CARIBBEAN DEVELOPMENT BANK

TECHNICAL ASSISTANCE - STRENGTHENING WATER RESOURCE MANAGEMENT AND CLIMATE RESILIENCE IN COASTAL AND INLAND COMMUNITIES - JAMAICA

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1. REQUEST

1.01 By correspondence dated May 18, 2023, The University of the West Indies, Mona Campus (The UWI) applied to the Caribbean Development Bank (CDB) for a technical assistance (TA) grant to support improved water resource management, lessen the impact of water-related hazards on people and infrastructure and enhance community resilience to climate change (CC) on the island of Jamaica.

1.02 The estimated cost of the project is one million, two hundred and sixty-four thousand, two hundred and twenty United States Dollars (USD) (USD1,264,220) of which nine hundred and nine thousand United States dollars (USD909,000) would be provided from CDB's Special Funds Resources (SFR) allocated from the Caribbean Action for Resilience Enhancement (CARE) Programme and three hundred and fifty-five thousand, two hundred and twenty United States dollars (USD355,220) from counterpart contribution.

2. BACKGROUND

Overview of Water Resources Quantity and Quality

2.01 Jamaica's water resources comprise groundwater, captured in both limestone and alluvial aquifers, and surface water from rivers and streams. The island has an abundant freshwater supply with 77 percent (%) of the safe yield remaining unused. However, freshwater supply is unevenly distributed as the major sources, mainly in the north, often lie distant from population centres, irrigation areas and industries that are located in the south. Groundwater accounts for 84% of production, with rivers providing 16%.

2.02 In Jamaica, water demand varies across domestic, agricultural, industrial, and tourism sectors, each with distinct usage patterns. The domestic sector, a major consumer, primarily uses water for drinking, cooking, bathing, and sanitation. Agriculture and tourism are key productive sectors that are heavily reliant on water for their growth and sustainability. Agriculture mainly needs water for irrigation, and tourism requires substantial water for hotels, resorts, landscaping, pools, and guest services. However, Jamaica and six other Caribbean countries (Antigua and Barbuda, Barbados, Dominica, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago) are among the 36 countries designated as most water stressed by the World Resources Institute (WRI)[1]. Though water stress is not apparent at the national level, water stress occurs locally due to imbalances in supply and demand. Variabilities in rainfall patterns, increase in

[1] World Resource Institute: 36 Most Water Stressed Countries. December 12, 2013 (World's 36 Most Water-Stressed Countries | World Resources Institute)

urbanisation and improper pollution management practices have also led to water shortage in several parishes. In some areas of the country, there is an over reliance on groundwater extraction to meet demand, leading to over-pumping and saline intrusion. For instance, in the densely populated Kingston Metropolitan Area (KMA), water is extracted from several wells, but over pumping; nitrate contamination from sewage; and saline intrusion have led to the closure of many wells, exacerbating water scarcity.

2.03 Jamaica is divided into 26 watershed management units (WMU), 10 of which are considered to be "degraded" or "severely degraded". This degradation affects both the quantity and quality of groundwater and surface water sources. One third of these watersheds have deteriorated as a result of deforestation [2]. Consequently, low-lying areas experience increased sedimentation, rapid runoff, reduced infiltration into the aquifers leading to a reduction in recharge and water resources availability (National Environmental Policy Act (NEPA) 2011). These conditions also contribute to flooding and altering of river courses. In addition, approximately 10% of surface water and groundwater quality have been negatively affected by poor waste management practices, including inadequate treatment and disposal from domestic, industrial and commercial activities. Nutrient and faecal pollution are major issues that affect the island's ground and surface water resources (Government of Jamaica (GOJ), 2019).

Climate Context

2.04 Climate change has significant implications for water security. Jamaica has been experiencing a linear warming trend from 1950-2014[3]. Regional climate models project an increase in mean temperature of between 0.3°C and 1.3°C by 2030 and 2.52ºC to 3.20ºC by mid-century[4]. Models project a range of possible changes in average rainfall, from a decrease of 32% to an increase of 25%. Short-term rainfall variability has shown a noticeable increase, along with evidence of more frequent and intense extreme rainfall events between 1940 and 2010, which can precipitate flooding and landslides. Variability is noticeable in the occurrence of drought. Since the early to mid-1970s there have been several periods of drought, both short-term (three months) and year-long. More prolonged dry spells are projected.

2.05 Severe weather events such as tropical storms and hurricanes, have led to flooding of inland and coastal communities due to improper drainage systems; storm surge; beach erosion and mangrove destruction; and caused damage to infrastructure as well as saline intrusion of soil and water resources. Other factors such as local geology, geomorphology, hydrology, building design, inadequate disaster management policies, and land use also contribute to flooding[5]. Flooding is the most common hazard across the Caribbean, causing over 250,000 deaths and affecting 24 million people since 1950, with economic costs exceeding USD22 billion[6]. Jamaica has suffered major social and economic impacts, with an average annual loss of four lives and costs of USD96.3 million (approximately 1% of gross domestic product)[7]. Consequently, as temperatures increase due to CC, severe weather events and sea level are expected to increase, thus heightening the vulnerability of inland and coastal communities to flooding. For example, the Rio Cobre Basin and the Outram River Watershed have both experienced significant flooding from the passage of hurricanes and extreme rain events.

2.06 Warming oceans and rising sea levels pose significant threats to coastal communities, affecting fish stock, coral reef and mangrove degradation, agricultural soils, health and livelihoods. Sea level rise can lead to freshwater contamination, shoreline erosion, flooding, and increased storm surge risks. In recent

[2] State of the Environment Report 2017, Jamaica. NEPA 2019.
[3] State of the Jamaican Climate Report 2015. Climate Studies Group Mona (CSGM), 2017.
[4] World Bank Climate Change Knowledge Portal.
[5] Flood hazard mapping in Jamaica using principal component analysis and logistic regression. Nandi et al. 2016; Carby et al. 2012.
[6] Otker and Srinivasan 2018.
[7] Fontes de Meira and Phillips 2019.

years, Jamaica's coastal communities have also been facing challenges like pollution, destruction of marine habitats, sargassum seaweed influx, impacting vital infrastructure and livelihoods. With 60% of Jamaica's population and important infrastructure located in the coastal zones, the country is particularly vulnerable to multiple threats. Coastal zones provide a buffer from waves, tides and currents, and support food security and economic growth. A recent study showed that for Jamaica, a 1-meter rise in sea level places 8% of major tourism properties at risk[8], which could significantly impact the country's economy. Efforts, including the establishment of marine protected areas, are ongoing to protect the coastal zones in Jamaica, but additional support is required to counteract the long-term effects on livelihoods, tourism, health, food, energy, water security and economic growth.

Socio-economic Context

2.07 In end-2019, Jamaica's population was estimated at 2,734,092 (1,352,109 males and 1,381,983 females). The population is relatively young, with 54% below 30 years, and 8% over 64 years (2011 census). According to the United Nations Population Division (2023), with a low fertility rate, Jamaica's population is projected to decline to 2,505,988 by 2050. Most of the country's population (49%) resides in 4 parishes (of 14), in proximity to the largest city of Kingston. The 2019 Jamaica Survey of Living Conditions (SLC) revealed that the All-Jamaica poverty rate fell to 11.0% compared with 19.3% in 2017. This decline in poverty headcount was registered predominantly in GKMA, which recorded a 4.5 percentage point fall in its poverty headcount to 4.7%. Conversely, the incidence of poverty in OUC and rural areas remained relatively unchanged at 13.4% and 14.2%, respectively. Available disaggregated data shows that a slightly higher proportion of males than females were poor (.13.1% and 10.4%)[9], a slightly greater proportion of female-headed households (FHH), compared to male-headed households (MHH) were poor (15.9% and 13.2%). The largest share of total poverty was concentrated in rural areas (44.9%), followed by GKMA (31.6%) and OUC (23.5%). Of the total poor, 28.2% were children (0-14 years), 62.8% working age (15-64), and 9.0% dependent elderly (65+ years). The indigence rate, however, rose marginally to 4.0% in 2019 compared with 3.6% in 2018.

2.08 The poor and vulnerable, including women, children, the elderly and those with disabilities, often struggle to access safe and affordable drinking water and are disproportionally affected by disasters. The Jamaica National Water Sector Policy and Implementation Plan (2019) outlined that rural and peri-urban communities regularly face water shortages, inadequate access to potable water, and poor water quality due to various factors like deficiencies in the existing treatment process, aging infrastructure, inadequate storage capacity and distribution systems. The 2019 Sector Policy and Plan revealed that most rural Jamaicans rely on public standpipes, rainwater harvesting and minor water supply systems, which are outdated and unreliable. These communities also experience higher levels of poverty (SLC 2019), further limiting access to clean water sources and sustainable livelihoods, leading to adverse health effects and food insecurity.

2.09 Resultantly, such challenges stymie social and economic well-being at the micro, meso and macro levels such as livelihood, social and community activities. Improving access to water is crucial, particularly to alleviate the burden on women and children who typically collect water in Jamaican households. Protecting and exploring alternative water sources are essential to address this challenge. Third National Communications of Jamaica to the United Nations Framework Convention on Climate Change highlighted farming and fishing as the most climate-sensitive livelihoods. Gender-responsive and socially inclusive programming is necessary to ensure equitable access to water and reduce vulnerability to disasters, including through more robust Early Warning Systems (EWS).

[8] The Caribsave Climate Change Risk Atlas (CCCRA). 2012.
[9] VNR_Goal_1.pdf

2.10 Countries or communities with comprehensive EWS generally experience lower mortality rates from disasters than those without such systems[10]. The Global Commission on Adaptation Report indicates that providing just 24 hours' notice of an impending hazardous event could reduce damage by 30%. The United Nations has set a target for citizens worldwide to be protected by EWS against extreme weather and CC by 2027.[11] This target underscores the urgent need for Caribbean countries, including Jamaica, to intensify efforts in establishing and enhancing EWS to protect the most vulnerable communities.

Addressing Challenges in the Water Sector

2.11 Several initiatives have sought to address challenges in the water sector in Jamaica. The 2019 National Water Sector Policy and Implementation Plan outlines government strategies including irrigation, drought management, climate adaptation, energy efficiency, and rainwater harvesting. Priorities include modernising infrastructure, providing rural water supply and enhancing drainage networks. The government also supports programs to boost adaptation and resilience.

2.12 CDB provided grant financing of EUR218,751 from 2017 to 2020, through the African Caribbean Pacific-European Union-CDB Natural Disaster Risk Management (ACP-EU-CDB NDRM) in CARIFORUM Countries Programme, to the GOJ to upgrade the flood EWS on the Rio Cobre. In June 2020, CDB also provided USD750,000 through resources from the Agence Française de Développement under the European Union Caribbean Investment Facility to help the Government of Jamaica strengthen its capacity for evidence-based decision-making in rural water supply development and to guide a more comprehensive capital water supply project. However, significant resources are still needed to tackle Jamaica's water sector challenges and address flood risk in other communities.

2.13 The proposed project targets one coastal community (Port Maria/Outram River Watershed) and two inland areas (Kingston and Rio Cobre Basins). These communities include areas where work has already begun and an area that has historically been neglected. Port Maria, chosen for the EWS interventions, has experienced severe flooding, being particularly vulnerable due to its location below sea level. To address water supply challenges, comprehensive assessments of surface and groundwater resources are needed for the Kingston and Rio Cobre Basins to understand long-term trends and model the impact of CC. Further detailed description of the target communities and the watershed characterisation are presented in Appendix 1.

3. ISSUES AND CONSTRAINTS

3.01 As previously indicated, various factors have contributed to Jamaica's challenges in water quality and supply-demand imbalances, leading to shortages of clean and affordable water in several parishes. In addition, CC poses significant threats to water supply and quality, with potential cascading effects on multiple sectors such as energy, agriculture, tourism, health, and education. These challenges are compounded by inadequate capacities of key water sector stakeholders and weak EWS, particularly negatively impacting vulnerable communities. Addressing these challenges requires strategic partnerships involving governmental entities, academia, local communities, and development agencies to mobilise expertise and financial resources at scale for building water sector resilience and implementing effective, people-centred EWS in Jamaica.

[10] United Nations Climate Action 2022.
[11] United Nations 2022.

Institutional Capacity

3.02 The project will be based in the Faculty of Science and Technology (FST) at The UWI (Organisational Structure shown at Appendix 2). The university has a track record of successfully implementing research and developmental projects funded by local and international donors including foundations, development agencies, including multilateral development banks, and regional blocks. All projects are managed through a centrally operated system and conform to the clients' and the university's financial procedures, procurement policies and guidelines. The UWI receives and manages an average of JMD500,000,000 (USD3,230,000) new grants per year from several funding agencies. This includes the recent "State of the Caribbean Climate" Project and Report (2020) which was successfully implemented by the CSGM (FST) with financing received through TA provided by CDB from resources allocated under the ACP-EU-CDB NDRM in CARIFORUM Countries Programme. The strength of The UWI brand, and its recent ranking by Times Higher Education in the elite band of the top 1.5% of universities worldwide based on evaluation of over 25,000 recognised universities globally[12], makes The UWI an appropriate and very strategic partner to implement this new project.

3.03 The UWI's cadre of scientists and academics are known internationally and regionally for their expertise in the respective technical areas of this project. The interdepartmental group of scientists who will provide technical leadership for the project are not only respected academics but have practical on-the-ground experience in the activities to be implemented under this project, having worked on similar projects supported by other funding agencies. The UWI Special Projects Office will provide counterpart support to this project, including financial management, administrative services and procurement (See Execution Arrangements below).

4. PROPOSAL

4.01 It is proposed that CDB approve a grant to The UWI in the amount of nine hundred and nine thousand United States dollars (USD909,000) from CDB's SFR allocated from resources provided under the CARE Programme to assist The UWI in financing the costs of consulting services and the procurement of goods and services aimed at strengthening water resources management and climate resilience in coastal and inland watershed communities in Jamaica. Specifically, the grant will be used to finance the implementation of three main components, as described below.

4.02 Component 1: In-depth Evaluation of Surface and Groundwater Resources

This component is focused on conducting a comprehensive assessment of surface and groundwater resources in the Kingston and Rio Cobre Basins, emphasising their current state and potential implications under various projected CC scenarios. Modelling of the surface and groundwater resources, with demand and supply, will be done using the Soil and Water Assessment Tool (SWAT), MODFLOW and water evaluation and planning (WEAP) models (see Appendix 3 for descriptions of the models). Key activities of this component include:

(a) Data collection and analysis[13]: systematic gathering and thorough analysis of pertinent data.
(b) Mapping of aquifer and surface water resources: employing field geological mapping alongside existing geographical information system (GIS) data to create comprehensive maps.

[12] https://www.timeshighereducation.com/world-university-rankings/university-west-indies, https://www.mona.uwi.edu/news/uwi-soars-top-latest-global-universities-rankings.
[13] Research assistant/graduate student will be engaged to assist with data collection and analysis.

(c) Collection of water quality data, assessment and mapping of surface and groundwater quality.
(d) SWAT model simulation: utilising the SWAT model for predicting daily and annual flows under projected CC scenarios, and surface water abstraction rate for potable and irrigation use.
(e) Groundwater modelling: employing MODFLOW to model groundwater flow and nutrient transport, abstraction and water level depths, under current and future projected CC scenarios.
(f) Using WEAP in connection with SWAT and MODFLOW outputs (surface and groundwater) to estimate current and future demand.
(g) Host consultations with key stakeholders and integrate inputs into the evaluation.

