

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

D 4.7 - Stakeholder Working Group
closure meeting report

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1 Introduction

1.1 Project summary

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 in these areas.

Groundwater is also used as a source of drinking water in all districts in Belize, using rural water systems and Belize Water Services Limited (BWLS) wells. 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 area includes the New River watershed.

The Nationally Determined Contribution (2022)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) is implementing a project to develop a Groundwater Monitoring System for the New River Watershed.

¹ Belize's Nationally Determined Contribution, 2022

<https://unfccc.int/sites/default/files/NDC/2022-06/Belize%20Updated%20NDC.pdf>

² Technology Needs Assessment for Adaptation, 2017

https://unfccc.int/tclear/misc_/StaticFiles/gnwoerk_static/TNA_key_doc/3db7d7bbba4c4deebecbc11fd24fb67d/5331353e87a0488e861d1fe6aca1b747.pdf

1.2 About this report

The purpose of this report is to detail the discussions held at the Groundwater Monitoring System Closure Consultation workshop held on June 7th, 2023. This report presents a summary of the presentation made to the Stakeholder Working Group (SWG), and details feedback from the SWG on the final design of the monitoring system. The feedback received provides inputs to finalising Output 4 of the Project- Design a fully integrated groundwater monitoring system that will enable Belize to manage groundwater resources in the New River watershed. Additionally, the report includes a detailed record of the consultation proceedings, including the participants present.

2 Stakeholder Working Group- Workshop

2.1 Objectives

The workshop set out to:

1. Provide an opportunity for organisation of the SWG to contribute to present the design of the groundwater monitoring system and the expected implementation plan for the New River watershed in northern Belize by facilitating discussions on the monitoring system and design options to incorporate final adjustments if needed.
2. Provide an overview of the next step and final output (Output 5 - Enabling factors for implementation: financing, institutional settings and capacity building).

2.2 Workshop Structure

The consultation was held over one and a half hours and utilised a presentation of the monitoring system and implementation plan. The discussion set out to respond to four key input areas including: locations for monitoring; implementation plan; costing; data dissemination and access.

2.3 Participation

SWG members from 7 of the 10 SWG agencies attended the Inception Meeting. Agencies present were:

1. National Hydrological Service (NHS) - Ministry of Natural Resources, Petroleum & Mining;
2. National Climate Change Office (NCCO) - Ministry of Sustainable Development, Climate Change & Disaster Risk Management;
3. Belize Water Services Limited (BWSL);
4. Forest Department- Ministry of Sustainable Development, Climate Change & Disaster Risk Management;
5. Belize Sugar Industry- ASR Group;
6. Ministry of Economic Development (MED).

42% of participants at the workshop were female and 58% were male.

2.4 Discussion on initial design of groundwater monitoring system

The stakeholder working group representatives participated in this meeting to provide feedback on the final design area of the monitoring system for the New River. Generally, there was convergence in the feedback coming from the group, the results of which are presented below.

3 Workshop record

Date of meeting:	Time of meeting:	Place of meeting:	Recorded by:
07/06/2023	9:00am (4:00pm UK time)-10:30pm (5:30pm UK time)	Virtual (teams meeting)	HR Wallingford team

3.1 Attendees

Name	Organisation	Initials
Andrew Ball	HR Wallingford	AB
Azucena Rodriguez Yebra	HR Wallingford	ARY
George Woolhouse	HR Wallingford	GW
Nigel Walmsley	HR Wallingford	NW
Tennielle Hendy	National Hydrological Service (Belize)	TH
Gina Young	National Climate Change Office	GY
Adrian Zetina	Belize Sugar Industry- ASR Group	AZ
Lucien Chung	Local Project Assistant (for HR Wallingford)	LC
Elishah St. Luce	Communication and Gender Expert (for HR Wallingford)	EST
Minerva Gonzalez	Landscape Restoration Desk	MG
Leroy Martinez	Ministry of Economic Development	LM
Ian M. McMillan	Local Financial Specialist (for HR Wallingford)	IM
Hugo Rancharan	Belize Water Services Limited (BWSL)	HR
Elsa Cardinez	Ministry of Rural Transformation	EC

Apologies:

Marisela Ricardez Garcia - CTCN representative for Latin America and Caribbean.

3.2 MINUTES

Item No.	Item	Action
1	Welcome remarks. Welcome and introduction. Agenda: Present to the stakeholder working group, our proposed groundwater monitoring design and the thought process behind this for the New River Province, covering frequency and location of monitoring and costs Discussion questions regarding scheme.	
2	HR Wallingford presentation. Provided a project overview - working on output 4 (of 5) focusing on designing the groundwater monitoring system. Benefits of groundwater monitoring for quantity and quality. Defining the area to be monitored. Defining the information needs and monitoring objectives. Proposed monitoring system description. Implementation plan. Costs for system set up and operation. Information is summarised in the slide pack.	

