



**GREEN
CLIMATE
FUND**

Meeting of the Board
17 – 20 October 2022
Incheon, Republic of Korea
Provisional agenda item 13

GCF/B.34/02/Add.02

29 September 2022

Consideration of funding proposals - Addendum II

Funding proposal package for FP192

Summary

This addendum contains the following seven parts:

- a) A funding proposal titled "The R's (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados (3R-CReWS)";
- b) No-objection letter issued by the national designated authority(ies) or focal point(s);
- c) Environmental and social report(s) disclosure;
- d) Secretariat's assessment;
- e) Independent Technical Advisory Panel's assessment;
- f) Response from the accredited entity to the independent Technical Advisory Panel's assessment; and
- g) Gender documentation.

Table of Contents

Funding proposal submitted by the accredited entity	3
No-objection letter issued by the national designated authority(ies) or focal point(s)	139
Environmental and social report(s) disclosure	140
Secretariat's assessment	144
Independent Technical Advisory Panel's assessment	163
Response from the accredited entity to the independent Technical Advisory Panel's assessment	176
Gender documentation	180

Funding Proposal

Project/Programme title:	<u><i>The R's (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados (3R-CReWS)</i></u>
Country(ies):	<u><i>Barbados</i></u>
Accredited Entity:	<u><i>Caribbean Community Climate Change Centre (CCCCC)</i></u>
Date of first submission:	<u><i>2022/02/24</i></u>
Date of current submission	<u><i>2022/07/28</i></u>
Version number	<u><i>V.005</i></u>



GREEN
CLIMATE
FUND

Contents

Section A	PROJECT / PROGRAMME SUMMARY
Section B	PROJECT / PROGRAMME INFORMATION
Section C	FINANCING INFORMATION
Section D	EXPECTED PERFORMANCE AGAINST INVESTMENT CRITERIA
Section E	LOGICAL FRAMEWORK
Section F	RISK ASSESSMENT AND MANAGEMENT
Section G	GCF POLICIES AND STANDARDS
Section H	ANNEXES

Note to Accredited Entities on the use of the funding proposal template

- Accredited Entities should provide summary information in the proposal with cross-reference to annexes such as feasibility studies, gender action plan, term sheet, etc.
- Accredited Entities should ensure that annexes provided are consistent with the details provided in the funding proposal. Updates to the funding proposal and/or annexes must be reflected in all relevant documents.
- The total number of pages for the funding proposal (excluding annexes) **should not exceed 60**. Proposals exceeding the prescribed length will not be assessed within the usual service standard time.
- The recommended font is Arial, size 11.
- Under the [GCF Information Disclosure Policy](#), project and programme funding proposals will be disclosed on the GCF website, simultaneous with the submission to the Board, subject to the redaction of any information that may not be disclosed pursuant to the IDP. Accredited Entities are asked to fill out information on disclosure in section G.4.

Please submit the completed proposal to:

fundingproposal@gcfund.org

Please use the following name convention for the file name:

“FP-[Accredited Entity Short Name]-[Country/Region]-[YYYY/MM/DD]”

LIST OF ACRONYMS	
AE	Accredited Entity
AMA	Accreditation Master Agreement
AMCECC	Adaptation Measures to Counteract the Effects of Climate Change project
BNEP	Barbados National Energy Policy
BSTP	Bridgetown Sewage Treatment Plant
BWA	Barbados Water Authority
CARICOM	Caribbean Community
CAS	Conventional Activated Sludge
CCCCC	Caribbean Community Climate Change Centre
CFATF	Caribbean Financial Action Task Force
CMMS	Computerized Real-time Management System
CRew	Caribbean Regional Fund for Wastewater Management project
CSME	Single Market and Economy
DEFM	Dynamic Economic and Financial Model
EE	Executing Entity
EFE	Extended Facility Fund
ELPA	Electric Light and Power Act
ESIA	Environment and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESS	Environmental Social Safeguard
FATF	Financial Action Task Force
FP	Funding Proposal
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas Emission
GOB	Government of Barbados
IDB	Inter-American Development Bank
IDP	Information Disclosure Policy
IPR	Indirect Potable Reuse
IRMF	Integrated Results Management Framework
IWRM	integrated management of water resources
IWWM	Integrated Water and Wastewater Management
MENB	Ministry of Environment and National Beautification
NDA	National Designated Authority
NWRP	National Water Reuse Policy
PDMU	Programme Development and Management Unit
PDP	Physical Development Plan
PEA	Public Education and Awareness



GREEN
CLIMATE
FUND

PM	Preventative Maintenance
R2RP	Roof-to-Reef Programme
RAFF	Revolving Adaptation Fund Facility
RE	Renewable Energy
RFP	Request for Proposals
RO	Reverse Osmosis
SCSTP	South Coast Sewage Treatment Plant
SCWRP	South Coast Water Reclamation Project
SIDS	Small Island Developing States
SLR	Sea Level Rise
SOPs	Standard Operating Procedures
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research
VFD	Variable Frequency Drives
WSRN S- Barbados	Water Sector Resilience Nexus for Sustainability in Barbados
WWD	Wastewater Department

A. PROJECT/PROGRAMME SUMMARY				
A.1. Project or programme	Project	A.2. Public or private sector	Public	
A.3. Request for Proposals (RFP)	<u>Not applicable</u>			
A.4. Result area(s)			GCF contribution	Co-financers' contribution¹
	Mitigation total		7.5 %	--- %
	<input checked="" type="checkbox"/> Energy generation and access		5%	--- %
	<input type="checkbox"/> Low-emission transport		--- %	--- %
	<input checked="" type="checkbox"/> Buildings, cities, industries and appliances		2.5 %	--- %
	<input type="checkbox"/> Forestry and land use		--- %	--- %
	Adaptation total		92.5 %	100 %
	<input checked="" type="checkbox"/> Most vulnerable people and communities		17.5%	25%
	<input checked="" type="checkbox"/> Health and well-being, and food and water security		37.5%	75%
	<input checked="" type="checkbox"/> Infrastructure and built environment		37.5 %	--- %
	<input type="checkbox"/> Ecosystems and ecosystem services		--- %	--- %
A.5. Expected mitigation outcome <i>(Core indicator 1: GHG emissions reduced, avoided or removed / sequestered)</i>	40,875 tCO ₂ e over 25 years	A.6. Expected adaptation outcome <i>(Core indicator 2: direct and indirect beneficiaries reached)</i>	Population of Barbados or 277,821 persons (136,132males and 141,689 females) (excluding annual tourist arrival of approximately 1,237,200 million visitors per year) (World Bank WDI, 2021) 136,220 (66,748 males and 69,472 females) direct beneficiaries 141,601 (69,384 males and 72,217 females) indirect beneficiaries 49% 51%	
A.7. Total financing (GCF + co-finance)	50 Million USD	A.9. Project size	Small (Upto USD 50 million)	
A.8. Total GCF funding requested	<u>39.4 Million</u> USD			

¹ Co-financer's contribution means the financial resources required, whether Public Finance or Private Finance, in addition to the GCF contribution (i.e. GCF financial resources requested by the Accredited Entity) to implement the project or programme described in the funding proposal.