4.03 Component 2: Strengthening EWS and Enhancing Disaster Risk Reduction

This component is focused on designing and developing gender responsive and socially inclusive EWS[14] with an emphasis on three elements: risk knowledge, monitoring and warning service, and response capability. Work under the risk knowledge element will also draw on the outputs from Component 3 below on climate vulnerability and risk assessments, and community risk maps. Key activities of this component include:

(a) Harnessing expertise for data collection and analysis: collaborating with experts, research assistants, students and local community members to facilitate relevant data collection and in-depth analysis, and desktop literature reviews.
(b) Comprehensive data gathering: collecting data related to population demographics, movement patterns, traffic patterns, topography, geography, geomorphology, rainfall, soil composition, land use, landscape features, building structures, channel profiles, and flood watermarks.
(c) Conducting focus group sessions and organising community meetings: These sessions will also serve as a medium for training and information dissemination activities. A baseline survey will be conducted in Port Maria and surrounding communities and statistical analysis will be used in data processing.
(d) Collect disaggregated data by sex for gender monitoring across all research/data collection activities
(e) Installing weather monitoring stations, stream gauges, rain gauge unit, flood gauge and streamflow measurement stations at designated sites in Port Maria, including utilising hydrological and hydraulic modelling for flood forecasting, enabling timely responses to flood threats by installing a new EWS in Port Maria in consultation with the Meteorological Service of Jamaica (MSJ) and the Water Resources Authority (WRA). This would be the first of its kind in this area.
(f) Flood inundation mapping: generation of GIS-based flood inundation maps by leveraging the hydrologic and hydraulic models (HEC HMS and HEC RAS). Models will be developed for past extreme events, 50- and 100-year flows for present and future CC scenarios (Representative Concentration Path (RCP) scenarios).
(g) Mobile data analysis, GIS analysis and hydraulic calculations, data entry and computer programming, conducting model run simulations, testing and calibration.

[14] The four elements of an EWS are: (a) risk knowledge; (b) monitoring and warning service; (c) communication and dissemination of warnings; and (d) community response capability.

(h) Development of an AI flood planning model/tool and resource materials for future flood events in Port Maria/Outram River Watershed that calculates (i) optimum evacuation times, (ii) optimum evacuation routes/escape routes, (iii) optimal shelter locations, (iv) future flood impact for search and rescue planning and response (measured in terms of casualty by gender, age and other demographics by time of day, day of week), (v) safe/unsafe zones in order to enhance community evacuation plans. This will enhance/inform community evacuation plans for the Port Maria Area which will be operationalised through evacuation drills, activating/organising search and response teams, influencing shelter assignments and declaring safe/no safe zones, among others, in consultation with the Office of Disaster Preparedness and Emergency Management (ODPEM).

(i) Selection of pilot site (in one or more of the target communities) for deploying a dedicated wireless sensor system for monitoring, while considering the challenges associated with transmitting wireless signals across various terrains in Jamaica.

(j) Design and develop sensor monitoring system to acquire relevant water parameters (e.g., water pH, water level/height, and oxygen saturation) using appropriate sensor probes.

(k) Design and setup wireless communication link for the transmission of data to central location.

(l) Perform pilot testing at sensor monitoring site; collection and transmission of sensor data; data validation and analysis.

(m) Development of online server-based repository for storage of parametric data and suitable user interface.

(n) Host consultations with men and women, vulnerable groups, and indigenous populations as a project component during preparation, implementation, and completion.

4.04 Component 3: Supporting Livelihoods, Community Capacity Building and Climate Resilience

Component 3 will focus on enhancing gender responsive and socially inclusive knowledge and awareness about flood risks, along with other climate risks, in the vulnerable communities targeted by Components 1 and 2. It will also support livelihoods by providing targeted capacity-building opportunities in integrated water resources management and sustainable land management practices. The activities will be organised in three phases: a vulnerability and risk profile, resilience mapping workshops and capacity building. Information from a climate risk and vulnerability and assessment (CVRA), taking account of gender, age and disability status, along with the outputs from the various modelling exercises will be used to conduct several community resilience mapping workshops using a variety of participatory methods such as focus groups and design charrettes to identify potential areas of intervention aimed at reducing flood vulnerability. The goal of the charrette is to capture the vision, values, and ideas of community members in designing a robust action plan for the community with the aid of the technical team. Capacity building and training will be provided to farmers, residents, community organisations, as well as equipment to support effective response to climate-related disasters, improving climate awareness and knowledge within these vulnerable communities, and ultimately saving lives and livelihoods. Results from the modelling exercises will also be shared with the community at these workshops. Key activities to be implemented include:

(a) Conducting CVRA in Port Maria and at least one community in the Kingston and Rio Cobre basins. This will include socio-economic and livelihood data and sex disaggregated data collected at the household level.

(b) Developing integrated community risk profiles, based on the results of the CRVA[15].
(c) Conducting stakeholder consultation workshops to co-develop robust community resilience-building action plans, based on the results of the CVRA and validation workshops based on these plans.
(d) Developing gender responsive and socially inclusive knowledge products, materials and resources for educational and training purposes.
(e) Strengthening community livelihoods in Port Maria, through tailored capacity building training workshops in the community to support adaptation and flood mitigation efforts.
(f) Dissemination of results to community residents, parish disaster coordinators, government agencies and officials, and the wider public.
(g) Host consultations with men and women, vulnerable groups, and indigenous populations as a project component during preparation, implementation, and completion.

5. OUTCOMES

5.01 The expected outcomes of the project listed below will contribute to achieving the CARE Outcome 1 "Governance on disaster risk management and climate change adaptation (CCA) in the BMCs improved" and Outcome 3 "Community infrastructure and livelihood resilience to CC effects and natural hazards enhanced".

(a) Use of updated water supply and demand data to enhance food and water security improved.
(b) Capacity for planning, preparedness and evidence-based decision making to mitigate flood risks and impacts strengthened.
(c) Knowledge and awareness about flood risks, other climate risks, and potential mitigation measures enhanced.

5.02 The Results Monitoring Framework is presented at Appendix 4 and the Work Implementation Schedule at Appendix 5.

6. JUSTIFICATION AND BENEFITS

6.01 The proposed project aims to address the pressing needs of vulnerable communities residing in watershed and coastal areas, with a focus on improving water quality and security, managing flood risks, enhancing disaster mitigation efforts, and promoting sustainable livelihoods. The overarching goal is to strengthen water resources management, enhance community resilience to hazards, support CCA, and establish best practices applicable to Caribbean communities. The project will facilitate a comprehensive study of surface and groundwater resources, including long-term monitoring of water quality, resource mapping, and groundwater modelling in critical areas such as the Kingston, Rio Cobre, and Port Maria basins. The data collected from these efforts will be instrumental in designing integrated water resource management strategies.

6.02 Furthermore, the project will enhance flood forecasting capabilities to enable timely warnings and effective community evacuation efforts. Enhanced EWS will be developed through the implementation of real-time transmission systems utilising sensors and wireless communication technologies, focusing on coastal threats. Expanding this system across the island can significantly mitigate disasters along Jamaica's coast, safeguarding lives and livelihoods.

[15] The risk profile will be for Port Maria as a whole, while the two communities in the Kingston and Rio Cobre Watersheds, respectively, would be chosen based on an initial scoping exercise at the beginning of the project.

6.03 The project will also allocate funds for community capacity building and resilience initiatives, including gender responsive and socially inclusive assessments of target communities' vulnerability to climate impacts, flood hazard mapping, and enhancing adaptative capacity to climate change. Strategies will involve leveraging community knowledge, conducting targeted training workshops, providing resources for farmers, residents, and community organisations, as well as equipping them to effectively respond to climate-related disasters. The project will also host consultations with men and women, vulnerable groups, and indigenous populations as a key project strategy during preparation, implementation, and completion. Additionally, efforts will be made to enhance climate awareness and knowledge within these vulnerable communities, ultimately contributing to the preservation of lives and livelihoods.

6.04 Overall, the project will use a multifaceted approach to improve EWS and water resource management, enhance resilience in vulnerable communities, and empower local residents to adapt to the challenges of climate change and disasters.

6.05 Based on CDB's Performance Rating System, the project has been assessed as highly satisfactory with an overall score of 3.75. A summary of the project performance score is shown in Table 1, and Appendix 6 shows the details of the Performance Rating System.

TABLE 1: PROJECT PERFORMANCE SCORE SUMMARY

Criteria	Relevance	Effectiveness	Efficiency	Sustainability	Overall Score
Score	4.0	3.75	3.75	3.5	**3.75**

7. GENDER MARKER AND PERFORMANCE ASSESSMENT

The Project is assessed as Gender Mainstreamed (GM) based on CDB's Gender Marker, having scored a total of 3 points. The project has the potential to contribute significantly to gender equality. The gender marker is summarised in Table 2 below. Please see Appendix 7 for further details on the gender marker and performance assessment.

TABLE 2: GENDER MARKER SUMMARY

GM	Analysis	Design	Implementation	Objective/ Outcome	Score	Code
	1.0	1.0	1.0	0	3.0	GM

8. EXECUTION

8.01 The UWI, will execute the project through the FST, Dean's Office. As such, the FST would be primarily responsible for all aspects of project execution including technical and fiduciary. A Project Coordinator (PC) will be engaged through a competitive process and paid from CDB resources. The PC should be a qualified management professional with experience working on environment or natural resources management projects. The PC will be responsible for the day-to-day administration of the project, including its coordination, procurement, financial management, reporting and safeguards in accordance with the Grant Agreement with CDB and The UWI procedures. The Dean of the FST will have responsibility for direct supervision of the PC. The draft terms of reference of the PC is presented at Appendix 8. The FST and the PC will work with The UWI Special Projects Office to support the

implementation of the project. The Special Projects Office will provide oversight and financial management. Existing staff of the office, including administrative support, procurement officers and accounting personnel of the Special Projects Office will be involved in the project execution.

8.02 Technical support for the project will be provided by a multidisciplinary team from The UWI comprising a hydrogeologist, chemist and engineer. Each component will have a team lead from The UWI, responsible for the coordination of all activities under that component. The project will also engage the following specialists on a part-time basis: community liaison specialist, engineering hydrologist, statistician, website developer, and computer programmer; as well as technical assistants and service delivery contractors[16], which will include undergraduate and postgraduate students who will be assigned to the project; TORs shown at Appendix 9A-9K.

8.03 A Project Steering Committee (PSC) will be established to provide oversight and strategic guidance to the Project and will meet (virtually) every quarter to review the project. The composition and responsibilities of the PSC are described in Appendix 10. The establishment of the PSC shall be a condition precedent for first disbursement.

8.04 Various stakeholders will be involved at different stages of the project including the WRA, MSJ, National Works Agency, National Water Commission (NWC), National Irrigation Commission (NIC), Spectrum Management Authority, ODPEM, parish disaster coordinators, municipal authorities, local non-governmental organisations and community groups, along with at least one telecommunications provider. The role of each organisation is described below:

Role of Participating Organisations in the Project

8.05 The WRA will be involved in field work for data collection for surface and groundwater sources (streamflow measurements, water level depth and water sampling from wells for water quality monitoring). Installation of a stream gauge at Port Maria will be completed in consultation with WRA who will be responsible for maintaining the stations during and post completion of the project. The project team will liaise with the WRA and other key stakeholders in the water sector (NWC and NIC) to complete activities under Component 1: In-depth Evaluation of Surface and Groundwater Resources. For example, well water level data, streamflow, etc. will be sourced from the WRA and NIC for use in the models. Water demand and consumption models will be calibrated using secondary data from these water agencies.

8.06 The MSJ will provide access to weather and climate data to support the research and programme objectives under Component 2. The entity will provide daily rainfall data from the MSJ-monitored weather stations in the project areas and access to available reports (held by MSJ) outlining past flooding events. The MSJ will partner with the project team on the site selection, installation and maintenance of an automated weather station (AWS) at Port Maria. They will also participate in related stakeholder consultations and workshops. The AWS installed will be jointly monitored by the MSJ, WRA and The UWI. Post project completion, the equipment will be owned and maintained by MSJ. This will strengthen the national hydro-meteorological network and help improve climate services in Jamaica.

8.07 ODPEM will play an important role in the implementation of Components 2 and 3. They will provide access to data on past hydro-meteorological (and other related) hazards as well as damage and loss incurred from these hazards in the study areas. The agency will work along with the project team to provide

[16] Service delivery contractors, including undergraduate and postgraduate students, will assist the technical team with fieldwork, data collection and analysis, as well as flood model development and simulation. Their involvement is crucial for the project's success, given the tight timeline and significant workload.

geospatial data on flood prone areas, maps and any existing evacuation plans for Port Maria (including evacuation routes and shelter locations). They will also participate in stakeholder consultations and workshops with the project team. The AI flood planning model/tool will be loaded unto computer tablets and relevant data generated from the project will be made available for upload to ODPEM and WRA web platforms, the local municipal authorities and community organisations. The model/tool will also be uploaded to a platform with a supporting website made available to other key stakeholders. It is anticipated that the model/tool will support more effective communication/discussions with community representatives and parish disaster coordinators, enhancing disaster management strategies.

8.08 The Spectrum Management Authority (SMA) is the technical advisory agency in the Government of Jamaica for the use of radio frequency. Approval will be required from the SMA to transmit data between remote sites via wireless communication networks, and they will also provide technical guidance on the use of radio frequency bands. This support will be integral to the execution of Component 2, in which real-time transmission systems using sensors and wireless communication technologies will be developed to disseminate early warnings for threats to coastal communities.

8.09 There is a need to incorporate more telecommunications services in Emergency Management across all sectors of the Jamaican society. Thus, telecommunications providers in Jamaica (FLOW and DIGICEL) will play a critical role in the project by providing anonymised call data for use in the development of the AI flood model/tool and setting up the architecture for text messaging and warning alerts for more effective disaster management.

8.10 The Social Development Commission will play a critical role in community engagement and capacity building activities in the targeted communities. They will also provide access to geo-spatial data which highlights boundaries/borders of the communities, as well as socio-economic data related to population, economics, livelihoods, buildings/infrastructure, transportation and social activities. These datasets are critical to the development of the AI flood planning model/tool because it is important to know the physical location of residents in the event of a crisis, and the ability of households to cope with climatic events/hazards.

8.11 Letters of commitment from WRA, MSJ, SMA and ODPEM for the project implementation are provided in Appendix 11A-11D.

8.12 The UWI is expected to submit the initial grant disbursement application to CDB no later than April 30, 2025. The disbursement of the grant funds is scheduled to be completed by October 31, 2026.

9. COST AND FINANCING

The total cost of the project is estimated at USD1,264,220. Seventy-two percent of financing (USD909,000) will be provided by a grant from CDB's SFR allocated from the CARE Programme, and twenty-eight percent (USD355, 220) from The UWI. Funds are available within the CARE programme.

9.01 The Financing Plan is summarised in Table 3 and the detailed budget is shown at Appendix 12.

TABLE 3: SUMMARY OF FINANCING PLAN

Contributors	USD	%
CDB	909,000	72%
The University of the West Indies (Mona) (In-kind)	355,220	28%
TOTAL	1,264,220	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 Programme and thus, in accordance with that agreement, eligibility shall be extended to countries which are eligible for procurement under the EU-funded Programme, in accordance with the EU Eligibility Rules and which are not CDB member countries. The Procurement Plan is shown at Appendix 13.

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 risk and potential mitigation measures to address them. A summary of potential environmental, social, and climate and disaster risks and impacts is presented later in this section.

