CARIBBEAN DEVELOPMENT BANK

TECHNICAL ASSISTANCE - IMPLEMENTATION OF MULTI-HAZARD IMPACT-BASED FORECASTING AND EARLY WARNING SYSTEM FOR THE BELIZE RIVER WATERSHED BELIZE

Considered at the Three Hundred and Fourth Meeting of the
Board of Directors, December 12, 2023

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DECEMBER 12, 2023

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CARIBBEAN DEVELOPMENT BANK

THREE HUNDRED AND FOURTH MEETING OF THE BOARD OF DIRECTORS

TO BE HELD IN BARBADOS

DECEMBER 12, 2023

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TECHNICAL ASSISTANCE - IMPLEMENTATION OF MULTI-HAZARD IMPACT-BASED FORECASTING AND EARLY WARNING SYSTEM FOR THE BELIZE RIVER WATERSHED - BELIZE

1. REQUEST

1.01 By correspondence dated January 18, 2023, the Government of Belize (GOBZ) applied to the Caribbean Development Bank (CDB) for a technical assistance (TA) grant to support improving weather and climate data collection, modelling and analysis, conducting climate and disaster risk assessment, and providing training for public officers and the public in the use and application of the tools that will be developed to produce impact-based forecasting and early warnings for impending natural hazards.

1.02 The estimated cost of the TA project is one million (mn), two hundred and sixty-four thousand, eight hundred and ninety-six United States dollars (USD1,264,896), of which one million, two hundred and twenty-five thousand, eight hundred and ninety-six United States dollars USD1,225,896 is provided from CDB's Special Funds Resources (SFR) allocated from the Caribbean Action for Resilience Enhancement (CARE) Programme and thirty-nine thousand United States dollars (USD39,000) from counterpart contribution.

2. BACKGROUND

2.01 Belize's population was estimated at 444,802 (222,404 males and 222,398 females) in 2022[1]. The country is prone to natural hazards such as heat waves, floods, droughts, tropical storms and hurricanes. Several human, technological and financial capacity constraints coupled with unregulated land use and development contribute to increasing Belize's vulnerabilities to natural hazards, which often result in significant damage to infrastructure (e.g. roads, housing, schools, water supply network) and livelihoods. In addition, uncertainties associated with climate predictions and potential increased impacts of climate-related events make the process of adequately preparing, responding and adapting to those events more difficult for decision makers, as available resources remain limited to address the spectrum of development priorities. Belize City is the most populated urban area in the country with 66,083 inhabitants or 15.4% of the country's population, and it is extremely vulnerable to weather events, which often have disproportionate impacts on the most vulnerable groups inclusive of women, children, youth, the elderly and the disabled. Recently, several hurricanes and heavy rainfall events have affected Belize City including the severe flooding event of October 2015 and Hurricanes Earl in 2016, Iota in 2020 and Lisa in 2022. These events have revealed, inter alia, the weaknesses of the national hazard early warning system (EWS) in terms of predicting and forecasting natural hazards and generating timely and accurate warnings to the communities and sectors at risk.

2.02 The World Meteorological Organisation (WMO) is promoting impact-based forecasting to help countries adapt to climate change (CC) extremes and variability and reduce disaster impacts. Impact-based forecasting is critical to supporting evidence-based planning and decision making. It also entails informing

[1] 2022_Abstract_of_Statistics.pdf (sib.org.bz)

the public of not only what the weather is likely to be, but also what the weather could do. Therefore, vulnerable communities could be better prepared for any eventual adverse impacts from extreme weather events.

2.03 Given its high vulnerability to climate-related hazards and as member of WMO, Belize is focusing on strengthening its capacities for climate data collection, impact-based forecasting and climate services under the lead of the National Meteorological Service (NMS) of Belize and in collaboration with other key national entities such as the National Emergency Management Office (NEMO) and regional institutions with relevant expertise such as the Caribbean Institute for Meteorology and Hydrology (CIMH).

2.04 The NMS is a department within the Ministry of Sustainable Development, Climate Change and Disaster Risk Management. The department is comprised of 20 technical staff members and 10 administrative/support staff members, headed by a Chief Meteorologist who oversees its administration and management (see Organisational Structure at Appendix 1). The Chief Meteorologist is assisted by the Deputy Chief Meteorologist. Apart from the administration section with supporting staff, the department has three main functional units/sections: weather analysis and forecasting, agro-climatic, and electronics and information technology. The technical team includes six meteorologists with Bachelor of Science degrees in meteorology and related fields, three electronic technicians skilled in equipment maintenance, programming, web development and radar maintenance, along with several other meteorological assistants assigned to perform various tasks such as weather observation, data quality control and analysis, data entry, instrument installation repair, and general maintenance. To ensure business continuity in the face of disaster events, the department maintains an annual operation plan, a hurricane plan, and a staff continuity plan.

2.05 The department's material assets include a doppler radar, an extensive network of automatic weather stations (AWS), a lightning detection network, an upper-air observing system, two field vehicles and a staff van. Operational funding primarily relies on annual budget allocation of BZD1.6 mn (USD800,000) from the GOBZ. Approximately 80% of this allocation supports salary and emoluments, with the remaining 20% allocated for operating and maintenance costs. As a result, the department often seeks donor funding to execute TA and capital projects, as well as to strengthen staff capacities for weather analysis, impact-based forecasting and climate services.

2.06 In August 2022, NMS collaborated with WMO to convene a high-level meeting on the establishment of a National Framework for Weather and Climate Services (NFWCS) for Belize. The NFWCS aims to respond to the growing need of users of climate information countrywide, using science-based weather and climate predictions and services focused on sectors such as agriculture and food security, disaster risk reduction, energy, health, and water. The NFWCS will serve as a critical mechanism for coordinating, facilitating and strengthening collaboration among national institutions to the co-production, tailoring, and delivery of climate services in alignment with the WMO-led Global Framework for Climate Services. The meeting agreed that NFWCS needs to advance efforts to reduce disaster risks and impacts associated with hydrometeorological hazards on these key sectors and the most vulnerable groups, including female-headed households, socially isolated men and women, the elderly, youth and boys and girls. The NFWCS follows a structured step-process:

(a) Step 1: Assess the baseline on climate services capacities at the national level to identify users and providers, map existing services and establish capacities.

(b) Step 2: Organise a national consultation workshop on climate services to bring together stakeholders, identify gaps and define key elements for an action plan to implement the NFWCS.

(c) Step 3: Develop a national strategic plan and costed action plan for climate services to establish NFWCS.

(d) Step 4: Gain endorsement for the strategic plan and costed action plan, complete with implementation timelines for the NFWCS.

(e) Step 5: Officially launch the NFWCS, implement the national action plan for climate services, and rigorously monitor and evaluate its effectiveness.

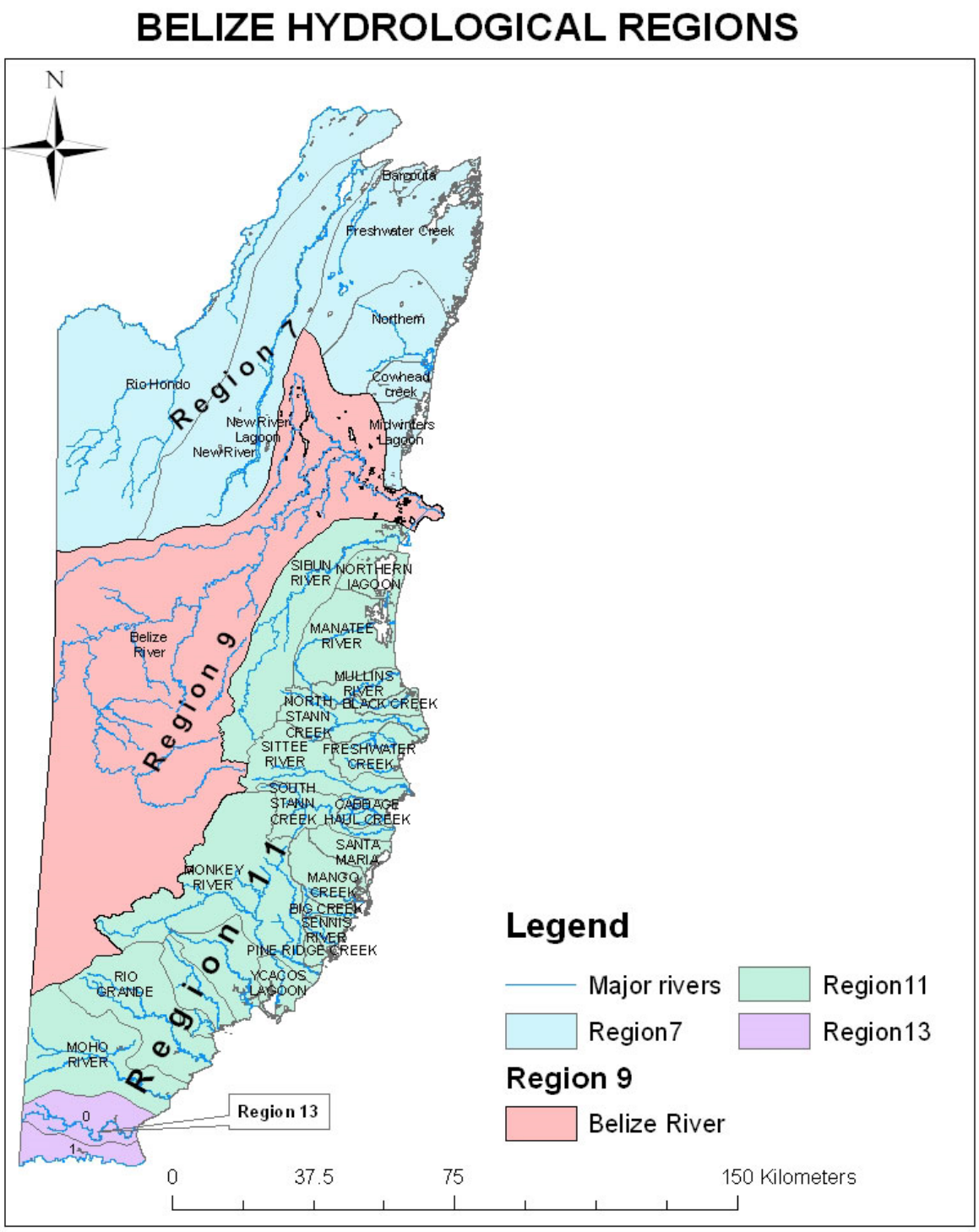
As of now, Belize has successfully completed steps 1 and 2 of this process.

2.07 In Belize, multiple EWS projects have primarily focused on enhancing community resilience, particularly against riverine flooding. The International Cooperation and Development Fund of Taiwan supported a project covering the lower Belize river watershed from San Ignacio to Belize City. In its initial phase, the project engaged with the San Ignacio community, and its second phase with downstream villages. One key aspect of this effort involved the acquisition of water level sensors for monitoring the Belize river's water levels. The Energy Resilience for Climate Adaptation Project focused on the upper Belize River watershed, specifically for flood control measures, aimed at minimising the potential consequences of dam spillage or a dam breach on the Macal River. There are draft proposals submitted to the Adaptation Fund to establish a coastal early warning project for hazards such as hurricanes, storm surges, and sea level rise. Simultaneously, under the Integrated Water Resource Management Readiness project, a flood model is under development to address flooding in the New River watershed.

2.08 One of the strategic goals of the NMS is to streamline and enhance the collaborative efforts of existing and future projects and to implement impact-based forecasting across the entire country as an integral part of a people-centered multi-hazard impact-based forecasting (MH-IBF) EWS. However, this requires additional financial and human resources. The proposed project will support NMS' efforts towards achieving these goals and will focus on Belize City area and the communities[2] within the Belize River Watershed. Figure 1 shows the project area - the Belize River Watershed highlighted in pink as Region 9.

[2] Communities of San Ignacio, Bullet Tree, Santa Familia, Iguana Creek, Roaring Creek, Burrell Boom, and Cooked Tree.

FIGURE 1



Map of Belize Hydrological Regions (Sources NHS)

3. ISSUES AND CONSTRAINTS

3.01 Belize is highly exposed and vulnerable to hydrometeorological hazards, which frequently result in disasters, affecting substantially key economic sectors and the population. The value of annual average loss from hurricanes is estimated at USD7.7 mn (0.45% of gross domestic product [GDP]) and the probable maximum loss from hurricanes (250-year return period) can be as high as USD383 mn or 22.6% of GDP[3]. Based on CC projections, the Caribbean, and by extension Belize, is expected to experience more frequent major hurricanes. However, the existing multi-hazard EWS in Belize are not sufficiently robust to help effectively minimise loss of life in the most vulnerable communities and reduce damage to property and livelihoods. The gaps in EWS in Belize are related *inter alia* to limited observation network coverage for data collection and transmission in near real time, the weak capacities of NMS and NEMO staff to produce and deliver accurate forecasts and warnings to the at-risk population, and inadequate awareness of the latter to respond timely to the warnings. Currently, financial and human resources are insufficient to facilitate establishing more effective EWS in Belize.

4. PROPOSAL

4.01 It is proposed that CDB approve a grant to the GOBZ in an amount not exceeding the equivalent of one million, two hundred and twenty-five thousand, eight hundred and ninety-six United States dollars (USD1,225,896) from CDB's SFR allocated from the CARE Programme, to assist with financing consultancy services and procurement of goods and services for implementing multi-hazard impact-based forecasting and EWS for Belize including to:

(a) Improve current observation network, modelling and analysis tools, including:
  (i) Procurement of computer systems and components to support data retrieval, processing and programming.
  (ii) Procurement of weather stations parts (dataloggers, cell modems, satellite transmitters, rain gauges, temperature sensors, temperature and relative humidity sensors, wind sensors, solar radiation sensors, and barometers).
  (iii) Procurement and installation of a Geonetcast-Americas Satellite Reception System.
  (iv) Engagement of consultancy services to establish high availability kubernetes server cluster and enhance/update existing applications that will be made available on cluster.
  (v) Engagement of consultancy services to update and expand flood EWS (FEWS) and conduct training on FEWS operation, configuration, and maintenance.
  (vi) Acquisition of additional tsunami equipment for at-risk coastal communities.

