Employer's requirement

Groundwater monitoring wells

1. Objectives

The objective of the monitoring well system is to continuously (e.g. at an hourly frequency) monitor the salinity in the groundwater at various depths up to a depth of about 15m. This will be achieved by drilling six boreholes at close-proximity of each other, with each borehole reaching a different depth. Boreholes should be lined with waterproof casing down to the respective monitoring level with the last metre having perforations so that the water will be collected only from that depth. Salinity monitoring should be done with a submerged data logger in each borehole with measurements of temperature, pressure (hence water depth) and salinity (measurement range from freshwater to seawater). The data loggers should continuously measure salinity at a frequency of, for example, once per hour

2. Establishment of monitoring wells, supply and installation of sensors and training

a) Preliminary assessment to identify the well-sites, consultation with respective stakeholders. All key experts identified in the RFP shall take part in this assessment.
b) The contractor shall propose appropriate and practical sites for the construction, operation and maintenance of the groundwater wells after the site visit in coordination with the island council.
c) The contractor shall produce a detailed design report on the monitoring wells, the reports shall be submitted for client approval.
d) The contractor shall produce an EIA report as per the requirements of Maldives Environmental Protection EPA.
e) Wells should be drilled close to each other so that the whole set of wells can be protected together, but considering the minimum space needed for the structural integrity of the system.

f) The waterproof casing should be non-corrosive and guaranteed to last long in field conditions. For example uPVC or HDPE. Casing and wellscreens (slotted bottom part) shall be supplied by an ISO9001 approved manufacturing company.

g) The internal diameter of the well shall be at least 5 cm so that it is possible to send a sampling pipe in while the data logger is deployed.

h) The lining of the borehole should be watertight until it reaches the last 1m depth. At this depth, the lining should work as wellscreen (e.g. slotted). The bottom of the borehole should also be lined (with or without holes) to prevent silt from getting into the well.

i) The top of the borehole should provide a secure way of closing so that (a) water does not enter the well from the top (b) The well is safe from vandalism.

j) The salinity/temperature/pressure datalogger sensor ('sensor' hereafter) should be suspended above the bottom of the well, close to the bottom following the sensor manufacturers instructions.

k) The sensor should be able to measure salinity, water-level (using hydrostatic pressure) and temperature (to convert salinity). The specifications should be as follows

Parameter	Unit	Range (minimum)	Accuracy (maximum measurement error)
Conductivity	mS/cm	0 – 60	±2%
Temperature	℃	0 – 50	0.2 units
Pressure	m (hydrostatic)	Up to 40	±0.1

l) The sensor should be rated suitable to be submerged continuously in water under pressure up to 40m. (e.g. IP68 rating).

m) The sensor should be completely corrosion resistant under highly saline conditions (e.g. seawater).

n) The sensor data logger should be able to store the recordings of at least 2 years continuously (more than 20000 measurements). This operation should be completely unattended. The data logger operation should be battery-powered (with a battery life of at least 2 years)

o) The data should be accessible from the well top while the sensor remains deployed (e.g. Built-in data cable or wireless). If using data cables, those should also be

waterproof (IP68) and the cable end on the well top should be protected with a suitable waterproof enclosure.

p) Each well should have a sampling pipe which is closed with a suitable endcap. Two units of movable sampling pumps should be provided (for the entire contract). These pumps should have a minimum lift of 5m and should operate with (rechargeable) batteries.

q) The wells should be constructed as close to each other as possible so that the footprint is minimal. However, the spacing should be adequate to ensure structural integrity and proper operation.

r) The set of wells should be protected from weather and vandalism. A suitable enclosure that can be securely locked should be provided.

s) The depths of the wells are suggested to be:

Depths
2m
4m
6m
8m
15m

t) The contractor should conduct a hands-on training session for a team of personnel selected by the client.

u) A video clip explaining the procedure of (a) deploying, maintenance of the sensor and accessing data. (b) Sampling water from the sampling pipe/pump setup.

v) Four well-sets in two selected islands should be constructed. Tentative locations and provided in the attached document

w) The contractor shall submit an operation and maintenance plan

x) Additional data on the aquifer of the island is found in the publication in the link, https://www.environment.gov.mv/v2/en/download/10708

3. Deliverables

All works must be completed within a duration of 06 months (180 days)

Deliverables	Timeline	Documents Required	Remarks
Detailed design report	30 days from the date of commencement	Detailed design Report, Detail Drawings.	Subject to Approval by Client
Submission of Environmental Impact Assessment Report to EPA	45 days from the date of commencement	Land approval from island council, EIA report	Subject to approval by EPA
Mobilization, Site preparation and training	60 days from the date of commencement	Mobilisation shall take place after the approval of detailed design report and EIA report	
Completion of the works of groundwater monitoring well establishment per employers requirements, approved detailed design and EIA	150 days from the date of commencement	-	Subject to Approval by Client
Provision of training to staffs identified by the client (10 - 15 participants)	180 days from the date of commencement	Training report inclusive of all materials use for training and attendance sheets	Subject to Approval by Client
Providing video clip, operation and maintenance plan as per Employers requirement	180 days from the date of commencement	Operation and maintenance plan Video clip	Subject to Approval by Client

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.
- Two numbers of hardcopies shall be submitted in the form of a book for each deliverable with the following requirement,
    - Front and Back cover – Hard Cover
    - High Quality Color Print

Size: A4 and A3. A3 pages should be folded appropriately