



HR Wallingford
Working with water

Groundwater monitoring for mapping aquifers in Belize as a tool for climate change adaptation planning

Implementation plan



FWR6741-RT001-R01-00

30 September 2022

Document information

Document permissions	Confidential - client
Project number	FWR6741
Project name	Groundwater monitoring for mapping aquifers in Belize as a tool for climate change adaptation planning
Report title	Implementation plan
Report number	RT001
Release number	01-00
Report date	30 September 2022
Client	Climate Technology Centre & Network (CTCN)
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Document history

Date	Release	Prepared	Approved	Authorised	Notes
30 Sep 2022	01-00	GFW	NW	NW	

Document authorisation

Prepared George Woolhouse	Approved Nigel Walmsley	Authorised Nigel Walmsley
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1 Introduction

1.1 Project context and background

In Belize, 56% of the population lives in rural areas where groundwater is a vital source for fresh water, and represents almost 95 per cent of the fresh water supply.

Groundwater is also used as a source of drinking water in the cities of the Corozal, Orange Walk, Cayo and Toledo Districts and in some rural areas of Toledo and Cayo. However, the existing aquifers and their annual recharge rate have not been quantified.

Increase in demand for fresh water resulting from increasing population, greater economic activity and agricultural expansion are threatening the quality and availability of fresh water. Each year during low rainy seasons exists the possibility of droughts due to low recharge of aquifers.

Transboundary aspects and distribution of population are other factors that affect the water sector. For example, central and northern regions (Orange Walk and Corozal) have much larger populations and higher agriculture zones for water intensive crops, but less water resources.

Although there is a need for groundwater information across the country, the priority areas include the New River watershed.

The Nationally Determined Contribution (2016)¹ indicated water resource assessment (especially groundwater) as part of the main actions to be implemented to build resilience.

The results of the prioritization of adaptation technology factsheets for the Water Sector documented in the technologies needs assessment (TNA) for adaptation (2017)² include:

- Drought Monitoring System for Northern Belize with Specific Focus on Groundwater Resources;
- Water Efficient Fixtures and Appliances;
- An Integrated Management Strategy for Water Safety for Eight Rural Water Supply Systems in Belize.

The National Hydrological Service (NHS) is leading a process for building an inventory of existing data on groundwater. The objective is to identify and homogenize information that is currently available but spread among different agencies and institutions, and their various departments.

Requests have been made from the executive level of the Ministry (responsible for the NHS) to other ministries for sharing of relevant groundwater data. However, this is still a work in progress. Additionally, the Ministry of Rural Transformation has indicated that they do not geo-reference their wells.

Following the foreseen adaptation actions in the NDC and the TNA for Adaptation for the water sector, the National Climate Change Office of the Ministry of Sustainable Development, Climate Change, and Disaster Risk Management, and the National Hydrological Service (NHS) started conversations to develop a proposal for a Groundwater Monitoring System.

¹ Belize's Nationally Determined Contribution, 2016
https://unfccc.int/files/focus/ndc_registry/application/pdf/belize_ndc.pdf

² Technology Needs Assessment for Adaptation, 2017
https://unfccc.int/tclear/misc_/StaticFiles/gnwoerk_static/TNA_key_doc/3db7d7bbba4c4deebecbc11fd24fb67d/5331353e87a0488e861d1fe6aca1b747.pdf

1.2 Problem statement

Belize is located in Central America and is exposed to climate change and variability events can affect the access to clean water due to intensification of the hydrological cycle, saltwater intrusion into coastal aquifers, sea level rise and impact of hurricane seasons.

These events can reduce the amount of fresh water and the availability for utilization especially in rural areas where the demand of water is provided mainly (95%) from ground water.

Quality assessment of the water sources and its dynamics is a key aspect in order to handle the impacts of climate change and increase the resilience of the communities where groundwater is relevant. The increased demand for fresh water projected by population increase, economic growth and agricultural expansion will increase pressure for resources.

However, the lack of the monitoring system to properly assess the water sources and low capacity developed in institutions and communities are barriers to overcome for better management of the resources.

Therefore, designing a monitoring system for managing groundwater is the first step towards addressing future problems related to water availability. Additionally, capacity building and knowledge transfer on groundwater management represent valuable actions to assure the correct implementation of a monitoring system.

1.3 Project purpose and outputs

The overall purpose is to design a groundwater monitoring system useful for the National Hydrological Service and government agencies in Belize to identify water supply risks for diverse groundwater users in Belize. The project outcomes will increase climate resilience in Belize by designing a groundwater monitoring system to assess and control the impacts of groundwater abstraction and contaminant loads to Belize aquifers through monitoring aquifer response and quality trends. The main outputs include:

1. A communications plan and detailed work plan;
2. Map stakeholders and establish a stakeholder working group;
3. An assessment of groundwater availability and demand;
4. Design of an integrated monitoring system that will enable Belize to manage groundwater resources in the priority area;
5. Establish enabling factors for implementation, including financial, institutional setting and capacity building.

The project outcomes respond directly to SDG 6 'Ensure availability and sustainable management of water and sanitation for all' through the design of a monitoring system for groundwater and the identification of risks to the supply of water for diverse groundwater users, particularly those in rural areas where 56% of the population in Belize lives. The outcomes also respond to SDG 13 'Taking early action to combat climate change and its impacts' by identifying risks and vulnerabilities associated with groundwater sources, supporting the design of adaptation actions, informing national policies and strategies related to the water sector; and building institutional capacity of relevant entities in Belize on groundwater monitoring and management.

1.4 About this plan

At the delivery level this implementation plan serves as the focal point for the project, and documents how the project will be delivered and managed. It includes the listing of controls that are in place for the project (e.g. communication processes, issue escalation processes) and also the organisational processes that are

likely to influence how the project will be delivered. At the delivery level, the implementation plan answers questions such as: Why is the project needed? What are the objectives, scope and deliverables? How will the project be delivered, controlled and managed? How much budget is available? Who is responsible for what? When are the key milestones due? Where will the work be performed? It also identifies project risks and how these will be managed.