(b) Undertake risk analysis and vulnerability assessment and develop multi-hazard maps.

(c) Establish reliable and operational forecasting and warning systems including:
  (i) Design/update and implementation of common alerting protocols (CAP).
  (ii) Development of a knowledge and decision support system and tools for IBF and timely communication and dissemination of all-hazard alerts.
  (iii) Implementation of a public awareness campaign on hazard risks for communities in the Belize River Watershed.

(d) Improve NMS and NEMO technical staff capacity, including:

[3] Belize.pdf (gfdrr.org)

(i) Training needs assessment for NMS and NEMO staff in network/database management, data processing, meteorology, impact-based forecasting, computer science, multi-hazard EWS.
(ii) Preparation and delivery of relevant training in AWS maintenance, weather-data quality control, data transfer and storage, computer networking, systems administration, cloud computer, containers and virtualizations, R-Instat Software and Python, meteorology, climatology, impact-based forecasting and multi-hazard EWS.
(iii) Delivery of training in R-Instat software and Python for preparation, processing and analysis of weather and climate data and information.
(iv) Capacity building/training in AWS Training from CIMH.
(v) Post-graduate training in Networking and System Administration through distance-learning.
(vi) Training at the undergraduate level in meteorology and computer science through on-campus learning at the University of the West Indies[4].

5. OUTCOME

5.01 The expected outcome of the project is improved institutional capacity of NMS and NEMO to deliver effective early warning and climate services. A Results Monitoring Framework is presented at Appendix 2 and the Work Implementation Schedule at Appendix 3.

6. JUSTIFICATION AND BENEFITS

6.01 Climate and hazard data and information are critical to understand and assess potential disaster risks and impacts on economic sectors as well as to design and implement robust EWS to save lives and minimise loss and damage of properties and livelihoods. They can therefore, support decision-making and planning for adequate climate resilience and disaster risk management (DRM) interventions. In Belize, the expansion/update of the observation network is necessary to collect more reliable data and produce more accurate forecasts and warnings to the at-risk population and support climate resilient interventions in key economic sectors. The project will improve the observation network in the Belize River Watershed.

6.02 This project will also address the urgent need for a more proactive and inclusive climate and DRM mechanism/framework in Belize with a focus on a people-centered MH-IBF-EWS. Institutional strengthening and capacity building is a key component for the successful implementation of the MH-IBF-EWS. The project will support relevant training in forecasting and for managing the local computer network in keeping with internationally regulated standards. Staff of the NMS will acquire skills in meteorology, climatology, and computer science. The public awareness campaign in the Belize River Watershed communities (San Ignacio, Bullet Tree, Santa Familia, Iguana Creek, Roaring Creek, Burrell Boom, Crooked Tree, Belize City) will help enhance risk awareness and prompt adequate responses to warnings, ultimately saving lives and protecting livelihoods and properties.

6.03 In addition to financing interventions to increase availability of, and access to, climate data and information by upgrading the observation networks and to build capacities of NMS and NEMO, the project will strengthen resilience of the most vulnerable people and communities as well as key sectors such as health, agriculture, water, energy and tourism. This will be achieved through effective user-focused

[4] The University of the West Indies (UWI) offers a competitive undergraduate programme in meteorology and computer science. Affiliated with UWI, the CIMH primarily delivers the Bachelor of Science programme in meteorology. CIMH is the regional organisation for training and research in meteorology, climatology, hydrology, and agro-meteorology in the Caribbean. It serves as a repository for climate data from the Caribbean Meteorological Organization Member States and is recognised by the WMO as the WMO regional training centre for meteorology and hydrology in the Caribbean. CIMH is committed to assisting the NMS of Belize with the implementation of this technical assistance project.

weather and climate services. As designed, the project shall enable the development and management of effective EWS and response mechanisms in the Belize River Watershed. Technical support on the design of impact-based multi-hazard EWS, IBF models, risk information, dissemination mechanisms and procedures will help NMS and NEMO develop/enhance an integrated observation, forecasting and communication system that is suitable for the project area and expandable to the rest of the country. The central database, web-based platforms and tools will provide easy access to and enhanced integration of forecast information, for planning and decision-making. As such, the project will promote timely responses to imminent threats, preservation of life, and the design of relevant interventions to build resilience in key climate-sensitive sectors.

6.04 In addition to direct beneficiaries such as NEMO and NMS, the project will benefit indirectly approximately 127,683 end users (63,102 males and 64,581 females) located in the Belize River Watershed, as they will have access to IBF and timely warnings for multiple hazards such as flood, storm surge, strong wind, and extreme heat.

6.05 Based on CDB's Performance Rating System, the project has been assessed as highly satisfactory with an overall score of 3.5. A summary of the project performance score is shown in Table 1, and the detailed Performance Rating System at Appendix 4.

TABLE 1: PROJECT PERFORMANCE SCORE SUMMARY

Criteria	Relevance	Effectiveness	Efficiency	Sustainability	Overall Score Highly Satisfactory
Score	4	3	3	4	**3.5**

7. GENDER MARKER AND PERFORMANCE ASSESSMENT

7.01 The Project is assessed as gender mainstreamed (GM) based on CDB's Gender Marker, having scored a total of three points. The gender marker is summarised in Table 2 below. Please see Appendix 5 for further details on the gender marker and performance assessment.

TABLE 2: GENDER MARKER SUMMARY

GM	Analysis	Design	Implementation	Monitoring and Evaluation	Score	Code
	0.5	0.5	1.0	1.0	3.0	GM

8. EXECUTION

8.01 The project will be implemented by GOBZ through the Ministry of Economic Development (MED), which is responsible for coordinating all donor-financed DRM and climate projects. The MED will provide oversight to ensure that the project is effectively implemented and that project progress reports are prepared timely and submitted to CDB. The NMS of Belize will lead the technical aspects for the execution of project activities and review/validate deliverables with the support of the NEMO, Ministry of Sustainable Development, Climate Change and Disaster Risk Management. A Project Coordinator (PC) will be engaged and assigned responsibility for the overall implementation and management of the project, as well as the project monitoring and evaluation. The PC will report to the Chief Meteorologist and will be required to provide progress updates to the Project Steering Committee (PSC) that will be created to provide

overall oversight of the project. The terms of reference (TOR) of the PC is presented at Appendix 6. The establishment of the PSC and the engagement of the PC shall be conditions precedent to the first disbursement of the Grant.

8.02 The PSC will be co-chaired by the Ministry of Sustainable Development, Climate Change and Disaster Risk Management and the MED. The committee will include key project stakeholder who will serve as a critical oversight and decision-making body to ensure successful project implementation in alignment with CDB's policies and procedures. The PSC's composition, roles and responsibilities are shown in Appendix 7.

8.03 Consultants will be engaged to provide services as set out in the TORs shown at Appendix 8A to 8E. They will report directly to the PC.

8.04 CIMH will also support the implementation of project activities to build capacity of NMS and NEMO in the areas network/database management, weather and climate data processing, IBF and AWS maintenance. A letter of CIMH's commitment to the project is shown at Appendix 9.

8.05 GOBZ is expected to submit the initial grant disbursement application to CDB no later than March 31, 2024. The disbursement of the grant funds is scheduled to be completed by September 30, 2026.

9. COST AND FINANCING

9.01 The total cost of the project is estimated to be is one million, two hundred and sixty-four thousand, eight hundred and ninety-six United States dollars (USD1,264,896), of which one million, two hundred and twenty-five thousand, eight hundred and ninety-six United States dollars (USD1,225,896) will be provided by a grant through CDB from the CARE Programme, and thirty-nine thousand United States dollars (USD39,000) will be provided in kind from GOBZ.

9.02 The Financing Plan is summarised in Table 3. The main activities and the detailed budget are presented at Appendix 10.

TABLE 3: SUMMARY OF FINANCIAL PLAN

Contributors	USD	%
CDB	1,225,896	96.9
GOBZ	39,000	3.1
Total	**1,264,896**	**100**

10. PROCUREMENT

10.01 Procurement shall be in accordance with the CDB Procurement Policy for Projects Financed by CDB (November 2019) and CDB's Procurement Procedures for Projects Finance by CDB (January 2021). Financing shall be provided under the CARE agreement and thus, in accordance with that agreement, eligibility shall be extended to countries which are eligible for procurement under the European Union (EU)-funded Programme, in accordance with the EU Eligibility Rules and which are not CDB member countries. A procurement consultant will be engaged to expedite implementation under the project in accordance with the Terms of Reference at Appendix 11. The Procurement Plan is shown at Appendix 12.

11. RISK ASSESSMENT AND MITIGATION

11.01 The identified risks have been classified according to their relevance to the implementation and operational phases of the Project. Table 4 summarises these risks and potential mitigation measures to address them. An environmental, social, and climate and disaster risk assessment is presented later in this section.

TABLE 4: SUMMARY OF RISKS AND MITIGATION MEASURES

Risk Type	Level of Risk	Description of Risk	Mitigation Measures
Implementation	High	Limited human resource capacity within the NMS for project management.	Engage a PC and Procurement Consultant from CDB resources to support NMS.
		Extreme climatic events (hurricanes, flooding, storms, etc.) can impact project implementation.	Activities will be planned and carried out by taking into account the hurricane season and ensuring contingency plans are in place.
Operational	Medium	Limited use/application of the tools developed and impact-based forecasting and early warnings products and services.	NMS and NEMO will work collaboratively to ensure that developed tools, products and services are tailored to the needs of end-users. NMS and NEMO will continue to facilitate the interactions between producers and users of climate products and services.

Environmental, Social, Climate and Disaster Risk Assessment Summary

11.02 The project is anticipated to have no adverse environmental or social impacts. On the contrary, it is expected to deliver significant benefits for decisions-makers, practitioners and end-users of climate services across key economic sectors and within vulnerable communities in the Belize River Watershed. The project primary objective is to develop an effective EWS and response mechanisms within the Belize River Watershed. This effort will include technical support to enhance the observation, forecasting, and communication system of NMS and NEMO, with the potential for nationwide expansion. The introduction of centralized databases and web-based tools will greatly enhance access to forecast information, thereby facilitating more effective planning and decision-making processes.

11.03 The project geographical area is exposed to a range of natural hazards such as extreme temperatures, precipitation, flooding, prolonged drought, storm surges, strong winds, and sea level rise. Past occurrences of these hazards have led to significant damage to critical infrastructure like roads, schools, water supply networks, and various buildings.

11.04 The TA project is financing the upgrade to the observation network, including hydrometeorological stations and a robust computer system. These installations are designed to withstand natural hazards. Hydrometeorological stations, for example, are typically installed ten metres above ground level. The computer system is securely housed within an NMS facility equipped with hurricane shutters, which has never experienced flooding. The computer system incorporates physical redundancies and cloud-based

data storage to further build resilience against natural hazards and fire risks. Overall, the project is assessed as having a low risk of not achieving its expected outcomes.

12. RECOMMENDATION

12.01 It is recommended that the Board of Directors approve a grant to GOBZ of an amount not exceeding the equivalent of one million, two hundred and twenty-five thousand, eight hundred and ninety-six United States dollars (USD1,225,896), from CDB's SFR allocated from resources provided under the CARE Programme to assist GOBZ in financing consultancy services and the procurement of goods and services for implementing multi-hazard impact based forecasting and EWS for Belize on CDB's standard terms and conditions, and on the following terms and conditions:

No.	Subject	Terms and Conditions of the Grant
1.	**Parties**	Bank: Caribbean Development Bank (CDB). Beneficiary: Government of Belize (GOBZ).
2.	**Amount of Grant**	The Bank agrees to make available to the Beneficiary by way of grant, an amount not exceeding the equivalent of one million two hundred and twenty-five thousand, eight hundred and ninety-six United States dollars (USD1,225,896) from the Special Funds Resources (SFR) of the Bank allocated from the Caribbean Action for Resilience Enhancement (CARE) Programme (the Grant).
3.	**Purpose**	The purpose for which the Grant is being made is to assist the Beneficiary in financing consulting services and the procurement of goods and services for implementing multi-hazard impact-based forecasting and early warning systems for Belize, more particularly described in paragraph 4.01 of the Paper (the Project).
4.	**Disbursement of Grant**	Except as the Bank may otherwise agree, disbursement of the Grant shall be made by the Bank to the Beneficiary as follows: (a) an amount not exceeding the equivalent of sixty thousand, eight hundred and twenty-three United States dollars (USD60,823) shall be paid to the Beneficiary as an advance (the Advance) on account of expenditures in respect of the Project after receipt by the Bank of: (i) a request in writing from the Beneficiary for such funds; and (ii) evidence, acceptable to the Bank that the condition(s) precedent to first disbursement of the Grant has/have been satisfied; and (b) the balance of the Grant (the Balance) shall be paid to the Beneficiary periodically after receipt by the Bank of an account and documentation satisfactory to the Bank in support of expenditures incurred by the Beneficiary in respect of, and in connection with, the Project. The Bank shall not be under any obligation to make: (a) the first payment of an amount of the Balance until the Bank

