

## **TERMS OF REFERENCE**

### **Terms of Reference for formulation of design criteria and technical specifications for designing drainage and flood management systems in the Maldives using Sustainable Drainage System (SuDS) and Manage Aquifer Recharge (MAR) principles**

## **1. Background and Context**

The Republic of Maldives is a low lying, atoll based, archipelagic nation in the central Indian Ocean. It comprises 1,190 islands grouped into 26 atolls that together occupy a land area of 298 km<sup>2</sup> and form a chain over 820 km in length, spread over an area of around 90,000 sq km. With a total population of 341,256, it is the smallest Asian country in terms of area and population. The country has an average elevation of 1.5 meters above sea-level. The two most important sectors of the economy are tourism and fisheries which contribute nearly 80% of the country's Gross Domestic Product (GDP). Maldives is among the most susceptible and vulnerable to climate change.

### **1.1 Project description**

The Government of Maldives has received funding from the Green Climate Fund (GCF) for the project "Supporting Vulnerable Communities in Maldives to Manage Climate Change-Induced Water Shortages".

The outer islands of the Maldives experiences drinking water shortages during the dry season. These shortages have had significant adverse human, environmental and social impacts on the outer island. The key problems pertaining to freshwater security relate to the increasingly variable rainfall patterns induced by climate change and sea-level rise induced salinity of groundwater. The Government faces constraints in responding to the challenge at hand without assistance, especially in the context of anticipated impacts of climate change.

In response to this climate challenge, the 5-year GCF funded project has the objective to deliver safe and secure freshwater to 105,000 people in the islands of Maldives in the face of climate change risks. This will be achieved by delivering the following results:

- a. Scaling up integrated water supply system to provide safe water to vulnerable households (at least 32,000 people, including 15,000 women);
- b. Decentralized and cost-effective dry season water supply system introduced benefiting 73,000 people across 7 Northern Atolls;
- c. Groundwater quality improved to secure freshwater reserves for long term resilience on 49 islands;

The Government intends to apply part of the proceeds towards procuring the services of Consultancy Firm for the works of “Formulation of design criteria and technical specifications for designing drainage and flood management systems in the Maldives using SuDS and MAR principles”

## **1.2 Vulnerability of Maldives**

The Maldivian islands are regularly exposed to multiple natural hazards and the disaster risk scenario for the country can be described as “moderate” due to a low probability of hazard occurrence and high vulnerability from exposure to geographical, topographical and socio-economic factors. Its unique geography makes this archipelagic small-islands nation particularly vulnerable to projected adverse consequences of climate change, including sea-level rise, as well as increases in sea surface temperature, ocean acidification and frequency/intensity of droughts and storms. For example, sea levels are projected to rise within the range of 10 to 100 centimeters by year 2100, threatening submergence of the entire country in the worst-case scenario. Extreme rainfall events are likely to occur at twice the current frequency by 2050. Higher ocean temperatures increase the rate of coral bleaching and increase the risk of massive coral die-off during the local ocean temperature spikes that occur during El Niño events. Within the archipelago some islands are naturally more vulnerable when compared to other islands. Moreover, various human factors have had a compounded effect on making some of the islands more vulnerable.

## **1.3 Groundwater in Maldives**

The freshwater lens underlying each island has historically been the most important water source for islands. The thickness of the freshwater lens, which typically floats atop the denser sea water, is controlled by a number of factors including island width, rainfall rates and associated infiltration and recharge. Knowledge regarding quantity of groundwater of the Maldives during average annual climatic variations is lacking, but recent modelling results indicate that many of the islands are expected to have a measurable freshwater lens although significant decreases in thickness can occur during the dry season months. For smaller islands complete depletion of the lens is likely to occur during the dry season or after successive years of low annual rainfall. The freshwater lens is thicker for islands in the South of the country due to higher rainfall levels than the Central and Northern regions, with the North being particularly dry. Furthermore, excessive groundwater extraction in relation to recharge has led to salt water intrusion and up-coning of saline water together with the preferential flow paths and reduction of the efficiency of natural recharge processes. Thus, the concern is that during droughts, over-pumping can alter the size of the aquifer and limit recovery to its former size. Observation and anecdotal evidence points to ponding due to soil compaction and reduced infiltration capacity in areas of roads and built up areas, leading to evaporation losses.