TABLE 4: SUMMARY OF RISKS AND MITIGATION MEASURES

Risk Type	Level of Risk	Description of Risk	Mitigation Measures
Data management	High	Secondary data may not be readily available which can affect the accuracy and timeliness of data model outputs.	Secondary data will be assessed early for any gaps. Any gaps will be complemented by primary data collection and proxy data where feasible. The implementation schedule has factored in time buffers for such activities.
Data management	High	Data quality may not be accurate for use in models.	The UWI team will work with other key stakeholders (e.g. Meteorological service, WRA, ODPEM) to explore best data alternatives for the models.
Implementation	Medium	Low community/stakeholder participation in training and capacity building activities (meetings, workshops, data collection) is lower than expected, inadequate monitoring of field equipment.	Convenient scheduling of meetings with community and incentives provided (e.g., stipends, refreshments at workshops, travel and communication allowance), training certification).
Operational	Medium	Theft/damage of equipment installed in the field sites would compromise data collection efforts.	Equipment and resources will be installed in a secure area or appropriate community space
Force Majeure	Medium	Adverse weather events can delay the project.	Work on other aspects of the project that do not require on-site visits. Field activities will be programmed outside of the peak

Risk Type	Level of Risk	Description of Risk	Mitigation Measures
			of the hurricane season where practical.
Regulatory	High	Approvals from regulatory agencies (e.g., NEPA, WRA, SMA) and approval from the university's ethics committee is delayed.	These stakeholders are committed to the project; they have submitted letters of commitment. and have representation on the PSC. The regulatory approvals will be requested early and The UWI will continue to actively engage them throughout project implementation.

TABLE 5: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY

Environmental Impact	Major	Medium	Minor X	Not Applicable
Social Impact	Major	Medium X	Minor	Not Applicable

11.02 The TA project aims at strengthening IWRM in targeted communities and is anticipated to generate positive environmental and social outcomes. The main project activities involve field research, developing analytical models and tools, training and capacity building initiatives. The project is focused on the development of analytical models for assessing water supply and demand, and flood forecasting capabilities to enable timely warnings and effective community evacuation efforts. Additionally, the project emphasises strengthening community resilience to CC. This will be achieved through training workshops designed to develop risk profiles, conducting vulnerability mapping, and building local capacity.

11.03 The project will strive to achieve gender mainstreaming in project activities, ensuring that women participate equitably at all levels of decision-making. To this end, gender analysis will be integral to the planning and implementation of project activities, with an effort to identify and address gender disparities. An example of this approach includes selecting community volunteers and participants in training programmes inclusively and ensuring a balanced recruitment of male and female computer programmers to develop early warning computer applications. All capacity-building activities within the project will ensure that both men and women benefit equally.

Climate Change and Natural Hazard Risk Summary

11.04 Project activities can be exposed to natural hazards including floods, intense rainfall, tropical storms, hurricanes, and earthquakes. These events may cause potential disruptions and delays in implementation schedule. The project involves advanced planning implementation strategies to mitigate disaster-related risks.

12. RECOMMENDATION

12.01 It is recommended that CDB's Board of Directors approve a Grant to The UWI of an amount not exceeding the equivalent of nine hundred and nine thousand United States dollars (USD909,000), from CDB's SFR allocated from resources provided under the CARE Programme to assist The UWI in financing the costs of consulting services and the procurement of goods and services for implementing the "Strengthening Water Resources Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica" (the Project) on CDB's standard terms and conditions, and on the following terms and conditions:

No	Subject	Terms and Conditions
1.	**Parties**	Bank: Caribbean Development Bank Beneficiary: The University of the West Indies
2.	**Amount of Grant**	The Bank agrees to make available to the Beneficiary by way of grant, from the Special Funds Resources (SFR) of the Bank comprising an amount not exceeding the equivalent of USD909,000 allocated from resources provided under the Caribbean Action for Resilience Enhancement (CARE) Programme (the CARE Programme).
3.	**Purpose**	The purpose for which the Grant is being made is to assist the Beneficiary in financing the costs of consulting services and the procurement of goods and services aiming to improve water resources management and community resilience to climate change and extreme weather events in Jamaica, more particularly described in paragraph 4 above (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 one hundred thirty-six thousand, three hundred and fifty United States dollars (USD136,350) shall be paid to the Beneficiary as an advance (the Advance) on account of expenditures in respect of the Project following 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 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.

No	Subject	Terms and Conditions
		The Bank shall not be under any obligation to make: (a) the first payment of an amount of the Balance until the Bank 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; (ii) the requisite number of copies of the reports or other deliverables, in form and substance acceptable to the Bank, required to furnished by the Beneficiary to the Bank in accordance with the **Reporting Requirements** (as defined below); and (c) payments exceeding the equivalent of eight hundred and eighteen thousand one hundred United States dollars (USD818,100) 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 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 April 30, 2025, or such later date as may be specified in writing by the Bank. The Grant shall be disbursed up to October 31, 2026, or such later date as may be specified in writing by the Bank.
6.	**Procurement**	Except as provided below, procurement of goods and services to be financed from the Grant shall be in accordance with the following procedures or such other 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)* The following procurement exceptions apply:

No	Subject	Terms and Conditions
		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.	**Condition Precedent to First Disbursement**	The Beneficiary 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 (a) Project Steering Committee (PSC) is established. (b) The Project Coordinator is engaged.
8.	**Project Execution**	Except as the Bank may otherwise agree, the Beneficiary shall execute the Project.
9.	**Project Management**	The Beneficiary shall establish and, for the duration of the Project, maintain a PSC with the composition and functions described in the TOR –PS**C**. The Beneficiary shall engage as PC a person, with qualifications and experience acceptable to the Bank, to carry out the duties and responsibilities set out in the TOR – PC.
10.	**Engagement of Consultants**	The Beneficiary shall, in accordance with the procurement policy and procedures applicable to the Grant, select and engage consultant(s) to provide the consulting services (the Consulting Services) identified for financing by the Bank in (Section III/C)┼in accordance with the applicable **TORs for the Consulting Services**: See Procurement Plan for full list of *Bank-financed* consulting services to be procured using the Grant resources. 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.
11.	**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 other information set out in **TORs for 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.

No	Subject	Terms and Conditions
12.	**Beneficiary's/Borrower'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 Financing Plan; (ii) any amount by which the cost of the Project exceeds the cost set out in the Financing Plan; (iii) the case of any other items needed for the purpose of, or in connection with, the Project; (b) and provide or cause to be provided, all other inputs required for the punctual and efficient implementation of the Project, which are not financed by the Bank
13.	**CARE Programme Conditions**	<u>Information and Visibility:</u> Unless the European Commission (EC) requests or agrees otherwise, the Beneficiary shall take all appropriate measures to publicise the fact that the Project has received funding from the European Union (EU). Information given to the press, as well as all related publicity material, official notices, reports and publications shall acknowledge that the Project 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 Project, 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 EU, or with any other guidelines agreed between the EC and the Bank. <u>Access and financial checks:</u> – The Beneficiary shall allow the EC, 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 Project. – 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

No	Subject	Terms and Conditions
		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 EC, 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.
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 of the CARE Programme or any part thereof is suspended, cancelled, or required to be refunded.

SUPPORTING DOCUMENTATION:

Appendix 1:	Google Earth Image of Jamaica showing Locations of Target Communities and Descriptions
Appendix 2:	Organisational Structure – The University of the West Indies, Mona
Appendix 3:	Project Design and Components including Model Descriptions
Appendix 4	Results Monitoring Framework
Appendix 5	Work Implementation Schedule
Appendix 6	Performance Rating System
Appendix 7	Gender Marker Analysis
Appendix 8	Terms of References (TOR) – Project Coordinator
Appendix 9A	TOR – Technical Assistant (TA) Water Resource Management
Appendix 9B	TOR – TA Chemical Analysis
Appendix 9C	TOR – Consultancy Services for a Computer Programmer
Appendix 9D	TOR – TA Artificial Intelligence Modelling
Appendix 9E	TOR – Consultancy Services for an Engineering Hydrologist
Appendix 9F	TOR – Consultancy Services for a Statistician
Appendix 9G	TOR – TA Sensor and Wireless Network System Design and Development
Appendix 9H	TOR – Consultancy Services for a Website Developer
Appendix 9I	TOR – Consultancy Services for a Social Scientist – Livelihood, Community Capacity Building and Resilience
Appendix 9J	TOR – TA Community Resilience to Climate Change
Appendix 9K	TOR – Consultancy Services for Media and Communication Consultant
Appendix 10	Duties, Composition, and Responsibilities of the Project Steering Committee
Appendix 11A	Letter of Commitment - Meteorological Service of Jamaica
Appendix 11B	Letter of Commitment- Water Resources Authority
Appendix 11C	Letter of Commitment - Spectrum Management Authority
Appendix 11D	Letter of Commitment - Office of Disaster Preparedness and Emergency Management
Appendix 12	Detailed Budget
Appendix 13	Procurement Plan

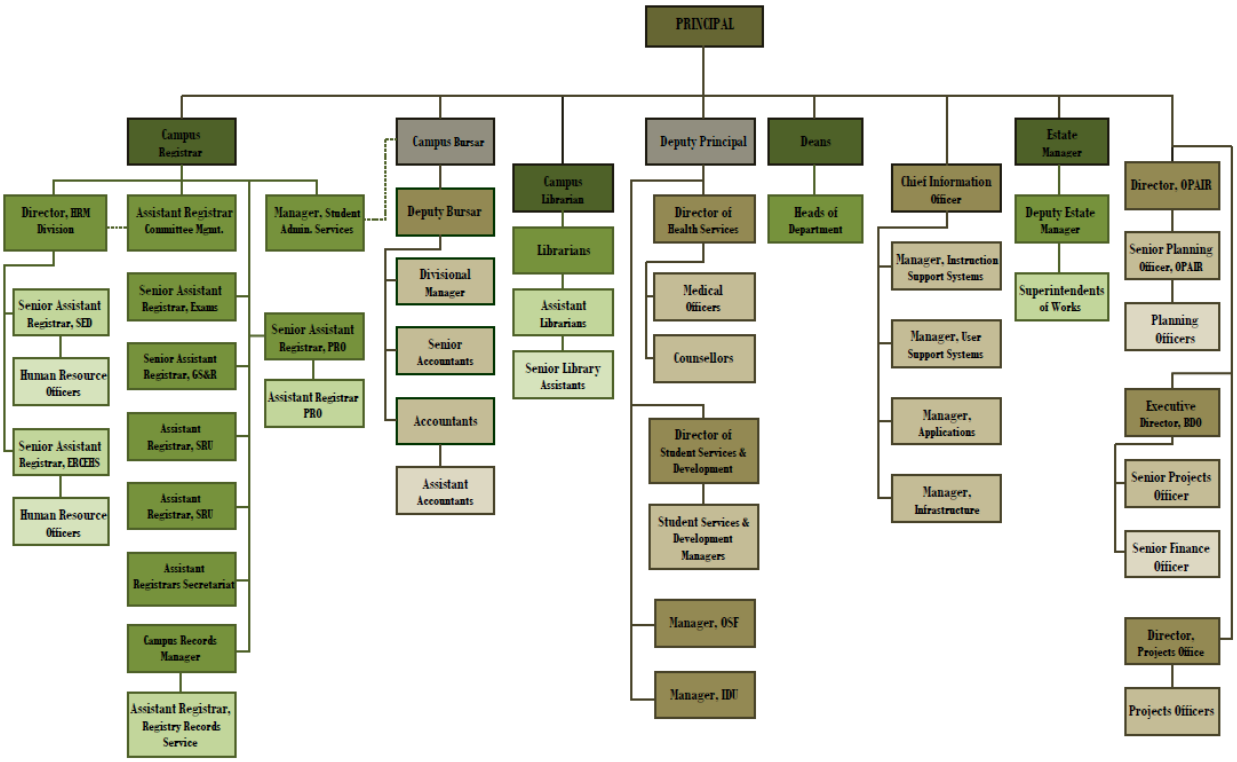
APPENDIX 1

GOOGLE EARTH IMAGE OF JAMAICA SHOWING LOCATIONS OF TARGET COMMUNITIES AND DESCRIPTIONS

APPENDIX 2

THE UNIVERSITY OF THE WEST INDIES, MONA
ORGANISATIONAL STRUCTURE

1. The University of the West Indies (UWI) is a regional institution, established by Royal Charter, which offers a wide range of undergraduate, master and doctoral programmes in Humanities and Education, Pure and Applied Sciences, Science and Agriculture, Engineering, Law, Medical Sciences and Social Sciences. It was started in 1948, as a College of the University of London, at Mona in St. Andrew, Jamaica and achieved full university status in 1962. The Imperial College of Tropical Agriculture in Trinidad was converted into the St. Augustine Campus in 1961; then in 1963, a third campus was instituted at Cave Hill in Barbados. The UWI Open campus, established in 2008, is the fourth campus of this consortium offering multi-mode teaching and learning services through virtual and physical site locations across the Caribbean region. This campus serves 16 countries in the English-speaking Caribbean at 42 sites. More recently, the Five Islands Campus was established in Antigua and Barbuda in 2019. The figure below shows the organisational chart of the UWI, Mona.



2. The project will be implemented by the UWI Mona, through the Faculty of Science and Technology. The project will also include a Project Coordinator who will oversee the timely execution of the project and the administrative duties. The project technical team comprises:

a. **Dr. Debbie-Ann Gordon-Smith,** Environmental Chemist and Lecturer, UWI Mona. Her work is focused on the investigation of the sources and behaviour of chemical contaminants in the freshwater and nearshore marine environments of Jamaica and the impact of land-based activities

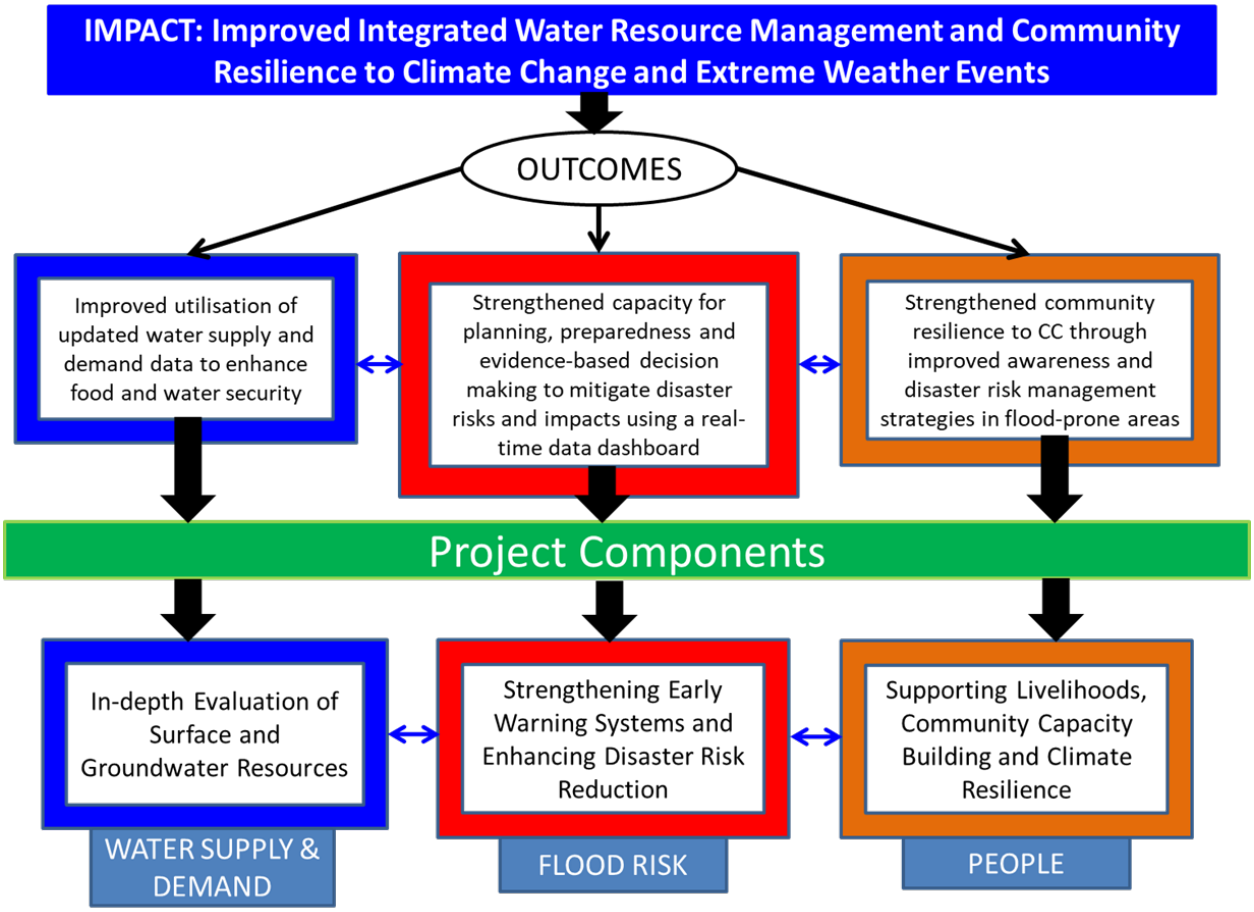
on these aquatic environments. This information is required to properly manage Jamaica's water resources, especially in the context of climate change. Her research group is investigating the flow and quality of the underground and surface waters in four of Jamaica's hydrologic basins in partnership with water agencies in the Government of Jamaica as well assessing coastal water quality and ecosystem health in four marine protected areas in Jamaica. This research involves a community cooperative education component and is being carried out in collaboration with other universities and departments at the UWI. Dr. Gordon-Smith also manages the Environmental Research Laboratory (Department of Chemistry, The UWI) which provides technical and analytical support for multiple departments at the university, public and private entities.