2 Project Management set up

HR Wallingford uses a bespoke project management system, which covers all our project management processes and supporting systems. It is part of our quality, safety and environment management system. These processes are used from the initial identification of an opportunity through to the delivery of bids and projects. These procedures ensure that project managers keep track of the contract, correspondence, project plan, resourcing schedule, quality monitoring and risk mitigation measures using a structured and traceable method.

HR Wallingford requires all staff to be familiar with our project management procedures, and is rolling out a revised in-house training package. Staff are assisted in their use of the project management system by resources such as a User Manual, an online toolbox of standard templates and forms, and an on-line user forum with updated frequently asked questions.

To reflect our commitment to maintain the standard of our project management, HR Wallingford also has a corporate Key Performance Indicator (KPI) of having 10% of our staff certified in project management. We therefore have an active programme of project management certification through the APMP Project Management Qualification training course. APMP is adopted as standard training for project professionals in leading organisations such as Siemens, Network Rail and BAA. HR Wallingford currently has over 20 APMP Level D certified Project Managers.

Our project management team for this project has the skills and expertise to support planning, managing and resourcing each activity, to ensure the project is delivered to time, quality and budget. Our Team Leader has been accredited by the Association of Project Management Professional (APMP) qualification, which covers 37 knowledge areas (PRINCE2 covers 12) and is the equivalent of the International Project Management Association (IPMA) Level D.

Role definitions:

- **Project Director (Nigel Walmsley):** The prime responsibility of the Project Director (PD) is the ownership of the business case and its continuing viability, culminating the measurement of the realised benefits at some point in the Operation's phase of the project lifecycle. The PD should liaise with the client on key issues relating to the definition of deliverables, contractual matters and any concerns that arise over the management or running of the project. Maintain oversight on project progress and financial performance, including the need for variations where appropriate. Provide support and mentoring to the Project Manager and other members of the project team as needed.
- **Team Leader (George Woolhouse):** Accountable for delivering a product that will achieve the project benefits. The Team Leader (TL) is responsible for accepting the project deliverables, as well as approving any changes that have an impact on any of the project's defined objectives. The TL must ensure the motivation of the team, use interpersonal and influencing skills, with effective communication being one of the most important skills. The Team Leader is the main point of contact between the client and consulting team for day-to-day liaison on project delivery.
- **Project Manager (Azucena Rodriguez Yebra):** Responsible for defining and planning the project and be competent in a range of project management tools and techniques. The Project Manager plays a central role in supporting the Team Leader and will: Manage the project in accordance with the project management procedures; Agree resource allocation with the relevant Group Managers; Ensure internal

co-ordination of all project activities; Assign the tasks required to complete the project to Task Managers (for small projects this may include the management of those tasks); Ensure successful delivery of the tasks to time and to budget; Ensure that all work complies with the quality management procedures and that the necessary checking has been assigned to a competent individual and completed to a satisfactory standard.

- **Team Members (Figure 2.1):** These are responsible for creating the deliverables. They will be heavily involved in the identification of risks and estimation and sequencing of project activities. Regular status updates from the team are crucial if corrective action is to be taken in an informed and timely manner.
- **HR Wallingford Project Support:** They assist with report production; project support; project administration including document control. Ensure that report preparation complies with the relevant quality management procedures and that deliverables comply with Company standards.
- **Users (stakeholders from Belize):** The users defined the need for the project and will provide the necessary input to the specified requirements and acceptance criteria.
- **Client (CTCN):** The client provides resources for the project, assures that the project is being managed correctly, may be involved in the resolution of project issues. CTCN is also responsible for accepting the project deliverables, as well as approving any changes that have an impact on any of the project's defined objectives.

The below Figure shows the structure of the project team.

