrated water resource management in Maldives, the following barriers seem apparent:

1) *Public financing shortfalls lead to insufficient coverage of islands with integrated, climate-resilient water management systems*

The Government of Maldives has undertaken substantial efforts to improve freshwater security in a number of islands, using different financial mechanisms. These include funding from the national budget (public sector investment-PSIP), loans, grants, development assistance and private sector investments. Key players who contribute loan and grant financing to water management projects include WHO, UNICEF, UNDP, the World Bank, the Asian Development Bank, the Islamic Development Bank, JBIC, JICA, and the Kuwait Fund.

With the exception of Male', Vilingili and Hulhumale, inhabited islands on Maldives do not have a functioning water supply and distribution network available that can ensure sufficient supply of safe freshwater during dry periods. This situation is rooted in a lack of financial resources to ensure comprehensive coverage in such a widely spread island nation; high initial investment costs for alternative water supply (e.g. desalination); high initial investment costs for wastewater treatment installations; and high operation and maintenance costs in connection with centralized water supply and management schemes (with state subsidies required to keep them going).

At present, water utilities are being established in seven provinces across the country, with utility managers in charge of developing and providing water supply, sewerage and electricity services. However, these utility companies lack the capacity to address the issues mandated to them by the government. As a result, the target islands under this project do not have a functioning freshwater management system that can buffer the effects of climate variability and change.

2) *Lack of awareness about the impact of climate change on freshwater resources*

Besides general aspects of environmental awareness (e.g. the impact of environmental pollution on protective ecosystem services, the relationship between water quality and public health, and the benefits of a clean environment to the economy and society as a whole), there is limited awareness in most communities about how climate change is affecting the reliability and quality of freshwater supply. According to a stocktaking report by ADB (2005), capacity-building and awareness raising activities across Maldives were more concentrated on hygiene education rather than on an inclusive environmental health and management program to develop widespread understanding of the interdependence between human activity and fragile ecological and natural resources. In order to advance climate change adaptation objectives, awareness programs need to propagate the following messages:

- Freshwater is a natural resource which will become much more variable in a changing climate;
- Interconnected freshwater collection and storage systems can be an effective community-based climate change adaptation measure;

- Improper management of wastewater reduces the effectiveness of the ecosystem (especially with regards to the filtration capacity of the groundwater aquifer and the health of the coral reef) to buffer against the impacts of extreme weather events; and
- Water users on inhabited islands, which are currently using decentralized, individual systems, can benefit from interconnected, more robust and integrated water management systems that can effectively buffer supply bottlenecks in dry periods.

Key reasons why these messages are not yet propagated include weak political coherence for the message of integrated adaptation planning; lack of trained resource people available at island level who can guide inclusive participatory processes on water management issues; lack of local NGOs/CBOs with experience on integrated water resource management; and lack of adequate resource materials that addres water resource management questions at the interface with climate change and environmental protection.

3) Current practices of wastewater management undermine the resilience of natural freshwater storage against climate change

Shortages of clean and safe freshwater during dry spells are common across the country. As dry spells are becoming more pronounced with global warming, the water stored in rainwater tanks and the natural groundwater lens is crucial. In addition to unregulated extraction of groundwater from shallow aquifers, a major challenge for the conservation and protection of valuable groundwater resources during dry periods is the absence of appropriate means for domestic wastewater disposal. Sewerage systems built on islands discharge frequently untreated onsite and near shore, through brick masonry septic tank systems and near shore sewage outfalls, which heavily pollute island groundwater aquifers and the coastal environment with sewage. As such, these practices undermine the potential of the aquifer to buffer against climatic extremes and store sufficient freshwater for the affected island to make it through a dry spell without having to import bottled water.

Across Maldives, there are no large scale wastewater collections and treatment systems, except on a few newly built resorts. After the 2004 tsunami, with loans from development banks and support by donor agencies, sewerage systems have started to be built with fair treatment (e.g. gravel bed filters, vacuum systems etc) and central collection facilities with ocean outfalls. No considerations are still given to the relationship between growing freshwater stress in a changing climate and opportunities of wastewater reclamation and reuse. Hence, it is essential to connect wastewater treatment planning to considerations of long-term freshwater supply, and to make sure to treat the management of wastewater and the management of freshwater in an integrated manner. If this connection is not made, the lack of proper wastewater management planning will undermine all efforts of adaptive rainwater harvesting and groundwater management schemes to buffer against climate-related hazards.

4) Institutional Capacity Barriers

Outside the capital Malé, the Maldives has a shortage of professional capacity in all

sectors and at all levels of environmental management, especially at the level of atoll and island administrations. The Climate Change and Energy Department (CCED) has limited staff and budget and its main role to date has been to develop climate change & energy policies, programs, projects, oversee implementation of climate change related projects and engage in the international climate change negotiations, in which the Maldives is actively and successfully engaged. The Water and Sanitation Department (WSD) is the lead government agency dealing with water and sanitation policies and programmes in the country. The Environmental Protection Agency (EPA), which is mandated to oversee the Environmental Impact Assessment (EIA) process, amongst other functions, has greater human resources than the CCED, but also suffers from severe technical capacity constraints. The EPA has few staff who can evaluate the implications of proposed water management projects in the context of a changing climate, or identify locally appropriate adaptation options in the field of water supply management. Generally, there is little knowledge available about the possible range of locally appropriate adaptation options for water resources planning, including the costs and benefits of different high-tech and low-tech options and how to combine them. These capacity gaps in climate risk planning are even more apparent with authorities at the atoll and island levels, as historically all development planning was done at the national level. Such capacity is increasingly critical, given that many national planning and decision-making functions will be devolved to the atolls and islands through a decentralization programme.

5) Insufficient Policy Implementation and Enforcement

Despite the existence of an Environmental Act adopted by the Peoples Majilis in 1993 for environmental protection, the apparent gap in the country's legal framework is the absence of relevant laws and regulations that enforce better environmental governance. Major causes of these weaknesses are the lack of stability within the government system and absence of institutional mechanisms for environment management at the community level. Written policy statements related to water resources (e.g. groundwater aquifers) protection in the country have for the first time been documented in 1989 in the First National Environment Action Plan, followed by other policy level documents namely the Second National Environment Action Plan 1999, the First Health Master Plan 1996 – 2005, the Fifth National Development Plan 1997 – 2000, the Sixth National Development Plan 2001 – 2005, the Seventh National Development Plan 2006 – 2010, the Five Year Activity Plan (MWSA) 2006 – 2010, the Water and Sanitation Master Plan 2008, the Maldives National Strategies for Sustainable Development 2009, and the Third National Environment Action Plan 2009.

Despite the fragmentations, the key national policy on water and sanitation has always been to provide access to safe drinking water and improved sanitation to all Maldivians.
Provision of access to safe water and adequate sewerage system to people in Maldives
became a constitutional right for the first time in 2008 under Article 23 of the new constitution. Yet, despite the availability of proper policies, policy compliance and enforcement is still weak across the country, which is mainly due to a lack of

infrastructure for pollution monitoring, trained resource people at island level, and a shortage of finance for decentralized enforcement of compliance with environmental and water management guidelines. The country needs to find a comprehensive approach to the implementation of national water policy in highly decentralized settings, giving proper consideration to good practices of climate-resilient water governance that are suitable and appropriate for the situation in outer islands.

PROJECT / PROGRAMME OBJECTIVES:

The proposed project is responsive to objectives spelled out in the Government of Maldives Strategic Action Plan 2009, the 3rd National Environment Action Plan (NEAP -3, 2009), the National Sustainable Development Strategy (NSDS 2009), and the National Adaptation Programme of Action (NAPA, 2007). For details on policy coherence, please see Part II, Section D of this project concept.

Project Objective:

The objective of this project is to ensure reliable and safe freshwater supply for Maldivian communities in a changing climate.

Project Strategy:

The primary problem addressed by this project is a significant, climate change-induced decline of freshwater security that is affecting vulnerable communities in Maldives. As surface freshwater is generally lacking throughout the country, the key problems pertaining to freshwater security relate to the management of increasingly variable rainwater resources and increasingly saline and polluted groundwater. In order to reduce the aforementioned barriers to effective climate change adaptation in the water management sector, it is essential to reinforce the perspective of Integrated Water Resources Management (IWRM) on inhabited islands. This will ensure that measures responding to additional, climate change-related risks (such as greater rainfall variability, unreliable recharge of aquifers, longer dry periods, and increasing damage to infrastructure from extreme weather events) are addressed in concert with a response to basic development problems (such as insufficient sewage and wastewater treatment, lack of environmental awareness, lack of water conservation, and lack of comprehensive stakeholder participation in the design and monitoring of water management schemes).

Through the rollout of an integrated water resource management programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo, the project will ensure consistent, safe and equitable access of all island communities to safe freshwater in a changing climate. Through a targeted mix of the following investments, the project will address the effects of variable rainfall, extreme weather events, salinization and pollution of aquifers:

- Establishment of a sustainable freshwater supply system that incorporates and integrates rainwater harvesting and desalination technology;
- Improvement of groundwater quality through artificial groundwater recharge and better integration between freshwater and wastewater management;
- Increasing community participation in the development, allocation and monitoring of freshwater use in a changing climate;
- Replication and up scaling of climate-resilient freshwater management

PROJECT / PROGRAMME COMPONENTS AND FINANCING:

The following table has been prepared in alignment with the Adaptation Fund Strategic Results Framework. For details of Outputs and corresponding activities, please refer to Part II, Section A of this concept.

PROJECT COMPONENTS	EXPECTED OUTCOMES	EXPECTED CONCRETE OUTPUTS	AMOUNT (US$)
1. Establishment of integrated, climate-resilient water supply and -management systems in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo	1. Ground water aquifer rehabilitated and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo to provide reliable, equitable and cost-effective access to safe freshwater in a changing climate	1.1 Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons	~~228,296~~ 188,163
		1.2 Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods	~~3,717,893~~ 1,392,482
		1.3 Production and distribution system for desalinated water supply established	~~3,296,733~~ 5,645,652
		1.4. Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods	~~77,476~~94,101
2. Increase participation in the development, allocation and monitoring of freshwater use in a changing climate	2. Strengthened local awareness and ownership of integrated, climate-resilient freshwater management	2.1. Community consultations on each target island ensure participative design, sustainability and continued maintenance of integrated water resource management schemes	70,000
		2.2.Targeted training events conducted in each region to strengthen water user participation and skills in adaptive, integrated water resource management	40,000
3. Replication and up scaling of climate-resilient freshwater management	3. Improved institutional capacity to promote and enforce climate-resilient freshwater management on all inhabited islands	3.1.Training of technicians in the design, operation and management of integrated water resource management systems	30,000
		3.2 Institutional mechanisms created to integrate adaptive management of freshwater resources into the design and rollout of new water management projects and schemes	30,000
		3.3. Action plan developed and financing mobilized to replicate integrated, climate-resilient freshwater management on at least 4 additional islands	20,000
		Project/Program Execution cost	774,602
		Total Project/Program Cost	8,285,000

Project Cycle Fee charged by the Implementation Entity (if applicable) [4]	704,225
Amount of financing Required	8,989,225

PROJECTED CALENDAR:

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

MILESTONES	EXPECTED DATES
Submission of Concept to AF	October 2010
Approval of the Concept by the AF Board	December 2010
Commence Development of a Full Project	January2011
Submission to AF of a Full Project Proposal	June 2011
Start of Project/Programme Implementation	November 2011
Mid-term Review (if planned)	October 2013
Project/Programme Closing	October 2015
Terminal Evaluation	July 2015

[4] On the request of the Government of Maldives, the project will be implemented by UNDP using the MIE modality. UNDP is able to provide the following implementation services through its country office, regional and headquarters networks: project identification, formulation, and appraisal; determination of execution modality and local capacity assessment of the national executing entity; briefing and de-briefing of project staff; oversight and monitoring of AF funds, including participation in project reviews; receipt, allocation and reporting to the AF Board of financial resources; thematic and technical capacity building and backstopping; support with knowledge transfer; policy advisory services; technical and quality assurance; and troubleshooting assistance to the national project staff. The breakdown of specialized technical support services provided through the MIE fee is provided in Annex A.

PART II: PROJECT / PROGRAMME JUSTIFICATION

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

COMPONENT 1: Establishment of integrated, climate-resilient water supply and -management systems in Mahibadhoo, Ihavandhoo and Gadhdhoo

Component 1 focuses on the establishment of integrated water supply and -management systems in Mahibadhoo, Ihavandhoo and Gadhdhoo to meet the demand of reliable and safe freshwater supply in a changing climate. This effort will involve

a) the planning and installation of *groundwater protection and recharge* measures using surplus rainwater and improved management of wastewater;
b) the redesign of existing *rainwater harvesting* schemes, including optimization of total storage capacity to meet supply needs in dry periods; interconnection of isolated units to ensure equitable water supply in dry periods; improvement of structural integrity of rainwater collection and storage systems against extreme weather events; integration of filter elements to improve safety of freshwater supply
c) the systematic improvement of septic tank maintenance and redesign of *wastewater management* schemes to ensure sufficient quantities of safe groundwater during dry periods and prevent polluted wastewater to undermine freshwater stocks in time of climate-induced water scarcity
d) the application of *desalination* technology in the context of a diversified, integrated water supply and distribution infrastructure, ensuring supply capacity of at least 20 liters per person per day during dry spells and climatic extremes.

Under Component 1, the project will meet the domestic and economic water supply needs of 1264 families, thereby covering the water needs of all targeted island communities and benefiting 6209 people directly. This covers 24% of all rural Maldivians who are currently dependant on unsecured individual household systems outside of the capital zone.

After approval of the project concept by the AF Board, targeted assessment missions were conducted on each target island over the course of March 2011. The appropriate mix of the above components for each target island was established and will be reconfirmed through additional stakeholder consultations determining the location, setup, maintenance protocols and willingness to pay for integrated water management services. For additional information on assessment findings and technical design considerations, please refer to Annexes D (describing the baseline situation) and E (describing design characteristics and technical options for the proposed integrated systems).

With regards to overall design considerations, it is important to note that prior to any construction activities, an Environmental Impact Assessment (EIA) will be conducted

under the leadership of the Maldives Environment Protection Agency (EPA). For all water resource planning purposes under this programme, the demand of water has been calculated for a 30 year time horizon on the minimum supply of 20 liters per person and day. This design integrates factors of population and economic growth, as well as migratory trends to the targeted islands. Proper buffer allowances for institutional and commercial demand, as well as basic pipeline losses have been factored into demand-side calculations. This means that the beneficiaries of the project do not only include the current population of the target islands, but also of people who migrate to these islands in search of economic opportunities or for reasons of increasing vulnerability.

Component 1 consists of the following Outputs and activities:

Output 1.1: *Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons*

Artificial recharge of groundwater is the process of adding water to an aquifer through human effort. Under this project, the method of artificial recharge with surplus rainwater will be used to control sea water intrusion into aquifers and reduce pollution. Artificial recharge is recognized by many countries with recurrent water scarcity problems (including Indian ocean islands, Caribbean and Pacific SIDS) as an effective method to raise the ground water level and counter the intrusion of saline or polluted water into aquifers. Groundwater recharge reduces surface runoff which chokes storm water drains, and reduces flooding of roads. This reduces soil erosion and improves the overall quality of groundwater. Finally, groundwater recharge improves energy savings from groundwater extraction that is driven by electrical pumps: A one meter rise in water level saves about 0.40 KWH of electricity.

In the context of the 3 islands targeted under this programme, a number of methods have been evaluated which are potentially applicable to recharge aquifers and thereby increase groundwater supply in a changing climate. These methods include recharge pits, recharge trenches, recharge wells, dug wells, recharge through handpumps, recharge shafts and lateral shafts with bore wells. It was found that the most effective way to improve groundwater quality in the 3 target islands is the collection of overflow rainwater from rainwater harvesting systems to selected recharge pits and wells, coupled with systematic cleaning of septic tanks in connection with newly designed sewage and wastewater treatment systems (under Output 1.4). As spillovers of septic tanks during flooding events keep polluting groundwater and would undermine any groundwater recharge efforts, it is vital that septic tank systems are properly connected with sewage and wastewater treatment systems.

<u>Activities under Output 1.1 include:</u>

- Conduct regular benchmark groundwater tests (minimum every 6 months) to verify improvement of groundwater quality over the course of the project and beyond

- Install provisions in new and existing rainwater harvesting systems (both in individual households and public buildings) to capture and redirect excess rainwater for purposes groundwater recharge.

- ~~Install a critical number of recharge pits consisting of perforated concrete pipes which are backfilled by gravel and sand to support infiltration: 700 household recharge pits and 30 communal recharge pits in HA. Ihavandhoo; 275 household recharge pits and 30 communal recharge pits in ADh. Mahibadhoo; and 495 household recharge pits and 30 communital recharge pits in GDh. Gadhdhoo.~~
- Undertake a groundwater foundational study to underpin the groundwater management plan to include further investigations of lenses and various plausible options for controlled recharge and extraction.

Output 1.2: *Existing rainwater harvesting schemes are redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods*

The prevailing rainwater harvesting technique in Maldives is the collection of rainwater in simple vessels at the edge of the roof. Variations on this basic approach include collection of rainwater in gutters which drain to a collection vessel through down-pipes constructed for this purpose, and/or the diversion of rainwater from gutters to containers for settling particulates before being conveyed to a storage container for domestic use.

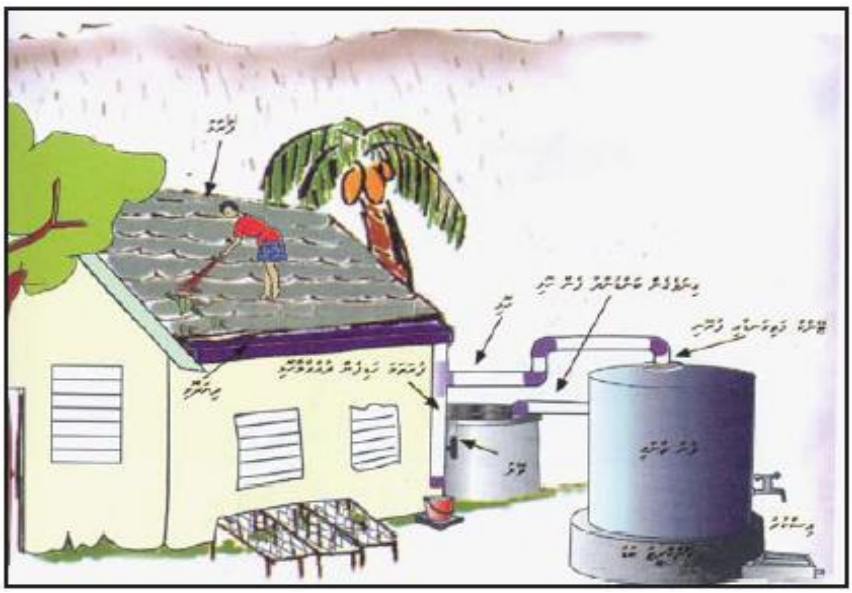


Fig.3:
Basic elements of a domestic rainwater harvesting scheme in the Maldivian context (WHO, 2007)

When analyzed vis a vis the challenges posed by a changing climate - most notably longer dry periods and more frequent and extreme weather events - the existing rainwater harvesting systems in Maldives display a number of important drawbacks:

- They are not yet systematically laid out to incorporate greater water resource needs and more uneven supply in a changing climate;

- They are largely disconnected from each other, thereby creating unequal distribution of available freshwater during dry periods;
- Not all rainwater harvesting installations are making full use of the available roof catchment area, thereby reducing freshwater yields;
- Public buildings are not yet systematically connected to central rainwater storage units;
- Not all rainwater harvesting systems are robust enough to withstand the impact of extreme weather events, such as storms and swell waves.

The proposed project will address these shortcomings by optimizing household and communal rainwater harvesting schemes on each island, and ~~installing the~~ in combination with desalinated water to supply minimum required capacity ~~to~~of water for the 90 day dry period. The rainwater storage capacity that will be put in place to ensure that with the proportionate mix of desalinated water meet all communal freshwater needs in a changing climate, are:

- ~~9,000~~1,550 m^3 in HA. Ihavandhoo;
- ~~6,300~~1,250 m^3 in ADh. Mahibadhoo;
- ~~6,300~~1,450 m^3 in GDh. Gadhdhoo.

Basic design considerations of improved rainwater harvesting systems are summarized in Annex E, which follows from additional technical assessment missions that were conducted on each target island during project preparation. The basic design ~~options~~option that will be integrated into the rollout of improved rainwater harvesting systems on each island are as follows:

~~*Option 1:* Increasing the capacity of individual rainwater harvesting tanks in each household and optimizing water collection from individual rooftops. Connection of water collection with carbon activated and UV filter systems, as well as existing household piping and pumping networks. In this option, consumers are not required to pay water tariffs.~~

~~*Option 2:*~~
Communal rainwater harvesting through collection from public facility roof areas and private houses (provided that land is available for large storage tanks). Pumping of raw water to a central tank for filtration and UV disinfection and further distribution. Elevated water tanks are required to distribute the water through gravity flow. This option will require metered connection to households, and agreement on a water tariff.

Activities under Output 1.2. include:

- Verify design considerations with island communities, based on Output 2.1
- Define localities for the installation of additional rainwater harvesting and storage capacities
- Design and install additional communal rainwater harvesting systems on public buildings (schools, mosques, clubs, community centers, hospital, council houses,

etc.) with a large roof area covered with apposite roof materials and an economic distance from a water treatment area

- Install a water transmission and storage system (including transmission pumping pipeline running from a treatment site to elevated tanks providing a gravity distribution system)

- Install additional disinfection devices to treat freshwater to WHO standards before human consumption (using UV disinfection as close as possible to the consumers and preferably at the elevated reservoir outlet point).

- Establish a distribution network to transport potable water produced at the treatment plant (used for both rainwater and desalinated water) to elevated water storage tanks located near the center of the island for subsequent gravity distribution to consumers.

- Install flow meters in key locations of the distribution network to identify water losses.

- Improve individual house connections to enable potable water intake from both internal (household RWH) and external sources

- Improve water quality control in existing household rainwater harvesting systems by incorporating additional components such as first-flush diverters, UV disinfectant systems, inline demand pumps, improvement to gutter and downspouts, preliminary filtration systems, and additional storage tanks.

- Optimize use of solar energy in communal rainwater harvesting systems by installing solar-powered pumps wherever feasible and appropriate

Output 1.3: *Production and distribution system for desalinated water supply established*

Desalination technology is a vital component of an Integrated Water Resource Management (IWRM) scheme on the 3 target islands. Desalination is the only technology that works independently from climatic factors and can provide freshwater to the population irrespective of climatic extremes. Even in prolonged times of drought, when rainwater harvesting systems do not yield sufficient quantities of freshwater to the population, or in times of flooding, when saltwater infiltrates the recharge wells of an inhabited island, desalination technology can ensure consistent water supply. The diversification of different sources of freshwater supply is therefore a vital consideration in the design of an integrated, resilient water resource management system. The combination of rainwater harvesting, groundwater recharge and desalination technology will generate the necessary diversification and redundancy in the water supply system to ensure that no matter how the climate develops, there is always a sufficient supply of safe freshwater for the local population.

The assessment mission conducted to the 3 target islands in March 2011 has confirmed the need for sufficient desalination capacity to buffer times of insufficient or unpredictable rainfall. As desalination is a comparably expensive option, both in terms of fuel consumption cost and high carbon emissions (if run by diesel generators as opposed to solar or wind power), the project does not propose to make desalination plants the primary source of potable water on the target islands. Instead, it is proposed to resolve shortages of potable water during climatic extremes (drought, flooding, storm disasters) by tapping all available avenues with a view to minimizing the overall production cost and environmental risk. As discussed previously, the economically most resilient and viable approach is an integrated water supply system which integrates community-based rainwater harvesting systems, improved household rainwater harvesting systems, and sufficient desalination capacity to supply the minimum water requirement in critical situations of freshwater shortage. Under the proposed project, all potable water supplied by these three independent systems will be directly connected to each household to reach the overall aim of providing a safe and sustainable pipe-borne water supply system around the clock. The selection of a particular source for operations at any given time largely depends on the judgment of the operators and house owners; Ideally, the least expensive household rainwater harvesting system should be in operation during the rainy season and beyond, whilst moderately costly community-based rainwater harvesting should commence operations immediately after the rainy season has finished, supplemented by the more expensive desalinated water in times of drought.

The required desalination capacity on the 3 target islands was calculated on the basis of a minimum supply of 20 liters per person per day during times when no alternative source of freshwater is available. At present, no desalination capacity is available on HA. Ihavandhoo, whereas ADh. Mahibadhoo and GDh. Gadhdhoo both have small desalination capacities of 10 m^3 per day which were installed by the Red Cross after the 2004 Indian Ocean Tsunami. This capacity, however, is not fully operational due to a number of design and maintenance problems (see Annex D) and therefore insufficient to satisfy communal water demand in times of climatic extremes. To satisfy water demand of the 3 densely populated target islands, and avoid costs of importing bottled water, the proposed project will install ~~90~~70 m^3 of desalination capacity per day on Ihavandhoo and upgrade existing desalination capacity on ADh. Mahibadhoo to 50m^3 and in GDh. Gadhdhoo from 10m^3 per day to 60m^3 per day.

One single administrative building in each island will house the entire IWRM system that includes the following infrastructure units and their operations system: (i) desalination - RO plant; (ii) rainwater storage tank; (iii) glass fiber reinforced plastic - GRP storage tanks; (iv) solar powering units; (v) water filtering system; and (vi) a backup power generator. This building requires to be robust enough to accommodate multiple infrastructure units and their operation systems. Complexity of such interconnected infrastructure will facilitate truly integrated water production and supply operations. It will therefore require extended capacities of a so-called administrative building in each target island. Based on initial estimations capacity for such administrative unit would cover 30m^2. However, more in-depth feasibility revealed the need of an upgrade up to 268m^2 in all three islands.

Previous shortcomings in the operation and maintenance of desalination systems (such as the non-availability of spare parts, intake clogging, affordability limits of operations and high maintenance costs) will be addressed through a participatory process in which the willingness of communities to pay for clean and safe freshwater supply is factored into operations and maintenance protocols of state-contracted water utility companies.

Regarding continued operation of desalination plants after the project has ended, the Government of Maldives has recognized the need to systematize the follow-up maintenance of water supply and sanitation infrastructure across the country. As a result, the Government has established state-owned utility companies for all provinces and transferred available water and sanitation facilities (including desalination plants) to these utilities for continued and professional operation and maintenance. The operation and maintenance of desalination plants is not a new skill in Maldives; Following the 2004 Indian Ocean tsunami, a number of desalination plants have been installed across the country, and the Ministry of Housing and Environment continues to provide management and technical support to the new utility companies to ensure their sustained and smooth operation. Under the proposed project, the 3 target islands will be covered by 3 different utility companies. The project will involve these utility companies from the very initial stages to ensure that after the project has ended, operation and maintenance of water-related infrastructure on these islands is continuously ensured, based on actual willingness to pay for these services. So far, high initial investment costs have been a prohibitive factor for many utility companies to actively invest in water supply and distribution infrastructure; With AF financing reducing this barrier, utility companies have a strong business case to engage in the continued operation and maintenance of new infrastructure and draw up business models that meet the needs of the local population. The technical skills of utilities to effectively operate and maintain integrated water supply, storage, distribution and water quality testing will be addressed by Output 3.1 of the project; Consultations between utility companies and local communities to draw up participative water management schemes is targeted under Component 2.

Activities under Output 1.3 include:

- Verify population data and growth rates provided by the 2006 census on each target island and calibrate capacity of desalination plants to ensure minimum provision of 20 liters per person and day by 2030

- Bring existing desalination capacity on Mahibadhoo to 50m^3 and Gadhdhoo to a functional state and upgrade to a total of 60m^3 per day

- Install a new desalination plant on Ihabandhoo with a capacity of ~~90~~70 m^3 /day

- Connect distribution system for desalinated water with distribution, filtering and collection systems for harvested rainwater housed within one administrative building in each island.

- Interconnect desalination plants with an environmentally safe wastewater disposal system

Output 1.4: *Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater*

The safe disposal of domestic and municipal wastewater/sewerage in densely populated communities has always posed a challenge in the Maldives. Although septic tanks are acceptable means of safe discharge of wastewater/sewerage to the environment, the improper use of septic tanks, the faulty construction of septic tanks or the flooding of septic tanks during periods of heavy rainfall and inundation can create hazardous conditions for communities, causing communicable diseases such as Cholera, Diarrhea, and Typhoid. Moreover, the use of septic tanks to dispose wastewater/sewerage safely can pose a serious challenge to communities with congested populations (such as the 3 target islands of this project) and may lead to serious pollution of ground water sources to a level that makes it unfit for hygiene or household uses.

The context in the target islands of Ha Ihavandhoo and Gdh. Gadhdhoo is no exception to the above phenomena. The ground water sources in the above islands have been badly deteriorated and become unfit for any domestic purpose due to contamination from sewage and salinization. Therefore, it has become imperative to find durable and lasting treatment process to dispose wastewater/ sewerage generated by the communities in these islands to the environment with safe BOD and COD levels. Without a systematic coupling of freshwater supply and wastewater disposal systems, as demonstrated by this project, the wastewater problem will continue to undermine any efforts of adaptive freshwater management. Hence, it is crucial to demonstrate how such coupling can be undertaken, from the design and planning to the maintenance and monitoring stages.

In the assessment phase of the proposed project, it was found that a new wastewater treatment plant is currently under construction in Mahibadhoo by an international contractor (Shin Nippon Air Technologies Co.Ltd.). The system has an estimated cost of 4.3 million US$ and is planned to be completed by September 2011. A gravity wastewater conveyance system with 3 pumping stations has been planned for transmission of sewage. Similar wastewater treatment plans (with costs of around 6 million US$ per plant) are currently being planned for Ihavandhoo and Gahdhoo.

For the proposed project, as other financing sources have already been allocated to address the investment costs for wastewater treatment plants on the target islands, AF funds will not be used to install anaerobic digesters, conventional wastewater treatment schemes or package plants with Membrane Bio Reactor technology. Instead, AF resources will be used to ensure that unsecured septic tanks do not continue to pollute groundwater and undermine groundwater recharge on the target islands, and that the Government has workable design options on how to integrate new wastewater engineering designs with climate-resilient freshwater supply and storage, groundwater protection, and artificial recharge. These will be guided through appropriate studies on aquifer recharge.

Activities under Output 1.4 include:

- Establish a cleaning protocol for septic tanks in connection with groundwater quality testing and ensure regular cleaning of septic tanks before the wet season

- Ensure connectivity between sewage/wastewater management designs and new freshwater supply/storage and distribution installations on each target island

- Conduct managed aquifer recharge study to guide ground water recharge

- Provide workable design options to MHE on how to integrate climate resilient freshwater supply systems (encompassing communal rainwater harvesting, household-based rainwater harvesting, groundwater recharge and desalination) with sewage and wastewater management schemes

COMPONENT 2: Increase participation in the development, allocation and monitoring of freshwater use in a changing climate

While the bulk of project inputs will be programmed for tangible adaptation measures that ensure adaptive management of freshwater resources on three densely populated islands, the project is also aiming to develop capacity at government, atoll and island level to increase water user participation in the planning, monitoring and maintenance of climate resilient freshwater management.

In this context, it is important to note that the project will not establish new decision-making structures. Instead, it will ensure equitable participation of local water users in the new local governance structures that are currently being established across the country. Maldives will be holding its first local elections in 2011 to elect local authorities (councils) at island and atoll level. These councils will be established as new constitutional bodies that have the authority to make their own local level decisions. In this context, through Component 2 of the project, the project will ensure that water users in local island communities can effectively engage with island councils and water utilities on all issues related to freshwater governance. This involves participation in technical training activities that explain the design and functioning of the local water supply and –distribution system; participation in the design of new agreements with water utility companies; and continued engagement in the monitoring of local water supply quantity and quality.

Along these lines, Component 2 of the project will introduce a range of communication, awareness and training activities which will enable public, private and communal stakeholders (including water suppliers, planners and users) to effectively engage with each other and participate in the inclusive development, allocation and planning of water resource schemes on their home islands.

Output 2.1.: *Community consultations on each target island ensure participative design, sustainability and continued maintenance of integrated water resource management schemes*

In line with the IWRM approach to water management, stakeholder identification and participation under the project will involve four steps:

1. Identifying key stakeholders from the large array of groups and individuals that could potentially affect, or be affected by, changes in water management on each island;
2. Assessing stakeholder interests and the potential impact of the project on these interests;
3. Assessing the influence and importance of the identified stakeholders in sustaining integrated freshwater and wastewater management on each island; and
4. Outlining a stakeholder participation and empowerment strategy (a plan to involve the stakeholders in different stages of the project and beyond) in alignment with the existing governance system.

Activities under Output 2.1. include:

- Facilitation of inclusive, participatory consultations between MHE, island councils, community representatives, civil society organisations, utility companies and project staff to present the project, verify assumptions and solicit additional feedback on technical design issues

- Conduct a "willingness to pay"-survey on each island to guide the design of a water supply service and maintenance scheme

- Devise a scheme to finance the continued operation and maintenance of integrated water resource management systems on each target island after the project has ended

- Integrate community representatives in project-related works, including construction, operation, maintenance and water quality testing

- Conduct regular feedback sessions between MHE, island councils, community representatives, civil society organisations, utility companies and project staff to enable analysis of project experiences and lessons learned

Output 2.2.: *Targeted training events conducted in each region to strengthen water user participation and skills in adaptive, integrated water resource management*

In all activities related to awareness, communication and training, the project will adopt the principles of Integrated Water Resources Management (IWRM). IWRM is widely recognized as a basis for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives. The approach recognizes that water is a scarce natural resource, subject to many interdependencies in conveyance and use. There is a variety of different uses of water resources, and these uses are all interdependent. The failure to recognize such interdependency, coupled with unregulated use, can

lead to water wastage and the unsustainability of water resources in the long term. This, in turn, will reduce resilience to the pressures exerted by a changing climate.

IWRM is cross-sectoral in nature and entails a departure from narrow professional and political boundaries and perspectives, broadening them to incorporate participatory decision-making among all stakeholders that have a stake in water supply, use and management on a targeted island. This means that different user groups (households, farmers, businesses, public and private entities) can actively influence strategies for water resource development and management. This brings additional benefits, as informed users apply local self-regulation in relation to issues such as water conservation, protection of aquifers and protection of sensitive ecosystems from water-borne pollution far more effectively than central regulation and surveillance can achieve.
In all participative processes facilitated under this project, the following perspectives will be integrated (applicable for each island separately):

- All water (spatial);
- All interests (social);
- All stakeholders (participatory);
- All levels (administrative);
- All relevant disciplines (organizational);
- Sustainability (in all senses: environmental, political, social, cultural, economic, financial and legal).

Across all components, this project will treat water as both an economic as well as a social good, which is sensitive to climate-related shocks and stresses and therefore needs to be managed responsibly. Output 2.2 is the main delivery vehicle to mobilize stakeholders for IWRM and convey this message.

Activities under Output 2.2. include:

- In cooperation with other specialized UN agencies (WHO, UNICEF), conduct a country-wide communication and awareness campaign about principles of Integrated Water Resource Management

- Organize targeted consultations between island councils, water utility companies, community representatives and the proposed project about IWRM design, installation, operation and maintenance. These consultations and trainings will benefit from UNDP Cap-Net's training materials and resources related to IWRM.

- Organizepublic debates and focus group sessions on the rights and responsibilities of different water users with regards to communal water use and water resource protection

- Arrange school presentations and field visits pertaining to water efficiency and groundwater pollution issues

- Arrange study visits and field excursions of political authorities from all regions and atolls to water supply, storage, treatment and distribution systems implemented by the project;

- Prepare project briefs for political authorities, parliamentarians, utility companies and industry representatives to highlight the economic, environmental and adaptation benefits of the installed systems

- Prepare local media news items about the project in local language

- Prepare and/or adopt training materials (leaflets, brochures, posters, DVDs) to describe the project in the context of IWRM and disseminate best practice IWRM guidance materials and tools (using synergies with complementary IWRM projects including the global project "Implementing Integrated Water Resource and Wastewater Management in Atlantic and Indian Ocean SIDS"

- Ensure visibility of the project on public websites, Email groups and discussion platforms

COMPONENT 3: Replication and upscaling of climate-resilient freshwater management

Building on participative processes initiated under Component 2 of the project, and drawing on the technical experiences in groundwater recharge, rainwater harvesting and coupled wastewater/groundwater management generated under Component 1, Component 3 will introduce targeted activities to enable the analysis, replication and up-scaling of the project approach on other inhabited islands. This will entail a campaign to present the findings from the project to different public entities, political authorities, utility companies and development partners, as well as other atolls and islands with similar degrees of vulnerability. This campaign will integrate all administrative regions and aim at the replication of the project approach in at least 4 other inhabited islands. Exchange programmes to the target sites in Mahibadhoo, Ihavandhoo and Gadhdhoo will be facilitated to promote learning and transfer of experience on climate-resilient freshwater management (especially with regards to the design of coupled rainwater harvesting/groundwater recharge schemes). At the level of the central government, a consultative mechanism will be created that allows the integration of project experiences into the design and rollout of new water management projects and schemes.

In connection with this project component, it is important that the Government of Maldives is willing to follow through on its commitment to adopting an integrated water resources management approach as a key strategy to address a critical, climate change-related challenge that lies at the heart of the country's survival. Consequentially, the issue commands priority attention at the highest levels of government. A concerted effort is under way to establish public-private partnerships with utility companies and mobilize resources from public, private, bilateral and multilateral sources to follow through with the constitutional obligation to provide access to safe and reliable freshwater to every Maldivian. This is reflected and formalized in a three year programmatic budget (based on the Strategic Action Plan). With AF resources catalyzing additional private investments from utility companies to operate and maintain climate-resilient freshwater supply and distribution systems, it is expected that water management in Maldives will be able to draw on more

effective public private partnerships over the course of the next few years so as to sustain the system in the face of climate change. Considering this conducive policy environment, the Government has indicated very high confidence that co-financing can be mobilized for the replication of the project approach on 4 additional islands under Output 3.3 of the proposed project. If no additional investments from utility companies can be mobilized, the fallback option will be the use of public financing to leverage additional bilateral support, accompanied by continued technical and financial support by the United Nations system.

Output 3.1.: *Training of technicians in the design, operation and management of integrated water resource management systems*

The project will ensure that technicians from all utility companies that are currently engaged in the planning and/or implementation of dedicated water supply, sewage and drainage projects in Maldives are properly trained in the principles of climate-resilient, integrated water resources management. Utility companies will be exposed to the design principles employed by the project and visit the project sites. Targeted training activities will include guidance on water quality testing, environmental impact assessment, establishing connectivity and redundancy between individual water supply options, establishing connectivity between freshwater and wastewater systems, improving freshwater safety and quality, protecting groundwater resources, and maintaining communal buy-in and cooperation in the continued operation and maintenance of water supply systems.

Activities under Output 3.1. include:

- Selection of at least 5 representatives from each utility company to be trained
- Organizing exposure visits of utility companies to project sites, led by project engineers and technical experts involved in the design of the integrated systems
- Conduct targeted training modules in IWRM, design of climate-resilient freshwater supply systems, design of climate resilient wastewater management systems, provisions to ensure long-term safety of freshwater, groundwater protection, desalination design, operation and maintenance, environmental impact assessment
- Evaluate training through feedback forms and interviews
- Assess and define targeted support actions for concrete utility companies to improve the design of water supply projects which are currently in the pipeline

Output 3.2: *Institutional mechanisms created to integrate adaptive management of freshwater resources into the design and rollout of new water management projects and schemes*

In Maldives, there is no institutional mechanism which ensures that new water and wastewater management projects are subject to technical reviews on the basis of

IWRM and climate resilience principles. Although the government solicits proposals from utility companies, there are no technical screening safeguards which ensure that the submitted designs are climate resilient, integrate the views of both water users and providers on the target islands, and can be operated and sustained after their installation is completed. Output 3.2 aims to establish a systematic screening routine in the MHE which can ensure that every single new water and sewage management proposal in Maldives can be reviewed and improved on the basis of lessons learned from Mahibadhoo, Gadhdhoo and Ihavandhoo.

Activities under Output 3.2. include:

- Synthesize technical and non-technical lessons learned from the project and make them available in a form suitable for practical screening purposes
- Evaluate existing proposals from water utility companies against principles of IWRM and climate resilience, based on lessons learned from the project
- Provide technical assistance to MHE on the design and/or improvement of at least 4 water resource management proposals
- Support the MHE in devising a systematic screening processes for new water supply and wastewater management proposals (training of trainers)

Output 3.3.: *Action plan developed and financing mobilized to replicate integrated, climate-resilient freshwater management on at least 4 additional islands*

The project will undertake a targeted effort to mobilize financing from other sources, using AF funds as leverage to work with private utility companies and development partners to replicate the project approach. Towards this end, a financing and action plan will be elaborated to ensure that the AF-funded project can be expanded into a fully-fledged water management programme that effectively connects with various pilot initiatives in other islands.

Activities under Output 3.3. include:

- Conduct targeted consultations with MHE, utility companies and development partners to define where the project approach should be replicated
- Undertake assessment missions on 4 additional target islands to evaluate the economic, social and technical context for integrated, climate resilient water resources management
- Frame and/or improve a project document for each island for discussion with political authorities and potential financing partners
- Draft and approve a financing plan for 4 additional water resources management projects which are designed and implemented on the basis of lessons learned from this project

B. Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities.

In terms of social benefits, the project will provide safe and reliable freshwater supply to 1264 families (comprising 6701 people) who live on the 3 target islands of this project.[5] In relation to data from the updated MDG assessment (UNICEF, WHO; 2010), this represents 24% of all rural Maldivians who are currently dependent on unreliable and unsafe freshwater supply and experience water shortages during dry periods[6]. Through a dedicated Component focused on replication planning and financing (Component 3), the project is aiming to integrate at least 4 additional islands into a resilient water management programme, thereby benefiting at least 50% of all rural Maldivians who live outside the safe water capital zone and don't have access to an improved water source.

As highlighted previously, the target islands under this project do not have integrated water supply/waste water management schemes, and the inhabitants are compelled to rely on uncertain supplies of rain water for their drinking water needs, and polluted ground water for other needs. The lack of reliable rainfall quantities to produce adequate and reliable volumes of safe drinking water, coupled with increased contamination of ground water sources due to improper waste water and sewage disposal, have rendered drinking water unreliable and groundwater supply unhygienic.

In terms of economic benefits, the project will increase water management efficiency on all 3 densely populated target islands, reducing energy requirements for groundwater extraction and reducing the need to import/transport freshwater from other places. In addition, the project will reduce costs to the public health system from water-borne diseases, which are related to the use of groundwater from over-used and polluted aquifers and rainwater tanks. Recent studies conducted by the Maldives Water and Sanitation Authority (MWSA) showed that over 30% of rainwater tanks and 40% of groundwater wells on a random sample of target islands were faecally contaminated. Comparison of these data and health statistics therefore confirms a direct correlation between unsafe rainwater harvesting and diarrheal diseases. Furthermore, the project will ensure that salinisation of groundwater on the target islands will be effectively reduced, thereby diversifying the different systems of freshwater supply in times of need. This will improve the security of livelihood assets in a changing climate.

Environmental benefits of the project include greater awareness across the country about the sensitive interface between water resources and the health of coral reefs,

[5] Updated calculation based on census data from 2006 (population status and growth rate on each island) and related to rural water supply data provided by the new MDG country report: 'Progress on Sanitation and Drinking Water' (UNICEF, WHO, 2010).

as well as tangible measures to reduce groundwater pollution and disposal of polluted waste water on sensitive coastal ecosystems.

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

As discussed previously, the project will provide direct long-term, safe and reliable freshwater supply to 24% of all Maldivians who live outside of the fully serviced capital zone that encompasses Male, Hulhumale and Vilingili. Through a dedicated replication and upscaling plan, the project will aim to systematically increase the group of beneficiaries to at least 50% of all Maldivians who currently rely on unsafe and unreliable freshwater supply. By integrating 30 year planning parameters for population growth, economic growth and expected migratory shifts, the project will maintain water supply efficiency for not only the present, but also future generations. This is considered a critical impact of the AF investment in a country that is extremely vulnerable to climate change impacts and continually more reliant on imports to meet its basic needs.

This project represents a substantive impact for Maldives both in terms of the overall number of beneficiaries served, but also in terms of economic return on investment. Reducing long-term water insecurity in three of the most densely populated islands reduces a number of follow-up investments, including:

- transport and import of freshwater in times of water shortage (at present valued by the MHE at about 2 million USD per year);
- Public health costs from water-borne diseases, resulting from unsafe groundwater and rainwater storage[7];
- energy costs for the extraction of groundwater from depleted aquifers; and
- Reconstruction of insufficiently robust rainwater harvesting schemes after extreme weather events

In this context, it is important to mention that at present, thousands of litres of bottled water are imported into Maldives. The 2004 State of Environment report indicates that between 1996 and 2003 there was a sharp increase in the volume of water imported into the country. In 1996, nearly 1.2 million litres of mineral water was imported; In 2003, the volume has jumped close to 6 million litres. With the effects of global warming, this trend is projected to continue in an unabated manner.

Alternative project approaches have been considered, but deemed less cost-effective and beneficial than the proposed course of action. As there are only three major resources of water in Maldives (groundwater, rainwater and desalinated water), a diversified approach that integrates all 3 types was considered the most beneficial both in terms of diversity as well as cost efficiency. An exclusive focus on

[7] According to MCST (2002) recent studies conducted by the Maldives Water and Sanitation Authority (MWSA) showed that over 30% of rainwater tanks and 40% of groundwater wells were faecally contaminated. Comparison of these data and health statistics confirms a direct correlation of unsafe rainwater harvesting and diarrheal diseases.

desalination technology (with an upfront investment of approximately 7 million USD) would have been an alternative to an integrated approach, but such a setup would not yield a number of critical economic benefits: Exclusive, stand-alone desalination would not address rising problems with soil and groundwater salinity (which is relevant for agricultural uses as well); it would not address problems arising from insufficient wastewater management (which is a key problem for public health as well as the integrity of ecosystem services provided by coral reefs); and it would not build on existing capacity that exists with rainwater harvesting technology that is already established in all outer atolls. Considering the benefits of a diversified approach that integrates an optimized mix of technologies in line with the specific context of each target island, it was assessed that the proposed course of action would yield a more sustainable return on investment and greater chances for replication.