b. **Dr. Arpita Mandal,** Senior Lecturer in Hydrology and Hydrogeology in the Department of Geography and Geology, UWI Mona. Her research focuses on hydrological modelling, climate change (CC) and impact on flood risk and water resources. She has worked on projects funded by national and international funding agencies on several watersheds in Jamaica (Port Maria, Rio Minho, Hope and Yallahs, Rio Cobre). She is interested in early warning systems (EWS) and disaster risk reduction, flood risk assessment in selected communities (inland and coastal), and flood modelling in vulnerable communities, within the context of CC. Although flooding occurs frequently in Jamaica, there lacks an EWS in many watersheds which are effective in informing local communities on time to peak discharge and time it will take for the flood waters to reach the vulnerable communities, which can thus aid in evacuation strategies. Her work also focuses on IWRM in watersheds such as Rio Cobre and Kingston, looking at water availability, demand and supply, water quality monitoring and impact of CC.

c. **Dr. Louis-Ray Harris,** Senior Lecturer and Engineer whose research interests include the study of applications of wireless communications technologies in various fields, and investigations of the impact of these technologies on human life. Previous projects have focused on modelling radiofrequency propagation in different physical environments and investigating the impact of wireless device use on male fertility. In the context of this project, his focus is on the application of modern long-range wireless communication technologies to enable the acquisition of data related to the impacts of climatic variables on the marine environment and the provision of real-time data on increased threats triggered by factors such as the higher frequency of intense storms, the influx of sargassum seaweed, and the release of pollutants from land sources and marine vessels. His electronics and telecommunications background will be helpful in establishing long-range wireless communications links using a combination of sensors and other communication equipment.

APPENDIX 3

PROJECT DESIGN AND COMPONENTS INCLUDING MODEL DESCRIPTIONS



DESCRIPTION OF WATER RESOURCE ANALYSIS MODELS

1. The soil water assessment tool (SWAT) is a surface water model which is used to model daily, monthly and annual flows of dendritic river systems. The model uses ArcGIS as the graphic user interface for creating the watershed model using the digital elevation model (DEM) of the watershed as the base input layer. Preprocessing involves extraction of hydrologic response units (HRU) or sub-catchments and the drainage network from the topography data, soil and land use data. Climate variables, such as rainfall and temperature, are used as the external forcings which along with the different HRU spatial data estimates flow/hydrographs for different sections of the drainage channels. Long term flows can be simulated using the rainfall and temperature time series for stations in the study areas. The model can also be used for predicting flow under different climate change scenarios.

2. MODFLOW is a Groundwater model which can be used for both distributed and semi-distributed systems. The model uses the finite difference method to simulate groundwater flow using Darcy's Law. It can be used for both confined and unconfined aquifers and under steady and unsteady state boundary conditions. Input data includes the topography model, surface and subsurface geology, hydraulic properties of the different aquifer materials (porosity, hydraulic conductivity), structure of the aquifer, water level in the wells, depth and thickness of the aquifer, rainfall and temperature. Model outputs are groundwater flow and direction and overall hydrogeological assessment of the aquifer.

3. The Water Evaluation and Planning (WEAP) system is a user-friendly software tool that takes an integrated approach to water resources planning and management. Coupled with SWAT and MODFLOW, it can be used to assess both surface and groundwater demand and supply to address the issues of external and internal water supply, sectoral demand, water conservation, water allocation priorities and groundwater and streamflow simulations. This analyst tool integrates various water supply sources (rivers, tributaries, and groundwater), transmission links, water demands and pollution generation. WEAP thus allows for scenario generation which will evaluate the basin with regard to water sufficiency, compatibility with environmental targets and issues and sensitivity to key variables.

4. HMS and HEC RAS are hydrological and hydraulic models developed by the US Army Corps of Engineers. HEC HMS is a 1D semi-distributed model which simulates flows for dendritic river systems for extreme events as well as for flows for different return periods (50, 100 yr). It uses different methods for estimating runoff from rainfall such as the Green and Ampt, SCS TR55 method; the SCS method is most commonly used for simulating surface runoff and time to peak flow. It also uses ArcGIS software to create the watershed model using the DEM as the base layer and extracting the sub-catchments, drainage network along with its different properties (slope, length, area etc). The watershed model is used as the basin model in HEC HMS which, along with rainfall data, can simulate peak flows and flood hydrographs for sub-catchments and at points of interest in the drainage network. The hydrographs from the HEC HMS are then used as input in HEC RAS, the hydraulic model, which estimates the depth of inundation and extent of flooding. The model can be run under steady and unsteady state boundary conditions. Model inputs are channel cross-sections, soil types, flood hydrographs and friction coefficients of the river channel. Model outputs are displayed in GIS showing the depth and extent of flooding.

5. Artificial intelligence modelling software includes 3D cellular automata, dynamic analysis and systems dynamics. These will be used to visualise future flood impacts and predict estimations related to optimum evacuation times, warnings and flood impact. These models will be developed along with residents in the target communities to enhance resilience and save lives.

APPENDIX 4

RESULTS MONITORING FRAMEWORK

	Results chain	Indicator	Baseline (value and reference year)	Target (value and reference year)	Source and means of verification	Assumptions
Impact (overall objective)	Improved Integrated Water Resource Management and Community Resilience to Climate Change.					Not applicable
Outcome(s) (Specific objectives)	1. Use of updated water supply and demand data to enhance food and water security Improved.	Model-generated supply and demand data/information (estimates of surface and groundwater volume) being used by WRA, NWC and NIC to inform water resource planning.	Limited demand and supply data used to inform planning to improve food and water security in Kingston and Rio Cobre available in 2024.	By March 2027. Data from updated supply and demand model in use to inform planning to improve food and water security in Rio Cobre and Kingston Basins. The model will estimate current (i.e. up to 2026) demand and supply as well as future projected demands under different CC scenarios for 2040, 2050 and 2100.	Model (SWAT, MODFLOW and WEAP) results accessible by WRA, NWC and NIC. WRA, NWC and NIC work programmes and plans.	WRA, NWC and NIC and other key stakeholders remain engaged during project implementation.
	2. Capacity for planning, preparedness and evidence-based decision making to mitigate flood risks and impacts Strengthened.	(a) Data on time to peak flood, flood depth and extent (past and future climate scenarios) in use by ODPEM and other stakeholders for planning and decision making.	No data on peak flow and for past events in use for planning and decision making by key stakeholders.	By March 2027. ODPEM and other stakeholders use data on time to peak flood, flood depth and extent (past and future climate scenarios) for planning and decision making by end of 2026.	Project progress reports. ODPEM and other key stakeholders' technical reports and publications.	Model results are made available to ODPEM and other stakeholders. Key stakeholders, including ODPEM, WRA, MSJ, Fire Department, Parish disaster management coordinators and

		Percent of Port-Maria residents (currently estimated at 7 463) receiving timely flood warnings and alerts.	None	By March 2027 90 % of Port Maria residents.	Surveys of Port-Maria residents. Final project report.	community representatives participate in the development of the flood EWS.
		(b) Number of evacuation drills conducted to enhance community response to flood hazards.	N/A	By October 2026. Two community drills/simulation exercises executed.	Evacuation drills/emergency simulations executed and recorded on log sheets of OPDEM.	
	3. Knowledge and awareness about flood risks, other climate risks, and potential mitigation measures Enhanced.	Percent of community residents (disaggregated by sex) in target areas who acknowledge increased knowledge and awareness of flood risks, other climate risks, and/or the implementation of mitigation measures.	To be determined.	By March 2027 20% percent of community residents in target areas.	Project progress reports.	Community members actively engaged in the projects.
Outputs	1.1. Surface and groundwater flow models for Rio Cobre and Kingston basins developed.	(a) Surface and groundwater model (SWAT, WEAP, MODFLOW) results with valuable insights into water demand and supply.	Currently no modelling data exists.	By October 2026. Model simulations completed and available.	Project progress reports. Online access to model outputs.	Observed station data and well data managed by WRA are available to calibrate the model.
		(b) Maps showing spatial distribution of aquifers and graphs	Current data on the resources till 2024.	By October 2026 Model trends and volume of water resources and their	Project progress reports.	

		showing trends and amount of surface and groundwater resources in the basins produced from models.		demand and supply for future climate projections (2100).	Online access to maps produced.	
	1.2. Water quality model for the Kingston and the Rio Cobre basins developed.	MODFLOW models results and maps showing concentration contours of nutrients and their transport pathways.	No nutrient/ contamination models/maps exist for Rio Cobre and Kingston basins in 2024.	By October 2026. MODFLOW modelling and mapping for Rio Cobre and Kingston basins complete.	Project progress reports. Online access to maps/ model outputs.	
	2.1. Flood forecasting model (accounting for both present and future climate change scenarios) for Port Maria developed.	(a) 50 and 100-yr flood inundation depth and time of concentration to peak flow for Port Maria for different climate change scenarios.	No flood map exists for Port Maria.	By October 2026 Flood maps and models for Port Maria complete.	Project progress reports. Online access to maps/ model outputs.	Data from key agencies (WRA, MSJ, ODPEM) and field survey are available. Key stakeholders including WRA, MSJ, ODPEM, telecommunication providers, Parish councils and community members are fully engaged.
		(b) Model output showing travel time of flood waves to Port Maria	No model exists for Port Maria in 2024.	By December 2025 A preliminary model will be ready to predict time taken for flood waters to reach Port Maria.	Project progress reports.	
		(c) Flood risk, hazard and vulnerability maps, charts/graphs developed using A.I. technology.	No maps in 2024.	By October 2026 At least 4 Maps, 10 charts/graphs produced	Project progress reports.	
		(d) Flood EWS developed for floods based on model	Flood EWS operational in Rio	By October 2026	Project progress reports	

		results/maps for Port Maria.	Cobre and Rio Grande in 2024.	Flood EWS operational in Port Maria/Outram River Watershed.		
	2. Wireless sensor network comprising sensor probes and wireless communication links installed and operational.	Design and deployment of Wireless sensor system.	None	By October 2026 Operational wireless sensor network.	Project progress reports documenting the successful wireless transmission and reception of sensor data from both lab and remote site(s) to database stored on dedicated server (Remote Sensing Workstation at the UWI).	Timely acquisition of wireless equipment.
	1. Climate vulnerability and risk assessment (CVRA) and risk profile report completed for target communities.	CRVA Report	No	By October 2026. Yes, CRVA report and risk profile available for Port Maria, and sections of Rio Cobre and Kingston Basins.	Project progress reports. Consultant Report	Timely engagement of consultant.
	2. Community climate resilience action plan developed for Port Maria, sections of Rio Cobre and Kingston Basins.	Community climate resilience action plans.		By October 2026. Community climate resilience action plans available for Port Maria, sections of Rio Cobre and Kingston Basins.	Report on community resilience action plans in target communities.	
	3. Knowledge products, materials and resources on	Development and availability of new knowledge products,	None	New knowledge products, materials and resources available for	Project progress reports.	

	climate and disaster risks developed.	materials and resources.		community training and awareness in DRM, IWRM and sustainable land management for Port Maria, sections of Rio Cobre and Kingston Basins (by 2026).		
	4. Port Maria community residents trained in flood mitigation.	Number of community residents trained (disaggregated by sex).	0	By September 2026 22	Project progress reports. Training/workshop reports. Attendance registers.	

APPENDIX 5

WORK IMPLEMENTATION SCHEDULE

Outputs/Activities	Quarterly							
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Component 1: In-depth Evaluation of Surface and Groundwater Resources								
Data Collection								
Meeting with stakeholders (WRA NWC, NIC) for geospatial data on wells and rivers								
Field survey to identify surface and groundwater resources in the Kingston and Rio Cobre basin; GIS based mapping showing location of aquifers and wells								
Data collection on rainfall, streamflow and abstraction from wells in the basins, ongoing for 2 years								
Surface Water Analysis and Modelling								
Baseflow separation using WETSPRO and trend analysis of rainfall and streamflow data from available stations								
SWAT modelling to simulate daily, monthly and annual flows under projected climate change scenarios and for the different catchments, river segments of the Rio Cobre and Kingston basin								
Groundwater Modelling								
MODFLOW simulation results showing pathways of transport of nutrients, underground flow direction and volume								
Water Quality Monitoring and Mapping								
Monthly sampling of surface and groundwater and chemical analysis.								
GIS based maps using kriging								
Dissemination and Training on Modelling Techniques as a part of capacity building								
Dissemination of Results and workshops on training on modelling techniques for stakeholder								
Report Writing								
Component 2: Strengthening Early Warning Systems and Enhancing Disaster Risk Management								
Data Collection								
Collection of rainfall data for the communities prone to flooding, anecdotal data collection on past floods, literature survey and stakeholder consultation								

Outputs/Activities	**Quarterly**							
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**
Field work								
Topographic survey for elevation data, channel cross section								
Geological mapping, soil and land use mapping								
Hydrological Modelling								
HEC HMS modelling of the communities, GIS based flood mapping for coastal areas. Modelling using present and future climate scenarios; Modelling using different storm tracks from SMASH model								
Hydraulic Modelling								
Hydraulic Modelling using HEC RAS, model validation and calibration, GIS based maps showing flood plain inundation depths and extent								
Installation of AWS and stream gauge								
Community Meetings, Data Dissemination								
Execution of EWS								
SMS Alerts, Radio messages, news bulletins disseminated to MET office, trainings for disaster agencies, communities e.g. use of SMS texts, radio, Social Media, TV								
Artificial Intelligence Modelling (AIM) - EWS								
Data Gathering, Lit. Reviews and the purchase of equipment and software								
Recruiting and Screening of Team Members								
Field Work: Data Collection, Mapping, Community Meetings, Training sessions, Stakeholder engagement meetings								
Data Processing and Analysis (G.I.S., Mobile Data, Statistical, Hydrological, Building / Structural analysis)								
Data Entry and Computer Programming								
Model Runs / Simulations, Testing and Calibration								
Evacuation Drills, Search and Rescue simulations								
Generation of Maps (Evacuation, EWS)								
Development of Community Warning Alerts System								
Uploading of EWS to Computer Tablets								
Uploading of EWS to Platform and dedicated website								