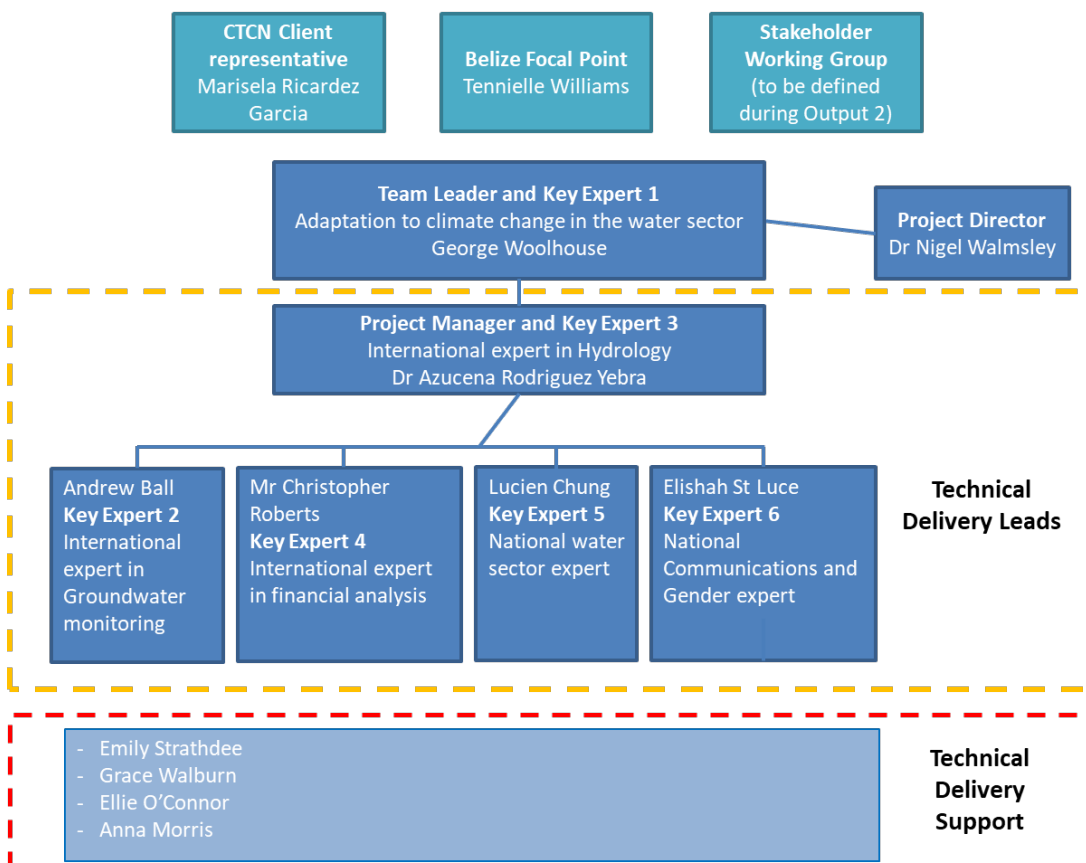


Figure 2.1: Project delivery team

3 Project outputs, activities and deliverables

3.1 Project scope

Project Outcome:

Control the impacts of groundwater abstraction and contaminant loads to Belize aquifers through monitoring aquifers response and quality trends.

Project Objective:

Design a groundwater monitoring system useful for the National Hydrological Service and government agencies in Belize to identify water supply risks for diverse groundwater users in Belize.

Project Outputs

- Output 1: Development of work plan and related communication documents;
- Output 2: Map Stakeholders and establish a Stakeholder Working Group;
- Output 3: Assess groundwater availability and demand based on the available technical information;
- Output 4: Design a fully integrated groundwater monitoring system (in priority areas);
- Output 5: Enabling factors for implementation: financing, institutional settings and capacity building.

3.2 Detailed activities

3.2.1 Output 1: Development of work plan and related communication documents

Activity i: A detailed work plan and communications plan

The implementation plan presented in this proposal will be discussed and reviewed at a virtual Kick-off meeting with the Client and an updated detailed work plan and communications plan will be developed for all activities, deliverables, outputs, deadlines, and responsible persons/organisations produced. Gender studies will help inform the implementation plan as well as the M&E plan.

Box 4.2: Approach to gender mainstreaming

The approach to gender mainstreaming throughout the project will follow CTCN's 3-step process:

- Step 1: Conduct a gender analysis (or assessment) at the start of the project;
- Step 2: Develop an action plan; and,
- Step 3: Monitor and evaluate.

Steps 1 and 2 will be completed as part of the first main activity – the preparation of an Implementation Plan (Activity i). Step 3 will be incorporated into the project implementation process, i.e. each project activity will be assessed for its alignment to gender mainstreaming principles. Rather than developing a separate monitoring and evaluation plan for gender mainstreaming, gender-based indicators will be included in the project's overall monitoring and evaluation plan (Activity ii).

We will ensure that the action plan developed in step 2 is continually monitored throughout the remainder of the project to ensure it remains relevant and that new information is taken into account as it emerges. The design of the groundwater monitoring network, including its key performance indicators, locations, variables to be monitored, data collection, storage and use will all factor in gender considerations. This will be a key area of focus for the team's Gender Expert Elishah St Luce.

Activity ii: Monitoring and evaluation plan

Based on the implementation plan, a monitoring and evaluation (M&E) plan will be developed to evaluate the timeliness and appropriateness of implementation (using the Client's template). The indicators selected in the monitoring and evaluation plan will include both process indicators and output indicators aligned to the technical assistance services. The M&E plan will be the basis for completing the CTCN Closure and Data Collection Report at the end of the assignment and, in doing so, will include consideration of gender-specific data and information.

Activity iii & iv: Impact Statement and Project Closure Report

An impact statement will be prepared at the start of the assignment and updated at the end of the project together with a Project closure report based on the Client's template, which will include lessons learned.

Deliverables

- D.1.1: Detailed implementation plan;
- D.1.2: Monitoring and evaluation plan;
- D.1.3: Impact Statement (initial and final version);
- D.1.4: Technical Assistance Closure Report.

3.2.2 Output 2 Map the stakeholders and establish a stakeholder group

We will work with the client team to identify a list of key stakeholder organisations and individuals who would be able to represent those organisations. We would suggest that the individuals be carefully selected, and have a real interest in the project, so that they engage with us throughout.

Activity 2.1: Map Stakeholders

Relevant stakeholders among government institutions at national and community levels, professionals in the agriculture and tourism sectors, experts in water management and use, climatology, early warning services, representatives of farmers, as well as women and youth for Belize. HR Wallingford carried out a similar stakeholder mapping in 2021 as part of the Vulnerability Assessment and Water Utility Adaptation Planning project (CCCCC-funded) and this, together with support by the National Designated Entity (NDE) and the National Designated Agency (NDA), will enable a final group of relevant stakeholders to be quickly assembled and presented in a report in which each actor will be linked to its sector of expertise and include individual contacts and details.

Activity 2.2: Establish a stakeholder working group

Based on the stakeholder mapping, a streamlined Stakeholder Working Group (SWG) (up to 8 persons) will be agreed and formalised, taking account of gender balance and an adequate representation of vulnerable groups. It is important that the Stakeholder Working Group can provide a technical overview and high-level guidance at each stage of the assignment whilst members of the SWG have capacity to make sound decisions on some key aspects of the assignment such as the collection of data and prioritisation of watersheds.

The composition of the SWG will be summarised in a report, disaggregated by gender, and will likely include those identified in the Response Plan (see Table 4.2). It may also be beneficial for regional organisations such as CCCCC, CIMH, CARPHA or others to be engaged in a technical support role within the wider stakeholder grouping if necessary, and to be engaged in activity 4.5. We will be guided by the Client on the final selection.