In terms of cost-effectiveness, it is important to highlight that the proposed approach integrates readily available, low tech adaptation options such as rainwater harvesting, which can easily be adjusted to allow effective coupling with innovative groundwater recharge, wastewater treatment and desalination technology. Rainwater harvesting does not have a technology entry barrier for the Maldivian market, and can easily be adopted in various shapes and forms to accommodate the requirements of greater robustness and adaptive design.

In addition, the project is treating water as an economic good and prioritizes the principle of community participation and ownership. Users who have been properly involved and trained in integrated water management are much more likely to apply local self-regulation in relation to issues such as water conservation, protection of aquifers, and protection of coastal ecosystems from polluted effluents. In highly decentralized settings such as Maldives, this approach is much more likely to result in policy compliance than central regulation, surveillance and policing.

At the operational level, cost effectiveness of the project concept is reflected through the following characteristics:

- Throughout the project, AF resources will be aligned with the financing and delivery of project Outputs that have competitive procurement components to ensure best value for money. In this regard, the project will apply best practices identified by other, ongoing climate change adaptation projects (including the LDCF-funded project “Integrating Climate Change Risks into Resilient Island Planning”).
- The project will undertake a targeted effort to mobilize co-financing for wastewater management-related components of the project. This will diversify financial risks and retain focus on AF funds on activities which correspond to the principle of additionality.
- The bulk of project financing will be directed to community-level activities and connect directly to local opportunities for the procurement of goods and services.

D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national

communications, or national adaptation programs of action, or other relevant instruments, where they exist.

The proposed initiative is responsive to the Government of Maldives Strategic Action Plan 2009, the 3rd National Environment Action Plan (NEAP-3, 2009), the National Sustainable Development Strategy (NSDS, 2009) and the National Adaptation Programme of Action (NAPA-, 2007).

The National Adaptation Programme of Action of Maldives highlights 2 urgent and immediate adaptation priorities which correspond to the focus of this project:

- 'Enhance adaptive capacity to manage climate change related risks to fresh water availability by appropriate technologies and improved storage facilities' (NAPA priority 4), and
- 'Enhance adaptive capacity to manage climate change related risks to fresh water availability by appropriate wastewater treatment technologies' (NAPA priority 5).

The project is therefore fully compliant with 2 adaptation priorities which the Maldivian government has highlighted as urgent and immediate. In addition to the NAPA, integrated water resource management (IWRM) is featuring in various national policy documents, including the first Health Master Plan (1996 -2005). Some of the aspects identified include:

- Provision of sustainable freshwater on cost effective means
- Integrated water resource management and development of such strategies
- Development of water resource conservation strategies
- Establishment of groundwater protection zones on islands through land use plans

Similarly, the first (1989), second (1999) and third (2009) National Environment Action Plan (NEAP) gave emphasis to the importance of integrated water resource management across the country. The measures to manage water sector issues and concerns through the Ministry of Housing and Environment (MHE) are outlined in the following:
Key sector goals:

a. Ensure access to safe drinking water and sanitation as a basic human right
b. Protect and preserve the country's vital freshwater resources
c. Provide legislative support to improve sector performance
d. Strengthen institutional and financial capacity to meet growing needs and challenges
e. Enhance the role of private sector participation in the provision of water and sanitation services
f. Introduce the use of renewable energy and other modern technologies to minimize the cost of providing drinking water and sanitation systems and to protect groundwater.

Key sector policies:

a. Prioritize provision of safe water and sanitation when designing developmental

projects
b. Establish effective operation and maintenance procedures for water and sanitation systems in the Maldives
c. Strengthen technical, financial and human resources capacity for water and sanitation sector
d. Facilitate private sector investment in the water and sanitation sector
e. Enhance community and civil society participation in the water and sanitation sector
f. Improve water resource management to preserve environment

Key sector strategies

a. Increase rainwater and desalinated water capacity in the islands;
b. Ensure availability of safe drinking water and establish adequate sanitation systems in the seven regions of the country;
c. Facilitate establishment of water stocks in designated regions of the country for use in emergency or during disasters;
d. Establish a system to manage and maintain the water and sewerage systems already established in islands through local governance systems;
e. Create a business- friendly environment for investing in the sector;
f. Conduct research on wastewater disposal technologies and assess the health and environmental impacts of using treated wastewater for different purposes, including recharging aquifers;
g. Strengthen and enforce protocols, procedures and capacity at water and sanitation regulatory authorities;
h. Enact the Water and Sanitation Act of Maldives;
i. Develop land use plans, taking into consideration the protection of natural freshwater resources;
j. Increase capacity at all levels for monitoring water quality, including establishing island level monitoring capacity;
k. Develop water safety plans for the islands.

In addition, the project is fully aligned with UNDAF Outcome 1: "Communities have access to safe drinking water and adequate sanitation and sustainably manage the natural environment to enhance their livelihoods".

E. Describe how the project / programme meets relevant national technical standards, where applicable.

The project will comply with the following technical standards relevant to freshwater and wasterwater management in Maldives:

- Drinking water guidelines (2006)
- Domestic wastewater guidelines (2006)
- Domestic and commercial effluent standards (2006)
- Guidelines on septic tanks and soakway construction, operation and maintenance (2003)
- Guidelines and manual for rainwater harvesting in Maldives (2009)

- Guidelines on Integrated Water Resources Management

The design of all technical elements under the project will be conducted in such a way to comply with these standards and ensure that there is thorough alignment with existing best practices. With regards to the quality of freshwater provided by this project, the following standards (approved by MHE according to WHO guidance) will apply:

No	Parameter	Unit	Maximum allowable limit
A	**Physical parameters**		
1	Colour		colourless
2	Taste & Odour		Not offensive
3	Turbidity	NTU	Less than 1
4	Electrical conductance	µS/cm	Less than 1500
5	pH		5.0 to 9.5
B	**Chemical parameters**		
1	Free chlorine	Mg/L	0.08 to 0.2
2	Chloride as Cl		Less than 250
3	Nitrates as NO_3		Less than 50
4	Ammonia as N		Less than 1.5

Tab.1: Freshwater standards applied by the proposed project

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

A review of on-going projects funded by development partners shows that there is no duplication of the proposed project with other funding sources. With regards to NAPA follow-up, the project “Integrating Climate Change Risks into Resilient Island Planning in Maldives”, which is jointly funded by the LDCF, UNDP and the Government of Maldives, focuses on coastal protection issues, thereby addressing NAPA priority 1 (‘Integration of Future Climate Change Scenarios in the Safer Island Strategy to Adapt to Sea Level Rise and Extreme Weather Risks Associated with Climate Change’) and NAPA priority 2 (‘Coastal Protection of Safer Islands to Reduce the Risk from Sea Induced Flooding and Predicted Sea Level Rise’). At present, no projects are under way to address NAPA priority 4 (‘Enhance adaptive capacity to manage climate change related risks to fresh water availability by appropriate technologies and improved storage facilities’) and NAPA priority 5 (‘Enhance adaptive capacity to manage climate change related risks to fresh water availability by appropriate wastewater treatment technologies’). These NAPA priorities represent the key focus of this project.

During the project formulation process, an assessment was carried out about any complementary development efforts that are currently under way in the target islands of Mahibadhoo (Alifu Dhaalu Atoll), Ihavandhoo (Haa Alifu Atoll) and Gadhdhoo (Gaafu Dhaalu Atoll). All government stakeholders listed under section H of this concept have been consulted, in order to avoid any potential duplication of efforts and geographical coverage. The project development phase has ensured that any

initiatives that have been conducted on topics of rain- and groundwater management in the past, such as the work financed by WHO and UNICEF after the 2004 Tsunami, is adequately consulted and integrated into the project approach as appropriate. In doing so, specific benefits are expected with UNICEF in the cross-sharing of awareness materials on rainwater harvesting, waste management and IWRM and in the training of island authorities, atoll authorities and utility companies.

A special effort will be made to coordinate with the GEF-funded project "Implementing Integrated Water Resource and Wastewater Management in Atlantic and Indian Ocean SIDS", which has been submitted to the GEF CEO for endorsement in September 2010. This global project, which will jointly be implemented by UNDP, UNEP and UNOPS, incorporates a technical demonstration component that is aimed at the protection of the freshwater lens of Thoddoo Island from agro-chemical pollution and salinity. The project will employ IWRM principles, and hence provide an ideal interface for coordination and cooperation. The proposed AF project will thereby be able to benefit from inter-regional IWRM networks to share knowledge, experiences and best practices, and draw on a range of relevant awareness materials, training materials and policy guidelines on IWRM.

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

As discussed in Part II, Section A of this project concept, the project will employ the following learning tools (applied under Components 2 and 3):

- Local media news items in local language;
- Public & school presentations;
- School field visits;
- Public debates, focus group sessions;
- Water management briefs with industry;
- Water management briefs with tourism resorts and operators;
- Government newsletters;
- Awareness actions for parliamentarians;
- Awareness actions for water utilities;
- Training workshops and short courses for atoll, island and community officials;
- Field excursions and exchange visits between atolls and islands;
- Best practice guidance materials and tools;
- Websites and virtual fora; and
- Email groups and virtual discussion platforms.

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. Apart from consultative face to face meetings and interactive events, the project will also prepare brochures, leaflets and posters on the effects of climate change on freshwater resources, and on the relationship between water management practices and the health of the coral reef ecosystem. Existing awareness materials on IWRM will be adopted from existing sources (such as the global project "Implementing Integrated Water Resource and Wastewater Management in Atlantic and Indian

Ocean SIDS", see section F).

H. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation.

The scope of this initiative was defined in close consultation with members of the local Island Councils; the Minister of Housing and Environment; the Maldives' Designated National Authority for the Adapation Fund; the UNFCCC focal point; the GEF Focal Point and a range of relevant UN agencies who provided baseline data and assessment information about the target islands (UNOPS, UNICEF, WHO). The initiative is based on analysis and recommendations from a number of official reports and studies, including:

- Draft technical concepts about methods of groundwater recharge, wastewater management and rainwater harvesting that are applicable to the Maldivian context (UNOPS, 2010);
- National IWRM Diagnostic Report (Environmental Protection Agency (EPA), 2010);
- Integrated Water Resource Management Report on 4 selected islands (MWSA, 2001);
- Selected case studies about water Management in Maldives (Mustafa M., 2009).

After approval of the project concept by the AF Board, an assessment mission was conducted in all target islands to confirm assumptions of the project and concretize a number of technical design issues with regards to Component 1 (see Annexes D, E). During this mission, community representatives were consulted on all target islands and views of island council members, NGO representatives, communal service workers, private utility companies and youth groups have been solicited.

In alignment with the recent governance reform in Maldives, the project assessment team made sure to closely liaise with members of the elected Island Councils: These Island Councils are newly established, representative local institutions at island level, which represent and advocate community interests and represent the people living on the islands. The recent governance reform has ensured that local Island Council members get elected by their island constituency, rather than being appointed by the central government. The work of these new Island Councils is critical in enabling the people living on the islands to take part in deciding their own affairs, and in creating a vibrant civil society. As island councils are empowered by law to make independent decisions about service delivery functions on their island, this puts them in the driving seat articulating the priorities and concerns of communities with regards to the design and rollout of water/sanitation-related services.

During the project preparation phase, consultations in *Ihavandhoo* have involved elected island council members, NGOs, representatives from health and education services, the private sector, and youth groups. Main discussion points raised by these stakeholders were related to water scarcity and inadequacy during dry periods, with strong concurrence on the need to increase water supply and storage capacity. The group confirmed the community's willingness to pay for consistent, safe and reliable freshwater supply.

Community consultations in *Mahibadhoo* have solicited the views from local Island Council members and administrators, and members of the elected Atoll Council (which has confirmed the baseline and risk situation from the perspective of communities living in the larger atoll). Having been elected by the island communities to represent local views in interaction with the national government and development partners, the group confirmed recurrent issues of freshwater scarcity during dry periods and pointed towards a number of inadequacies of the existing technical setup. The stakeholders confirmed that additional investments on top of the existing baseline infrastructure are urgently required to buffer the effects of climatic extremes on freshwater availability. The cost-effectiveness of the proposed options was confirmed. Baseline information on existing wastewater treatment schemes and recommendations on how to reduce groundwater contamination were provided to reduce environmental and health risks of new interventions.

In *Gadhdhoo*, community consultations have involved local island council members, the local island council administration and representatives from the private sector. The utility company currently in charge of providing water/sanitation services on the island was represented in the discussions. The main issues raised were related to problems in the maintenance and operation of water supply systems, as well as ownership of / responsibilities for water supply systems (community- versus utility-owned models). The group supported the upgrading of water supply capacity, putting strong emphasis on the design of workable water governance and tariff structures. The assessment team therefore recommended additional consultations during the project inception phase to source additional local expertise on available options for decentralized water governance, including how the cooperation between island councils and utility companies can be structured.

Broadening the extent of consultations that have already been conducted with local representatives and community members during the project preparation phase, the proposed project will broaden community consultations through Output 2.1. ("Community consultations on each target island ensure participative design, sustainability and continued maintenance of integrated water resource management schemes"). This will be the first investment activity of the project to ensure that the priorities and concerns of targeted communities are comprehensively captured in the following reports:

- Participatory **Environmental Impact Assessments (EIAs)** on each target island, which will be supported by the MHE and government co-financing. These EIAs will summarize the possible positive or negative impacts of the proposed project on the environment, based on a comprehensive review of natural, social and economic aspects.
- A '**willingness to pay'-survey** report, which will delineate options for the operation and maintenance of integrated water management systems on each target island (including tariff structures and the roles/responsibilities of atoll councils, island councils and utility companies in sustaining, operating and maintaining the new investments);
- A project **Inception Report** which will capture any additions, changes and amendments to the original project document (including adjustments of timeline, workplan, budget, technical design) that were found necessary by the Project

Board on the basis of results from EIAs and additional community consultations (Output 2.1.)

The following table summarizes the stakeholders that have been consulted:

Stakeholders	Roles/Responsibilities
1. Ministry of Housing and Environment (MHE)	Integration of water and sewerage services with new housing development projects; land use planning (relevant for recharge planning).
2. Ministry of Fisheries and Agriculture	Ground water resource management; safe disposal of agricultural pesticides and use of fertilizers; promotion of water conservation practices; use of alternative technologies.
3. Ministry of Finance and Treasury	Resource mobilization and budgeting for public policy delivery
4. Dept. Of National Planning/Statistical Dept	Ensure water and sewerage services are integrated into national plans; collecting and disseminating relevant data.
5. Ministry of Economic Development (Invest Maldives)	Integrates water and sewerage delivery into public-private partnership schemes and facilitates the mobilization of investments for sector needs
6. Ministry of Health	a. Centre for Community Health and Disease Control: Responsible for disease control and improvements of community health b. Maldives Food and Drug Authority: Responsible for quality and safety of imported and locally bottled water.
6. Ministry of Tourism	Facilitates regulation of water and sanitation services by EPA in tourism resorts
7. National Disaster Management Centre	Facilitates provision of water and sanitation services and coordinates with the MHE to ensure water security of islands during emergencies.
8. Ministry of Education (Schools)	Promotes good hygiene practices and ensures provision of safe water and sanitation services to students, also during times of water insecurity.
9. Private Sector	Provides water supply and metering services and improves access to safe water and sanitation in all parts of the country through contractual agreements with provincial utilities' company.
10. Male' Water and Sewerage Company	Delivery of water and sanitation services in Male', and other regions
11. Provincial Utility Companies	Provide utility style water supply, sewerage and electricity services to inhabited islands
12. Members of local island and atoll councils, local authorities	Represent newly established, representative local institutions at island level which advocate community interests and represent the people living on the islands. Responsible for administrative services of inhabited

	islands and overseeing the operation/maintenance of public infrastructure.
13. Environmental NGOs	Raise public awareness on climate change and environment; Support participative processes; improve environmental awareness
14. UN Agencies: UNOPS, UNICEF, WHO	Providing baseline data and input to field assessment missions. Based on a request by MHE, UNOPS can provide direct implementation support services to component 1 of the project

I. Funding Justification

The following section is a summary of the baseline and additionality reasoning for each project component. They will be further expanded in the full project proposal submitted for final approval by the Adaptation Fund. The full proposal will outline any baseline development activities that are currently financed out of government funds and traditional ODA, and specify the value these initiatives can add to those outcomes that are financed with resources from the Adaptation Fund.

COMPONENT 1: Establishment of integrated, climate-resilient water supply and -management systems in Mahibadhoo, Ihavandhoo and Gadhdhoo

Baseline (without AF resources):

As discussed in previous sections, the three target islands under this project are not equipped with a climate-resilient water supply and wastewater management scheme. Existing rainwater harvesting systems are largely disconnected and sub-optimal in terms of their capacity and yield. Groundwater recharge is absent throughout the islands, and aquifers are saline and heavily polluted from unsecured septic tanks. No desalination capacity is presently available on the target island of HA. Ihavandhoo; ADh. Mahibadhoo and GDh. Gadhdhoo each have desalination capacities of 10 m^3 per day, which is insufficient to satisfy communal water demand in times of drought. At present, the Government of Maldives has to supply bottled water (financed from a national emergency fund) to all 3 islands in dry periods to ensure sufficient freshwater supply. Although the government has undertaken efforts to include these islands into a utility-driven water management scheme, the responses from the private sector to date have not been positive on economic grounds (especially a lack of consistent revenue from communities paying for water management services). As a result, freshwater supply and distribution systems remain ill-conceived in terms of their safety and collection/storage capacity, and are not able to meet the demands imposed by climatic extremes. In combination, the lack of reliable rainfall, increased salinity of soils and groundwater, and contamination of ground water sources with waste effluents are rendering freshwater supply highly unreliable and ground water supply highly unhygienic. Without AF support, the population of Mahibadhoo, Ihavandhoo and Gadhdhoo will not have a reliable supply of safe drinking water in the future. Wastewater effluent and sewerage management projects will fail to

protect groundwater as a vital buffer stock for hygienic, agricultural and household purposes. Groundwater salinity will increase, affecting any agricultural use on these islands adversely. Public health will continue to deteriorate in line with current trends of diarrhoeal diseases on outer islands (MoH, 2009). Existing rainwater harvesting systems will remain disconnected, preventing some households from meeting their water needs during the dry season, while other households are still able to cover their needs. In times of drought, potable water will need to be transported from the capital to affected islands, incurring considerable costs to the public budget which could easily be avoided.

Adaptation Alternative (with AF resources):

AF resources will be used to create a diversified, adaptive freshwater supply system in three vulnerable, densely populated islands which is suitable for replication. This system will be characterized by a) increased storage capacity to buffer the effects of less reliable rainfall and lack of new freshwater supply during longer dry periods; b) improved quality and safety of harvested rainwater based on improved collection, treatment and storage systems; c) Improved robustness of interconnected rainwater storage schemes, especially on public buildings; d) Improved production and supply systems for desalinated freshwater; e) improved quality and quantity of freshwater which is stored in the natural aquifer, both in terms of reduced salinity as well as human contaminants; f) reduced contamination of household effluents which are discharged to the environment and would otherwise damage the sensitive reef ecosystem. In their integration, these elements provide a compound solution to a number of critical climate and non-climate-related problems and a suitable model for replication on other islands with similar vulnerabilities.

COMPONENT 2: Increase participation in the development, allocation and monitoring of freshwater use in a changing climate

Baseline (without AF resources):

At present, although the Maldives have made some progress in improving the stakeholder linkages within their water sector (especially between the public sector and private water utilities), linkages between water planners and users are largely fragmented on all inhabited islands. On the three target islands of this project, there are only very few formal or informal linkages between water service providers and water users, and water is not treated as a common social and economic good. As a result, the drive and purpose required for integrated, climate-resilient water resources management is lost and unsupported with dedicated human and financial resources. There are no consultative processes which are able to connect the needs of different water users and their actual willingness to pay for clean freshwater and safe groundwater with utility requirements that would sustain the continued operation and maintenance of integrated water management systems. Although capacity development for environmental management with stakeholders at all levels is a major component of the World Bank-supported Maldives Environment Management

Programme (MEMP), there are no plans for in-depth technical training on climate change adaptation. The LDCF-funded project "Integrating Climate Risk into Resilient Island Planning" is the only project currently under implementation that has a fully resourced training and awareness component focusing on coastal zone adaptation. No equivalent capacity development activities are currently undertaken in the water management sector. The project "Implementing Integrated Water Resource and Wastewater Management in Atlantic and Indian Ocean SIDS", which has been submitted to the GEF CEO for endorsement in September 2010, is aiming to strengthen the capacity of government officials to fulfil their role in local, national and regional IWRM processes. As such, it represents a key baseline initiative that the proposed project can build on to create awareness about the interface between climate change and water supply, and about the relationship between IWRM and adaptive management of freshwater resources.

Adaptation alternative (with AF resources):

AF support will enable water users on the target islands to evaluate their freshwater supply needs vis a vis the additional freshwater supply options provided by the proposed project; contribute to the fine-tuning of the proposed integrated water supply systems; and articulate their collective willingness to pay for the continued operation and maintenance of water supply and management services. This will enable the definition of a tariff system which can sustain the continued operation and maintenance of integrated water management systems through government-contracted utility companies. Through this project, political and community representatives across all administrative regions in Maldives will be educated about the impact of climate change on the reliability and quality of freshwater supply, and enabled to consider freshwater as a natural resource which will become much more variable and precious in a changing climate. The importance of maintaining functional and safe rainwater harvesting operations will be emphasized, and communities will be made aware that the flooding of septic tanks and the disposal of untreated wastewater in near shore areas reduces the ability of the reef ecosystem to filter contaminants and buffer against the impacts of extreme weather events. Households will be empowered to participate in integrated water resources planning on their home islands, and encouraged to view water resources as an interconnected economic good that is valuable and needs to be managed jointly rather than individualistically in a changing environment.

COMPONENT 3: Replication and upscaling of climate-resilient freshwater management

Baseline (without AF resources):

Despite the absence of a comprehensive policy on water and sanitation, the provision of safe water and improved sanitation to all Maldivians became a constitutional right in 2008. As a result, the government is undertaking a number of efforts to mobilize financing for desalination plants and develop partnerships with water utility companies to increase the number of islands with safe freshwater supply. Considerations of climate change and the new demands it imposes on the

layout of water supply and management systems are not yet integrated in these discussions. The prevailing investment strategy is to meet baseline water supply needs with whichever means possible (both technical and financial). This, in turn, prevents a consistent perspective of integrated and resilient water resource management to be realized in new projects. As a result, the development of water management systems on inhabited islands is still patchy, both in terms of technical approach as well as the consistency of the planning process. With limited participation by different water users and without successful models of adaptive design to draw on, development of freshwater management systems on inhabited islands will continue to display a lack of integration, consistency and resilience in a changing climate.

Adaptation alternative (with AF resources):

With AF resources, Maldives will be able to draw on concrete examples of integrated water resources management which are based on principles of adaptive design and equipped to handle the stresses exerted by a changing climate. As these systems are building on available technology, they are suitable for decentralized planning in remote settings and can be adopted by all types of islands. AF resources will enable exchange programmes between Mahibadhoo, Ihavandhoo, Gadhdhoo and other island authorities to promote mutual learning and transfer experience on how freshwater can be managed in a rapidly changing environment. AF funding will ensure that the planning and rollout of new water management projects is integrating considerations of adaptive design, diversification of freshwater sources and functions that preserve the integrity of the reef ecosystem. Finally, a fully resourced action plan will enable the replication of integrated, climate-resilient freshwater management on at least 4 additional islands.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Project / programme management arrangements.

The Project will be implemented through UNDP's **National Execution Modality (NEX),** with the Ministry of Housing and Environment (MHE) serving as the designated national executing agency ("*Implementing Partner*") of the project. MHE will have the technical and administrative responsibility for applying AF inputs in order to reach the expected Outcomes/Outputs as defined in this project document. MHE is responsible for the timely delivery of project inputs and outputs, and in this context, for the coordination of all other responsible parties, including other line ministries, local government authorities and/or UN agencies.

Upon the request of the Government of Maldives, UNDP will serve as the Multilateral Implementing Agency (MIE) for this project. Services that UNDP will provide to the Implementing Partner in support of achieving project Outcomes are outlined in Annex A. UNDP's services will be provided by staff in the UNDP Country Office (Male), UNDP Asia Pacific Regional Centre (Bangkok) as well as UNDP Headquarters (New York).

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

The MHE 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 in-kind contribution to the project.

National Project Manager (NPM): He/she will be a dedicated professional designated for the duration of the project. The PM'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.

Project-Support: The NPM will be supported by a core team of technical and support staff forming the **Project Implementation Unit** (PIU) located at the MHE to execute project activities, including day-to-day operations of the project, and the overall operational and financial management and reporting. At the target demonstration sites, local coordinators will be recruited to oversee progress of technical project components.

Project assurance: UNDP Maldives will support project implementation by assisting in the monitoring of project budgets and expenditures, contracting project personnel and consultancy services, and subcontracting and procuring equipment at the request of the MHE. On the technical side, UNDP Maldives will monitor progress of project implementation and achievement of project outcomes/outputs as per the

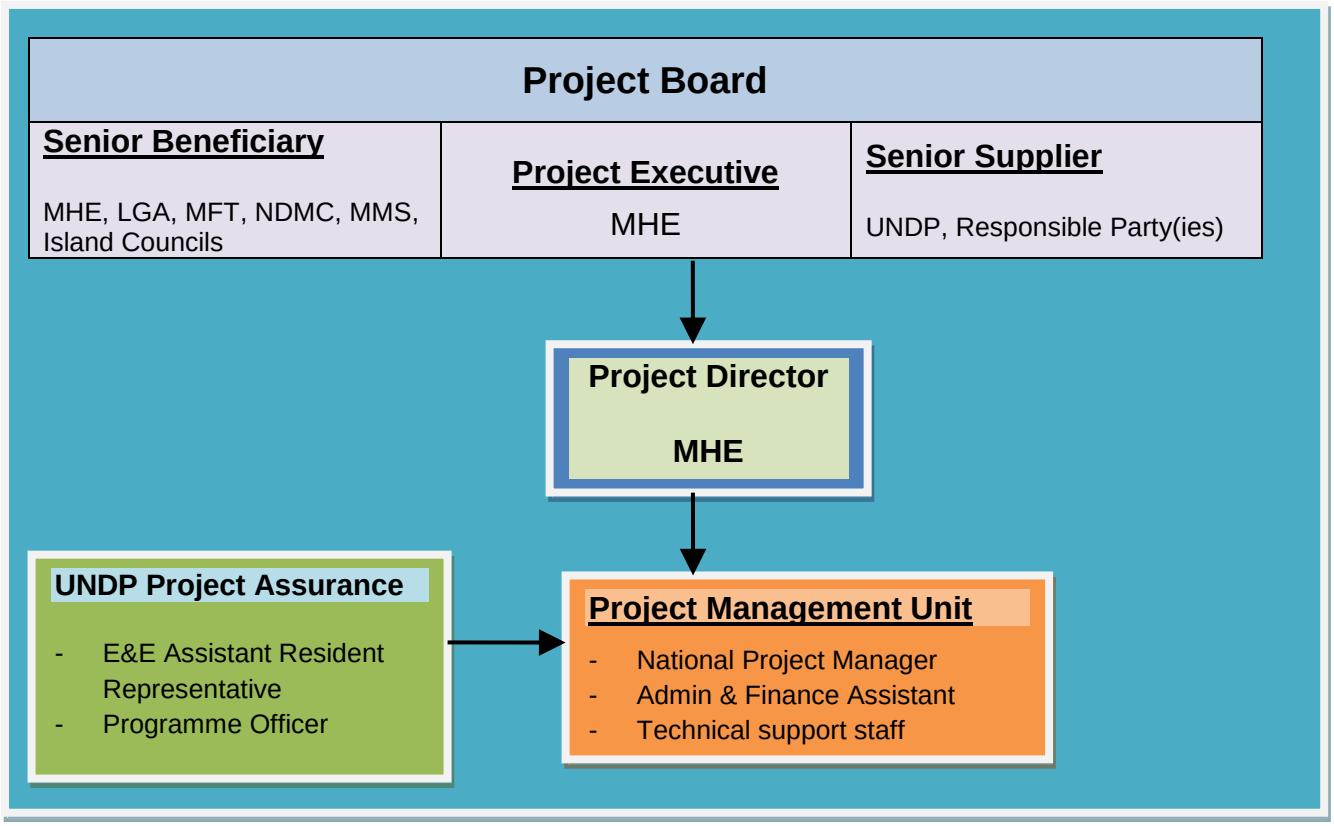
endorsed project document. A designated Programme Officer will be assigned in the Country Office in Male to provide financial and technical monitoring and implementation support services.

To deliver specific Outputs as outlined in the logical framework, MHE can delegate such responsibilities to external partners (to be referred to as *Responsible Parties*) through direct contracting. MHE will bear responsibility for the delivery of those Outputs and put in adequate place measures to oversee such work. MHE has already identified relevant institutions, including UNOPS, for the expedited delivery of urgently required freshwater supply infrastructure on the target islands (relating to Component 1 of the project). Such institutions will be contracted through ~~appropriate modalities (as advised by UNDP).~~a Memorandum of Agreement between the Implementing Partner and the Responsible Party. The corresponding Letters of Agreement (LoA) will be annexed to the project document that will be signed between UNDP and the Government of Maldives after the AF project document has been endorsed.

The Responsible Party, on behalf of the implementing partner, will be responsible for the purchase of goods and / or provide services using the project budget. The responsible party manages the use of these goods and services to carry out project activities and produce outputs. A Responsible Party is directly accountable to the Implementing Partner in accordance with the terms of their agreement. Implementing partner will use a responsible party in order to take advantage of their specialized skills, to mitigate risk and to relieve off administrative burden to deliver Component 1 of the Project. This will include but not limited to:

- Procurement (both national and international) of infrastructure units, associated equipment and spare parts;
- Services such as detailed feasibility study for the infrastructure type and capacity, including the operations and administrative systems;
- Supervision and quality control for all island level public works;
- Monitoring of all public works and compliance with the safety standards and labour regulations;
- Be responsible for test and trial of the installed infrastructure and final fittings, including the necessary adjustments, replacements and repairs;
- Detail out operations and maintenance procedures and protocols for all infrastructure units;
- Design and deliver series of specialized trainings to the utilities that will take over the operations and maintenance of the installed infrastructure.

The organigram of the project is as follows:



B. Measures for financial and project / programme risk management.

Key risks underlying the project have been analyzed during the formulation phase in connection with the target sites of the project. Over the course of the project, a UNDP risk log will be regularly updated in intervals of no less than every six months in which critical risks to the project have been identified.

No.	Type	Description	Rating	Risk Mitigating Actions
1	Institutional	Effective engagement and consensus building by different water users, public and private stakeholders to agree on an integrated approach to freshwater and wastewater management	Low	No infrastructure investments on target islands without comprehensive participatory consultations involving island councils, community representatives and utility companies (Output 2.1 to precede Outputs 1.1-1.4)
2	Institutional	Human resources capacity issues (e.g. staff turnover) in different government offices preclude effective engagement of particular stakeholders in the project	Medium	External recruitment of a new NPM to head a Project Management team which is hosted in MHE
3	Environmental	Extreme weather events during project	Medium	Engineering safety plans, contingency plans for construction

		implementation damage construction works;		
4	Institutional	Delays in recruitment of qualified project staff may affect the timeframe of different project activities.	High	At the request of MHE, direct execution of Component 1 by a Responsible Party to avoid implementation delays
5	Financial	Government is not able to leverage sufficient co-financing to increase and upscale project impact	Medium	UN support in the combination, sequencing and mobilization of climate change financing
6	Institutional	Community acceptance of technical design options proposed by project	Low	- Island-level community consultations (Output 2.1) will be the first activity of the project to validate and approve technical design options - Communities will be engaged and consulted during a participatory EIA, which will analyze the social, economic and environmental effects of the project on each target island - A willingness to pay survey will be conducted to ensure community buy-in and involvement in the continued operation and maintenance of new water supply systems - Elected island council members from each island will have a seat on the Project Board - Project offices will be established on each island to facilitate continued communication with communities -Community members will be represented on the project workforce

C. Monitoring and Evaluation- arrangements including a budget of M&E

Project monitoring and evaluation (M&E) will be in accordance with established UNDP procedures and will carried out by the Project team, verified by the MHE and the UNDP Country Office in Male. Dedicated support by the technical adaptation teams in the UNDP Asia-Pacific Regional Center and UNDP New York will be provided on a regular basis. A comprehensive Results Framework of the project will define success indicators for project implementation as well as the respective means of verification. A Monitoring and Evaluation (M&E) system for the project will be established, based on these indicators and means of verification. It is important to note that the Results Framework in Annex B, together with Output indicators, targets and means of verification, will be reconfirmed during the inception phase of the project. Any changes to the Results Framework require approval by the Project Board.

A Project **Inception Workshop** will be conducted within four months of project start up with the full project team, relevant government counterparts, co-financing partners, and UNDP. The Inception Workshop is crucial to building ownership for

project results and to plan the first year annual work plan. A fundamental objective of the Inception Workshop will be to present the modalities of project implementation and execution, document mutual agreement for the proposed executive arrangements amongst stakeholders, and assist the project team to understand and take ownership of the project's goals and objectives. Another key objective of the Inception Workshop is to introduce the project team which will support the project during its implementation. An Inception Workshop Report will be prepared and shared with participants to formalize various agreements decided during the meeting.

A UNDP **risk log** will be regularly updated in intervals of no less than every six months in which critical risks to the project have been identified. **Quarterly Progress Reports** will be prepared by the Project team and verified by the Project Board. **Annual Project Reports** will be prepared to monitor progress made since project start and in particular for the previous reporting period. These annual reports include, but are not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative);
- Project outputs delivered per project Outcome (annual);
- Lessons learned/good practices;
- Annual expenditure reports;
- Reporting on project risk management.

Government authorities, members of the Project Board and UNDP staff will conduct regular field visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress.

In terms of financial monitoring, the project team will provide UNDP with certified periodic financial statements. Audits on the project will follow UNDP finance regulations and rules and applicable audit policies. During project implementation, Annual Work Plans (AWP's) and Quarterly Work Plans (QWP's) will be used to refine project delivery targets and realign project work upon consultation and endorsement by the Project Board.

The project will undergo an independent **Mid-Term Evaluation (MTE)** at the mid-point of project implementation, which will determine progress being made toward the achievement of outcomes and identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; highlight issues requiring decisions and actions; and present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for the final half of the project's term. A summative **terminal evaluation** will be conducted 3 months before project closure.

The budgeted M&E plan is as follows:

Type of M&E activity	**Responsible Parties**	**Budget US$** *excluding project team staff time*	**Time frame**
Inception Workshop (IW)	▪ Project Manager	4,000	Within 4 months of start up

	▪ UNDP CO		
Inception Report	▪ Project Team ▪ UNDP CO	None	Within 1 month of IW
Measurement of Indicator status / Means of Verification	▪ Project Manager	Included in PMU budget	Start, mid and end-point of project implementation
Annual and Quarterly Progress reviews	▪ Project Team ▪ UNDP-CO	None	Quarterly and Annually
Project Board Meetings	▪ Project Manager ▪ UNDP CO	10,000	At least twice a year
Periodic status reports	▪ Project team	4,000	To be determined by Project team and UNDP CO
Technical reports on specific topics that arise over the course of project implementation	▪ Project team ▪ Consultants as needed	8,000	To be determined by Project Team and UNDP-CO
Mid-term External Evaluation	▪ Project team ▪ UNDP- CO ▪ External Consultants	20,000	At the mid-point of project implementation.
Terminal Report	▪ Project team ▪ UNDP-CO ▪ External Consultant	none	At least 1 month before the end of the project
Audit	▪ UNDP-CO ▪ Project team	8,000	Following UNDP finance regulations and rules
Visits to field sites	▪ Project staff ▪ Government representatives	40,000	At all stages of project implementation
Final Evaluation	▪ Independent external Consultants	20,000	6 months prior to the terminal tripartite review meeting.
TOTAL COST		**114,000**	

D. Project Results Framework Analysis

A detailed Project Results Framework, including quantified Outcome and Output targets as well as specific, measurable and time-bound indicators is provided in Annex B of this project document.

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

A. RECORD OF ENDORSEMENT ON BEHALF OF THE GOVERNMENT[8] *Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:*

Dr. Mohamed Shareef Minister of State for Housing and Environment & Designated Authority for the Adaptation Fund Ameenee Magu Male' 20392, Maldives Email: mohamed.shareef@mhte.gov.mv Tel.: +960 300 4300 Cell: +960 7775640	Date*: 08 April, 2011*

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

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board, understands that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme..	
 Yannick Glemarec Director, Environmental Finance, UNDP	
Date: ~~May19~~April 18, 2011	Tel. and email: +1-212-906-6843; yannick.glemarec@undp.org
Project Contact Person: Gernot Laganda	

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

Tel. and Email: +66 2288 2644; gernot.laganda@undp.org

LIST OF ANNEXES

ANNEX A

UNDP Fees for Support to Adaptation Fund Project:

Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island (PIMS 4582)

The implementing entity fee will be utilized by UNDP to cover its indirect costs in the provision of general management support and specialized technical support services. The table below provides a breakdown of the estimated costs of providing these services. Any additional Implementation Support Services (ISS) which have been requested by the national entity carrying out the project (MHE) are reflected directly in the project budget.

Category	Services[9] Provided by UNDP[10]	Estimated Cost of Providing Services[11]
Identification, Sourcing and Screening of Ideas	Provide information on substantive issues in adaptation associated with the purpose of the Adaptation Fund (AF). Engage in upstream policy dialogue related to a potential application to the AF. Verify soundness & potential eligibility of identified idea for AF.	$ 35,211
Feasibility Assessment / Due Diligence Review	Provide up-front guidance on converting general idea into a feasible project/programme. Source technical expertise in line with the scope of the project/programme. Verify technical reports and project conceptualization. Provide detailed screening against technical, financial, social and risk criteria and provide statement of likely eligibility against AF requirements. Determination of execution modality and local capacity assessment of the national executing entity. Assist in identifying technical partners. Validate partner technical abilities. Obtain clearances from AF.	$105,634
Development & Preparation	Provide technical support, backstopping and troubleshooting to convert the idea into a technically feasible and operationally viable project/programme. Source technical expertise in line with the scope of the project/programme needs. Verify technical reports and project conceptualization. Verify technical soundness, quality of preparation, and match	$140,845

[9] This is an indicative list only. Actual services provided may vary and may include additional services not listed here. The level and volume of services provided varies according to need.

[10] Services are delivered through UNDP's global architecture and 3 tier quality control, oversight and technical support system: local country offices; regional technical staff; and headquarters specialists.

[11] The breakdown of estimated costs is indicative only.

Category	Services[9] Provided by UNDP[10]	Estimated Cost of Providing Services[11]
	with AF expectations. Negotiate and obtain clearances by AF. Respond to information requests, arrange revisions etc.	
Implementation	Technical support in preparing TORs and verifying expertise for technical positions. Provide technical and operational guidance project teams. Verification of technical validity / match with AF expectations of inception report. Provide technical information as needed to facilitate implementation of the project activities. Provide advisory services as required. Provide technical support, participation as necessary during project activities. Provide troubleshooting support if needed. Provide support and oversight missions as necessary. Provide technical monitoring, progress monitoring, validation and quality assurance throughout. Allocate and monitor Annual Spending Limits based on agreed work plans. Receipt, allocation and reporting to the AFB of financial resources. Oversight and monitoring of AF funds. Return unspent funds to AF.	$316,901
Evaluation and Reporting	Provide technical support in preparing TOR and verify expertise for technical positions involving evaluation and reporting. Participate in briefing / debriefing. Verify technical validity / match with AF expectations of all evaluation and other reports Undertake technical analysis, validate results, compile lessons. Disseminate technical findings	$105,634
Total		***US$ $704,225***

ANNEX B PROJECT RESULTS FRAMEWORK

Project Strategy	Objectively verifiable indicators				
Goal	**To increase the adaptive capacity of Maldivian communities to the adverse effects of a changing climate**				
	Indicator	**Baseline**	**Target**	**Sources of verification**	**Risks and Assumptions**
Objective: **To ensure reliable and safe freshwater supply for Maldivian communities in a changing climate**	Number of Maldivians with safe and reliable freshwater supply in any extreme climatic condition	According to the 2010 MDG assessment for Maldives, 14% of all Maldivians living outside the capital zone lack reliable access to an improved freshwater source and face water shortages during climatic extremes	Integrated water resource management systems on Ihavandhoo, Mahibadhoo and Gadhdhoo provide 24% of all Maldivians who are vulnerable to water shortages and degrading water quality in a changing climate with a reliable supply of safe freshwater Replication of the project on 4 additional islands provides at least 50% of all Maldivians who are exposed to water shortages and degrading water quality in a changing climate with a reliable supply of safe freshwater	MDG assessment Reports from water utilities and island councils Design and investment plans for freshwater supply and wastewater management schemes Field surveys	New island councils ensure continued operation and maintenance of integrated water management systems through water tariffs The GoM is successful in mobilizing additional public and private financing for project replication

	Indicator	Baseline	Target	Sources of verification	Risks and Assumptions
Outcome 1: **Ground water aquifer protected and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo to provide reliable, equitable and cost-effective access to safe freshwater in a changing climate**	Number of people living on HA. Ihavandhoo, ADh. Mahibadhoo, and GDh. Gadhdhoo who have uninterrupted access to reliable and safe freshwater supply in extreme climatic conditions	6701 people living on HA. Ihavandhoo, ADh. Mahibadhoo, and GDh. Gadhdhoo are not able to meet their freshwater needs in a highly variable and changing climate. Water needs are met through unreliable supply of rainwater, which is frequently contaminated through insufficiently protected collection and storage systems. Total freshwater collection and storage capacity on each island is insufficient to address water needs during the dry season. Groundwater is highly saline and polluted and unfit for domestic use. Backup desalination systems do not supply the minimum humanitarian water requirements during climatic extremes and disaster events.	100% of the population living on HA. Ihavandhoo, ADh. Mahibadhoo, and GDh. Gadhdhoo will have uninterrupted access to reliable and safe freshwater supply of at least 20 liters per person per day at all times, including during extreme climate events	Reports from utility companies and island councils Field visits	Utility Companies and island communities successfully negotiate operation and maintenance schemes which sustain the provision of clean and safe freshwater

	Indicator	Baseline	Target	Sources of verification	Risks and Assumptions
Output 1.1: Artificial groundwater recharge systems ~~established~~options examined to protect groundwater resources from salinization and improve aquifer yields in dry seasons	Groundwater quality on each target island	Perception with target population of all islands that due to salinity and pollution, groundwater is unfit for consumption and most household uses. No current data available on the quality of groundwater in target islands ~~Existing groundwater recharge capacity:~~ ~~*Ihavandhoo:* 0 m^3~~ ~~*Mahibadhoo:* 0 m^3.~~ ~~*Gadhdhoo:* 0 m^3~~	Managed Aquifer Recharge Plan in place By the end of the project, a groundwater study and a plan/roadmap for individual aquifer studies resulting in a range of plausible recharge options will be established to improve the quality of groundwater in each target island ~~has improved~~ to levels that are safe for hygiene and agricultural purposes ~~*Ihavandhoo:* 700 groundwater recharge pits and 30 community recharge wells developed~~ ~~*Gadhdhoo:* 495 groundwater recharge pits and 30 community recharge wells developed;~~ ~~*Mahibadhoo*: 275 groundwater recharge pits and 30 community recharge wells developed~~	Managed Aquifer Recharge (MAR) Plan EPA technical tests of water quality Periodic water testing from utility companies and/or island communities Island council report at project competition	Island communities recognize the value of safe groundwater, participate in the regular monitoring of groundwater quality, and ensure proper maintenance of groundwater recharge systems
Output 1.2: Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods	Volume of rainwater collected and stored to supply safe and clean freshwater during dry periods	Existing rainwater harvesting capacity: *Ihavandhoo*: 1,289m^3 (households) + 105m^3 (communal) *Gadhdhoo:* no data (individual systems only) *Mahibadhoo:* no data (individual systems only)	Improved rainwater harvesting and storage capacity will be installed as follows: *Ihavandhoo*: ~~9,000~~1,550 m^3 *Mahibadhoo:* ~~6,300~~1,250 m^3. *Gadhdhoo:* ~~6,300~~1,450 m^3 All new rainwater harvesting systems will be equipped with	Field visits Reports from utility companies and island councils	Island councils, community members and utility companies agree on preferred options of centralized vs. decentralized rainwater harvesting and allocate sufficient land for additional storage capacity

	Indicator	Baseline	Target	Sources of verification	Risks and Assumptions
		Most existing rainwater harvesting systems have insufficient capacities of 2,5 m^3 per household and lack proper disinfection safeguards	disinfection safeguards to ensure safety of water supply		
Output 1.3 Production and distribution system for desalinated water supply established	Capacity of desalinated freshwater supply available during dry spells, drought and flooding	Existing capacity to generate freshwater supply from desalination: *Ihavandhoo:* 0m^3 / day *Gadhdhoo:* 10m^3 / day *Mahibadhoo*: 10m^3 / day	The following minimum capacity centralized water distribution tanks will be installed on the target islands: *Ihavandhoo*: 1550 m^3 *Mahibadhoo:* 1250 m^3. *Gadhdhoo:* 1450 m^3 The following minimum amounts of desalination capacity will be installed on each target island: *Ihavandhoo*: ~~90~~70 m^3 *Mahibadhoo:* ~~60~~50 m^3. *Gadhdhoo:* 60 m^3 Potable water quality levels will be in conformity with WHO standard at all times	Field visits Reports from island councils and utility companies	Utility companies and island communities monitor potable water quality at least twice per year and comply with their assigned responsibility for the maintenance of desalinization systems
Output 1.4 Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry	Number of planned wastewater management and sewage systems which integrate targeted measures to reduce groundwater	1 sewage treatment plant under construction by a contractor in ADh. Mahibadhoo 1 sewage treatment plant in design phase in HA. Ihavandhoo;	Study on Managed Aquifer Recharge (MAR) conducted All sewage and wastewater management systems which are planned and/or constructed on the 3 target islands integrate targeted measures to reduce	EPA technical assessments Sewage and wastewater management design plans prepared by utility	MHE can ensure that contractors engaged under the current and planned wastewater management projects will integrate project findings into the design of new sewage and