<p>A.10. Financial instrument(s) requested for the GCF funding</p>	<p><i>Mark all that apply and provide total amounts. The sum of all total amounts should be consistent with A.8.</i></p> <p> <input checked="" type="checkbox"/> Grant <u>39.4 Million USD</u> <input type="checkbox"/> Equity <u>Enter number</u> <input type="checkbox"/> Loan <u>Enter number</u> <input type="checkbox"/> Results-based payment <u>Enter number</u> <input type="checkbox"/> Guarantee <u>Enter number</u> </p>		
<p>A.11. Implementation period</p>	<p>5 years</p>	<p>A.12. Total lifespan</p>	<p>25 years</p>
<p>A.13. Expected date of AE internal approval</p>	<p>10/17/2022</p>	<p>A.14. ESS category</p>	<p>B</p>
<p>A.15. Has this FP been submitted as a CN before?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p>A.16. Has Readiness or PPF support been used to prepare this FP?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> PPF022</p>
<p>A.17. Is this FP included in the entity work programme?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>	<p>A.18. Is this FP included in the country programme?</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>
<p>A.19. Complementarity and coherence</p>	<p>Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p>		
<p>A.20. Executing Entity information</p>	<p>Caribbean Community Climate Change Centre (CCCCC), established by an Intergovernmental Agreement entered into force on February 2, 2002, a non-profit regional organization among Member States of the Caribbean Community (CARICOM). The CCCCC organized and existing under the laws of Belize pursuant to the ACT, Act No. 6 of 2015, dated 29th July 2015 and legally registered as an International Inter-Governmental Organisation under Article 102 of the United Nations Treaty and having its registered office at 3rd Floor, David L. McKoy Business Centre, Bliss Parade, P.O. Box 563, Belmopan, Belize, Central America. The CCCCC is a regional accredited entity (Direct Access Entity) to the GCF.</p> <p>The Barbados Water Authority is a Statutory Body established by an act of Legislature on October 8, 1980 to replace the Waterworks Department of Government. It commenced operations on April 1, 1981. BWA full registered address is The Pine Commercial Estate, The Pine St. Michael BB11000, Bridgetown, Barbados.</p>		
<p>A.21. Executive summary (max. 750 words, approximately 1.5 pages)</p>			

Climate Change Problem

Barbados is experiencing “absolute water scarcity” based on the Falkenmark water stress indicator since approximately 305-310 m³ of water is available per person per year, placing Barbados amongst the most water scarce countries in the world.

The issue of water scarcity becomes of greater concern in the face of climate change. The projections, representative for Barbados, using a multi-model CMIP6 ensemble with the SSP2-4.5 scenario and for the epoch 2041 – 2060, indicate that:

- The mean annual daily maximum temperature will increase by about 1.0°C. The mean annual daily minimum temperature will increase by about 1.3°C. The daily maximum temperature increase is largest during the wet season from September to November.
- The number of heatwaves (three consecutive days where the maximum temperature exceeds the average daily maximum temperature at the 90% threshold) has increased over the period 1991 – 2020 and may be expected to increase further with increasing temperatures.
- Annual mean precipitation will decrease by about 9%. The decrease is particularly severe in the May - July season, effectively extending the dry season by two months.

There is a cause-and-effect relationship with each of these scenarios. For instance, temperatures will affect the seasonality of crops, increase evapotranspiration rates, induce heat stress on the population, including tourists and livestock, increase cooling costs, induce changes in plant-wildlife-insect populations and distribution range and increase infectious and vector-borne diseases. More intense rainfall, severe storm conditions and SLR will promote flash flooding; saline intrusion into available ground water abstraction and irrigation wells and salinization of agriculture lands; coastal erosion and damage to coastal infrastructures and disruption to businesses.

The effects of climate change are already evident in Barbados as increased flash-flooding magnitude and frequency has caused havoc in Barbados: on 29 November 2016 Barbados experienced over 170 mm of rainfall in a few hours, which previously was only observed in 1995, and this contributed to the failing of the sewerage system.

The decreasing amount and increasingly skewed pattern of precipitation and increasing evapotranspiration due to higher temperatures will set the stage for increased drought which will further decrease underground recharge rates and increase salinization of aquifers, which provide 95% of the island’s potable water supply. The overall implication of the available body of work suggests that sustainable aquifer yields could decrease by around 50% by 2050. This is troubling for Barbados as the level of groundwater abstraction is already between 85-100% of the safe yield.

Project Summary and Climate Results

Wastewater management strategies using reclaimed water will be a critical component to help mitigate the impacts of climate change on water scarcity. Reclaimed water is wastewater that has been treated to tertiary levels so that it can be beneficially reused for non-potable sources, such as agriculture, landscaping, turf maintenance, and recharging the aquifer.

The goal of 3R-CReWS is to facilitate the enhancement of the health, wellbeing, and productivity of Barbadians through the use of carbon neutral and climate resilient water and energy management technologies and strategies that ensures water is protected, managed, recycled, reused, and conserved. This will be achieved through four outcome level results and ten output level results.

Outcomes 1 and 2 of this project are the largest, in terms of budget, as they are focused on infrastructure works and transfer of technology. Specifically, Outcome 1 aims to achieve a climate resilient pathway through the upgrade of the Bridgetown Sewage Treatment Plant (BSTP) to a tertiary treatment system and the installation of wastewater treatment systems in two Zone A locations in Barbados to harness reclaimed water, which will be utilized for aquifer recharge and agricultural irrigation. This will be achieved through the installation of a 9km pipeline that will supply reclaimed water to support irrigation developments in the Codrington-Neils-Lears-Salters-Constant-Valley, which will benefit 155 farmers on 235 Hectares and recharge

wells (injections wells) for replenishing the aquifer. This water reclamation and reuse process will be complemented with the installation of decision support tools and infrastructure that are critical for resilient building.

Outcome 2, which spans the installation of renewable energy PV systems, automated controls such as variable frequency drives (VFDs) and a sludge dewatering system, will contribute to the achievement of a low-emission pathway.

Outcomes 3 and 4 are “soft” developmental results that primarily aim to create an enabling environment for achieving a paradigm shift in the approaches to the management of water resources, specifically wastewater, and thereby promoting water security in the face of a changing climate. Specifically, Outcome 3 is targeting the enhancement of capacities and capabilities, primarily at the BWA, for managing, monitoring and operating the upgraded BSTP through the development of customized trainings, updating the Standard Operating Procedures (SOPs) and Operational Manual and implementing a risk management framework. Outcome 4 further strengthens the enabling environment through a legislative review, strengthening buy-in, ownership and leadership in the private sector for the adoption of wastewater technologies and reuse options and having nation-wide public education and awareness on the nexus between climate change and water availability, wastewater as a resource, wastewater treatment and reuse options and promoting transparency and lessons emerging from this project.

Outcomes 1 and 4 are expected to yield co-benefits related to social, economic, adaptation, mitigation and environmental sectors.