When considering factors that affect the quality of groundwater in the outer islands, population growth will mean that sewage discharges will increase by approximately the same rate, and the rate of urbanization (4.2%) will result in higher density communities with knock-on impacts on pollution from waste disposal, particularly given the fragility of the freshwater lenses. Furthermore, higher urbanization

will preclude the rainwater to permeate into the underground lenses unless a deliberative protection of catchment areas takes place.

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

Due to the hydrogeology of the island, the interrelated issues of groundwater quality and quantity can, among others, be majorly addressed by management approaches that encompass the entire recharge / catchment area. One of the project results is ensure groundwater quality is improved to secure freshwater reserves for long term resilience. In line with this project objective, it is planned to design criteria and technical specifications (DC&TS hereafter) for the future designs drainage and flood management systems in the Maldives using SuDS and managed aquifer recharge principles.

## **2. Objectives of the Consultancy**

Development of Design criteria and technical specifications for integrated and sustainable management of storm drainage, flood mitigation and groundwater recharge (hereafter referred to as “Sustainable Drainage Systems” or SuDS).

## **3. Scope of Work**

The envisaged and planned scope of work for respective deliverables includes but not limited to the following;

The consultant shall develop design criteria and technical specifications (DC&TS hereafter) for the future designs drainage and flood management systems in the Maldives using SuDS principles. The intention is for these to be used by the government as a basis of approving future SuDS proposals. In addition to the expertise of the consultant and relevant literature study on the topic, it is expected that the consultant will ensure that the DC&TS are appropriate for the particular context of the Maldives.

DC&TS should include (but not limited to) the guidance and standards for the following:

1. Required precipitation data including its duration, resolution, etc. Required design rainfall for flood mitigation aspects.
2. Required hydrogeological (e.g. soil characteristics, bore well data) and geographical (e.g. land use) data.
3. Establishing the requirements and potential of the groundwater recharge
4. Required topographic, geographic data collection standards.

5. Overview of the island land use planning with storm water management, aquifer recharge opportunities, etc., indicated in a spatially explicit manner. These should be in consultation with the island council and compatible with their spatial planning.
6. Guidance and requirements on detailed design of island specific SuDS. These should include guidance, specifications and standards on detailed drawings, detailed hydrologic and hydraulic calculations, BOQs, etc.
7. Guidance on hydraulic modelling results demonstrating (a) Drainage/flood management performance and (b) MAR performance and (c) other co-benefits.
8. Guidance on modelling the performance of the system under extreme rainfall with different return periods.
9. Guidance on evaluating the performance of the system under (simple) future scenarios of rainfall (e.g. % increase of extreme rainfall) and land use (e.g. increase of built-up area) should be presented.
10. Guidance on required and recommended groundwater flow modelling.
11. Guidance on providing maintenance and renewal requirements of the systems
12. Guidance on economic analysis including cost-benefit and life cycle costing.

When preparing DC&TS, the consultant should provide specific, in-detail information on the recommended data, approaches and methodologies that are needed and recommended.

#### 4. Expected outputs and Deliverables

1. Inception report
2. Technical specifications for design of flood mitigation and groundwater recharge

Note:

- Electronic copies of the all deliverables shall be provided to the client in the following formats (where applicable)
  - All the engineering designs should be in CAD formats (e.g. AutoCAD)
  - Documents in editable formats (e.g. Microsoft Word). Final versions should be provided both in editable and PDF formats.
- For all deliverables, 3 weeks shall be given for client review and comments.

#### 5. Duration and Payments Schedule

The consultancy will be undertaken with a period of 4 months and is expected to start from May 2021. The consultancy contract will be based on lump sum modality and all payments based on realization of respective deliverables as set out in the table below;

Activity / Deliverable	Due date and remarks	Instalment for Payment upon client acceptance and approval of deliverable
Inception Report with a detailed methodology and consultancy implementation plan. This will be based on prior consultation with the PMU and other key stakeholders	14 days from contract signing, upon client review and approval	10% of contract amount
Technical specifications for design of flood mitigation and groundwater recharge	120 days from contract signing, upon client review and approval	90% of contract amount

## 6. Qualifications of the Consultant

The Consultant should submit full CV highlighting the criteria given below.