	Indicator	Baseline	Target	Sources of verification	Risks and Assumptions
periods	pollution	1 sewage treatment plant in design phase in GDh. Gadhdhoo Sea level rise and unsecured septic tanks pollute groundwater and render it unsafe for household uses	groundwater pollution All septic tanks on each target island are cleaned at least twice per year to prevent groundwater pollution from flooding events	companies Island council reports	wastewater management projects Utility companies and island communities ensure proper maintenance and functioning of wastewater systems
Outcome 2: **Strengthened local awareness and ownership of integrated, climate-resilient freshwater management systems**	Number of integrated water management systems which are based on participatory planning between water users and water providers and can be sustained in line with actual willingness to pay for operation and maintenance	Willingness to pay for integrated water management services is unknown No participatory planning and design process for water supply and management schemes	Integrated water management systems on all target islands are designed and installed based on community participation, and their operation and maintenance is based on actual willingness to pay	Willingness to pay survey Reports from utility companies Infrastructure maintenance status at the end of the project	Operation and maintenance of IWRM systems can be sustained on the following basis: (Number of households) x (average cost value of willingness to pay) = total running cost of the IWRM system
Output 2.1: Community consultations on each target island	Communal willingness to pay for continued operations and	Willingness to pay for integrated water management services is unknown	Integrated water resources management systems on each target island are designed and installed on the basis of	Willingness to pay survey Reports from	Utility Companies and island communities successfully negotiate operation and

	Indicator	Baseline	Target	Sources of verification	Risks and Assumptions
ensure participative design, sustainability and continued maintenance of integrated water resource management schemes	maintenance of freshwater supply on each target island	No participatory planning and design process for water supply and management schemes	community input, and their continued operation is aligned with actual willingness to pay for the operation and maintenance of the installed infrastructure	Island Councils and utility companies Observations from stakeholder consultations	maintenance schemes which sustain the provision of clean and safe freshwater (Number of households) x (average cost value of willingness to pay) = Total running cost of IWRM systems
Output 2.2: Targeted training events conducted in each region to strengthen water user participation and skills in adaptive, integrated water resource management	Number of Maldivians which are aware about their rights, roles and responsibilities in the management of freshwater resources in a changing climate	Limited awareness across all islands and atolls about the value of water as both an economic as well as social good, which is sensitive to climate-related shocks and stresses and therefore needs to be managed responsibly.	At least 1 IWRM training campaign is conducted in each administrative region (7 total) to strengthen dialogue between water users and providers and increase sensitization about the economic, social and environmental role of water in a changing climate	Training protocols Attendance lists Training materials Feedback forms	Training materials from global IWRM projects can be adopted to support training purposes in Maldives
Outcome 3: **Improved institutional capacity to promote and enforce climate-resilient freshwater management on all inhabited islands**	Number of fully financed follow-up projects which adopt the climate resilient, integrated water resources management approach demonstrated by	Maldives has no integrated water resources management project in place that is suitable for replication and upscaling	Project approach is replicated on at least 4 islands	Design and investment plans	The GoM is successful in mobilizing additional public and private financing for project replication

	Indicator	Baseline	Target	Sources of verification	Risks and Assumptions
	the project				
Output 3.1: Training of technicians in the design, operation and management of Integrated Water Resource Management systems	Number of staff from water and sewage utility companies trained in the technical principles and skills required to design, implement and maintain climate-resilient and integrated water management systems	No staff of public or private utility companies in Maldives has received targeted training on IWRM	At least 5 staff from each water and sewage utility company currently active in Maldives are trained in the technical principles of integrated water resource management and recognize basic design principles which make water supply and sewage systems adaptive to a changing climate	Training protocols Attendance lists Training materials Feedback forms	Utility companies recognize the value of the training and designate senior technical staff to participate
Output 3.2: Institutional mechanisms created to integrate adaptive management of freshwater resources into the design and rollout of new water management projects and schemes	Number of new water and sewage management projects which are reviewed and improved on the basis of lessons learned from the project	Maldives has no adaptive and integrated water resources management project in place that is suitable for replication and upscaling The government is not able to draw on best practices in the adaptive management of freshwater resources	Each new water and wastewater management project that is approved by the Government of Maldives is subject to technical reviews on the basis of IWRM and climate resilience principles	Design plans Expert reviews Government feedback Documented approvals of new projects	Lessons learned and design principles of the project are sufficiently codified to enable use by the Government in the approval and financing of new IWRM projects MHE establishes a systematic review process for new water management projects that integrates lessons learned from the project
Output 3.3	Financing allocated to new water	The government is not able to draw on best	The government approves at least 4 new, fully financed	Design plans	Financing is mobilized from public and private

	Indicator	Baseline	Target	Sources of verification	Risks and Assumptions
Action plan developed and financing mobilized to replicate integrated, climate-resilient freshwater management on at least 4 additional islands	management projects which integrate climate resilient and integrated design and are approved by the government for implementation	practices in the adaptive management of freshwater resources to enable systematic planning and financing of additional projects	freshwater and/or wastewater management projects on the basis of lessons learned and design principles replicated from the proposed project	Documented financial commitments	sources to replicate the project in other sites

ANNEX C

Project Budget

Award ID:	**TBC after AFB approval**
Project ID:	**TBC after AFB approval**
Business unit	**MDV10**
Project title:	**Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island**
Implementing partner	**Ministry of Housing and Environment (MHE)**

Project Outcome/Atlas Activity	Responsible party/ implementing agent	Donor name	Budget description	Year 1	Year 2	Year 3	Year 4	Total (USD)	Cost Description
OUTCOME 1: Ground water aquifer rehabilitated and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo to provide reliable, equitable and cost-effective access to safe freshwater in a changing climate									
Output 1.1 Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons	**MHE / Responsible Party**	**Adaption Fund**	Contractual Services	~~37,357~~ 34,344	~~4,358~~ 006	~~500~~ 460	~~500~~ 460	~~42,715~~39,269	A
			Materials and Goods	~~159,435~~ 106,698	~~17,805~~ 11,916	~~2,046~~ 1,369	~~1,050~~ 703	~~180,336~~ 120,686	B
			In-country logistics	~~2,408~~ 14,009	~~1,033~~ 6,010	~~400~~ 2,327	~~400~~ 2,327	~~4,241~~ 24,673	C
			IT and Communications	~~800~~ 2,816	~~100~~ 352	~~54~~ 190	~~50~~176	~~1,004~~ 3,534	D
			Sub-Total Output 1.1	**~~200,000~~157,867**	**~~23,296~~22,284**	**~~3,000~~4,346**	**~~2,000~~3,665**	**~~228,296~~188,163**	
Output 1.2 Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods			Contractual Services	~~360,931~~ 188,515	~~316,789~~ 165,460	~~9,946~~ 5,195	~~7,966~~ 4,161	~~695,632~~ 363,331	E
			Materials and Goods	~~1,563,650~~ 529,474	~~1,337,427~~ 452,871	~~22,300~~ 7,551	~~13,458~~ 4,557	~~2,936,835~~ 994,453	F
			In-country logistics	~~36,617~~ 16,517	~~31,455~~ 14,188	~~500~~ 226	~~500~~ 226	~~69,072~~ 31,156	G
			IT and Communications	~~8,802~~ 1,906	~~7,448~~ 1,613	~~54~~12	~~50~~ 11	~~16,354~~ 3,541	H
			Sub-Total Output 1.2	**~~1,970,000~~736,412**	**~~1,693,119~~634,132**	**~~32,800~~12,983**	**~~21,974~~8,954**	**~~3,717,893~~1,392,482**	

Output 1.3 Production and distribution system for desalinated water supply established			Contractual Services	~~423,494~~ 132,877	~~176,350~~ 55,332	~~9,083~~ 2,850	~~7,905~~ 2,480	~~616,832~~ 193,539	I
			Materials and Goods	~~1,823,764~~ 3,785,177	~~744,519~~ 1,545,231	~~22,693~~ 47,099	~~13,177~~ 27,349	~~2,604,153~~ 5,404,855	J
			In-country logistics	~~42,637~~ 30,440	~~17,510~~ 12,501	~~600~~428	~~500~~ 357	~~61,247~~ 43,726	K
			IT and Communications	~~10,105~~ 2,460	~~4,146~~ 1,010	~~150~~ 37	~~100~~24	~~14,501~~ 3,531	L
			Sub-Total Output 1.3	**~~2,300,000~~ 3,950,955**	**~~942,525~~ 1,614,074**	**~~32,526~~ 50,414**	**~~21,682~~ 30,210**	**~~3,296,733~~ 5,645,652**	

Output 1.4 Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods livelihood and infrastructure			Contractual Services	~~21,000~~23,584	~~18,232~~20,475	~~18,232~~20,475	~~18,232~~20,475	~~75,696~~ 85,010	M
			In-country logistics	~~200~~777	~~413~~1,604	~~413~~1,604	~~413~~1,604	~~1,439~~ 5,590	N
			IT and Communications	~~191~~1,961	~~50~~513	~~50~~513	~~50~~513	~~341~~3,501	O
			Sub-Total Output 1.4	**~~21,391~~26,322**	**~~18,695~~22,593**	**~~18,695~~22,593**	**~~18,695~~22,593**	**~~77,476~~94,101**	
			Sub Total Outcome 1	***~~4,491,391~~871,556***	***~~2,677,635~~293,083***	***~~87,021~~90,336***	***~~64,351~~65,423***	***7,320,~~398~~397***	
OUTCOME 2: Strengthened local awareness and ownership of integrated, climate-resilient freshwater management systems									
Output 2.1 Community consultations on each target island ensure participative design, sustainability and continued maintenance of integrated water resource management schemes	**MHE**	**Adaption Fund**	Contractual Services	30,000	0	0	0	30,000	P
			Materials and Goods	6,000	0	0	0	6,000	Q
			Travel	34,000	0	0	0	34,000	R
			Sub-Total Output 2.1	**70,000**	**0**	**0**	**0**	**70,000**	
Output 2.2 Targeted training events conducted in all atolls to strengthen water user participation and skills in adaptive, integrated water resource management			Contractual Services	3,000	2,000	1,000	1,000	7,000	S
			Materials and Goods	2,000	2,000	2,000	1,000	7,000	T
			Travel	5,000	6,000	7,000	8,000	26,000	U
			Sub-Total Output 2.2	**10,000**	**10,000**	**10,000**	**10,000**	**40,000**	
			Sub Total Outcome 2	***80,000***	***10,000***	***10,000***	***10,000***	***110,000***	
OUTCOME 3: Improved institutional capacity to promote and enforce climate-resilient freshwater management on all inhabited islands									
Output 3.1 Training of technicians in the design, operation and management of Integrated Water Resource Management systems	**MHE**	**Adaption Fund**	Contractual Services	4,000	3,000	3,000	0	10,000	V
			Materials and Goods	3,000	4,000	3,000	0	10,000	W
			Travel	3,000	3,000	4,000	0	10,000	X
			Sub-Total Output 3.1	**10,000**	**10,000**	**10,000**	**0**	**30,000**	
Output 3.2			Contractual Services	0	5,000	0	15,000	20,000	Y

Institutional mechanisms created to integrate adaptive management of freshwater resources into the design and rollout of new water management projects and schemes			Travel	0	5,000	0	5,000	10,000	Z
			Sub-Total Output 3.2	**0**	**10,000**	**0**	**20,000**	**30,000**	
Output 3.3 Action plan developed and financing mobilized to replicate integrated, climate-resilient freshwater management on at least 4 additional islands			Contractual Services	0	0	0	10,000	10,000	AA
			Travel	0	0	0	10,000	10,000	BB
			Sub-Total Output 3.3	**0**	**0**	**0**	**20,000**	**20,000**	
			Sub Total Outcome 3	***10,000***	***20,000***	***10,000***	***40,000***	***80,000***	
Project Execution, Monitoring and Evaluation									
Monitoring and Evaluation	**MHE**	**Adaption Fund**	Contractual Services	3,000	24,000	5,000	24,000	56,000	CC
			Materials and Goods	5,000	3,000	5,000	5,000	18,000	DD
			Travel	10,000	10,000	10,000	10,000	40,000	EE
			Sub-Total Monitoring & Evaluation	**18,000**	**37,000**	**20,000**	**39,000**	**114,000**	
Project Management Unit	**MHE / Responsible Party**		Local Technical Staff	66,000	66,000	21,000	21,000	174,000	FF
			Int'l Senior Technical Engineer	105,000	105,000	0	0	210,000	GG
	MHE		PM National Staff	42,000	42,000	42,000	42,000	168,000	HH
			Travel	12,000	12,000	12,000	12,000	48,000	II
			Materials & Goods	3,500	3,500	3,500	3,500	14,000	JJ
			IT and Communications	4,000	4,000	4,000	4,000	16,000	KK
			Miscellaneous	9,949	10,948	1,148	8,557	30,602	LL
			Sub-Total Project Management Unit	**242,449**	**243,448**	**83,648**	**91,057**	**660,602**	
			Sub-Total Project Execution, Monitoring and Evaluation	***260,449***	***280,448***	***103,648***	***130,057***	***774,602***	
			PROJECT TOTAL	**4,841,840**	**2,988,083**	**210,669**	**244,408**	**8,285,000**	

Budget notes:

A.	Contracts for the provision of ~~groundwater provision in the three islands – small contractor for approx. 1555 artificial wells~~managed aquifer recharge (MAR) study, ground water recharge design desk studies, and Implementation Support Services for procurement, contracting, and logistics
B.	Material cost associated with ~~1555~~implementation of MAR plan including artificial wells
C.	Appropriated cost of logistics and transport for equipment and materials for the duration of the project – includes a share of ~~a project boat, and~~ project offices in each island
D.	Communication and IT service costs for the project duration – includes appropriated costs of IT equipment and 10 laptop computers, 4 printer/scanner/fax A4 in island offices, as well as IT and communication consumables
E.	Contracts for the provision of Rainwater harvesting in the three islands – small and medium contractors for the integration of household and community rainwater systems and Implementation Support Services for procurement, contracting, and logistics
F.	Correspondent materials for the integration of rainwater harvesting components of the project
G.	Appropriated cost of logistics and transport for equipment and materials for the duration of the project – includes a share of a project boat, and project offices in each island
H.	Communication and IT service costs for the project duration – includes appropriated costs of IT equipment and 10 laptop computers, 4 printer/scanner/fax A4 in island offices, as well as IT and communication consumables
I.	Contractual services for the provision of the integration of the desalination plant facilities into the island water network and the installation of the desalination plant in the islands, with the correspondent intakes, and related infrastructure and related EIAs, and Implementation Support Services for procurement, contracting, and logistics
J.	Correspondent materials for the integration of desalination water sources into the project
K.	Appropriated cost of logistics and transport for equipment and materials for the duration of the project – includes a share of a project boat, and project offices in each island
L.	Communication and IT service costs for the project duration – includes appropriated costs of IT equipment and 10 laptop computers, 4 printer/scanner/fax A4 in island offices, as well as IT and communication consumables
M.	Contractual services related to the pumping of 2 times per year of the septic tanks in each island for 4 years = 24 times; Design costs of MAR Study and Implementation Support Services for procurement, contracting, and logistics
N.	Appropriated cost of logistics and transport for equipment and materials for the duration of the project – includes a share of a project boat, and project offices in each island
O.	Communication and IT service costs for the project duration – includes appropriated costs of IT equipment and 10 laptop computers, 4 printer/scanner/fax A4 in island offices, as well as IT and communication consumables
P.	Technical consultations on each target island between MHE representatives, island councils, community members, utility companies and project staff. Includes a questionnaire-based 'willingness to pay' survey
Q.	Materials & catering for at least 3 consultations per island
R.	Travel of project staff related to consultations with island councils, government authorities, utility companies
S.	Facilitator/Trainer for IWRM workshops
T.	Workshop materials (1000,- USD per region): Leaflets, brochures, DVDs
U.	Travel costs for workshop participants
V.	Workshop facilitation and resource people (2 workshops)
W.	Training materials (maps, plans, handbooks, water quality testing kits)
X.	Travel support to workshop participants
Y.	Expert review and input to make new water management / wastewater management proposals climate resilient and integrates
Z.	Exposure visits of government officials and private sector representatives to target islands
AA.	Assessment missions to 4 islands for follow-up project design and planning
BB.	Travel costs for assessment missions
CC.	Costs for external mid-term evaluation, terminal evaluation, specialized analytical/technical reports as required
DD.	Materials for Inception workshop and project launch, PB meetings, presentations to CC Council
EE.	Travel & DSA for external evaluators and technical analysts
FF.	1 International Senior IWRM engineer, senior manager for technical assurance, and 1 International Electromechanical Engineer supporting the PMU and the project implementation
GG.	Monitor and Quality Assurance on each island: 3 civil/mechanical engineers in different disciplines (Water-Sanitation); 1 community liaison officer and 1 logistics assistant. One engineer technical project officer in the PMU
HH.	1 National Project Manager (2500 USD per month), 1 Admin & Finance Assistant (1000 USD per month), 1 National Technical Officer
II.	PMU Travel for project monitoring, supervision, participation in technical consultations
JJ.	PMU office consumables
KK.	PMU communication costs (including 2 laptops, 1 fax/printer, cellphone)
LL.	Contingency amount to address currency fluctuations

Cost Estimates for Contractual Services and Equipment on each target island (excluding costs for transport, communication and technical supervision)

Preliminary Cost Estimate for Ihavandhoo Water Supply System-Table 1					
Item	**Description of Item**	**Unit**	**Quantity**	**Unit Rate in US $**	**Amount in US $**
1	Topographic Survey, water quality testing	LS	1	10,000	10,000
2	Construction of Intake Facilities	Nr	1	20,000	20,000
3	Construction of Intake pump house & generator house	Nr	1	50,000	50,000
4	Supply and Installation of Intake pumps (3.75m^3/hr, 10m head)	Nr	2	20,000	40,000
5	Supply & laying of 110mm dia PE Raw water pipe line from Intake to WTP	m	1,000	20	20,000
6	Provision of Desalination Treatment Plant of 90 cum capacity (Supply and installation)	m^3	90	3,700	333,000
7	Supply of 4 x 10 cum capacity CWT	Nr	4	1,250	5,000
8	Construction of clear water pump house	Nr	1	20,000	20,000
9	Supply and Installation of high lift pumps (4.5m^3/hr, 30m head) to convey water to elevated tank	Nr	2	20,000	40,000
10	Construction of elevated tank 30cum, height 20m	m^3	30	1,000	30,000
11	Transmission line to ET, 90mm	m	1500	15	22,500
12	Distribution network with PE pipes of dia. varying from 90mm to 50mm	m	18,000	10	180,000
13	Supply and Installation of Generator 40KVA capacity including panels and necessary cable connections to demand centers	Nr	2	25,000	50,000
14	House connections with water meter	Nr	700	75	52,500
15	Administration Building 1 Nr	m^2	30	600	18,000
16	DI Valves, fittings & accessories	LS	1	40,000	40,000
17	Improvement to household RWH system	Nr	700	460	322,000
18	Improvement to roofs for community RWH system	LS	1	50,000	50,000
19	Transmission pipeline 75mm to TP site	m	5000	15	75,000
20	Low lift pumps	Nr	6	15,000	90,000
21	Solar Panels	Nr	3	85,000	255,000
21	Filtration system	Nr	1	50,000	50,000
22	UV disinfection system	LS	1	2,500	2,500
23	Raw Water storage tank	m^3	9000	79	711,000
24	PE pipe welding plant	Nr	1	50,000	50,000
25	Groundwater recharge	Nr	730	116	84,680
26	Water quality testing equipment kit	Nr	1	400	400
27	Pumping of wastewater from septic tanks	Nr	8	3,000	24,000
				Grand Total	**2,645,580**

Preliminary Cost Estimate for Mahibadhoo Water Supply System: Table – 2					
Item	**Description of Item**	**Unit**	**Quantity**	**Unit Rate in US $**	**Amount in US $**
1	Topographic Survey, water quality testing	LS	1	10,000	10,000
2	Construction of Intake Facilities	Nr	1	20,000	20,000
3	Construction of Intake pump house & generator house	Nr	1	50,000	50,000
4	Supply and Installation of Intake pumps (2.5m^3/hr, 10m head)	Nr	2	20,000	40,000
5	Supply & laying of 90mm dia PE Raw water pipe line from Intake to WTP	m	1,000	20	20,000
6	Provision of Desalination Treatment Plant of 50 cum capacity (Supply and installation)	m^3	50	4,600	230,000
7	Supply of 2 x 10 cum capacity CWT	Nr	2	-	0
8	Construction of clear water pump house and generator house	Nr	1	20,000	20,000
9	Supply and Installation of high lift pumps (3.0m^3/hr, 30m head) to convey water to elevated tank	Nr	2	20,000	40,000
10	Construction of elevated tank 20cum, height 20m	m^3	20	1,000	20,000
11	Transmission line to ET, 90mm	m	1500	15	22,500
12	Distribution network with PE pipes of dia. varying from 90mm to 50mm	m	12,000	10	120,000
13	Supply and Installation of Generator 30KVA capacity including panels and necessary cable connections to demand centers	Nr	2	20,000	40,000
14	House connections with water meter	Nr	275	75	20,625
15	Administration Building 1 Nr	m^2	30	600	18,000
16	DI Valves, fittings & accessories	LS	1	30,000	30,000
17	Improvement to household RWH system	Nr	275	460	126,500
18	Improvement to roofs for community RWH system	LS	1	50,000	50,000
19	Transmission pipeline 75mm to TP site	m	5000	15	75,000
20	Low lift pumps	Nr	6	15,000	90,000
21	Solar Panels	Nr	3	85,000	255,000
21	Filtration system	Nr	1	50,000	50,000
22	UV disinfection system	LS	1	2,500	2,500
23	Raw Water storage tank	m^3	6300	79	497,700
24	PE pipe welding plant	Nr	1	50,000	50,000
25	Upgrading of existing desalination plant	LS	1	50,000	50,000
26	Water quality testing equipment kit	Nr	1	400	400
27	Groundwater recharge	Nr	305	116	35,380
28	Pumping of wastewater from septic tanks	Nr	8	3,000	24,000
				Grand Total	**2,007,605**

Preliminary Cost Estimate for Gadhdhoo Water Supply System: Table – 3					
Item	**Description of Item**	**Unit**	**Quantity**	**Unit Rate in US $**	**Amount in US $**
1	Topographic Survey, water quality testing	LS	1	10,000	10,000
2	Construction of Intake Facilities	Nr	1	20,000	20,000
3	Construction of Intake pump house & generator house	Nr	1	50,000	50,000
4	Supply and Installation of Intake pumps (2.5m^3/hr, 10m head)	Nr	2	20,000	40,000
5	Supply & laying of 90mm dia PE Raw water pipe line from Intake to WTP	m	1,000	20	20,000
6	Provision of Desalination Treatment Plant of 50 cum capacity (Supply and installation)	m^3	50	4,600	230,000
7	Supply of 4 x 10 cum capacity CWT	Nr	4	-	0
8	Construction of clear water pump house and generator house	Nr	1	20,000	20,000
9	Supply and Installation of high lift pumps (3.0m^3/hr, 30m head) to convey water to elevated tank	Nr	2	20,000	40,000
10	Construction of elevated tank 20cum, height 20m	Nr	20	1,000	20,000
11	Transmission line to ET, 90mm	m	1500	15	22,500
12	Distribution network with PE pipes of dia. varying from 90mm to 50mm	m	12,000	10	120,000
13	Supply and Installation of Generator 30KVA capacity including panels and necessary cable connections to demand centers	Nr	2	20,000	40,000
14	House connections with water meter	Nr	495	75	37,125
15	Administration Building 1 Nr	m^2	30	600	18,000
16	DI Valves, fittings & accessories	LS	1	28,959	28,959
17	Improvement to household RWH system	Nr	495	460	227,700
18	Improvement to roofs for community RWH system	LS	1	50,000	50,000
19	Transmission pipeline 75mm to TP site	m	5000	15	75,000
20	Low lift pumps	Nr	6	15,000	90,000
21	Solar Panels	Nr	3	85,000	255,000
21	Filtration system	Nr	1	50,000	50,000
22	UV disinfection system	LS	1	2,500	2,500
23	Raw Water storage tank	m^3	6300	79	497,700
24	PE pipe welding plant	Nr	1	50,000	50,000
25	Upgrading of existing desalination plant	LS	1	50,000	50,000
26	Water quality testing equipment kit	Nr	1	400	400
27	Groundwater recharge	Nr	525	116	60,900
28	Pumping of wastewater from septic tanks	Nr	8	3,000	24,000
				Grand Total	**2,149,784**

ANNEX D

Technical Baseline

A combined team of senior engineers from UNOPS and community development officers from UNDP undertook a field survey visit to all three targeted islands from 14th to 16th March 2011 to reconfirm the physical characteristics of each island, inventorize existing facilities, take stock of immediate requirements of the inhabitants, opinions and views of the islanders, and assess fresh- and wastewater management initiatives which are proposed or currently under implementation.

1. EXISTING FACILITIES

1.1 General

It was confirmed that the most important and urgent priority requirement of the inhabitants in all three islands is access to safe, secure, sustainable and non-interrupted potable pipe-borne water supply. Canvassed inhabitants stated that they are prepared to pay a tariff charged to cover the operational and maintenance costs of the system, this despite economical hardships faced by some. The islanders consulted were fully aware of the quality of the existing groundwater, and that this has been seriously contaminated by salinity intrusion and human waste, due to unsecured septic tanks. Traditional rainwater harvesting is the primary source of drinking water for the inhabitants throughout the year particularly during the rainy season. However, many are unable to store sufficient quantity of rainwater for the prolonged dry season period due to inadequate land space in their individual plots to install large capacity storage tanks. Moreover, they are understandably reluctant to use rainwater stored for a protracted period of time as no facilities are on hand at island level for water quality testing. It was reported that currently the dry period lasts for almost 5 to 6 months and there is a scarcity of safe drinking water during that time.

The current facilities in the three targeted islands, namely potable water supply, wastewater management and groundwater recharge, are very similar. The degree of hardship experienced every year by inhabitants during the prolonged drought periods are also similar. At present, no functional pipe-borne water supply scheme or wastewater treatment system exists in these islands, and the inhabitants are obliged to rely on traditional rainwater harvesting techniques for their drinking and cooking water requirements. Inhabitants use contaminated shallow groundwater for other domestic water needs such as washing of clothes and bathing. Imported and locally produced bottled-water is extensively utilized for drinking and cooking, particularly during dry season, as reported by the inhabitants during the site visit.

The rainwater harvesting system adopted for isolated islands of the Maldives as a primary source for drinking water is an acceptable low-cost solution with proven to provide good quality water, if the system is maintained regularly to acceptable standards. The 2,500litres capacity PE storage tanks commonly available to the islanders was reported by inhabitants during the site visit to be insufficient to cover the entire dry period for a standard size family to cater for drinking, cooking, etc. In Ihavandhoo, current figures provided by the MHE indicate that a total storage capacity on the island of approximately 134 m3. The total roof area of privately owned buildings is 19,483m2 and 611m2 for public buildings. Comparable information is currently being collated for Mahibadhoo and Gadhdhoo.

The inhabitants on all three islands are currently experiencing difficulties in storing large quantities of water in a small plot of land for utilization during a prolonged dry period of four to six months period. In addition, inhabitants are reluctant to drink water stored for a prolonged period of time as no disinfection facilities have been incorporated in the rainwater harvesting system. Furthermore, this is compounded by

the lack of water quality testing equipment at island level. These three densely populated islands have been experiencing a significant potable water crisis and serious sanitation issues due to lack of available quality water as well as a proper wastewater disposal system. This has not only exposed these communities and their children to communicable diseases such as diarrhea, typhoid etc. which in turn may lead to other socio-economic effects such as loss of income, poor work turnouts, etc. in the long run.

1.2 Household Rainwater Harvesting

In the Maldives, rainwater collection is a generations old tradition which can be traced back to 3,000 years ago and has been a longstanding means of collecting high-quality water for domestic, drinking, agricultural and other uses. Maldives used to receive relatively regular and substantial rainfall amounts, however in the recent past declining and erratic rainfall patterns have become a major cause for concern, as reported by MHE officials. Despite experiencing substantial seasonal rainfall across all islands, inhabitants are becoming more and more reluctant to collect rainwater during the rainy season for year round consumption, due to the lack of large volume storage facilities needed for such a purpose. The cost of such large capacity storage tanks is high and it is technically complex to install such a tank on a small plot of land provided to each family.

1.2.1 Maintenance of Rainwater Harvesting System

The rainwater harvesting system, installed by island communities, is a traditional one and no effort has been made to upgrade the system to reflect recent innovations such as the incorporation of disinfection facilities with easily installable UV-ray and other components such as leaf guard, leaf screen, roof washer tank, etc. The removal of tree branches over-hanging the water capture area is not practiced regularly. Installation of a small on-demand in-line pump is very valuable as the water could be made to flow automatically into the water taps installed at each house for maximum convenience.

The first-flush diverter concept is practiced extensively, but without any systematic monitoring of the quantity of water diverted on each occasion. Thus, some important modifications have to be incorporated into the traditional household rainwater harvesting system with a view to improving water quality and maximizing expediency.

1.3 Groundwater

The freshwater lens is available on all three targeted islands, lying 1.0 to 2.0 meters beneath the existing ground surface in the coral that makes up the islands. A limited quantity is sandwiched between saline water below and human waste above. The proximity of groundwater to the land surface, and the porous nature of the sandy soil, makes it highly susceptible to pollution and contamination from human activities and saltwater intrusion. Most islander households use individual septic tanks that are poorly built and maintained. This has led to untreated sewage infiltrating and polluting the shallow fresh groundwater by seepage and leaching. Thus, all three islands groundwater has been severely contaminated by human waste. The contaminated groundwater is extensively used by the island community for bathing, washing of clothes, flushing of toilets, etc. Usage of contaminated groundwater for bathing and washing of clothes, presents a health hazard to inhabitants.

1.4 Desalinated Water Supply

Identical membrane reverse osmosis desalinization plants, with a production capacity of 10 m^3 per day each, have been installed aftermath of the 2004 Indian Ocean Tsunami in Mahibadhoo and Gadhdhoo.

The installation of these two plants was completed in 2006 / 2007 by the International Red Cross Federation and handed over to the respective communities. These plants have not been functional for more than a year due to several technical reasons. These include the non-availability of spare parts in the country, intake clogging, insufficient funds to cover operation and maintenance costs, etc. The desalinated water has been delivered to consumers through public standpipes for two hours each day whenever the plant is in operation. The average monthly energy cost for operating the plant for 8 hours a day is estimated at about MVR 30,000.00 (approximately USD 2,345.00), according to local sources

1.4.1 Mahibadhoo Desalination Plant

The desalination plant at this island is not in operation at present due to a problem associated with the intake pump. This pump has since repaired and the plant is ready to resume operations. An OD 75mm PE pipeline has been laid along the main road of the island from the desalination plant as a trunk main. A total of seven (07) public standpipes have been installed at different locations within the island with 25mm diameter branch pipelines. Water has been supplied to consumers between 16.00hrs and 18.00 hrs whenever the plant is in operation. The facilities incorporated in this water supply system are as follows:

- 10 m^3/day capacity RO desalination plant complete - 01 Nr
- Clearwater storage tanks, 10,000 litres capacity - 02 Nr
- Public standpipes - 07 Nr
- Recommended minimum quantity per capita consumption - 20litres
- Maximum quantity of water available per day - 10 m^3
- Minimum water demand / day (2,110 x 20/1000) - 42 m^3

The power required for the operation of the plant has been supplied by the island power station and no tariff is collected at present for the supply of water. No standby provision is available for almost all pumps except for the high lift installed at the desalination plant. The transmission pipelines already laid for the present water supply system will be incorporated into the new project wherever feasible.

1.4.2 Gadhdhoo Desalination Plant

The desalination plant at this island is not in operation at present due to a problem associated with its intake facility. The degree of salinity at its intake appears to be high at times for the plant to operate effectively. Modifications to the intake are necessary to resolve this problem, according to the plant operator. An OD 90mm PE pipeline has been laid along the main road of the island from the desalination plant as a trunk main and ten (10) public standpipes have been installed at different locations within the island with 25mm diameter branch pipelines. Water is issued to consumers between 16.00hrs and 18.00 hrs whenever the plant is in operation. The facilities incorporated into this water supply system are as follows:

- 10 m^3/day capacity RO desalination plant complete - 01 Nr
- Clearwater storage tanks, 10,000 litres capacity - 04 Nr
- Public standpipes - 10 Nr
- Minimum quantity per capita consumption - 20litres
- Maximum quantity of water available per day - 10 m^3
- Minimum water demand / day (2,850 x 20/1000) - 57 m^3
- RWH storage tank, 5,000 litres capacity - 06 Nr

The power required for the operation of the plant has been supplied by the island power station and no tariff is collected at present for the supply of water. No standby provision is available for almost all

pumps, except for high lift installed at the desalination plant. The transmission pipelines already laid for the present water supply system will be incorporated into the new project whenever feasible.

1.5 Wastewater Treatment

The safe disposal of domestic and municipal wastewater / sewage to the environment in densely populated communities, always posed a challenge in the past, prior to the introduction of septic tanks. Though the septic tanks are an acceptable means of safe discharge of wastewater / sewerage to the environment, the improper use of septic tanks (which discharge untreated or partially treated effluents) may cause potentially hazardous environmental effects to the communities, risking an increased spread of communicable diseases such as cholera, diarrhea, typhoid, etc. Moreover, the use of septic tanks to dispose wastewater / sewage safely in an area housing a high-density population can pose a serious challenge and may often lead to serious pollution of groundwater sources to such an extent that it can no longer be used to meet the water needs of the communities.

Remote islands in the Maldives are no exception to the above phenomena, and the groundwater sources in such islands have been badly deteriorated and become unfit for any domestic purpose due to contamination from sewage and salinity intrusion. Therefore, it has become imperative to find a durable and sustainable treatment process to dispose wastewater/ sewage generated by the communities in these islands to the environment with safe BOD and COD levels. Functional wastewater treatment facilities are not in existence in any of the three targeted islands at present and sewage is discharged into unsecured and poorly built septic tanks that are prone to leaking and leaching into the shallow groundwater aquifer.

2.5.1 Mahibadhoo Sewage Treatment Plant (STP)

A new wastewater treatment plant is currently under construction at Mahibadhoo by an international contractor “Shin Nippon Air Technologies Co. limited” at an estimated cost of US$ 4.3 million due to be completed by September 2011. A gravity wastewater conveyance system with three dedicated pumping stations has been planned for transmission of sewage. The depth of pipelines below the ground level is limited to a maximum of 2.0m in view of the shallow ground water table and the minimum depth of the pipeline is about 0.5m to create anticipated gravity flow. µPVC pipes have been used for the gravity conveyance pipelines while PE pipes have been used for the pressure lines.

In addition, the treated sludge from the STP will be deposited by pumping into the sludge drying beds located near the plants and naturally composted with the bio - degradable waste on the islands. Humus generated from this composting process will be utilized to improve soil conditions on the islands and to promote and increase agriculture and home gardens. The quality of effluent anticipated from the anaerobic / aerobic sewage treatment system is in excess of BOD $\geq$ 20 and cannot be utilized for the watering of plants and recharging of ground water in the islands. Thus, it has been planned to safely discharge effluent into the brackish water at the periphery of the island with a suitably constructed outfall structure. It would be possible to improve the quality of the effluent in the future with additional secondary and tertiary treatment of the wastewater.

The µPVC pipes used for the gravity conveyance system are likely to crack under heavy loads and are prone to leak through the socket and spigot type joints. In consideration of this situation, UNOPS would use PE pipes for the new water supply transmission and distribution network in Mahibadhoo.

1.5.2 Ihavandhoo and Gadhdhoo STP

Government of Maldives MoHE officials confirmed that similar wastewater treatment plants have been planned for Ihavandhoo and Gadhdhoo and the engineering designs have been already completed with implementation anticipated in the near future. The estimated cost of each plant is about US$ 6.0million.

In consideration of the prevailing groundwater situation, the construction of wastewater treatment plants for the three targeted islands are in the pipeline and will be financed by other means. Hence, and to avoid unwarranted duplication of efforts, no action is required under this project for this particular component. However some specific activities are required and will be undertaken through this project to integrate cleaning mechanisms to improve groundwater pollution, and ensure synergies between the operation of freshwater management and wastewater management systems.

1.6 Groundwater Recharge

The coastal areas of the targeted islands are very fragile and continuously threatened by migration of sea water inwards and saline water intrusion into the shallow freshwater aquifer, primarily due to over exploitation. In addition, leaking wastewater from household septic tanks contaminates the scarce groundwater source.

No concrete initiatives have been taken to artificially recharge the ground water to reduce the likely ground water pollution by saline water and wastewater. Only natural groundwater replenishment and recharging is occurring during each rainy season at present.

ANNEX E

Design Considerations for an Integrated Water Resource Management System on Ihavandhoo, Mahibadhoo and Gadhdhoo

1. General

The traditional rainwater harvesting system extensively practiced on all three targeted islands as a primary source for potable water supply is becoming more and more unpredictable due to changes in rainfall patterns. Thus, identifying an alternate fully independent option for the supply of drinking water is imperative. A relatively expensive option is desalination, both in terms of fuel consumption cost, and high carbon emissions if desalination plants are run by diesel generators as opposed to solar or wind power. Under this scenario, UNOPS proposes to resolve this acute shortage of potable water by tapping all available avenues with a view to minimizing the overall production cost and environmental risk with a view to cutting carbon emissions. The economically viable approach of a combined water supply system within the context of fully Integrated Water Resource Management (IWRM) consists of the following list of sources:

- Community-based rainwater harvesting system
- Modernized household rainwater harvesting system
- Desalination Plant to supply the minimum water requirement only in critical situations

It is not intended that desalination plants become the primary source of potable water. That said, all potable water supplied by the three independent systems recommended above would be directly connected to each household to reach the overall aim of providing a safe and sustainable pipe-borne water supply system operational around the clock. The selection of a particular source for operations at any given time largely depends on the judgment of the operators and house owners. Ideally, the least expensive household rainwater harvesting system should be in operation during the rainy season and beyond, whilst moderately costly community-based rainwater harvesting should commence operations immediately after the rainy season has finished, supplemented by the more expensive desalinated water.

2. Design Standards

It is important to select an appropriate design horizon in the planning and design of any infrastructure project. In consideration of the Maldivian context and the nature and magnitude of municipal infrastructure, this comprises a considerable amount of electromechanical equipment that having a lifespan of not more than 20 years. Thus, it is appropriate to design an IWRM system for a midterm period of 20 years with the option to expand it in the future.

2.1 Water Supply

The system will be designed in a manner to provide sustainable potable water to the consumers within the supply area on a continuous basis under normal circumstances. The system in general will comply with the following conditions:

- All inclusive consumption rates per person from each house connection are expected to vary between 20 and 45 litres per day.

- Non Revenue Water (NRW) shall be limited to 5% for these new water supply schemes.
- No public standpipes to be provided as 100% house connections envisaged. Commercial and industrial demand to be determined for each scheme individually as a percentage of population water demand in conjunction with local trends, development patterns and historical records.
- Service coverage ratio will be 100% on completion of the project.
- Pumping efficiency will be in the region of 50% to 75%.
- Bulk water meters will be installed at all strategic locations including raw water, treated water and reservoir outlets.

2.2. Pipelines

The design concept adopted for sizing the pipes for raw water transmission, treated water transmission, distribution network etc. will be generally in compliance with the provisions set out by local specifications and other internationally recognized standards.

Hazen Williams Pipeline Friction Factor (C) for various pipe materials are given below:

- DI pipe (mortar lined): New - 130
  Old - 120
- PVC pipe: New - 140
  Old - 130
- PE pipe: New - 150
  Old - 150
- Velocity of liquid flow in pumping main will be limited to 1.5m/s.
- Losses at fittings and specials would be either computed separately item by item or allowed as an overall percentage of 10 for DI, PVC and PE pipe materials.
- The size of the washout pipe will be between 1/3 and 1/6 of the diameter of the main transmission pipe.
- The normal depth of earth cover for the pipeline will be maintained at a minimum of 0.5m for 50mm diameter and increased further for larger pipes according to local standards.
- Transmission pipeline capacity will be 1.20 times the daily average production capacity for the year 2030.
- Distribution pipeline capacity will be 2.0 times the daily average flow capacity for the year 2030 to allow for the peak hourly flow.
- Residual pressure head at connections to distribution mains will be a minimum of 10m.

2.3 Storage Reservoirs

Service reservoirs in the form of elevated towers or ground level tanks have to be provided in the vicinity of the supply area at the highest ground elevation to minimize construction costs. The shape of reservoirs will be determined taking into account site conditions and cost. In consideration of the low-lying flat nature of the islands in question, an elevated tank is required for the proper distribution of water by gravity, with sufficient residual pressure. A maximum pressure of three bars would be allowed for in this project with a minimum pressure of one bar.

- A minimum reservoir storage capacity of at least 30% of the daily average demand for the year 2030 including that of the clear water tank would be provided to account for the variable demands from the consumers.
- The storage capacity of the elevated tank shall be limited to 20% of the daily average demand for the year 2030 due to the high cost of construction.

- A dedicated transmission main for each service storage reservoir will be provided, if economically viable.

The reservoir types of foundation, either pad or raft, will be determined based on the results of the geotechnical investigations. The inlet, outlet, overflow and drain pipes will be provided for the tank. Service access to the tank will be incorporated for maintenance purposes.

3. Area of Coverage

The shallow groundwater sources available for the inhabitants of these islands have been completely contaminated by the intrusion of saline water and leaking from poorly constructed septic tanks. Hence, a larger section of the population within the supply areas needs to be provided with potable water from the proposed water supply systems. The coverage area will be 100% and the minimum per capita consumption will be limited to 20 litres initially and gradually increased to 45 litres by 2030, as described into the proposed strategy below.

3.1. Raw Water Source

Identification of the most appropriate and reliable raw water source of acceptable quality, adequacy in quantity and optimal distance from the service area is of paramount importance to the development of any cost-effective water supply system. Since the availability of surface water is virtually non-existent in these islands and ground water is contaminated with salinity intrusion and fecal coli-forms, the use of such sources for treatment cannot be considered favorably. In this context, the treatment of rainwater collected through household / community level rainwater harvesting systems, supplemented by the use of combined sea water desalination treatment through reverse osmosis process are considered advantageous.

Desalination has been in use successfully and is seen as a favorable option in bigger and more populated islands such as the capital Male', Hulhumale', Villinigili and some tourists' resorts in the Maldives during last decade due to the abundance of available seawater. The high energy costs and hi-tech operation of such plants make desalination an unfavorable option for small and remote communities. While desalination plants can provide the minimum potable water requirement in all conditions, the maximum exploitation of low-cost and hassle-free rainwater harvesting in the targeted islands will be the main focus of the project. Rainwater harvesting is a more environmentally sound option that protracted over reliance on desalination plants with their inherent high running costs and problematic ongoing maintenance challenges.

3.2. Population Forecast and Water Demand

The daily production capacity of the proposed water supply system is primarily influenced by the projected population and the corresponding daily water usage pattern of the affected community. The actual population of the targeted islands for the year of 2000 and 2006 (census) has been obtained from the Department of National Planning (DNP). The project population of each selected island has been computed and presented below using the formula: $[P_n = P_o (1+R/100)^{n-1}]$

Where	P_n	-	Population after n years
	P_0	-	Population of base year
	R	-	Annual population growth
	N	-	Period

	Ihavandhoo	Mahibadhoo	Gadhdhoo
Population 2000	2062	1714	1701
Population 2006 (census)	2447	1780	1439
Growth rate %	2.840	0.630	(2.78)
Growth rate % (Design)	2.500	1.750	1.750

Island	**Growth Rate in %**	**Actual Population**		**Projected Population**				
		2000	**2006**	**2011**	**2015**	**2020**	**2025**	**2030**
Ihavandhoo	2.50	2062	2447	2640	2914	3296	3730	4220
Mahibadhoo	1.75	1714	1780	2038	2185	2383	2599	2835
Gadhdhoo	1.75	1701	1439	2023	2169	2365	2580	2813
Consumer Demand = 45 litres per day				**Total Water Demand in m^3**				
Ihavandhoo				119	131	148	168	190
Mahibadhoo				92	98	107	117	128
Gadhdhoo				91	98	106	116	127
Consumer Minimum Demand = 20 lit per day				**Minimum Demand - Desalination Plant**				
Ihavandhoo				53	58	66	75	85
Mahibadhoo				41	44	48	52	57
Gadhdhoo				41	44	47	52	57

Based on the computation shown in the table above, the capacity of the proposed system for each island per day will be as follows:

	Ihavandhoo	Mahibadhoo	Gadhdhoo
Required Desalination Plant	90.0	60.0	60.0
Capacity of existing plant	00.0	10.0	10.0
Capacity of the proposed new plant	90.0	50.0	50.0

Consequently, the remaining potable water supply requirement shall be met from the community based rainwater harvesting system.

	Ihavandhoo	Mahibadhoo	Gadhdhoo
Community RWH system	100.0	70.0	70.0

Conflicting data from different sources on population figures for Gadhdhoo has emerged during preliminary research, thus further investigation is recommended during the detailed design stage to accurately determine the actual and projected population figures for this island.