Outputs/Activities	**Quarterly**							
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**
Development of Training, Educational and Promotional materials (support public awareness campaigns)								
Reporting to key stakeholder groups, hand over meetings, sensitization sessions etc								
Report Writing								
System Design & Test								
Design/Procure equipment for monitoring platform								
Design and perform land-based tests of sensor systems								
Design and perform land-based tests of communication links								
Perform tests of combined sensor and communication systems								
Site Analysis								
Software Acquisition								
Combination of S/W tools and ground-truthing around coastline								
Pursue lease agreements at selected sites and site preparation (as necessary)								
Setup equipment at leased sites and perform preliminary tests								
System Implementation								
Perform tests of installed sensor and communication systems								
Data acquisition and verification								
System performance analysis								
Data verification and validation								
Report Writing								
Component 3: Supporting Livelihoods, Community Capacity Building and Resilience								
Community Vulnerability and Risk Assessment								
CVRA – household surveys and community mapping								
Data Entry								
Data Analysis								
CVRA Report *(Knowledge Product/Deliverable)*								
Resilience Workshops								
Development of Workshop Guides								

Outputs/Activities	**Quarterly**							
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**
4 Stakeholder Workshops (Focus groups and Design Charrettes)								
Translation of workshop notes								
Workshop Report *(Knowledge Product/Deliverable)*								
Technical Capacity Training – Port Maria								
Selection of community volunteers from Port Maria								
Trainer(s) with experience in DRM, EWS & Sustainable Land Management engaged								
Development of training manuals for each focal area *(Deliverable)*								
Training in DRM, EWS & Sustainable Land Management								
Distribution of resources (e.g., megaphones, flag system)								
Certification provided for participants								

APPENDIX 6

PERFORMANCE RATING SYSTEM

Criteria	Score	Justification
Relevance	4.0	The project aligns with the Government of Jamaica's Vision 2030 development plan and will contribute to three of its four strategic goals related to empowering Jamaicans through healthy, stability and education; fostering a prosperous economy with an enabling business environment, energy security and efficiency, technological advancement; and ensuring a healthy natural environment with sustainable natural resource management, hazard risk reduction and adaptation to CC. The Natural Resources and Environmental Management and Hazard Risk Reduction and CC Sector Plan focuses on the protection of Agro, Coastal, Marine and Freshwater Ecosystems. Despite substantial improvements made in environmental management, challenges like deteriorating water quality, poor waste management and watershed degradation remain. In line with the sector plan, this project promotes adaptation strategies to help vulnerable communities cope with climate risks and impacts. This project also will support under-resourced environmental management institutions. Vision 2030 includes a commitment to "create prosperity through the sustainable use and management of our natural resources" and "create and advance national prosperity and security by vigorously seeking, learning, generating, and applying scientific and technological knowledge." Achieving Vision 2030 is at risk due to damage and destruction from frequent disasters from natural hazards, particularly flooding. Climate change has intensified these events. The project aligns with the 2019 Jamaica National Water Sector Policy, which highlights frequent water shortages and poor quality in rural areas due to outdated infrastructure. Reliance on unreliable water sources and high poverty further restricts access to clean water, impacting health and food security. Additionally, the project aligns with the overall vision laid out in the Government of Jamaica Climate Change Policy Framework and Action Plan (GoJ, 2015) that: "Jamaica achieves its goals of growth and prosperity for its people while meeting the challenges of CC as a country with enhanced resilience and capacity to adapt to the impacts and to mitigate the causes in a coordinated, effective and sustainable manner." It also aligns with a number of the the United Nations 2030 Agenda for sustainable development, especially Goal No. 6 (Clean Water), in terms of access and use of water resources; Goal No. 9 (Industry, Innovation and Infrastructure) in terms of the use of artificial intelligence models for decision making purposes and remote sensing; and Goal No. 13 (Climate Action). The project also supports the Early Warning Systems for All

Criteria	Score	Justification
		Initiative (2022 – 2027), spearheaded by the United Nations as well as the outcomes and outputs from the CREWS17 Caribbean project. The project is informed by the outcomes realised under the previous 2017 CDB-funded project that supported the upgrade of the existing flood monitoring system on the Rio Cobre. It is also designed to help address new and emerging challenges related to flood monitoring as Jamaica experiences more frequent and obvious impacts of CC. The project also expands on community-based projects focused on vulnerability, climate change adaptation and resilience conducted previously, e.g., in the Deans Valley River WMU (Westmoreland), between 2012 and 2016, funded by the Latin American Caribbean Environmental Economics Programme (LACEEP), the Department of Foreign Affairs, Trade and Development, Canada (DFATD) and the US Fulbright Program. The project will contribute to achieving CARE's Outcome 1 "Governance on disaster risk management (DRM) and climate change adaptation (CCA) in the BMCs improved" and Outcome 3 "Community infrastructure and livelihood resilience to CC effects and natural hazards enhanced".
Effectiveness	3.75	A project coordinator will be engaged to manage activities and financial resources effectively. The project will also involve expertise from the UWI team, research assistants, postgraduate students, and external consultants/trainers. A detailed work plan has been prepared to guide project activities and will be adjusted as needed. Supported by experts, research assistants, and consultants, and with planned stakeholder consultations and community meetings at various stages, the project is expected to be implemented effectively and achieve its goals.
Efficiency	3.75	The expertise of the UWI team, research assistants, postgraduate students, and consultants will be invaluable during the execution of project activities. This collaborative approach ensures resource-efficient project execution. Additionally, progress will be rigorously monitored and evaluated, allowing the project team to identify potential challenges and implement timely measures to address them. This will help keep activities on track and ensure the project meets its deliverables within budget.
Sustainability	3.5	Community residents will be trained as volunteers to collect data on a long-term basis and will be part of a network of disaster risk management activities and organisations. Residents will receive resources to support disaster risk reduction, lives and livelihoods during floods. MPhil and PhD students will be trained to carry out further research in the related project areas, enabling capacity building which will support future similar research. Parish disaster coordinators will be trained who can then continue the training with community members post completion of the project. Disaster planners (parish and national level) and representatives

17 Caribbean Risk and Early Warning Systems Initiative 2018 – 2022 (WMO, World Bank GFDRR and UNDRR)

Criteria	Score	Justification
		from the targeted community organisations will receive computer tablets, with an A.I. Flood Planning Model / Tool uploaded to it. This is to assist with continued emergency management decisions, search and rescue operations, evacuation drills and training/capacity building activities. The A.I. Flood Planning Model / Tool will also be uploaded to a dedicated platform, supported by a website, accessible to key stakeholders identified in this project. Equipment such as AWS and stream gauges installed at the respective sites will be a part of the Meteorological and Hydrological network in the country and will be monitored by MSJ and WRA post completion of the project. Data from these hydromet stations will strengthen the country's database of climatological data, which will be used for forecasting as well as research at the UWI. Equipment for water quality assessments and remote sensing will be the property of The UWI and will be used for ongoing water projects and research activities.
Overall Score	**3.75**	

APPENDIX 7

GENDER MARKER 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 require the identification of socioeconomic, sectoral and institutional gender issues.	0.5
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.	1.0
	Project objective/outcome includes the enhancement of gender capacities, gender data collection, gender equality or the design of gender-responsive policies or guidelines.	1.0
Score:		3.0
Gender Mainstreamed (GM): the project has the potential to contribute significantly to gender equality		

APPENDIX 8

DRAFT TERMS OF REFERENCE

PROJECT COORDINATOR

1. BACKGROUND:

1.01 In order to successfully carry out the captioned project the Faculty of Science and Technology at The University of the West Indies, Mona Campus plans to engage a Project Coordinator (PC) under contract. The PC will be responsible for undertaking the general administrative requirements of the overall project, including those related to project management, oversight, reporting and funding.

2. OBJECTIVE

2.01 The overall objective of the PC is to ensure that project activities are executed in a timely and appropriate manner to achieve expected outputs and outcomes. The PC will be working with the Team Leads throughout the entire duration of the project.

3. SCOPE OF WORK

3.01 To successfully and effectively manage and coordinate the project's implementation, the PC's specific duties and responsibilities will include, but are not limited to:

(a) Monitoring the activities of the project against the deliverable timelines and liaise with administrative departments at the UWI, Mona Campus and CDB for smooth disbursement of funds against deliverables.
(b) Ensuring project deadlines are met.
(c) Managing relationships with clients and stakeholders.
(d) Designing and signing off on contracts and work plan agreements.
(e) Overseeing all incoming and outgoing project documentation.
(f) Updating project procurement as necessary and at least annually.
(g) Managing the selection and engagement of consultants and contractors, and the procurement of goods and services in accordance with Procurement Procedures for Projects Financed by CDB (January 2021) and Procurement Policy for Projects Financed by CDB (November 2019).
(h) Organising and assisting in project related activities, where required. These may include planning for meetings, local and national workshops, consultations, trips, and other project related activities.
(i) Preparing risk mitigation plans.
(j) Conducting project reviews and creating detailed reports for executive staff.
(k) Maintain records of Project Steering Committee meetings, decisions, actions etc.
(l) Optimising and improving processes and the overall approach where necessary.
(m) Securing growth opportunities and initiating new projects (if applicable).
(n) Reviewing and managing project budgets.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The PC must have the following minimum qualifications, training, experience and competencies:

(a) Bachelor Degree in Environmental Sciences, Engineering, Disaster Risk Management, Natural Resource Management, Project Management, or relevant field or Project Management Professional certificate qualification and at least seven (7) years of experience

in managing project teams as well as demonstrated competence in administration, record keeping, communication and engagement with relevant stakeholders such as senior government officials, international agencies and technical staff.

(b) In addition, there is a strong preference for a candidate who has experience working in the area of climate change and sustainable development in the Caribbean (including community work and fieldwork) as well as knowledge management and data management.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 The PC will be required to provide the following reports and deliverables to CDB:

(a) Preparation of a work plan with timeline for the project.
(b) Provide reports to the executive team on a monthly and quarterly basis highlighting project advancement, challenges and adjustments.
(c) Develop the performance reports.
(d) Manage the project budget consistent with project rollout plans.
(e) General Project oversight and management.

6. DURATION

The duration of this assignment is expected to be 24 months.

APPENDIX 9A

DRAFT TERMS OF REFERENCE

TECHNICAL ASSISTANT - WATER RESOURCE MANAGEMENT

1. BACKGROUND

4.01 Under the supervision of the component/team lead - In-depth Evaluation of Surface and Groundwater Resources, the Technical Assistant will provide support for the collection and analysis of fieldwork data, modelling of surface and groundwater resources as well as the dissemination of results. The Technical Assistant is expected to possess postgraduate training with skills, knowledge and competence in geographic information system (GIS) based surface and groundwater modelling, water resources and CC research. The goal is to contribute to building up the competence of young professionals to engage in the urgent issues of CC and water resources.

2. OBJECTIVES

2.01 To assist the component lead with fieldwork and secondary data collection, with data analysis (rainfall, streamflow and groundwater abstraction data), and the creation and use of soil and water assessment tool (SWAT), water evaluation and planning (WEAP) and modular flow (MODFLOW) models. The Technical Assistant will also assist the component lead in writing reports and research publications.

3. SCOPE OF WORK

3.01 The duties of the Technical Assistant are:

(a) Research Duties - Secondary research and background document reviews
- (i) Drafting of reports and summaries.
- (ii) Assist with field and secondary data collection on rainfall, surface and groundwater resources.
- (iii) Modelling of water resources using SWAT, WEAP, hydrologic modelling system (HEC HMS) and MODFLOW.

(b) Collection of Data
- (i) Field data collection: water samples and in-situ measurements (e.g., pH, conductivity, temperature), streamflow, water levels in wells, pump tests, if needed, and collection of water consumption per sector and zones in the basins of study.

(c) Data entry and Analysis
- (i) Data entry using quantitative software packages.
- (ii) Assessment of data quality control.
- (iii) Mapping using GIS software.
- (iv) SWAT model for surface water resources using present and future climate scenarios.
- (v) MODFLOW for groundwater resources under scenarios of climate change and demand.
- (vi) WEAP modelling for demand and supply for surface and groundwater under impacts of climate change and population growth.
- (vii) Appropriate illustration of project findings.

(d) Writing
  (i) Co-authoring research reports and manuscripts for journals.
  (ii) Dissemination of data for various purposes e.g., workshop and conference presentations.

(e) General Administration

  (i) Assist with tracking of fieldwork progress.
  (ii) Secure management of data collection and storage.
  (iii) Support the organisation of meetings and contacting stakeholders.
  (iv) Support with the organising of research trips.
  (v) Develop presentations and related materials.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Technical Assistant shall have the following:

Required:

(a) Postgraduate degree in Hydrology, Hydrogeology, Water Resources or relevant disciplines.
(b) Excellent writing and analytical skills.
(c) Experience in carrying out research on water resources using modelling tools.
(d) In depth knowledge of GIS, SWAT, WEAP, HEC and MODFLOW modelling tools.
(e) Willingness to travel and availability for training.
(f) Ability to write reports, research papers and presentation skills.

Desirable:

(a) Quantitative research experience, including data collection, modelling and mapping.
(b) Knowledge of quantitative software packages.
(c) Ability to communicate effectively in English and Jamaican Creole (Patois).

5. DELIVERABLES

5.01 The Technical Assistant will prepare monthly reports that will underscore inter-alia:

(a) Main activities undertaken, and key results achieved, and
(b) Key challenges and opportunities.

6. DURATION

6.01 The Technical Assistant will be hired for 24 months and paid on a monthly basis.

APPENDIX 9B

DRAFT TERMS OF REFERENCE

TECHNICAL ASSISTANT – CHEMICAL ANALYSIS

1. BACKGROUND

1.01 Under the supervision of the component/team lead, the Technical Assistant will be responsible for collecting and conducting chemical analyses on water samples collected in the Rio Cobre and Kingston Basins. They will use a variety of analytical techniques, including spectroscopy and chromatography, and assist with the interpretation of the results to produce detailed reports. The Technical Assistant must possess knowledge of laboratory safety, instrumentation, excellent problem-solving skills, and be able to work independently.

2. OBJECTIVES

2.01 To assist the component lead with fieldwork and data collection and laboratory analysis. They will also assist the component lead in writing reports and research publications.

3. SCOPE OF WORK

3.01 The duties of the research assistant will fall the following categories:

(a) Research Duties
- (i) Drafting of reports and summaries.
- (ii) Assist with historical data collection.
- (iii) Maintain laboratory instrumentation.
- (iv) Assist with the management of the Water Research Laboratory at The University of the West Indies.

(b) Collection of Data
- (i) Field data collection: water samples and in-situ measurements (e.g., pH, conductivity, temperature), streamflow, water levels in wells, pump tests, if needed, and collection of water consumption per sector and zones in the basins of study.
- (ii) Laboratory analysis: analyse water samples collected using standard and automated chemical methods of analysis including a complete suite of water chemistry parameters, e.g., nitrate, phosphate, chloride, alkalinity, sodium and potassium.

(c) Data entry, Analysis and Writing
- (i) Prepare laboratory reports.
- (ii) Data entry using quantitative software packages.
- (iii) Assess data quality control.
- (iv) Co-authoring research reports and manuscripts for journals.
- (v) Dissemination of data for various purposes e.g., workshop and conference presentations.

(d) General Administration

(i) Assist with tracking of fieldwork progress.
(ii) Secure management of data collection and storage.
(iii) Support the organisation of meetings and contacting stakeholders.
(iv) Support with the organising of research trips.
(v) Develop presentations and related materials.

4. QUALIFICATIONS AND EXPERIENCE

The Technical Assistant should have:

Required:

(a) Undergraduate degree in Chemistry or relevant disciplines.
(b) Excellent writing and analytical skills.
(c) Willingness to travel and availability for training.
(d) Ability to write reports, research papers and presentation skills.

Desirable:

(a) Experience in carrying out water quality research.
(b) Quantitative research experience, including data collection, mapping.
(c) Knowledge of quantitative software packages.
(d) Ability to communicate effectively in English and Jamaican Creole (Patois).