	The Consultant (SuDS expert)		Sub- Category	Total Score	Sub-Score
<b>Education &amp; Qualification</b>	Must have bachelors or Masters' degree in civil engineering or equivalent.			<b>30</b>	<b>20</b>
	Additional advantage in PhD in civil engineering, hydrology, water resources or related field				<b>10</b>
<b>General Experience</b>	Experience in designing Drainage networks, small-scale flood management solutions and SuDS.	(a)	At least 10 years	<b>40</b>	<b>20</b>
	Experience/demonstrated exposure with small island environment	(b)	Experience/demonstrated exposure with small island environment		<b>20</b>
<b>Specific Experience</b>	Proven experience on drafting guidelines, technical specifications related to the whole or parts of the assignment.	(a)	>5 assignments	<b>30</b>	<b>10</b>
		(b)	<5 assignments		<b>20</b>

**The Consultant for this assignment SHOULD NOT be working in any project assignment in the Ministry of Environment.**

Only candidates achieving **at least 65 points** from the technical evaluation shall be considered for financial evaluation.

## 7. Reporting Requirements

The consultants should submit the deliverables as follows

Activity / Deliverable	Due date and remarks	Instalment for Payment upon client acceptance and approval of deliverable
Inception Report with a detailed methodology and consultancy implementation plan. This will be based on prior consultation with the PMU and other key stakeholders	14 days from contract signing, upon client review and approval	10% of contract amount
Technical specifications for design of flood mitigation and groundwater recharge	120 days from contract signing, upon client review and approval	90% of contract amount

The consultant shall have weekly meeting with the client regarding the progress of the works.

### 1. Financial Proposal (40%)

Financial proposal will be evaluated as per total cost quoted on Financial Proposal form in Annex A.

Financial Score (Sf) will be calculated by the following formula:

The formula for determining the financial scores is the following:

$Sf = 40 \times Fm / F$ , in where Sf is the financial score, Fm is the lowest price and F the price of the proposal under consideration.

### 1. Fee Proposal/ Price Schedule

The consultant is expected to include his/her proposal a lump sum fee in Maldivian Rufiyaa (MVR) for carrying out this task as in the FORMAT provided in the ANNEX A, fees will be paid based on completion of deliverables as detailed in the scope of work.

### 2. Required Documents for submitting proposals

The following documents shall be submitted with the application for this consultancy:

1. Completed proposal submission form (Form-1)

2. A cover letter indicating why the candidate considers himself/herself suitable for the required consultancy;
3. CV of the applicant (in format provided **ANNEX B**)
  - i. Summary on similar works (experiences) performed in the past
  - ii. Reference letters of works carried out
4. Copy of identification (National Identity Card or Passport Copy) and contact details
5. Copies of Educational Certificates (copies taken from accredited original certificates)
6. Financial Proposal (All fees inclusive of tax should be included) as in the **FORMAT** provided in the **ANNEX A (all prices must be in MVR)**.

## **10 REGISTRATION AND CLARIFICATIONS**

1. The Bidder shall be registered to submit a bid upon submission of the attached bidders registration form to the email address [proc.gcfws@environment.gov.mv](mailto:proc.gcfws@environment.gov.mv) not later than **1200 hours on April 06, 2021**. Any clarifications to the bid may be sent to the email addresses [proc.gcfws@environment.gov.mv](mailto:proc.gcfws@environment.gov.mv) on or before **1400 hours on April 06, 2021**.

### **3. SUBMISSION**

The Bidder shall be registered to submit a bid upon submission of the attached bidders registration form to the email address [proc.gcfws@environment.gov.mv](mailto:proc.gcfws@environment.gov.mv) not later than **1200 hours on April 6, 2021**. Unregistered parties will not be able to participate in the bid.

Interested individuals may **submit their proposals on or before 1000hrs 12<sup>th</sup> April 2021**, to the following address in a sealed envelope. The proposals are expected to be submitted to the address on local time **1000hrs 12<sup>th</sup> April 2021**. Only bids submitted at this time will be eligible to proceed to evaluation and **Late bids will be rejected**.