B. PROJECT/PROGRAMME INFORMATION

B.1. Climate context (max. 1000 words, approximately 2 pages)

National Context

Barbados has a population of approximately 287,000, with a density in the region of 660 persons per km², ranking the island within the top fifteen most densely populated countries in the world². Barbados is experiencing “absolute water scarcity” based on the Falkenmark water stress indicator³ since approximately 305-310 m³ per person per year of water is available, making Barbados amongst the most water scarce countries in the world.⁴ Water availability in Barbados is acutely affected by the periods and intensities of the wet and dry seasons and by extreme weather systems so much so that a dry spell of only 7-10 days has the potential to reduce yields, thus influencing the livelihoods of farmers and wider population and increasing their climate vulnerability.⁵

Climate change projections for Barbados and impacts

As is indicated the Feasibility Study, climate change projections using a multi-model CMIP6 ensemble with the SSP2-4.5 scenario and for the epoch 2041–2060 indicate that the current issues and challenges faced by Barbados will increase over the coming decades, relative to the current climatological normal, the period 1991–2020⁶:

- The mean annual daily maximum temperature will increase by about 1.0°C. The mean annual daily minimum temperature will increase by about 1.3°C. The daily maximum temperature increase is largest during the wet season from September to November.
- The number of heatwaves (three consecutive days where the maximum temperature exceeds the average daily maximum temperature at the 90% threshold) has increased over the period 1991–2020 and may be expected to increase further with increasing temperatures.
- Annual mean precipitation will decrease by about 9%. The decrease is particularly severe in the May - July season, effectively extending the dry season by two months.

The results of the analyses on the climate change projections on temperature are aligned with the findings of Working Group I of the IPCC in their report for the Sixth Assessment Report (AR6). For precipitation and droughts there is no agreement in the CMIP6 models for the Caribbean region (although the local precipitation data for Barbados does show trends such as an increase in extremely heavy precipitation). From Chapter 11, for the Caribbean region:

- Table 11.13: Significant increases in the intensity and frequency of hot extremes and significant decreases in the intensity and frequency of cold extremes: CMIP6 models project a robust increase in the intensity and frequency of TXx events and a robust decrease in the intensity and frequency of TNn events
- Table 11.14: Insufficient data and a lack of agreement on the evidence of trends in heavy precipitation: CMIP6 models, CMIP5 models, and RCMs project inconsistent changes in the region
- Table 11.15: Mixed trends between subregions, but some evidence of increases in drought duration.

For the Caribbean, and Barbados, the number of hot days is projected to increase substantially, in turn increasing the frequency of hot days and nights that are considered “hot”, there will be more intense and shorter duration rainfall events interspersed with long periods of dry weather and increased frequency and

² World Population Review (Barbados 2020): <http://worldpopulationreview.com/countries/barbados-population/>

³ This method defines water scarcity in terms of the total water resources that are available to the population of a region; measuring scarcity as the amount of renewable freshwater that is available for each person each year. If the amount of renewable water in a country is below 1,700 m³ per person per year, that country is said to be experiencing water stress; below 1,000 m³ it is said to be experiencing water scarcity; and below 500 m³, absolute water scarcity (Falkenmark, M., J. Lundquist and C. Widstrand (1989), “Macro-scale Water Scarcity Requires Micro-scale Approaches: Aspects of Vulnerability in Semi-arid Development”, Natural Resources Forum, Vol. 13, No. 4, pp. 258-267)

⁴ Barbados Second National Communication (2018).

⁵ Barbadian farmers, especially small farmers, are becoming increasingly vulnerable to drought as their livelihoods are threatened by low rainfall where crops are rainfed and by low water levels and increased production costs due to increased irrigation. Their livestock grazing areas change in nutritional value, as more low quality, drought tolerant species dominate during extensive droughts, causing the vulnerability of livestock to increase. The potential for livestock diseases also increases. <http://www.fao.org/americas/noticias/ver/en/c/419202/>

⁶ See Feasibility Study for more details.

intensity of extreme storms and sea-level rise (SLR). Higher temperatures will affect the seasonality of crops, increase evapotranspiration rates, induce heat stress on the population, including tourists and livestock, increase cooling costs, induce changes in plant-wildlife-insect populations and distribution range and increase infectious and vector-borne diseases⁷. Already, in recent years Barbados has experienced high incidences of vector borne and waterborne diseases that were attributed to episodic changes in temperature (+0.7°C - +4.0°C) and rainfall patterns and linked to events such as dry season droughts and wet season flash flooding. It is projected there could be even more of an increase in water-borne diseases, due to limited water availability and wastewater sanitation.⁸

More intense rainfall, severe storm conditions and SLR will promote flash flooding; saline intrusion into available groundwater abstraction and irrigation wells and salinization of agriculture lands; coastal erosion and damage to coastal infrastructures and disruption to businesses. Increased flash-flooding magnitude and frequency has caused havoc in Barbados: on 29 November 2016 Barbados experienced over 170 mm of rainfall in a few hours, which previously was only observed in 1995, and this contributed to the failing of the sewerage system. Stormwater run-off from intense rainfall activity that contain debris, microorganisms and chemicals also contribute to nutrient loading in near-shore environments which negatively impact coral reefs. Barbados has over 50 hard coral species and 600 species of fish. Coral reefs, which serve as natural breakwaters along the coasts, also support more than 25% of all marine species, making them the most biologically diverse of marine ecosystems and an equivalent, in terms of biomass productivity, to rainforests on land.⁹ Furthermore, the coral reefs generate significant revenues for local fishermen and the tourism sector through snorkelling and scuba diving¹⁰. The tourism sector in Barbados employs about 26,000 persons (9% of the total population) and indirectly contributes to about 40% of Barbados earnings¹¹, making climate change a great threat to the island's main economic earner.

The decreasing amount and increasingly skewed pattern of precipitation and increasing evapotranspiration due to higher temperatures will increase water shortages and competition over water between tourism and other productive sectors, increase in wildfires and agriculture productivity¹². These conditions also set the stage for increase drought which will further decrease underground recharge rates and salinization of aquifers, which provide 95% of the island's potable water supply.¹³ At the onset of the 2020 wet season, Barbados had completed a 24-month period with below normal rainfall that had a severe impact on aquifer recharge and resulted in seawater intrusion into coastal aquifers and reduced yields (see Figure 1). The future is even more worrying since hydrogeological modelling using MODFLOW 2000¹⁴, indicated that by 2050 under an RCP 2.6 scenario, groundwater yields could be reduced to 26.9 Mm³/year, and 25.5 Mm³/year under the RCP 8.5 scenario, as compared to a no climate change estimate of between 65.7 Mm³/year and 82.3 Mm³/year, depending on which estimate is used¹⁵. Studies which took a mass-balance approach to changes in groundwater storage indicated that under all climate change scenarios aquifers would be progressively depleted.¹⁶ The overall implication of the available body of work suggests that sustainable aquifer yields could decrease by around 50% by 2050. This is troubling for Barbados as the level of groundwater abstraction is already between 85-100% of the safe yield. The Barbados Water Authority (BWA)

⁷ Simpson et al. (2011)

⁸ Water scarcity carries a range of health risks in Barbados. These are related to the following: (a) Reduced amounts of water available for basic hygiene (e.g. water-washed diseases); (b) Chemical and microbial contamination as a result of increased drought; (c) Gastrointestinal diseases. In addition, water scarcity may result in water-storage and vector-borne diseases. Barbados has the highest incidence of dengue in the world. Rainwater storage as a response measure to lack of freshwater provides breeding sites for the disease vector of dengue, the *Aedes aegypti* mosquito. <http://www.who.int/globalchange/projects/adaptation/PHE-adaptation-final-Barbados.pdf>

⁹ Barbados Second National Communication (2018).