Table 3.1: Possible National stakeholders in the SWG

National Stakeholder	Function in the implementation of the technical assistance
National Climate Change Office	National Designated Entity to UNFCCC Technology mechanism
National Hydrology Service	Chair of the SWG
Department of Rural Transformation Belize Water Services Limited Ministry of Agriculture, Food Security, and Enterprise Ministry of Health and Wellness Ministry of Tourism and Diaspora Relations Women, Youth and community group representatives	Potential members of the SWG with roles in providing guidance, information and data Potential beneficiaries of capacity development activities.

Activity 2.3: Conduct an inception meeting

Once the stakeholder working group is in place, a face to face inception meeting will be held with the Stakeholder Working Group and the key experts in Belize (assumed to be in Belmopan or Belize City). The inception meeting will introduce the team of experts, the goals, milestones, anticipated deliverables, and be used to fully understand the role of the stakeholder working group, particularly at key decision points within the assignment. It will offer the opportunity for the key experts to familiarise themselves with the data and context within Belize. The results of the inception meeting will be captured in the implementation plan (see Output 1).

Output 2 Deliverables

- D 2.1: Report on stakeholder mapping;
- D 2.2: Detailed description of the stakeholder working group;
- D 2.3: Minute of the inception meeting.

3.2.3 Output 3: Assess groundwater availability and demand in Belize

Activity 3.1: Compile information.

We will compile information on demand for water in Belize and then baseline information on hydrogeology, including water quality data. We will also consider how EO data could support the project, providing information on areas of irrigation rainfall or evapotranspiration.

Activity 3.2: Baseline analysis

We will develop an assessment of current demand for water (based on information such as population data, well ownership, agricultural production and (from a sample of pumps) power use and pump installation details.

We will then develop initial assessments of available supply based on rainfall data, recharge estimates (and any previous modelling) and hydrological data.

Activity 3.3: Analysis of trends in water demand

We will use socio economic analysis (such as population forecasts and agricultural trends) to identify those areas where growth in groundwater abstraction, combined with sea-level rise and reduced rainfall is likely to impact groundwater quality and quantity. We will identify watersheds where there is likely to be the greatest water balance deficit in the short and medium term based on this analysis. We will consider how sea level rise may impact on coastal and low-lying regions.

We will focus on gender considerations to understand where these trends may result in the greatest.

Activity 3.4: Map the groundwater resources of Belize in the prioritized area of the New River Watershed.

As set out in Section 4 of our technical proposal, we propose to review the existing data, but after discussions with contractors and based on our expertise, the key uncertainties are likely to be the hydrogeology of the aquifers, rather than their geometry, so our focus would be on gathering data on water levels and hydraulic performance and water quality of existing boreholes, rather than resistivity logging. If we felt that resistivity logging would be of benefit then we would propose this as a later study to enhance the groundwater monitoring network.

Note that at the kick off meeting (15th Sept 2022) the NHS noted that resistivity equipment was available in Belize. Consultant team indicated that our proposed approach was to use existing borehole records and maps to compile 3D information on the aquifer due to the uncertainty associated with the scope and extent of resistivity mapping. This can be re-evaluated when the extent of borehole log data becomes known.

Output 3 Deliverables

- D 3.1 – 3.3: Assessment of groundwater demand and availability;
- D 3.4 Report on the geology of the New River watershed.

3.2.4 Output 4: Design of groundwater monitoring system

Activity 4.1: Defining the area to be monitored

As set out in Section 4 of our technical proposal we propose to use a risk based approach to defining the areas to be monitored. We will use multiple impact assessments (e.g. impacts on people, impacts on agriculture) and then combine these risks to develop either an overall score (e.g. 1 to 10) or overall cost impact (e.g. BZ\$4000). We are fully aware of the strengths and weaknesses of alternative technical solutions and a SWOT analysis of the various approaches will form part of the assessment process. *Note that the Consultant Team was requested by NHS and NCCO at Kick Off Meeting (15th Sept 2022) to explore options for an in person visit during Output 4 within the current project budget envelope. Consultant team currently determining optimal composition of team visits to maximise project benefit.*

Activity 4.2: Defining the information needs

A key aspect for the project is to determine what information is required by the different stakeholders and in what form and frequency. For instance providing detailed water quality information may not be as useful as

providing a red/amber/green status, particularly for those with less technical backgrounds. We expect wide consultation with the stakeholder group at this point.

Activity 4.3: Defining the monitoring objectives

Once we have identified the prioritization areas and the information needs we will define the monitoring objectives. This will include an extensive discussions with stakeholders to understand the requirements for the specific location of information and any site-specific requirements (such as specific monitoring around environmentally sensitive sites or vulnerable properties (such as hospitals dependent on groundwater)).

Activity 4.4: Benchmark and select the most appropriate technologies.

There are a number of different approaches to collecting data, and each has its own pros and cons. For instance water level data can be collected by using locally-based people to manually record water levels using a dipper tape or can be collected using pressure transducers which send frequent information using mobile phone technology.

We would identify the different technologies available to meet the monitoring objectives and work out costs and benefits of each type. We will produce a technical note which sets out the pros and cons of different approaches.

Activity 4.5: Organize a workshop with wider stakeholders and the SWG.

Once we have identified the prioritised areas, information requirements, monitoring objectives and considered the most appropriate technologies we will organise a stakeholder workshop to agree the recommendations from our work and agree the plan for the final phases of the project. We need to ensure wide stakeholder support at this stage, so this workshop will be important.

Activity 4.6 Design groundwater monitoring system for New River watershed

Once the system characteristics that seem the most suitable for Belize have been approved by the Stakeholder Working Group and the NDE, we will design the different components of the system. The design of this system will be detailed in a report along with an expected implementation plan.