5. DELIVERABLES

5.01 The Technical Assistant will prepare monthly reports that will underscore inter-alia:

(a) Main activities undertaken, and key results achieved, and
(b) Key challenges and opportunities.

6. DURATION

6.01 The Technical Assistant will be hired for 24 months and paid on a monthly basis.

APPENDIX 9C

DRAFT TERMS OF REFERENCE

CONSULTANCY SERVICES FOR COMPUTER PROGRAMMER

1. BACKGROUND

1.01 Flooding from extreme events is the most common, and costliest of hazards in the Caribbean region. Flooding has claimed thousands of lives and resulted in millions of dollars in damages to infrastructure across Jamaica and by extension the wider Caribbean region. One of the contributing factors to this high level of devastation, is the lack or absence of early warning systems (EWS), especially at the community level. Additionally, when EWS are designed and implemented, there are other challenges related to a top-down approach that is not people centred; the use of aggregated population movements (static) to calculate warning times despite the fact that population movements are dynamical and vary by time of day/day of the week (micro-level movements). This has implications for risk and vulnerability assessments used in the design of EWS, determining its effectiveness and useability. There is therefore a need for higher resolution/granular data, to assist disaster planners, search and rescue responders, community organisations when designing and using EWS as part of their disaster management strategies.

2. OBJECTIVES

2.01 The overall objective is to design and develop an EWS for floods to issue warnings when a flood is imminent or already occurring. This will be supported by a flood planning model/tool using artificial intelligence modelling (AIM) which would assess flood risk. The EWS will help communities mitigate the risk of disasters by providing advanced notice of potential disasters, based on accurate and reliable forecasts, and effective dissemination and communication of messages, thus allowing them to take appropriate measures to lessen the potential impact. Specific objectives are to create:

(a) AIM for EWS incorporating risk knowledge and management and developing hazard monitoring and warning services (optimum warning times, evacuation times, and community evacuation plans for flood prone areas).
(b) AIMs that help identify suitable, and appropriate evacuation shelter placements in communities, as well as zones of safety
(c) AIMs that support efficient and effective deployment of search and rescue teams, as well as humanitarian aid organisations into communities

2.02 Overall, all these objectives should help build capacity among parish level and national disaster agencies, community and humanitarian aid organisations – and contribute to a reduction in lives lost and damage to physical infrastructure, from extreme events in flood prone communities.

3. SCOPE OF WORK

3.01 The computer programmer will use AI software and the relevant programming languages, to design and develop the AIM. This model/tool will comprise flood impact and early warning scenarios based on past and future flood events. Future flood projections will also be influenced by the latest Caribbean climate model predictions, downscaled data and representative concentration pathways. The AI model should be developed to:

(a) estimate flood impact times, and casualty, by gender, age and other demographics.
(b) estimate the location of the population by time of day and day of week.

(c) identify viable escape routes, safe zones and shelter locations to enhance community evacuation plans (and the decision-making process).
(d) calculate optimum early warning times which give residents sufficient time to reach evacuation shelters or leave their communities due to floods.

3.02 The programmer will also be required to update the existing baseline AI flood planning model.

3.03 The data that the A.I. Computer programmer will use includes geographic, demographic, hydrologic, hydraulic buildings, transportation, and mobile cell data for Port Maria. Thus, the Consultant will be heavily engaged in data mining. It is expected that a user-friendly graphical user interface will be created, allowing for easy/comfortable operationality by users.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Consultant should have at a minimum a Bachelor's degree in Computer Sciences/Information Technology.

4.02 The Consultant should:

(a) Be able to use A.I. Software and have experience using programming languages such as Java, Python and Objective-C or other relevant languages;
(b) A minimum of 5 years relevant experience
(c) Be exposed to geographic information systems software and be able to incorporate GIS extensions into the A.I. Model (N.B. geographic information systems certification will be seen as a plus as well as experience in programming on climate changed/disaster risk reduction related projects.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 The Consultant will be required to:

(a) report under Component 2 of this project and report to the Component Lead;
(b) work closely with the engineering hydrologist, technical assistant (AI) and statistician;
(c) be part of the data collection process i.e. join field trips;
(d) program, test, calibrate, and deliver completed user-friendly AI flood planning model/tool with an appropriate graphical user interface;
(e) upload user-friendly AI flood planning model/tool to computer tablets and online platform
(f) document all programming codes using the UML and ODD model protocols (forms part of reports);
(g) submit quarterly reports and a final report at the end of the consultancy; and
(h) train, as well as participate in training and capacity development sessions attached to this project, which involve disaster planners, stakeholder groups and community residents.

6. DURATION

6.01 The duration of this assignment is 120 days over a period of 2 years.

APPENDIX 9D

DRAFT TERMS OF REFERENCE

TECHNICAL ASSISTANT – ARTIFICIAL INTELLIGENCE MODELLING

1. BACKGROUND

1.01 Flooding from extreme events is the most common, and costliest of hazards in the Caribbean region. Flooding has claimed thousands of lives and resulted in millions of dollars in damages to infrastructure across Jamaica and by extension the wider Caribbean region. One of the contributing factors to this high level of devastation, is the lack or absence of early warning systems (EWS), especially at the community level. When EWS are designed and implemented, there are other challenges related to a top-down approach that is not people centred, and the use of aggregated population movements (static) to calculate warning times even though population movements are dynamical and vary by time of day/day of the week (micro-level movements). This has implications for risk and vulnerability assessments used in the design of EWS, determining its effectiveness and useability. There is therefore need for higher resolution/granular data, to assist disaster planners, search and rescue responders and community organisations when designing and using early warning systems as part of their disaster management strategies.

2. OBJECTIVES

2.01 The overall objective is to design and develop an EWS for using Artificial Intelligence Modelling (AIMs). The EWS will help communities mitigate the risk of disasters by providing advanced notice of potential disasters, based on accurate and reliable forecasts, and effective dissemination and communication of messages, thus allowing them to take appropriate measures to lessen the potential impact of disasters. Specific objectives are the development of:

(a) AIMs for EWS incorporating risk knowledge and management and developing hazard monitoring and warning services (optimum warning times, evacuation times, and community evacuation plans) for flood prone areas.
(b) AIMs that help identify suitable, and appropriate evacuation shelter placements in flood prone communities, as well as zones of safety.
(c) AIMs that support efficient and effective deployment of search and rescue teams, and humanitarian aid organisations into flood prone communities.

2.02 These objectives above should increase knowledge and build capacity among parish level and national disaster agencies, community and humanitarian aid organisations – contributing to a reduction in lives lost and damage to physical infrastructure, from future flood events.

3. SCOPE OF WORK

3.01 The Technical Assistant will provide support for: the collection and analysis of data (pre-fieldwork, during field work and post field work); the development of a community alert system; the dissemination of results to stakeholder groups; and documentation and reporting.

The Technical Assistant will be engaged in:

(a) Desktop/Literature Reviews
(b) Data Collection and Mapping during field assignments.
(c) Community Evacuation Drills
(d) Data Analysis and Report Writing.
(e) Focus Group, Training and Information Dissemination activities (community engagement)

(f) Tracking the progress of the project, specifically the EWS that forms part of component 2.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Technical Assistant should possess at least an undergraduate degree in geography, geology, the geo-sciences, environmental sciences, or disaster risk management.

4.02 The Technical Assistant should:

(a) be computer savvy and have information technology skills;
(b) have geographic information system skills and be able to create maps;
(c) have experience working with databases or database management;
(d) be able to engage in field work and related activities;
(e) possess public speaking skills and is able to train and engage residents;
(f) have people-oriented skills and be team-oriented; and
(g) have experience in climate change adaptation (CCA) and or disaster risk reduction (DRR) projects.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 The Technical Assistant will:

(a) work under Project Component 2 (Strengthening Early Warning Systems and Enhancing Disaster Risk Reduction) and report to the Component Lead, work closely with the computer programmer, engineering hydrologist and statistician to support the development of an A.I. Flood Planning Model/Tool.
(b) produce results using GIS and A.I. Software.
(c) document the activities related to evacuation drills, focus groups, training and capacity development sessions in logbooks.
(d) document all their assigned activities and submit quarterly reports to the project team.
(e) assist in the writing and development of the final report for component 2.

6. DURATION

6.01 The Technical Assistant will be hired for two years and paid on a monthly basis.

APPENDIX 9E

DRAFT TERMS OF REFERENCE

CONSULTANCY SERVICES FOR ENGINEERING HYDROLOGIST

1. BACKGROUND

1.01 Flooding from extreme events is the most common, and costliest of hazards in the Caribbean region. Flooding has claimed thousands of lives and resulted in millions of dollars in damages to infrastructure across Jamaica and by extension the wider Caribbean region. One of the contributing factors to this high level of devastation, is the lack or absence of early warning systems (EWS), especially at the community level. Additionally, when EWS are designed and implemented, there are other challenges related to a top-down approach that is not people centred; and the use of aggregated population movements (static) to calculate warning times despite the fact that population movements are dynamical and vary by time of day/day of the week (micro-level movements). This has implications for risk and vulnerability assessments used in the design of EWS, determining its effectiveness and useability. There is therefore a need for higher resolution/granular data, to assist disaster planners, search and rescue responders, community organisations when designing and using early warning systems as part of their disaster management strategies.

2. OBJECTIVES:

2.01 The overall objective is to support the design and develop an EWS for using Artificial Intelligence Modelling (AIMs) by providing suitable building, infrastructure and inundation extensions for the model. The EWS will engage users in wise planning for future flood events. The specific objective is to ensure the interconnectedness of key data sets that supports the operation of the AI Flood Planning Model/Tool for Port Maria, using appropriate software.

3. SCOPE OF WORK

3.01 The consultant should:

(a) Perform building, infrastructural, hydrologic and hydraulic calculations/measurements for use in the AI model/tool. The datasets used should relate to rainfall (past and future) (hydrographs), underground water supplies, building design/codes, roadways, bridges and drains.
(b) Perform analysis of buildings, drains and bridges (assess type of structures, codes and determine their adaptability under extreme weather conditions).
(c) Be able to advice/perform calculations related to flood defence systems (eco-systems based and man-made) for use in the AI model/tool.

3.02 The simulated floods used in the AI model/tool will be a combination of historical and present-day flood events. The model will also use the latest climate model projections and representative concentration pathways in its calculations as well. It is therefore imperative that the consultant has an interdisciplinary outlook that supports the interconnectedness and synchronisation of the data sets mentioned in part (a).

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Consultant should have at minimum a Bachelor's degree in Civil Engineering, Geographic Information Systems or Hydrology, (or an equivalent professional qualification) and at least five years' professional experience including in the field.

4.02 They shall be familiar with AIM techniques/software (cellular automata), programming languages such as Java, Python and Objective-C, have experience using the Jamaica 2 model (NWA). Experience on to climate change/DRR projects, as well as the ability to code will be seen as a plus.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 The Engineering Hydrologist will:

(a) Work under Project Component 2 (Strengthening Early Warning Systems and Enhancing Disaster Risk Reduction) and report to the Component Lead. The consultant will also work closely with the Computer Programmer and the Technical Assistant.
(b) Produce hydrographs for specific flood prone communities.
(c) Produce building/infrastructural charts and graphs for specific flood prone communities.
(d) Produce the results from a flood defence system analysis for specific flood prone communities.
(e) convert and ensure that data produced above, can easily be synchronised with the AI Flood Model/Tool.
(f) Document all work done and submit in quarterly reports, as well a final report at the end of the consultancy.
(g) Participate in focus groups, stakeholder engagement and training sessions involving decision makers, planners and community residents.

6. DURATION

6.01 The duration of the assignment is 120 person days over a one-year period.

APPENDIX 9F

DRAFT TERMS OF REFERENCE

CONSULTANCY SERVICES FOR A STATISTICIAN

1. BACKGROUND

1.01 Flooding from extreme events is the most common, and costliest of hazards in the Caribbean region. Flooding has claimed thousands of lives and resulted in millions of dollars in damages to infrastructure across Jamaica and by extension the wider Caribbean region. One of the contributing factors to this high level of devastation, is the lack or absence of early warning systems (EWS), especially at the community level. Additionally, when EWS are designed and implemented, there are other challenges related to a top-down approach that is not people centred, and the use of aggregated population movements (static) to calculate warning times despite the fact that population movements are dynamical and vary by time of day/day of the week (micro-level movements). This has implications for risk and vulnerability assessments used in the design of EWS, determining its effectiveness and useability. There is therefore a need for higher resolution/granular data, to assist disaster planners, search and rescue responders, community organisations when designing and using EWS as part of their disaster management strategies.

2. OBJECTIVES:

2.01 The overall objective is to support the design and development of an artificial intelligence (AI) flood planning model/tool using statistical analysis. The EWS will engage users in wise planning for future flood events. Specific objectives are:

(a) The synchronisation of statistical techniques with AI modelling techniques for the design/development of a EWS in flood prone communities.
(b) Producing data with meaning for suitable/appropriate use in the model/tool.

3. SCOPE OF WORK

3.01 The consultant should:

(a) Perform statistical analysis on field survey data using the appropriate software.
(b) Perform statistical analysis on call/mobile data using the appropriate software.
(c) Collate the results in a suitable format from (a) and (b) above for synchronisation with the AI model/tool

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Consultant should have:

(a) a master's degree in mathematics, statistics, data science or a related discipline;
(b) at least four years of experience working in this area;
(c) excellent analytical, graphical and report writing skills;
(d) demonstrate prior experience working on climate change adaptation/disaster risk reduction related projects.

4.02 Experience with coding, as well as AI Modelling will be beneficial.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 The Consultant will:

(a) work under Project Component 2 (Strengthening Early Warning Systems and Enhancing Disaster Risk Reduction) and report to the Component Lead. The consultant will also work closely with the Computer Programmer and the Technical Assistant.
(b) Produce charts, graphs and reports from field and call data analysis.
(c) document all work done and submit monthly reports, as well a final report at the end of the consultancy.
(d) participate in focus groups, stakeholder engagement and training sessions involving decision makers, planners and community residents

6. DURATION

6.01 The duration of the assignment is 60 person days over a one-year period.

APPENDIX 9G

DRAFT TERMS OF REFERENCE

TECHNICAL ASSISTANT – SENSOR AND WIRELESS NETWORK SYSTEM DESIGN AND DEVELOPMENT

1. BACKGROUND

1.01 Under the supervision of the component lead – Disaster Risk Mitigation and Management, the Technical Assistant will play a key role in designing and testing the sensor and wireless communications systems (hardware and software) as well as their subsequent installation in the field. He/she will provide support with the assessment and selection of remote sites, the installation of equipment at the selected site(s), and the collection and analysis of field data during the testing and post-installation phases. The Technical Assistant should possess a good undergraduate degree in a Physics or related Engineering field, and should have demonstrable knowledge and competence in computer programming and the design of electronic systems. This project provides an early-career opportunity for an individual to engage a real-world project that applies technological solutions to water resource management.

2. OBJECTIVES

2.01 To assist the component lead with the tasks required under this component, including primary research, the design of electronic and communications systems for field placement, and site determination, and data acquisition and analysis.

2.02 To assist the component lead with the development of a reliable communications link for the acquisition and reliable/secure transmission of sensor data from the field, review of techniques, data storage, analysis, reporting, and subsequent dissemination.

2.03 To provide an opportunity for an early-career graduate in the field to develop and apply skills learnt as well as engaging in a real-world project that aims to improve water resource management capabilities at the UWI, nationally, and regionally.