No.	Subject	Terms and Conditions of the Grant
		shall have received an account and documentation satisfactory to the Bank, in support of expenditures incurred by the Beneficiary with respect to the Advance; (b) any subsequent payment of an amount of the Balance until the Bank shall have received: (i) an account and documentation, satisfactory to the Bank, in support of expenditures incurred by the Beneficiary in respect of or in connection with the Project; and (ii) the requisite number of copies of the reports or other deliverables, in form and substance acceptable to the Bank, required to be furnished by the Beneficiary to the Bank in accordance with: (aa) the Terms of Reference (TORs) for the Consultancy Services (as defined below); and (bb) the **Reporting Requirements** (as defined below); and (c) payments exceeding the equivalent of one million, fifty-nine thousand, seven hundred and ten United States dollars (USD1,059,710) representing ninety percent (90%) of the amount of the Grant until the Bank shall have received: (i) the requisite number of copies of the reports or other deliverables, in form and substance acceptable to the Bank, required to be furnished by the Beneficiary to the Bank in accordance with: (aa) the TORs for the Consultancy Services; and (bb) the **Reporting Requirements**; and (ii) a certified statement of the expenditures incurred by the Beneficiary in respect of, and in connection with the Project. The Beneficiary shall comply with the Bank's "*Disbursement Guidelines for CDB-Financed Projects*" published in January 2019, which may be amended from time to time by the Bank.
5.	**Period of Disbursement**	The Bank shall have received an application for first disbursement of the Grant by March 31, 2024, or such later date as may be specified in writing by the Bank. The Grant shall be disbursed up to September 30, 2026, or such later date as may be specified in writing by the Bank.
6.	**Procurement**	Except as provided below, procurement of goods, works and/or services to be financed from the Grant resources shall be in accordance with the following policy and procedures or such other policy or procedures as the Bank may from time to time specify in writing: *Procurement Policy for Projects Financed by CDB (November 2019)* *Procurement Procedures for Projects Financed by CDB (January 2021)*

No.	Subject	Terms and Conditions of the Grant
		Eligibility for procurement shall be extended to countries eligible for procurement under EU-funded projects, which are not Member Countries of the Bank. The Beneficiary shall comply with the procurement requirements set out in the **Procurement Plan**. Any revisions to the **Procurement Plan** shall require the Bank's prior approval in writing.
7.	**Additional Condition(s) Precedent to First Disbursement**	The Bank shall not be obliged to make the first disbursement of the Grant until the Beneficiary has furnished or caused to be furnished to the Bank, evidence acceptable to the Bank, that the following condition(s) have been satisfied: • the PSC had been established. • the PC has been engaged.
8.	**Condition(s) Precedent to Disbursement in respect of the procurement of Goods, Works, Consulting Services and Non-Consulting Services**	The Bank shall not be obliged to disburse any amount of the Grant in respect of the procurement of Goods, Works, Consulting Services and Non-Consulting Services until the Borrower has furnished or caused to be furnished to the Bank evidence acceptable to the Bank that the following condition(s) have been satisfied. • the Procurement Consultant has been engaged.
9.	**Project Implementation**	Except as the Bank may otherwise agree, the Beneficiary shall implement the Project through the Ministry of Economic Development.
10.	**Project Management**	The Beneficiary shall establish and, for the duration of the Project, maintain a PSC with the composition and functions set out at Appendix 7. The Beneficiary shall, in accordance with the procurement policy and procedures applicable to the Grant, engage as: (a) Project Coordinator, a person to carry out the duties and responsibilities set out at Appendix 6; and (b) Procurement Consultant, a person to carry out the duties and responsibilities set out at Appendix 11.
11.	**Engagement of Consultant(s)**	The Beneficiary shall, in accordance with the procurement policy and procedures applicable to the Grant, select and engage consultant(s) to provide the following consulting services (the Consulting Services): (a) Consultancy Services to Establish a High Availability Kubernetes Server Cluster for the National Meteorological Service of Belize

No.	Subject	Terms and Conditions of the Grant
		(b) Consultancy Services to Update and Expand Flood Early Warning Systems (FEWS) and Conduct Training on FEWS Operation, Configuration, and Maintenance. (c) Consultancy Services to Conduct a Risk Analysis and Vulnerability Assessment for the Belize River Watershed. (d) Consultancy Services for the Development of a Multi-Hazard Impact-Based Forecast and Early Warning System for the National Meteorological Service of Belize. (e) Consultancy Services for Capacity Building and Training for the National Meteorological Service and National Emergency Management Office of Belize. The Beneficiary shall, within a timeframe acceptable to the Bank, implement such recommendations arising from the Consulting Services, as may be acceptable to the Bank.
12.	**Beneficiary's Contribution to the Project**	Except as the Bank may otherwise agree, the Beneficiary shall: (a) meet or cause to be met: (i) the cost of the items designated for financing by the Beneficiary in the **Detailed Budget**; (ii) any amount by which the cost of the Project exceeds the cost set out in the **Detailed Budget**; and (iii) the cost of any other items needed for the purpose of, or in connection with, the Project; and (b) provide all other inputs required for the punctual and efficient implementation of the Project, which are not being financed by the Bank.
13.	**Reports and Information**	Except as the Bank may otherwise agree, the Beneficiary shall furnish or cause to be furnished to the Bank the reports and information required to be furnished to the Bank in accordance with the TOR for the Project Coordinator and the **TOR(s)** for the Consulting Services, in the form specified therein, or in such form or forms as the Bank may require, not later than the times specified therein for so doing (**Reporting Requirements**).
14.	**Additional Event(s) of Suspension, Cancellation and Refund**	The Bank shall be entitled to suspend, cancel or require a refund of the Grant, or any part thereof, if the whole or any part of the CARE Programme resources is suspended, cancelled or required to be refunded.

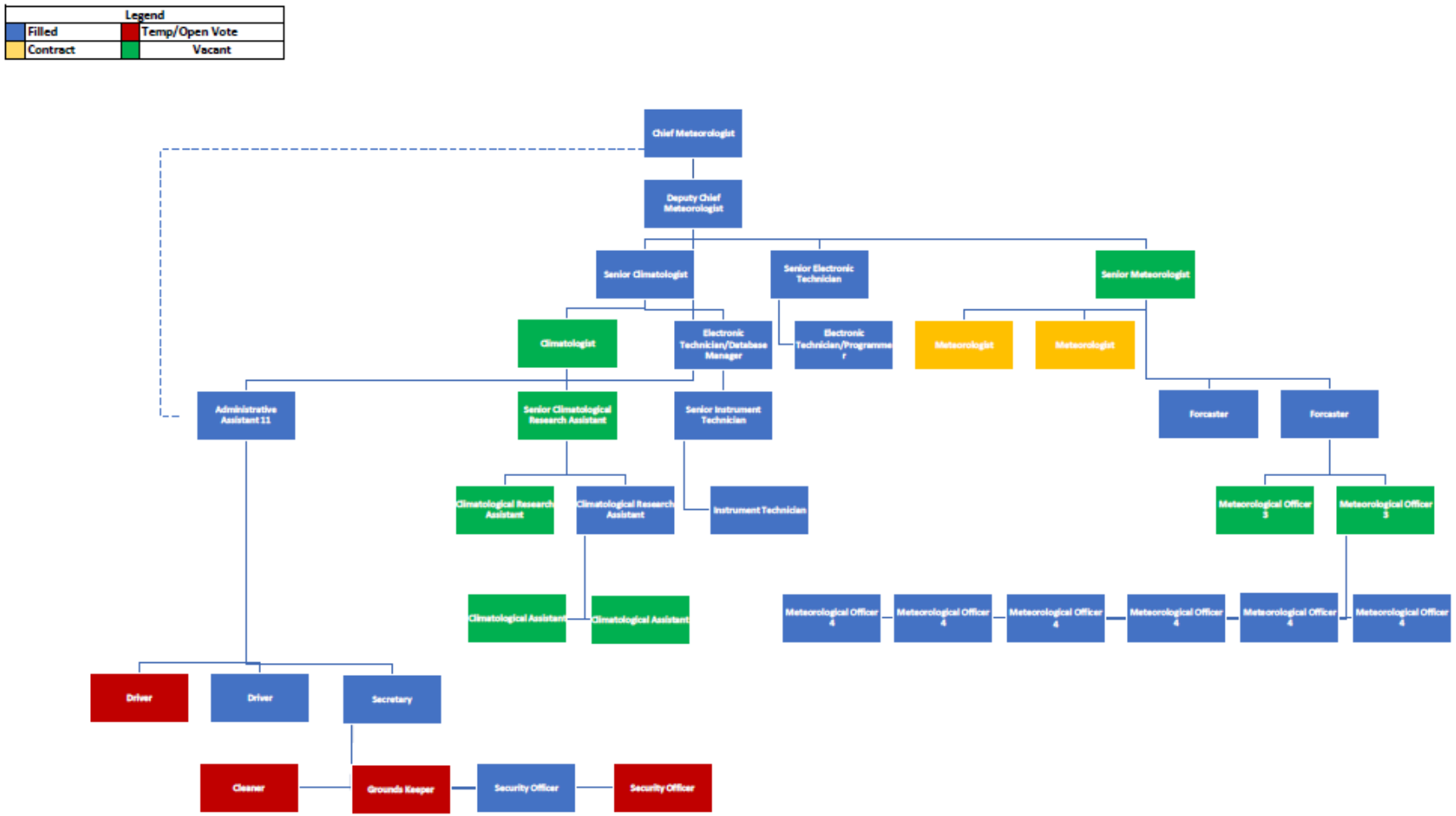
No.	Subject	Terms and Conditions of the Grant
15.	**CARE Programme Conditions**	Information and Visibility: Unless the European Commission requests or agrees otherwise, the Beneficiary shall take all appropriate measures to publicise the fact that the Action has received funding from the EU. Information given to the press, as well as all related publicity material, official notices, reports and publications shall acknowledge that the Action was carried out "with funding by the European Union" and shall display the EU logo (twelve yellow stars on a blue background) in an appropriate way. Publications by the Beneficiary pertaining to the Action, in whatever form and whatever medium, including the internet, shall carry the following disclaimer: "This document was produced with the financial assistance of the European Union. The views expressed herein can in no way be taken to reflect the official opinion of the European Union." Such measures shall be carried out in accordance with the Communication and Visibility Requirements for EU External Action published by the European Commission, or with any other guidelines agreed between the European Commission and CDB. Access and financial checks: • The Beneficiary shall allow the European Commission, or any authorised representatives, to conduct desk reviews and on-the-spot checks on the use made of the EU Contribution on the basis of supporting accounting documents and any other document related to the financing of the Action: • The Beneficiary agrees that the European Anti-Fraud Office (OLAF) may carry out investigations, including on-the-spot checks and inspections, in accordance with the provisions laid down by EU law for the protection of the financial interests of the EU against fraud, corruption and any other illegal activity. • The Beneficiary undertakes to provide officials of the European Commission, OLAF and the European Court of Auditors and their authorised agents, upon request, information and access to any documents and computerised data concerning the technical and financial management of operations financed under the Agreement, as well as grant them access to sites and premises at which such operations are carried out. The Beneficiary shall take all necessary measures to facilitate these checks in accordance with its Regulations and Rules.

SUPPORTING DOCUMENTATION:

Appendix 1:	Organisational Structure
Appendix 2:	Results Monitoring Framework
Appendix 3:	Work Implementation Schedule
Appendix 4	Performance Rating System
Appendix 5	Gender Marker System
Appendix 6	Draft TOR - Project Coordinator
Appendix 7	Composition, Roles and Responsibilities of the Project Steering Committee
Appendix 8A	Draft TOR - Consultancy Services to Establish a High Availability Kubernetes Server Cluster for the National Meteorological Services
Appendix 8B	Draft TOR - Consultancy Services to Update and Expand FEWS and Conduct Training on FEWS Operation, Configuration and Maintenance
Appendix 8C	Draft TOR - Consultancy Services to Conduct Risk Analysis and Vulnerability Assessment for the Belize River Watershed
Appendix 8D	Draft TOR - Consultancy Services - Development of a Multi-hazard Impact-Based Forecast and EWS for the NMS
Appendix 8E	Draft TOR - Consultancy Services - Capacity Building and Training for the NMS and NEMO of Belize
Appendix 9	Letter of Commitment - CIMH
Appendix 10	Detailed Budget
Appendix 11	Draft TOR – Procurement Consultant
Appendix 12	Procurement Plan

APPENDIX 1

ORGANISATIONAL STRUCTURE



APPENDIX 2

RESULTS MONITORING FRAMEWORK/LOGICAL FRAMEWORK

Results chain	Indicator	Baseline (value and reference year)	Target (value and reference year)	Source and means of verification	Assumptions
Impact: Reduce the impact of extreme weather events for at least 12000 people in Belize City and surrounding communities along the Belize River basin					
Outcome Improved Institutional capacity of NMS and NEMO to deliver effectively early warnings and climate services.	Percentage of residents (disaggregated by sex) in Belize City and Belize River Watershed receiving timely and accurate warnings.	0***	75% by project year (PY) 3.	Surveys residents in Belize City and Belize River Watershed. Project final report and technical publications by NMS and NEMO.	NMS and NEMO actively engage communities in Belize City and Belize River Watershed during project implementation.
	Observation network repair time.	2023 60 days	4 days by PY3.	Periodic project progress reports. CDB supervision reports.	Spare parts available Technicians trained for troubleshooting and repair.
Outputs Current observation network, modelling and analysis tools upgraded.	Number of weather stations equipment installed or upgraded.	0	10 by PY 2.	Periodic project progress reports. CDB supervision reports.	Weather stations or parts procured. Transportation provided timely by NMS to technicians to install and/or upgrade weather stations.
					.
	Geonetcast-Americas (GNC-A) Satellite operational.	-	By the end of PY2 GNC-A operational and used by NMS. Maintenance and operation training delivered to four staff.	Periodic project progress reports. CDB supervision reports.	GNC-A procured and installed.

Results chain	Indicator	Baseline (value and reference year)	Target (value and reference year)	Source and means of verification	Assumptions
	Number of essential applications and tools (Kubernetes cluster, Weather Research and Forecasting (WRF), PLUVO, WIMP and Surface) that are operational.		Four by the end of PY2.	Periodic Project Progress reports.	Kubernetes Cluster installed, Weather Research and Forecasting (WRF) model enhanced, PLUVO updated, WIMP and SURFACE migrated.
	Flood EWS in the Belize River Basin updated.	-	By the end of PY2. .	Final Consultancy Report on Flood EWS in Belize River basin.	Consultancy services engaged to upgrade the Flood EWS in the Belize River Basin. NMS provided guidance and worked collaboratively with stakeholders and the consultant.
Risk analysis and hazard maps.	Acceptance of Risk assessment report. Timely updates of hazard maps.	- -	By the end of PY2. By the end of PY2.	Final Risk assessment report. Report/files of hazard maps.	Consultant engaged and delivered the services.
Reliable and operational forecasting and warning system established.		-		.	