4. Water Treatment Facilities - Desalination Plant

The desalination plant capacity of the proposed water supply schemes for the targeted three islands Ihavandhoo, Mahibadhoo and Gadhdhoo is based on a design horizon of the year 2030. A limited usage of potable water is estimated at 90 m^3, 60 m^3 and 60 m^3 respectively each day. The plant capacity will be designed to produce 3.75/ 2.5 m^3/hour of fully treated water. The initial daily operating time of the plant is estimated at about 14 to 16 hours in the year 2011 and gradually increases to 24 hours by the year 2030. The saline water required for the production of drinking water has to be obtained from the ocean or brackish lagoon or beach wells. The cost of desalination plant is significantly impacted by the degree of water salinity. Hence, the location of the water abstraction point has to be carefully determined based on detailed investigation and appropriate laboratory water quality analysis.

Desalination plants using different technologies such as multi-stage flash distillation (thermal distillation), membrane process, ion exchange, freezing, etc. are available on the international market. Membrane technology-based desalination plants consume relatively little energy for the amount of water produced. The optimum cost (capital investment and energy consumption) for an effective desalination plant has to be identified for this project during the detailed design stage. The proposed desalination treatment process of the systems [90 m^3/day and 60 m^3/day] comprises the following major components of works:

- Intake works
- Raw water pumps to transmit water to the desalination plant (abstraction velocity shall be about 0.10m/s to facilitate fish escape, if direct abstraction from ocean or lagoon is opted for)
- Raw water conveyance main of OD 110mm / 90mm PN 10, PE 100 pipe (based on low velocity abstraction) of about 1,000 m long
- Desalination plant of production capacity 3.75 / 2.50 m^3/hour (maximum 24 hrs of operation)
- 40 /30 m^3 capacity of clear water tank
- Clear water pump house and generator house (standby provision)
- Variable speed pumps with standby provision for direct pumping to supply area [or alternatively 30 / 20 m^3 capacity elevated storage tank, 1.5km of OD 90mm PN6 PE80 pumping main and standard centrifugal pump with standby provision for gravity distribution]
- Standby generator
- Concentrated safe wastewater disposal system
- Distribution system of pipe sizes varying from 90mm to 50mm PE 80, PN 6 pipes of about 18 / 12 km length
- Administrative building for operations and maintenance

Approximately 3.70 kWh of energy is required daily to run the desalination plant to produce one m^3/day of drinking water. The required power supply has to be obtained from the island power supply with provision for a standby generator.

5. Water Treatment Facilities – Rainwater Harvesting (RWH)

Following an IWRM approach, the project will work closely with local authorities and utility companies to ensure that the rainwater harvesting scheme and groundwater recharging activities are linked directly with provision for safe disposal of wastewater. The project recommends rainwater harvesting systems as the most feasible cost effective solution for isolated island communities in Maldives. This is a consumer friendly and acceptable option already used by inhabitants. Thus the project will advocate for a rainwater harvesting system as the primary option for supply of potable water with a desalination plant in addition

as a supplementary measure to ensure potable water security. Two possible rainwater harvesting systems could be considered for this project:

- Individual household system
- Community-based centralized system

Household rainwater harvesting is extensively practiced in the targeted islands and the improvements needed to this existing system will be discussed in more detail separately.

5.1. Community-Based Centralized System

The community-based centralized rainwater harvesting system is an essential extension of the traditional household system, but with operations and maintenance carried out by properly trained personnel. Rainwater will be collected from selected buildings (schools, mosques, clubs, community centers, hospital, council houses, etc.) with a large roof area covered with apposite roof materials, an economic distance from the water treatment area, etc. All rainwater transmitted to the central treatment area will be subject to sand filtration / activated carbon, disinfection and dispensed to consumers through a distribution network to individual households. The quality of water produced at the centralized water treatment plant is expected to be very high and to conform to WHO standard at all times with the close monitoring of all components of the system including roof catchment area by operating and maintenance staff.

The total requirement of water for 90 days of continuous dry period shall be approximately (100 x 90 = 9,000) 9,000 m3 for Ihavandhoo and (70 x 90 = 6,300) 6,300 m3 for the other two islands of Mahibadhoo and Gadhdhoo. This requirement may need to be adjusted during the design period if required based on the actual population forecast.

5.2. Catchment Area

It is reasonable to assume that the improved household rainwater harvesting system would be used exclusively by the islanders during the rainy season and rainwater harvesting from the centralized system is needed only during the estimated dry period of up to 90 days. Thus the roof area required to capture rainwater for the dry period consumption could be estimated from the formulae Q = CIA, where,

Q	=	Total rainfall volume
I	=	Rainfall
A	=	Roof area
C	=	Run off coefficient (this is taken as 0.85)

Roof area required for Ihavandhoo	$A = 9,000 / 1.407 / 0.85 = 6,400m^2$
Roof area required for the other 2 islands	$A = 6,300 / 2.124 / 0.85 = 3,490m^2$

Any excess water must be channeled through the groundwater recharge system (filtered pits/well/infiltration) introduced by the project as much as possible at pre-determined times to improve the groundwater quality and increase its quantity.

The public buildings managed by central and local governments with large roof catchment areas have to be identified for collection of rainwater at 3 to 4 locations based on the Islands available infrastructure facilities. These collection points shall be interconnected and water pumped to the central treatment plant and subjected to filtration and disinfection. Both desalination and community based rainwater treatment

systems shall be located at the same place for ease of operations. A major challenge posed by this system is the provision of a large cost effective raw water storage facility at a suitable location/s.

The sedimentation or clarification process is usually incorporated in conventional water treatment system for the separation and removal of larger solid particles from the raw water. The raw water turbidity during this process is anticipated to decline well below 10 NTU in order to maximize the benefits of filtration. The rainwater utilized for this project would not have any heavy sediment and hence clarification process is not required. Filtration is the most essential component of the water treatment process and the final solid-liquid separation stage. The rainwater collected from the roof is anticipated to contain some finer suspended solid matters with an average turbidity level of less than 5 NTU and it has to be removed during the filtration process. Rapid gravity sand filtration system has not been considered for this project due to its complexity in the backwashing process. Slow sand filter or other more advanced filters such as a dyna-sand filter will be evaluated during the detailed design stage for incorporation.

5.3. Transmission System

The transmission pumping main of OD 90mm PN6 PE 80 pipeline running about 1.5km long may have to be laid from the treatment plant site to the elevated tank provided a gravity distribution system is adopted for the project. Similarly, OD 75mm PN6 PE80 pipeline of about 5km may be required for the conveyance of raw water from rainwater harvesting storage tanks to the treatment plant site.

The single largest and most expensive component of the water supply system is the provision of large capacity storage tanks for raw water produced from rainwater harvesting. It is proposed that raw water storage tanks are provided in steel or HDPE prefabricated tanks. This will not only reduce the project's construction costs but saves substantial time frame during implementation. Other available options such as ferro-cement, buried hume pipes, etc. will be evaluated during detailed design stage.

5.4. Disinfection

The need to disinfect the final treated water before distributing to the consumers cannot be overemphasized. Some of the current technical approaches available to provide effective drinking water disinfection techniques are highlighted below:

- Chlorine is the most commonly used disinfectant as it treats larger organisms and offers residual chlorine to cater for the tail end of the distribution system disinfection, but can be expensive with its need for a specially trained operator; and its environmentally detrimental supply chain of a potentially hazardous material;
- Boiling water over a biomass cook-stove, the most well known and reliable treatment method, demands labor, and imposes high economic, environmental, and human health costs.
- UV rays disinfection

It is proposed that the proven cost-effective UV rays disinfection system will be used for this project to disinfect final water. The disinfection location shall be as close as possible to the consumers and preferably at the elevated reservoir outlet point.

5.5. Distribution Network

Potable water produced at the treatment plant (desalination and/or rainwater harvesting) will be transmitted to the elevated water storage tank located at the center of the island for subsequent gravity distribution to consumers. Alternatively, the pumping of water from the treatment plant directly to the

distribution system, with the aid of variable speed pumps, will also be evaluated. In the event the latter option is selected, the need for elevated water tower would be eliminated from the system. Pipes made of PE or PVC material will be utilized for the distribution and transmission lines.

WatCad software will be utilized for the sizing of various pipelines identified for the system. A minimum pipe diameter of 90mm will be used for all major roads within the supply area and 63mm / 50mm diameter for minor roads. The distribution network would be carefully planned to cover the entire developed area and potential development areas. Minimum requirement for laying of a distribution line along a particular street will be to have at least six houses per hundred meters.

The piping system will be incorporated with air valves and washout valves to improve pumping efficiency and cleaning of pipelines respectively. Furthermore, isolation valves will be used in all important stretches of the pipelines in order to isolate a particular section of pipeline during repair and/or maintenance without affecting other areas of the network. Flow meters will also be used in key locations of the distribution network to identify water losses.

5.6. House Connection

An individual house connection with a 19mm / 25mm pipeline from the water main to the household incorporating water meters is proposed under this project. Potable water from both internal (household RWH) and external sources would be connected to the same inlet pipeline to the household with a provision to measure the quantity of water consumed from external source separately.

5.7. Improvements to Household RWH

Individual household rainwater harvesting systems are already practiced in these islands extensively by utilizing traditional methods (collection, transmission, storing and distribution) with minimum or no water quality control. This potentially causes health hazards due to the unchecked spread of water borne diseases. The system may have been constructed without much technical input currently available in the market. Under this program, it is proposed to upgrade the existing system to the present standard of rainwater harvesting for potable water by incorporating additional components such as first-flush diverters, UV disinfectant system, inline demand pump, improvement to gutter and downspouts, preliminary filtration system, additional storage tank, etc.

5.8. Power Supply

Water pumps working with solar energy will be used for the pumping of water from the community rainwater harvesting collection reservoirs to the treatment plant area. Similar pumps will be utilized for transmitting the treated water to the relevant storage reservoir or directly to the distribution system. The project will establish minor pump houses at each location where lifting of water is absolutely necessary.

The electricity requirements to run the system and plant shall be sourced from solar panel where possible and economically viable; when a solar panel is inactive during the monsoon or overcast weather conditions, power will be obtained from island grid.

6. Groundwater Recharge

The project will integrate groundwater recharging system to enhance the capacity of each household to extract adequate groundwater to use for washing clothes and toilet flushing through a well or borehole (with a pump). The groundwater recharging system should contemplate adequate measures to ensure that

no more human waste is leaking or leaching from existing septic tanks. It is highly desirable to empty all the existing septic tanks and close them down with backfilling on completion of the proposed sewage system (to be executed by the government selected contractors). This action will significantly contribute to the gradual improvement of groundwater quality in the near future through persistent recharging process. It is pertinent to mention here that the quality of the groundwater should ideally be clean enough for bathing purposes. Some water is consumed by the users (with or without their knowledge) during the bathing process, and this consumption of contaminated water may lead to health problems.

The groundwater recharge system will be adopted using simple techniques in 2 (two) options:

- Use overflow of rainwater during rainwater harvesting to selected wells
- Recycle the wastewater, after appropriate treatment, from the sewage treatment plant. It is acceptable by Maldives Environmental authority that the BOD<20 can be discharged to sea outfall. However, this water cannot be recycled for groundwater recharge; as this requires more tertiary treatment to reduce the BOD<5.0. This treatment will be expensive in the context of the project.

Benchmark groundwater quality tests will be conducted for all 3 Islands and monitored each half year (or annually) to verify the improvement of the ground water quality. Testing equipment shall be provided by the project to the Utility companies or island community members in charge of the freshwater supply. However, this groundwater will not be suitable for drinking purposes.

6.1 Benefits of Groundwater Recharging

The following benefits may be achieved from groundwater recharging:

- An ideal solution to water problems in areas having inadequate water resources.
- A solution to reduce the intrusion of saline water in agricultural land and to reduce groundwater contamination by sewage, saltwater or other factors.
- The ground water level will rise.
- Mitigates the effects of drought.
- Reduces the runoff which chokes storm water drains.
- Quality of water improves.
- Soil erosion will be reduced.
- Saving of energy per well for lifting of ground water – a one meter rise in water level saves about 0.40 KWH of electricity.

6.2 Source of water used for recharge:

Rainwater harvesting supplemented by a quantity of quality water available for recharging during the rainy season using the overflow from the rainwater harvesting tank. It is recommended to integrate the system in each household and public facilities (Schools, Mosques, Health centers/Hospitals, Community Centers etc.).

6.3 Number of groundwater recharge systems:

The main source of groundwater pollution is at household level and from public buildings on the islands. Hence, groundwater will be recharged at household level and at community facility buildings.

- 1.0 meter diameter and 0.50 meter length of perforated pre-cast pipe will be installed at household level and filled by gravel/sand for infiltration. One in each household.
- 1.5 meter diameter and 0.75 meter length of perforated pre-cast pipe will be installed at public building facilities and filled by gravel/sand for infiltration. Several at each facility.

	No. of Houses	1.0 dia	1.5 m dia
Haa. Ihavandhoo	700	700	30
Ada. Mahibadhoo	275	275	30
Gda. Gahdhoo	495	495	30

7. Wastewater Management Improvement

The project will include a small parallel component to the current government plan on the construction of the wastewater systems in the three islands, as follows:

7.1. Integration of planned and proposed wastewater systems into the IWRM process

The project aims to ensure that the current planned wastewater systems espouse the principles and components of a holistic IWRM process. Specifically the project will revise the designs planned for these systems and will integrate the provision of proper wastewater management systems.

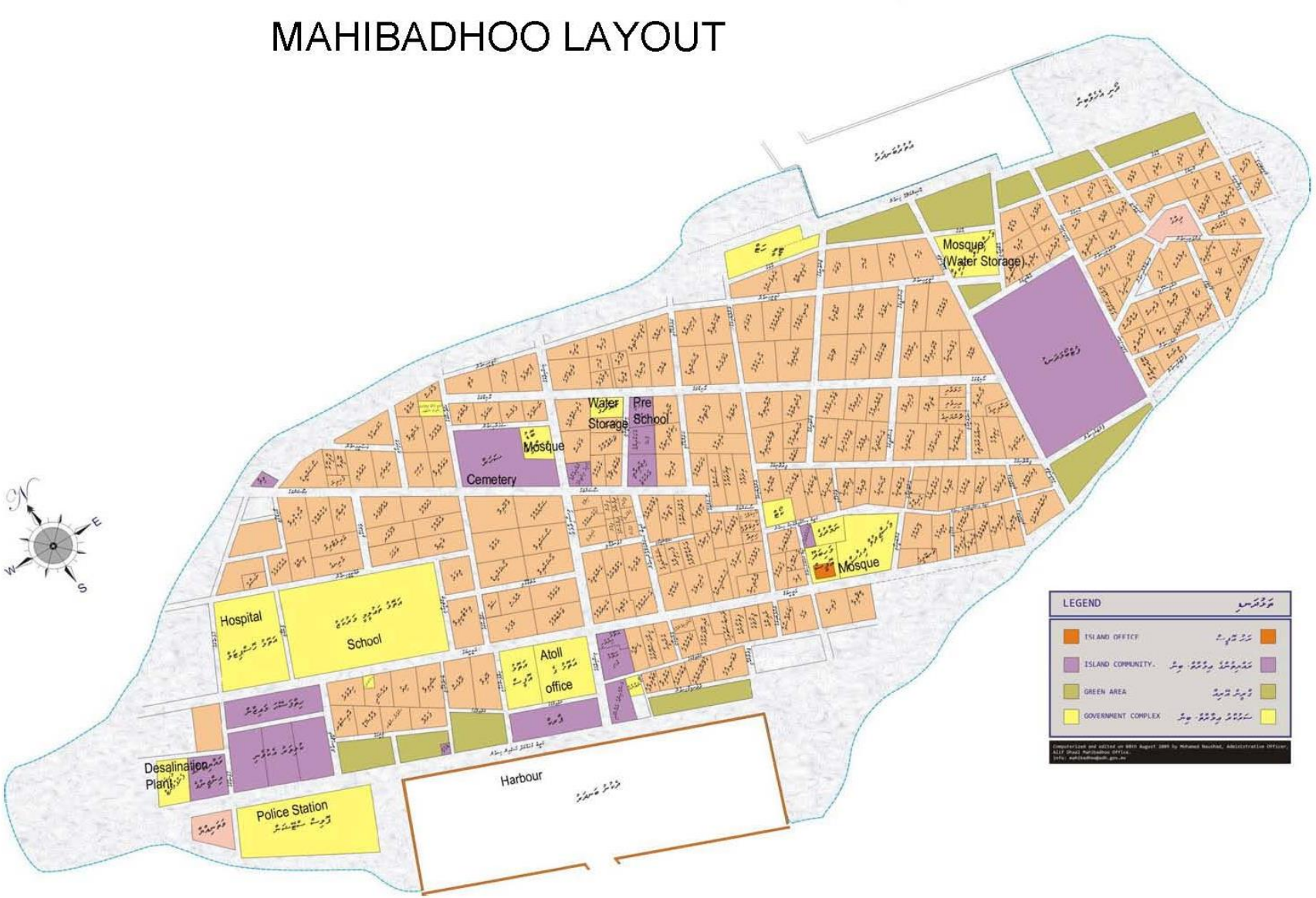
7.2 Cleaning the existing septic tanks:

The existing household septic tanks are the main source of groundwater contamination due to the lack of appropriate sewage system in all three islands. The sewage construction system will be implemented by other agencies appointed by the MHE. The project will assist the MHE to ensure that all sewage construction contractors include additional provisions in contracts to allow for the following scope of work: the cleaning up, flushing and filling with sand of all septic tanks (especially septic tanks open to ground infiltration) to successfully recharge and protect the groundwater.

8. Island Layout Plans

LAY OUT PLAN FOR IHAVANDHOO ISLAND

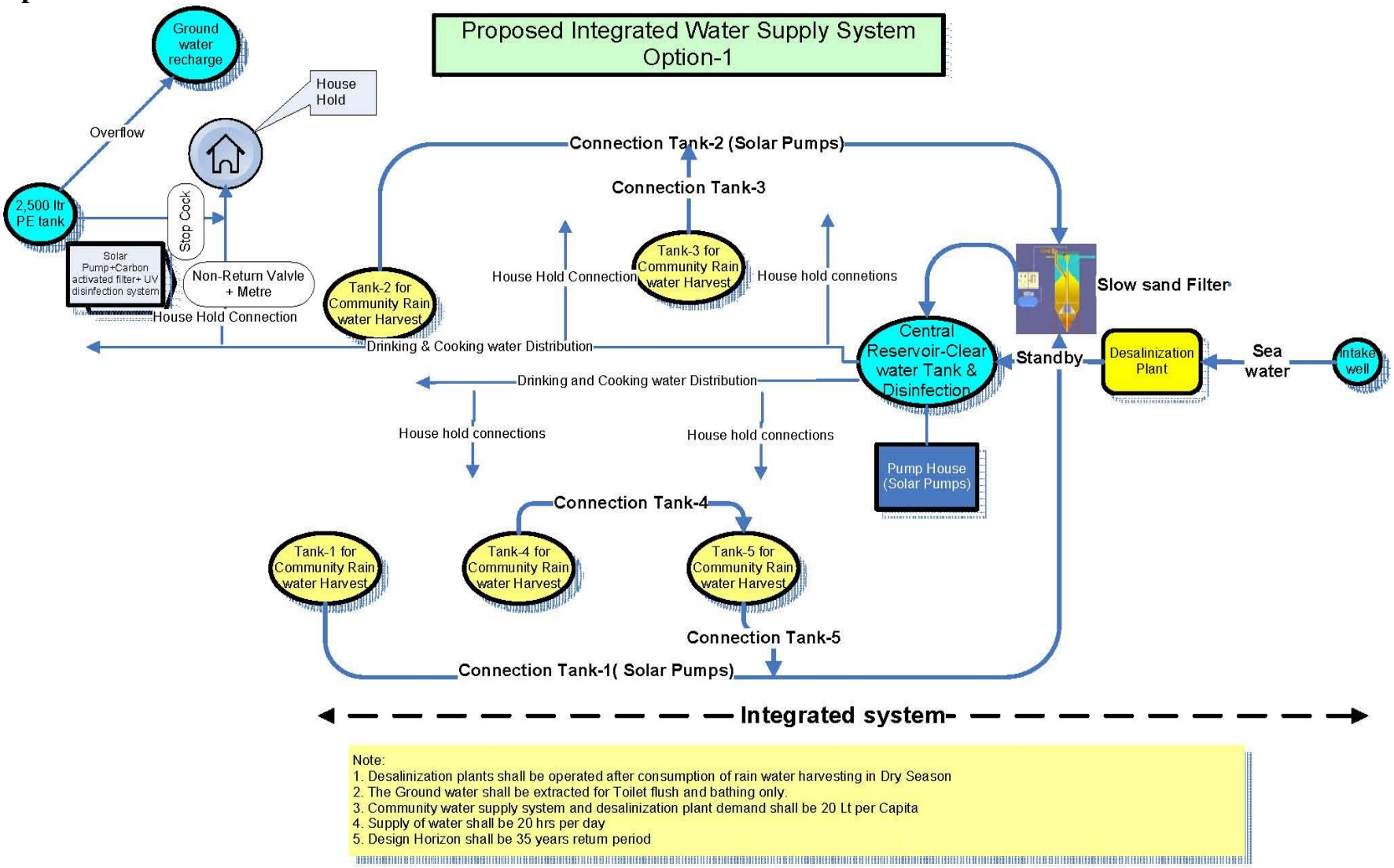
LAY OUT PLAN FOR MAHIBADHOO ISLAND



LAY OUT PLAN FOR GADHODHOO ISLAND

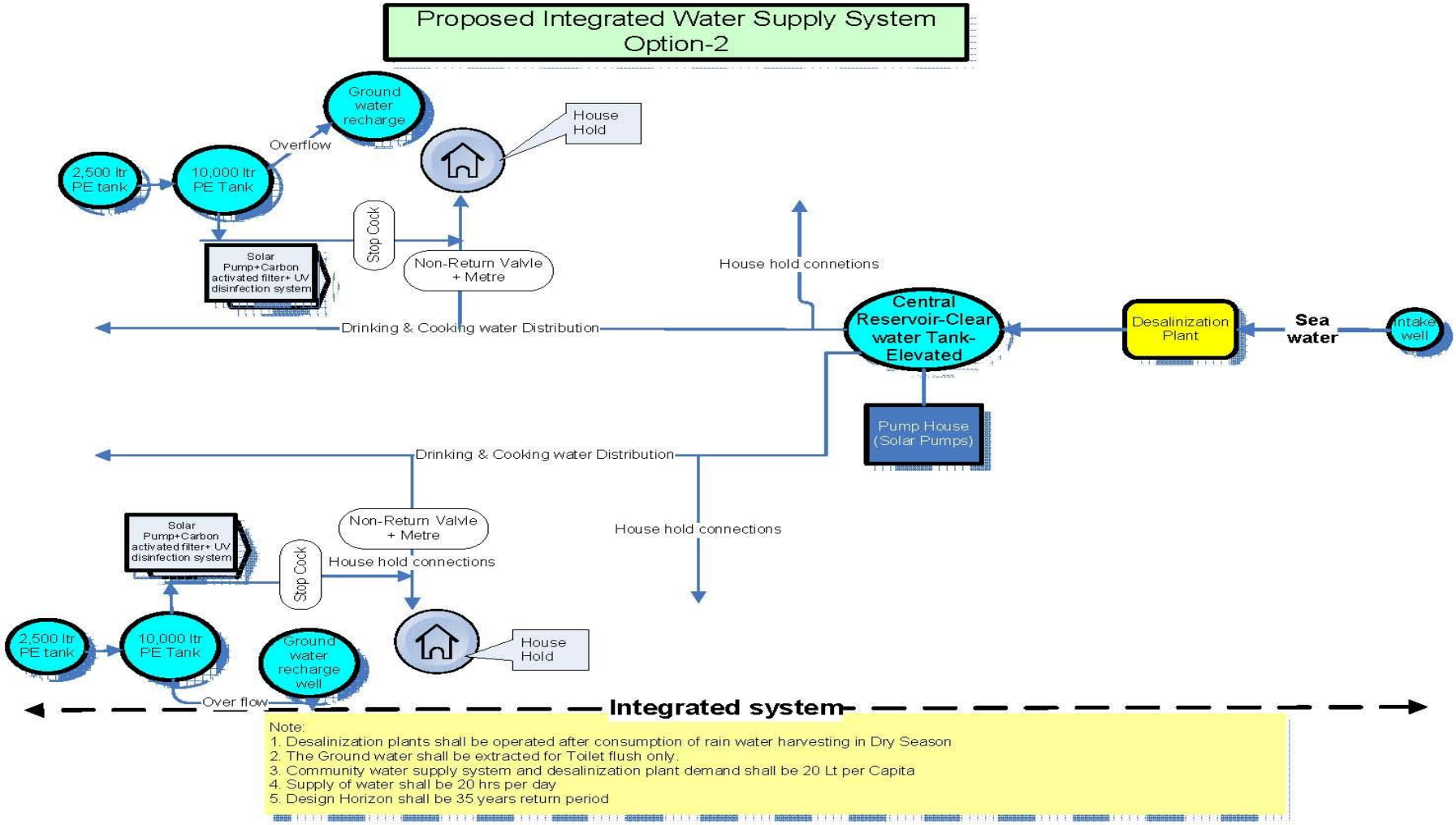
9. Design Options for Integrated Water Supply System on Target Islands

Option-1:



Note:
1. Desalinization plants shall be operated after consumption of rain water harvesting in Dry Season
2. The Ground water shall be extracted for Toilet flush and bathing only.
3. Community water supply system and desalinization plant demand shall be 20 Lt per Capita
4. Supply of water shall be 20 hrs per day
5. Design Horizon shall be 35 years return period

Option-2:


Proposed Integrated Water Supply System
Option-2
Ground water recharge
House Hold
Overflow
2,500 ltr PE tank
10,000 ltr PE Tank
Stop Cock
Solar Pump+Carbon activated filter+ UV disinfection system
Non-Return Valvle + Metre
House hold connetions
Drinking & Cooking water Distribution
Central Reservoir-Clear water Tank-Elevated
Desalinization Plant
Sea water
Intake well
Pump House (Solar Pumps)
Drinking & Cooking water Distribution
Non-Return Valvle + Metre
House hold connections
House hold connections
Solar Pump+Carbon activated filter+ UV disinfection system
Stop Cock
2,500 ltr PE tank
10,000 ltr PE Tank
Ground water recharge well
House Hold
Over flow
Integrated system
Note:
1. Desalinization plants shall be operated after consumption of rain water harvesting in Dry Season
2. The Ground water shall be extracted for Toilet flush only.
3. Community water supply system and desalinization plant demand shall be 20 Lt per Capita
4. Supply of water shall be 20 hrs per day
5. Design Horizon shall be 35 years return period

ANNEX F

Terms of Reference

Project Management

Project Board (PB)

The Ministry of Housing and Environment will be responsible for establishing the Project Board. The board will meet at least twice a year, with more frequent meetings held when necessary. The Project Board will be chaired by the Minister of Housing and Environment. The National Project Director will be the Executive Member nominated by the MHE and is expected to be a senior official not below the rank of Deputy Minister. The Members of the Project Board include representatives from the Implementing Partner (MHE), UNDP, designated Responsible Parties and other important stakeholders and Island Council members from the demonstration islands. The list of PB nominees (including alternates) will be prepared and approved over the course of the project inception workshop.

Responsibilities

- Provide strategic guidance and direction to the project, ensuring it remains within any specified constraints of time, scope and budget;
- Provide advice and guidance on efficient and timely execution of the project, when required;
- Establish policies when required to define the functions, responsibilities, and delegation of powers for the implementing agencies and the Project Management Unit;
- Ensure that project's policy recommendations are integrated within the policies of respective sectors each member represents;
- Address project issues as raised by the National Project Manager including approval of major project revisions;
- Provide guidance and agree on possible countermeasures/management actions to address major issues and risks;
- Ensure that AF resources are committed exclusively to activities that relate to achievement of the project objective;
- Resolve significant conflicts within the project, and negotiate a solution to major problems that may arise between the project and external bodies;
- Appraise the Project progress and make recommendations for next steps.

National Project Director (NPD)

The National Project Director (NPD) will be a state employee appointed by the Ministry of Housing and Environment to be responsible, on behalf of the government, for the project. The NPD will be responsible for overseeing overall project implementation on a regular basis and ensuring that the project outcomes are achieved. This function is not funded through the project and will be covered as in-kind contribution. On behalf of the Implementing Agency, the NPD is accountable to the UNDP for the appropriate use of the project resources provided by AF. The

NPD, assisted by the National Project Manager, will report to the Project Board on the progress of the Project. The NPD will be responsible for coordinating the flow of results and knowledge from the project to the members of the Project Board.

Responsibilities

- Review project activities, and their adherence to the work plan set forth in the project document;
- Approve project Annual work plans and budget revisions.
- Approve annual project status and financial reports.
- Ensure that Maldivian legislation, rules and procedures are fully met in the course of the project implementation;
- Oversee implementation of Project Board directives;
- Facilitate government support to EIA processes;
- Report to UNDP and the Project Board on the use of the project resources and achievement of the project outputs.

National Project Manager

The National Project Manager (NPM) is a full-time, project-funded staff who will be responsible for the day-to-day management, administration, coordination, and technical supervision of project implementation. He/she will implement guidance from the National Project Director and Project Board, and lead the project team through the timely planning, implementation, and delivery of project Outputs and Outcomes as indicated in the Strategic Results Framework. S/he will be responsible for financial management and disbursements, with accountability to the government and UNDP. The NPM will be appointed by the Implementing Agency and coordinate with any technical staff who is provided to the PMU through direct implementation support services from UN agencies (envisaged under this project for Outcome 1).

In carrying out her/his responsibilities, s/he will advocate and promote the work of adaptation to climate change in Maldives and will also closely work and network with the relevant government agencies, UNDP, UNOPS, the private sector, NGOs, and civil society organizations.

Responsibilities

- Facilitate the day-to-day functioning of the PMU, supervision and coordination of PMU staff;
- Coordinate the distribution of responsibilities amongst team members and organize the monitoring and tracking of all project management services;
- Manage human and financial resources provided by the project, in consultation with the project's senior management, to achieve results in line with the Outcomes and Outputs outlined in the project document;
- Plan the activities and inputs provided by the project and monitor progress against the initial quality criteria;
- Mobilize goods and services to initiative activities, including drafting TORs and work specifications;

- Facilitate and organize events as determined in the Project Monitoring Plan, and update the plan as required;
- Manage requests for the provision of financial resources by UNDP, using advance of funds, direct payments, or reimbursement using the FACE (Fund Authorization and Certificate of Expenditures);
- Monitor financial resources and accounting to ensure accuracy and reliability of financial reports;
- Prepare and submit financial and technical reports to UNDP on a quarterly and annual basis;
- Manage and monitor the project risks initially identified, submit new risks to the Project Board for consideration and decision on possible actions if required; update the status of these risks by maintaining the Project Risks Log;
- Be responsible for managing issues and requests for change by maintaining an Issues Log;
- Prepare regular progress reports (progress against planned activities, update on Risks and Issues, expenditures) and submit the report to the Project Board, NPM and UNDP;
- Prepare the AWP for the following year, as well as Quarterly Plans if required;
- Update the Atlas Project Management module if external access is made available;
- Work with all co-financing partners to ensure that their activities/programs are integrated and complementary with those of the AF-funded project.
- Support linkage of project activities with related and parallel activities within MHE;
- Support the NPD in organizing Project Board meetings;
- Manage relationships with project stakeholders including NGOs, government agencies, atoll and island councils and others as required.

Qualifications/ Requirements

- University graduate with at least 5 years working experience in project management within the disciplines of engineering, environmental science, geography, or natural resource management
- Sound understanding of water management issues in Maldives and basic knowledge of the international climate change discourse
- Extensive business and information exchange contacts with national and international partners involved in water resources and waste management planning;
- Excellent inter-personal, communication and negotiating skills
- Previous work experience in the country on issues relevant to the project
- Ability and willingness to travel within and outside the Maldives
- Demonstrable skills in office computer use – MS-Word, MS-Excel, Powerpoint
- Proven track record of project management and project team experience working with government, NGOs, and other key stakeholders in Maldives
- Excellent verbal and written skills in English and Dhivehi

Administrative and Finance Assistant

The Administrative & Finance Assistant will undertake administration of the day-to-day operations of the project office. The Administrative Assistant will report to the National Project Manager.

Responsibilities

- Set up and maintain all files and records of the project in both electronic and hard copies
- Collect and inventorize project related data pertaining to stakeholder consultations
- Prepare minutes of meetings
- Organize Project Board meetings in coordination with the National Project Manager
- Establish document control and assurance procedures
- Compile, copy and distribute project-related reports
- Provide logistical support to the National Project Manager, and national/international consultants in organising training events, workshops, and seminars
- Assist short-term consultants by organizing their travel schedules, arranging meetings with different stakeholders, and booking hotel accommodations
- Prepare monthly leave records for the project staff and long-term national/international consultants
- Provide support in the use of Atlas for monitoring and reporting
- Review layout, spelling and formatting of project-related reports in coordination with the NPM
- Assist the NPM to monitor technical activities carried out by responsible parties
- Draft necessary correspondence with local and international project stakeholders

Qualifications

- At least 3 years of relevant administrative or program experience at the national or international level
- Undergraduate degree and/or certificate in secretarial or computer training
- Demonstrated experience in using computers and office software packages, particularly word processing and spreadsheets (MS Word, Excel)
- Knowledge of database packages and web-based management systems
- Excellent inter-personal and communication skills
- Proficient verbal and written English and Dhivehi skills

ANNEX G Project Milestones and Disbursement Schedule

	Year 1												Year 2												Year 3												Year 4											
	MONTHS																																																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
PROJECT OUTPUT																																																
Output 1.1 Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons			20,000		80,000			60,000			40,000			20,297			1,000			1,000			1,000			1,000			1,000			1,000						1,000						1,000				
Output 1.2 Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods			20,000		150,000			1,000,000			800,000			700,000			663,000			280,000			50,119			10,826			10,987			10,987						10,987						10,987				
Output 1.3 Production and distribution system for desalinated water supply established					150,000			1,300,000			850,000			600,000			246,900			75,625			20,000			10,842			10,842			10,842						10,842						10,840				
Output 1.4 Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during					12,043			9,348						9,348						9,348						9,348						9,348						9,348						9,348				
Output 2.1 Community consultations on each target island ensure participative design, sustainability and continued maintenance of integrated water resource management schemes			40,000		30,000																																											
Output 2.2 Targeted training events conducted in each region to strengthen water user participation and skills in adaptive, integrated water resource management											10,000												10,000											10,000												10,000			
Output 3.1 Training of technicians in the design, operation and management of integrated water resource management systems								10,000												10,000											10,000																	
Output 3.2 Institutional mechanisms created to integrate adaptive management of freshwater resources into the design and rollout of new water management projects and schemes																																	10,000			10,000			10,000									
Output 3.3 Action plan developed and financing mobilized to replicate integrated, climate-resilient freshwater management on at least 4 additional islands																																							10,000			10,000						
Project Execution, M&E	65,112			65,112			65,112			65,112			65,112			65,112			65,112			65,112			25,912			25,912			25,912			25,912			25,912			25,912			25,912			52,321	

Disbursement schedule:

	Upon MoU signed (July 2011)	Jul-11	Oct-11	Oct-12	Oct-13	Oct-14	Total
Project Funds	0	145,112	4,696,728	2,988,083	210,669	244,408	8,285,000
IA Fee	281,690	7,401	239,533	152,392	10,744	12,465	704,225
TOTAL	281,690	152,513	4,936,261	3,140,475	221,413	256,873	8,989,225
	Transferred by Trustee in a single tranch		Transferred by Trustee in 4 tranches				

Ministry of Environment and Energy (MEE)

UNOPS - General Infrastructure Unit (GIU)

Project Initiation Document – Revision of PID issued on 23 April 2012

Increasing climate resilience through an Integrated Water Resource Management Programme in the Islands of HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo in Maldives

Ahmed Saleem
Permanent Secretary

Component -1: Establishment of integrated, climate-resilient water supply and management systems in Mahibadhoo, Ihavandhoo & Gadhdhoo.

(Project ID 00079220)

Funded by

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Mr. Sivakolundu Sriskandarajah, Senior Programme Manager - GIU
Presented to:
Ministry of Environment and Energy, Maldives
Date: 28 October 2013

Table of Contents

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UNDP	Maldives Office	Mr. Mohamed Inaz	Assistant Resident Representative - Environment and Energy

Project Definition

Background

The project to increase climate resilience through an Integrated Water Resource Management Programme will address issues induced by the decline of freshwater resources that is currently gravely affecting the population of Maldives, especially in the islands of ADh. Mahibadhoo, GDh. Gadhdhoo and HA. Ihavandhoo islands. Freshwater resources are very scarce in the Maldives due to the hydro-geological nature of the country. As surface freshwater is generally lacking throughout the country (with the exception of a limited number of natural fresh water ponds in some islands), the key problems pertaining to freshwater security relate to the management of persistent salinity intrusion into groundwater and unpredictable variation in rainfall patterns.

Freshwater aquifer in Maldives lies beneath the islands in shallow depths of 1 to 1.5m below the surface and no more than a few meters of thick. The magnitude of the floating groundwater lenses in the islands is primarily determined by the extent of the island and the permeability of the soil column among other contributing factors. Adding to this is the critical determinant of net rainfall recharges that is becoming more erratic in an increasingly unpredictable changing climate. Over the last few years the National Disaster Management Centre has been transporting potable water to many islands recurrently facing acute water shortages due to prolonged dry periods, which is costing over US$ 2 million to the Maldivian government every year.

The current facilities in the three targeted islands are not capable to adequately address issues relating to potable water supply, wastewater management and deteriorating groundwater potential. These issues are comparable between islands hence, the degree of hardship experienced every year by inhabitants during the prolonged drought periods are similar. At present, there is no functional pipe-borne water supply scheme in the islands and the inhabitants are constrained to rely on traditional rainwater harvesting techniques for their drinking and cooking water requirements. Potentially hazardous contaminated shallow groundwater from wastewater and other sources of pollution is been used for other domestic water needs such as washing of clothes and bathing. Wastewater treatment systems are also lacking in these islands, except in ADh. Mahibadhoo, where sewerage drainage scheme has being currently completed. Imported and locally produced bottled-water is extensively utilized for drinking and cooking particularly during dry season

Rainwater harvesting (RWH) systems adopted for isolated islands of the Maldives as a primary source for drinking water is an acceptable low-cost solution that has been proven to offer good quality. Water provided through the system is maintained regularly to acceptable standards. The 2,500 litres capacity polyethylene (PE) storage tanks commonly available to the islanders is insufficient to cover the drinking and cooking needs of a standard sized family throughout the entire dry period.

A Memorandum of Agreement (MOA) signed between the Ministry of Environment and Energy (MEE) and United Nations Office for Project Services (UNOPS) requests the implementation support of UNOPS to Component 1 of the larger Project Document (ProDoc) signed between the MEE and UNDP for the Adaptation Fund[1] along with the technical Project Management Unit's (PMU) support. UNOPS support to the PMU will consist of local and international staff, who will ensure high quality and effective financial management, procurement, direct implementation as well as supporting the MEE and the selected utility operators managing infrastructure interventions. Under the larger Adaptation Fund funded UNDP-MEE

[1] Please refer to the approved UNDP Project Document signed on the 15 December 2011

Project, MEE is responsible for the implementation of Components 2 and 3 with UNOPS technical inputs and UNDP support and coordination. A brief description of the larger project components are:

Component-1:

- Establishment of a sustainable freshwater supply system that incorporates desalination and improved rainwater harvesting (RWH) technology
- Establishment of a sustainable groundwater management system that incorporates groundwater recharge and wastewater management technology

Component-2:

- Increasing community awareness and participation in the development, allocation, and monitoring of freshwater use in a changing climate

Component-3:

- Replication and up-scaling of climate-resilient freshwater management

The purpose of the Project Initiation Document is to provide a detailed explanation of the implementation of Component 1, the PMU support component and all its related activities, which the UNOPS supports.

Objectives and Desired Outcomes

The objective of Component 1 is to ensure climate-resilient, reliable and safe freshwater supply to Mahibadhoo, Gadhdhoo and Ihavandhoo islands through the actual physical infrastructure design and works required for this purpose. The below described outcomes from Component 1 are intrinsically related to the outcomes from the other two key components of this overall project leaded by MEE, which are:

- Redesign existing RWH schemes to better deal with the strain brought on by the intense dry period. Such efforts include optimizing the total storage capacity, interconnecting isolated units of community based RWH systems (if economically feasible); improving the structural integrity of RWH and storage systems; integrating filter elements and disinfectant to improve safety of freshwater supply.
- Introduction of reverse osmosis (RO) desalination technology in the context of a diversified, integrated water supply and distribution infrastructure, ensuring supply capacity of at least 15 litres per person per day[2], which will support communities during extreme dry periods
- The planning and installation of groundwater protection and recharge measures using surplus rainwater and improved management of wastewater;
- Redesign of wastewater management schemes (under a separate program) to ensure sufficient quantities of safe groundwater during dry periods and prevent freshwater contamination.

Under the holistic implementation of this project, it will meet the domestic and economic water supply needs of estimated 1,470 families, thereby covering the water needs of all targeted island communities and benefiting 6,209 people directly. This program covers approximately 4% of all rural Maldivians who are currently dependant on unsecured individual household RWH systems.

Component-1 consists of the following Outputs:

Output 1.1: Artificial groundwater recharge systems established to enhance water quality and to protect

[2] Consumption level based on historical consumption data and evidence collected by the Environment Protection Agency (EPA)

groundwater resources from saline intrusion

Output 1.2: Redesigned, upgraded and structurally improved already existing RWH schemes

Output 1.3: Production and distribution system for desalinated water established to supplement the improved RWH

Output 1.4: Redesigned and improved existing wastewater management systems (under a separate program) to ensure sufficient quantities of safe groundwater

Additionally UNOPS, through the support in strengthening the PMU. will ensure building up the technical capabilities and project management capacities of the MEE Project Team to deliver the technical aspects of components 2 and 3 within the agreed project duration.

Project Scope and Exclusions

Under the signed MOA, UNOPS is leading with MEE the delivery of the work-package Component-1 for the above outputs described in the previous section and broadly summarized as follows:

- Consult and liaise with the respective island councils, the Atoll Council if available, the MEE, and the appropriate Utility Companies assigned by the concerned ministries to identify and address issues and concerns over the planning and design processes.
- Advise stakeholders, the MEE, and UNDP on technical issues and propose appropriate solutions where necessary.
- Topographical survey, detailed data collection of each compound to facilitate upgrading the RWH, population survey confirmation, periodic ground water quality test, and soil investigation of the proposed sites for construction (major installations).
- Prepare master-plans within national specific guidelines and regulations, and if required recommend on minimum standard guidelines by engaging local MEE representatives.
- Prepare bidding documents comprising of the system layout, civil, structural and electro-mechanical drawings together with technical specifications.
- Tender works contracts through national/international competitive bidding processes to select the most cost effective and technically competent contractor(s).
- In the case of international competitive biddings, international bidders associated with local firms may be given preference.
- Evaluate tender documents, nominate and award contracts in accordance with strict UNOPS procurement protocols.
- Prepare contract documents including construction drawings for execution of Contract Agreement.
- Administer contracts according to sound and well proven project and contract administration principles to ensure quality and value for money product for the Client.
- Commissioning, arrange training on operation, and maintenance of the systems followed by the handing over to MEE.
- Maintain good relations and consistent liaison and communication networks with MEE, and UNDP to ensure transparency and trust.
- Assist and support the MEE and UNDP with technical issues pertaining to the project.
- Support the MEE PMU capacity building for both project management and technical issues to ensure the technical delivery of the project and its correlations with components 2 and 3.

Constraints and Assumptions

The project work-package component to be implemented by UNOPS has been developed with a firm assumption that clear management and decision making structures will be in place to assure an effective and timely delivery to the end users. In this document we recommend an international best practice for Project Management revised from the original roles description of the signed UNDP Project Document, and the details of the work-package implementation structure. The project roles structure will assure the highest quality and accountability of the timely project delivery in the islands. Constraints are related to the current political volatility of the country and the recurrent changes within the political sector, which will be mitigated by assuring that the overall project director for the project's entirety is a high ranking civil servant to avoid any focal point change during the implementation of the project.

The User(s) and other known Interested Parties

The main user for this project is the three island councils and communities, while the MEE and the PMU play a high important oversight role. UNDP, through its role as Multilateral Implementing Entity, will be providing oversight of the project implementation and project assurance for the overall project as mentioned in the UNDP Project Document.

Interfaces

The project work-package will interface with the following on-going initiatives/projects and programmes within the government and the UN agencies to promote knowledge sharing and information exchange to build into the expansion of the national knowledge, and learning component on IWRM related issues.

- Programme and Project Management capacity development at the MEE – (this project will support MEE best practices on Project Management, Public Procurement and the further utilization of documentation and guidelines for future projects at other projects at MEE)
- Integrated Water Resource Management (IWRM) projects housed under the Department of Water and Sanitation of the MEE (It is envisioned that the designs and concepts developed under this demonstration project will serve the overall MEE Water and Sanitation portfolio, which will support the development and integration of new IWRM projects in the country)
- UNDP Environment programmes and portfolios – (this project will gain from UNDP's experience in other thematic sectors that have focus on the environment and will eventually have an effect on water resources and IWRM)
- Water and Sanitation programmes for the Low Emission Carbon Resilient Development (LECReD) Programme – (these new projects and local development programs will gain from the knowledge, best practices and lessons learned from this project, in relation to designs, local applicable concepts and application into local island climate resilient settings)
- Water Act which will be developed by the MEE with support of United Nations Children's Fund (UNICEF) – (the project could also bring some IWRM conservation components into the Water Act to promote the protection of aquifers and by stimulating the further utilization of communal rainwater harvesting systems in the country)
- Regional SIDS IWRM project funded by the Global Environment Facility (GEF) – (the designs, lessons, applications and best uses from this project will serve to extrapolate the benefits of an integrated water supply system through the regional integration of the SIDS IWRM project. The SIDS IWRM will enable this project to bring the IWRM issues to high level platforms and increase knowledge and the importance of the scarce water resources in the Maldives)

PROJECT APPROACH

The following activities and implementation mechanisms are planned to achieve the objectives and the intended results from the signed MOA between MEE and UNOPS through the implementation of the Component 1 and the technical support of the PMU of the project.