Activity 4.7 Workshop with SWG

We will present the proposed design report and plan to the SWG for comment and refinement before it is submitted in its final version.

Output 4 Deliverables

- D 4.1 to D 4.3: Technical notes and minutes of meetings;
- D 4.4: Benchmarking report;
- D 4.5: Virtual workshop report;
- D 4.6 Monitoring system design report;
- D 4.7 Workshop with SWG and final version of monitoring system design report.

3.2.5 Output 5: Enabling factors for implementation and capacity building

Activity 5.1: Specification of costs for monitoring system

We will provide cost estimates for the proposed monitoring system at the scale of Belize, and conduct an assessment of the potential sources of funding and financing for the system.

Activity 5.2: Develop a Finance Strategy

Our financing expert will consider a range of different finance models and possible sources of finance, including both initial financing and long term funding arrangements for the sustainability of the system. We will produce a concept note for discussion with climate finance institutions. The concept note will need to

ensure the climate rationale is strongly articulated and the cost / benefit for a monitoring system, set against a 'do nothing' situation is made clear.

Activity 5.3: Institution assessment

Once the finance strategy note has been agreed, our financing expert will undertake a more detailed review of the institutional arrangements for the operation and long term sustainability of the monitoring system. As noted above the institutional arrangements for IWRM in Belize are in a state of flux, and we hope that this project can act as a catalyst to progress IWRM, the institutional assessment will be cognisant of the present and potential future institutional situations.

Activity 5.4: Feasibility analysis

Once the institutional assessment is complete and the SWG have agreed their preferred approach, we will determine a road map for the implementation of the monitoring system, which will include for instance when finance is required; a phased approach to developing the system and confirm earlier decisions about the data presentation.

The key deliverable from the project will be a roadmap which pulls together all the information and presents a time-bound plan for the development of the groundwater monitoring system. This will compile the outputs from:

Activity 5.5: Capacity Training

We will provide training, in Belize, on the roadmap, for instance describing approaches to water quality sampling and demonstrating the technology we propose to use (we can use suppliers to provide sensors for the training).

We will also discuss the rollout of the monitoring network and matters such as data management and storage.

We will provide each of the delegates with a copy of the report setting out the road map for implementation.

Output 5 Deliverables

- D 5.1: Cost analysis and finance strategy;
- D 5.2 Concept note;
- D 5.3 Proposal on implementation plan including institutional setting;
- D 5.4: Implementation roadmap (which contains the above elements);
- D 5.5: Copies of the road maps and summary for the training. Project closure report on the training and recommended next steps.

3.2.6 Progress reporting

In addition to the specified deliverables, we recommend that bi-monthly progress reports are prepared following completion of the inception phase. Following submission of the bi-monthly progress reports, catch-up calls with the client can be organised on an 'as needed' basis.

Each progress report will include activities undertaken during the month, planned activities for the following month and any deviation of progress against the agreed work plan. A summary of the finances in terms of invoices submitted, paid and remaining will also be included. The bi-monthly progress reports will ensure any issues or challenges are flagged and highlighted to the client at the earliest possible stage.

4 Work schedule

Our proposed % level of effort breakdown per output is given in Table 4.1 and our proposed work schedule for the project activities and deliverables is given in Table 4.2.

Table 4.1: Split of time input by project output

Output	Percentage effort (based on resource input)
Project Management	7%
Output 1: Development of work plan and related communication documents	4%
Output 2: Map Stakeholders and establish a Stakeholder Working Group	6%
Output 3: Assess groundwater availability and demand based on the available technical information	27%
Output 4: Design a fully integrated groundwater monitoring system (in priority areas)	28%
Output 5: Enabling factors for implementation: financing, institutional settings and capacity building	27%

Table 4.2: Work schedule

Outputs	Activities	Deliverables	2022				2023							
			September	October	November	December	January	February	March	April	May	June	July	August
Output 1: Development of work plan and related communication documents	Activity 1.1: Develop detailed Implementation Plan	Activity duration												
		Deliverable D.1.1	●											
	Activity 1.2: Develop a monitoring and evaluation plan	Activity duration												
		Deliverable D.1.2	●											
	Activity 1.3: Impact Statement of the CTCN technical assistance prepared at the start and updated at the end of the CTCN technical assistance	Activity duration												
	Deliverable D.1.3	●												
	Activity 1.4: A Technical Assistance Closure report	Activity duration												
		Deliverable D.1.4											●	
Output 2: Map Stakeholders and establish a Stakeholder Working Group	Activity 2.1: Conduct stakeholder's mapping	Activity duration												
		Deliverable D.2.1		●										
	Activity 2.2: Establish a Stakeholder Working Group (SWG)	Activity duration												
		Deliverable D.2.2		●										
	Activity 2.3: Conduct an inception meeting	Activity duration												
	Deliverable D.2.3													
Output 3: Assess groundwater availability and demand based on the available technical information	Activity 3.1: Information compilation	Activity duration												
		Deliverable D.3.1												
	Activity 3.2: Baseline analysis	Activity duration												
		Deliverable D.3.2												
	Activity 3.3: Analysis of the current and projected economic activities and the water demand on groundwater sources	Activity duration												
	Deliverable D.3.3													
	Activity 3.4: Map the groundwater resources of Belize in the prioritized area of the New River watershed	Activity duration												
	Deliverable D.3.4													
Output 4: Design a fully integrated groundwater monitoring system that will enable Belize to manage groundwater resources in the two priority areas	Activity 4.1: Defining the area to be monitored	Activity duration												
		Deliverable D.4.1												
	Activity 4.2: Defining information needs	Activity duration												
		Deliverable D.4.2												
	Activity 4.3: Defining monitoring objectives considering different users and data needs including topics such as uses of the land and nature conservation	Activity duration												
		Deliverable D.4.3												
	Activity 4.4: Benchmark and select the most suitable groundwater monitoring technologies	Activity duration												
		Deliverable D.4.4												
Activity 4.5: Virtual workshop to share similar experiences in the region and a meeting with the SWG to discuss the characteristics of the groundwater monitoring system	Activity duration													
	Deliverable D.4.5													
Activity 4.6: Design a groundwater monitoring system	Activity duration													
	Deliverable D.4.6													
Activity 4.7: Organize a virtual meeting with the SWG and the NDE to present the groundwater monitoring system and the implementation plan	Activity duration													
	Deliverable D.4.7													
Output 5: Enabling factors for implementation: financing, institutional settings and capacity building	Activity 5.1: Specification of required budgets for each monitoring objective	Activity duration												
		Deliverable D.5.1												
	Activity 5.2: Finance strategy	Activity duration												
		Deliverable D.5.2												
	Activity 5.3: Institutional assessment	Activity duration												
	Deliverable D.5.3													
Activity 5.4: Feasibility analysis	Activity duration													
	Deliverable D.5.4													
Activity 5.5: Training with relevant entities in the sector	Activity duration													
	Deliverable D.5.5													