Results chain	**Indicator**	**Baseline (value and reference year)**	**Target (value and reference year)**	**Source and means of verification**	**Assumptions**	
	Weather and forecasting dissemination tools developed.	-		By end of PY2.	Consultancy report/ Project progress report.	Consultant engaged in time and delivered the services.
	Multi-Hazard Platforms developed to provide early warning to residents in the targeted areas, Impact-based forecasting software/tool installed or designed and communicated and disseminated.			By end of PY2	Consultancy report/ Project progress report	Consultant engaged in time and delivered the services.
4. NMS and NEMO staff are equipped to effectively manage EWS	Number of staff (disaggregated by sex) improving their skills in network/database management, data processing, meteorology, impact-based forecasting, computer science, multi-hazard early warning systems.	0	15 by end of PY3			

*** The baseline, set at zero, does not mean the current value is zero. Instead, it indicates that achieving the defined target is directly linked to the successful implementation of this TA project.

APPENDIX 3

PROJECT IMPLEMENTATION SCHEDULE

			v												2025												2026								
ACTIVITY	**Days**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**
CDB Board Approval	1	■																																		
Sign Grant Agreement	30		■																																	
Meet Grant Conditions Precedent to 1st Disbursement	90		■	■	■																															
Project Launch Workshop	30				■																															
Project Steering Committee	943		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Project Coordinator	729				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■								
Procurement Consultant	65				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■															
Update Weather and Climate Observation Network																																				
• Procure weather station parts	150													■	■	■	■	■																		
• Procure computer systems and components	120													■	■	■	■																			
• Procure GNC-A Satellite reception system	183							■	■	■	■	■																								
• Implement high availability Kubernetes server cluster	260								■	■	■	■	■	■	■	■	■																			

• Update and enhance NMS mobile app	121																■	■	■	■																					
• Update and expand FEWS	230				■	■	■	■	■	■	■	■	■	■																											
• Tsunami Equipment	183				■	■	■	■	■	■																															
Risk analysis and vulnerability assessment completed, and multi-hazard maps developed																																								
• Risk analysis and vulnerability Assessment	90								■	■	■	■																													
• Updated hazard maps	90									■	■	■	■	■																											

			2024												2025												2026								
ACTIVITY	**Days**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**
Reliable and Operational Forecasting and Warning System Established																																				
• Public education campaign for CAP	152				■	■	■	■	■																											
• Public survey for EWS	60							■	■																											
• MH-IBF-EWS	243					■	■	■	■	■	■	■	■																							
• Public education campaign for MH-IBF-EWS and NMS mobile app	213																		■	■	■	■	■	■	■											
NMS and NEMO Staff Capacity Improved																																				
• Capacity building and training	30						■	■	■	■	■	■	■	■	■	■																				
• Distance Learning	699						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
• On Campus (UWI)	881		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
• On Campus (CIMH)	639				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											
Project Progress Report	913				■		■		■		■		■		■		■		■		■		■		■		■		■		■		■		■	
Project Completion Report	30																																			■

APPENDIX 4

PERFORMANCE RATING SYSTEM

Criteria	Score	Justification
Relevance	4	The Project is aligned with Belize's priority to reduce the vulnerability of at-risk populations as stated in the national medium term development plan. The project is also consistent with the establishment and goal of the NFWCS as it involves capacity development of the NMS, NEMO, and key stakeholders in the generation of risk based, user-relevant early warning information, and their application in planning and decision-making in relevant climate-sensitive sectors. The project will contribute to CARE's expected outcome "governance on disaster risk management and climate change adaptation improved" and output "operational multi-hazard EWS within BMCs expanded/upgraded". It also aligns with the strategic objective of building environmental resilience as presented in CDB's Strategic Plan Update 2022- 2024.
Effectiveness	3	The Project will make use of existing mechanisms such as the Disaster Risk Management policy, previous risk assessment reports, CAP, and build on previous and ongoing climate and disaster risk management frameworks (such as WMO's Global Framework for Climate Services (GFCS), National Climate Outlook Forums, municipal forecasts, etc.) and on existing capacities within NMS, NEMO, sectoral agencies, and other stakeholders. In addition, the project facilitates synergised Standard Operating Procedures between NMS, NEMO and key agencies, central database with climate information products, and innovative dissemination methods to enhance forecast generation and dissemination. This will likely facilitate the use of climate information in planning and decision-making.
Efficiency	3	National and local stakeholders will be engaged in the project and will share their knowledge on tool development to support decision making and assist in facilitating community engagement processes, reducing the need for numerous technical consultants and, thus, project costs. Project activities will be integrated into both departments' work programmes and therefore will be reported quarterly and monitored by the Ministry of Sustainable Development, Climate Change and Disaster Risk Management as part of the national priorities for action which must be reported to the Office of the Prime Minister. Monitoring and evaluation activities to assess project implementation/delivery process, outcomes, and early impacts will be undertaken regularly.
Sustainability	4	NEMO and the NMS will ensure adequate resources are allocated in the annual recurrent and Capital II budgets for equipment maintenance and upgrade as well as for supporting public education and training. The Capital II budget sets resources aside for capital spending on assets such as weather instruments, buildings, vehicles, etc. The project is also designed to improve skills of NEMO and NMS' staff to facilitate equipment maintenance and overall operation of the observation network. Local stakeholders from the public and private sectors will be encouraged to actively participate in the design and implementation of public education, information and communication campaigns on EWS to ensure these are operational, effective and sustainable.
Overall Score	**3.5**	

APPENDIX 5

GENDER MARKERS ANALYSIS

Project Cycle Stage	Criteria	Score
Analysis: Background	Sex-disaggregated data included in the background analysis, and/or baselines and indicators, or collection of sex-disaggregated data required in TOR.	0.5
	Socioeconomic/Sector/Institutional analysis considers gender disparities, or TOR requires the identification of socioeconomic, sectoral and institutional gender issues.	
Design: Project Proposal/Definition/ Objective	TA interventions are designed, or will be identified as part of the project, that address gender disparities or enhance gender capacities.	0.5
	Project objective/outcome includes the enhancement of gender capacities, gender data collection, gender equality or the design of gender-responsive policies or guidelines.	0
Implementation: Execution	Implementation arrangements include either: • Capacity building initiatives to enhance gender mainstreaming of the executing and/or implementing agency, or • Active participation of representatives of gender-relevant stakeholders in project execution. Terms of Reference of consultancy/project coordinating unit/project management unit includes responsibilities and resources, including budgets for gender mainstreaming.	1
Monitoring and Evaluation: Results-Monitoring- Framework (RMF)	Sex-disaggregated data included in the baselines, indicators and targets of the RMF. Or Collection of sex-disaggregated data is part of the project. At least one gender-specific indicator at the outcome and/or output level in the RMF.	0.5 0.5
Maximum Score:		3
Gender Mainstreamed (GM) and Gender Mainstreamed (MM): if 3 to 4 points		

APPENDIX 6

TERMS OF REFERENCE

PROJECT COORDINATOR

1. BACKGROUND

1.01 The Project Coordinator will be responsible for managing the implementation of the multi-hazard impact-based forecasting and early warning system project for the Belize River Watershed in Belize. The project aims to improve the current observation network, modelling and analysis tools, undertake risk analysis and vulnerability assessment, develop multi-hazard maps, establish a reliable and operational forecasting and warning system, and enhance the technical staff capacity of the National Meteorological Service (NMS) of Belize and the National Emergency Management Office (NEMO) of Belize.

2. KEY RESPONSIBILITIES

2.01 The Project Coordinator will have the following responsibilities:

(a) **Project Management:**
- (i) Develop and maintain a detailed project plan, including timelines, milestones, and deliverables.
- (ii) Coordinate and oversee all project activities, ensuring their timely and successful completion.
- (iii) Monitor project progress, identify potential risks and issues, and develop mitigation strategies.
- (iv) Facilitate effective communication and collaboration among project stakeholders.
- (v) Oversee all incoming and outgoing project documentation.
- (vi) Update project procurement plan as necessary and at least annually.
- (vii) Prepare regular progress reports and present them to project stakeholders and Project Steering Committee (PSC).
- (viii) Maintain records of PSC meetings, decisions and actions.

(b) **Financial Management:**
- (i) Assist with the financial management of the project, including budgeting, tracking expenditures, and ensuring compliance with funding requirements.
- (ii) Coordinate the engagement of consultants and the procurement of goods and services.
- (iii) Monitor project expenditures and ensure efficient utilisation of project funds.

(c) **Technical Implementation**:
- (i) Work closely with the NMS and NEMO to coordinate and oversee the implementation of project activities.
- (ii) Provide guidance and support in improving the observation network, modelling and analysis tools, and multi-hazard mapping.
- (iii) Facilitate the establishment of a reliable and operational forecasting and warning system.
- (iv) Coordinate capacity-building initiatives to enhance the technical staff capacity of the NMS and NEMO.

(d) **Stakeholder Engagement:**

(i) Liaise with relevant government agencies, regional institutions (e.g. Caribbean Institute for Meteorology and Hydrology, the University of the West Indies) and community stakeholders to ensure their active participation and support in the project.

(ii) Organise and facilitate meetings, workshops, and training sessions to promote stakeholder engagement and collaboration.

(iii) Foster effective relationships and partnerships with key stakeholders to achieve project objectives.

(e) **Reporting and Deliverables**

(i) The Project Coordinator will report to the NMS. Key deliverables include:

(aa) Preparation of a Work Plan with timeline for the project.

(bb) Preparation of progress narrative and financial reports to NMS on a monthly and quarterly basis highlighting project advancement, challenges and adjustments. Upon validation of these reports by NMS, submit them to CDB for review and approval.

3. QUALIFICATIONS AND EXPERIENCE

3.01 The ideal candidate for the position of Project Coordinator should possess the following qualifications and skills:

(a) A Bachelor's or Master's degree in a relevant field (e.g., project management, environmental sciences, disaster management).

(b) Proven experience in project management, preferably in the field of climate resilience, disaster risk reduction, or meteorology.

(c) Strong organisational and leadership skills, with the ability to manage multiple tasks and stakeholders simultaneously.

(d) Excellent communication and interpersonal skills, with the ability to engage and collaborate with diverse stakeholders.

(e) Proficiency in English is essential. Proficiency in Spanish is an asset.

(f) Knowledge of multi-hazard impact-based forecasting and early warning systems is highly desirable.

(g) Familiarity with the institutional and operational aspects of meteorological services and emergency management is an advantage.

(h) Proficiency in project management software and tools.

(i) Knowledge of the cultural and socio-economic context of the Caribbean and experience working in the Caribbean

4. DURATION AND LOCATION

4.01 The Project Coordinator will be engaged for two years and will be based in Belize.

APPENDIX 7

TERMS OF REFERENCE

PROJECT STEERING COMMITTEE: COMPOSITION, ROLES AND RESPONSIBILITIES

1. The Project Steering Committee (PSC) will be co-chaired by the Ministry of Sustainable Development, Climate Change and Disaster Risk Management and the Ministry of Economic Development. The committee will include representatives from key stakeholders, including National Meteorological Services, National Emergency Management Office, the National Climate Change Office, the Belize Network of non-governmental organisations, the private sector and civil society. The PSC will play a pivotal role in ensuring the successful implementation of the project. Its roles and responsibilities are as follows:

(a) Project Compliance: The PSC is responsible for ensuring that the project activities align with the project proposal approved by the Caribbean Development Bank (CDB). This involves monitoring and verifying that the project is on track in terms of its objectives and activities.

(b) Project Resource Efficiency: The PSC oversees the judicious use of project resources and assets to advance the project's defined goals. This includes ensuring that funds, equipment, and personnel are allocated efficiently and effectively.

(c) Strategic Issue Resolution: The PSC plays a crucial role in addressing strategic-level issues and risks that may arise during the project's implementation. This involves making informed decisions and providing guidance on how to navigate challenges and uncertainties.

(d) Change Management: The PSC approves or rejects proposed changes to the project that have a significant impact on project timelines and budget. This oversight ensures that any modifications are thoroughly assessed and aligned with the project's objectives and CDB guidelines.

(e) Project Progress Assessment and Reporting: The PSC evaluates the project progress, milestones and outcomes, and ensures project progress reports are accurate.

APPENDIX 8A

TERMS OF REFERENCE

CONSULTANCY SERVICES TO ESTABLISH A HIGH AVAILABILITY KUBERNETES SERVER CLUSTER FOR THE NATIONAL METEOROLOGICAL SERVICE OF BELIZE

1. BACKGROUND

1.01 The National Meteorological Service of Belize (NMS) currently operates five applications which are critical to the NMS daily operations as well as an early warning system. These are:

(a) Numerical Weather Prediction Model (NWP) for higher resolution over Belize. Locally run NWP takes inputs from a global weather model such as the Global Forecast System and downscales the results over Belize at a higher resolution.
(b) SURFACE Climate Data Management System (CDMS) – National CDMS for Belize which stores, processes, validates and disseminates data from weather stations across Belize.
(c) PLUVO – Application which ingests data from multiple weather and climate related sources for easy display so that alerts can be created and displayed. PLUVO currently ingests data from lightning detection network, radar, numerical weather predicting models and satellite observations.
(d) Website Information Management Platform – used by forecasters to update the NMS website with forecasts and alerts.
(e) Enhance mobile application and background processes.

1.02 These five applications serve as the backbone of the technological stack at the NMS and are highly automated, often communicating with each other to process and display data. As more and more stakeholders rely on the data processed by these applications the need for them to be continuously operational has become a top priority. Therefore, based on best information technology (IT) practices at this time, a kubernetes cluster will be implemented within the NMS to deploy and maintain these applications. Kubernetes is an open-source container orchestration system for automating software deployment, scaling, and management, providing high available services with redundancy, load balancing and little to no down time. This will allow these critical services to be continuously operational and, in the event of application failure, to minimise downtime for redeploying applications.