Designs and Specifications

The water supply and ground water recharge systems of the targeted intervention will be designed and constructed according to the concept adopted and approved by the Adaptation Fund and agreed upon by the local island communities and MEE. All final detailed designs will be held to international best practices and quality standards by utilizing UNOPS internal expertise[3]. [4]. UNOPS will specifically review the designs in following areas: (a) groundwater aquifer management recharge studies and proposed holistic recharge and aquifer management plan, (b) renewable energy component – feasibility study of the various electrical options, and (c) general external assessment of the integrated water supply system detailed design. UNOPS will seek prior approval from MEE should UNOPS need engage any third parties for quality assurance or review.

Bidding and Contracting Activities

The bidding documents will be prepared as per UNOPS standard procurement procedures and templates to ensure consistency and select the most cost effective and technically competent contractor(s).

In the case of international competitive biddings, international bidders associated with local firms will be given preference and those ones that have presence in the country and engaging local groups. Clarification meeting for the bids will be organized at UNOPS Office located in the UN building. The bid documents will be issued and received at the UNOPS Office. This will be publicly opened in presence of bidders and observers from MEE. The bid documents will then be evaluated according to UNOPS' standard procurement procedures, Financial Regulation and Rules, and the bidding documents. A representative of MEE will participate in the evaluation of the bids as observer, before any follow-up revisions are undertaken by UNOPS Procurement Authority (PA). Following the Bid Evaluation and review and recommendation for award by the UNOPS' relevant Procurement Authority (PA), the processes and documentation will be shared with the MEE for approval. Once approval is received formally the Ministry, the bid will be awarded to the successful bidder.

Preferences will be given for the engagement of local contractors. The bid notice will be circulated to the local contractors association and will be published in local newspapers. A competitive bidding process can be anticipated. The local contractors will be given technical and contract administration support, and training by UNOPS staff to enhance their capacity. The main reason for proposing this modality is to enhance the local contractors' capacity and to provide employment opportunities to the local people and thereby improving their livelihood.

International competitive bidding procedure will be launched if the local competitive bidding procedure does not provide a good result. This will attract large scale contractors from the region and other parts of the world. The project cost will be considerably higher compared to the previous option as the cost of

[3] For the initial groundwater aquifer management recharge study, renewable energy component – feasibility study of the various electrical options, and general external assessment of the integrated water supply system detailed design, UNOPS has used its engineering partner Ove Arup & Partners International Limited, for which UNOPS has established a global Long-Term Agreement (LTA) with under which Arup provides technical engineering support to UNOPS for a non-for-profit cost basis according to the signed global agreement in 8th Oct 2010.

mobilization, overhead, and profit margin of major established contractors will be higher. In the case of international competitive biddings, international bidders associated with local firms may be given preference.

Construction

Full time on-site construction supervision will be carried out by UNOPS staff and payments will be made through UNDP Maldives/UNOPS Colombo office[5], based on the following procedures:

- Site supervision, quality control of works
- Joint measurements would be taken with the contractor for preparation of payment certificates and recommendation of payments to be made to the Contractors by UNOPS staff.
- Contracts management in accordance with the Conditions of Contract.
- Completion and handing over of the project to the Users.
- Monitoring the completed work during the defects liability period and notify appropriate actions.

Land Issues

Prior to the award of contracts to the selected contractors, all issues related to any land required for the installation of RO desalination plant, overhead water tank, ground water reservoirs etc, shall be resolved by the corresponding government entities with the support of UNOPS. UNOPS technical team will work with the island councils for the approval of the existing site locations identified in the land use plans for the integrated water supply system construction. Once identified, the Island Council will confirm the designation of the selected plots with the Land and Survey Authority under the Ministry of Housing and Infrastructure. Final confirmation letters will be circulated to all parties involved in the project. No construction activity will begin (especially for new sites) on any place until all land issues are indisputably resolved.

Integrated Water Design Issues

Prior to the development of any concept design for the integrated water supply systems for each island, community consultations will be held at the island level by MEE with the support of EPA with the technical support from UNDP and UNOPS. The teams will engage with the local communities on the possible technical infrastructure design options for this project to agree on a proposed approach. Upon MEE's approval, UNOPS technical team will work on the concept design works and will get further approval to move into the detailed design phase. In order to avoid any delays in the technical detailed design, thedetailed design will be then carried out according to the approved set of variables which will be further discussed (as required) with a technical design working group, which shall comprise of members from the MEE – Water Department, UNOPS technical team, Senior IWRM Engineer, EPA, the Utility Operator(s), and national and international consultants (as required). The final detailed design will be checked against international best practices mentioned earlier, as to the proposed geographical set-up (small island based context) and operation and implementation feasibility. At a later stage, UNOPS will seek final approval of the final documents from MEE before tendering and award of contracts to contractors.

a. **Running Operating Costs for New System**

[5] The use of UNDP Maldives and UNOPS Colombo office is to reduce transaction and additional costs to be bare by the project. All related small transactional costs will be covered by the budgeted UNOPS ISS costs

Prior to the award of contracts to the selected contractor/s, all households must be aware of the future running costs of the installation of the entire system which will have an integrated OR desalinization system. These will increase power consumption for its operation, which shall operate on a regular basis as well as permanently during long dry periods, after exhaustion of the integrated rain water harvested. Awareness of fee for the integrated water system will be imposed by the utility company to recover the operation and maintenance cost with the help of existing studies and the support from UNDP/MEE. A detailed "Willingness to Pay" survey was undertaken through Component 2 implemented by MEE and the results show the feasibility of the proposed integrated model, for which a healthy level of cash flow and a reserve fund for replacements will be able to attaint under the proposed model. Based on the preliminary calculations for the Operations and Maintenance Manual developed for this project, based on the demand, load and capacity of the system during long-dry seasons and during normal operations, the running operating cost of the new system is as follows:

Table 4: Estimated Project Running Operational Costs per year in MVR

	HA. Ihavandhoo	ADh. Mahibadhoo	GDh. Gadhdhoo
Long-dry season – 100% use of RO desalination Plant	996,132	874,188	961,224
Normal season – 50% RO Desalination and 50% RWH utilization	836,468	761,098	731,707
Average Operating Cost	916,300	817,643	846,466

From current survey undertaken under the "Willingness to Pay" the yearly running operating costs for similar islands are as follows:

Calculated Annual Operational and Fixed Costs (based on similar island size and projected demand)	1,401,873	1,138,170	1,292,165

Under these calculations and the newly proposed tariff structure for the three project islands (details of the tariff will be described under the Project Business Case), the additional generated revenue will serve the Utility operator to maintain and upgrade the system accordingly.

b. Implementation of various water collection approaches

Prior to the beginning of any physical works on the islands, all island household must be made aware of integrated water design solution, including the upgraded RWH concept and its linkages with the OR desalination component, specifically the installation of rainwater collection tanks, GRP tanks, gutters, solar panels, pumps, and ground water recharge approaches.

The identification and selection of the private households that will be connected to the communal RWH system will be initially be performed by the design teams defining the quantification of catchment area available for the integrated water supply system. A compiled list per island will be developed and presented by the Island Council to the Environment Impact Assessment (EIA) team for the final EPA approval of the design. To ensure avoiding future conflicts between the water service provider and the household owners, it is imperative that a clear agreement will be signed between the Utility Corporation and the private house/land owner to define the roles and responsibilities accounted to support the community water system before the award of contracts for the linkages of private roofs into the public integrated water system. An awareness campaign to ensure the community support the collective collection of water to reduce potential flooding will be undertaking by the other components of the project concurrently.

UNOPS will provide operations and maintenance guidance manual for the sustainable use of the system. No household pipeline connectivity will be done until clearance is received from the Island Councils to use

community arrangements and individual house/land owners agreement to for the utilization of thehousehold roof for rain water collections.

Services and Utilities

Prior to construction, UNOPS will lead in partnership with MEE and the Island Councils on the identification of any possible conflict with the existing services and utilities at each location especially along the pipeline routes with the assistance of service providers for telephone, TV. electricity and sewage. UNOPS will coordinate and liaise with relevant service such as the Utility Company or Cable service providers within the island to avoid any accidental damage and ensure relocation and reinstatement of services is provided in a timely and efficient manner. UNOPS will liaise with appropriate service providers (which may differ from Island to island according to the available utility and other services in place) for the sustainability of the services to the respective sites identified for new installations as required in the designs.

Project Management

Technical Project Management services required for the Component-1 and the support to the PMU will be provided by UNOPS. In the course of project implementation, the PMU will provide programmatic liaison with the different stakeholder entities by maintaining close interaction with the relevant technical governmental authorities. UNOPS will work with MEE and UNDP to ensure transparency in project design and implementation with an emphasis to promote local participation in the operations and maintenance of the newly constructed or augmented water supply scheme, improving practices and approaches for ground water recharge and improve designs for wastewater systems in the project islands.

UNOPS will commence the design work on the targeted islands in close coordination with MEE, and will further implement the construction actions on the islands once the project obtains its final approval and clearance for such action from the relevant government agency/official. Similarly, government satisfaction with completed work for each island by securing "Certificate of Conformity" must be obtained by UNOPS from MEE prior to final handing over of the works to relevant authority. UNOPS will assure that this project complies fully with Project Management Principles and will become a reference for other IWRM projects to be implemented at the Ministry, through effective documentation of all the processes for the government/utilities to replicate in the future.

Communication, Media Releases and Liaison

All liaison and consultation (specific to the implementation of this programme) with the national and local government, the media (local and international), donors and NGOs shall be the responsibility of the Project Manager from MEE with the support of UNOPS Project Coordinator (PC), when required. The will be the main focal point of the project for high level political liaison with MEE. On technical issues, UNOPS Lead Project Engineer (LPE) and UNOPS Senior Program Manager (SPM) may liaise directly with the MEE. Notwithstanding, all policy and concept matters pertaining to the programme shall be channelled through MEE/UNDP.

Financial Administration

Annual Workplans (AWP) for the Component 1 will be prepared by UNOPS in close consultation with MEE and the PMU support during the quarter/year. This process will include the assessment of the potential risks and delays that the component 1 could encounter, and will be set as realistic as possible. MEE PMU will compile this and forward the signed AWP to UNDP, which makes and monitors all disbursement for the project based on the signed AWP with MEE. Mid Annual Reviews of the AWP will be conducted to analyse

the implementation completion and to set final realistic targets for the years. Quarterly workplans will be prepared based on the AWP.

All payments due to contractors will be verified and recommended for payment by UNOPS Maldives Office, with prior approval from MEE. and the transactions processed and monitored by the Sri Lanka UNOPS office. While the UNOPS Project Coordinator (PC) is responsible for the daily monitoring of project implementation, the Lead Project Engineer (LPE), with the Supervisors/Technicians' at the islands, will be responsible for the measurements of completed works, which will be undertaken on a monthly basis or when works progress is significantly completed. The MEE IWRM Consultant will perform spot checks during joint inspections with the LPE for quality check and payment approvals. The payment requests and measurements shall be certified by the SPM and submitted to the UNOPS PC for endorsement for the UNOPS Maldives Office Manager's approval for payment. All payment requests and measurement sheets are to be sent by email and certified hard copies to follow. Payment requests will be duly informed to the MEE Project Manager. Payments will be made through bank transfer to the vendor's account under the responsibility of the UNOPS Finance Manager. Local payments will be made by UNOPS Maldives in accordance with established operational arrangements. More details on the process flow are further explained in the diagram *"Process flow for Personnel Recruitment and Contracts for Services and Works"* on page 32.

UNOPS will report to MEE on its expenditures on a monthly basis according to the templates provided by the Ministry in Annex 4 that will be presented according on a transaction basis according to the ATLAS expenditure codes. UNOPS uncertified financial expenditures in ATLAS will be reported on a quarterly basis to MEE and UNDP

The financial report will accompany monthly progress reports that will be issued to MEE for distribution (as required) to the Project Board members. More details on the communication management strategy and dissemination of information are further detailed on pages 35 and 36.

Business Case for Component 1

The concept of an IWRM design approach promotes the coordinated development and management of water, land, and related resources, within the context of a policy and planning framework, in order to maximize the resultant economic and social welfare (of recipient communities) in an equitable manner without compromising the sustainability of vital ecosystems[6] IWRM thus implies not only the management of 'hard systems' (water, land, resources) but also the coordination and management of the 'human system' (policy planners, stakeholders, the community). 'Hard resources' are the tangible resources ie:

- Existing freshwater resources (rainwater, groundwater) and additional resources (seawater)
- The environment upon which these resources depend, including the land and the adjacent coastal and marine environment, and,
- Energy sources to be utilized in exploiting these water sources

[6] Adapted from Global Water Partnership Technical Advisory Committee d water efficient strategies

A grasp of the 'human system' within which these hard systems depend so that they are integrated effectively is required.

- Understanding the context of the project within local and national policy
- Ensuring the participation of recipient communities through the process
- Direct and indirect stakeholders support is sustained throughout the design process

In the case of the Maldives, as a small island state in particular, the effectiveness of this human system requires a deep understanding for the human system to be effective. Integration thus, incorporates both the management of the 'hard resources' – water, the environment and energy, with the management of the 'human resources', the recipient communities, the implementing stakeholders and the policy makers.

The proposed design approach for the water demand, supply and the other resources (RO desalination) capacities aims to strengthen the hard resources. While the remaining components of the project will ensure to integrate the human elements, with the on-going efforts towards informing the community, stakeholders and policies to promote the IWRM concepts and awareness for a resilient development process.

The resilience concept for this IWRM project refers to the design of the supply system, its ability to withstand shocks and stresses without catastrophic failure i.e. complete collapse of the supply. This can be achieved by considering:

- Diversity of supply – no reliance on a single source
- Self-sufficiency of supply
- Back-up or redundancy in the system
- Increasing available supplies through storage
- Control and maintenance of the system including monitoring

The table below illustrates the described resilience approach.

Table 1 Maldives Concept for IWRM Resilience Capability

Situation after IWRM Project	FRESHWATER SUPPLIES			
	Primary Supplies →			Back-up Supplies
Scenario 1. Wet Season	Groundwater abstraction	Private Household Rainwater		Community Rainwater
Scenario 2. Short Dry Periods		Private Household Rainwater	Community Rainwater	Desalinated Water
Scenario 3. Long Dry Periods /		Private Household Rainwater	Community Rainwater / Desalinated Water	Bottled Water / Tankers
Scenario 4: Natural Hazard		Bottled Water / Tankers		
	ROBUST AND APPROPRIATE MONITORING / OPERATIONS & MAINTENANCE FOR ALL SUPPLY OPTIONS			

Concept analysis and table based on Arup 2013

Considering the IWRM concept to be employed, the 'hard' elements detailed design described hereby, contains the critical analysis for the effective integration of RWH and back-up RO Desalination that will support the development of an initial integrated water supply system for the existing communities. Concurrently a deeper groundwater recharge strategy and the 'human' approaches are being further developed and analysed to ensure the effective interrelation of all project components.

Based on a planning horizon given to this project of 15 years with the option to expand it in the future, the objectives for the proposed design are to: (1) ensure a 100% total of fresh water service coverage on each island, and, (2) to ensure catering for a per capita consumption of 15 l/h/d for the estimated 2030 population,

based on EPA recommendations on the system capacity requirements, which is informed by historical data and the migratory characteristics of the working population in the islands.

The project also includes a component of groundwater recharge, and the promotion of the effective use and conservation of water resources (with specific emphasis on the protection of groundwater island aquifers) which will be linked to the awareness campaign work-package of the larger project.

The technically feasible options for producing a quality potable water supply to the inhabitants of the project area are:

- Community and Domestic based Rainwater Harvesting (CRWH and DRWH) systems
- RO desalination plant to secure minimum water requirement in all situations

Potable water produced from the two independent sources (rainwater and seawater) would be directly connected to households to provide a safe and sustained pipe-borne water supply system. The proposed integrated water supply system should essentially embrace the climate reliance RO Desalinated option due to unpredictable climate-induced rainfall pattern and polluted groundwater. Desalinated water is considered necessary during extreme climatic conditions as well as to supplement potable water from other inexpensive sources. This economically viable approach is environmentally friendly, and cost-effective with sound capital investment and minimum affordable production cost (operation and maintenance) to the end users.

During the analysis of the sustainability of the proposed system, during the "Willingness to Pay" survey, it was identified that in all three islands, most of the respondents are willing to pay for piped water supply. In Gadhdhoo and Mahibadhoo MVR 40 was the predominent price inhabitants were willing to pay. While in Ihavandhoo the majority of respondents were willing to pay up to MVR 65. As a result of the survey carried out by the MEE a tariff structure for this project was recommended as presented below.

Table 1. Recommended tariff structure for Ihavandhoo and Gadhdhoo

Proposed tariff table				
Customer Class	Band	Litres per day HH	CBM per month	MVR per CBM
Domestic	A	0-100	3.00	22.00
	B	101-500	3.01-15.00	70.00
	C	>500	>15.01	95.00
Institution	D	Flat rate	N/A	75.95
Commercial	E	Flat rate	N/A	101.26

It was also found that an increased tariff structure would be feasible for ADh. Mahibadhoo by making sure that price for all the bands and customer classes will be higher to make the operation feasible, taking into ccount the assumptions for the cost of the operations and maintenance structure for the new system. The estimated operating cost values in the "Willingness to Pay" survey did not take in consideration the potential savings from the system that will be achieved through the integration of RWH, and Renewable Energy (RE) solar panels into the overall system

Table 2. Recommended tariff structure for Mahibadhoo

Proposed tariff table				
Customer Class	Band	Litres per day/ HH	CBM per month	MVR per CBM
Domestic	A	0-100	3	27.00
	B	101-500	3.01-15.00	77.00
	C	>500	>15.01	102.09
Institution	D	Flat rate	N/A	85.95
Commercial	E	Flat rate	N/A	111.26

As mentioned earlier, under the Willingness to Pay[7] survey, the proposed tariff model structure will generate sufficient revenue to cover the operation and fixed costs of the new proposed system, as presented below:

Table 5: Calculations of Projected Revenue vis-à-vis production and fixed costs – based on similar islands

Gadhdhoo

Cost per year (MVR)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Projected Revenue	1,541,178	1,595,181	1,651,089	1,708,969	1,768,890	1,830,924	1,895,147	1,961,635	2,030,466	2,101,730
Production Cost	892,766	904,046	915,890	928,326	941,384	955,095	955,095	955,095	955,095	955,095
Fixed Cost	399,399	419,369	437,517	456,432	476,286	497,132	519,020	542,002	566,134	591,472
Net Revenue	249,013	271,766	297,682	324,211	351,220	378,697	421,032	464,538	509,239	555,163

Ihavandhoo

Cost per year (MVR)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Projected Revenue	1,617,774	1,699,088	1,784,515	1,874,265	1,968,555	2,067,615	2,171,668	2,281,026	2,395,896	2,516,579
Production Cost	994,560	1,005,640	1,017,684	1,030,120	1,043,178	1,056,889	1,056,889	1,056,889	1,056,889	1,056,889
Fixed Cost	407,313	427,678	446,242	465,593	485,905	507,232	529,625	553,138	577,826	603,749
Net Revenue	215,901	265,570	320,589	378,552	439,472	503,494	585,174	670,999	761,181	855,941

Mahibadhoo

Cost per year (MVR)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Projected Revenue	1,287,389	1,332,544	1,379,291	1,427,688	1,477,791	1,529,662	1,583,363	1,638,958	1,696,515	1,756,102
Production Cost	754,379	782,676	812,138	842,814	874,758	908,017	928,257	949,213	970,908	993,369
Fixed Cost	383,791	402,980	420,309	438,364	457,314	477,211	498,103	520,040	543,074	567,259
Net Revenue	149,219	146,888	146,844	146,510	145,721	144,434	157,003	169,705	182,533	195,474

[7] Operation and Maintenance Guidelines for IWRM conducted by MEE and UNOPS 2013, and Willingness to Pay Survey, MEE conducted by Ryan 2013

PROJECT MANAGEMENT TEAM STRUCTURE

International best practices for Project management suggest the following structure will work most effectively for the entire implementation of the Adaptation Fund Project. The structure for the roles of the project was taken from the originally proposed one under the UNDP ProDoc:

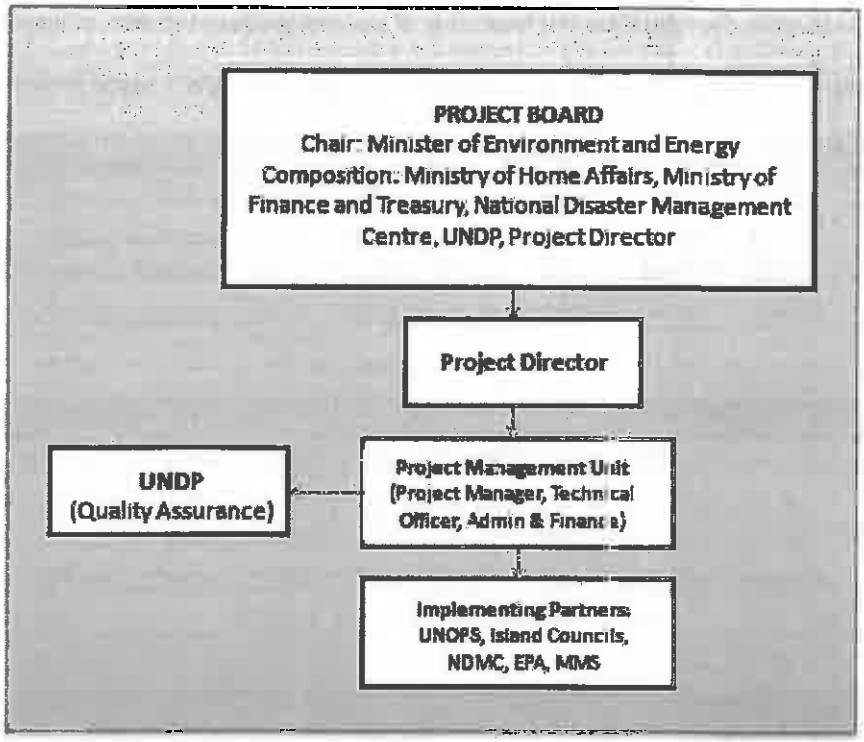
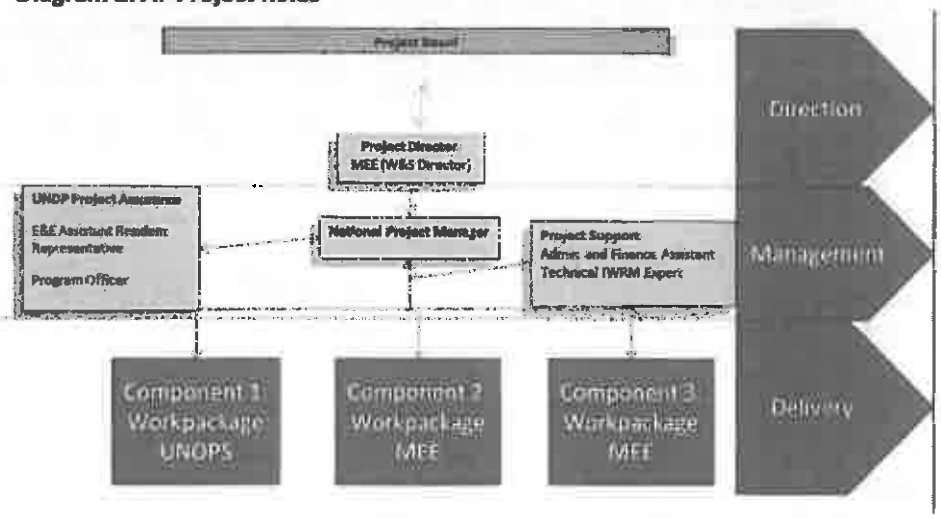
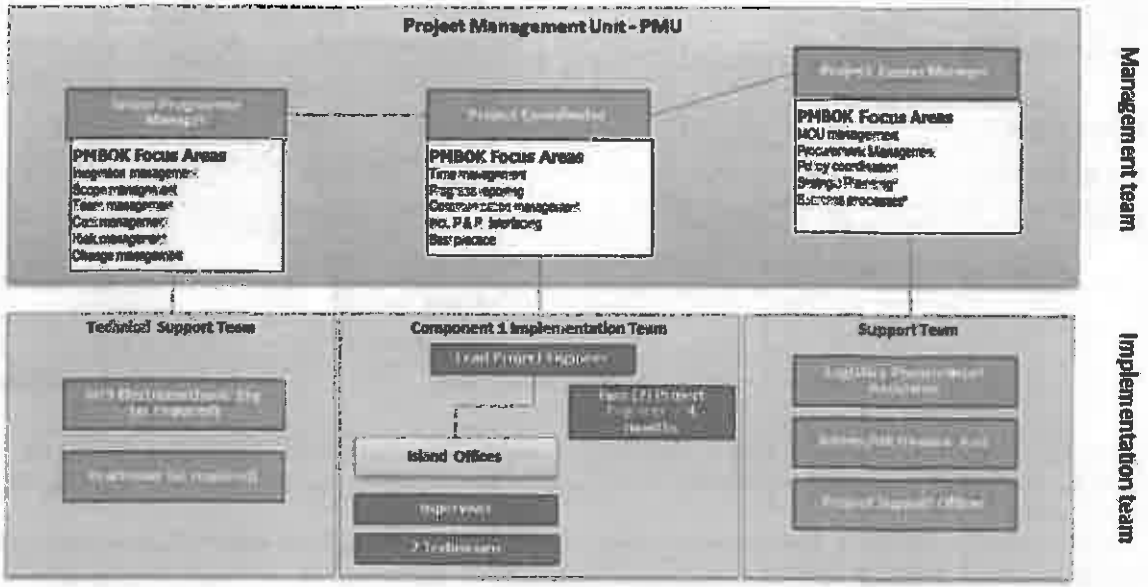


Diagram 2: AF Project Roles



For the implementation of the Work package Component-1 and the PMU component, UNOPS proposes the following structure to ensure the effectiveness of UNOPS operations for the implementation of this project:

Diagram 3: UNOPS Work-package 1



In order to implement the technical components of the project, UNOPS support includes having the necessary capacities to support the entire project team to ensure its adherence to international project management and public procurement standards. In line with the ProDoc PMU UNOPS supported activities, all the described staffing requirements fall under the budget lines O and N designated for this purpose see table below.

Table 4: ProDoc PMU Roles and Proposed Roles for UNOPS Supporting PMU component

ProDoc roles		
Position	**No**	**Total**
International Senior IWRM Engineer	1	210,000
Electromechanical Engineer	1	
National Project Manager	1	
National Technical Officer	1	
Engineer Technical Project Officer	1	174,000
Island Civil Engineer (Water)	3	
Island Mechanical Engineer	3	
Island Sanitation Engineer	3	

Proposed roles		
Position[x]	**No.**	**Total**
Int'l IWRM Expert (retainer contract[xx])	1	215,006
Senior Program Manager (technical assurance)	1	
Electromechanical Engineer (20% on retainer contract)	1	
Maldives Office Manager (PM Liaison and assurance)	1	
Lead Project Engineer	1	
Component 1 Project Coordinator (50%)	1	168,994
Civil Engineer (water)/Technical Project Officer - *Design Phase*	1	
Project Engineer	2	

Community Liaison Officer	3	
Logistics Assistant	3	
Budget Line "O"		4
Budget Line "N"		16
Total		384,000

Draftsman (Design/implementation phase)	1	
Island Supervisors	3	
Technicians (Islands)	6	
Logistics/Proc Assistant - Male'	1	
Admin/HR/Finance Assistant (40%)	1	
Project Support Officer (70%)	1	
Budget Line "O"		5
Budget Line "N"		17
Total		384,000

[x] There was an Int'l IWRM PM hired initially for this project during the design phase (described into the detailed budget and expenditure report in Annex 3) however this position was further revised into the proposed structure presented in this revised PID

[xx] Retainer contract indicates a total amount allocated for the position, which will be based on certain number of working days – according to its level

Under budget line "O", it is proposed that the original role of a full time Senior IWRM Engineer is shifted towards having a Senior IWRM Expert on a retainer contract to provide technical advice during the implementation phase (this position will be recruited through the Ministry MEE), complemented with a Senior Programme Manager on actual implementation guidelines and specifications for the project. The National Project Manager post has been shifted towards the support from the Maldives Office Manager to provide linkages to the other 2 components of the project and to support with expertise on Project Management to support the improvement of capabilities at the MEE PMU. Additionally a National Project Coordinator (under a part time basis) will support on the operational project management activities to liaise and coordinate UNOPS activities with MEE during its implementation. The National Technical Officer role has been converted into the Lead Project Engineer (LPE), in charge of managing the contracts, quality and monitoring at all the islands during the actual implementation of the project.

Under the budget line "N" UNOPS propose shifting the role of the 3 civil water engineers to 2 engineers to be based at the islands for a period of 4 months (during the critical laydown of the pipes and testing of the new system – technical capabilities as required), instead of having three, as the LPE will be based on one island covering for the critical implementation time. One draftsman on a retainer basis will be available to make any modifications and changes to the designs as required. In order to ensure sustainability of the project (added by a direct request of the MEE), UNOPS has changed the posts of island mechanical and sanitation engineers to local supervisors (who will hold this mentioned position to be later transferred to the selected utility operator in the island). Additionally the posts of Technicians (2 per island) have been incorporated following the same principle instead of the community mobilizers and logistics assistants. It is important to note that all the technical functions for sanitation, mechanical and community mobilization will be complemented by the technical team described above. A full time dedicated logistics/procurement assistant based in Male' will support on the management of contracts and the logistics of the project to support the rest of the team, with the additional support of part time admin/HR Assistant, and a Project Support Officer to monitor UNOPS direct budgets and expenditures related to Component 1 and the PMU.

The details of the roles and responsibilities are described as follows:

ROLE DESCRIPTIONS

Project Direction:

Project Board: (Specific for the AF IWRM Project) - The Project Board is responsible to approve key management decisions of the project and will play a critical role in assuring the technical quality, financial transparency and overall development impact of the project, will be established as soon as this project is approved. The PB will be composed of designated senior-level representatives of the MEE, island council representatives and other key stakeholders as such as the Representatives from the Ministry of Finance and Treasury, National Disaster Management Centre (NDMC) among others. The Chair of the Project Board will be the Project Executive, in this case a senior MEE Representative – State Minister of Environment and Energy

Project Director: *Director Water and Sanitation Department* - The Project Director role is to ensure that the project is focused throughout its life cycle on achieving its objectives and delivering a product that will achieve the projected benefits. The Executive has to ensure that the project gives value for money, ensuring a cost conscious approach to the project, balancing the demand of business, user and supplier. Specific project related activities:

- Review project activities, and their adherence to the work plan set forth in the project document;
- Approve project Annual work plans and budget revisions
- Approve annual project status and financial reports
- Ensure that Maldivian legislation, rules and procedures are fully met in the course of the project
- implementation;
- Oversee implementation of Project Board directives;
- Facilitate government support to EIA processes;
- Report to UNDP and the Project Board on the use of the project resources and achievement of the
- project outputs.

Senior User/Beneficiary *(Utility responsible for island level water management, Island Councils)* – Representatives of the three selected islands (Island Council Presidents) and a Senior Representative of *the utility responsible for island level water management* - The Senior User is responsible for the specification of the needs of all those who will use the final product, for user liaison with the project team and for monitoring that the solution will meet those needs within the constraints of the Business Case in terms of quality, functionality and ease of use. Specific project related activities:

- Represent the beneficiaries and their interests on the implementation of the project
- Raise any issue or implementation problem to the executive for immediate intervention
- Appoint an assurance representative that will oversee the implementation by the PM in order that the proposed product is aligned with the beneficiaries needs
- Receive highlight reports from the PM on a quarterly basis (minimum) to ensure the project is aligned with the original objective and business plan
- Agree on the defined levels of tolerance for the project – in relation to cost, time and quality

Senior Supplier *(UNOPS, UNDP, and MEE)* – UNOPS MV Office Manager, UNDP senior representative, Senior MEE Representative - The Senior Supplier represents the interests of those designing, developing, facilitating, procuring, implementing of the project product. The role is accountable for the quality of the product delivered and also has the authority to commit or acquire required supplier resource within the bounds of any legal agreements. Specific project related activities are:

- Commit their resources and people to ensure the project objective is achieved
- Respond to any high level integration of resources and activities
- Appoints an assurance representative that will ensure the proposed product achieves a high level of quality – within the defined levels of cost and tolerances
- Agrees on the required levels tolerances for cost, time and quality

UNDP Assurance Focal Point: This individual will provide inputs to the PMU and Project Board members on the implementation of the project. The role should also ensure that the supplier aligns its activities for the effective implementation of the project.

MEE Project Management Unit (MEE PMU):

Project Manager (PM): The Project Manager will manage all the components of the project during all the project stages (design, approval and implementation) and will liaise with the Project Executive and the Work-package managers on the delivery of the project. S/he will monitor the implementation of the project in the three islands based in Male'. S/he will perform the key following activities:

- Ensure that the tasks/activities are delegated to the project team with technical speciality to deliver the outputs.
- Ensure that detailed Work Packages are written and agreed with Work Package Managers before the Stage is approved with appropriate controls and reports.
- Ensure that the planned outputs do trigger an outcome
    - Make sure you have regular updates from the Team Managers, o Current Forecast vs. Original Forecast Vs Actual forecast - Cost, quality, time, outputs –
- Monitor product delivery and ensure quality of all the products reviewed before acceptance
- Update Log/registers with risks, issues and Lessons Learned
- Record any issues into the Log, and report to the Project Board, if issues become critical obstacles to the project that may take you outside of any tolerance that have been set
- Ensure that Product Assurance is done during the stage
- Execute the Communication Plan, Quality Plan
- Meet with the Project Team to manage inter-team dependencies, risks, resource issues
- Develop the plan for the next stage, agree any tolerances –
- This process will be repeated until the project achieves the original objectives or the project is stopped by the Project Board

Senior IWRM Consultant at MEE:
The role of the project technical advisor is to provide guidance on the design of the proposed product, from its initial design (by chairing the technical working group with experts from various entities and fileds), to the approval of the design process, throughout the implementation. The Senior Consultant will seek support and guidance from the Work-package Experts hired for this purpose, and will propose ways to ensure the project achieves the project objective and business case. This post can play the role of Quality Assurance and be designated as assurance for the project executive. This position will be recruited and funded through the Ministry.

Project Support Staff: *According to Prince2 and other best practices methodologies an effective Project Support Team consist of the required personnel, who can support in the areas of: Financial Management and Accounting, Human Resources Management, Procurement and Supply Chain, Logistics and general Administration.*

Support staff will be involved in this project to assure effective project management and administration support. The basic project support staff will support in the admin and financial components of the project and reporting.

Knowledge Management and Project Assistant: Support on the capturing of documentation and reporting from MEE side. Supports the project team in capturing lessons learned and best practices for replication purposes.

Finance, Budget and Administration Management: This role (functions) of the PMU will be undertaken by the following personnel:

MEE Admin and Finance Assistant, and Procurement Assistant:
Support staff will be involved in this project to assure effective administration and national procurement support specifically for the components 2 and 3. Project support staff will support in the admin and financial components of the project and reporting.

UNOPS Component 1 Project Team Description UNOPS PMU):

Management team:

Project Coordinator (50% - part-time basis):
S/he have to monitor the progress of work, coordinate the activities of all selected sub-work packages within their geographical areas and follow-up required support services in terms of payments, contractual issues and logistics. The position also requires facilitating and maintaining communication and liaison links with relevant Government and community stakeholders (as required), and reporting progress to the MEE PM and UNOPS-Maldives Office Manager. The PC will support the Lead Project Engineer and the MEE PM to the sequencing of the construction process to ensure integration of scientific dimensions for effective integration of all project components.

UNOPS Assurance - Senior Program Manager (SPM): Based in Colombo, this position will have an overall technical responsibility for the implementation of the work package. This will include monitoring and evaluation of achievements, staff performance and support services. The SPM is in charge of direct quality and budget control. This assurance role is required until the completion of the project in stages during design and implementation phases, and developed in close coordination with the WM quarterly submits physical and financial progress reports to MHE and/or UNDP.

UNOPS PM Assurance and Project Liaison - Maldives Office Manager: This role will be responsible for overall Project Management assurance and maintaining close high level liaison with MEE and UNDP. He/She will be the main focal point between MEE and UNDP on all issues and is responsible for liaison at the strategic level with UN and Government partners, but also provides direct management support on a day to day basis as well as critical management trouble shooting in the field level. This position will serve to integrate and mainstream Project Management practices, as well as effective public procurement systems into the project. Additionally this role position is in charge of supporting the MEE Project Manager to integrate the technical components into components 2 and 3 of the entire project.

Implementation Team:

Lead Project Engineer (LPE) *- Implementation phase*
This position will have overarching duties covering all the three sites. S/he will be responsible for the technical component of the project in relation to the design and technical issues throughout construction. The main responsibilities of the LPE include:

a) Leading the finalization of any engineering design changes and bid documents
b) Providing technical engineering support to the procurement process

c) Leading the finalization of the award for contracts and all the contract management with the contractors and suppliers at the sites
d) guiding the field teams during the implementation phase, including the relevant training and capacity building of the Island Supervisors and Technicians
e) Generating the processes and procedures to monitor daily activities in the islands and the engagement with the contracting entities
f) Coordinating the supporting Project Engineers, who will monitor on a short term basis (4 months) the water system installation and testing quality
g) Recommending payments to suppliers and contractors according to established milestones to the PC for disbursement
h) Sequencing of the construction process and ensuring the integration of all various project dimensions in coordination with the PC.

Island Supervisors (IS)
Each project site will have an Island Supervisor (IS) during the implementation phase to ensure realization of quality end product with the support of the LPE. The IS will conduct frequent site meetings with the contractor to monitor quality and progress, coordination with local Government officials, receive/issue the procured materials, support the LPE and the PEs guaranteeing quality control and ensuring that the construction is implemented according to the specified drawings, design and technical specifications. With the support of the LPE and PEs the IS will:

- Support the giving site possession to Contractor
- Check and approve the Construction Work Programme
- Ensure product quality and compliance of bid documents
- Monitor Programme/Progress
- Review monthly Progress
- Issue variations with the approval of LPE/SPM
- Give approval for works recommended by Technician(s), [Daily basis for setting out / concreting / pipe laying etc]
- Recommend Monthly Payment Certificates based on measurement certified by Site Engineers/Technicians
- Maintain relevant site records of all activities
- Liaise with MEE and other Government Institutions

Technician
Each project site will have two (2) technicians, under a respective IS, to control the field activities on a daily basis under each sub-project based in Island. Preferably the technician will be local guaranteeing daily monitoring of the contractor, support Island Supervisors, and PEs to ensure the quality of works and measure completed works for payment.

Project Engineers (2) - *Implementation phase for max. 4 months each*
Two Project Engineers will support the construction phase, specifically during the critical lay-out of the pipeline systems and testing of the same. The PEs will review the original design in conjunction with the current site conditions; monitor the construction works while carrying out additional design works, particularly for the rainwater harvesting system. The two engineers will ensure the quality of the overall water system in the islands.

Electromechanical Engineer - *Implementation phase – as required*
The Electromechanical Engineer will be involved as required to specify the necessary components such as various types of pumps, pipe network valves, power source options, backup generators, electrical wiring, ventilation and illumination of operational and ancillary building, etc.

Draftsman - *Implementation phase – as required*
The Draftsman will be responsible for producing the necessary design drawings for both the bidding and construction activities of the work package. S/he will receive the finalised technical details from the Project and M&E engineers and prepare Civil, Mechanical and Electrical drawings for the necessary components of the desalination plant and pipe network.

Procurement and Logistics Assistant (PLA)
All the procurement processes, following thoroughly all the UNOPS procurement guidelines and adhering to UNOPS financial rules and regulations, will be undertaken by the Procurement and Logistics Assistant (PLA). The PLA will also be responsible for the logistics of all imported materials (desalination plants, pipes, valves and fittings, etc.) that will be delivered to Male' and then transported to the respective islands. S/he would be responsible for clearance of such materials and safe timely disposal in the respective islands. The PLA will be in charge of purchasing necessary construction and other materials locally for direct implementation work and arrange delivery to relevant site promptly. In addition, the PLA will arrange all transportation of officials from various sites to Male' and vice a versa.

Admin/HR/Finance Assistant (40%) and Project Support Officer (70%)
These two part-time positions will be involved in this project to ensure effective project management and administration support. These staff will support of adhering to UNOPS financial rules and regulations in documenting all administrative processes, human resources management (contracts), budget, finance management, and reporting

QUALITY MANAGEMENT STRATEGY

The Product Quality Management process ensures that the quality expected by the user / customer is achieved without any compromise. It encompasses all the project management activities that determine and implement the Project Quality Plan. The key elements of quality management system for the project are broadly summarized as follows;

The ***Quality System*** which has an organizational structure, procedures and processes to implement quality management will be used in this project.

The ***Quality assurance***, this creates and maintains the quality system and monitors its application to ensure that the quality system is operated and is effective in achieving an end product that meets quality and customer requirements.

Quality Planning, this establishes the objectives and requirements for quality and lays out the activities for the application of the quality system. The quality methods for the whole project are defined in the Project Quality Plan.

Quality Control, this is the means of ensuring that end products meets the quality criteria specified for them in the technical specifications and contract document.

Project Quality Plan

Project Quality Plan defines the quality techniques and standards to be applied, and the various responsibilities for achieving the required quality levels, during the project. In general terms this defines how the project will meet the customer's quality expectations. The Project Quality Plan contains the following,

Customer's Quality Expectations:

The purpose of this Quality Management Strategy is to ensure the project work-package delivered to the minimum technical standard stipulated in the contract documents and within the limits of tolerances acceptable in the project document. The work-package team shall identify and to record the quality procedures to be applied for the administrative and technical aspects of the Supervision of the project during implementation of the work-package on the supply, installation and civil construction works. It is intended that the project be subject to various quality audits during the life of the contract periods being:

- Design Reviews
- Verifications
- Checks
- Training of User groups/ Utility company technical staffs, and
- Quality Audits

The Quality management strategy should be a technical volume of specifications i/c tolerances that can be used by all involved in the supervision and hence should reflect precisely the actual procedures used. Consequently it must be created by members of the team working on the project who provide the benefit of their individual experience and specialization.

The Quality management strategy is a living document. If procedures are found to be un-workable they should be modified or replaced by procedures that do fulfil the end requirement. However the amendment must be recorded in the field and the section updated to reflect these changes.

Scope of Quality Management

Design Phase:

During the design phase the UNOPS will be coordinating the development of the concept and detailed design of the all the proposed components of the project, while UNOPS Senior program manager (technical assurance) will be supporting on reviewing the designs and technical specifications to ensure its effective alignment with international best practices according to the intended objectives and defined limitations of the project. Additionally to ensure quality of the additional components of the project, UNOPS will engage with MEE on obtaining prior authorization should there be a need to engage UNOPS partners, such as Arup, particularly for supporting the UNOPS design team with (1) their expertise on the feasibility study of renewable energy power for the proposed system – which will also contain an internal auditing process to ensure the quality of the proposed scenarios to the project; and (2) with the groundwater desk review study and a proposed Managed Aquifer Recharge (MAR) Study to propose additional groundwater recharging interventions which will also look into ways to mitigate and improve existing sanitation practices – all for which an internal quality assurance capability will be integrated.

Implementation Phase:

UNOPS LPE is responsible for the delivery/implementation of Component-1 of the project according to UNOPS high level standards on project delivery – based on Project Management principles. S/he will be supported by a the Senior Programme Manager based in Colombo, Sri Lanka . The LPE will be responsible of developing the Contract Documents for all activities for all 3 (three) Island' construction contracts.

UNOPS-LPE will be responsible of administering the civil works contract and ensure that the works are constructed in accordance with its contract provisions to ensure that projects will be sustainable. The PC shall forward the required documentation for approval with previous revision of the SPM and Maldives Office Manager to assure that the process complies with UNOPS Rules and Regulations, to the MEE Project Manager to approve, specifically for:

- issuing the order to commence the works;
- approving variation orders with change of scope and which have financial implications (if the contract falls outside of the approved budgets);
- approving significant variations in quantities;
- approving extensions of time.

The PC will support as required the MEE Project Manager to present information to the Project Board as it might be required. Thie reporting requirements will be discussed on a following section on stakeholder communication.

Continuous quality management activities will be undertaken throughout the implementation of the work-package by the LPE, which are related to:

- Supervision of the construction works
- Training of the Employer's staff
- Project performance monitoring

Category A: Supervision of Construction Works

On the daily activities of the LPE the supervision of works falls under his/her responsibilities, which shall be given to the island supervisors with the specific amount of tolerances to assure effective implementation process. During the critical months of the implementation of the water supply system, a dedicated Project Engineer will be engaged on each island to support the activities and train the supervisors and technicians. This supervision activity consists of but not limited to:

- Reviewing the detailed design prepared for the Project to identify any inconsistencies, etc and advising any potential impacts of those issues, such inconsistencies could be presented at the site construction during the implementation phase – which could derive into small modifications on the design

- Approving the contractor's work program, method statements, material sources, etc. where requested under the Contract,
- Preparing and issuing reports as defined subsequently;
- Approving and/or issue working drawings, approving the setting out of the works and give instruction to the contractor;
- Making measurements and keep measurement records;
- Maintaining records, correspondence and diaries;
- Certifying work volume and interim certificates for progress payments;
- Assisting the PMU team with the maintenance of consolidated Project accounts, and with preparation of financial statements and withdrawal applications for submission to theUNDP under the AWP ;
- Issuing the Taking over Certificate – final handover document - for part or all of the works, in conjunction with the authorized UNOPS/MEE officials;
- Inspecting the works at appropriate intervals during the defects liability period and certify the Defects Liability Certificate for issuance by the LPE;
- Advising the PMU on all matters relating to the execution of the works.
- Ensuring compliance with the environmental and social impact mitigation requirements of supply contractors, civil works contracts.
- Preparation and checking and certifying as built drawings for the works completed and submit the certification of completion to MEE and UNDP;
  Providing the PMU with complete records, and inception, monthly and completion reports;

Category B: Training of government counterparts and Utility Company (ies)UNOPS Maldives will develop and implement training programs, to assist MEE to enhance project management, procurement, environment management and project planning. In addition the related utility company which will be maintaining the assets after the finalization of the works will be trained during installation of plants and equipment during implementation and hence shall be organized formal training with the supplier's technical staffs on the operation and maintenance of the project. A planned training schedule based on the Operation and Maintenance plan for this project will be developed and shared for its further implementation accordingly.