3. SCOPE OF WORK

3.01 The duties of the technical assistant will fall under five (5) main areas as follows:

(a) Design of Wireless Communications System

(i) Develop detailed work plan.
(ii) Assess conditions and related parameters at remote sites using a mapping tool(s) and through field assessment.
(iii) Perform wireless link design using established methods and software tools (where appropriate), including recommending the locations of remote and relay site(s).
(iv) Assess current wireless equipment and make recommendations for suitable hardware based on field parameters and design results.
(v) Assist with procurement of equipment.
(vi) Perform testing of wireless equipment in both lab and field environments.
(vii) Install and test wireless equipment at all sites – remote, relay and local (UWI) receiver site.
(viii) Perform verification of the secure and reliable transmission and reception of sensor data from remote site(s) to relay and local (UWI) sites.
(ix) Produce thorough and accurate documentation for all stages.

(b) Design of Sensor System

(i) Develop detailed work plan.
(ii) Research and assess current sensor equipment and make recommendations for suitable hardware based on parameters to be measured and field conditions.
(iii) Perform site visit(s) to ascertain optimum site(s) for sensor placement.
(iv) Design and configure sensor network(s) using established techniques and software tools (where required) considering parameters of selected sensor(s).
(v) Assist with procurement of sensors.
(vi) Perform testing of stand-alone sensors in both lab and field environments.

(c) Integration of Sensor and Wireless Communications Systems

(i) Perform testing to integrate sensor and communication equipment in lab environment and analyse results.
(ii) Use test data to make adjustments to ensure optimum performance of integrated system.
(iii) Install integrated sensor and communications system and relevant equipment at remote site(s).
(iv) Test performance of integrated sensor and communications system on site using established techniques.
(v) Produce thorough and accurate documentation for all stages.

(d) Configuration of Server, Data Acquisition, and Data Analysis

(i) Assist with the assessment of network and server hardware and software.
(ii) Develop interactive user interface (UI) on the server to enable the visualization of data acquired remotely from designed sensor communications system.
(iii) Configure the server to acquire and securely store sensor data received from remote and relay sites in a format(s) that simplify the process of analysis.
(iv) Verify the ability to reliably receive accurate data from remote site to local site (UWI) through any relay site(s).
(v) Perform data analysis using data received and assess the need for design improvements.
(vi) Perform any improvements required based on data analysis.

(e) General

(i) Support the organization of meetings and stakeholder engagement.
(ii) Support the planning of site visits.
(iii) Liaising with field workers and other individual(s) related to the project.
(iv) Develop presentations and related materials.
(v) Co-authoring research reports and journal paper.
(vi) Assist with dissemination of data for various purposes, e.g., workshops.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Technical Assistant should have:

Required:

(a) An undergraduate degree in electronics and computer science or engineering.
(b) Experience in the design, building and testing of electronic systems.
(c) Excellent writing and analytical skills.
(d) Familiarity with the use of wireless equipment, e.g. spectrum analysers and antennas.
(e) Experience with the development of web-based server systems.
(f) Willingness to travel to remote sites at least twice per month.

Desirable:

(a) Quantitative research experience.
(b) Experience with data acquisition using sensors.
(c) Familiarity with a variety of software simulation tools.

5. DELIVERABLES

5.01 The Technical Assistant will prepare monthly reports that will include:

(a) Main activities undertaken and a detailed summary of results achieved.
(b) Key challenges encountered.
(c) Solutions that have been proposed, tested and implemented to overcome challenges.
(d) Recommendations.
(e) Opportunities.

6. DURATION

6.01 The Technical Assistant will be hired for 24 months and will be paid on a monthly basis.

APPENDIX 9H

DRAFT TERMS OF REFERENCE

CONSULTANCY SERVICES FOR A WEBSITE DEVELOPER

1. BACKGROUND

1.01 Flooding from extreme events is the most common, and costliest of hazards in the Caribbean region. Flooding has claimed thousands of lives and resulted in millions of dollars in damages to infrastructure across Jamaica and by extension the wider Caribbean region. One of the contributing factors to this high level of devastation, is the lack or absence of early warning systems (EWS), especially at the community level. Additionally, when EWS are designed and implemented, there are other challenges related to a top-down approach that is not people centred, and the use of aggregated population movements (static) to calculate warning times despite the fact that population movements are dynamical and vary by time of day/day of the week (micro-level movements). This has implications for risk and vulnerability assessments used in the design of EWS, determining its effectiveness and useability. There is therefore a need for higher resolution/granular data, to assist disaster planners, search and rescue responders, community organisations when designing and using EWS as part of their disaster management strategies.

2. OBJECTIVE:

2.01 The main objective is the development of a user-friendly online platform to host the artificial intelligence model and the design of the project's website.

3. SCOPE OF WORK

3.01 The consultant should:

(a) Create a user friendly and easy to navigate project website.
(b) Gather and upload relevant content to the project website.
(c) Create an online web platform to host the AI flood model/tool, that will be accessible to authorised persons.
(d) Ensure there is synchronisation between the online platform and project website.
(e) Ensure data security measures are in place to protect sensitive information and restrict access to authorized personnel only.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Consultant should possess:

(a) At minimum a Bachelor's degree in Computer Sciences or related discipline.
(b) Five years of professional experience.
(c) Familiarity and previous experience with web infrastructure and content management systems such as Symfony, Docker and PHP would be a distinct advantage.
(d) Knowledge of data security and backup protocols to ensure data integrity and protection.
(e) Proven ability to work large datasets to construct and deploy interactive and updatable databases.

5. REPORTING REQUIREMENTS AND DELIVERABLES

5.01 Under Project Component 2 (Strengthening Early Warning Systems and Enhancing Disaster Risk Reduction) the consultant will report directly to the Project Coordinator on this project. The consultant will also work closely with the Media and Communications Consultant and the technical team.

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5.02 A report detailing overview of the applied data management and security measures, including the systems used for categorisation and the protocols for restricting access to sensitive information will be required.

6. DURATION

6.01 The duration of the assignment is 52 person days over a 6 month-period.

APPENDIX 9I

DRAFT TERMS OF REFERENCE

CONSULTANCY SERVICES FOR A SOCIAL SCIENTIST – LIVELIHOOD, COMMUNITY CAPACITY BUILDING AND RESILIENCE

1. BACKGROUND

1.01 In order to successfully carry out the captioned project the Faculty of Science and Technology at The University of the West Indies, Mona plans to engage a Social Scientist under contract. The Social Scientist will be working with the Component Lead for Component 3: Community Capacity Building and Resilience and with the entire team to build community resilience and capacity building in the target communities i.e., Port Maria.

2. OVERALL OBJECTIVES

2.01 The overall objective is to develop framework and timeline and work plan for activities to be undertaken for this component such as fieldwork, secondary research, development of data collection tools, proper identification of the sites and participants, arranging for fieldwork entry. Specific objectives are:

(a) Take lead in stakeholder consultation and engagement with the team for this component.
(b) To assist the component lead with the smooth management of collecting fieldwork data, revising research strategies, proper storage of data and dissemination activities.
(c) To provide opportunities to graduate students to develop skills and knowledge as well as participate in writing and dissemination of climate change and community resilience research, thereby strengthening capacity training at the UWI.

3. SCOPE OF WORK

3.01 The duties of the Social Scientist will fall under five main areas as follows:

(a) Research Duties
  (i) Field survey along with team.
  (ii) Secondary research and background document reviews.
  (iii) Prepare questionnaires and survey tools and lead the students and technical assistant working with the consultant.
  (iv) Contributing to the conceptualization of data collection tools and calculating population samples.

(b) Collection of Data
  (i) Train students and staff in this component in contacting Interviewees and setting up focus groups and interviews.
  (ii) Training on field collection of data.

(c) Data entry and Analysis
  (i) Data entry using qualitative and quantitative software packages.
  (ii) Maintaining large data sets.
  (iii) Assisting with the Coding and Analysis of Qualitative Data.
  (iv) Summaries of Findings.
  (v) Appropriate illustration of project findings.

(d) Writing

(i) Co-authoring research reports and manuscripts for journals.
(ii) Dissemination of data for various purposes e.g., workshop and conference presentations.

(e) General Administration
(i) Tracking of fieldwork progress.
(ii) Liaising with field volunteers and transcribers.
(iii) Secure management of data collection and storage.
(iv) Support the organisation of meetings and contacting stakeholders.
(v) Support with the organising of research trips.
(vi) Developing presentations and related materials.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Consultant should have:

Required:

(a) Postgraduate degree in a social science discipline.
(b) Minimum of 7 years' relevant experience
(c) Excellent writing and analytical skills.
(d) Experience in carrying out research or relevant training in research courses.
(e) Ability to revise qualitative tools.
(f) Willingness to travel and availability for training.
(g) Ability to assemble data – audio-recordings, transcripts, typed notes.
(h) Ability to develop PowerPoint presentations.

Desirable:

(a) Qualitative research experience, including data collection design, implementation and analysis.
(b) Knowledge of qualitative and quantitative software packages.
(c) Ability to communicate effectively in English and Jamaican Creole (Patois).

5. DELIVERABLES

5.01 The Consultant will prepare monthly reports that will underscore inter-alia:

(a) Main activities undertaken, and key results achieved.
(b) Key challenges and opportunities.

6. DURATION

6.01 The Consultant will be hired for 24 months and will be paid on a monthly basis.

APPENDIX 9J

DRAFT TERMS OF REFERENCE

TECHNICAL ASSISTANT - COMMUNITY RESILIENCE TO CLIMATE CHANGE

1. BACKGROUND

1.01 Under the supervision of the component/team lead Livelihoods, Community Capacity Building and Resilience, the Technical Assistant will provide support for the collection and analysis of fieldwork data as well as the dissemination of results. They will also assist with the administrative tasks such as developing and implementing a qualitative strategy to be used in the field, designing data collection instruments and protocols and maintaining a database of qualitative and quantitative data. The Technical Assistant should possess postgraduate training in Social Sciences, with skills, knowledge and competence in the collection and analysis of climate and/or community data. The goal is to contribute to building up the competence of young professionals to engage in the urgent issues of climate change and community resilience.

2. OBJECTIVES

(a) To assist the component lead with the preparation activities for fieldwork, such as secondary research, development of data collection tools, proper identification of the sites and participants, arranging for fieldwork entry. Assist in stakeholder consultation and engagement with the Consultant for this component.

(b) To assist the component lead with the smooth management of collecting fieldwork data, revising research strategies, proper storage of data and dissemination activities.

(c) To provide opportunities to graduate students to develop skills and knowledge as well as participate in writing and dissemination of climate change and community resilience research, thereby strengthening capacity training at The UWI.

3. SCOPE OF WORK

3.01 The duties of the technical assistant will fall under five main areas as follows:

(a) Research Duties

(i) Secondary research and background document reviews.
(ii) Drafting summaries.
(iii) Contributing to the conceptualization of data collection tools and calculating population samples.

(b) Collection of Data

(i) Contacting Interviewees and setting up focus groups and interviews.
(ii) Field collection of data.

(c) Data entry and Analysis

(i) Data entry using qualitative and quantitative software packages.
(ii) Maintaining large data sets.
(iii) Assisting with the Coding and Analysis of Qualitative Data.
(iv) Summaries of Findings.
(v) Appropriate illustration of project findings.

(d) Writing

(i) Co-authoring research reports and manuscripts for journals.
(ii) Dissemination of data for various purposes e.g., workshop and conference presentations.

(e) General Administration

(i) Tracking of fieldwork progress.
(ii) Liaising with field volunteers and transcribers.
(iii) Secure management of data collection and storage.
(iv) Support the organisation of meetings and contacting stakeholders.
(v) Support with the organising of research trips.
(vi) Developing presentations and related materials.

4. QUALIFICATIONS AND EXPERIENCE

4.01 The Consultant should have:

Required:

(a) Postgraduate degree in a social science discipline.
(b) Excellent writing and analytical skills.
(c) Experience in carrying out research or relevant training in research courses.
(d) Ability to revise qualitative tools.
(e) Willingness to travel and availability for training.
(f) Ability to assemble data – audio-recordings, transcripts, typed notes.
(g) Ability to develop PowerPoint presentations.

Desirable:

(a) Qualitative research experience, including data collection design, implementation and analysis.
(b) Knowledge of qualitative and quantitative software packages.
(c) Ability to communicate effectively in English and Jamaican Creole (Patois).

5. DELIVERABLES

5.01 The Research Assistant will prepare monthly reports that will underscore inter-alia:

(a) Main activities undertaken, and key results achieved.
(b) Key challenges and opportunities.

6. DURATION

6.01 The Technical Assistant will be hired for 24 months and will be paid on a monthly basis.

APPENDIX 9K

DRAFT TERMS OF REFERENCE

CONSULTANCY SERVICES FOR MEDIA AND COMMUNICATIONS CONSULTANT

1. BACKGROUND

1.01 The Media and Communications Consultant will support the work of the project by promoting awareness and advocacy around issues of climate change (CC) and disaster risk mitigation in vulnerable communities in the studied areas. They will work closely with the team for effective dissemination of project results to donors, stakeholders, and local communities as well as help to promote events, workshops and training sessions. The Consultant will develop materials for press release, social media and project website updates as well as be responsible for designing knowledge products, flyers, handbooks and early warning system materials to be used during training and workshops.

2. SCOPE OF WORK

2.01 The Media and Communications Consultant will be responsible for increasing awareness as well as advocacy around issues of CC, early warning systems (EWS) and disaster risk mitigation within the scope of the project. They will work closely with the project team for seamless dissemination of project results to the donors, stakeholders and local communities in the study areas. The Consultant will be responsible for designing flyers, booklets, handbooks and EWS materials to be used during training and workshops. They will be responsible for translating the outputs and results of the modelling work to non-technical language for decision-makers, develop materials for press releases, social media updates and the project website.

2.02 The Consultant will also assist in organising and publicising stakeholder engagement meetings, workshops, training events and community evacuation drills during the course of the project. They will also collaborate with the media by organising project site visits, facilitating media coverage and utilising both web-based and traditional media as appropriate.

2.03 Finally, the Communications Consultant will develop and archive communication materials, including digital, such as publications, press releases and clippings, photographs, audio-visual materials, books, booklets, web resources as well as training and promotional videos for the artificial intelligence flood planning model/tool.

3. QUALIFICATIONS AND EXPERIENCE

3.01 The Consultant must have an advanced degree in communications, journalism, public relations or a related field with at least seven years' including experience of working in projects in the Caribbean on disaster risk reduction, climate change and community resilience or similar work.

3.02 The Consultant must also possess:

(a) excellent written and oral English communication skills;
(b) proficiency in Jamaican patois;
(c) advanced working knowledge of MS Office (Word, PowerPoint, Excel and Publisher).

3.03 Basic design and layout skills and demonstrated and extensive social media experience is an added advantage.

4. REPORTING REQUIREMENTS AND DELIVERABLES

4.01 The Consultant will be required to prepare:

(a) A communication plan for the project.
(b) Develop press releases on project progress and achievements.
(c) Work with the team in content development for the website.
(d) Develop promotional material such as flyers, booklets, handbooks and EWS materials to be used during training and workshops, evacuation drills, etc.
(e) Develop social media guidelines and social media posts.

5. DURATION

5.01 The Communication Consultant will be working for 40 person days over the duration of the project.

APPENDIX 10

DUTIES, COMPOSITION AND RESPONSIBILITIES OF THE PROJECT STEERING COMMITTEE

1. DUTIES OF THE PROJECT STEERING COMMITTEE

(a) The Project Steering Committee (PSC) shall meet quarterly and will guide the Project on a strategic level, providing high-level supervision to the project management team on specific operational aspects relating to project performance.

(b) The PSC shall have the right to make requests to the Project Coordinator.

(c) The PSC shall have the right to call for progress evaluations at any time as deemed necessary and fit for the success of the Project.

(d) All decisions are taken by consent. Any decision related to a change in the strategic orientation of the Project will require the no-objection of CDB.