2. OBJECTIVES

2.01 To provide continuously available data to stakeholders by deploying all essential NMS applications within a kubernetes cluster. Set up a kubernetes cluster with best practices on four or five physical servers and migrate existing applications to it. The Consultant will be responsible for designing and implementing the cluster architecture, as well as ensuring the smooth transition of the existing applications to the new environment.

2.02 Setup a numerical weather prediction model to provide 3km weather forecasts for Belize based on the Weather Research and Forecasting model (WRF). The WRF is a widely used numerical weather prediction system that helps in understanding and predicting the weather. The model is computationally intensive and running it on a single machine can take a long time. Therefore, it is necessary to use a cluster of computers or a cloud-based system to run the model efficiently. In the scope of this project, the WRF model should be set up to leverage the high availability cluster based on Kubernetes that will be delivered as the first result of this project.

2.03 Enhance PLUVO (the application currently used to monitor severe weather conditions in Belize) so that the system is compliant with international standards and best practices for alerting based on the Common Alerting Protocol and can be used by other organisations in Belize.

2.04 Migrate the three existing web-based applications to high availability cluster to improve their scalability, reliability, maintainability, and optimal performance.

2.05 Enhance Mobile applications with data processed by kubernetes cluster.

3. SCOPE OF WORK

3.01 Kubernetes Cluster

(a) Initial assessment: The Consultant will conduct an initial assessment of the client's infrastructure, including hardware, network, and security requirements. This will help to identify any potential challenges or constraints that may impact the project.

(b) Kubernetes cluster design: The Consultant will design the Kubernetes cluster architecture based on best practices, taking into account the client's specific requirements, workload, and scalability needs. This will include the configuration of the Kubernetes master node and worker nodes, as well as the deployment of necessary add-ons and tools.

(c) Cluster setup and configuration: The Consultant will set up and configure the Kubernetes cluster on the four physical servers. This will involve installing and configuring the necessary components, such as the Kubernetes API server, etc.

(d) Containerisation of Existing Applications: The Consultant will work with the client to identify and containerise the existing applications. This will involve creating Docker images files for each application and configuring them to run in a Kubernetes environment.

(e) Kubernetes deployment: The Consultant will deploy the containerised applications to the Kubernetes cluster, ensuring that they are running smoothly and efficiently. This will involve creating Kubernetes deployment files, setting up pods, and configuring the necessary services and ingress.

(f) Testing and optimisation: The Consultant will conduct thorough testing of the Kubernetes cluster and the deployed applications to ensure that they are functioning as intended. Any issues or bottlenecks will be identified and addressed, and optimisations will be made to improve performance and scalability.

(g) Monitoring and Alerting: The Consultant will set up monitoring and alerting systems for the Kubernetes cluster, which will help to identify any issues or potential problems in real-time. This will involve configuring tools such as Prometheus, Grafana, and Alert manager to monitor the cluster's resource utilisation, uptime, and performance.

(h) Logging and Tracing: The Consultant will also set up logging and tracing systems to capture and analyse logs and events generated by the Kubernetes cluster and the containerised applications. This will help to troubleshoot issues and improve overall system performance.

(i) Disaster Recovery and Backup: The Consultant will work with the client to implement a disaster recovery and backup strategy for the Kubernetes cluster and the containerised applications. This will include regular backups of the data and configuration files, as well as setting up a disaster recovery plan in case of system failure or data loss.

(j) Web-Based Graphical Interface: The Consultant will also set up a web-based graphical dashboard to manage the Kubernetes cluster. The dashboard should provide an intuitive, user-friendly interface for the client's IT team to monitor and manage the cluster and containerised applications.

The dashboard should provide the necessary authentication and authorisation mechanisms to secure the dashboard and restrict access to authorised users.

(k) Documentation and Knowledge Transfer: The Consultant will document the entire process of setting up the Kubernetes cluster and migrating the applications, including any custom configurations and settings. Knowledge transfer sessions will also be conducted to ensure that the client's IT team is equipped to manage and maintain the Kubernetes environment going forward.

3.02 Numerical Weather Prediction

(a) Install and configure the WRF model: Setup the WRF model based on the latest release and install it to execute on the Kubernetes cluster.
(b) Set up the model to generate hourly weather forecasts for the next 72h (3 days) at 3 kilometres (km) resolution and 3/3h forecasts for the next 168h (7 days) at 9 km resolution.
(c) Initialize the WRF model from GFS data: Download and process data from GFS global forecasts1 to create the necessary input files to initialise the WRF model.
(d) Set up the model to run twice a day: Use a scheduling service to automate the execution of WRF model to generate weather forecasts for 0Z and 12Z.
(e) Monitor and optimise performance: Use Kubernetes monitoring tools to monitor the performance of the WRF model and alert failures and delays. Use Kubernetes autoscaling to scale the cluster up or down based on the resource utilization of the WRF model and cluster workload.
(f) Provide a final report documenting setup technical details, results of the performance of the WRF model and any optimisations made during the project.

3.03 Enhance PLUVO

(a) Enable Pluvo support to CAP protocol: The existing system must be updated to support the CAP protocol to ensure that alerts are interoperable with other alerting systems and adhere to international standards for alerting.
(b) Alert creation and edition: The system must be extended to allow authorized external users from other organisations to create and edit their own alerts. This includes the ability to add and modify text, images, and other multimedia elements.
(c) Dissemination: The system must support the dissemination of alerts to relevant stakeholders, including emergency responders, government agencies, and the public. This includes the ability to send alerts via email, SMS, and social media.
(d) Tracking and reporting: The system must be able to track and report on the status of alerts, including the number of alerts sent, received, and acknowledged by stakeholders.
(e) Test the enhanced system to ensure that it is functional and meets the requirements specified in the terms of reference.
(f) Provide technical documentation and training materials to enable the client to maintain and operate the enhanced system.

3.04 Migrate Applications to Cluster

(a) Development of a migration plan based on the analysis of the existing applications and their dependencies.
(b) Configuration of the Kubernetes cluster to support the automation of deployments of the applications via CI/CD.
(c) Modification of existing docker images and configuration files to create Kubernetes manifests that can be used to deploy the applications to the cluster.

(d) Deployment of the applications to the Kubernetes cluster and testing to ensure their correct functioning.
(e) Implementation of a monitoring and logging solution to detect and diagnose issues.
(f) Documentation of the migration process, including the configuration, deployment, and monitoring of the applications.
(g) Training of the client's IT team to operate and maintain the applications in the Kubernetes environment.

3.05 Enhance Mobile application and background processes

(a) Update and enhance the NMS mobile app developed by the Resilient Rural Belize to include features developed through output 2 and 3.
(b) Train staff in the usability of app.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Lead Consultant should have the following:

(a) must be a specialist in web application development and PostgreSQL technologies such as PostGIS and timescaled;
(b) a minimum of ten years of experience working in the field of data science/machine learning, earth observation, meteorological data, big data pipelines and other data analysis and visualisation tools; and
(c) should have management skills and be familiar with the use of agile software practices.

4.02 In addition to the Lead Consultant, the team should consist of specialised team members listed below. The Consulting Firm shall select and hire other experts as required according to the needs and will have to demonstrate in their offer that they have access to experts with the required profiles, including professional qualifications, language skills and work experience. The consulting firm should provide detailed curriculum vitae of experts in the following fields:

(a) Kubernetes, Docker, Micro services and Virtual computing.
(b) NWP models.
(c) Web application development.
(d) Mobile application development.

4.03 The firm should possess at least the following:

(a) Must have a minimum of five (5) years' experience working with web applications used for weather and climate data analysis.
(b) Regional experience (Caribbean or Central America) in delivering data processing and analytical services to National Meteorological Services.
(c) Operating knowledge of Apache Airflow and establishing data pipelines.
(d) Experience in configuring NWP models that can simulate atmospheric phenomena at different scales and resolutions.
(e) Strong communication, presentation and reporting skills.

5. REPORTING REQUIREMENTS AND DELIVERABLES

(a) Deliverables 1: Inception report: the consultancy firm shall submit an electronic copy of the Inception Report to the NMS which should include a detailed methodology including tools to be used for installation and configuration of applications and responsibility of team members.
(b) Deliverable 2: To establish and Capacity building training on Kubernetes Cluster.
(c) Deliverable 3: All essential web applications running in High availability mode within Kubernetes Custer.
(d) Deliverable 4: Implement NWP Model over Belize:

6. DURATION

6.01 The duration of the consultancy services is expected to be approximately 260 working days over the period of a 13 month-period. The NMS will provide office accommodation, equipment and appropriate administrative support to the Consultant while in country.

APPENDIX 8B

TERMS OF REFERENCE

CONSULTANCY SERVICES TO UPDATE AND EXPAND FLOOD EARLY WARNING SYSTEMS AND CONDUCT TRAINING ON FLOOD EARLY WARNING OPERATION, CONFIGURATION, AND MAINTENANCE

1. BACKGROUND

1.01 From September 2020 through December 2021 the Government of Belize implemented a hydrologic forecast system within the Macal River Basin for the purpose of improving decision support for planning, flood management, and dispatch of hydropower for both near-term (7-day hourly forecasts) and extended (accumulated 45-day) operations. The work was financed under the World Bank Energy Resilience for Climate Adaptation Project (ERCAP) with co-financing provided by the Government of Belize. The project was implemented in close coordination among the Belize National Meteorological Service (NMS), Belize Electricity Limited (BEL), the National Hydrological Service (NHS), and the Belize dam operators, Fortis Belize. Since the completion of the project, the hydrologic forecast system has been running operationally on NMS servers with system accessibility and updates to reservoir operations provided by BEL and Fortis Belize. The system has improved decision support for reservoir operations as well as communication among Belizean stakeholders regarding inflow forecasts and resultant reservoir operations. This project seeks to leverage and build upon the work completed under ERCAP to enhance and expand Belize's hydrologic forecast system. This includes both system and modelling upgrades as well as enhanced capacity development for stakeholder agencies.

1.02 The initial hydrologic forecast system developed under the ERCAP project was focused on improving the inflow forecasts for the three primary hydroelectric plants (Chalillo, Mollejon, and Vaca) within the Macal River Basin. This includes ten sub-basins with associated forecasts available for each outlet (see Figure 1 below). Chalillo Dam consists of four upstream sub-basins; Mollejon includes one local sub-basin in addition to upstream releases from Chalillo; Vaca inflows include contributions from two sub-basins as well as releases from Mollejon; and finally, there are three sub-basins downstream of Vaca to improve flood forecasting warnings for the town of San Ignacio and the Upper Belize River.

1.03 After an initial review of tradeoffs for system and modelling options, stakeholders elected to build the system leveraging the Delft-FEWS platform with legacy United States National Weather Service hydrologic models (SAC-SMA, UNIT-HG, LAG-K). Some primary reasons for this choice included license free software and a history of similar successful forecast systems throughout the world leveraging these same tools.

1.04

1.05 Local data leveraged by the system includes precipitation and river stage station-based data managed by the NMS as well as reservoir pool elevation and flow releases manually reported by Fortis Belize. At the time of development, limited station-based precipitation data within the Macal River Basin existed so the National Aeronautics and Space Administration's Integrated Multi-satellite Retrievals for Global Precipitation Measurement (IMERG) product is leveraged for Mean Areal Precipitation (MAP) estimates for each sub-basin.

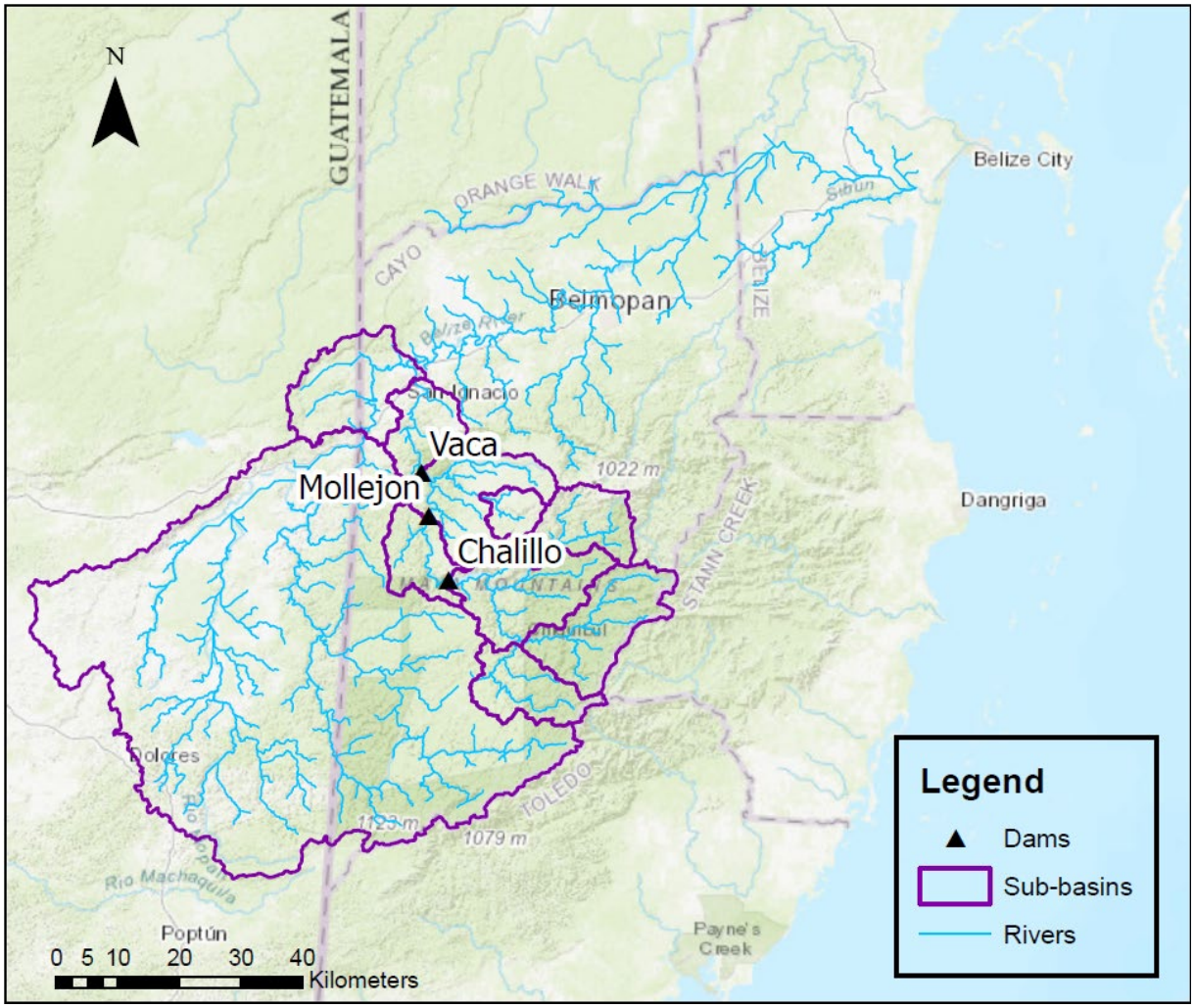


Figure 1. Belize's hydrologic forecast system dams, sub-basins, and rivers

1.06 Similarly, current forecast MAP estimates (near-term) are based on the United States National Center for Environmental Prediction's Global Forecast System. Although the NMS Weather Research Forecast model was also initially implemented as an option for forecast MAPs, issues with running the model locally at NMS limited its use in the hydrologic forecast system and its reinstatement is planned under this project. Long-range (45-day and greater) forecasts leverage climatological ensembles based on retrospective processing of IMERG with the Tropical Rainfall Measuring Mission (TRMM) and TRMM Multi-satellite Precipitation Analysis data set extending back to June 2002.