Category C: Project Performance Monitoring
At the completion of the contracts, undertaking project performance monitoring of the Project in a prescribed format; and assist in preparing a consolidated Project Completion Report in a format to be provided by the UNOPS;

Key Reference documents for Quality Assurance (with reference to UNOPS' model Contract documents)

- **Conditions of Contract:** General Conditions of Contract issued by UNOPS Head Quarters shall be used for this project
- A Special Conditions of Contract (Conditions of Particular Application) which an amendment with reference to General Condition of Contract shall be included in the set of Contract Documents in Part-I of Volume I.
- **Specification:** The Specifications are included in the set of Contract Documents in Part-II of Volume 1. The Control Copy of these is held in the PC's office in Male'-Maldives UNOPS office.
- **Drawings and BOQ:** Drawings for each contract are included as Volume 2 of the documents
- **Codes of Practice:** The Control Copy set of the Codes of Practice accepted by International Engineers Institutions relevant to the works are held in the office of the PC's office.
- **Standards:** The Controlled Copy set of the Standards relevant to the works are held in the office of the PC.

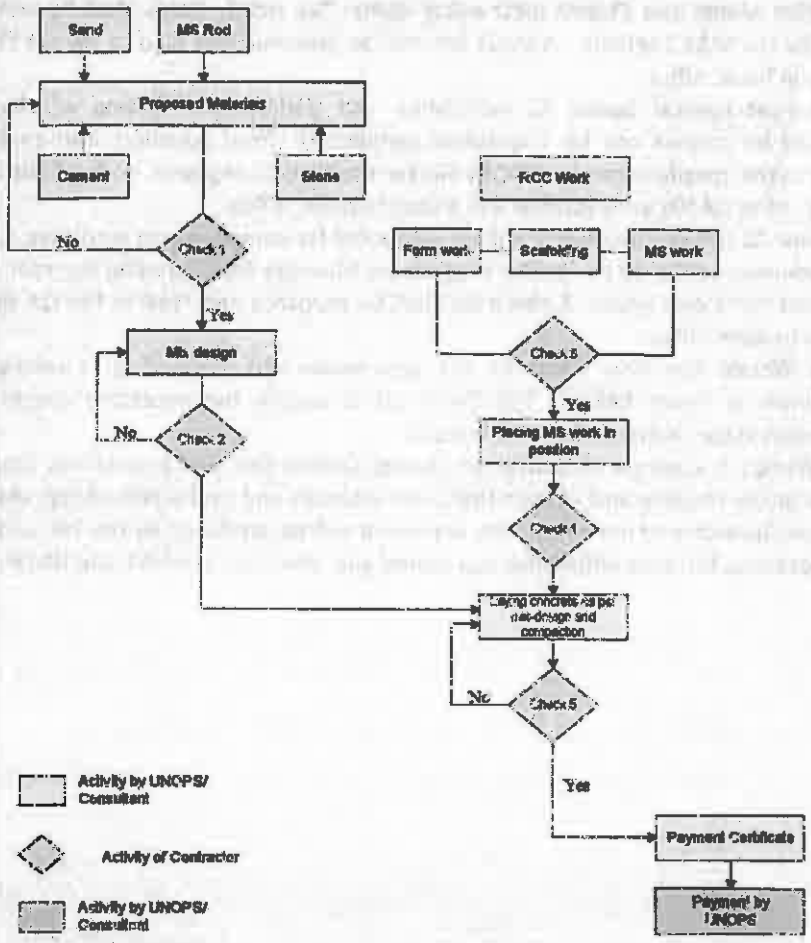
Supervision and Monitoring:[8]

- **Supply of construction materials:** All construction materials to be supplied by the contractors shall be monitored for compliance in according to the specifications stipulated in the contract Part II Volume-1 and shall be tested through the laboratory where required. A check list shall be prepared and filed to the QA file at field office and a copy to Male' office.
- **Supply of desalinisation plants and Electro-mechanical items:** The supply items shall be verified against the base line by the M&E Engineer . A check list shall be prepared and filed to the QA file at field office and a copy in Male' office.
- **Installation of Electro-mechanical items:** All installation and performance testing of electro-mechanical items shall be carried out by a qualified technician/s from suppliers and shall be monitored according to the specifications by UNOPS electro-mechanical engineer. A check list shall be prepared and filed to the QA file at field office and a copy to Male' office.
- **Civil construction items:** All civil constructions shall be monitored for compliance in according to the specifications and guidelines approved by "Senior Programme Manager for upgrading the roof with gutters, pipe laying and other civil works. A check list shall be prepared and filed to the QA file at field office and a copy to Male' office.
- **Reinforced Concrete Works:** The Flow Chart for the supervision and monitoring of reinforced concrete works is shown in Figure below. The Check List to ensure the necessary checks are undertaken at the various stages is indicated in Table inset.
- **Quality Control for Works:** A separate document on Quality Control test and procedures shall be produced to conform to the requirement of such tests, test intervals and evaluation of test shall to as laid down in the specification and drawings. The document will be produced by the LPE and will be distributed to all contracts for strict adherence and shared with the PMU and MEE and UNDP.

[8] Samples of the monitoring tools are attached to this PID on Annex 6.

Reinforced Concrete Inspection and Approval

FLOW CHART



EXPLANATION

Check 1
- Stone - Crushing strength, abrasion loss and other requireemnts
- Cement - Binding Property
- MS rod - Tensile Strength
- HT Wire - Tensile Strength, fatique test and other tests

Check - 2
- Crushing strength of Mix-design concrete sample

Check - 3
- Formwork - Material quality, levels, joints of form work
- Scaffolding - prop strength, soundness of scaffolding arrangement
- MS road - dia, bending check

Check - 4
- Distribution and placing of MS rods, levels, etc

Check - 5
- Collect concrete sample
- Test crushing strength

Review and Verifications

- **Technical Reviews:** A technical review of the project will be undertaken during detailed design period to determine if the field results being analysed correctly. This Review will be undertaken by a senior member of the team, the LPE and shall be cross checked the validity through MEE and UNOPS' Senior Program Manager.
- **Verifications**: Verification of the operation of the Supervision team and the extent to which this is functioning in accordance with the planned methodology is to be undertaken by the PC and LPE on a bi-monthly basis. The Scope of this verification will be limited to operational effectiveness, utilisation of available staff and impact of the supervision team in achieving the objectives of the services.
- **Checks:** Checks will be undertaken by the LPE to determine that the analysis of testing procedures is adequate and acceptable within the limits of the Codes of Practice and Standards are being correctly applied in the testing and analysing process. Joint supervision checks will be conducted with MEE from time to time especially in critical issues. Scope of checking will be limited to review of a sample of test results and spot checks on laboratory operations.
- **Arrangements for Consultations with MEE**: MEE and UNDP will be invited to comment on the performance and perceived strengths, weaknesses and successes or failures of the supervisory team in the course of the Review and Verification process. The Scope of this will be limited to comments on feedback of information, consultation and response to requests for special actions. The evaluation of this will take into account the limits included within this SQP and will be performed on a quarterly basis.

Quality Audits[9]

- **Frequency of Audits:** An Audit will be undertaken once every month until end of project through monthly site visit/progress meetings by the LPE or Senior Program Manager and dependent upon the results of that audit the subsequent requirements will be determined.

Site Records and Document Control

The object of this Procedure is to identify the various records which are kept on site and to ensure that the system for document control is managed in a proper way.

- **Scope:** The Site office records are kept to a consistent format to include the following:
  - Daily reports
  - Daily diaries
  - Equipment calibration
  - Daily weather records
  - Testing and materials records
  - Weekly and monthly reports
  - Record drawings
  - "As-built" drawings
  - Construction records
  - Site instructions
  - Taking-off measurement and calculations
  - Contractors request for inspection
  - Contractors request for measurement/survey

[9] Formats on the internal auditing controls are attached to this document

- Non-conformity report
- Plant, labour and materials on site records
- Details of borrow pits
- Any client specific requirements

The receipt, distribution, transmittal and control of documents are carried out in accordance with the system established elsewhere and the filings done according to the file lists.

- **Responsibility:** The LPE with the support of the Supervisors is responsible for document control and the keeping of agreed records on site for their respective contracts and the PC is responsible for the office of in Male'. This procedure is audited by the Maldives Office Manager.

- **Actions:** The LPE establishes the client's requirements, using check-list as an aid, and with the PC agrees the appropriate level of document control and the types of records to be kept. The Forms agreed shall be used at the Site Quality Plan.

Site Inspection

The purpose of this Procedure is to ensure that construction is carried out in accordance with the Contract provisions. Site Inspection includes ensuring all items supplied to the site are in accordance with the Contract Specifications.

- **Scope:** The extent for Site Inspection is as laid down in the Agreement and as incorporated into the Quality Plan.

- **Responsibility:** The LPE with the support of the Island Supervisors on site is responsible to the for quality supervision. MEE Senior Technical Officer and the UNOPS Senior Programme Manager will audit the quality on site on an ad-hoc basis during the period of construction.

- **Definitions:** Contract - The various documents comprising the construction of the Works including Agreement, Conditions of Contract, Specification and Drawings together with any properly ordered variations thereto. **Actions: The** Engineer's Representatives/LPE draw up and approve forms to act as check-list and a record of inspections, approvals and or rejections of work. The forms are used by the supervising staff for each site operation whether it is setting out, formwork for concrete pours etc. The essential purpose is to ensure that construction is carried out in accordance with the respective Contracts and that any non-compliance is put right at the time rather than left until later. Non-conformity is to be recorded; remedial action is to be taken according.

  In the event of non-compliance or not being rectified at the time, full details are recorded for future action with details of the fault and options for remedy. Details of continuing non-compliances are notified to the Senior Program Manager.

  Daily reports will be compiled by the Supervisors with the assistance of Technicians. The monthly report shall include the LPE's action with respect to the activities of the Contractors that did not comply with the Specification and Contracts. The Site Inspection forms are kept in sub-divided files for ease of future reference until Project Close Out.

- **Forms**
  - Site Inspection Form
  - Non-Conformance Report

Monitoring Progress & Cost

The purpose of this Procedure is to ensure that physical progress and the cost of construction is monitored throughout the construction phase of the project.

- **Scope:** The procedure covers the activities required to achieve such monitoring.

- **Responsibility:** The responsibility for monitoring progress and cost is in the first instance that of Engineer's Representatives and Site Staff. The extent to which monitoring is carried out is laid down in the Quality Plan. The Engineer's Representative/LPE keep the Senior Program Manager informed on progress and cost matters.

- **Definitions:** Programme - The approved Contractual Programmes of the Project drawn under the Conditions of Contract.

  Financial Programme - A programme which shows the planned periodic expenditure on the basis of planned work at Bill of Quantity or other appropriate contractual rates.

- **Actions:**
  Check-list - Check-list is used to ensure that all actions needed for monitoring progress and cost control are established.

  Contractor's Programs - The Island Supervisor obtain the Contractor's programmes for the works to be carried out under their respective contracts and check for compliance with the requirements of these construction contracts. A report is prepared by him with the support of the LPE, who as the Engineer's Representative under the construction contract normally process for the Engineer's concurrence of the programmes. Items are not in accordance with the contract documents are referred back to the Contractor by the Engineer's Representatives for correction or clarification prior to approval of the program. Once the programme has been approved the Contractors price the work shown using the contract rates to produce a graph of planned expenditure. The Supervisor with the support of the Project Engineer reviews and forwards to the LPE who in turn forwards to the Engineer.

  Progress Monitoring - The physical progress of construction is monitored against the approved programme or any subsequent approved revision thereto. Progress is monitored either by comparing the physical work done with the planned or by comparison of planned with actual expenditure. This exercise is normally carried out monthly.

  Cost Monitoring - Cost monitoring is carried out by adjusting the tender value to take account of changes in measurement and any variations ordered, together with an assessment of any claims, to determine an estimated out turn cost. This assessment is checked by adding the estimated cost of completing the project to the expenditure to date.

  Variations - Variations and changes in measurement are evaluated as the project proceeds with a formal update of the out turn cost estimate at not more than three monthly intervals. Any variations and changes to the budget will be authorized and endorsed by MEE prior to any changes are brought on by UNOPS.

Contractors Proposals and Queries
The purpose of this Procedure is to have a system to receive, assess and respond to the Contractors proposals and queries.

- **Scope:** Contractor's proposals and queries shall fall under the following categories:

(i) Contractual matters:
- Contract programme
- Method statements for all parts of the Works
- Proposals for overcoming unforeseen conditions
- Interpretation of the contract

(ii) Contractors proposals:
- Contractors proposed temporary Works
- Contractors proposed alternative designs
- Contractors proposed equipment, furniture, etc as part of the attendance to the Engineer.

(iii) Queries arising from the Engineer's Design:
- Contract information which the Contractor cannot understand e.g. Design, Specification, Drawings
- Information which the Contractor considers to be incorrect
- Information which the Contractor considers to be incomplete
- Information which the Contractor considers unsatisfactory or unclear.

- **Responsibility:** The Engineer's Representatives (LPE) receive and respond to the Contractors proposals and queries. Responsibility for the investigation and determination of the response is allocated in accordance with Quality plan. The LPE keeps the "Engineer" informed of the Contractor's proposals and obtains any necessary Employer approval.

- **Actions:** The Engineer's Representative's and Supervisors (with the support of the Project Engineer), establish and operate a system to record the receipt of queries, response to the Contract and final resolution of the query. For avoidance of future problems all queries and responses are in writing.

- **Contractual Matters** - The Site Staff study the Contractor's submissions and report to the Supervisors (with the support of the Project Engineer) concerned who in turn reports to LPE. The LPE determines or confirms to Supervisor the response to be made to the Contractor. The Supervisor concerned makes the formal response to the Contractor unless the subject matter comes under a clause of the Contract not delegated to him. In such a case the Engineers Representative, if the subject matter has been delegated to him responds directly to the Contractor with a copy to the relevant Supervisor on site.

- **Contractor's Proposals** - The Contractor's proposals for temporary works are assessed by the Site Staff and those of a minor category responded to directly with details of the proposal and response copied to the LPE for information. Major proposals are reviewed by the Site Staff and passed with their comments and a copy of the Contractor's proposal to the LPE for consideration. Alternative designs proposed by the Contractor are initially reviewed by the Site Staff to determine whether they are practicable and acceptable technically, achieve completion in accordance with the specification, safe to carry out and use. Supervisors shall forward his findings together with a copy of the contractor's proposal to LPE for further consideration. LPE in turn gets it reviewed by the respective design team and forward to the Engineer for his approval and processing for MEE's approval as appropriate.

- **Queries on Contract Information:** Non-design matters which are unclear, apparently incorrect or incomplete to the contractor are initially reviewed by Site Staff and a response given to the Contractor. Any issues that cannot be resolved by the Site Staff shall be referred LPE for clarification.

  Design matters which the Contractor considers unsatisfactory are referred to the LPE through Supervisors for a decision together with the Contractor's submission and any relevant comments

from the Site Staff. LPE shall clarify the issue to the satisfaction of the contractor. In cases where design is clearly shown to be incorrect, the Engineer is informed by the LPE for his review and a decision.

CONFIGURATION MANAGEMENT STRATEGY

The aim of configuration management is identification, observation and protection of project products. The configuration librarian functions will initially be performed by the PC.

All files associated with the project will be available in the UNOPS office in Maldives and the project extranet and will be properly maintained on a daily basis to make sure that all the project related correspondence, reports, plans, drawings and meeting minutes are kept in order for reference.

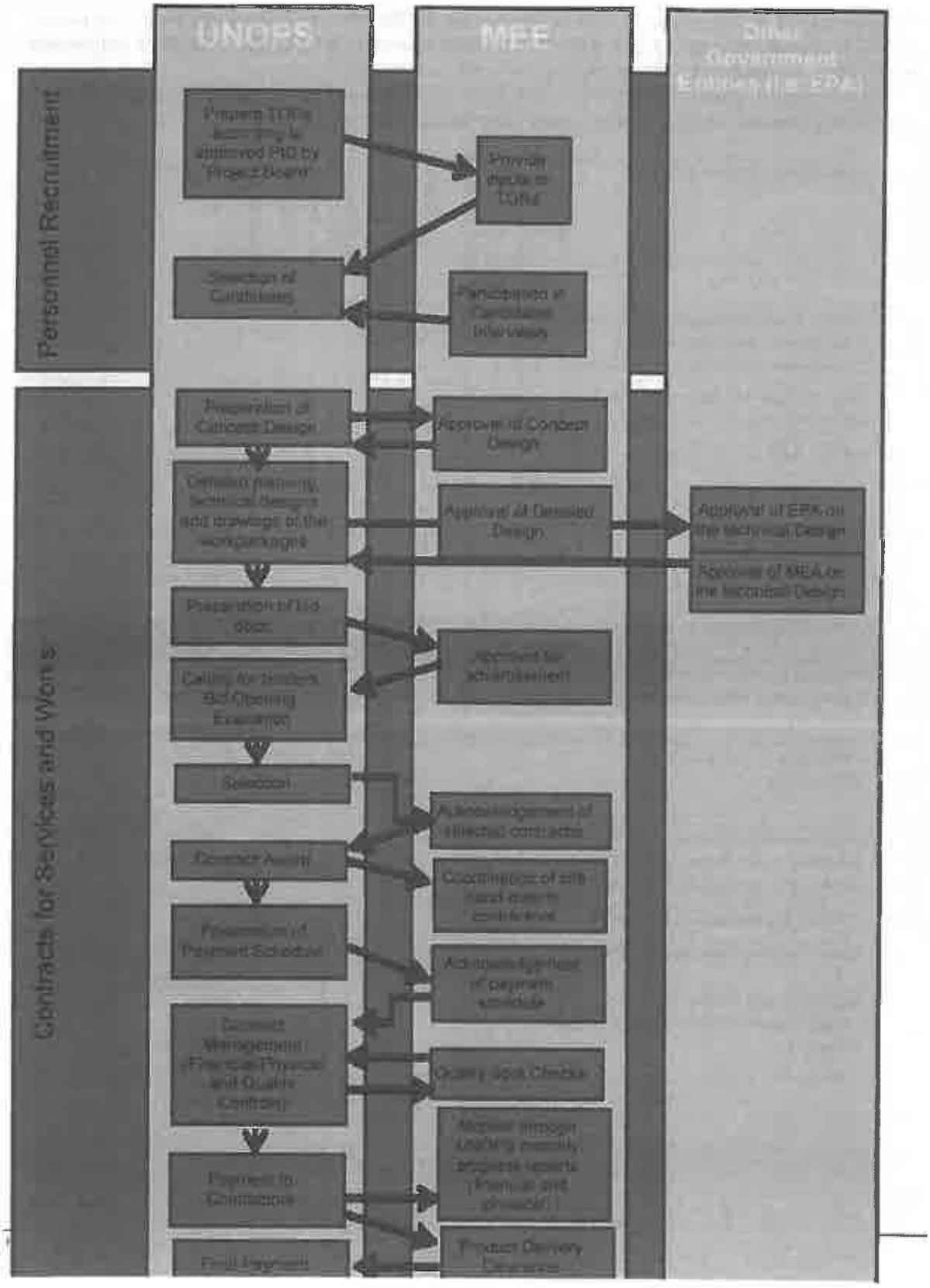
Responsibility Matrix for Project Products under Work Package - Component 1[1];

#	Description of Core Activities	National Project Manager	UNOPS Assurance	Project Coordinator	Lead Project Engineer	Island Supervisors	Remarks
1	Overall project management, financial management and liaison with Beneficiaries/ UNDP on policy matters	X	√	√			
2	Work Package Management and Operations on technical matters		√	X	√		
3	Budget and budget revision	√	√	X			Budget approval from Project Board
4	Development of TORs for Staff Recruitment	√	√	X			MEE to approve TORs[2]
5	Staff recruitments	√	X	√			Participation into staff recruitments[3]
6	Concept design, detail planning, technical detailed design and engineering drawings of the work Package components	√		√	X	√	Required approval from MEE, EPA, and MEA on technical designs and workpackages[4]
7	Preparation of bid documents, (Technical Specifications, BOQ, engineering drawings etc.)			√	X		
8	Approval of bid documents for advertisement	X	√		√		
9	Calling for ITBs (National and International), Bid opening, Bid review, Evaluation and Awarding of works to Contractors	√	√	X	√	√	UNOPS bid review team shall assist to PC
10	Contract supervision and monitoring			√	X	√	
11	Quality assurance and quality control	√	X	√	√		Spot Checks by MEE for quality assurance
12	Ensure contractor's payment on time through payment certificates & Approval of Payments	√		X	√	√	Upon signature of contract, payment schedule to be acknowledged by MEE

13	Ensure project delivery on schedule period	√	√	X	√		

X Detailed description of process flow for personnel recruitment and contracts in table below
Legend: "X" is the core responsibly and" √" is the Assisting responsibility

Process flow for Personnel Recruitment and Contracts for Services and Works



RISK MANAGEMENT STRATEGY

Key risks underlying the project have been analyzed during the formulation phase of the project in connection with the target sites. Over the course of the implementation of the workpackage , a UNOPS risk log will be regularly updated in intervals of not less than every six months of the critical risks to the project and work package that have been identified previously. The maintenance of the Risk Register is the responsibility of the PC and its review is that of the National Project Manager. The potential escalation of any given risk is to be highlighted in consultation between the PC and the National Project Manager for recommendation to the Project Board.

Input from the Work Package Team will be handled initially through the updating of the Issue Log. Any new risks or escalation issues will then be added to the Risk Register for review by the PC and National Project Manager. When a perceived risk become an issue, the issue log in turn will be updated to reflect the kind of escalation.

These risks have been generally assessed as medium to high depending on the project region. The risks are deemed to be much higher in the northern and southern regions of the project area due to the distances and means of communications. Hence, it is strongly recommended that a review of the situation is undertaken by UNOPS, MEE and UNDP mid-way through project implementation to ensure joint decisions are made on the path ahead.

#	Risk	Risk Type	Risk Description	Rating	Risk Mitigation Actions
1	Upcoming Elections	Political	The current political situation and upcoming political leadership changes might delay the implementation of the project	Very High Risk	Ensuring that other non-political parties/stakeholders are engaged in the project - engaged island members to own the project through strategic communication
2	Breaking Ground Ceremony	Political	Ceremonies might have an impact on the project implementation	Very High Risk	Prepare stakeholders on the political effects of the foundation ceremony - Ensure other risk responses are in place to potentially avoid this risk
3	Delayed Implementation	Implementation	Project will not be implemented on time, cost and quality as per the ProDoc	Low Risk	Ensuring that all parties apply Project Management tools for effective implementation, such as Board Meetings, planning workshops, highlight reports, weekly meetings, risk log revisions, stakeholder management and communications strategy
4	Community Priorities	Implementation	Due to elections in 2013, local communities might be engaged in other activities that will/could potentially delay and/or disrupt the	High Risk	Communication plan for the island to inform them about the importance of Water - informal monthly briefing - build into local

			implementation fo the project		ownership of the project
5	Politicization of Procurement	Implementation	Selection of contractors that are against the political interest of the island	High Risk	Ensure to have at least a member of each island on the selection of the contractors - based on actual documentation
6	Supply Availability	Implementation	On-time availability of supplies	Low Risk	Procurement Plan - ensure there will be stock of items to avoid delays of supplies - include clause on the contracts for works
7	Community Expectation Management	Implementation	Expectations on the community to have high water quality	Low Risk	Communication quarterly on quality standards - ownership on the system and monitoring of quality levels through testing equipment
8	Increase of scope of works	Implementation	New houses to be built in Gadhdhoo reclaimed area by end of 2012	Low Risk	Ensure the utilization of any balance funds of the selected options to lay down pipes on main roads of reclaimed area
9	Delayed Financial Expenditures	Financial	Financial expenditures might be delayed as risks have become issues, increasing project cost	Low Risk	Ensure the project implements strategic risk responses on communication with communities and key stakeholders
10	Inflation	Financial	Price increases in the country - inflation	Low Risk	Having clauses in the contract for price variations
11	Weather Variance	Environmental	Potential effect of strong weather in the islands	Low Risk	Ensure the infrastructure works take into account the seasonal weather changes
12	Construction Supervision	Implementation	The staff selected through the joint recruitment exercise of FENAKA and UNOPS do not perform as required with regard to their construction supervision and quality assurance perspectives	Medium Risk	Ensure to have key Project Engineers at the site when the critical works are underway. Ensure that the relevant project responsibilities and liabilities are fully explained to the chosen candidates. Ensure an effective training component by the Technical experts of the project.

COMMUNICATION MANAGEMENT STRATEGY

The communications strategy defines the parties interested in the project and the means and frequency of the communication between them and the project.

Communication set-up

D – Daily W – Weekly M - Monthly Q – Quarterly A – As Required	Project Board	Project Assurance	MEE Project Manager	UNOPS Project Coordinator	Lead Project Engineer	Project Island Offices	Local Island Communities
Project Board	-	Q	Q	-	-	-	-
Project Assurance	Q	-	Q	Q/M	-	-	-
MEE Project Manager	Q	Q/M	-	W/M	W/D	A	W/M
UNOPS Project Coordinator	-	Q/M	W/M	-	-	W/D	-
Lead Project Engineer	-	-	W/D	A	-	-	-
Project Island Offices	-	-	-	M/D	-	-	W/M
Local Island Community	-	-	W/M	-	-	W/M	-

This table stipulates the minimum communication requirements between all project participants. It should be assumed that parties will also meet on an ad hoc needs basis.

Bi-yearly Project Board Meetings (with the provision of extraordinary Project Board meetings) must be attended by the **Project Board Members, Project Assurance, MEE Project Manager, and UNOPS Maldives Office Manager (as a supplier)** in order to discuss the findings in the *Quarterly Reports*. This report (with Annexes) must be provided to all parties a week prior to the meeting. All parties should receive a brief prior to any ad hoc meetings, whenever possible, highlighting the purpose and topics to be discussed.

In addition to quarterly meetings, the **Project Manager** must hold weekly meetings with the **UNOPS Project Coordinator** and **Lead Project Engineer**. The **Project Manager and UNOPS Project Coordinator** must be in constant communication.

In addition to attending quarterly and weekly meetings specified above, the **UNOPS Lead Project Engineer** must have daily contact with the **Island Offices** and perform sight visits on monthly basis.

The channels of communication between the **MEE Project Manager** and the **UNOPS Project Coordinator** must be kept open in order to produce effective and cohesive results, which are communicated to the **Project Board** by the **MEE Project Manager** on a quarterly and ad hoc basis.

Island Offices must report to the **UNOPS Lead Project Engineer** on a daily basis as well as disseminate the *Monthly Informational Brief* to the **Local Island Communities**. The Island Offices will have communication as required with the MEE Project Manager on these communication activities in the islands.

The **UNOPS Project Coordinator along with the PMU** are responsible for taking minutes at all meetings and disseminating them to participants. The PMU with the leadership of the Project Manager is also responsible for the timely production and dissemination of: the *Quarterly* and *Monthly Report* to the **Project Board, Project Assurance**; the *Monthly Information Brief* will be supported by the **UNOPS Project Coordinator and Lead Project Engineer** and **Island Offices,** and will be transmitted upon approval from the **MEE Project Manager to the Island Communities**.

Dissemination of information

A - As required / updated D - Daily W – Weekly M - Monthly Q - Quarterly	Project Initiation Report	Quarterly Reports	Issue Reports	Monthly Reports	Monthly Informational Brief	Weekly Minutes	Project Closure Report	Ad Hoc
Project Board	A	Q	A	-	-	-	A	A
Project Assurance	A	Q	A	M	-	-	A	A
MEE Project Manager	A	Q	A	M	-	W	A	A
UNOPS Project Coordinator	A	Q	A	M	-	W	A	A
Lead Project Engineer	A	Q	A	M		W	A	A
Project Island Offices	A	-	-	-	-	W	A	A
Local Island Community	-	-	-	-	M	-	A	A

The reporting format for *Quarterly, Interim Final and Final Reports* should be in accordance with Project Monitoring Form C, No 01/2012. The structure is as follows:

1) Project Details
2) Total Project Cost
3) Expenditure
4) Tender Details
5) Progress Detail
6) Schedule of Components - based on AWP
7) Scope of the Project
8) Achievement of Objectives
9) Implementation Delays / Problems Faced

The *Monthly Report* is a brief highlighting change and achievements. The reporting format for the monthly report is as detailed below. Reports must contain information on the following subjects:

1) Narrative report
   - Update risk log
   - Revision of project plan
   - Revision of procurement plan
2) Expenditure report
   - Cost and Budget (Financial statements are to be provided in accordance with UNOPS Financial Rules and Regulations)
3) Lessons Learned

A *Monthly Informational Brief* will be submitted by MEE to the **Island Councils** in order update them on the progress of the project and to involve their positive commitment on the project outcomes and activities. This report however, will not include details on financial updates, risks and any other sensitive matters.

Project Plan

This describes how and when the projects objectives are to be achieved, by showing the major products activities and resources required on the project. It provides a baseline against which to monitor the projects progress stage by stage. Please refer the General Implementation Schedule of Annex 1.

PROJECT CONTROLS

Project controls ensure that for each level of the project management team, the next superior level of management can:

- Monitor progress
- Compare achievement with plan
- Review plans and options against future situations
- Detect problems
- Initiate corrective action
- Authorise further work

The Project Board assumes overall responsibility for the control of the project. The Project Board receives information from the National Project Manager and has control over whether the project activities should continue or stops or changes direction or scope. The major controls for the Project Board are as follows:

a) Project Initiation - to ensure that before significant commitment of resource on to the project, all related issues and disputes involved in the project has been agreed upon.

b) End Stage Assessment - the Project Board only commits to one stage of work at a time. This assessment approves the works to date and provides authority to proceed to the next stage.

c) Highlight Reports - provides by the PC to the National Project Manager on a regular basis to report progress during a stage. The highlight report for this project will be produced quarterly and will contain details of progress accomplished to date, achievements in the current period and achievements expected in the next period, details of actual or potential problems and suggestions for their resolution.

d) Exception Reports - notification by the LPE through the PC to the National Project Manager that the stage (or project) plan will deviate outside tolerance limits. This details the problem, outlines the available options and identifies the recommended option and will be issued on an as required basis.

e) Mid-Stage Assessment - this assessment is held between the National Project Manager and PC after an Exception Report or a significant milestone to determine how the project will proceed further.

f) Project Closure - the Project Board along with the National Project Manager formally closes the project, confirming that the project has been completed.

Other project controls which will be used during the project tenure are as follows:

a) Checkpoints - these meetings will be held weekly (if possible) between the PC and the Project Team to discuss the progress of the Project against the plans and any problems that need to be resolved.

b) Tolerance - permissible deviation from the stage or project plans without recourse to the Project Board. The Project and Stage Tolerances for this project are outlined in project plan.

ANNEXES

Annex 1 – General Implementation Schedule

Annex 2 – UNOPS Work Package Budget – described per output

Annex 3 – Clarification of proposed budget change

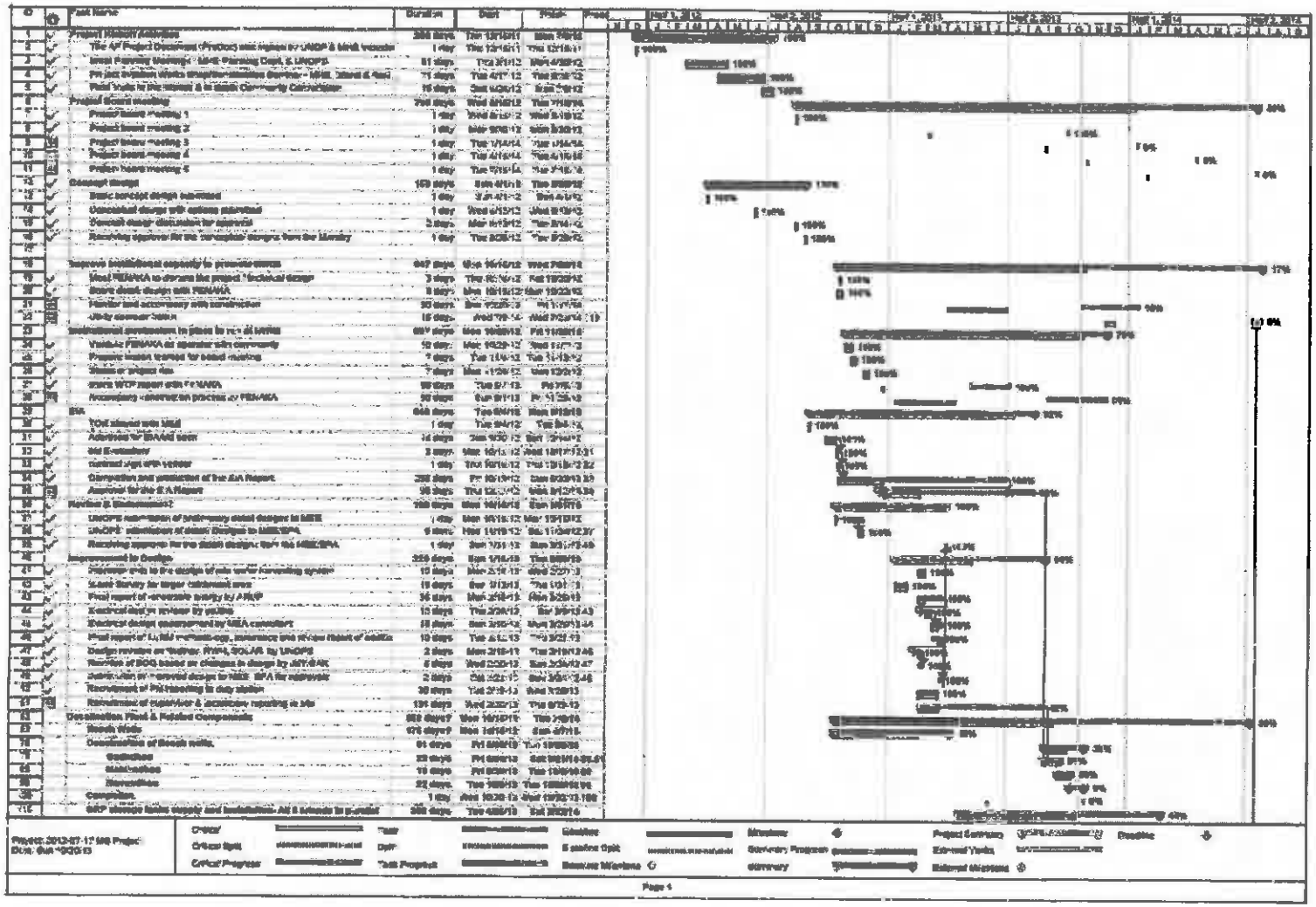
Annex 4 - Detailed Budget Expenditures

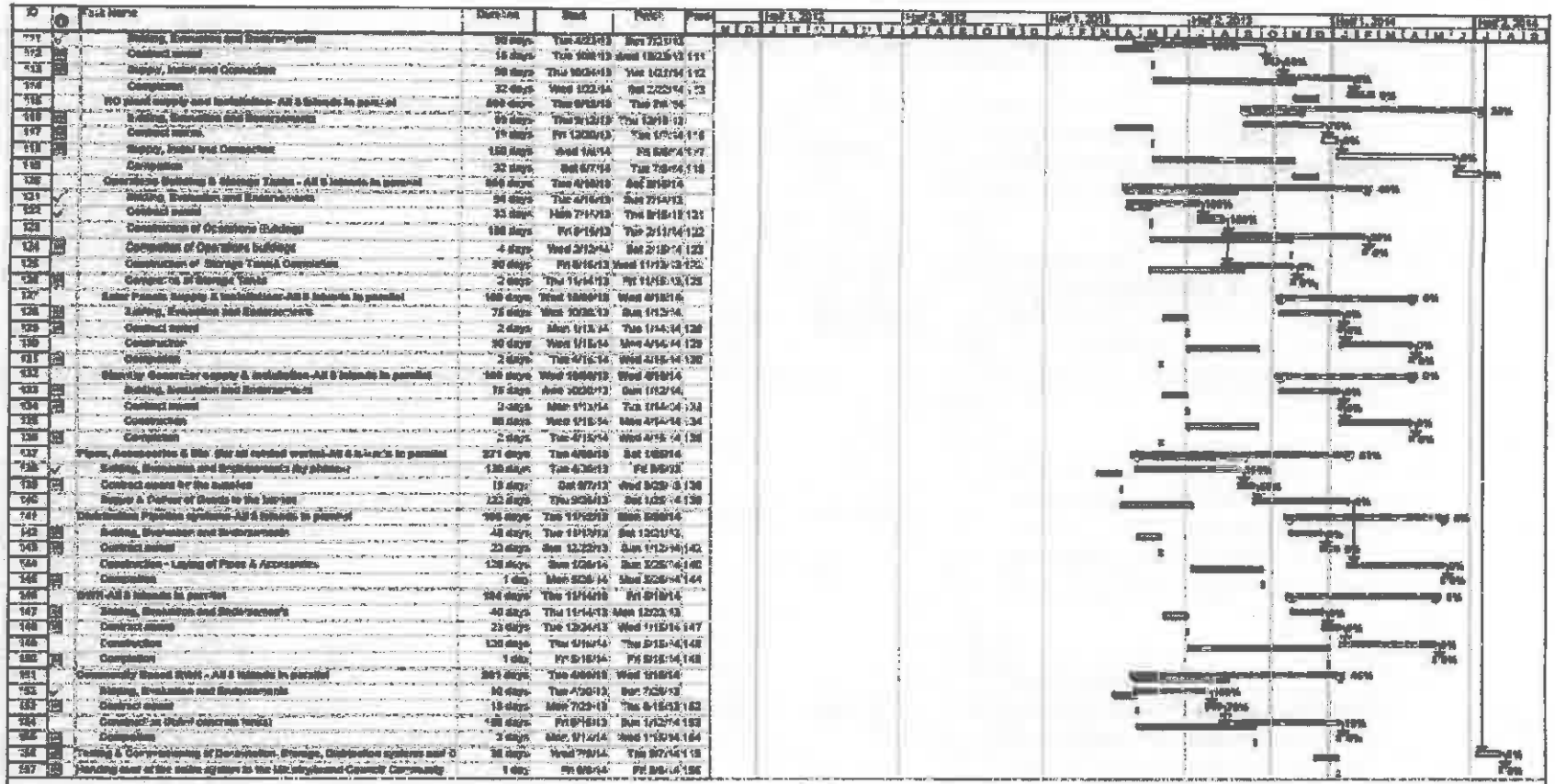
Annex 5 – Monthly Expenditure Reporting Format

Annex 6 – Health and Safety Plan

Annex 7 – Samples of Construction Monitoring Tools

Annex 1- General Implementation Schedule





Annex 2 – UNOPS Work Package Budget – described per project outcome

Analysis of Original ProDoc Budget and Revised PID Budget – Based on Engineering and Procurement Estimates (see detailed budget)

OUTCOME #	EXPECTED CONCRETE OUTPUTS	ProDoc Total	PID Budget Revision	Rationale
OUTCOME 1: Coastal water aquifer rehabilitated and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo to provide reliable, equitable and cost effective access to safe freshwater in a changing climate.	1.1 Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons	228,296	188,162	This item includes components of groundwater recharge studies, and a budgeted pilot recharge option for the three islands.
	1.2 Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods	3,717,893	1,392,481	This item includes the connection from households and community roofs, collection tanks at the three islands. The original ProDoc budget included individual tanks at each household level
	1.3 Production and distribution system for desalinated water supply established	3,296,733	5,645,653	This item includes the RE component of Solar Panels plus back-up generators, the entire water piped system, GRP tanks and the RO desalination plant and infrastructure
	1.4. Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods	77,476	94.100	This component includes the preparation of the recommendations for wastewater improvements in one island.
	Sub Total	7,320,398	7,320,928	

OUTCOME UNOPS PMU	Local Consultants	174,000	168,994	Budget changes due to team conformation – see page 19
	International Consultants	210,000	215,006	Budget changes due to team conformation – see page 19
	Sub Total	384,000	384,000	
Total Project UNOPS Component		**7,704,398**	**7,704,398**	

Annex 3 – Clarification of Budget Changes to the Project Board from the Original Project Document Budget for Component 1

Outcome 1: *"Groundwater aquifer rehabilitated and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo, and GDh. Gadhdhoo to provide reliable, equitable and cost-effective access to safe freshwater in a changing climate"*

Output 1.1: *"Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons"*

In order to achieve the overall outcome and specific output for this component, the proposed changes into the budget from USD 228,296 to USD 188,162 correspond primarily to the design change from the originally planned700 groundwater recharging pits and 30 community recharge wells for the islands, into a comprehensive Managed Aquifer Recharge (MAR) Study plan and specific recommendations actions for the specific conditions of the islands. This specific MAR recommendations will be implemented and additional tentative provision has been made for three pilot recharging mechanisms at each island(which will capture the overflow from the Rainwater harvesting tanks to slowly recharge the aquifers), located next to the rainwater harvesting collection tanks.

Output 1.2: *"Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods"*

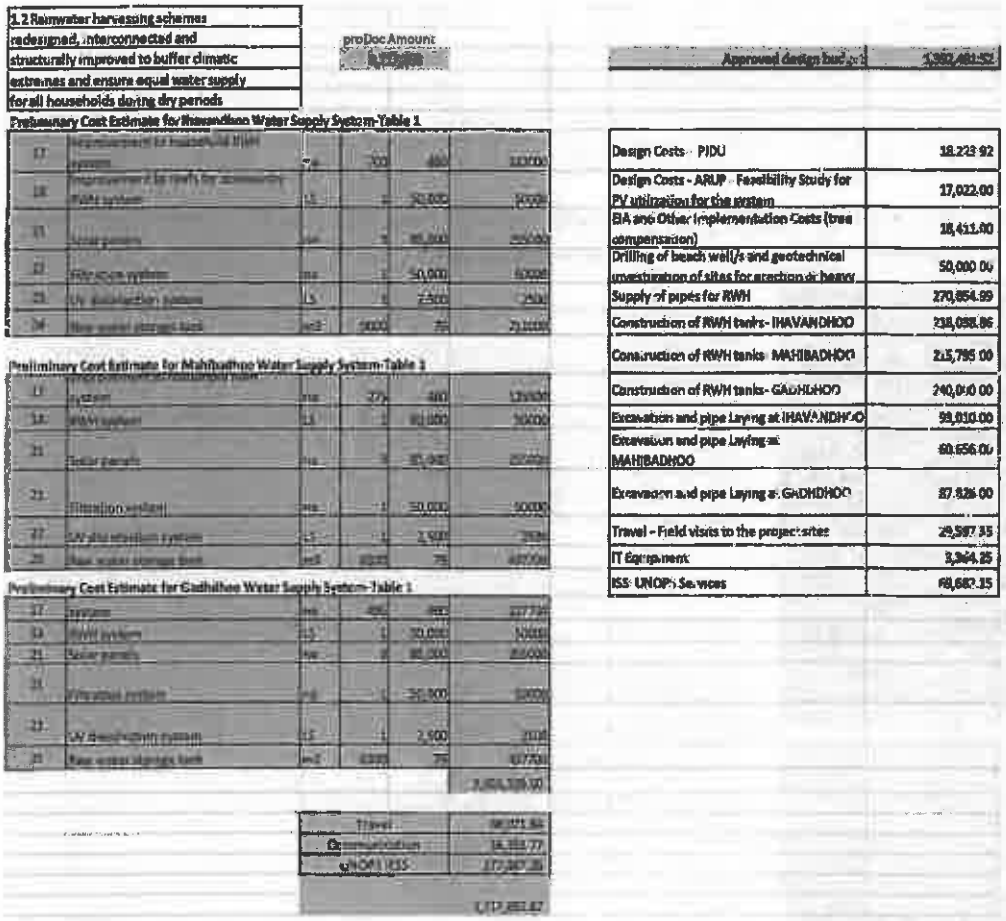
In order to achieve this specific output, the proposed changes into the budget from USD 3,717,893 to USD 1,392,481 correspond primarily on the reduction from the original plan of providing individual household rainwater harvesting tanks into considering only the provision of communal reinforced concrete rainwater harvesting tanks that will capture the rain from community buildings and adjacent private homes. This proposed change came from the lessons learned from the post-tsunami evaluation, where individual household rainwater harvesting caused several equity issues. The actual rainwater harvesting water capacity storage has changed from the originals to the current set-up as follows:

HA. Ihavandhoo: 9,000m3 (original plan) to 1,550m3
ADh. Mahibadhoo: 6,300m3 (original plan) to 1,250m3
GDh. Gadhdhoo: 6,300m3 (original plan) to 1,450m3

The new proposed budget does also have an additional reduction of the initial allocated amounts for Solar Panels, which have been moved to the component 1.3. This budget component consider the correspondent excavation and lay down of the pipe system that will connect rainwater harvesting into the large freshwater community water system. Additional household connection will be further explored, as there is provision to potentially increase the number of household participants under the current budget. RWH from Houses was done after a survey for each Island. Based on the survey households to be connected for RWH were selected. The below table shows the summary- give total houses/ No of houses selected.

Island name	Total Houses	Agreed house	Houses in between agreed house (possibility to connect to system)	Roof Area of agreed houses (discarded all old roof, asbestos, rusted roof for the system)
H.A Ihavandhoo	450	70	40	5638m2
A.Dh.Mahibadhoo	435	27	18	1927m2
G.Dh.Gadhdhoo	450	59	25	8801m2

A detailed budget comparison of $3.7m and $ 1.4m is given below.