¹⁰ Farrell, D., Nurse, L., & Moseley, L. (2007). Managing water resources in the face of climate change: A Caribbean perspective. UWI.

¹¹ <http://www.cbc.bb/index.php/news/item/2059-poverty-on-the-rise-in-barbados>

¹² Simpson et al (2011)

¹³ The poor are vulnerable as food price increases are often associated with drought. Expensive, desalinated water resources are becoming more important in the Caribbean, and this can impact the poor significantly. Rural communities are vulnerable since potable water networks are less dense and therefore more heavily impacted during drought, while children are at highest risk from inadequate water supplies during drought. <http://www.fao.org/america/noticias/ver/en/c/419202/>

¹⁴ The modelling work did not take into account the potential impact of sea level rise or fluxes between the freshwater and seawater interface and therefore should be treated with some caution (Cashman, 2021)

¹⁵ Cashman (2021)

¹⁶ Cashman, et al., 2012 in Cashman (2021)

has estimated that their own abstraction is approximately 47 Mm³/year and that total abstraction could be as much as 62.5 Mm³/year when other sources are included. Recall that a lower estimate of safe yield given above is 65.7 Mm³/year. The BWA abstraction, includes real losses¹⁷, which have been reported as approximately 20.0 Mm³/year or some 38% of production. Even removing all losses from the distribution system, which is unrealistic, would not be sufficient to offset the projected impact of climate change on aquifer yields again, even if the impact has been over-estimated¹⁸. The challenges in groundwater management become very apparent in the increasing levels of salinity in groundwater (see Figure 1).

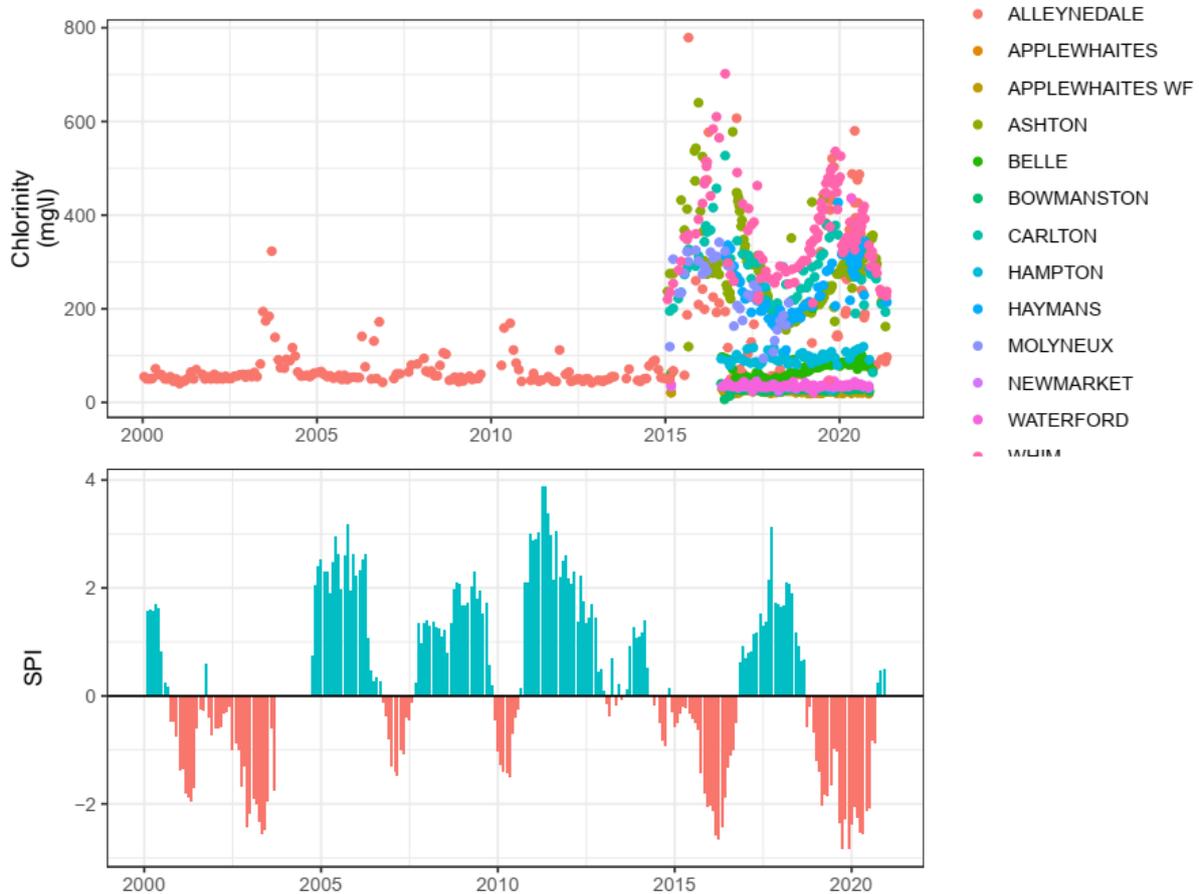


Figure 1: Chlorinity levels in BWA wells (top panel) and monthly Standardised Precipitation Index values (12-month period) at the weather observation station at the Caribbean Institute for Meteorology and Hydrology (bottom panel), for the period 2000 – 2020. Note how episodes with negative SPI values correlate with increasing chlorinity in the wells.

Interventions to counter the impacts of climate change

As a result of the projected effects of climate change on water quality and availability in Barbados, coupled with projected increases in the population¹⁹ and development growths that may attract more tourist arrivals, it will be necessary for Barbados to not only develop current wastewater management practices but also implement new technologies that are climate resilient and reduce greenhouse gas (GHG) emissions and identify new sources of water that can be used to recharge the underground aquifers to be later used as potable water after proper treatment. In terms of water consumption, irrigation is second only to domestic use. It is estimated that approximately 80-90% of the water used for domestic activity is discharged as wastewater. This represents a sustainable source of wastewater that could be treated and used as reclaimed water in other productive activities where potable water quality is not required.²⁰ In October 2018, the

¹⁷ water lost to bursts and leakage from the water distribution system

¹⁸ Cashman (2021)

¹⁹ According to the World Bank (2021), the population of Barbados is projected to peak in 2031 after which it is projected to decline

²⁰ EPD and BWA (2018)

Government of Barbados (GOB) enacted a National Water Reuse Policy (NWRP), which states that *“the traditional interpretation of the term water must expand beyond conventional freshwater sources to encompass treated wastewater (reclaimed water), storm water and other sources as part of the total water resources”*²¹.

There are two municipal wastewater treatment facilities: the Bridgetown Sewage Treatment Plant (BSTP) and the South Coast Sewage Treatment Plant (SCSTP). The 30-year-old BSTP has approximately 1,500 connections and is a secondary treatment plant with a short ocean outfall. The SCSTP has advanced primary treatment works with an ocean outfall and accommodates approximately 3,000 connections, of which there are currently 2,000 active connections. The SCSTP had a UV disinfection system installed, but it never operated properly and was abandoned many years ago.²²

According to the 2010 population census, whilst virtually 100% of all households in Barbados are connected to the water distribution system, only 10 to 15% are connected to one of these two centralised wastewater systems that do not have the capacity to disinfect the treatment plant effluent prior to being discharged through ocean outfalls²³. The remaining households in Barbados use pit latrines, septic tanks and soakaways. Private properties such as hotels and some businesses make use of package treatment plants and in some instances the treated wastewater is reused for landscaping purposes - currently there are 68 package treatment plants in operation²⁴. Apart from the latter scenario, there is little reuse of treated wastewater in Barbados.