1.07 In addition to the data analysis, model calibration, and forecast system development work carried out under ERCAP, a hydrometeorological network for the Macal River Basin was also designed to identify the locations of precipitation stations and river gauges within the basin. The installation of these stations is underway and incorporation of this new data into the forecast system is planned under this project.

2. OBJECTIVES

2.01 The primary objective of this consultancy is to enhance and expand the existing functionality of the hydrologic forecast system while further developing the capacity of Belizean stakeholders. The primary tasks for completion are outlined below with further details provided in the Scope of Work.

(a) Expansion of forecast system and modelling to include the entire Belize River Basin.
(b) Incorporation of hydrometeorological station data within the Macal and Belize Rivers.
(c) Reservoir operations updates.
(d) Reestablish NMS Weather Research and Forecasting model forecasts integration.
(e) Coordination of hydrologic forecasts with San Ignacio Flood Inundation Tool.
(f) Capacity development of Belize stakeholders through in-person training and extended support.

3. SCOPE OF WORK

3.01 Within the framework of these Terms of Reference, the consulting firm is expected to perform, at a minimum, the tasks described below. Additional considerations from the consultant that may further enhance these minimum requirements are welcome. All responses for each task should describe coordination and project management activities to be carried out.

(a) Task 1 - Expansion of system to include modelling and forecasting of the entire Belize River Basin, including:

  (i) Update flood early warning systems (FEWS) configuration with additional sub-basins and station data based on stakeholder needs.
  (ii) Quality control of historic precipitation data and the development of sub-basin mean areal time series.
  (iii) Quality control of historic river stage and flow data; review of existing stage-discharge rating curves.
  (iv) Model calibration (SAC-SMA, UNIT-HG, and LAG-K) of new basins.

(b) Task 2 - Additional Belize station integration in Macal and Belize Rivers

  (i) Automatically import precipitation and where available river stage/flow data for approximately 25 stations within the Macal and Belize river from NMS database.
  (ii) Develop preprocessing workflows to ensure quality control of real-time data.
  (iii) Calculate station-based mean areal precipitation time series for use in hydrologic models.

(c) Task 3 - Reservoir Operations Updates

  (i) Investigate and develop scripts to import real-time reservoir data from Fortis.
  (ii) Update reservoir modelling simulation based on feedback from Belize Electricity imited and Fortis Belize.
  (iii) Test and adjust updates to reservoir models in operational system.

(d) Task 4 - Reestablish NMS WRF forecasts integration

(i) Ensure the NMS WRF forecasts are being ingested by FEWS properly.
(ii) Test updates and provide guidance on how import processes currently function so NMS may upgrade with potential changes in the future.

(e) Task 5 - Coordination with San Ignacio Flood Inundation Tool (SIFIT)

(i) Initial investigation of leveraging forecast data from FEWS to drive San Ignacio Flood inundation tool during flooding events. With Belize stakeholders assess and determine whether FEWS will export data sets to SIFIT model to be run separately during floods, or an actual model integration will be pursued within FEWS system.
(ii) Includes testing model operationally.
(iii) Develop warning messages when river level thresholds are exceeded.

(f) Task 6 - Capacity development through in-person training and extended support

(i) Minimum one week in-person training on hydrologic forecast system and models.
(ii) Ongoing remote support for one year including regular monthly meetings on the system status.
(iii) On-call system support and debugging (during business hours).

4. QUALIFICATIONS AND EXPERIENCE

4.01 Execution of this Terms of References requires a consulting firm having, at a minimum, the following composition and qualifications:

Key Experts:

4.02 **Team Leader**: The team leader will be responsible for the overall planning, management, and administration of all tasks, coordinating the work simultaneously undertaken by different staff and consolidating the outputs in the expected deliverables.

(a) The team leader must have extensive management experience working in a variety of countries and projects related to hydrologic forecasting with a preference in familiarity with the Delft-FEWS software. Demonstrated skills in project planning, institutional and capacity development, and stakeholder facilitation, coupled with the technical understanding gained through a career working on hydrologic forecasting systems is essential.

(b) Minimum qualifications: Masters degree or equivalent degree in water resources management, hydrology, or civil engineering with a minimum of 12 years' of professional experience. The expert should have proven experience in conducting similar projects within the Caribbean/Belize region. The expert should have experience managing at least three similar projects related to hydrologic forecast systems.

4.03 **Systems Engineer**: The systems engineer will be primarily responsible for updating the Delft-FEWS hydrologic forecast system while coordinating with stakeholders and the project team. This will include connecting additional data feeds and modelling zones as outlined in the scope of work.

(a) Minimum qualifications: Bachelor (Masters degree preferred) or equivalent degree in water resources management, hydrology, civil engineering, software development, or computer science with a minimum of five years' of professional experience. The expert should have proven experience in conducting similar projects within the Caribbean/Belize region. The expert should have experience developing Delft-FEWS hydrologic forecast system for three similar projects.

4.04 **Hydrologic Modeler**: The hydrologic modeler will be responsible for updating existing hydrologic modelling locations and calibration of models to new locations. The expert will have experience preparing and analysing historical hydrometeorological data for model forcings. The expert will have experience with the United States National Weather Service hydrologic modelling suite inclusive of SAC-SMA, UNIT-HG, and LAG/K models.

(a) Minimum qualifications: Bachelor (Master preferred) or equivalent degree in water resources management, hydrology, or civil engineering with a minimum of three years of professional experience. The expert should have proven experience in conducting similar hydrologic modelling tasks as outlined in the scope of work (SOW) and experience calibrating the SAC-SMA, UNIT-HG, and LAG/K models.

4.05 **Reservoir Modeler**: The reservoir modeler will be responsible for updating the forecast system reservoir operations per feedback from project stakeholders. The expert should have experience developing reservoir models for real-time operations.

(a) Minimum qualification: Bachelor (Master degree preferred) or equivalent degree in water resources management, hydrology, or civil engineering with a minimum of five years of professional experience. The expert should have proven experience in conducting similar reservoir modelling tasks as outlined in the SOW.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 Report to Belize NMS, the Consultant will be required to submit electronically the following:

(a) An Inception Report outlining a detailed work plan and implementation schedule based on the scope of work;
(b) Updated hydrologic forecast system and accompanying models per the SOW;
(c) Updates to hydrologic forecast system manual based on completed work;
(d) Regular monthly meetings with the Belize NMS and their stakeholders detailing recent and planned updates to the hydrologic forecast system with demonstrations;
(e) In-person capacity development trainings on the updated forecast system and components to be completed over a work week with the Belize NMS and their stakeholders at local offices; and
(f) Final updates to hydrologic forecast system manual based on all completed work and approved by key stakeholders.

6. DURATION

6.01 The duration of the consultancy services is expected to be approximately 230 working days over the period of January to October 2024. The NMS will provide office accommodation, equipment and appropriate administrative support to the Consultant while in country.

APPENDIX 8C

TERMS OF REFERENCE

CONSULTANCY SERVICES TO CONDUCT A RISK ANALYSIS AND VULNERABLITY ASSESSMENT FOR THE BELIZE RIVER WATERSHED

1. BACKGROUND

1.01 The initial stages of reducing disaster and climate risk and promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic, and environmental vulnerabilities to disasters that communities face, and of the ways in which hazards and vulnerabilities are changing in both the short and long term. These inform actions to be taken to reduce these risks and enhance resilience. The National Meteorological Services of Belize is moving towards using Multi-hazard Impact-based Forecast and Early Warning System (MH-IBF-EWS) to communicate risks and impacts to the public and different sector end users. Through Impact based forecasting, a structured approach for combining hazard, exposure, and vulnerability data is utilized to identify risk and support decision-making, with the ultimate objective of encouraging early action that reduces loss of life and damage property and livelihoods from natural hazards.

1.02 This consultancy seeks to identify risks and hazards in the project area and update existing hazard maps. The identification of different levels of risks and impacts will enable the issuance of different warnings to encourage adequate responses by relevant users to reduce damage and loss.

2. OBJECTIVES

2.01 The main objective of this consultancy is to provide baseline information on hazard risk and vulnerability assessment in the project area to facilitate the articulation and development of an MH-IBF-EWS and to develop hazard maps.

3. SCOPE OF WORK

3.01 The Consultancy firm will be engaged to conduct a risk analysis and vulnerability assessment, develop multi-hazard maps and identify forecast procedures for early warning systems and extreme events at varying timescales for the Pilot Project, covering the Belize River Watershed for hazards to be agreed upon with the National Meteorological Services (NMS).

3.02 More specifically, the firm will report to the Project Coordinator through the assigned team leader and will perform a risk analysis and vulnerability assessment and develop multi-hazard maps. The main tasks are:

Risk and Vulnerability Assessment

(a) Review existing data, information, maps and studies for the project area and conduct a gap assessment of previous risk and vulnerability assessments.

(b) Identify and assess key natural hazards affecting the project (climate-related and geophysical hazards):

(i) analyse hazard characteristics (e.g. intensity, frequency and probability) of identified hazards taking historical data into consideration; and

(ii) evaluate climate variable and climate change (CC) scenarios:

(aa) determination of climate variables of interest (precipitation, drought conditions, precipitation extremes and potential flooding, temperature, winds.), and defining baseline conditions;

(bb) determine CC scenarios, based on the best available information.

Community Vulnerability Analysis

(a) Conduct community vulnerability analysis for all relevant natural hazards, considering historical data sources and potential future hazard events in the vulnerability analysis.

(b) Analyse community practices for natural resources management: identify major causes of natural resources degradation and good practices for sustainable natural resources management, and assess potential impacts on livelihoods.

(c) Analyse factors affecting the community capacity to undertake risk and impact assessments, to plan and implement mitigation and adaptation actions.

(d) Estimate potential human and economic losses based on the exposure and vulnerability of people (particularly youth. elderly, persons with disabilities.) buildings and infrastructure.

(e) Map and document vulnerabilities identified in item (d) above.

(f) Conduct a detailed assessment (two years) to collect baseline information and identify gaps relating to the impacts of different weather hazards and the exposure of vulnerable assets and population.

(g) Help target forecasts and warnings for exposed and vulnerable people and sectors:

(i) Identify relevant weather and climate parameters and establish critical threshold values required to issue a warning for hazard events (flooding, storm surge, heat waves and extreme temperatures, severe thunderstorms, strong winds, drought) and develop understandable, recognisable, and timely warnings for the NMS and National Emergency Management Organisation (NEMO).

(ii) Develop probabilistic forecasts of extreme events at sub-seasonal, seasonal, inter-annual, decadal timescales (multi-hazard, multilevel and multi-sector).

(aa) Identify requirements for weather forecasts and warnings to be used within the MH-IBF-EWS.

(bb) Conduct stakeholder consultations to establish effective dissemination and communication systems whereby all actors clearly understand their functions, roles and responsibilities as well as the identification of appropriate communication media for warning dissemination.

(cc) Assist key stakeholders to develop warning alerts and messages that are specific to the nature of the threat and its potential impacts, and tailored to the needs of the groups/communities at risk.

Multi-Hazard Maps

(a) Develop probabilistic hazard maps for strong wind, storm surge, drought, flood and extreme heat, and tropical cyclones in the project area.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The consulting team should comprise a team of professionals with the following key personnel:

(a) **Team Leader: Disaster Risk Management Specialist**

Experience: no less than ten years professional experience and a graduate degree in disaster risk management or related fields. Experience conducting natural hazard risk assessment in the Caribbean or similar context, development of participatory disaster risk reduction and climate change adaptation plans or similar initiatives, development or implementation of EWS. Working experience as facilitator of consultations with multiple stakeholders, including but not limited to representatives from public and private sector and vulnerable communities. The Specialist should be fluent in English. Other languages such Spanish would be an asset.

(b) **Key professional 2: Hydrometeorology/Climate Change Expert**

Experience: no less than ten years professional experience and a graduate degree or equivalent in climate change, Hydrometeorology or related fields. Experience should include developing hydro-meteorological observation networks and EWS, working with data provided by Global Circulation Models and Regional Circulation Models, and familiarity with the Sixth Assessment Report by the Intergovernmental Panel on CC. Fluency in Spanish is an asset.