5 Stakeholder management process

5.1 Considerations

Projects can encounter problems where there are multiple stakeholders and/or project steering groups. Although managing stakeholders should be planned at the bid stage and start of a project, it is actually a dynamic and iterative process that requires excellent communication skills and a great deal of adaptability, as well as careful planning. It can be very challenging but also highly rewarding. When done well, stakeholder engagement should enable you to maximise the benefits from your project. To carry out the project successfully we will:

- Identify and assess the needs and expectations of our stakeholders at the outset;
- Make sure that roles of key individuals are clearly defined;
- Implement the agreed plan, but also be open to the prospect of having to deal with the unexpected;
- Have an auditable system for filtering/ prioritising feedback and keeping a record of responses;
- Include potential issues/problems in the project risk assessment and identify mitigation actions;
- Use specialists in stakeholder engagement and facilitation.

5.2 Approach to stakeholder management

Stakeholders are individuals or groups with an interest in the project because they are involved in the work or affected by the outcome. Stakeholder management is important for this project as stakeholders ultimately determine the success or otherwise of the project by accepting or rejecting the project outputs. The approach to stakeholder management that will be implemented throughout this project is set out in Figure 5.1. This involves:

- Stakeholder identification through research, brainstorming and discussion between the project team;
- Stakeholder assessment to understand their needs or most important goals, their levels of interest and influence and how best to engage them;
- Planning communications by identifying who will communicate what, how and when;
- Engaging stakeholders throughout the project.

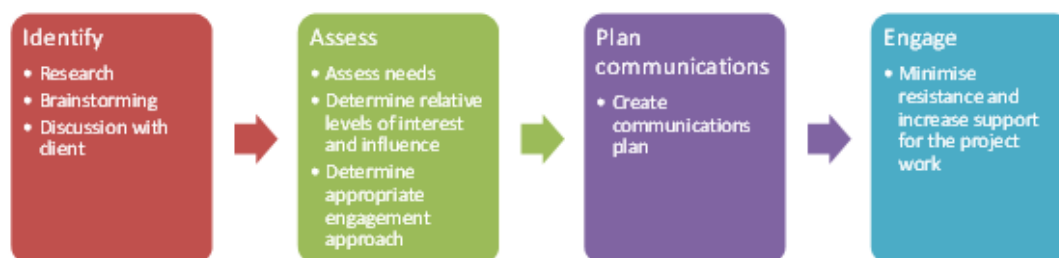


Figure 5.1: Stakeholder management process

The stakeholder assessment process aims to understand the needs and expectations of stakeholders as well as their relative levels of interest and influence in order to determine an appropriate engagement approach. Interest level indicates how much the project will affect them. Influence indicates how much their actions or decisions can affect the success of the project. This analysis is used to determine an appropriate engagement approach for each stakeholder, as shown in Figure 5.2.

The engagement approaches are³:

- Partnership: Shared accountability and responsibility. Two-way engagement joint learning, decision making and actions.
- Participation: Part of the team, engaged in delivering tasks or with responsibility for a particular area/activity. Two-way engagement within limits of responsibility. In this project, this approach relates to the stakeholders who will attend the workshops.
- Consultation: Involved, but not responsible and not necessarily able to influence outside of consultation boundaries. Limited two-way engagement: organisation asks questions, stakeholders answer. In this project, this approach relates to the stakeholders who will not attend the workshops but who may be able to provide information or ideas.
- Push communications: One-way engagement. The project team may broadcast information to all stakeholders or target particular stakeholder groups using various channels e.g. email, letter.
- Pull communications: One-way engagement. Information is made available, and stakeholders choose whether to engage with it e.g. web-pages, blogs, press releases.

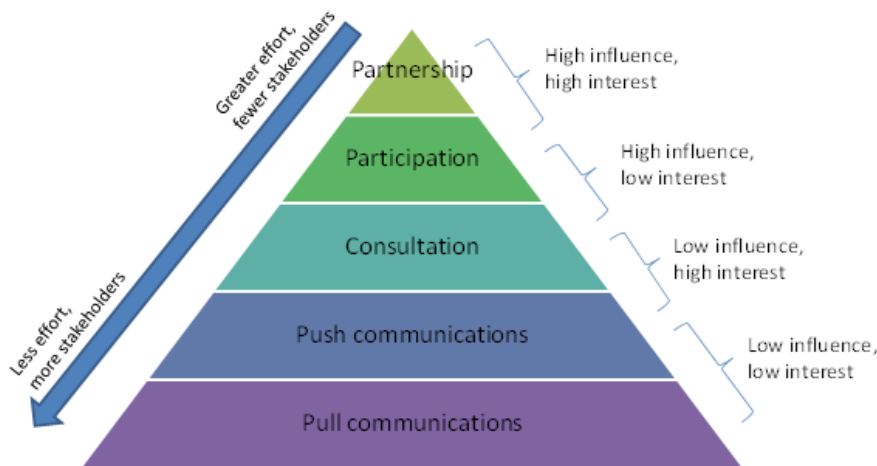


Figure 5.2: Stakeholder engagement approaches

Source: Based on <https://www.stakeholdermap.com/stakeholder-engagement.html>

5.3 Overview of the stakeholder engagement activities

Table 5.1 summarises the main stakeholder engagement activities within each of the project outputs, in addition to the regular dialogue between the consultant team and the client as set out in Section 8 on Communications.