The infrastructure and facilities in place to manage water resources are also vulnerable to climate change. For instance, majority of the BWA’s operations are dependent on energy from the grid. Whenever, a storm or hurricane or other climatic or non-climatic factor disrupt power supply to pumping stations, water supply to the population is disrupted. Based on calculations by the BWA, in face of extended island wide power disruption, the BWA will have just under one day’s reservoir storage capacity. Recently, BWA began implementing grid-tied photovoltaic systems to reduce its energy cost and minimize its carbon footprint;²⁵ however, these efforts alone cannot mitigate the vulnerability of the water supply system to extreme storm events. Examples of climate parameters that can affect wastewater infrastructure and assets include:

Precipitation

- Higher intensity, frequency and duration of precipitation events leading to infrastructure flooding and overflow conditions;
- Increased inflow to sewers;
- Increased likelihood and frequency of sewer flooding, overflows, and spills;
- Increased surface erosion and introduction of sediment to sewers;
- Excessive loading to wastewater sewage treatment works; and
- Surface flooding, due to intense rainfall events, can lower the efficiency and efficacy of onsite wastewater treatment systems, such as soak-away fields.

Wind

- Increased wind loading on infrastructure assets and buildings.

Temperature

- Heat waves leading to reduced water availability and higher sewage contaminant concentrations (less dilution) increased sewer related odour generation and release;
- Increased hydrogen sulphide production (resulting in increased infrastructure damage due to corrosion); and
- Increased environmental impacts of residual contaminants including nutrient impacts due to elevated receiving water temperatures.

21 Barbados Environmental Protection Department and the Barbados Water Authority (2018). National Water Reuse Policy for Barbados. Pg. 4

22 GEF (2019) National Package for Barbados for the CReW+ Project

23 (Integrated Sustainability, 2021 – Baseline Report)

24 Cashman (2021) Baseline Study and Wastewater Demand Analysis

25 The FP060 project that builds resilience into the water supply system on Barbados includes the installation of a PV system to ensure uninterrupted operation at the Belle, Bowmanston and Hampton pumping facilities.

Ocean and Geotechnical

- Increased incidents of storm surges affecting wastewater discharge and property flooding; and
- Increased soil saturation impacting geotechnical stability to support tanks and other infrastructure as well as affecting the efficiency of onsite wastewater treatment systems, such as soak-away fields in affected areas.

The impact of climate change on groundwater resources also extends to on-site wastewater disposal, for such practices as septic fields. On-site ground disposal of wastewater relies on the soil being unsaturated to effect natural biological, physical, and chemical treatment processes and protect groundwater quality. Saturated soil conditions result in significantly lower treatment and enable pathogenic microorganisms to travel long distances through the soil, as well as result in surface failure and break-out of wastewater on the surface with potential health risks.

Through a concerted effort, this **Three Rs (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados (3R-CReWS)** project proposes to not only support the adaptation of Barbados to the water scarcity conditions that will be amplified by climate variability and change, but to also reduce its carbon footprint and GHGs emissions and serve as a practical example for Caribbean for climate resilient water and wastewater management systems, treated wastewater reuse and aquifer recharge through the enhancement of the wastewater treatment process to the tertiary level.

The 3R-CReWS will benefit from the lessons of the following projects and the project management team, which will work in close collaboration with the staff at BWA, will ensure these areas of complementarity are leveraged:

- The GOB received a loan from the Inter-American Development Bank (IDB) for the **Water and Sanitation Systems Upgrade of the BWA** that ran from 2011 to 2016. The project supported the modernization of the institutional setting of the water and sanitation sector and improve water production infrastructure and the efficiency of the operations of the BWA. This project is benefiting from the work done towards wastewater management such as the preparation of the wastewater reuse master plan.
- The Global Environment Facility (GEF) funded **Testing a Prototype Caribbean Regional Fund for Wastewater Management (CReW) project**, which began in 2011 and completed activities in 2017. The project used an integrated and innovative approach to reduce the negative environmental and human health impacts from untreated wastewater discharges. Barbados was not a beneficiary country of this pilot project; however, the noted challenges and key lessons coming out of this pilot project are highly applicable to results of this project to promote buy-in and sustainability²⁶. However, there is an ongoing follow-up project called the CReW+, and Barbados is a beneficiary country,²⁷ set to roll out activities related to (i) institutional, policy, legislative and regulatory reforms for Integrated Water and Wastewater Management (IWWM), Sustainable and tailor-made financing options for urban, peri-urban and rural IWWM; (ii) Provision of innovative small-scale, local, rural, peri-urban and community-based solutions for IWWM; and (iii) Knowledge Management and Advocacy on the importance of IWWM order to achieve the Sustainable Development Goals.²⁸ All the components of this project are complementary to the 3R-CReWS project since it strengthens the enabling environment and awareness of wastewater as a resource at the community level and promotes private sector buy-in. These are key areas that will promote the sustainability of the 3R-CReWS project.
- **The Water Sector Resilience Nexus for Sustainability in Barbados (WSRN S-Barbados) project**, which is funded by the GCF (FP060), includes the following complementary results (i) making Barbados society aware of the water cycle and climate change impacts threatening the island's drinking water supply, and (ii) establishing a revolving fund strictly for supporting climate

²⁶ Notably, the lessons pertaining to ensuring that an enabling environment (policy, legislation and regulations and protocols) is in place, importance of education/sensitization not only the public, but decision-makers of the benefits of wastewater reuse, training and capacity building in the enhanced technologies for operators, identifying a national champion (high profile policy maker or agency) to promote the project and its endorsement etc.

²⁷ Full project name is: An integrated approach to water and wastewater management using innovative solutions and promoting financing mechanisms in the Wider Caribbean Region

²⁸ Full project name is: An integrated approach to water and wastewater management using innovative solutions and promoting financing mechanisms in the Wider Caribbean Region

change adaptation and mitigation actions in the water sector. These areas will provide awareness and finances for enhancing climate resilience in the water sector, which are important for maintaining sustainability of the 3R-CReWS project results. In fact, the 3R-CReWS will expand the RAFF charter to promote the adoption of wastewater treatment systems and reuse options