(c) **Key professional 3: Geophysicist/Seismologist**

Experience: no less than ten years professional experience and a graduate degree or equivalent in geophysics, seismology, or related fields. Experience should include identifying geographic areas where seismic activity frequently occurs, setting up devices to record and measure earth movements, and collecting and analysing this data. Fluency in Spanish is an asset.

(d) **Key professional 4: Geographic Information System Specialist**

Experience: no less than eight years professional experience with a graduate degree or equivalent in Cartography and geographic information system or related fields. Experience should include development of maps of natural hazard risks and development of database using GIS. Fluency in Spanish is an asset.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 The consultancy firm shall submit electronically the following deliverables to NMS:

(a) An Inception Report which should include a detailed methodology including tools to be used to gather data/information, quality assurance, mechanism of data/information collection, analyses and roles and responsibility of team members and key milestone. The Inception Report should also detail the fieldwork plan after discussions with the NMS and NEMO to including the following: Final Workplan with Gantt Chart taking into account

the comments from stakeholders, detailed methodology on data collection and analysis, and expected tasks, responsibilities, and schedule of delivery of each member of the team.

(b) A Situational Analysis Report based on data collected and analysed.

(c) Risk Maps showing vulnerability and hazards for 30-year period.

(d) A Comprehensive and Analytical Risk and Vulnerability Report considering inputs and comments from stakeholders.

(e) A Comprehensive and Detailed Report identifying weather forecasts and warnings used for EWS and probabilistic forecast of extreme hazard at different timescales considering comments from NMS staff in consultation meeting.

6. DURATION

6.01 The level of effort required for this consultancy is estimated at 90 days spread within 6 months. The time for reviewing and commenting on the results of the NMS and confirming/receiving the approval is 10 days. The NMS will provide office accommodation, equipment and appropriate administrative support to the Consultant while in country.

APPENDIX 8D

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR THE DEVELOPMENT OF A MULTI-HAZARD IMPACT-BASED FORECAST AND EARLY WARNING SYSTEM FOR THE NATIONAL METEOROLOGICAL SERVICE OF BELIZE

1. BACKGROUND

1.01 The initial stages of reducing disaster and climate risk and promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic, and environmental vulnerabilities to disasters that communities face, and of the ways in which hazards and vulnerabilities are changing in both the short and long term. These inform actions to be taken to reduce these risks and enhance resilience. The National Meteorological Service of Belize (NMS) is moving towards using multi-hazard impact-based forecast and early warning systems (MH-IBF-EWS) to communicate risks and impacts to the public and different sector end users. Through impact-based forecasting, a structured approach for combining hazard, exposure, and vulnerability data is utilised to identify risks and support decision-making, with the ultimate objective of encouraging early action that reduces damage and loss of life and property from natural hazards.

2. OBJECTIVES

2.01 The main objective of this consultancy is to facilitate the articulation and development of an MH-IBF-EWS framework based on the collective knowledge and experience of the forecasters at the NMS, the staff of the National Emergency Management Organization (NEMO) and other personnel of key stakeholder organizations, and to help put in place a functional MH-IBF-EWS project.

3. SCOPE OF WORK

3.01 The Consultant will be engaged to develop and implement the MH-IBF-EWS for the Pilot Project, covering the Belize River Watershed and for hazards to be agreed upon with the NMS.

3.02 A methodological framework of impact-based forecasting will be developed and other application components such as PLUVO will be enhanced, and an impact-based forecasting software will be developed/procured and integrated with the SURFACE climate database. The web and mobile app interfaces being developed through the Resilient Rural Belize project with the Ministry of Agriculture, Food Security and Enterprise will be enhanced to incorporate other hazard alerts and warnings apart from drought and pest risk, and a user manual will be produced and published. The mobile app will support the development and implementation of a MH-IBF-EWS by assisting with the dissemination of warning messages.

3.03 More specifically, the consulting firm will report to the Project Coordinator. The team leader will ensure that a reliable and operational forecasting and warning system is established. The main tasks that the consulting firm will perform include:

(a) **Task 1: Multi-Hazard Impact-Based Forecast and Early Warning System Software/tool installed or designed, and Communication and Dissemination Enhanced**

(i) Provide on-site assistance to NMS for a period of three months.

(ii) Identify the required hazard monitoring and early warning services by utilising the information provided by the Risk Assessment and Hazard maps in the pilot area and identify the hazard(s) to be covered.

(iii) Identify early warning information requirements and systems, procure, or develop impact-based forecasting software, coordinate relevant inputs, and recommend means by which to communicate risks and early warning information to the public for each hazard.

(iv) Generate local probabilistic weather forecasts for heavy rainfall, strong wind, and extreme heat using numerical weather prediction (NWP) at the local level.

(v) Establish MH-IBF-EWS supported by a knowledge and decision support system to aid in integrating climate risk information in local planning and programming to increase the communities' risk reduction efforts and enhance their adaptive capacity.

(vi) Define standard operating procedures (SOPs) for the preparation and communication of warnings and advice (technical meetings).

(vii) Help develop SOPs and any other instruments as necessary (e.g. Memorandum of Understanding) to enable a successful collaborative partnership between NMS, NEMO and other relevant stakeholders.

(viii) Develop impact-based forecast/warnings protocol from hazard to impact-based using collaborative approaches for the project sites to reduce potential impacts. (Tips issued to vulnerable population to deal with different forecasted hazards and potential impacts).

(ix) Conduct meetings, table-top simulation exercises and working sessions between NMS, NEMO and other relevant stakeholders for the development of impact, hazard and response matrix tables which are primary to an MH-IBF-EWS system. Develop risk matrix with agreed risk levels and colour codes and accompanying general impact table and general response table for each hazard in collaboration with key national and local stakeholders.

(x) Put in place an end-to-end MH-IBF-EWS framework and adopt national policy on MH-IBF-EWS to guide the implementation of the framework by national government, local government units and all stakeholders nationwide and include consultation meetings.

(xi) Conduct test warning exercises between NMS and NEMO and other relevant stakeholders, with a view to make the MH-IBF-EWS framework operational.

(xii) Develop a knowledge and decision support system for the implementation of MH-IBF-EWS.

(xiii) Facilitate a follow-up workshop on MH-IBF-EWS providing refresher training on MH-IBF-EWS, including the basic knowledge of MH-IBF-EWS.

(xiv) Conduct an awareness survey to assess the percentage of the target population that is cognisant of the possible consequences and potential extreme weather hazards in their immediate area.

(xv) Test and validate the impact and response tables of the project sites and plan for public awareness and education activities.

(b) **Task 2: Common Alerting Protocol implemented nationally.**

(i) Conduct consultations with telecommunication (Digi Belize and Smart Belize) and multimedia companies (local media houses) on message retrieval and dissemination procedures and design a Media Campaign (communications ads, videos etc.) on Common Alerting Protocol and its messaging.
(ii) Identify and assess which public education and training programs are needed for early warning systems and implement public awareness campaign.
(iii) Conduct a survey to assess the percentage of target population receiving alerts and responding favourably after implementation and conduct a simulation exercise using early warning system and training.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Lead Consultant must have a minimum of a Master of Science degree in Meteorology, Applied Meteorology, Disaster Risk Management or related field.

4.02 In addition to the Lead consultant, the team should consist of specialized members. The consulting firm shall select and hire other experts as required according to the needs and will have to demonstrate in their offer that they have access to experts with the required profiles, including professional qualifications, language skills and work experience. The consulting firm should provide detailed curriculum vitae of experts in the following fields:

(a) Disaster and Climate Risk Reduction.
(b) Weather and Climate Forecasting.
(c) Impact-based Forecasting Early Warning Systems.
(d) Communication and policy.

4.03 The firm should possess at least the following:

(a) At least three (3) years' experience in implementing pilot projects in MH-IBF-EWS.
(b) At least five (5) years' demonstrated experience in conducting workshops, developing frameworks and implementation plans.
(c) Qualifications and/or demonstrated experience in meteorology, disaster risk reduction, MH-IBF-EWS or a related field.
(d) Strong communication, presentation and reporting skills.

5. REPORTING AND DELIVERABLES

5.01 An inception meeting between the consulting firm and key personnel at the NMS and NEMO and other key agencies will be conducted to clarify the scope of the work and expected

deliverable. Further consultations will be conducted particularly with NMS prior to preparing the Inception Report. The consulting firm will prepare the following deliverables as part of this assignment:

(a) Inception Report detailing the approach to be used in the execution of the Consultancy as well as a detailed work implementation plan.
(b) An outline of the MH-IBF-EWS Framework, including an Implementation Plan of MH-IBF-EWS at NMS, which should be compliant with World Meteorological Organization guidelines, and comprise inter alia the proposed method and resources to be utilised.
(c) Preparation of workshop training materials, delivery of training and preparation of a report summarizing the outcomes of the workshop.
(d) A Final Report on the MH-IBF-EWS Framework and Implementation Plan. This report should inter-alia document lessons learnt and make recommendations for sustaining and scaling up the project in other parts of Belize.

6. DURATION

6.01 The level of effort required for this assignment is estimated at 200 days over the period April 2024 to November 2024. The time for reviewing and commenting on the results of the Project Implementation Unit and confirming/receiving the approval is 10 days. The NMS will provide office accommodation, equipment and appropriate administrative support to the Consultant while in country.

APPENDIX 8E

TERMS OF REFERENCE

CONSULTANCY SERVICES FOR CAPACITY BUILDING AND TRAINING FOR THE NATIONAL METEOROLOGICAL SERVICE AND NATIONAL EMERGENCY MANAGEMENT OFFICE OF BELIZE

1. BACKGROUND

1.01 The initial stages of reducing disaster and climate risk and promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic, and environmental vulnerabilities to disasters that communities face, and of the ways in which hazards and vulnerabilities are changing in both the short and long term. These inform action to be taken to reduce these risks and enhance resilience. The National Meteorological Service of Belize (NMS) is moving towards using Multi-hazard Impact-based Forecast and Early Warning Systems (MH-IBF-EWS) to communicate risks and impacts to the public and different sector end users. Through impact-based forecasting, a structured approach for combining hazard, exposure, and vulnerability data is utilized to identify risks and support decision-making, with the ultimate objective of encouraging early action that reduces damage and loss of life and property from natural hazards.

1.02 The project intends to support relevant training in forecasting and for managing the local computer network in keeping with internationally regulated standards. Staff of the NMS will acquire skills in meteorology, climatology, and computer science. The project will finance interventions to increase availability of and access to climate data and information by upgrading the observation networks and building capacities of NMS and National Emergency Management Organisation (NEMO).

1.03 NMS and NEMO will collaborate with the Caribbean Institute for Meteorology and Hydrology (CIMH) on the preparation and delivery of training modules for impact-based forecasting, data processing, Python, multi-hazard early warning, and the Common Alerting Protocol. CIMH is the regional training and research organisation focusing on meteorology, climatology, hydrology, and agro-meteorology in the Caribbean. The modules that will be developed and training carried out will increase the NMS and NEMO staff skills to facilitate inter-alia data processing, impact-based forecasting, multi-hazard early warning systems, computer programming.

2. OBJECTIVES

2.01 The main objective of this assignment is to increase capacity of NMS, NEMO and other relevant stakeholders for impact-based forecasting and timely communication of early warning to at risk communities and vulnerable sectors for adequate responses.

3. SCOPE OF WORK

3.01 The NMS plans to utilise the skills and services of CIMH for capacity building exercises to support data management and early warning services. CIMH has committed to supporting NMS and to leading these capacity building exercises that would require an estimated level of effort of 30 non-consecutive days. The main tasks to be performed by CIMH are as follows:

(a) **Task 1:** Training needs assessments. First, CIMH will collaborate with NMS for conducting a gap analysis of the existing monitoring and forecasting systems, data analysis and visualisation and multi-hazard early warning mechanisms within the target watershed and a review of the data

processing and validation procedures to support effective data analyses of NMS and NEMO. Necessary training will then be identified for NMS and NEMO.

(b) **Task 2:** Preparation of training modules and training material. In collaboration with the World Meteorological Organisation Education and Training Programme, training modules will be prepared delivered on impact-based forecasting, data processing, Python, multi-hazard early warning, and Common Alerting Protocol.

(c) **Task 3:** Conduct training in R-Instat software and Python for preparation, processing and analysis of weather and climate data and information.

4. QUALIFICATIONS AND EXPERIENCE

4.01 CIMH will lead this assignment. CIMH is the regional training and research organisation focusing on meteorology, climatology, hydrology, and agro-meteorology in the Caribbean. It is a repository for climate data from the Caribbean Meteorological Organisation Member States. The role and mission of CIMH is to improve meteorological and hydrological services and to promote awareness of the benefits of these services for the economic well-being of the member countries. CIMH is affiliated with the University of the West Indies where its primary responsibility is the delivery of the Bachelor of Science Programme in Meteorology. CIMH is recognised by the World Meteorological Organisation (WMO) as: (a) the WMO regional training centre in the Caribbean for meteorology and hydrology and related disciplines; (b) a regional instrument centre for the Caribbean; (c) a centre of excellence in satellite meteorology training; and (d) the WMO's Regional Climate Centre (RCC) for the Caribbean.

5. REPORTING AND DELIVERABLES

5.01 CIMH shall submit electronically to NMS the following:

(a) An Inception Report which should include a detailed methodology and training agenda/programme.
(b) Training module materials.
(c) Training report.

6. DURATION

6.01 The level of effort required for these responsibilities is currently estimated at thirty (30) non-consecutive days within a 10-month period. The time for reviewing and commenting on the results of the PIU and confirming/receiving the approval is 10 days. The NMS will provide office accommodation, equipment and appropriate administrative support to the Consultant while in country.