³ Source: <https://www.stakeholdermap.com/stakeholder-engagement.html>

Table 5.1: Summary of project outputs and stakeholder engagement

Project output	Stakeholder engagement
Output 1: Development of work plan and related communication documents	<ul style="list-style-type: none"> Kick off meeting with CTCN and Belize representatives (National Climate change Office and National Hydrological Service)
Output 2: Map Stakeholders and establish a Stakeholder Working Group	<ul style="list-style-type: none"> Email or virtual meeting for NCCO and NHS to support identification of stakeholders. Inception meeting in Belize with consultant team and Stakeholder Working Group
Output 3: Assess groundwater availability and demand based on the available technical information	<ul style="list-style-type: none"> Ah-hoc communications between consultant team and NHS and SWG to identifying data and information.
Output 4: Design a fully integrated groundwater monitoring system (in priority areas)	<ul style="list-style-type: none"> Virtual workshop with SWG to discuss and agree the area to be monitored, information needs and monitoring objectives (<i>note Consultant Team requested at Kick Off Meeting to explore options for an in person visit during Output 4 within the current project budget envelope. Consultant team currently determining optimal composition of team visits to maximise project benefit.</i>) Virtual workshop with SWG and regional participants to share experiences in groundwater monitoring systems. Virtual meeting with SWG to discuss characteristics of the groundwater monitoring system. Virtual meeting with SWG to present monitoring system.
Output 5: Enabling factors for implementation: financing, institutional settings and capacity building	<ul style="list-style-type: none"> Face to face training meeting with SWG and other relevant stakeholders in Belize.

6 Gender analysis process

The project's outputs must be gender-responsive, in that they must take into consideration, the differential needs and circumstances of men/boys and women/girls. This Gender analysis will assist the Team in incorporating a gender perspective into the development of the groundwater monitoring system through taking account of the different needs, characteristics and behaviours of the affected groups.

In light of this purpose, the project will identify:

- Differential risks between men and women faced by issues with groundwater quality and quantity and the data and information needs to manage such risks;
- Potential gender participation gaps and entry points which may affect key outputs and outcomes;
- Stakeholders who are able to provide insight into needs, characteristics and behaviours of men/women and girls/boys; and,
- A Gender balanced Stakeholder Working Group.

7 Change management process

7.1 Changes in scope of work

All requests for changes to the technical scope or duration of a project must be checked against the project scope in the contract. If this check indicates that the scope needs to be modified and/or additional work is required then the **Project Manager** should:

- Discuss the required change with the **Team Leader**;
- Discuss any changes and additional work required with the client;
- Ensure discussion and agreement with the TA proponent and the Chair of the Stakeholder Working Group;
- Use a Contract Variation Order (CVO) (or equivalent as set out in the Contract) to agree/confirm variations with the client where changes require identifiable additional work. It is essential that any change in scope is formally recorded so that additional (or lesser) cost or time can be allocated.

7.2 Changes to technical approach

We may make changes to the technical approach as the project proceeds, for example, in response to the extent and quality of data and information available and as the project requirements are refined during implementation of the project. In such occasions:

- The **Team Leader** should discuss the change with **Project Director** and the **Project Manager**;
- If the change is to be implemented, the **Team Leader** must discuss its consequences with the **Project Manager**, and inform all appropriate staff;
- If the change has an impact on the overall timing or technical output of the project then the **Team Leader** must discuss it with the client;
- The **Team Leader** should discuss changes required by the client with the **Project Manager**;
- If a change could have a significant negative commercial impact for HR Wallingford, the **Responsible Director** should be informed and they will assess whether additional actions should be taken (e.g. advise our insurers or help manage any aspect of client or public relations).

All changes to the project are recorded in a Change Management Plan section of the implementation plan, together with comments on the likely impacts / mitigations.

8 Communications management

8.1 Communication requirements for the project

Table 8.1 includes details on the frequency of disseminating information relevant to the project, lists the project team members that need to receive or send information, the media best suited for the exchange of information and the purpose of communicating the information.

Table 8.1: Project communication plan

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
Weekly catch-up	Weekly meeting for the technical delivery team	weekly	Microsoft Teams call	Consultant team	Actions (email)	Azucena Rodriguez Yebra
Bi-monthly progress reports	To provide the client (CTCN and Belize) with an update on all project aspects (technical delivery, M&E, sustainability, issues, risks)	Bi-monthly	Report via email	Consultant team, CTCN, NDE, NHS	Report via email	Azucena Rodriguez Yebra
Monthly progress calls	To provide an update on all project aspects (technical delivery, M&E, sustainability, issues, risks)	Monthly	Microsoft Teams call	Consultant team, NDE, NHS, CTCN	Actions (email)	George Woolhouse
Stakeholder working group (SWG) meeting	To discuss progress to date and gather feedback on outputs	As per work schedule	Microsoft Teams call / in person	Consultant team, NDE, NHS, CTCN, SWG	Minutes with actions	George Woolhouse
Regional virtual meeting	To share knowledge and good practice on groundwater monitoring (technical, institutional, financial)	Once as per work schedule (Activity 4.5)	Microsoft Teams call	Consultant team, NDE, NHS, CTCN, SWG, Regional Participants	Meeting minutes and recommendations	George Woolhouse
Publicity items: website articles, blogs, press releases, sound bites.	For information and awareness raising	Ad hoc as needed/as appropriate	Website, twitter, LinkedIn, community meetings, conference, media	Consultant team, NDE, NHS, CTCN	Ad hoc as needed/as appropriate	Consultant team

9 Quality management process

A process of continual development and improvement is inherent in the HR Wallingford quality assurance management systems. This is implemented as an ongoing process based on the 'Plan, Do, Check, Act' cycle, details of which are provided below. This process will continue to drive improvements in quality assurance on work delivered to the Environment Agency as a Collaborative Delivery Team (CDT) partner through the Collaborative Delivery Framework.