Item No.	Item	Action
3	<p>General Questions:</p> <p>GY: Where will the automatic and manual stations be located? AB: Boreholes for monitoring groundwater salinity will be automated due to potentially rapid changes.</p> <p>GY: Would like the number of boreholes confirmed? GW: 27 boreholes, so will need to amend the uplift costs to reflect the number.</p> <p>TH: Would like the automated stations highlighted on the maps.</p> <p>TH: Would like to know more on the assumptions on the cost used for the community level monitoring? GW: Assumed 1 reading per week, at a cost of BZ\$10 for well dipping and simple handheld meter (temp, conductivity and pH). Fee used for the surface water monitoring so made an assumption</p> <p>TH: Have you specified a specific dipper. AB: Have a price for a particular model that is a fairly robust system and is well regarded, due to risk of damage. However, if there is already a recommend logger then we can use this.</p> <p>TH: Have tried to use a well dipper before, but they experienced that due to the type of tip and the sensor at the end, the weight moved away from the tape due to frequency of use (once every two months). What are some recommendations (currently use Stevens Water Systems). AB: Suggested that boreholes have dip tubes installed to reduce the change of tangling with cables etc. and this helps with the longevity of the dipper.</p> <p>TH: Their equipment was expensive, but after three years they were unusable. There is other equipment that measure EC, temperature and other parameters whilst doing dipped water, so they were looking at these types.</p> <p>AB: Really focused on reliability of equipment and estimated that a water quality meter will have a life of 3 years (and needs frequent calibration and are not particularly robust) and dip meter will have a life of 5 years. This has been included in the costing.</p> <p>TH: Frequency of the readings. AB: for the manual dips this will be once a week, although there could be some locations that could require more frequency, and 15 minutes for the automated dips.</p> <p>TH: When monitoring for a hydrological drought, is once a week sufficient frequency. AB: There could be sites that we become concerned about, especially if we are seeing large fluctuations. However, this would be the exception and not the norm.</p> <p>TH: Once we have this network in place over time, we can change the frequency of monitoring, to once per week. AB: Agreed. TH: Initially, they would do much higher frequency for the groundwater stations and then decrease to once a week. So initially it will be more expensive, so this needs to be captured in the costing. AB: Once a day will be good to start with, although this can could be different for a couple of sites, and then this can be toned down to once a week.</p>	

Item No.	Item	Action
4	<p>Discussion Questions: Locations for monitoring – are we missing any important areas? GY: Are there 5 new boreholes proposed? AB: We have chosen a particular boreholes, but there are other ones close by the end. GW: For those without boreholes nearby it could be a case of drilling a new one, but there may be some existing ones that are unmarked on the map? TH: Some locations have been selected under a complimentary project, so on the same page. Starting out, this is good, but as we go to the analysis we could see some gaps but we may need expand the network. In the East of the area, we might need see a need to put stations in there eventually. However, we may need to drop some of the locations based on commonalities. Implementation Plan – reasonable balance of ambition and realism? TH: Concern with salinity wells, the type of equipment is crucial as has had previous issues with corrosion. Requires equipment that can deal with high levels of salinity. Costing – comments on costs and assumptions? GW: Developed a spreadsheet cost model, which is quite flexible so these cost estimates are based on best knowledge but we can refine them should any further information comes in. Data dissemination and access – how would users wish to access the data? Raw data/ annual summary reports? TH: The Ministry in partnership with the Department of Environment has secured a database The Water Information Systems by Kisters Internationals (WISKI). Currently migrating data to this, and conducting training and it can store groundwater. Implementation is ongoing. ARY: This is addressed in the report. AB: If we have a data logger, can WISKI take the information straight from a data logger or does it have to go into a third party system. TH: We have programming abilities to send by FTP to help standardise and this support is built into the maintenance and software of licencing requirements.</p>	
5	<p>Next steps</p> <ul style="list-style-type: none"> ● The next activity is feeding into the final system design report (output 4) and then to accompany that, there is also a meeting report from this workshop. Feedback from this meeting will be integrated, and then sent to GY and TH. ● Once received comments and feedback from GY and TH, work will begin on output 5. ● Next stakeholder working group will be an in-country meeting in the first week in September. 	

A Appendix

A.1 Presentations

Presentation slides attached as a separate pdf document.

We design smarter, more resilient solutions across both the natural and built environment to help everyone live and work more sustainably with water.

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