2. COMPOSITION OF THE PROJECT STEERING COMMITTEE

2.01 The PSC shall comprise the following principal members:

No.	Member	Organisation
1.	Dean or Representative (Chair)	Faculty of Science and Technology
2.	Co-ordinator, Resource Mobilization Unit	Faculty of Science and Technology
3.	Project Lead (1)	Faculty of Science and Technology
4.	Finance	Bursary
5.	Representative	Water Resource Authority
6.	Representative	Meteorological Service of Jamaica
7.	Representative	Office of Disaster Preparedness and Emergency Management
8.	Representative	National Water Commission
9	Representative	Local Government Authority
10	Representative	National Irrigation Commission
11	Representative	Social Development Commission

3. RESPONSIBILITIES OF THE PROJECT STEERING COMMITTEE

3.01 The following are the specific responsibilities of the PSC:

(a) Setting a strategic direction, and coordinating interventions;
(b) Provide advice and guidance on business issues facing the project;
(c) Providing guidance and agreeing on possible countermeasures/management actions to address specific project related risks;
(d) Approving the annual work plans prepared by the Project Coordinator;
(e) Conducting regular meetings (quarterly) to review the progress of project resources and providing direction and recommendations to ensure that the agreed deliverables are produced to a satisfactory standard;

(f) Reviewing and approving all activities that are supported by the project based on the project objectives, work plan and availability of funding;
(g) Provide strategic and technical advice to create synergy and uniformity between supported activities, policies and aligned projects;
(h) Reviewing reports on all activities supported by the project to serve as an additional basis for monitoring and assessing project resources' performance and delivery;
(i) Ensuring efficient use of project resources;
(j) Approve or reject changes to the project with a high impact on timelines and budget;
(k) Use influence and authority to assist the project in achieving its outcomes;
(l) Review and approve final project deliverables.

APPENDIX 11A

LETTER OF COMMITMENT
METEROLOGICAL SERVICE OF JAMAICA

Tel: (876) 929-3694, (876) 929-3706
(876) 929-3700, (876) 929-7268

Fax: (876) 960-8989

METEOROLOGICAL SERVICE
65¾ Half-Way-Tree Road
P.O. Box 103, Kingston 10
JAMAICA

Reference No: A.4030.EGT

May 4, 2023

Dr Yves Personna
Senior Programme Manager
ACP-EU-Caribbean Action for Resilience Enhancement (CARE) Programme
Environmental Sustainability Unit (ESU)
Caribbean Development Bank
Barbados

Dear Dr Personna,

Re: Strengthening Water Resources Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica

The **Meteorological Service of Jamaica** (MSJ) is keen to partner with The University of the West Indies, Mona, in undertaking the captioned project. The project objectives will support important national priorities that are in alignment with the National Development Plan – Vision 2030 and key Climate Change adaptation and mitigation plans, projects and programmes.

The MSJ will provide access to weather and climate data to support the research and larger programme objectives and anticipates that research outcomes will strengthen national climate services. The entity will provide the following:

1. Rainfall data (daily) from the MSJ-monitored weather stations in the project areas (Port Maria, Kingston, Rio Cobre basin, the parishes of Hanover and Westmoreland)
2. Access to available reports outlining past flooding events in the project areas.
3. MSJ partnership with the project team on site selection and installation of an AWS for flooding in Port Maria.
4. Participation in stakeholder consultations and workshops with the project team during the course of the project, as and when needed.

Page 2

May 4, 2023

Dr Yves Personna
Senior Programme Manager
ACP-EU-CARE Programme ESU
CDB

Re: Strengthening Water Resources Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica

This project will be beneficial to the local communities involved and will significantly impact national water security and disaster risk management priorities. The research outputs will also influence regional and international policy frameworks. We look forward to being implementation partners with The UWI Mona.

Sincerely,

Evan G. Thompson
Principal Director

APPENDIX 11B

LETTER OF COMMITMENT
JAMAICA WATER RESOURCES AUTHORITY

WATER RESOURCES AUTHORITY

ESTABLISHED BY THE WATER RESOURCES ACT, 1995

HOPE GARDENS, P.O. BOX 91, KINGSTON 7, JAMAICA
TEL: (876) 927-0077, 927-0189, 927-0302, 977-4194, 619-1297
FAX: (876) 977-0179, 702-3937

REF: DR 8-20

April 24, 2023

Dr. Yves Personna
Senior Programme Manager
ACP-EU-Caribbean Action for Resilience Enhancement (CARE) Programme
Environmental Sustainability Unit (ESU)
Caribbean Development Bank
Barbados

Dear Dr. Personna,

Re: Strengthening Water Resources Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica

The **Water Resources Authority of Jamaica** is keen to partner with The University of the West Indies, Mona, in undertaking the captioned project. The project objectives will support important national priorities that are in alignment with the National Development Plan – Vision 2030 and key Climate Change adaptation and mitigation plans, projects and programmes.

The Water Resources Authority of Jamaica will provide access to hydrometeorological data as well as groundwater resources data to support the research and larger programme objectives and anticipates that research outcomes will strengthen national climate services. The agency will provide the following:

1. Rainfall data from the WRA-monitored weather stations in the project areas (Port Maria, Kingston, Rio Cobre basin, the parishes of Hanover and Westmoreland)
2. Access to daily and sub-daily streamflow data for surface water sources in the above study areas. Daily data can be accessed from the webmap of WRA; sub-daily and peak flow data from the inhouse database and reports.
3. Access to reports outlining past flooding events in the project areas.
4. Field assistance for measuring streamflow data and water level measurement for the wells in the basins of Kingston and Rio Cobre.
5. WRA partnership with the project team on site selection and installation of an EWS for flooding in Port Maria.
6. Participation in stakeholder consultations and workshops with the project team during the project as and when needed.

Dr. Ives Persona

Re: Strengthening Water Resources Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica

Page 2 **April 24, 2023**

The EWS implemented will be jointly monitored by WRA, Meteorological Service of Jamaica (MSJ) and The UWI, and flood watch information will be issued by WRA and MSJ. Post project completion, the equipment will be owned and maintained by the WRA. This will assist with capacity building and strengthening the hydromet network in Jamaica.

The project will be beneficial for the local communities involved and significantly impact national water security and disaster risk management priorities. The research outputs will also influence regional and international policy frameworks. We look forward to being implementation partners with The UWI Mona.

Yours sincerely,
WATER RESOURCES AUTHORITY

Peter Clarke J.P., P.E.
Managing Director

APPENDIX 11C

LETTER OF COMMITMENT
SPECTRUM MANAGEMENT AUTHORITY

Spectrum MANAGEMENT AUTHORITY

13 – 19 Harbour Street
Kingston, Jamaica W.I.
Telephone: (876) 967-7948 / 948-7800
Fax: (876) 922-4093

April 28, 2023

Dr Yves Personna
Senior Programme Manager
ACP-EU-Caribbean Action for Resilience Enhancement (CARE) Programme
Environmental Sustainability Unit (ESU)
Caribbean Development Bank
Barbados

Dear Dr Personna,

Re: UWI Research Project - Strengthening Water Resources Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica

The Spectrum Management Authority (SMA) has the responsibility of being the Technical Advisory Agency regarding the use of radio frequency for the government of Jamaica (GOJ). Resultantly, the SMA must be afforded opportunities that will provide the ability to network and collaborate with other key stakeholders concerning the use of radio frequency at the national and regional layers.

Therefore, without reservation, the SMA endorses the University of the West Indies (UWI) Mona research project – *"The Strengthening of the Water Resources Management.... Watershed Communities in Jamaica"*, which is being proposed by the UWI research team. Based on the information presented, the project is poised to provide critical information on a national strategy that will ultimately contribute to building resilience in our national water resource and disaster risk management strategies for our nation and possibly the region.

Hence the ability to acquire data in real-time, using ICT, especially the last mile – where wireless devices (such as sensors and other types of transmitters utilising the emergency band or related bands) are utilized, will strengthen the responsiveness of different agencies, and enable them to fulfil their respective mandates.

Subsequently, it has been agreed that prior approval will be required from the SMA regarding the transmission of data between remote sites via wireless communication networks. The SMA's team of engineers and technocrats stand ready to provide the required technical guidance as it relates to the use of radio frequency bands. Additionally, this partnership will provide the necessary input to ensure regulatory compliance.

We believe that this project will be beneficial to local communities by contributing to the improvement in the management of water resources across Jamaica as well as improving the outcomes surrounding calamities associated with flooding. We support this project in its entirety and look forward to its positive impact on various facets of our socio-economic pillars.

Again, thank you for this opportunity to support this critical muti-sectoria. initiative and await the next phases.

Yours sincerely,
SPECTRUM MANAGEMENT AUTHORITY

Dr Maria Myers-Hamilton
Managing Director

APPENDIX 11D

LETTER OF COMMITMENT
OFFICE OF DISASTER PREPAREDNESS & EMERGENCY MANAGEMENT

OFFICE OF DISASTER PREPAREDNESS & EMERGENCY MANAGEMENT
2-4 Haining Road, Kingston 5, Jamaica, W.I. Tel: (876) 906-9674-5, (876) 754-9077-8
Tel. /Fax: (876) 754-3229, E-mail: odpem@cwjamaica.com, Website: www.odpem.org.jm

April 26th 2024

Dr. Yves Personna
Senior Programme Manager
ACP-EU-Caribbean Action for Resilience Enhancement (CARE) Programme
Environmental Sustainability Unit (ESU)
Caribbean Development Bank
Barbados

Dear Dr. Personna,

Re: Strengthening Water Resources Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica

The **Office of Disaster Preparedness and Emergency Management (ODPEM)** is keen to partner with The University of the West Indies, Mona, in undertaking the subject project. The project objectives will support important national priorities that are in alignment with the National Development Plan – Vision 2030 and key Climate Change adaptation and mitigation plans, projects and programmes.

ODPEM will provide access to data on past hydro-meteorological hazards (and other related hazards) as well as damage and loss incurred from these hazards in the study areas. ODPEM aims to support the research and larger programme objectives and anticipates that research outcomes will strengthen national climate services. The agency will provide the following:

1. Access to reports outlining past hurricane and flooding events in the project areas.
2. Geospatial data on flood prone areas in the study sites.
3. Evacuation plans (including evacuation routes and shelter locations) and maps for the study sites.
4. Participation in stakeholder consultations and workshops with the project team during the project as and when needed.

We believe the project will be beneficial to the local communities involved and significantly impact national water security and disaster risk management priorities. The research outputs will also influence regional and international policy frameworks. We look forward to being implementation partners with The UWI Mona.

Sincerely,

Richard Thompson (Mr.)
Director General

APPENDIX 12

DETAILED BUDGET

Budget Item	**Total Cost**
	(USD)
1. In-depth Evaluation of Surface and Groundwater Resources	
Technical Assistants	48,000
Equipment and Software:	282,510
Project Activities	48,600
Subtotal 1	**379,110**
2. Strengthening Early Warning Systems and Enhancing Disaster Risk Reduction	
Professional Fees	237,600
Equipment and Software**:**	101,705
Project and Administrative Activities	61,320
Subtotal 2	**400,625**
3. Supporting Livelihoods, Community Capacity Building and Climate Resilience	
Professional Fees	125,800
Project and Administrative Activities	90,460
Equipment and Software:	10,915
Subtotal 3	**227,175**
4. Project Management	
Project Coordinator	72,000
Office Space (including electricity, water, internet)	96,620
Subtotal 4	**168,620**
Total Direct Eligible Cost (1+2+3+4)	**1,175,530**
Bank Charges	**10,000**
Contingency	**78,690**
Total	**1,264,220**

APPENDIX 13

PROCUREMENT PLAN

I. General

1. Project Information:

Country: Jamaica

Grantee: The University of the West Indies (The UWI), Mona

Project Name: Strengthening Water Resource Management and Climate Resilience in Coastal and Inland Watershed Communities in Jamaica

Project Implementing Agency (PIA): The UWI Faculty of Science and Technology

2. Bank's Approval Date of the Procurement Plan: December 1, 2024

3. This Procurement Plan is valid until: December 1, 2024 – September 30, 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	Comments
1.	Direct Selection (DS)		
2.	Limited Bidding (LB)		

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

4. **Any Other Special Procurement Arrangements**: To comply with the requirements of the CARE Financing shall be provided under CARE Finance Agreement and thus eligibility shall be extended to countries that are not members of the CDB, in accordance with the EU Eligibility Rules.

5. **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.	**In-depth Evaluation of Surface and Groundwater Resources**							
(a)	Field and laboratory equipment		LB National	No	No	Prior	January 2025	
(b)	Project activities: Fieldwork travel, subsistence, and surface and groundwater quality analyses supplies		LB National	No	No	Prior	April 2025	
2.	**Strengthening Early Warning Systems and Enhancing Disaster Risk Reduction**							
(a)	Equipment and software		LB International	No	No	Prior	January 2025	
(b)	Project activities: workshops, community meetings, evacuation drills, volunteers' stipends		LB National	No	No	Prior	July 2025	Cost will be spread over 5 workshops, 2 evacuation drills and 10 community visits.
3.	**Supporting Livelihoods, Community Capacity Building and Climate Resilience**							
(a)	Transcribers stipend (3) for taped interviews, workshops, focus groups, fixed time		LB National	No	No	Post	January 2026	Cost will be spread over training workshops
(b)	Equipment (laptop, digital voice recorders etc)		LB National	No	No	Post	January 2026	
(c)	NVivo Qualitative Software		LB National	No	No	Post	January 2026	
(d)	Project activities: field workers stipend, transportation (12 trips)		LB National	No	No	Prior	January 2026	

(e)	Project team training and skills building, training of volunteers in DRM, EWS (venue, training materials and volunteers' stipend)		LB National	No	No	Post	January 2026	Cost will be spread over 8 workshops.
(f)	Farming supplies		LB National	No	No	Post	January 2026	

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	Comments
1.	Individual Consultant Selection (ICS)		Several individual consultants will be engaged to support project implementation.

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 CARE Finance Agreement and thus eligibility shall be extended to countries that are not members of the CDB, in accordance with the EU Eligibility Rules.

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

Ref No.	Assignment (Description)	Estimated Cost (USD)	Selection Method	Review Bank	Expected Proposal Submission Date	Comment
1.	Project Coordinator		ICS	Prior	January 2025	
2.	Technical Assistant (Water Resource Management)		ICS	Prior	January 2025	
3.	Technical Assistant (Chemical Analysis)		ICS	Prior	January 2025	

Ref No.	Assignment (Description)	Estimated Cost (USD)	Selection Method	Review Bank	Expected Proposal Submission Date	Comment
4.	Computer Programmer		ICS	Prior	October 2025	
5.	Technical Assistant (Artificial Intelligence Modelling)		ICS	Prior	January 2025	
6.	Engineering Hydrologist		ICS	Prior	January 2025	
7.	Statistician		ICS	Prior	January 2025	
8.	Technical Assistant (Sensor and Wireless Network System Design and Development)		ICS	Prior	January 2025	
9.	Website Developer		ICS	Prior	January 2025	
10.	Social Scientist		ICS	Prior	January 2025	
11.	Technical Assistant (Climate Resilience to Climate Change)		ICS	Prior	January 2025	
12.	Media and Communications Consultant		ICS	Prior	October 2025	

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 (days)	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	Q1 2025	
2.	Increased capacity of Implementing Agency to undertake procurement in accordance with CDB's Procurement Procedures through CDB's Online Procurement Training.	0	5	Q1 2025	

Summary of Proposed Procurement Arrangement

Project Component	CDB (USD'000)						TOTAL (USD'000)	UWI (USD'000)	TOTAL COST (USD'000)
	Primary								
	ICS	DS	LB	FA	QCBS	QBS			
In-depth Evaluation of Surface and Groundwater Resources									
Strengthening Early Warning Systems and Enhancing Disaster Risk Reduction									
Supporting Livelihoods, Community Capacity Building and Climate Resilience									
Project Management									
Sub-total									
Contingency									
Bank Charges									
Total Project Cost									

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.