- The USAID funded **Adaptation Measures to Counteract the Effects of Climate Change (AMCECC) project**, executed under the Ministry of Environment and National Beautification (MENB) sets out proposals for stormwater policy and plans, which, when implemented, will enhance the functioning of the sanitary sewer systems, which are designed solely for the transport of sewage but are currently frequently affected by the infiltration of stormwater.
- **The Roof-to-Reef Programme (R2R)** is the Government's sustainable development model for the next decade and represents the country programme for Barbados. The primary focus is on improving the social and environmental circumstances of the people in Barbados. The R2RP will enhance the country's ability to recover from climatic events. The R2RP is hinged on six thematic areas: Shelter, Water, Energy, Waste, Land use, and Ecosystems Management. The thematic areas under the R2RP are aligned to Barbados' NDC priority areas. Barbados intends to develop a pipeline of projects under the R2RP that will improve the country's resilience to climate change as well as increase its push to become carbon neutral by 2030. Some of the named projects such as the WSRN and this 3R-CReWS will fall under the R2R umbrella.
- Barbados received a **second readiness programme from the GCF** to advance Outcome 2: Country Programming Process and Outcome 4 Climate Finance strategies and project pipeline strengthened of the R2R Programme. This preparatory support program will assist the National Designated Authority (NDA) in building the capacity needed to handle large cross sectoral projects involving multiple stakeholders, implementing entities and interest groups. The development of a Country Programme will assist in aligning the national GCF approach with existing national policies/programmes. The Country Programme will provide clear guidelines in project selection and ensure that all projects are linked to the national green economy priorities and Barbados' NDC and will also assist in operationalizing the NDC and obtaining financing for national projects or programmes. The readiness support will also assist in identifying and exploring synergies with ongoing initiatives which can be scaled up.
- Also notable is the proposed **South Coast Water Reclamation Project (SCWRP)** valued at USD105 million and is aimed at transforming the existing South Coast Plant, into a futuristic Water Resource Recovery Facility. The goals of the project include: (i) augmenting existing water supplies, (ii) mitigating climate change effects, (iii) addressing seawater intrusion and sea level rise, (iv) diversifying potable water sources, (v) enhancing water supply resiliency and (vi) reducing the impact of treated effluent on marine life and the environment. At the time of this proposal writing this project was in the inception phase but is expected to be in full implementation at the start of the 3R-CReWS. There are significant synergies between these projects as both plants will be upgraded to produce tertiary level reclaimed water quality that will be suitable for non-potable reuse purposes. The 3R-CReWS project will benefit from the lessons emerging from the implementation of the SCWRP to enhance efficiency and effectiveness as well as the momentum and stakeholder buy-in and awareness as it relates to the use of reclaimed water that has been built by the SCWRP.

Risks and Barriers

Whilst some degree of work has been advanced for the water sector, including wastewater; this project is directly responding to specific barriers that have hindered the government of Barbados to transform its wastewater sector. These include:

- **Financial:** Barbados has a high debt to GDP ratio - at the end of 2020 it was 144%. With the prolonged effects of COVID-19 on the tourism sector and increased government spending on health care in 2021, the debt to GDP ratio is expected to increase. Given the resources needed to service the debt, response to the COVID-19 pandemic and advance development and climate change priorities, **there is limited fiscal space**. To address water insecurity, which is a priority of the Government of Barbados, the use of reclaimed water is becoming a critical resource. More specifically, the transformation of the water and wastewater sector requires the utilization of

reclaimed water for productive/economic purposes; however, the adoption of upgraded treatment process and technologies is necessary. The 3R-CReWS project is a part of this paradigm shift. The 3R-CReWS has significant capital costs, most of which is covered by GCF funding, however, in the overall planned investment for transforming the sector, the GCF investment is less than a fifth of the planned investment. Further, the ownership and sustainability dimensions are critical and is the assumed responsibility of the Government of Barbados; as such the Operations and Maintenance costs for the wastewater treatment systems, which is, and will continue to be, a significant part of the operating budget at the BWA.

- **Social** - the underlying paradigm shift of this project is a change in culture and attitude towards the use of water at the household level; however, there is **limited knowledge and awareness about the usefulness of reclaimed water as a resource**. Therefore, to deliver the paradigm shift envisioned, 3R-CReWS will enhance the knowledge and awareness of the public, including visitors (tourists) and the private sector to change current behaviour to better manage and conserve water or accept proposed water reuse practices through a nation-wide public education and awareness programme and a strategy targeting the engagement of the private sector.
- **Institutional** – there is **lack of trained staff to meet the requirements of the upgrades planned by for BSTP and limited technical expertise in the private sector to manage and maintain wastewater systems implemented**. The 3R CReWS was specially designed to promote a paradigm shift in the adoption of wastewater treatment technologies through the provision of specialized training to BWA and key stakeholders, including from the private sector.
- **Technological: there is inadequate up-to-date technologies in place at the BSTP to treat waste water at a tertiary level and to support the BWA's operations in a manner that is effective, efficient and that promotes adaptation to and mitigation of climate change**; for instance, there is only 1 flow meter that was recently installed in December 2021, and prior to this there was a large gap in data on influent and effluent flows and there is limited automated controls related to energy efficiency and preventative maintenance. The 3R-CReWS is ensuring that state-of-the art technologies are being implemented that promote low carbon operations such as the installation of solar power to meet the energy demands of the upgrades, whilst also withstanding at least category 3 hurricanes given the location of Barbados in the hurricane belt and climate projections of more intense and frequent hurricane season for the Caribbean. Further, 3R-CReWS will be implementing decision-support systems that increases energy efficiency, the longevity of equipment through better maintenance and management, and better response to the changes in the hydraulic capacity during storm surges and/or flooding that result in waters infiltrating the sanitary sewer system. **Further, there is limited wide-spread use of up-to-date wastewater treatment technologies in the private sector** due to the reason noted in institutional barriers/risks (limited capacities). To promote the adoption of wastewater treatment and reuse technologies in the private sector, the project is investing in the development of an incentive programme as well as making resources available through a revolving fund (RAFF).
- **Regulatory**: whilst there is very recently updated legislation (last quarter of 2021) that speak to the use of wastewater treatment systems and reclaimed water, **some legislations have not gotten approval from cabinet (still at the stage of a bill) and limited sensitization to support mainstreaming**. Further, the larger issue of enforcement is a serious risk since there is already evidence of institutional challenges related to the enforcement of legislation and policies. Therefore, this project will undertake a gap assessment to determine if any gaps exist across the emerging policies and legislation to ensure that the paradigm shift regarding the use of wastewater technologies and reclaimed water are supported, promoted and enforced. There will also be an accompanying roadmap that articulates how these emerging policies and legislation should be promoted and recommendations for enforcement.

Background and Context

Small Island Developing States (SIDS), such as Barbados, are directly exposed to the extreme impacts of climate change. By their very nature, sea level rise (SLR) is having a significant impact on the coastal zones, where communities and infrastructure tends to be concentrated. SLR needs to be considered in all aspects of long-term national planning, and more so in planning for critical public infrastructure which tends to have a design lifetime of several decades. SLR is reducing the *solution space* available to Barbados, with options to protect assets or accommodate SLR diminishing, forcing solutions based on a retreat from the coastal zone (see Figure 2, below). This proposal is premised primarily on an approach to stretch the *protect* and *accommodate* solution space through augmenting the replenishment of the freshwater aquifer and thus reduce salination, arguably the most pressing impact of climate change on Barbados currently as virtually all freshwater used is extracted from groundwater. This will create more time for the Government to respond to the inevitable impacts of SLR.²⁹