APPENDIX 9

LETTER OF COMMITMENT

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Bridgetown
Barbados

June 16, 2023

Mr. Ronald Gordon
Chief Meteorologist
National Meteorological Service of Belize
Philip Goldson International Airport
Belize

Dear Mr. Gordon,

The Caribbean Institute for Meteorology and Hydrology (CIMH) has reviewed the draft proposal to be submitted to the Caribbean Development Bank (CDB) by the National Meteorological Service (NMS) of Belize. Based on the contents of the draft document, the CIMH is confident that it can and will provide support to the planned work programme in the following areas outlined by the NMS of Belize:

- **Task 1:** Training needs assessments of the NMS and NEMO in network/database management, data processing, meteorology, impact-based forecasting, computer science, multi-hazard early warning systems;
- **Task 2:** Preparation of training modules and training material on impact-based forecasting, data processing, Python, multi-hazard early warning, and Common Alerting Protocol.
- **Task 3:** Conduct training in R-Instat software and Python for preparation, processing and analysis of weather and climate data and information.
- **Task 4:** Capacity Building/training in Automatic Weather Station Maintenance (through the Mid-Level Meteorological Technician Course)

The CIMH has demonstrated experience in each of the four areas outlined having performed and/or supported similar training in each of these areas in the recent past. As a result, the CIMH looks forward to supporting the NMS of Belize in these four areas of work.

Regards,

David A. Farrell, PhD
Principal

APPENDIX 10

BUDGET

Project Component	**Contribution (USD)**		
	CDB	**GOBZ**	**Total**
Output 1 – Current observation network, modelling and analysis tools improved	564,000	5,000	569,000
Output 2 – Risk analysis and vulnerability assessment completed, and multi-hazard maps	75,500	2,000	77,500
Output 3 - Reliable and operational forecasting and warning system established	154,200	12,000	166,200
Output 4 - NMS and National Emergency Management Office staff capacity improved	167,600	20,000	187,600
Total Direct Cost	961,300	39,000	1,000,300
Project Coordinator	90,000	-	90,000
Procurement Consultant	42,250		42,250
Bank Transfer Fees	1,000		1,000
Contingency (12%)	131,346	-	131,346
Total	**1,225,896**	**39,000**	**1,264,896**

APPENDIX 11

PROCUREMENT CONSULTANT

1. BACKGROUND

1.01 The project execution will involve the engagement of a Project Coordinator (PC) and several consultancy services, including:

(a) Consultancy firm services to establish a high availability kubernetes server cluster for the National Meteorological Service (NMS) of Belize;
(b) Consultancy firm services to update and expand flood early warning systems and conduct training on flood early warning operation, configuration, and maintenance;
(c) Consultancy firm Services to conduct a risk analysis and vulnerability assessment for the Belize River Watershed;
(d) Consultancy firm services for the development of a multi-hazard impact-based forecast and early warning system for NMS of Belize;
(e) Consultancy services capacity building and training the NMS and National Emergency Management Office of Belize.

1.02 Timely engagement of the PC and consultants to provide the above-mentioned services is crucial to ensuring a smooth and successful project implementation and, consequently, achieving project expected outcomes. Against this background, a procurement consultant will be hired to support the NMS and will have responsibilities related to procurement activities associated with various aspects of the project.

2. KEY RESPONSIBILITIES

2.01 The Procurement Consultant will assist the NMS with:

(a) Defining procurement strategy and as necessary revising the procurement plan.
(b) Preparing procurement documents: requests for expressions of interest (EOIs) and requests for proposals (RFPs) and other tender documents and assisting the Client to respond to Request for Clarifications from Consultants and Bidders.
(c) Identifying potential consultants or providers, as necessary.
(d) Evaluating EOIs, RFPs or other relevant procurement documents.
(e) Negotiating the contract terms and conditions and drafting the contracts.

3. REPORTING AND DELIVERABLES

3.01 The deliverables under the assignment shall be written and verbal advice/feedback on:

(a) Bidding document;
(b) Pre-bid meeting (which the Consultant will attend as observer) and drafting requests for clarification and/or amendments to bidding document;
(c) Bid opening minutes and drafting of evaluation report; and
(d) Negotiations and contract drafting

3.02 The written deliverables would be submitted electronically by email to NMS.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The ideal candidate for the position of Procurement Consultant should possess the following qualifications and skills:

(a) A Bachelor's or Master's degree (preferred) in a relevant field (e.g., procurement, supply chain management, business administration, project management or a related discipline).

(b) Deep understanding of procurement regulations, guidelines, and best practices, particularly in the context of international development projects. This includes familiarity with the Caribbean Development Bank or other multilateral development banks or international financial institutions' procurement rules and procedures.

(c) Proven experience in managing procurement processes for similar technical assistance or infrastructure projects. This includes experience with procurement planning, vendor/provider selection, bid evaluation, and contract management.

(d) Excellent communication and interpersonal skills, with the ability to ability to prepare clear, concise, and accurate reports, procurement documentation, and other project-related materials.

(e) Proficiency in English is essential. Proficiency in Spanish is an asset.

(f) Familiarity with the institutional and operational aspects of meteorological services and emergency management is an advantage.

(g) Knowledge of the cultural and socio-economic context of the Caribbean and experience working in the Caribbean and of similar small island context.

5. DURATION

5.01 The level of effort for this assignment is expected to be 65 days over a period of 18 months. The NMS will provide office accommodation, equipment, and appropriate administrative support to the Consultant while in country.

APPENDIX 12

PROCUREMENT PLAN

I. General

1. **Project Information:**

Country: Belize

Borrower: The Government of Belize

Project Name: Pilot Project to Implement Multi-Hazard Impact-Based Forecasting and Early Warning Systems for the Belize River Watershed - Belize.

Project Implementing Agency (PIA): Ministry of Economic Development, Belize

2. **Bank's Approval Date of the Procurement Plan:** December 2023

3. **Period Covered By This Procurement Plan:** December 2023 – September 2026

II. Goods and Works and Non-Consulting Services

1. Prior Review Threshold: Procurement decision subject to Prior Review by the Bank as stated in the Procurement Procedures:

	Selection Method	Prior Review Threshold (USD)	Comments
1.	Limited Bidding - National: Goods/Non-consulting Services		
2.	Direct Selection		

2. Reference to (if any) Project Operational/Procurement Manual: Procurement Policy for Projects Financed by CDB (November, 2019) and Procurement Procedures for Projects Financed by CDB (January, 2021).

3. Any Other Special Procurement Arrangements: To comply with the requirements of the CARE Finance Agreement the following is required:

(a) Financing shall be provided under CARE and thus eligibility shall be extended to countries which are eligible for procurement under EU-Funded projects, which are not CDB member countries, in accordance with the EU Eligibility Rules.

4. Procurement Packages with Methods and Time Schedule

1	2	3	4	5	6	7	8	9
Ref No.	**Contract (Description)**	**Estimated Cost (USD)**	**Selection Method**	**Pre-qualification (Yes/No)**	**Regional Preference (Yes/No)**	**Review by Bank (Prior/ Post)**	**Expected Bid-Opening Date**	**Comments**
1.	**Current Observation Network, Modelling and Analysis Tools Improved**							
(a)	Weather station parts		Direct Selection	No	No	Prior	September 2024	NMS manages a standardised network of automatic weather stations (AWS) and other hydrometeorology equipment for efficient operation. This standardisation is cost-effective, simplifies maintenance, troubleshooting, and repairs, enhances technician training and specialization, and, crucially, ensures the acquisition of reliable data for NMS activities. The new AWS equipment and sensors from this project will expand NMS's observation network and will therefore be procured through direct selection of Huitzilin Consorcio Internacional S.A de C.v, Mexico.

1	2	3	4	5	6	7	8	9
Ref No.	**Contract (Description)**	**Estimated Cost (USD)**	**Selection Method**	**Pre-qualification (Yes/No)**	**Regional Preference (Yes/No)**	**Review by Bank (Prior/ Post)**	**Expected Bid-Opening Date**	**Comments**
(b)	Desktop computers (4), workstations (2), laptops (4), rugged field laptops (2), rack servers (2), hard drive and memory sticks		Direct Selection	No	No	Prior	June 2024	UNDP Belize Office will be selected to procure IT equipment through their global framework contracts, which were awarded competitively, as previously done in another project.
(c)	GNC – a station equipment		Limited Bidding - National	No	No	Prior		
(d)	Tsunami equipment for coastal at- risk communities		Limited Bidding - National	No	No	Post		
2.	**Risk analysis and vulnerability assessment completed, and multi-hazard maps developed**							
(b)	Local Travel (10)		Limited Bidding - National	No		Post		
(c)	Workshop/training (4)		Limited Bidding - National	No		Post		
(e)	Local travel (5)		Limited Bidding - National	No		Post		
3.	**Reliable and Operational Forecasting and Warning System Established**							
(a)	Public Awareness Campaign for CAP		Limited Bidding - National	No		Prior		
(c)	Local travel (4)		Limited Bidding - National	No		Post		
(d)	Workshops/Training (4)		Limited Bidding - National	No		Post		
(e)	Public Awareness Campaign		Limited Bidding - National	No		Prior		
4.	**NMS and NEMO Staff Capacity Improved**							

1	2	3	4	5	6	7	8	9
Ref No.	**Contract (Description)**	**Estimated Cost (USD)**	**Selection Method**	**Pre-qualification (Yes/No)**	**Regional Preference (Yes/No)**	**Review by Bank (Prior/ Post)**	**Expected Bid-Opening Date**	**Comments**
(b)	Workshop/Training (6)		Limited Bidding - National	No		Post		There are 6 workshops to be held at different times. The cost of an individual workshop falls under the threshold.
(c)	Distance Learning		Limited Bidding	No		Prior		
(d)	On-Campus Learning UWI		Direct Selection	No		Prior		UWI offers a competitive undergraduate programme in meteorology and computer science. Affiliated with UWI, the Caribbean Institute for Meteorology and Hydrology (CIMH) primarily delivers the bachelor of science programme in meteorology. CIMH is the regional organization for training and research in meteorology, climatology, hydrology, and agro-meteorology in the Caribbean. It serves as a repository for climate data from the Caribbean Meteorological Organization Member States and is recognized by the World Meteorological Organization (WMO) as the WMO regional training centre for

1	2	3	4	5	6	7	8	9
Ref No.	**Contract (Description)**	**Estimated Cost (USD)**	**Selection Method**	**Pre-qualification (Yes/No)**	**Regional Preference (Yes/No)**	**Review by Bank (Prior/ Post)**	**Expected Bid-Opening Date**	**Comments**
								meteorology and hydrology in the Caribbean. CIMH is committed to assisting the National Meteorological Service of Belize with the implementation of this technical assistance project.
(e)	On-Campus Learning CIMH		Direct Selection	No		Prior		As at (d).

III. Consulting Services

1. **Prior Review Threshold:** Procurement decision subject to Prior Review by the Bank as stated in the Procurement Procedures:

	Selection Method	Prior Review Threshold (USD)	Comments
1.	Individual Consultant Selection (ICS)		
2.	Quality Cost Based Selection (QCBS)		
3.	Direct Selection (DS)		
	Consultants Qualifications Selection (CQS)		

2. **Reference to (if any) Project Operational/Procurement Manual**: Procurement Policy for Projects Financed by CDB (2019) and [Procurement Procedures for Projects Financed by CDB (January, 2021)]

3. **Any Other Special Procurement Arrangements**: Financing shall be provided under the CARE agreement and thus, in accordance with that agreement, eligibility shall be extended to countries which are eligible for procurement under the EU-funded Programme, which are not CDB member countries, in accordance with the EU Eligibility Rules

4. **Procurement Packages with Selection Methods and Time Schedule**

1	2	3	4	5	6	7
No.	**Assignment (Description)**	**Estimated Cost USD**	**Selection Method**	**Review by Bank (Prior/Post)**	**Expected Proposal Submission Date**	**Comments**
1.	Project Coordinator		ICS	Prior	March 2024	
2.	Consultancy Services – Establish a high availability Kubernetes server cluster for the NMS. configuration and maintenance		QCBS	Prior	June 2024	
3.	Consultancy services – Update and expand flood EWS and conduct training on FEWS operation, configuration and maintenance		QCBS	Prior	June 2024	
4.	Consultancy services – Conduct risk analysis and vulnerability assessment for the Belize river watershed.		CQS	Prior	N/A	
5.	Consultancy services – Development of a multi-hazard impact-based forecast and EWS for the NMS.		QCBS	Prior		

6.	Consultancy Services – Capacity Building and Training for the NMS and NEMO – Belize		DS	Prior		DS with the CIMH. No professional fees are included. Only travel and accommodations will be covered for CIMH staff.
7.	Procurement Consultant		ICS	Prior		

IV. Implementing Agency Procurement Capacity Building Activities with Time Schedule

In this section the agreed Procurement Capacity Building Activities are listed with time schedule.

No.	Expected Outcome/ Activity Description	Estimated Cost	Estimated Duration	Start Date	Comments
1.	Project launch workshop (virtual or in-person) with CDB and Implementing Agency to increase the capacity of Implementing Agency to follow CDB's procurement procedures	0	2	Q4 2023	

V. Summary of Proposed Procurement Arrangement

Project Component	CARE (USD)					NBF (USD)		Total Cost (USD)
	LB - N	ICS	QCBS	DS	CQS	Country	Institution	
1.Current Observation Network, Modelling and Analysis Tools Improved								
2.Risk Analysis and Vulnerability Assessment completed, and multi-hazard maps developed								
3.Reliable and operational forecasting and warning system established								
4.NMS and NEMO staff capacity improved								
5.Project Coordinator								
6.Procurement Consultant								
Sub total								
7. Price Contingency (12%)								
8. Finance Charges								
Total Project Costs								

*This amount is provided under the CARE Programme

ICB	International Competitive Bidding	QBS	Quality Based Selection
NCB	National Competitive Bidding	QCBS	Quality and Cost-Based Selection
DS	Direct Selection	FBS	Fixed Budget Selection
LB	Limited Bidding	LCS	Least Cost Selection
RB	Regional Bidding	CQS	Consultants Qualifications Selection
FA	Force Account	ICS	Individual Consultant Selection
NBF	Non-Bank Financing		

This information is withheld in accordance with one or more of the exceptions to disclosure under the Bank's Information Disclosure Policy.