1.2 Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods	proDoc Amount [illegible]

Preliminary Cost Estimate for Ihavandhoo Water Supply System-Table 1

Preliminary Cost Estimate for Mahibadhoo Water Supply System-Table 1

Preliminary Cost Estimate for Gadhdhoo Water Supply System-Table 1

Approved design budget	3,207,481.52

Design Costs - PIDU	18,223.92
Design Costs - ARUP - Feasibility Study for PV utilization for the system	17,022.00
EIA and Other Implementation Costs (tree compensation)	18,411.00
Drilling of beach well/s and geotechnical investigation of sites for erection of heavy	50,000.00
Supply of pipes for RWH	270,854.99
Construction of RWH tanks- IHAVANDHOO	238,088.86
Construction of RWH tanks- MAHIBADHOO	215,795.00
Construction of RWH tanks- GADHDHOO	240,040.00
Excavation and pipe Laying at IHAVANDHOO	99,010.00
Excavation and pipe Laying at MAHIBADHOO	60,656.00
Excavation and pipe Laying at GADHDHOO	87,826.00
Travel - Field visits to the project sites	29,587.35
IT Equipment	3,364.25
ISS: UNOPS Services	69,687.15

Travel

UNOPS ISS

The revised design of RWH is simplified by treating the collected rain water in the RO plant and distribute the combined treated water for consumers. Hence the original RWH budget has been reduced.

Output 1.3: *"Production and distribution systems for desalinated water supply established"*

In order to achieve this specific output, the proposed changes into the budget from USD 3,254,683 to USD 5,645,653 correspond primarily on the increased addition under this component of larger centralized water distribution tanks (GRP tanks installed in the central water distribution building – RO Plant Building) which will collect the rainwater and the desalinated water before its mix for house-piped distribution, the inclusion of solar panels component from 1.2 to support the power the system, and the inclusion of back-up generators that will ensure the reliability of the water supply system. The system will integrated the following Reverse Osmosis (Desalinated) water plant capacities as follows:

HA. Ihavandhoo: 70m3 – from the original 90m3
ADh. Mahibadhoo: 50m3– from the original 60m3
GDh. Gadhdhoo: 60m3– from the original 60m3

The proposed final outputs for the redesigned system to each island will enablean estimated water mix according to the water consumption for 2030 as follows:

Island	Est. Population 2030	RWH/yr (m^3)	Water needs for 15l/d/p (2030)		Water needs for 20l/d/p (2030)		Water needs for 50l/d/p (2030)	
			Water mix of RO Plant (%)	Water mix of RWH (%)	Water mix of RO Plant (%)	Water mix of RWH (%)	Water mix of RO Plant (%)	Water Mix of RWH (%)
Ihavandhoo	8366	10,130	45%	55%	58.78%	41.22%	83.5%	16.5%

Mahibadhoo	2369	7,846	38.7%	61.3%	54.64%	45.36%	81.9%	18.1%
Gadhdhoo	3206	17,757	0%	101.2%	24.13%	75.87%	69.6%	30.4%

A detailed budget comparison from the original ProDoc and the proposed budget is described below

Please note that UNOPS works on actual cost ad any savings belongs to the project and could be utilized to addition works as required.

Output 1.4: *"Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods"*

In order to achieve this specific output, the proposed changes into the budget from USD 35,426 to USD 94,100 correspond primarily on the increased addition under this component of the Managed Aquifer Recharge (MAR) study that will address the planning and use of wastewaters for the islands, and will produce a plan to deal with the specific conditions at ADh. Mahibadhoo, as a new brand sewage system plant has been established in this island. An additional amount has been allocated to assess the existing STP effluent quality and recommend treatment with recharge pits for dry season. The original component did propose general recommendations for wastewater management, linked with community awareness campaigns to reduce and motivatepeople to change their behavior towards the improvement of the wastewater practices in the islands.

Annex 4 - Detailed Revised Budget for the implementation phase – as per September 2013

OUTCOME 1:	EXPECTED CONCRETE OUTPUTS	Activities	Amount	Committed contract amounts	Name of Contractor	Activity description or exact output produced	Expen to d
Ground water aquifer rehabilitated and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo to provide reliable, equitable and cost-effective access to safe freshwater in a changing climate.	1.1 Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons	Design Costs - Groundwater Recharge (GWR)-Desk review	10,388.43	10,388.43	ARUP	GWR Desk review Document	10,388
		Design Costs - Physical Infrastructure Design Unit (PIDU)	18,223.92	18,223.92	UNOPS - PIDU	Design cost of the proposed pilot recharge component	18,223
		Management Acquifer Recharge (MAR) Study	8,764.61			Manage Acqufier Recharge (MAR) Study - plan and recommendations for actions	-
		Implementation of activity recommended by MAR study	50,000.00			Above study will inform the propose additional set of work	-
		Supply of pipes for GWR	26,359.75	25,041.76	SRI KRITHIKA INTERNATIONAL	Over flow pipes, connection between 12 black tanks per island, connection to recharge pits	-
		Construction of Groundwater recharging pilot system IHAVANDHOO	13,059.00			GWR from collection of overflow of Rainwater - Supply and installation of black tanks, tank foundation and recharge pits	-
		Construction of Groundwater recharging pilot system MAHIBADHOO	10,726.00			GWR from collection of overflow of Rainwater - Supply and installation of black tanks, tank foundation and recharge pits	-

		Construction of Groundwater recharging pilot system GADHDHOO	14,725.00			GWR from collection of overflow of Rainwater - Supply and installation of black tanks, tank foundation and recharge pits	-
		Travel - Field visits to the project sites	23,484.00				6,479
		IT Equipment	3,364.00				2,727
		ISS: UNOPS Services[x]	9,068.19				1,498
		Total Output 1.1	188,162.90	53,654.11			59,5
	1.2 Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods	Design Costs - PIDU	18,223.92	18,223.92	PIDU	Design tanks and pipe network	18,2
		Design Costs - ARUP - Feasibility Study for PV utilization for the system	17,022.00	17,022.00	ARUP	Feasibility study for solar panel viability in Maldives context and identification of effective PV system	17,02
		EIA and Other Implementation Costs (tree compensation)	18,411.00	18,411.00	Sandcays Pvt Ltd	EIA and household survey for RWH	18,41
		Drilling of beach well/s and geotechnical investigation of sites for erection of heavy structures (single or multiple contracts)	50,000.00	50,000.00	ELS AMIN International	Soil investigation for design recommendation, and drilling of beach wells for RO desalination	17,38
		Supply of pipes for RWH	270,854.99	257,312.24	SRI KRITHIKA INTERNATIONAL	supply of pipes for household roof connection, gutter, down pipe, supply of pipes from concrete tank to clear water tank	
		Construction of RWH tanks-IHAVANDHOO	218,038.86	199,253.51	L.F. Construction	3 concrete tanks (1x250m3, 2 x 150m3)	
		Construction of RWH tanks-MAHIBADHOO	215,795.00	200,722.85	L.F. Construction	3 concrete tanks (1x250m3, 2 x 150m3)	

		Construction of RWH tanks-GADHDHOO	240,000.00			3 concrete tanks (1x250m3, 2 x 150m3)	
		Excavation and pipe Laying at IHAVANDHOO	93,010.00			Excavation, pipe laying and backfilling	
		Excavation and pipe Laying at MAHIBADHOO	60,656.00			Excavation, pipe laying and backfilling	
		Excavation and pipe Laying at GADHDHOO	87,826.00			Excavation, pipe laying and backfilling	
		Travel - Field visits to the project sites	29,597.35				11,33
		IT Equipment	3,364.25				2,7
		ISS: UNOPS Services	69,682.15				8,62
		Total Output 1.2	**1,392,481.52**	**760,945.52**			**93,7**
	1.3 Production and distribution system for desalinated water supply established	Design Costs - PIDU	18,223.92	18,223.92	UNOPS - PIDU	Design RO plant and pipe network	18,2
		Design Costs - ARUP - Review of RO and RWH Design, concept and approach	15,078.00	15,078.00	ARUP	Review of RO and RWH Design, concept and approach	15,07
		EIA and Other Implementation Costs (tree compensation)	18,411.00	18,411.00	Sandcays Pvt Ltd	EIA and household survey for RWH	18,41
		Drilling of beach well/s and geotechnical investigation of sites for erection of heavy structures (single or multiple contracts)	132,680.00	132,680.00	ELS AMIN international	SOil investigation for design recommendation and construction of Bore wells	33,73
		Construction of RO Building at IHAVANDHOO	413,190.12	378,354.65	L.F. Construction	Construction of RO plant building (2 storey), GRP foundation, Fence and supply of office funiture	

		Construction of RO Building at MAHIBADHOO	381,066.25	346,423.86	Rainbow construction	Construction of RO plant building (2 storey), GRP foundation, Fence and supply of office funiture
		Construction of RO Building at GADHDHOO	413,295.20	375,722.91	YUMAN construction	Construction of RO plant building (2 storey), GRP foundation, Fence and supply of office funiture
		Supply and installation of GRP tanks at IHAVANDHOO	272,828.00	248,273.48	MWSC	Supply & installation of GRP tank 1000m3
		Supply and installation of GRP tanks at MAHIBADHOO	227,235.00	206,783.85	MWSC	Supply & installation of GRP tank 700m3
		Supply and installation of GRP tanks at GADHDHOO	256,357.00	233,284.87	MWSC	Supply & installation of GRP tank 900m3
		Supply of pipe to all islands	627,131.33	595,774.76	SRI KRITHIKA INTERNATIONAL	Supply of pipes for distibution network, Fire hydrant and Brine disposal
		Excavation and pipe laying at IHAVANDHOO	207,165.00			Excavation, pipe laying and backfilling
		Excavation and pipe laying at MAHIBADHOO	147,935.00			Excavation, pipe laying and backfilling
		Excavation and pipe laying at GADHDHOO	167,299.00			Excavation, pipe laying and backfilling
		Supply and Installation of RO plant at IHAVANDHOO	380,109.29			Supply and installation of 2x 35m3/day RO plant, 2 discharge pumps, fire hydrant pump, intake and feed pump
		Supply and Installation of RO plant at MAHIBADHOO	298,824.90			Supply and installation of 2x 25m3/day RO plant, 2 discharge pumps, fire hydrant pump, intake and feed pump

		Supply and Installation of RO plant at GADHDHOO	355,264.90			Supply and installation of 2x 30m3/day RO plant, 2 discharge pumps, fire hydrant pump, intake and feed pump	
		Supply and Installation of SOLAR PANEL at IHAVANDHOO	279,864.00			Supply and installation of 166 nos PV panels and accessories	
		Supply and Installation of SOLAR PANEL at MAHIBADHOO	280,821.00			Supply and installation of 124 nos PV panels and accessories	
		Supply and Installation of SOLAR PANEL at GADHDHOO	287,057.00			Supply and installation of 133nos PV panels and accessories	
		Supply and Installation of BACK UP GENERATOR at IHAVANDHOO	51,272.00			Supply and installation of 100kw diesel generator and power cable from PH to RO plant building	
		Supply and Installation of BACK UP GENERATOR at MAHIBADHOO	51,074.00			Supply and installation of 100kw diesel generator and power cable from PH to RO plant building	
		Supply and Installation of BACK UP GENERATOR at GADHDHOO	51,647.00			Supply and installation of 100kw diesel generator and power cable from PH to RO plant building	
		Travel - Field visits to the project sites	41,660.40				12,9
		IT Equipment	3,364.25				2,727
		ISS: UNOPS Services	266,799.93				36,12(
		Total Output 1.3	**5,645,668.49**	**2,569,011.30**			**137,**
	1.4. Existing wastewater management	Design Costs - towards Management Acquifer Recharge (MAR) study	15,000.00			Manage Acqufier recharge study - which will also address the planning and use of Waste Waters	-

	systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods	Effluent treatment of STP at Mahibadhoo for DRY period GWR	66,683.00			Assessment of existing STP effluent quality and recommendation of treatment with recharge pits for dry period	-
		Travel - Field visits to the project sites	5,371.05				1,619
		IT Equipment	3,364.13				2,727
		ISS: UNOPS Services	3,682.71				183.1
		Total Output 1.4	94,100.89	-			4,5
TOTAL OUTCOME 1			7,320,398.80	3,383,610.94			274,8
	UNOPS PMU Cost	Int'l IWRM Project Manager (03/2013 to 07/2013)	38,506.00				38,50
		Project Coordinator (50%) (08/2013 to 08/2014)[xx]	19,000.00				14,92
		Lead Project Engineer (08/2013 to 07/2014)	60,500.00				12,14
		Two (2) Project Engineers (approx 11/2013 to 03/2014)	20,000.00				-
		Senior Programme Manager/LKOH (01/2012 to 07/2014)	19,200.00				14,67
		Senior IWRM Consultant - Based at MEE (08/2013 to 05/2014) Retainer	25,000.00				-
		Maldives Office Manager (01/2012 to 07/2014)	44,800.00				35,58
		Electromechanical engineer (20%) (04/2012 to 12/2013)	8,000.00				6,909.
		Draftsman - retainer					

	(04/2012 to 12/2013)	6,000.00				7,879
	Technical Officer/Water Civil Engineer (05/2012 to 07/2013)	39,534.00				40,67
	Island Supervisors (10/2013 to 08/2014)	24,900.00				-
	Island Technicians (10/2013 to 08/2014)	42,000.00				-
	Logistics/Procurement Assistant (05/2013 to 03/2014)	11,000.00				5,345.
	Finance and Admin Officer (40%) (01/2012 to 01/2014)	9,600.00				8,900.
	Project Support Officer (70%) (01/2013 to 07/2014)	15,960.00				13,24(
	Total UNOPS PMU	384,000.00	-			198,7
TOTAL UNOPS PROJECT COMPONENT		7,704,398.80				473,607.78

[x] UNOPS Implementation Support Services (ISS) are the associated costs are correlated to the actual delivery of the project in correspondence with the various implementation support services provided by UNOPS at the Regional and HQ levels. The costs cover the contractual staff costs related contractual support (Contracts Engineer, IT Assistant, National Program Officer), Procurement Services (LKOH Head of Support Services (HSS). This also covers the use of UNOPS HQ Procurement Structures and Mechanisms, Thematic Groups, Financial oversights and regulatory frameworks, support from UNOPS Regional Office and pool of resources on operationalization of services. In addition these covers the organization treasury, legal, UN fees, IT and HQ staff, HQ operations, Admin portion of treasury maintenance, costs of UN status, admin portion of external audits, external oversight board, procurement oversight committee, global IT services, enterprise resource planning system, policies and procedures, intranet upkeep, global long term agreements, UN web-buy service, supplier database maintenance, accountability to the UN 5th Committee, risk management mitigation reserve and global reporting.

[xy] This budgeted amount also includes the initial cost of a LKOH Project Coordinator (20%) who supported the project from (01/2012 to 02/2013)

Annex 4 – Monthly Expenditure Reporting Format

exchange rate used is MVR 75 = 1 USD

No.	Date	Description	Vendor	Doc Ref	Expenditure code = ATLAS	Component 1 or PMU	Amount MVR	Amount USD	OUTCOME 1: Ground water aquifer protected and freshwater supply ensured in Ihavandhoo, [illegible] Mahibadhoo to provide reliable, [illegible] and cost-effective access to safe freshwater in a changing [illegible]								Project management [illegible]	
									UNOPS	UNOPS	UNOPS	UNOPS	UNOPS	UNOPS	UNOPS	UNOPS	UNOPS	UNOPS
									71200	71300	72100	[illegible]	[illegible]	72300	[illegible]	72500	[illegible]	[illegible]
									International Consultants	Local Consultants	Contracts (Companies)	Travel	[illegible]	Materials & Goods	Audio Visual & Printing	[illegible]	Local Consultants	International Consultants
	04-Jul-2012	Mohamed	Mohamed	PA4/PA/2012	71620	PMU	540.00	36.00				36.00						
	13-Sep-2012	Air tickets travel May/June 2012 Island	Island Aviation Service Ltd	[illegible]/PA/20	71610	1	6,000.00	400.00				6,000.00						
Totals								436.00	0.00	0.00	0.00	6,036.00	0.00		0.00	0.00	0.00	0.00

Annex 5 - Health and Safety Plan

Health and Safety

1. Purpose

1.1. The purpose of this Health and Safety Plan is to help to provide a safe and healthy environment for the carrying out of work, prevent accidents, improve Health and Safety in the work place, and actively seek the reporting of near misses and to comply with UNOPS policy.

1.2 In order to provide a safe and healthy environment for the carrying out if works UNOPS has adopted the *ILO Safety, Health and Welfare on Construction Sites 1999*. A copy of these regulations can be made available on request and are also available at all times in the site office.

2. Employees Responsibilities

2.1. Under general Health and Safety at Work practices, your responsibilities are to:

- Take reasonable care for the health and safety of yourself and others who may be affected by your acts or omissions at work.
- Co-operate with your employer and UNOPS Site Management, as far as may be necessary, to enable them to carry out their duties in regard to Health and Safety matters relating to these rules.
- Not intentionally or recklessly interfere with anything provided for the Health, Safety and Welfare of yourself and others.
- The Superintendent will have overall responsibility for maintaining Health and Safety at work practices. The superintendent will work closely with the Health and Safety Officer. The Health and Safety Officer's role will be to monitor the effective implementation of the Health and Safety Plan, make spot checks, and support the superintendent with peer support and review of putting this policy into practice. The superintendent will conduct weekly 'toolbox' talks with all site staff. Copies of the 'toolbox' talks can be provided upon request and are to be available in the site office at all times.

3. General

3.1. Private vehicles may only be parked on the site by agreement with the UNOPS Site Manager. It is preferable that all vehicles entering site have a flashing amber beacon for increased visibility. The site speed limit has been set at 20 Kph.

3.2. The following articles are prohibited and must not be brought to site: Alcohol, Weapons of any kind, Non-prescribed drugs, Animals/ Pets, Children.

3.3. Anyone who has a medical condition that may give rise to difficulties for themselves or others on site should report the matter in confidence to UNOPS staff. Examples would be: heart condition, vertigo, asthma, epilepsy etc.

3.4. All visitors must be directed to the UNOPS site office prior to entry to site.

3.5. Anyone who acts in an aggressive or offensive manner towards a member of the public or anyone else will be excluded from the site.

3.6. Alcohol and Drugs – UNOPS has a policy of zero tolerance in respect of any person carrying out duties or work on this site having consumed drugs or alcohol. Random screening for alcohol and drugs may be carried out and specific testing may be undertaken on reasonable suspicion or following a work related accident or incident.

3.7. Mobile phones must not be used whilst driving or operating plant, personnel on foot must ensure that they are in a safe area before taking or making calls, any calls made or received on a mobile phone should be essential calls only, social calls should be made outside the working site and out with working hours.

4. Personal Protective Equipment

4.1. High visibility jacket/vests, safety helmets, and safety footwear (incorporating steel toe-caps and mid-sole) must be worn at all times.

4.2. Other P.P.E. must be worn during operations with specific health and safety risks, e.g.:

- Safety goggles for protection during all cutting, grinding and drilling operations or where there is risk from impact, dust, chemicals or hot metal.
- Respirators' for protection from dust.
- Ear protection during all operations which produce noise above the level at which you need to raise your voice to be heard.

4.3. Stocks of all necessary PPE should be held on site and be made available by your Employer. It is your Employer's responsibility to provide you with the relevant PPE for your task.

5. Reporting Of Accidents, Incidents And Near Misses

5.1. All accidents must be recorded in the Accident Book, which is held by the UNOPS staff.

5.2. UNOPS staff must immediately be informed of "near misses" or any unsafe conditions, including tools, plant and equipment.

5.3. Hazard/Near Miss Reports should be completed on site to record any concerns you may have with any aspect of site operations. Serious or imminent risks should be brought to the attention of a supervisor immediately.

6. Plant

6.1. Vehicles with restricted rear view vision must have a trained and authorised plant and vehicle "banksman" in attendance when reversing.

6.2. Items of plant such as dumpers, rollers, aerial platforms etc, must only be operated by persons who are competent and authorised by Site Supervision.

6.3. Under Health and Safety at Work practices, there is a general requirement to be trained to use or carry out adjustments to most power tools eg. Wood working machinery, cartridge tools, Cut off saws etc, such operations will be authorised by site management.

6.4. Plant and vehicle operators must not carry passengers unless the vehicle is specifically designed for that purpose with fixed seating and seatbelts. Other personnel must not request a lift, nor travel as a passenger on a site vehicle unless it is designed for that purpose. Failure to comply with these instructions will render all individuals involved liable to disciplinary action and removal from site.

6.5. All site personnel are requested to follow designated pedestrian routes. Do not walk in the vicinity of mobile plant unless this is directly relevant to the task you have been instructed to carry out, e.g. banksman.

6.6. Plant and vehicle operators must produce a copy of their Driving Licence (including the endorsements page) prior to driving a vehicle on site.

6.7. Towing of Plant and Equipment on site must not take place unless the Plant or Vehicle has been fitted for this purpose. Towing arrangements must be assessed, manufacturers towing information must have been briefed to personnel and site management have approved it.

7. Confined Space Work

7.1. Do not, under any circumstances enter a confined space unless you have been trained, you have all of the necessary equipment, and you have been directly instructed by the Foreman.

"A Confined Space is an area of work where there is an access/ egress problem or a lack of natural atmosphere, specifically on this site, Manholes, Chambers, and Pump Wells."

8. Scaffold/ False work

8.1. Do not take access to scaffolding unless instructed to do so after inspection and approval by the UNOPS Site Manager.

8.2. The use of timber without edge protection in place of a scaffold system is strictly forbidden on site, all access scaffolds for placing concrete or other works at height require a suitable edge protection to prevent personnel from falling.

8.3. Only access scaffolding or formwork areas by the use of a ladder, Do Not Climb on Scaffolding, all ladders must be placed at the correct angle of 1:4, all ladders must be in good working order and fit for use.

8.4. Do not alter, or interfere with scaffold in any way unless you are trained to do so and are authorised to do so from your Supervisor.

9. Excavation Work

9.1. Do not carry out any excavation work, by hand or machine, until you have been instructed to do so.

9.2. Do not carry out any excavation work until you have been told by UNOPS staff that all underground services in the area have been located, exposed and protected. If you encounter any unmarked services stop work and contact UNOPS site staff.

9.3. All underground services exposed in an excavation, including in trial pits, must immediately be protected as instructed by UNOPS staff.

10. Hazardous Substances (COSHH- Control of Substances Hazardous to Health)

10.1. A site file is maintained in the UNOPS Site Offices of Contractors COSHH Assessments, it is essential that proper procedures, as laid down by the manufacturers, are used when handling their materials.

10.2. You must be briefed by your Supervisor on the risks from the material and be issued with all necessary PPE required.

10.3. If you are in any doubt seek the advice of your Supervisor.

11. Electrical Equipment

11.1. All electrical equipment to be used on this site should be presented to UNOPS site staff for inspection prior to use. All guards should be fitted and be in good working order. All cables should be correctly housed with all cores protected by insulation.

12. Material Handling

12.1. Do not sling loads unless you are having received proper training as a Slinger/Signaller and are authorised by the UNOPS Site Manager.

12.2. Do not manually handle loads in excess of what you can safely and comfortably handle.

12.3. If there is a requirement to lift a load greater than what you can safely and comfortably handle then consult with your Supervisor to ensure that the necessary assistance is available.

12.4. Do not use any item of lifting equipment unless the UNOPS Site Manager has confirmed that it is properly certified and satisfactory for the task in hand. The use of "unauthorised" slings, chains, shackles etc., is strictly forbidden.

13. Setting Out

13.1. If kerb pins or setting out pins are to be driven into the ground ensure that the area has first been checked to ensure there is no risk of striking any underground services, most especially electrical cables.

13.2. Steel pins driven into the ground for any purpose must be protected to remove the hazard of personnel falling onto them and being spiked, this practice of driving steel pins into the ground must be approved by the UNOPS Site Manager prior to action.

14. Welfare Facilities

14.1. Canteens, toilets and drying rooms are provided by your Employer for your welfare and comfort. Anyone found defacing or abusing these facilities will be liable to be removed from site.

14.2. Care should be taken to ensure that heating appliances are used safely. Items of clothing must not be hung directly above heaters.

14.3. Smoking is not permitted within any construction buildings on site.

14.4. Eating and drinking is expressly forbidden in all areas, other than those designated welfare facilities.

15. Housekeeping

15.1. Your workplace must be kept tidy during and after work. Rubbish must be placed in the bins or skips provided and not discarded on the site.

15.2. Site fencing and pedestrian fencing must remain in place. If there is a requirement to open it for access purposes then ensure it is immediately reinstated.

15.3. Ensure that openings such as manholes and gully pots are securely covered at all times. If the cover must be removed temporarily, then physical barriers must be provided around the opening.

16. Further Briefings And Instructions

16.1. There are detailed Risk Assessments, Works Procedures and/or Method Statements for all of the operations involved in this project. Your Employer and Supervisor must give you any necessary briefings and instructions for the operations you take part in prior to a work activity commencing. Weekly 'tool box' talks will be conducted and are compulsory for all site based staff and employees/labour, failure to attend the 'tool box' talks will result in disciplinary action.

17. Access to Site

17.1. At all times consideration must be given to the occupier of the site

17.2. No subcontractor, visitor or any other individual must commence works without notifying the UNOPS site staff that they are on site and ready to start work. All personnel must be inducted, signed in and receive this briefing, failure to follow this procedure will render the individual to be removed from site permanently.

18. Emergency Arrangements

18.1. The Site Safety and Emergency Arrangement Chart gives details of the locations of key equipment and telephone numbers for the organisations to be contacted in the event of an emergency. Copies are posted at site office and canteen.

19. First Aid

19.1. The First Aiders on this site are (*Details TBC site specific*).

19.2. First Aid supplies are available at UNOPS Site Office

20. Permits

20.1. On this site, formal permits must be in place before any of the following operations may be carried out Permit to Dig, Hot Work Permit & Confined Spaces.

21. Workforce Consultation

21.1. This site operates an "Open door" policy which actively encourages employees to raise concerns they may have regarding health, safety or welfare with the site management. Anyone raising such a concern shall receive a fair hearing and be spoken to in a civilised and reasonable manner. To support this policy UNOPS has in place a health and safety consultation process. Supported by regional and head office management this gives the right of any individual on site to raise a health and safety issue, these can be raised with the site team verbally, in writing using a Hazard/ Near Miss Report form, or in the case of a situation where you are dissatisfied with the operation of the consultation process or wish to raise an issue confidentially, by phone to the closest UNOPS OC or RO Office.

21.2. Disposal of waste material by burning on site is **not** permitted.

22. Environmental

22.1. Drip trays to be placed under items of static plant.

22.2. All barrels to be stored in areas provided

22.3. No barrels or containers containing oil, fuel or chemicals to be left on site unattended

22.4. In the event of a spill report it to your supervisor

22.5. Do not carry out any work outside the site boundaries

22.6. Switch off all plant when not in use

22.7. Only nominated and trained personnel shall carry out fuelling operations.

22.8. Report environmental incidents or complaints to your supervisor.

23. Quality

23.1 It is essential that work is carried out in line with the contract requirements and the UNOPS systems. Therefore please follow instructions and if work appears to be carried out incorrectly, please inform your supervisor before you go too far and it is covered up. ***If in doubt please ask!***

FINALLY

If, at any time, you are unsure of the way in which a task should be carried out, or of the safety precautions to be taken, then you should IMMEDIATELY stop work and seek guidance from UNOPS staff.

If in doubt .....ASK.

Annex 6. Sample of Construction Monitoring Tools

The format, layout, content and method used to fill out the forms will be reviewed periodically during the course of construction and modified as required to ensure that the necessary information required for management of the construction contracts and controlling the progress and quality of the work is being obtained.

Concrete Compressive Strength Test Report											
CYLINDIRICAL-CUBE)						DATE :					
CLASSOFCONCRETE :						CRUSHINGDATEOFSAMPLES					
MOULD:						MM CUBE- CYLINDER					
STRENGTH - CURE			AGE3 DAYS IF REQUIRED			AGE 7 DAYS			AGE 28 DAYS		
TEM NU	SAMPLE NU	PLACE & TYPE OF STRUCTURE	WEIGHT (g)	STRENGTH		WEIGHT (g)	STRENGTH		WEIGHT(g)	STRENGTH	
				KN	kg / cm2		KN	kg / cm2		KN	kg / cm2
1											
2											
3											
4											
5											
6											
7											
8											
SPECIFICATION :											

REMARKS

CONCRETE INSPECTION AND TESTING PLAN						
SUBJECT	**INS / TEST**	**ACTION**	**QUALITY CONTROL DOC.**	**VERIFICATION LOG**	**REQ. OF MONITORING**	**COMMENTS**
Controls before Concreting						
1	REINFORCEMENT Compliance with Specs & Drwg., Rust Clearance – cleaning of elevation & axis	Quality Control / Group Manager	Drawings Specifications	Reports, certificates Control list before concreting		Testing according to
2	CONCRETE Premixed Concrete	Quality Control	Specifications	Water, material, additive reports Concrete mix & cement reports		
3	FORMWORK Elevation axes, Formwork Grease, Cleaning	Group Managers	Construction Drawings Specifications	Control list before concreting		
4	OTHERS Location of embedded	Group Engineers	Construction Drawings Specifications	Control list before concreting		

	elements Water Retainers, Anchorage					
Concreting						
5	Impermeability Test, Taking ConcreteSamples, Slump, Cubes, Temperatureof the Medium, Concrete Temperature	Quality control		Test Results Recording		All the recording of a conc work is filed all together (control list conc, air temp cube resistance results etc)
6	Concreting Location Controls	Group Engineers		A Nonconformance report is issued if needed.		The group eng should be present to see to it thatconcreting complies
7	Compacting Control	Group Engineers		A nonconformance report is issued if needed.		The group eng should attend Compacting
After Concreting						
8	Controlling Curing	Group Engineers		A nonconformance report is issued if needed.		

9	Topographic Controls After Concreting	Group Engineers	Turkish Standards Drawings	A nonconformance report is issued if needed	Should contain the correctiveactions suggested to correct the faults determined afterconcreting	Segragation, air particles opening the formwork etc
10	Fault Areas and Fixing	Group Engineers		A nonconformance report is issued if needed	information stating that these actions are finalized asrequired (If necessary these records should include the repeated test)	Segragation, air particles opening the formwork etc Segregation
11	Controlling the Concrete Equipment	Group Engineers				
12	Shotcrete Concrete	Group Engineers	f in the Specs			

PRE-CONCRETING INSPECTION FORM

Explanation :		RelatedDrawings :							
FormworkCheck		ReinforcementCheck		SurveyingCheck		MechanicalCheck		ElectricalCheck	
Supports	☐	**Size**	☐	**Lining**	☐	**Embedments**	☐	**Embedments**	☐
Ties	☐	**Spacing**	☐	**Level**	☐	**Blockouts**	☐	**Blockouts**	☐
Waterstops	☐	**Laps**	☐	**Position**	☐	**Notes**		**Notes**	
JointPrepare	☐	**Concrete Cover**	☐	**Sketch**	☐				
Cleanliness	☐	**Cleanliness**	☐						
Formoil	☐	**Quantity**	☐						
Embedments	☐								
Blockouts	☐								

Contractor		Contractor		Contractor		Contractor		Contractor	
Name Date Sign		Name Date Sign		Name Date Sign		Name Date Sign		Name Date Sign	
ResponsibleEngineer		ResponsibleEngineer		ResponsibleEngineer		ResponsibleEngineer		ResponsibleEngineer	
Name Date Sign		Name Date Sign		Name Date Sign		Name Date Sign		Name Date Sign	
Permission Given to Pour									
Employer's Representative Name : Date : Sign :									
Date of Concreting		Type of Concrete		Slump		Site Manager			

Notes :			
Controlsafterformworkstriking	Curing ☐ Line ☐ Level ☐ Position ☐ Repairs ☐	Employer'sRepresentative Name : Date : Sign :	QualityControlManager Name : Date : Sign :

EARTHWORKS CHECK SHEET		
STRUCTURE :		
PLACE :		
BACKFILL :		
ITEM	RESPONSIBLE	COMMENT
SETTING OUT		
TYPE OF MATERIAL		
PRE-FILL INSPECTION		
METHOD OF COMPACTION		
THICKNESS OF LAYERS		
ACCEPTANCE OF FINISHED LEVEL		
TEST ON COMPACTED FILL MATERIAL		
REFERENCE TEST NU.		
ITEM	COMMENTS	

MOISTURE CONTENT	
DRY DENSITY	
PERCENT COMPACTION	

QUALITY CONTROL REPORT

QUALITY CONTROL REPORT (QCR) DAILY LOG CONSTRUCTION	REPORT NUMBER 000 Page 1 of 2 DATE
PROJECT	CONTRACT NUMBER
CONTRACTOR	WEATHER

QC NARRATIVES

Activities in Progress:

Did anything develop that may lead to a Change Order/Claim?

Were there any Delays in Work Progress today?

General Comments / QC Issues

Verbal Instructions given by Government:

Safety: (Inspection made, Deficiencies noted):

Safety: Corrective Action taken:

Information

PREP/INITIAL DATES (Preparatory and initial dates held and advance notice)
ACTIVITY START/FINISH
QC REQUIREMENTS
QC PUNCH LIST(Describe QC Punch List items issued, Report QC and QA Punch List items corrected)
CONTRACTORS ON SITE (Report first and/or last day contractors were on site)

QUALITY CONTROL REPORT (QCR)	REPORT NUMBER 000 Page 2 of 2

DAILY LOG CONSTRUCTION		DATE	
PROJECT		CONTRACT NUMBER	
LABOUR HOURS			
EQUIPMENT HOURS			
ACCIDENT REPORTING (Describe accident)			
CONTRACTOR CERTIFICATION	On behalf of the contractor, I certify that this report is complete and correct a all equipment and material used and work performed during this Reportin period are in compliance with the contract plans and specifications, to the bes of my knowledge, except as noted above.		
QC REPRESENTATIVE'S SIGNATURE	DATE	SUPERINTENDENT'S INITIALS	DATE

APPROVAL FORM FOR MATERIALS AND PRODUCTS

APPROVAL FORM FOR MATERIALS/PRODUCTS

EMPLOYER	ENGINEER	CONTRACTOR

KABUL SCHOOLS PROJECT

Submittal No:	Date Submitted:	Revision No:

Description of Material/Product [including size, class, grade, type, strength, accesories, etc] :

- ☐ Civil
- ☐ Mechanical
- ☐ Electrical
- ☐

Location of Application [where the material will be used] :	Quantity:

Spec. Clause [attach relevant parts] :	Applicable Standard:	Reference Drawing [attach] :

Manufacturer :	Supplier :
Adress :	Adress :
Phone : Fax :	Phone : Fax :

Country of Origin :

Confirm that the following documents are attached [to be filled by the Contractor] :

☐ Manufacturers' Data ☐ Test Reports ☐ Certificates ☐ Samples

☐ Manufacturers' Confirmation of Compliance with Specifications/Standards

Contractor [name, surname, sign] :	..... [name, surname, sign] :	
	☐ Recommended ☐ Recommended As Noted ☐ Not recommended QA/QC Engineer	☐ Recommended ☐ Recommended As Noted ☐ Not recommended RE/Civil / ( ) Engineer
Date/Time ... / ... / ...	Date/Time ... / ... / ...	Date/Time ... / ... / ...

Remarks [to be filled by *the Engineer*] :

IMPORTANT. *All parts of this form must be completed. All related copies of the relevant part(s) of the specification(s), drawing(s), manufacturers' technical data, certification(s) and test information must be attached to this form. Where part(s) of this form are not applicable, write/mark "NOT APPLICABLE".*

REQUEST FOR INSPECTION

REQUEST FOR INSPECTION		
KABUL SCHOOLS PROJECT		
EMPLOYER:	ENGINEER:	CONTRACTOR:
We request your attendance to inspect the following works:		Request No:

1.1 Type: ☐ Buildings ☐ Roads ☐ Infrastructure ☐ Others

1.2 Disciplines: ☐ Civil ☐ Mechanical ☐ Electrical ☐ Architectural ☐ Surveying

2. Inspection Time: Date: ..../..../....

3. Location:

4. Inspection: ☐ First ☐ Second ☐ Others

5. Description of Works to be inspected:

6. The works involve the following trades (tick more than one if required):
☐ Surveying ☐ Architectural ☐ Civil ☐ Electrical ☐ Mechanical ☐ Others (specify)

Inspection Requested by Contractor	Received for
Name & Signature Date ..../..../....	Name & Signature Date ..../..../....

7. Inspection Report	Remark(s)	Signature & Date
☐ Surveying		
☐ Architectural		
☐ Civil		
☐ Electrical		
☐ Mechanical		
☐ QA / QC		

Date of Inspection: ..../..../.... Time of Inspection:

8. Engineer's Comments:

The works are, ☐ Approved ☐ Approved as noted ☐ Not Recommended ☐ Witnessed

Contractor	Engineer
Name & Signature Date ..../..../....	Name & Signature Date ..../..../....

Attach all relevant particular test forms. Existing ground levels and bottom excavation / top of the fill levels should be recorded on a separate sheet.

NONCONFORMITY REPORT

NONCONFORMITY REPORT		DATE:
PROJECT		
SUBJECT		
SUMMARY OF NONCONFORMITY		
PREPARED BY	DEPARTMENT	
SUMMARY OF DISPOSITION PLAN		
APPROVED BY	DEPARTMENT	DATE
RESULT	☐ USE - AS – IT - IS ☐ REPAIR ☐ REJECT	
☐	ACCEPTED	
☐	REJECTED	

CORRECTIVE ACTION COMPLETED		
	Department	QualityControlManager
Name		
Date		

Signature		

NON-CONFORMITIES LOG

NCR Record No	NCR Date	Brief Summary of Nonconformance	Disposition Date	Close-Out date

UNOPS

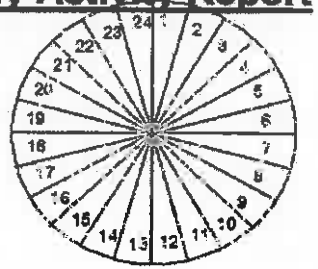
Maldives Project Center (MVPC)
UN Building, Buruzu Magu, Male'

Sub Project Name : Construction of RO building, GRP tank foundation, Fence, supply of furniture and other work within RO plant site
Sub Project Location : H.A Ihavandhoo
Sub Project No : MVPC/79220/2013/002
Contractor : L.F. Constructions Pvt Ltd

Date :

Sheet No :

Daily Activity Report



Working Hours :
Start : ..... Am
Finish : ..... Pm

Man Power	
Mason	
Carpenter	
Bar bender	
Other Skilled Labour	

Weather Condition

	Sunny
	Fair

Semi skilled Labour			Rainy
Unskilled Labour			Heavy Rainy

Material Available at Site				Material Usage during the day			
Cement (Bags)		Sand (bags)		Cement (Bags)		Sand (bags)	
Steel - 25mm (Bar)				Steel - 25mm (Bar)			
- 16mm (Bar)				- 16mm (Bar)			
- 12mm (Bar)				- 12mm (Bar)			
- 10mm (Bar)				- 10mm (Bar)			
- 6mm (Bar)				- 6mm (Bar)			
20mm metal(Bags)				20mm metal(Bags)			

Construction Machinery, Plant and Equipment						
Type	√ / X	Work Description	Type		√ / X	Work Description
Concrete mixer						
Poker Vibrator						
Water pump						
Tamping Rammer						

Work Description
Activities

Prepared By

Name:
Date:

Supervisor /technician (UNOPS)

Certified By

Name:
Date:
LEAD/Project Engineer
(UNOPS)

Contact information

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Increasing Climate Resilience through an Integrated Water Resources Management Programme in HA.Ihavandhoo, ADh. Mahibadhoo, and GDh. Gadhdhoo

Justification of the proposed Changes to the original project document budget for the Component 1

Stakeholder Consultation and Compliance with Approval Procedures:

The change in output-based budget allocations is due to modifications in the technical design of the water supply system to be implemented by the project. These changes to the initial design have been proposed as a result of consultations with all concerned stakeholders, including local residents, technical experts and government officials. The new design has been reviewed approved by the regulatory body, Environment Protection Agency as in full compliance with the national environmental regulations and standards (the EPA approval letter attached).

The changes in the project budget were discussed at the weekly project coordination meeting, among the project team comprising of staff from Ministry of Environment and Energy (MEE), UNDP, UNOPS and Project Management Unit. The changes in budget were also discussed and agreed by the senior staff of MEE and UNDP before submission and approval by the Project Board.

Technical Justification for the Budget Change under the Outcome 1: *"Groundwater aquifer rehabilitated and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo, and GDh. Gadhdhoo to provide reliable, equitable and cost-effective access to safe freshwater in a changing climate"*:

Table below presents the changes in the budget allocations across the outputs under the Component 1. Revisions have been made across the budget lines within the component 1 without changing the total allocation. More detailed budget comparisons are provided in the table 3 and more detailed budget breakdown in the attached PID.

Table 1: changes in output budget allocations

Output	Approved Prodoc Budget (USD)	Revised PID Budget (USD)	Variance (%)
Output 1.1 *"Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons"*	228,296	188,163	17.6%
Output 1.2: *"Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water*	3,717,893	1,392,482	62.5%

supply for all households during dry periods"			
Output 1.3: *"Production and distribution systems for desalinated water supply established"*	3,296,733	5,645,652	71.2%
Output 1.4: *"Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods"*	77,476	94,101	21.5%
	7,320,398	**7,320,398**	**0.0%**

Explanations for the changes

Output 1.1: *"Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons"*

The proposed change into the budget from USD 228,296 to USD 188,162 relates to the changes of the measures to deliver this output. It has been recognized that without more in-depth examination of the current conditions of aquifers (that will cover identification of principal aquifers, mapping their boundaries, determining aquifer yield, hydro-stratigraphy, depth to water table etc) the most cost-effective recharge solutions, including the maintenance protocols cannot be determined. The initial design was to construct and connect 700 groundwater recharging pits and 30 community recharge wells for the islands. The plan of recharging ground water through this network of recharge pits was not accepted by the government stakeholders based on experience with the similar system implemented in the capital Male' and faced difficulties with maintenance. Implementing Partner and other key stakeholders confirmed that there is a lack of technical knowledge of the target aquifer to support initially proposed engineering solution of a network of recharge pits.. Therefore, the project under this output should undertake a comprehensive aquifer study that will underpin Managed Aquifer Recharge (MAR) Plan for an actual implementation. Managed Aquifer Recharge (MAR) plan will be customized to the specific conditions of the target three islands. At this point, it has become clear that the Male practice cannot serve as a blueprint model and more customized solutions should be offered based on the proposed study. Moreover, initial reviews tentatively suggest three pilot recharging mechanisms at each island, located next to the rainwater harvesting collection tanks that will be designed to capture the overflow from the rainwater harvesting tanks and use it for slow and controlled recharge of the aquifers.

Activity/Item	Prodoc Budget	Revised PID budget
Topographic Survey, water quality testing	30,000	0
Ground water recharge	180,960	64,869.75
Water quality testing equipment kit	1,200	0
Design Costs - Groundwater Recharge (GWR)-Desk review	0	10,388.43
Design Costs - Physical Infrastructure Design Unit (PIDU)	0	18,223.92
Management Aquifer Recharge (MAR) Study	0	8,764.61
Implementation of activity recommended by MAR study	0	50,000.00
IT Equipment	0	3,364.00
Travel	4,241.35	23,484.00
Communication	1,004.20	0
UNOPS IESS	10,891.21	9,068.19
Total	**228,296.76**	**188,162.9**

Output 1.2: *"Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods"*

The proposed change in the budget from USD 3,717,893 to USD 1,392,481 relates to the removal of a household level rainwater harvesting component from the original design of an integrated water supply infrastructure. The original plan of providing individual household rainwater harvesting tanks was excluded and the revised design now includes communal rainwater harvesting tanks that will capture the rain from the community / public buildings and adjacent private houses. This proposed change emerged from the post-tsunami evaluation, where individual household rainwater harvesting proved inefficient, operationally challenging, with difficulties of quality control as well as equity issues in terms of water access. In the initial design, it was anticipated that the water from the community rainwater storage tanks will be used only during the 90 day dry period and the storage capacity of the tanks were calculated for 90 day use. However, due to budget constraints and difficulty in obtaining land for construction of tanks of such size, local experts and project stakeholders advised to change the size of the tanks and water storage capacity. Hence, in the new design, the sizes of the tanks have been reduced and rainwater is to be mixed with desalinated water and pumped to the households throughout the year. With these new storage capacities, it is not sufficient to supply only rainwater for 90 days of the dry

period, but these storage capacities will make water more affordable to the communities throughout the year and in the dry periods, the rainwater will last for the 90 days when mixed proportionately with the desalinated water. The design has put in place provisions for inclusion of more storage tanks in the future so that more rainwater is collected and supplied through the piped network. The rainwater harvesting storage capacity has been changed as following:

HA. Ihavandhoo: 9,000m^3 (original plan) to 1,550m^3
ADh. Mahibadhoo: 6,300m^3 (original plan) to 1,250m^3
GDh. Gadhdhoo: 6,300m^3 (original plan) to 1,450m^3

The new proposed budget does also have an additional reduction of the initial allocated amounts for Solar Panels, which has been moved to output 1.3. In the initial design, it was anticipated that the pumps for the rainwater distribution network will be powered by solar energy. In later discussions it has been agreed that providing solar energy for the operation of desalination plant would be more cost effective and hence this activity is now reflected in output 1.3.

This budget component of output 1.2, considers the excavation to install the pipe system that will connect target households to the large freshwater community water system and collect excess rainwater from households. This was not planned in the initial design and was included in the new design to increase the amount of rainwater collected. Houses for this scheme were identified based on a survey done in the target islands. The table 2 below shows the results of the survey:

Table 2: number of identified houses for the rainwater harvesting network

Island name	**Total Houses**	**Agreed house**	**Houses in between agreed house (possibility to connect to system)**	**Roof Area of agreed houses (discarded all old roof, asbestos, rusted roof for the system)**
H.A.Ihavandhoo	450	70	40	5638m2
A.Dh.Mahibadhoo	435	27	18	1927m2
G.Dh.Gadhdhoo	450	59	25	8801m2

A detailed budget comparison is given below in chart 1.