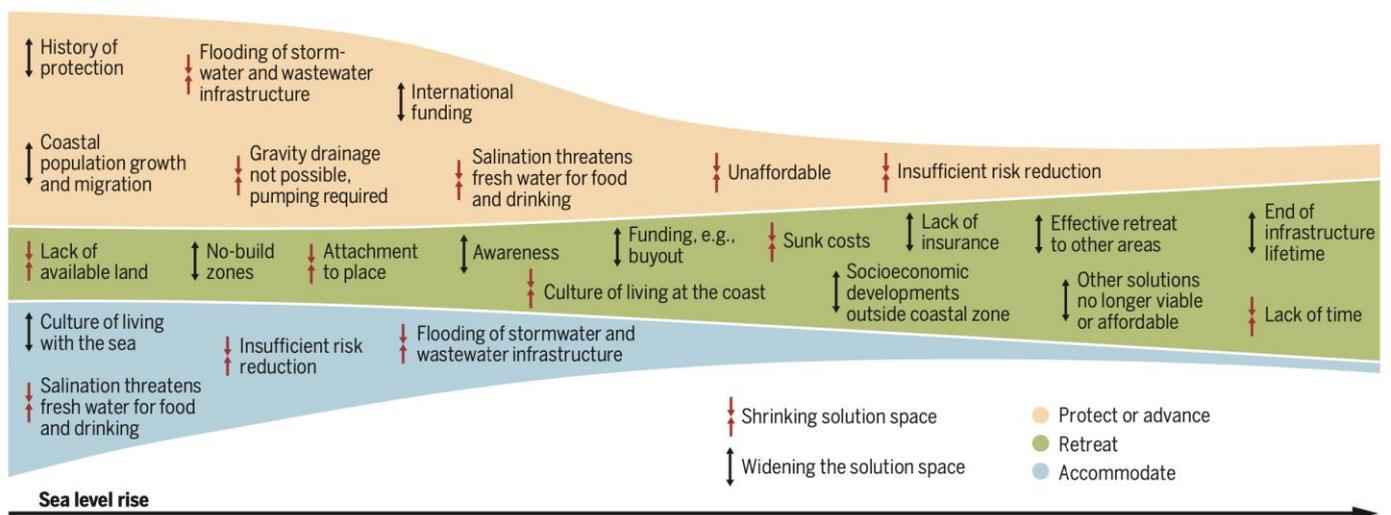


Figure 2: Decreasing solution space for small islands as sea level rises. Source: Haasnoot et. al. 2021. "Pathways to coastal retreat", Science, v.374(6548), pp.1287-1290.

Wastewater management strategies using reclaimed water will be a critical component to help mitigate impacts on groundwater levels, tightly linked to overall island water resources. Tertiary treatment of wastewater will allow for the reuse of water for non-potable sources, such as agriculture, landscaping, turf maintenance, and recharging the aquifer. Secondary treated sludge can be used as fertilizer for the agricultural community and activated sludge can be used in landscaping, turf maintenance of lawns, reclamation, soil erosion, and dump covering (CCCCC, 2019).

The goal of 3R-CReWS project is to facilitate the enhancement of the health, wellbeing, and productivity of Barbadians through the use of carbon neutral and climate resilient water and energy management technologies and strategies that ensures water is protected, managed, recycled, reused, and conserved.

To this end, the main objectives of the 3R-CReWS project are to:

²⁹ The IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (2019) predicts a global mean SLR of 0.43 - 0.55 - 0.86m by 2100 for RCP 2.6, 4.5 and 8.5 scenarios, respectively, relative to the period 1986-2005 (section 4.2.3.2, table 4.4), with "high confidence in continued thermal expansion and the loss of ice from both the [Greenland] and [Antarctica ice] sheets beyond 2100" (section 4.2.3.5).

1. increase knowledge of wastewater generation including sources of wastewater and the quantity and quality impacts, as well optimize treatment and minimize energy consumption and associated GHG emissions;
2. build resilience into Barbados' wastewater management systems, which results in increased water availability, production, distribution, and access thereby improving the community's resilience, health and wellbeing, and water and food security;
3. produce a treated wastewater effluent quality so that it can be reused for agricultural purposes, reducing stress on diminishing groundwater resources and potable water supplies as a result of climate change;
4. enable the use of reclaimed water for aquifer recharge thereby reducing saline intrusion and contamination of ground water resources while enhancing water security, particularly during period of droughts for Barbados;
5. reduce GHG emissions, increase self-sufficiency, contribute to the electricity grid and to contribute to the frequency stabilisation of the electricity grid and act as a power shortfall filler;
6. Increase supply of locally sourced renewable energy that allows for a long-term source of revenue through a feed-in tariffs program;
7. provide a standard and formal guidance to regulate and promote the use of reclaimed water and obtain greater buy-in from stakeholders;
8. build capacity and re-train BWA staff, including the private sector, to conduct preventive maintenance and adopt climate-risk related adaptation strategies to increase the wastewater collection and treatment systems resiliency; and
9. promote and demonstrate actions that encourage all water users in Barbados, including tourists, to conserve and efficiently use water resources.
10. strengthens the enabling environment and, strengthening buy-in, ownership and leadership in the private sector for the adoption of wastewater technologies and reuse options and having nation-wide public education and awareness on the nexus between climate change and water availability, wastewater as a resource, wastewater treatment and reuse options and promoting transparency and lessons emerging from this project

For achieving the goal and specific objectives, the 3R-CReWS is organised into four (4) key components as summarized in Figure 3.