Plan - We identify all quality, health & safety, and environmental aspects of our activities, products and services. We also identify any legal requirements that we have to comply with. Management sets out a Quality, Health, Safety and Environment (QHSE) policy and sets targets for improvements that are related to compliance with legal requirements and to our performance.

Do - We implement our improvement plans and work and conform to our own procedures and instructions. In areas where we already comply with legal requirements, we make sure that this remains the case. All activities aimed at maintaining the present level can be seen as assurance measures which are illustrated by the orange wedge in the diagram above.

Check - We monitor the performance we achieve with our QHSE Management System. Monitoring is directed both at our means of assurance and to our improvement plans.

Act - Management evaluates in a management review all results of the previous year and sets direction and new objectives for the coming period. In this stage, management also looks at legislation and new developments in our undertaking that are relevant to our QHSE Management System and which might require additional actions for improvement. This stage results in new objectives and areas for improvement which leads back to the Plan stage again.

9.1 Quality management

HR Wallingford uses a quality management system to help us to meet our business objectives and to ensure that we continually improve our ability to deliver solutions that match our clients' requirements in an efficient, accurate and timely way. Our quality management systems are certified to ISO 9001: 2008 and ISO 9001: 2015 respectively.

9.2 Continual improvement for our projects, and recording corrective actions

We look for continual improvement in our project management. We have developed Quality Track (QTrac) to log issues, improve compliance and support continual improvement.

The issues we identify may require action to correct failings in existing processes and/or procedures. These are usually corrective action requests where the cause of the issue is addressed or corrections where we need to fix a problem or issue.

When we anticipate that changes are needed to prevent problems developing in the future, we can take preventative action. Often though we simply need to propose improvements to the way we do things; these issues are termed suggestions for improvement.

10 Risks and assumptions

Our standard practice is to identify and discuss risks at project inception and monitor these throughout the project, thus helping us to anticipate and avoid unexpected issues and avoidable delays. Table 10.1 summarises identified risks and assumptions and proposes measures which can contribute to reducing negative impacts, and these will be revisited and discussed during the inception phase. Assumptions are also identified in the M&E plan, which will also be revisited during project implementation to guide the implementation process and check assumptions are correct and are being managed appropriately.

Table 10.1: Project risks, assumptions and risk reduction measures

Risks and Assumptions	Risk reduction measures
Inputs to outputs	
Delays to the schedule as a result of delays in convening SWG	<ul style="list-style-type: none"> Ensure that stakeholder mapping and engagement with NHS and NCCO on SWG membership is kicked off early in the project, and that any significant obstacles to convening the SWG are identified and mitigated as early as possible; Ensure invitations to the SWG are provided in a timely manner and SWG members are made aware of the benefits of groundwater monitoring (and risks of non-monitoring) in relation to their specific mandates.
Lack of data and information	<ul style="list-style-type: none"> Identify information sources during inception phase to allow early action on collating and analysing available data; Utilise one-on-one communication with stakeholders to verify data availability and to source specific pieces of information, where this is known to be available; Maximise synergies with other projects and initiatives where relevant data are being collected and collated. Utilise Earth Observation and similar products to fill spatial and temporal gaps where possible
Stakeholders are not available to participate in workshops	<ul style="list-style-type: none"> Plan well ahead (e.g. min 2 weeks in advance) and avoid holiday periods etc; Use surveys in advance of workshops and meetings to collate feedback from those who are unable to attend Ensure stakeholders are included in the review of project deliverables and outputs if they are not able to attend workshops.
Scope of works creeps or shifts as project progresses	<ul style="list-style-type: none"> Record changes in scope which can be accommodated and note those which cannot be accommodated as potential areas for future work.
Interruption to work schedule due to natural hazards and/or Covid 19	<ul style="list-style-type: none"> Changes to schedule discussed and agreed with the Client as appropriate; Be conservative and assume Covid restrictions will remain in place (e.g. for travel, quarantine, etc.) and plan accordingly.
Lengthy review and comment on draft deliverables leads to work plan slippage	<ul style="list-style-type: none"> Agree timeframes in advance. Issue draft deliverables with clear and achievable deadlines for comment.
Output to outcomes	
Groundwater monitoring system fails to attract financing	<ul style="list-style-type: none"> Ensure economic case for investment is robust and clearly articulated Take lessons from across the region on the institutional, technological and financial factors in accessing financing for similar systems De-risk investment by taking a staged approach to deployment of groundwater monitoring system
Financial and technical capacity in beneficiary organisations limits the ability to proceed with groundwater monitoring	<ul style="list-style-type: none"> Through the feasibility and institutional analysis, identify follow-up support action and maintenance requirements necessary to progress and sustain the system, in consultation with administrators and users



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HR Wallingford is an independent engineering and environmental hydraulics organisation. We deliver practical solutions to the complex water-related challenges faced by our international clients. A dynamic research programme underpins all that we do and keeps us at the leading edge. Our unique mix of know-how, assets and facilities includes state of the art physical modelling laboratories, a full range of numerical modelling tools and, above all, enthusiastic people with world-renowned skills and expertise.

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