Those wishing to be considered for this consultancy should submit their technical and financial proposals in a sealed envelope to:

GCF Project Management Unit  
Ministry of Environment  
Green Building, Handhuvaree Hingun,  
Maafannu, Male', 20392,  
Republic of Maldives.  
Tel. (960)-3018-395  
Email: [proc.gcfws@environment.gov.mv](mailto:proc.gcfws@environment.gov.mv)



# ANNEX 1

## 1. STANDARD FORMS

### 1.1 FORM -1: PROPOSAL SUBMISSION FORM

[Location, Date]

To: [Name and address of Client]

Dear Sirs:

[I/We], the undersigned, offer to provide the “ ” in accordance with your Terms of Reference dated [Insert Date] and our Proposal. [I am/We are] hereby submitting [my/our] Proposal; [my/our] financial offer is for the sum of [**Insert amount(s) in words and figures (Should quote the amount in Maldivian Rufiyaa)**] which is inclusive of the all applicable taxes.

[I/We] hereby declare that all the information and statements made in this Proposal are true and accept that any misinterpretation contained in it may lead to [my/our] disqualification.

Proposal validity is for a period of [Insert number of days, 45 days minimum] days. If negotiations are held during the period of validity of the Proposal, we undertake to negotiate on the basis of the price and work plan. [My/Our] Proposal is binding upon [me/us] and subject to the modifications resulting from Contract negotiations.

[I/We] undertake, if our Proposal is accepted, to initiate the services and fulfil the requirements of the terms of reference.

[I/We] understand you are not bound to accept any Proposal you receive.

[I/We] remain,

Yours sincerely,

Authorized Signature [*In full and initials*]: \_\_\_\_\_

Name and Title of Signatory: \_\_\_\_\_

Name of Company/Partnership/Institution/Individual: \_\_\_\_\_

Address: \_\_\_\_\_

**ANNEX A – FINANCIAL PROPOSAL (FORMAT)**

<b>Deliverables/ Outputs</b>	<b>Total amount (MVR)</b>
Inception Report with a detailed methodology and consultancy implementation plan. This will be based on prior consultation with the PMU and other key stakeholders	
Technical specifications for design of flood mitigation and groundwater recharge	
<b>Total :</b>	
<b>GST :</b>	
<b>Total with GST:</b>	

Indicate the total cost with detail cost to be paid in Maldivian Rufiyaa.

Note: The total contract price should be quoted inclusive of Goods and Services Tax (GST) as per the GST Legislation and Circulars where applicable.

**ANNEX B – CURRICULUM VITAE (CV) (FORMAT)**

**1. Proposed Position** [*only one candidate shall be nominated for each position*]: \_\_\_\_\_

**2. Name of Firm** [*Insert name of firm proposing the staff*]: \_\_\_\_\_

**3. Name of Staff** *Insert full name* \_\_\_\_\_

**E-mail Address** \_\_\_\_\_

**4. Date of Birth:** \_\_\_\_\_ **Nationality:** \_\_\_\_\_

**5. Education** [*Indicate college/university and other specialized education of staff member, giving names of institutions, degrees obtained, and dates of obtainment*]: \_\_\_\_\_

\_\_\_\_\_

**6. Membership of Professional Associations:** \_\_\_\_\_

\_\_\_\_\_

**7. Other Training** [*Indicate significant trainings since degrees under 5 - Education were obtained*]:

\_\_\_\_\_

\_\_\_\_\_

**8. Countries of Work Experience:** [*List countries where staff has worked in the last ten years*]:

\_\_\_\_\_

\_\_\_\_\_

**9. Languages** [*For each language indicate proficiency: good, fair, or poor in speaking, reading, and writing*]: \_\_\_\_\_

**10. Experience/ Employment Record** *[Starting with present position, list in reverse order every employment held by staff member since graduation, giving for each employment (see format here below): dates of employment, name of employing organization, positions held.]*:

From [Month/Year]: To [Month/Year]: \_\_\_\_

Employer: \_\_\_\_\_

Positions held: \_\_\_\_\_

Summary of Projects Undertaken/Role: \_\_\_\_

**11. Current commitments in Ongoing Projects with the Ministry of Environment**

Name of the Contract/Project: \_\_\_\_\_

From [Month/Year]: \_\_\_\_\_ To [Month/Year]: \_\_\_\_\_

Positions held: \_\_\_\_\_

Summary of Role: \_\_\_\_\_