Activity/Item	**Prodoc Budget**	**Revised PID Budget**
Improvement to household rainwater harvesting systems in 3 islands	676,200	0
Improvement to Community Rainwater Harvesting Systems	150,000	0
Solar panels	765,000	0
Filtration System	150,000	0
UV Disinfection System	7,500	0
Rainwater Storage Tank	1,706,400	673,833.86
Design Costs - PIDU	0	18,223.92
Design Costs - ARUP - Feasibility Study for PV utilization for the system	0	17,022.00
EIA and Other Implementation Costs (tree compensation)	0	18,411.00

Drilling of beach well/s and geotechnical investigation of sites for erection of heavy structures (single or multiple contracts)	0	50,000.00
Supply of pipes for RWH	0	270,854.99
Excavation and pipe Laying	0	241,492.00
Travel	69,071.84	29,597.35
Communication	16,353.77	0
IT Equipments	0	3,364.25
UNOPS ISS	177,367.26	69,682.15
Total	**3,717,892.87**	**1,392,481.52**

Output 1.3: *"Production and distribution systems for desalinated water supply established"*

The proposed change into the budget from USD 3,296,733 to USD 5,645,653 correspond primarily to the increased size of the centralized water distribution tanks (GRP tanks installed in the central water distribution building – RO Plant Building) which will collect the rainwater and the desalinated water before its mix for house-piped distribution, the inclusion of solar panels component from 1.2 to support the power system, and the inclusion of back-up generators that will ensure the reliability of the water supply system. The system will integrate the Reverse Osmosis (Desalinated) water plant capacities as follows:

HA. Ihavandhoo: 70m3 – from the original 90m3
ADh. Mahibadhoo: 50m3– from the original 60m3
GDh. Gadhdhoo: 60m3– from the original 60m3

The proposed final outputs for the redesigned system to each island will enable estimated water mix according to the water consumption for 2030 as follows:

Table 3: projected water demand and supply potential by 2030

Island	**Est. Population 2030**	**RWH/yr (m^3)**	**Water needs for 15l/d/p (2030)**		**Water needs for 20l/d/p (2030)**		**Water needs for 50l/d/p (2030)**	
			Water mix of RO Plant (%)	**Water mix of RWH (%)**	**Water mix of RO Plant (%)**	**Water mix of RWH (%)**	**Water mix of RO Plant (%)**	**Water Mix of RWH (%)**
Ihavandhoo	3366	10,130	45%	55%	58.78%	41.22%	83.5%	16.5%
Mahibadhoo	2369	7,846	38.7%	61.3%	54.64%	45.36%	81.9%	18.1%
Gadhdhoo	3206	17,757	0%	101.2%	24.13%	75.87%	69.6%	30.4%

A detailed budget comparison from the original ProDoc and the proposed budget is described below in chart 2:

Item/Activity	**Prodoc Budget**	**Revised PID Budget**
Construction of Intake Facilities	60,000	0
Construction of Intake pump house & generator house	150,000	0

Supply and Installation of Intake pumps (3.75m3/hr, 10m head)	120,000	0
Supply & laying of 110mm dia PE Raw water pipe line from Intake to WTP	60,000	0
Provision of Desalination Treatment Plant of 90 cum capacity (Supply and installation)	793,000	1,034,199
Upgrading of existing desalination plant	100,000	
Supply of 4 x 10 cum capacity CWT	5,000	0
Construction of clear water tank pump house	60,000	0
Supply and installation of high lift pumps (4.5m3/hr, 30m head) to convey water to elevated tank	120,000	0
Construction of elevated tank 30 cum height 20m	70,000	0
Transmission line to ET 90mm	67,500	0
Distribution network with PE pipes of dia varying from 90mm to 50mm	420,000	522,399
Supply and installation of Generator 40KVA capacity including panels and necessary cable connections to demand centers	130,000	153,993
House connections with water meter	110,250	0
Administration building	54,000	1,207,551
DI valves fittings & accessories	98,959	0
Transmission pipeline 75mm to TP site	225,000	0

Low lift pumps	270,000	0
PE pipe welding plant	150,000	0
	0	0
Design Costs - PIDU	0	18,223.92
Design Costs - ARUP - Review of RO and RWH Design, concept and approach	0	15,078
EIA and Other Implementation Costs (tree compensation)	0	18,411
Drilling of beach well/s and geotechnical investigation of sites for erection of heavy structures (single or multiple contracts).	0	132,680
Supply and installation of GRP tanks	0	756,420.00
Supply of pipes	0	627,131
Supply and Installation of SOLAR PANEL	0	847,742.00
IT Equipments	0	3,364
Travel	61,247.44	41,660
Communications	14,501.23	0
UNOPS ISS	157,275.25	266,799.93
Total	**3,296,732.92**	**5,645,651.85**

Output 1.4: *"Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods"*

The proposed change into the budget from USD 77,476 to USD 94,100 corresponds primarily to the additional activity of the Managed Aquifer Recharge (MAR) study that will address the planning and use of wastewaters for the islands, and will produce a plan to deal with the specific conditions at ADh. Mahibadhoo, as a new sewage treatment plant (STP) has been established in this island. An additional amount has been allocated to assess the existing STP effluent quality and recommend treatment with recharge pits for dry season. The original component did propose development of general recommendations for wastewater management, linked with community awareness campaigns to reduce and motivatepeople to change their behavior towards the improvement of the wastewater practices in the islands. However, the new plan, as requested by the government is to go beyond a mere plan and demonstrate some of the activities that can be carried out to protect the ground water from effluents.

Activity/Item	**Prodoc Budget**	**Revised PID Budget**
Pumping of waste water from septic tanks	72,000	0
Design Costs - towards Management Acquifer Recharge (MAR) study	0	15,000.00
Effluent treatment of STP at Mahibadhoo for DRY period GWR	0	66,683.00
IT equipments	0	3,364.13
Travel	1,439.37	5,371.05
Communication	340.79	0
UNOPS ISS	3,696.11	3,682.71
Total	**77,476.27**	**94,100.89**

Project Management cost for UNOPS

No changes to the budget for project management costs have been proposed. However, the composition of PMU has been proposed and endorsed by the project board. The change in the PMU is as follows:

ProDoc roles			Proposed roles		
Position	**No**	**Total**	**Position**	**No.**	**Total**
International Senior IWRM Engineer	1	210,000	Int'l IWRM Expert (retainer contract)	1	192,906
International Electromechanical Engineer	1		Senior Program Manager (technical assurance)	1	
National Project Manager	1		International Electromechanical Engineer (20% on retainer contract)	1	
National Technical Officer	1		Maldives Office Manager (PM Liaison and assurance)	1	
Engineer Technical Project Officer	1	174,000	Lead Project Engineer	1	
Island Civil Engineer (Water)	3		Component 1 Project Coordinator (50%)	1	185,960
Island Mechanical Engineer	3		Civil Engineer (water)/Technical Project Officer - *Design Phase*	1	
Island Sanitation Engineer	3		Project Engineer	2	
Community Liaison Officer	3		Draftsman (Design/implementation phase)	1	
Logistics Assistant	3		Island Supervisors	3	
			Technicians (Islands)	6	
Budget Line "O"		4	Logistics/Proc Assistant - Male'	1	
Budget Line "N"		16	Admin/HR/Finance Assistant (40%)	1	

Total		**384,000**

Project Support Officer (70%)	1	
Budget Line “O”		5
Budget Line “N”		17
Total		**378,866**

بسم الله الرحمن الرحيم

Environmental Protection Agency
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EPA

Date: 31/03/2013

Ref no: 203-FINHUM/PRIV/2013/169

Mr. Alejandro Ruiz-Acevedo,
UNOPS Manager
UNOPS
Male', Republic of Maldives

Dear Alejandro Ruiz-Acevedo,

With reference to your letter number MVO/13/0023 we would like to inform that EPA has approved the detail design of Integrated Water Resource Management Project for Ihavandhoo, Mahibadhoo and Gadhoo.

Please find the approved copies of the detail design, design report and BOQ's.

Thank you
Yours Sincerely

Mohamed Musthafa
Director

Attachments-

1. 2 copies of Detail design report
2. 2 copies of Detail design
3. 2 copies of the BOQs

CC: Ministry of Environment and Energy

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INTERNATIONAL YEAR OF FORESTS · 2011

Output 1.1

Activity/Item	Prodoc Budget	Revised PID budget
Topographic Survey, water quality testing	30,000	0
Ground water recharge	180,960	64,869.75
Water quality testing equipment kit	1,200	0
Design Costs - Groundwater Recharge (GWR)-Desk review	0	10,388.43
Design Costs - Physical Infrastructure Design Unit (PIDU)	0	18,223.92
Management Aquifer Recharge (MAR) Study	0	8,764.61
Implementation of activity recommended by MAR study	0	50,000.00
IT Equipment	0	3,364.00
Travel	4,241.35	23,484.00
Communication	1,004.20	0
UNOPS IESS	10,891.21	9,068.19
Total	**228,296.76**	**188,162.90**

Output 1.2

Activity/Item	Prodoc Budget	Revised PID Budget
Improvement to household rainwater harvesting systems in 3 islands	676,200	0
Improvement to Community Rainwater Harvesting Systems	150,000	0
Solar panels	765,000	0
Filtration System	150,000	0
UV Disinfection System	7,500	0
Rainwater Storage Tank	1,706,400	673,833.86
Design Costs - PIDU	0	18,223.92
Design Costs - ARUP - Feasibility Study for PV utilization for the system	0	17,022.00
EIA and Other Implementation Costs (tree compensation)	0	18,411.00
Drilling of beach well/s and geotechnical investigation of sites for erection of heavy structures (single or multiple contracts)	0	50,000.00
Supply of pipes for RWH	0	270,854.99
Excavation and pipe Laying	0	241,492.00
Travel	69,071.84	29,597.35
Communication	16,353.77	0
IT Equipments	0	3,364.25
UNOPS ISS	177,367.26	69,682.15
Total	**3,717,892.87**	**1,392,481.52**

Output 1.3

Item/Activity	Prodoc Budget	Revised PID Budget
Construction of Intake Facilities	60,000	0
Construction of Intake pump house & generator house	150,000	0
Supply and Installation of Intake pumps (3.75m3/hr, 10m head)	120,000	0
Supply & laying of 110mm dia PE Raw water pipe line from Intake to WTP	60,000	0
Provision of Desalination Treatment Plant of 90 cum capacity (Supply and installation)	793,000	1,034,199
Upgrading of existing desalination plant	100,000	
Supply of 4 x 10 cum capacity CWT	5,000	0
Construction of clear water tank pump house	60,000	0
Supply and installation of high lift pumps (4.5m3/hr, 30m head) to convey water to elevated tank	120,000	0
Construction of elevated tank 30 cum height 20m	70,000	0
Transmission line to ET 90mm	67,500	0
Distribution network with PE pipes of dia varying from 90mm to 50mm	420,000	522,399
Supply and installation of Generator 40KVA capacity including panels and necessary cable connections to demand centers	130,000	153,993
House connections with water meter	110,250	0
Administration building	54,000	1,207,551
DI valves fittings & accessories	98,959	0
Transmission pipeline 75mm to TP site	225,000	0
Low lift pumps	270,000	0
PE pipe welding plant	150,000	0
Design Costs - PIDU	0	18,223.92
Design Costs - ARUP - Review of RO and RWH Design, concept and approach	0	15,078
EIA and Other Implementation Costs (tree compensation)	0	18,411
Drilling of beach well/s and geotechnical investigation of sites for erection of heavy structures (single or multiple contracts).	0	132,680
Supply and installation of GRP tanks	0	756,420.00
Supply of pipes	0	627,131
Supply and Installation of SOLAR PANEL	0	847,742.00
IT Equipments	0	3,364
Travel	61,247.44	41,660
Communications	14,501.23	0
UNOPS ISS	157,275.25	266,799.93
Total	**3,296,732.92**	**5,645,651.85**

Output 1.4

Activity/Item	Prodoc Budget	Revised PID Budget
Pumping of waste water from septic tanks	72,000	0
Design Costs - towards Management Acquifer Recharge (MAR) study	0	15,000.00
Effluent treatment of STP at Mahibadhoo for DRY period GWR	0	66,683.00
IT equipments	0	3,364.13
Travel	1,439.37	5,371.05
Communication	340.79	0
UNOPS ISS	3,696.11	3,682.71
Total	**77,476.27**	**94,100.89**

Increasing Climate Resilience through an Integrated Water Resources Management Programme in HA.Ihavandhoo, ADh. Mahibadhoo, and GDh. Gadhdhoo, Maldives

Project Results Framework: budget revisions and implementation plan

PROJECT COMPONENTS	EXPECTED OUTCOMES	EXPECTED CONCRETE OUTPUTS	AMOUNT (US$)	CHANGE IN IMPLEMENTATION STRATEGY
1. Establishment of integrated, climate-resilient water supply and -management systems in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo	1. Ground water aquifer rehabilitated and freshwater supply ensured in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo to provide reliable, equitable and cost-effective access to safe freshwater in a changing climate	1.1 Artificial groundwater recharge systems established to protect groundwater resources from salinization and improve aquifer yields in dry seasons	**228,296** **(188,163)** **-17.6%**	The initial design was no longer feasible based on recent events that showed failure of a similar system in the capital island. Furthermore, placement of recharge pits has turned out a challenge due to land limitations as well as cost underestimations, especially for subsequent control and maintenance. Instead a foundational groundwater study has been delivered that will underpin a plan / road map for further site specific investigations of lenses (their position, depth, permeability of the surface, quality of water etc) and a range of viable and cost-effective recharge methodologies.
		1.2 Rainwater harvesting schemes redesigned, interconnected and structurally improved to buffer climatic extremes and ensure equal water supply for all households during dry periods	**3,717,893** **(1,392,482)** **-62.5%**	1) Individual household rainwater harvesting tanks in the initial design has been removed and communal tanks included based on reports that showed individual household tanks were less effective, operationally more challenging and more difficult for quality control. The size of communal water tanks were also reduced due to the very high cost and land availability. Instead designs now provide for future expansion of storage capacity

PROJECT COMPONENTS	EXPECTED OUTCOMES	EXPECTED CONCRETE OUTPUTS	AMOUNT (US$)	CHANGE IN IMPLEMENTATION STRATEGY
				whereby private house in immediate proximity have already been connected and the system allows for further expansion of the network. Therefore the system is adaptable and will bring in additional houses as demands rise. 2) Solar panels that were initially part of water distribution system has been removed and this concept is taken to output-1.3 because plugging renewable energy to the production system would be more cost-effective in the new design 3) The change also include pipe connectivity between households and communal tanks and collect excess rainwater from households. Expandability is an important adaptive feature of this new design.
		1.3 Production and distribution system for desalinated water supply established	**3,296,733** **(5,645,652)** **+71.2%**	1) Central distribution tank sizes were increased to accommodate the system design change as Output-1.2. 2) Inclusion of solar-power for the desalination system after removing this component from Output-1.2 The redesigned system to each island will enable estimated water mix according to the water consumption forecasts for the year 2030. 3) Additional design feature such as scrubber for aeration to eliminate unpleasant smell from the RO produced water and make it palatable for the target consumers.

PROJECT COMPONENTS	EXPECTED OUTCOMES	EXPECTED CONCRETE OUTPUTS	AMOUNT (US$)	CHANGE IN IMPLEMENTATION STRATEGY
		1.4. Existing wastewater management systems redesigned and improved to ensure sufficient quantities of safe groundwater during dry periods	**77,476** **(94,101)** **+21.5%** **Total for Component 1 = 7,320,398** **No change in the total**	This now includes an additional activity to the groundwater study under Output-1.1 to address waste water planning and usage. Effluent management to protect ground water, including treatment and separation of greywater from black water is a costly investment that was underestimated at a design stage.
2. Increase participation in the development, allocation and monitoring of freshwater use in a changing climate	2. Strengthened local awareness and ownership of integrated, climate-resilient freshwater management	2.1. Community consultations on each target island ensure participative design, sustainability and continued maintenance of integrated water resource management schemes	70,000 (No change)	
		2.2.Targeted training events conducted in each region to strengthen water user participation and skills in adaptive, integrated water resource management	40,000 (No change)	
3. Replication and up scaling of climate-resilient freshwater management	3. Improved institutional capacity to promote and enforce climate-resilient freshwater management on all inhabited islands	3.1.Training of technicians in the design, operation and management of integrated water resource management systems	30,000 (No change)	
		3.2 Institutional mechanisms created to integrate adaptive management of freshwater resources into the design and rollout of new water management projects and schemes	30,000 (No change)	

PROJECT COMPONENTS	EXPECTED OUTCOMES	EXPECTED CONCRETE OUTPUTS	AMOUNT (US$)	CHANGE IN IMPLEMENTATION STRATEGY
		3.3. Action plan developed and financing mobilized to replicate integrated, climate-resilient freshwater management on at least 4 additional islands	20,000 (No change)	
Project/Program Execution cost			774,602 (No change)	
Total Project/Program Cost			8,285,000 (No change)	
Project Cycle Fee charged by the Implementation Entity (if applicable)			704,225 (No change)	
Amount of financing Required			8,989,225 (No change)	

Note: Blue figures in blue brackets represent **budget increases** relative to planned budget in project approval stage. Red figures in red brackets represent **budget decreases** relative to planned budget in project approval stage.

Memorandum of Agreement
Between
The Government of Maldives, represented by
Ministry of Housing and Environment and
The United Nations Office for Project Services

WHEREAS the United Nations Office for Project Services (hereinafter referred to as "UNOPS") is a separate, self-financing entity established by United Nations General Assembly decision 48/501 of 19 September 1994 and provides, *inter alia*, services to United Nations agencies, entities, as well as International Financial Institutions and governments;

WHEREAS The Government of Maldives, represented by the Ministry of Housing and Environment (hereinafter referred to as "MoHE"), requests the assistance of UNOPS in for the implementation of the Component 1 of the Adaptation Fund project *"Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island"*;

WHEREAS UNOPS agrees to provide such assistance;

NOW THEREFORE, the MoHE and UNOPS, also referred to in this Memorandum of Agreement individually as "Party" and collectively as "Parties", agree to the following terms and conditions:

1. This Memorandum of Agreement (hereinafter referred to as "Agreement") establishes that UNOPS will provide the services and carry out activities (hereinafter referred to as "Services") as described in component 1 of the Project Document *"Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island"* endorsed by the MoHE on 15 December 2011 (hereinafter referred to as "Project Document").

2. UNOPS shall carry out the Services for which it is responsible under the Agreement, with due diligence and efficiency and in accordance with the rules, regulations, and procedures applicable to UNOPS.

3. The United Nations Development Programme (hereinafter referred to as "UNDP"), as Multilateral Implementing Partner for this Project shall provide funds to UNOPS for an estimated amount of USD 7,704,398 (Seven Million Seven Hundred and Four Thousand three Hundred Ninety-Eight United States Dollars only) correspondent of the budgeted activities for component 1 and the project management component under the project Management activity, specified in the Project Document except as otherwise agreed upon in writing between UNOPS and MoHE.

4. Funds received by UNOPS shall be administered by UNOPS in accordance with its Financial Regulations and Rules. All financial accounts and statements shall be

subject to audit by UNOPS internal audit and the United Nations Board of Auditors according to the procedures laid down in the Financial Regulations and Rules applicable to UNOPS.

6. UNOPS shall not be required to commence or continue, as the case may be, the provision of the Services until the provision of funds referred to in this Agreement has been received and shall not enter into obligations in excess of the funds received. Except as otherwise agreed upon in writing between UNOPS and MoHE, UNOPS shall not be responsible for costs required for the implementation of the Services, other than those specified for the component 1 of the Project document *"Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island"*. Any balance of funds received and uncommitted upon completion of the Services shall be promptly refunded. .

7. Any amendment to this Agreement or to any Annex hereto shall be effected by mutual agreement of the Parties in writing.

8. The MoHE agrees to apply the Convention on the Privileges and Immunities of the United Nations to UNOPS. Nothing in or relating to any provision in this Agreement shall be deemed a waiver, express or implied, of the privileges and immunities enjoyed by the United Nations and/or UNOPS.

9. Agreement and acceptance of this Agreement are indicated by the signature of the duly authorised representatives of both Parties below.

On behalf of the MoHE:

Mr. Mohamed Aslam
Minister
Ministry of Housing and Environment

Date: 15-12-11

On behalf of UNOPS:

Mr. Wang Yue
Asia and Pacific Regional Director
UNOPS

Date: 15 DEC 2011

ADAPTATION FUND BOARD SECRETARIAT TECHNICAL REVIEW OF PROJECT/PROGRAMME PROPOSAL

PROJECT/PROGRAMME CATEGORY: Regular-sized Project

Country/Region: **Maldives**
Project Title: **Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island**
AF Project ID: **MDV/MIE/Water/2010/6**
IE Project ID: **PIMS ID 4582** Requested Financing from Adaptation Fund (US Dollars): **$8,989,225**
Reviewer and contact person: **Mikko Ollikainen**
IE Contact Person: **Gernot Laganda**

Review Criteria	Questions	Comments on 10 November 2015	Comments on 7 January 2016	Comments on 7 March 2016
Country Eligibility	1. Is the country party to the Kyoto Protocol?	Yes.		
	2. Is the country a developing country particularly vulnerable to the adverse effects of climate change?	Yes.		
Project Eligibility	1. Has the designated government authority for the Adaptation Fund endorsed the project/programme?	Yes, in 2011. A revision document dated 23 April 2012 bears the signature of the designated authority.		

	2. Does the project / programme support concrete adaptation actions to assist the country in addressing adaptive capacity to the adverse effects of climate change and build in climate resilience?	Largely, yes. However, there are features in the revised design that raise questions on how effectively the project promotes adaptation. For example, specifically: **CR1:** There exists ambiguity regarding the groundwater recharge pit system. It had been communicated by UNDP that this activity had been largely or completely replaced by studies regarding such systems as "the plan of recharging ground water through this network of recharge pits was not accepted by the government stakeholders". It is not clear what the expected output is for activity "Based on aquifer studies, implement an aquifer recharge plan to install a critical number of recharge pits to ensure ground water recharge". The results framework (Annex B) still includes recharge pits as outputs. If recharge pits are retained, the output should be clear	**CR1:** The response sheet explains that the initial plan was not feasible and more studies are needed. This is also reflected in the revised results framework contained in a separate document. However, the main project document continues to include a results framework that lists numbers of recharge pits to be installed. This would need to be revised: outdated contents in the results framework would need to be updated with the current design. **CR2:** Addressed. The budget amounts have	**CR1:** Addressed. Recharge pits have been omitted.

		throughout the document. **CR2:** The budget amounts in the table under section “Project/ Programme Components and Financing” are the original one and should be revised to correspond to the revised design (e.g. Annex C) **CR3:** For Output 1.2, information seems to be conflicting within the document, and with information provided by UNDP previously about the design changes: for example, there is still “Option 1: Increasing the capacity of individual rainwater harvesting tanks in each household and optimizing water collection from individual rooftops”, even though UNDP had communicated that the household level rainwater harvesting component had been dropped. According to February 2015 information, “the revised design now includes communal rainwater	**CR2:** Addressed. The budget amounts have been revised and are now consistent. **CR3:** Addressed: references to rainwater harvesting tanks at the household level have been omitted, and figures have been streamlined.	

		harvesting tanks that will capture the rain from the community / public buildings and adjacent private houses". That document further provides "number of identified houses for the rainwater harvesting network" with 70, 27 and 59 houses for each island, respectively, but that information does not seem to be provided in the present revised project document. Also, the "minimum required capacity [installed] to meet all communal freshwater needs in a changing climate" has been radically reduced from the previous version. For HA. Ihavandhoo, the document provides two different targets in different parts of the document: 2,550 m3 and 1,550 m3. **CR4:** Under Output 1.3 the document has the original wording "To satisfy water demand of the 3 densely populated target islands, and avoid costs of importing bottled water, the	**CR4:** Partly addressed: the inconsistency has been corrected on p. 20 but not on p. 21. Please correct inconsistency on p. 21.	**CR4:** Addressed.

		proposed project will install 90 m3 of desalination capacity per day on Ihavandhoo and upgrade existing desalination capacity on ADh. Mahibadhoo and GDh. Gadhdhoo from 10m3 per day to 60m3 per day", though according to February 2015 information, the capacity for ADh. Mahibadhoo will be reduced to 50 m3. That is also the figure in Annex B. **CR5:** Activities under Output 1.4 seem to be the old ones that were revised based on earlier UNDP communication.	**CR5:** Addressed.	
	3. Does the project / programme provide economic, social and environmental benefits, particularly to vulnerable communities, including gender considerations, while avoiding or mitigating negative impacts, in compliance with the Environmental and Social Policy of the Fund?	The project continues to have potential for such benefits.		

	4. Is the project / programme cost effective?	**CR6:** It is not clear from the document budget which part of the services are provided by UNOPS and which costs correspond to them. Please clarify.	**CR6:** UNDP has clarified in the response sheet that in the project document budget (Annex C), "MHE / Responsible Party" under "Responsible party/ implementing agent" in fact means UNOPS. UNDP has also provided a copy of the Memorandum of Agreement between the Government of Maldives, represented by Ministry of Housing and Environment, and UNOPS. However, the presentation in the document does not enable the reader to understand the actual arrangement (see below).	**CR6:** See CR 8 below.
		CR7: The very large figure under Output 1.3 "Materials and Goods" would need to be justified and explained in detail. The figure has more than doubled from the previous version. The budget has increased even though the desalinated water output has decreased. The reasons given in the February 2015 document are not convincing: "the increased size of the centralized water distribution tanks, […] the inclusion of solar panels component from 1.2 to support the power	**CR7:** Brief explanation of the "administrative building" is provided in the response sheet but it is not detailed enough and it is not reflected in the project document. A breakdown at similar level as the cost estimates provided for the three islands in the original project document would be needed to be provided, with the textual clarification. Cost estimates that are not consistent with the current design would need to be omitted and if possible, replaced with updated ones.	**CR7:** Addressed. The cost of the administrative buildings for the three islands, respectively, have been provided.

			replaced with updated ones.	
	5. Is the project / programme consistent with national or sub-national sustainable development strategies, national or sub-national development plans, poverty reduction strategies, national communications and adaptation programs of action and other relevant instruments?	The project was initially assessed to be in compliance with national strategies and plans, and nothing indicates change in that situation.		
	6. Does the project / programme meet the relevant national technical standards, where applicable, in compliance with the Environmental and Social Policy of the Fund?	The project was initially assessed to be in compliance with national technical standards, and nothing indicates change in that situation. Compliance with the Environmental and Social Policy of the Fund has not been assessed for this project that was approved before the policy was put in place.		

	7. Is there duplication of project / programme with other funding sources?	No change to initial assessment. A new project recently approved by the Green Climate Fund Board builds on this project in different parts of the country.		
	8. Does the project / programme have a learning and knowledge management component to capture and feedback lessons?	Yes. No change to initial assessment.		
	9. Has a consultative process taken place, and has it involved all key stakeholders, and vulnerable groups, including gender considerations?	Yes. No change to initial assessment.		
	10. Is the requested financing justified on the basis of full cost of adaptation reasoning?	Unclear. Cf. CRs above.		
	11. Is the project / program aligned with AF's results framework?	Yes. No change to initial assessment.		

	12. Has the sustainability of the project/programme outcomes been taken into account when designing the project?	A sustainability concern relates to the recharge pits that have been indicated not to enjoy support by the community (cf. CR above).		
	13. Does the project / programme provide an overview of environmental and social impacts / risks identified?	Compliance with the Environmental and Social Policy of the Fund has not been assessed for this project that was approved before the policy was put in place.		
Resource Availability	1. Is the requested project / programme funding within the cap of the country?	Yes.		
	2. Is the Implementing Entity Management Fee at or below 8.5 per cent of the total project/programme budget before the fee?	Yes.		
	3. Are the Project/Programme Execution Costs at or below 9.5 per cent of the total project/programme budget?	Yes.		

Eligibility of IE	4. Is the project/programme submitted through an eligible Implementing Entity that has been accredited by the Board?			
Implementation Arrangements	1. Is there adequate arrangement for project / programme management?	Yes. However, **CR8** the roles of different agencies, including UNOPS, would need to be outlined clearly in the document.	**CR8:** The role of UNOPS is not clearly outlined in the document. The text in the Section III.A of the document, on management arrangements, is the same as it was originally. The response sheet makes a reference to the project budget where the term "responsible party" is used but which does not enable the reader to understand the actual arrangement. What would be needed is a practical explanation of the actual services UNOPS is providing for the project, as well as a brief explanation of the rationale and management arrangements. This does not need to be long, and it can be included as an annex to the document.	**CR8:** Addressed. The role and responsibilities of the "responsible party" (UNOPS) have been provided in section III.A.
	2. Are there measures for financial and project/programme risk management?	Yes. No change to initial assessment.		

	3. Are there measures in place for the management of for environmental and social risks, in line with the Environmental and Social Policy of the Fund? Proponents are encouraged to refer to the draft Guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social Policy, for details.	Compliance with the Environmental and Social Policy of the Fund has not been assessed for this project that was approved before the policy was put in place.		
	4. Is a budget on the Implementing Entity Management Fee use included?	Yes. No change to initial assessment.		
	5. Is an explanation and a breakdown of the execution costs included?	Yes. No change to initial assessment.		
	6. Is a detailed budget including budget notes included?	Yes. As noted above, some budget lines need to be clarified.		

	7. Are arrangements for monitoring and evaluation clearly defined, including budgeted M&E plans and sex-disaggregated data, targets and indicators?	Yes. No change to initial assessment.		
	8. Does the M&E Framework include a break-down of how implementing entity IE fees will be utilized in the supervision of the M&E function?	Yes. No change to initial assessment.		
	9. Does the project/programme's results framework align with the AF's results framework? Does it include at least one core outcome indicator from the Fund's results framework?	Yes. No change to initial assessment. Compliance with core outcome indicators has not been considered as the project was approved before that policy was put in place.		
	10. Is a disbursement schedule with time-bound milestones included?	Yes. No change to initial assessment.		

Technical Summary	Project Objective: The objective of this project is to ensure reliable and safe freshwater supply for Maldivian communities in a changing climate. Project Strategy: The primary problem addressed by this project is a significant, climate change-induced decline of freshwater security that is affecting vulnerable communities in Maldives. As surface freshwater is generally lacking throughout the country, the key problems pertaining to freshwater security relate to the management of increasingly variable rainwater resources and increasingly saline and polluted groundwater. In order to reduce the aforementioned barriers to effective climate change adaptation in the water management sector, it is essential to reinforce the perspective of Integrated Water Resources Management (IWRM) on inhabited islands. This will ensure that measures responding to additional, climate change-related risks (such as greater rainfall variability, unreliable recharge of aquifers, longer dry periods, and increasing damage to infrastructure from extreme weather events) are addressed in concert with a response to basic development problems (such as insufficient sewage and wastewater treatment, lack of environmental awareness, lack of water conservation, and lack of comprehensive stakeholder participation in the design and monitoring of water management schemes). The project was approved by the Adaptation Fund Board in its 14th meeting on 22 June 2011. During project implementation UNDP has together with executing entities made changes to the project design that go above the threshold of material change as defined in the project agreement. Therefore, UNDP submitted to the 25th Adaptation Fund Board meeting a request to approve such changes. Having heard a recommendation by the Ethics and Finance Committee, the Board decided to request the secretariat to conduct a new full review of the project. The current review responds to that request. The initial review of this proposal found that the document submitted by UNDP required clarification in three respects: 1) the document did not fully reflect the design/budget changes that were previously communicated by UNDP through separate documents; 2) the document did not explain the revised management arrangements also previously communicated by UNDP, including the significant role of UNOPS in project management; and 3) the document had internal inconsistencies, particularly between text that followed the original design and text that reflected the changes made. The initial technical review made 8 clarification requests, detailed above. UNDP submitted a revised document, with a response sheet. The review of that document found that there were still some issues unsolved, related to conflicting and inconsistent activity description, to the role of UNOPS, and to the considerable expenses related to an administrative building. UNDP submitted another revised document, with a response sheet, and the review finds that the all clarification

	requests have been addressed.
Date:	7 March 2016

ADAPTATION FUND BOARD SECRETARIAT TECHNICAL REVIEW OF PROJECT/PROGRAMME PROPOSAL

PROJECT/PROGRAMME CATEGORY: Regular-sized Project

Country/Region: **Maldives**
Project Title: **Increasing climate resilience through an Integrated Water Resource Management Programme in HA. Ihavandhoo, ADh. Mahibadhoo and GDh. Gadhdhoo Island**
AF Project ID: **MDV/MIE/Water/2010/6**
IE Project ID: **PIMS ID 4582** Requested Financing from Adaptation Fund (US Dollars): **$8,989,225**
Reviewer and contact person: **Mikko Ollikainen**
IE Contact Person: **Gernot Laganda**

Review Criteria	Questions	Comments on 10 November 2015	Comments on 7 January 2016	MIE Responses January 15, 2016
Country Eligibility	1. Is the country party to the Kyoto Protocol?	Yes.		
	2. Is the country a developing country particularly vulnerable to the adverse effects of climate change?	Yes.		
Project Eligibility	1. Has the designated government authority for the Adaptation Fund endorsed the project/programme?	Yes, in 2011. A revision document dated 23 April 2012 bears the signature of the designated authority.		

	2. Does the project / programme support concrete adaptation actions to assist the country in addressing adaptive capacity to the adverse effects of climate change and build in climate resilience?	Largely, yes. However, there are features in the revised design that raise questions on how effectively the project promotes adaptation. For example, specifically: **CR1:** There exists ambiguity regarding the groundwater recharge pit system. It had been communicated by UNDP that this activity had been largely or completely replaced by studies regarding such systems as "the plan of recharging ground water through this network of recharge pits was not accepted by the government stakeholders". It is not clear what the expected output is for activity "Based on aquifer studies, implement an aquifer recharge plan to install a critical number of recharge pits to ensure ground water recharge". The results framework (Annex B) still includes recharge pits as outputs. If recharge pits are retained, the output should be clear throughout the document.	**CR1:** The response sheet explains that the initial plan was not feasible and more studies are needed. This is also reflected in the revised results framework contained in a separate document. However, the main project document continues to include a results framework that lists numbers of recharge pits to be installed. This would need to be revised: outdated contents in the results framework would need to be updated with the current design.	The noted inconsistency addressed. Groundwater recharge pits have been removed from the targets under the Logframe and the main body of the document under the related Component 1.

		CR2: The budget amounts in the table under section “Project/ Programme Components and Financing” are the original one and should be revised to correspond to the revised design (e.g. Annex C) **CR3:** For Output 1.2, information seems to be conflicting within the document, and with information provided by UNDP previously about the design changes: for example, there is still “Option 1: Increasing the capacity of individual rainwater harvesting tanks in each household and optimizing water collection from individual rooftops”, even though UNDP had communicated that the household level rainwater harvesting component had been dropped. According to February 2015 information, “the revised design now includes communal rainwater harvesting tanks that will capture the rain from the community / public buildings and	**CR2:** Addressed. The budget amounts have been revised and are now consistent. **CR3:** Addressed: references to rainwater harvesting tanks at the household level have been omitted, and figures have been streamlined.	

		adjacent private houses". That document further provides "number of identified houses for the rainwater harvesting network" with 70, 27 and 59 houses for each island, respectively, but that information does not seem to be provided in the present revised project document. Also, the "minimum required capacity [installed] to meet all communal freshwater needs in a changing climate" has been radically reduced from the previous version. For HA. Ihavandhoo, the document provides two different targets in different parts of the document: 2,550 m3 and 1,550 m3. **CR4:** Under Output 1.3 the document has the original wording "To satisfy water demand of the 3 densely populated target islands, and avoid costs of importing bottled water, the proposed project will install 90 m3 of desalination capacity per day on Ihavandhoo and upgrade existing desalination capacity on	**CR4:** Partly addressed: the inconsistency has been corrected on p. 20 but not on p. 21. Please correct inconsistency on p. 21.	Has been corrected; All water production targets have been corrected and consistent.

		ADh. Mahibadhoo and GDh. Gadhdhoo from 10m3 per day to 60m3 per day", though according to February 2015 information, the capacity for ADh. Mahibadhoo will be reduced to 50 m3. That is also the figure in Annex B. **CR5:** Activities under Output 1.4 seem to be the old ones that were revised based on earlier UNDP communication.	**CR5:** Addressed.	
	3. Does the project / programme provide economic, social and environmental benefits, particularly to vulnerable communities, including gender considerations, while avoiding or mitigating negative impacts, in compliance with the Environmental and Social Policy of the Fund?	The project continues to have potential for such benefits.		

	4. Is the project / programme cost effective?	**CR6:** It is not clear from the document budget which part of the services are provided by UNOPS and which costs correspond to them. Please clarify.	**CR6:** UNDP has clarified in the response sheet that in the project document budget (Annex C), "MHE / Responsible Party" under "Responsible party/ implementing agent" in fact means UNOPS. UNDP has also provided a copy of the Memorandum of Agreement between the Government of Maldives, represented by Ministry of Housing and Environment, and UNOPS. However, the presentation in the document does not enable the reader to understand the actual arrangement (see below).	
		CR7: The very large figure under Output 1.3 "Materials and Goods" would need to be justified and explained in detail. The figure has more than doubled from the previous version. The budget has increased even though the desalinated water output has decreased. The reasons given in the February 2015 document are not convincing: "the increased size of the centralized water distribution tanks, […] the inclusion of solar	**CR7:** Brief explanation of the "administrative building" is provided in the response sheet but it is not detailed enough and it is not reflected in the project document. A breakdown at similar level as the cost estimates provided for the three islands in the original project document would be needed to be provided, with the textual clarification. Cost estimates that are not consistent with the current design would need to be omitted and if possible,	Addressed in the revised prodoc. See p 20. One single administrative building in each island will house the entire IWRM system that includes the following infrastructure units and their operations system: (i) desalination - RO plant; (ii) rainwater storage tank; (iii) glass fiber reinforced plastic - GRP storage tanks; (iv) solar powering units; (v) water filtering system; and (vi) a backup power generator. This building requires to be robust enough to accommodate

		panels component from 1.2 to support the power system, and the inclusion of back-up generators that will ensure the reliability of the water supply system". Especially, it is not clear how the budget breakdown increase in the allocation to the administrative building from US$ 54,000 to US$ 1,207,551 is linked to the rationale. Also, the price for solar panels (nearly US$ 850k) would need to be justified.	replaced with updated ones.	multiple infrastructure units and their operation systems. Complexity of such interconnected infrastructure will facilitate truly integrated water production and supply operations. It will therefore require extended capacities of a so-called administrative building in each target island. For all islands the area was increased from 30m3 to 268m2. This resulted in an increase of budget from US$ 54,000 to $1,207,551. The breakdown of the new figure per island is as follows: Ihavandhoo: US$ 413,190.12 Mahibadhoo: US$ 381,066.25 GAdhdhoo: US$ 413,295.20

	5. Is the project / programme consistent with national or sub-national sustainable development strategies, national or sub-national development plans, poverty reduction strategies, national communications and adaptation programs of action and other relevant instruments?	The project was initially assessed to be in compliance with national strategies and plans, and nothing indicates change in that situation.		
	6. Does the project / programme meet the relevant national technical standards, where applicable, in compliance with the Environmental and Social Policy of the Fund?	The project was initially assessed to be in compliance with national technical standards, and nothing indicates change in that situation. Compliance with the Environmental and Social Policy of the Fund has not been assessed for this project that was approved before the policy was put in place.		
	7. Is there duplication of project / programme with other funding sources?	No change to initial assessment. A new project recently approved by the Green Climate Fund Board builds on this project in different parts of the country.		

	8. Does the project / programme have a learning and knowledge management component to capture and feedback lessons?	Yes. No change to initial assessment.		
	9. Has a consultative process taken place, and has it involved all key stakeholders, and vulnerable groups, including gender considerations?	Yes. No change to initial assessment.		
	10. Is the requested financing justified on the basis of full cost of adaptation reasoning?	Unclear. Cf. CRs above.		
	11. Is the project / program aligned with AF's results framework?	Yes. No change to initial assessment.		
	12. Has the sustainability of the project/programme outcomes been taken into account when designing the project?	A sustainability concern relates to the recharge pits that have been indicated not to enjoy support by the community (cf. CR above).		
	13. Does the project / programme provide an overview of environmental and social impacts / risks identified?	Compliance with the Environmental and Social Policy of the Fund has not been assessed for this project that was approved before the policy was put in place.		

Resource Availability	1. Is the requested project / programme funding within the cap of the country?	Yes.		
	2. Is the Implementing Entity Management Fee at or below 8.5 per cent of the total project/programme budget before the fee?	Yes.		
	3. Are the Project/Programme Execution Costs at or below 9.5 per cent of the total project/programme budget?	Yes.		
Eligibility of IE	4. Is the project/programme submitted through an eligible Implementing Entity that has been accredited by the Board?			

Implementation Arrangements	1. Is there adequate arrangement for project / programme management?	Yes. However, **CR8** the roles of different agencies, including UNOPS, would need to be outlined clearly in the document.	**CR8:** The role of UNOPS is not clearly outlined in the document. The text in the Section III.A of the document, on management arrangements, is the same as it was originally. The response sheet makes a reference to the project budget where the term "responsible party" is used but which does not enable the reader to understand the actual arrangement. What would be needed is a practical explanation of the actual services UNOPS is providing for the project, as well as a brief explanation of the rationale and management arrangements. This does not need to be long, and it can be included as an annex to the document.	Addressed. Part III on Implementation Arrangement revised to include key services to be delivered by UNOPS in their capacity of a Responsible Party to the Implementing Partner. The Responsible Party, on behalf of the implementing partner, will be responsible for the purchase of goods and / or provide services using the project budget. The responsible party manages the use of these goods and services to carry out project activities and produce outputs. A Responsible Party is directly accountable to the Implementing Partner in accordance with the terms of their agreement. Implementing partner will use a responsible party in order to take advantage of their specialized skills, to mitigate risk and to relieve off administrative burden to deliver Component 1 of the Project. This will include but not limited to: • Procurement (both national and international) of infrastructure units, associated

				equipment and spare parts; • Services such as detailed feasibility study for the infrastructure type and capacity, including the operations and administrative systems; • Supervision and quality control for all island level public works; • Monitoring of all public works and compliance with the safety standards and labour regulations; • Be responsible for test and trial of the installed infrastructure and final fittings, including the necessary adjustments, replacements and repairs; • Detail out operations and maintenance procedures and protocols for all infrastructure units; • Design and deliver series of specialized trainings to the utilities that will take over the operations and maintenance of

				the installed infrastructure.
	2. Are there measures for financial and project/programme risk management?	Yes. No change to initial assessment.		
	3. Are there measures in place for the management of for environmental and social risks, in line with the Environmental and Social Policy of the Fund? Proponents are encouraged to refer to the draft Guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social Policy, for details.	Compliance with the Environmental and Social Policy of the Fund has not been assessed for this project that was approved before the policy was put in place.		
	4. Is a budget on the Implementing Entity Management Fee use included?	Yes. No change to initial assessment.		
	5. Is an explanation and a breakdown of the execution costs included?	Yes. No change to initial assessment.		
	6. Is a detailed budget including budget notes included?	Yes. As noted above, some budget lines need to be clarified.		

	7. Are arrangements for monitoring and evaluation clearly defined, including budgeted M&E plans and sex-disaggregated data, targets and indicators?	Yes. No change to initial assessment.		
	8. Does the M&E Framework include a break-down of how implementing entity IE fees will be utilized in the supervision of the M&E function?	Yes. No change to initial assessment.		
	9. Does the project/programme's results framework align with the AF's results framework? Does it include at least one core outcome indicator from the Fund's results framework?	Yes. No change to initial assessment. Compliance with core outcome indicators has not been considered as the project was approved before that policy was put in place.		
	10. Is a disbursement schedule with time-bound milestones included?	Yes. No change to initial assessment.		

Technical Summary	Project Objective: The objective of this project is to ensure reliable and safe freshwater supply for Maldivian communities in a changing climate. Project Strategy: The primary problem addressed by this project is a significant, climate change-induced decline of freshwater security that is affecting vulnerable communities in Maldives. As surface freshwater is generally lacking throughout the country, the key problems pertaining to freshwater security relate to the management of increasingly variable rainwater resources and increasingly saline and polluted groundwater. In order to reduce the aforementioned barriers to effective climate change adaptation in the water management sector, it is essential to reinforce the perspective of Integrated Water Resources Management (IWRM) on inhabited islands. This will ensure that measures responding to additional, climate change-related risks (such as greater rainfall variability, unreliable recharge of aquifers, longer dry periods, and increasing damage to infrastructure from extreme weather events) are addressed in concert with a response to basic development problems (such as insufficient sewage and wastewater treatment, lack of environmental awareness, lack of water conservation, and lack of comprehensive stakeholder participation in the design and monitoring of water management schemes). The project was approved by the Adaptation Fund Board in its 14th meeting on 22 June 2011. During project implementation UNDP has together with executing entities made changes to the project design that go above the threshold of material change as defined in the project agreement. Therefore, UNDP submitted to the 25th Adaptation Fund Board meeting a request to approve such changes. Having heard a recommendation by the Ethics and Finance Committee, the Board decided to request the secretariat to conduct a new full review of the project. The current review responds to that request. The initial review of this proposal found that the document submitted by UNDP required clarification in three respects: 1) the document did not fully reflect the design/budget changes that were previously communicated by UNDP through separate documents; 2) the document did not explain the revised management arrangements also previously communicated by UNDP, including the significant role of UNOPS in project management; and 3) the document had internal inconsistencies, particularly between text that followed the original design and text that reflected the changes made. The initial technical review made 8 clarification requests, detailed above. UNDP submitted a revised document, with a response sheet. The final technical review finds that some of the clarification requests have not been adequately addressed, as outlined above.
Date:	7 January 2016