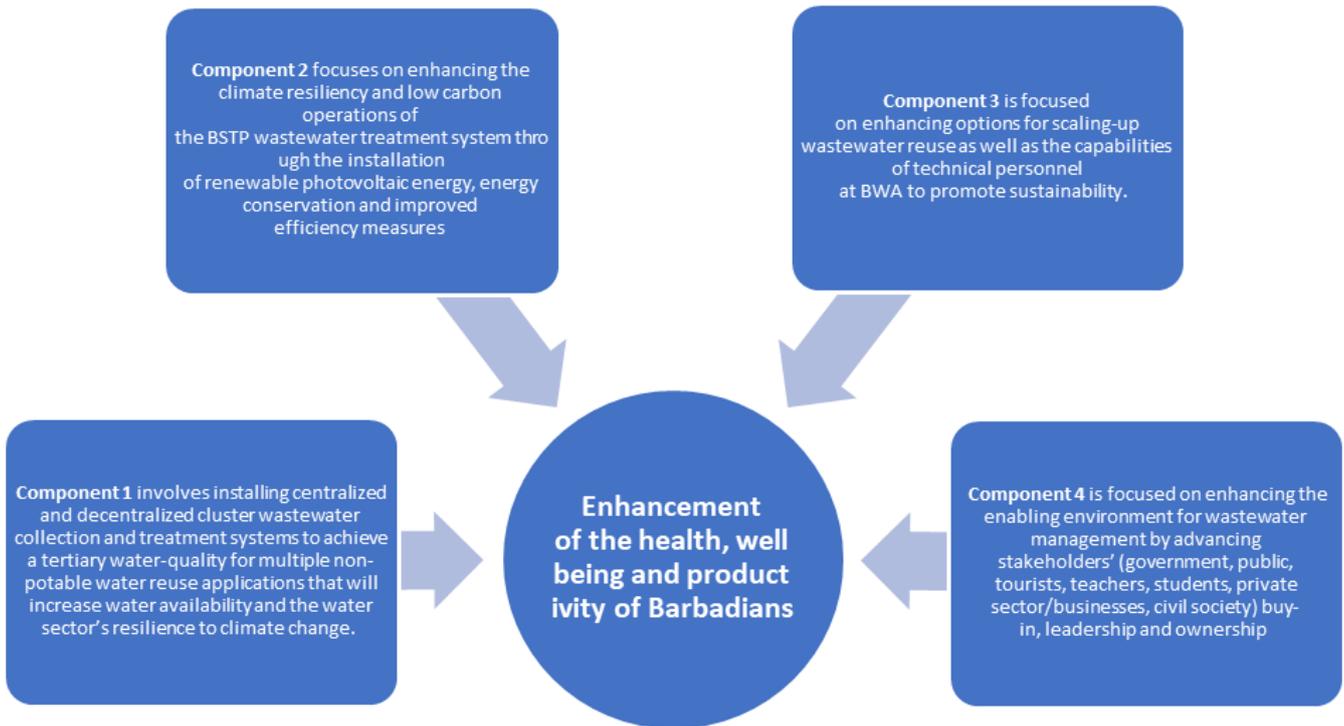


Figure 3: Summary of the Components of 3R-CReWS

These 4 components are synonymous with the following 4 outcomes of the project:

1. Enhanced availability, management and use of tertiary level reclaimed water to improve the water sector's resilience to climate change
2. Climate resilient low carbon operations achieved at BSTP
3. Enhanced capacity and capability to support a preventative maintenance (PM) and climate resiliency programme
4. An enabling environment is created for wastewater technologies and use of reclaimed water

Collectively, these four outcomes/components are designed in consideration of the barriers that exist in achieving a paradigm shift in the adoption of wastewater treatment technologies and reuse options in Barbados. These barriers include the limited fiscal space that exist in a highly indebted country, limited technical capacities in the public and private sectors to fully maintain and advance the adoption of wastewater technologies, limited knowledge and awareness about the usefulness of reclaimed water as a resource, and the absence of comprehensively developed and mainstreamed policy and regulatory frameworks that promote the adoption of wastewater treatment technologies and reuse options, particularly at the household level.

Outcome 1 of this project is the largest, in terms of budget, since it is primarily focused on the upgrades to the BSTP and transfer of technology. Specifically, Outcome 1 is made up of four (4) outputs. Output 1.1 aims to achieve a climate resilient pathway for the water sector through the upgrade of the BSTP to a tertiary treatment system by converting the current CAS to a CAS-4 stage Bardenpho system and the installation of a RO membrane. This output supports the achievement of GCF's ARA 2 and will resulting co-benefits, which include improving the quality in the near shore and marine environments, increase water available for the

agriculture sector and the participation of women in the production and use of reclaimed water. With higher quality water becoming available, this outcome includes as an output (1.2), the installation of a 9km pipeline that will facilitate the distribution of the reclaimed water for irrigation and aquifer recharge purposes. This output supports the achievement of GCF's ARA 1 and 2. Given the highly technical nature of the upgrades, it is being assumed that expertise exists for the installation of the required upgrades and that there will be favourable conditions for the construction works to be done in a timely and effective way. To complement the operations of the upgraded BSTP, there is an output (1.3) focused on the installation of critical decision-support systems to adapt to climate change, promote climate mitigation through energy efficiency and provide the tools necessary to monitor wastewater flow and quality. For instance, a sewer monitoring programme, an on-site laboratory and software and equipment to automate control of the upgraded system will be implemented. This output is aligned to GCF's ARA 3. A key assumption is that the staff at the BWA will consistently/routinely utilize the training and systems that have been implemented to optimize the operations of the BSTP. To further promote the paradigm shift in the use of reclaimed water, the final output (1.4) supports the installation of decentralized wastewater treatment systems in two Zone A locations in Barbados to harness reclaimed water, which will be utilized for aquifer recharge and agricultural irrigation through the installation of a 9km pipeline. Hence, this outcome and its supporting outputs will enhance resilience to climate change by promoting water security. This output is aligned to GCF's ARA 1, 2 and 3. Efforts will be made to ensure the inclusion of women, youth, LGBTQIA, and other vulnerable populations in these processes for effective adaptation and use of the upgraded systems; support to ensure budget allocations are gender-responsive and aligned with the specific needs of women and men in target Zones. Given that this final output is primarily funded by the GOB, it is assumed that they remain committed to the upgrades and co-financing materialize.

Outcome 2 is made up of one (1) output that is primarily focused on the installation of renewable energy PV systems, automated controls such as variable frequency drives (VFDs) and a sludge dewatering system. Collectively, these systems will ensure that there is low-emission at the BSTP, which contributes to the achievement of the country's a low-emission development pathway. This output is aligned to GCF's MRA 1, MRA3 and ARA 3 and is contributing to improved air quality since the impact of power outage linked to extreme climatic events will not impact the treatment processes at the plant. As above, a key assumption is that the staff at the BWA will consistently/routinely utilize the training and systems that have been implemented to optimize the operations of the BSTP.

Outcomes 3 and 4 collectively contribute to ARA1, ARA 2, ARA 3 and MRA1 and aim to create an enabling environment for achieving a paradigm shift in the approaches to the management of water resources, specifically wastewater, and thereby promoting water security in the face of a changing climate. Specifically, Outcome 3, which comprise two (2) outputs, is first targeting the enhancement of capacities and capabilities, primarily at the BWA, for managing, monitoring and operating the upgraded BSTP through the development of customized trainings, updating the Standard Operating Procedures (SOPs) and Operational Manual and implementing a risk management framework. 12 customised courses will be developed/adopted under this project covering topics such as: SCADA system, UWI/BWA Gender Sensitivity Training program, climate change nexus with biosecurity and wastewater, PV refresher training course offerings from CVQ & NVQ (Caribbean and National Vocational Qualifications), industrial waste inspector, CCTV equipment Operator training program based on upgraded systems, laboratory testing, analysis and management, management of the decentralized wastewater treatment plants, maintenance of CAS and RO technologies, SOPs and operational manual updated, the risk management framework developed to meet the needs of the upgraded system, CMMS, sewer monitoring and instrumentation and general wastewater course. It is assumed that there is willingness and the availability of BWA staff and other key stakeholders to participate in the training opportunities and that a total of 400 persons will be trained. Notable is that this output is aiming to address some of the known risks with the implementation of this project, primarily that of limited capacities to promote the adoption of wastewater technologies and reuse options. The second and final output for this outcome is to promote innovation for the wastewater sector through the development of a strategic plan to guide the

replication of water treatment facilities along the west coast corridor of Barbados. Given the highly specialized nature of this output, it is assumed that relevant technical expertise is available to develop the strategic plan.

Outcome 4, which is made up of three (3) outputs, further strengthens the enabling environment through the development of a water and sanitation masterplan and a legislative review (Output 4.1). Of importance to note is that the legislative review will identify gaps and recommendations for addressing same, as it relates to strengthening buy-in and the use of wastewater technologies and reuse options. The review process will ensure that gender differentiated needs and impacts of proposed amendments are considered and do not negatively impact the wellbeing of women and other vulnerable groups. There will also be a concerted effort to promote ownership and leadership in the private sector for the adoption of wastewater technologies and reuse options through a three-pronged approach that includes a targeted engagement strategy, an incentive programme and access to the RAFF resources aligned with the priorities arising from Stakeholder consultations and in consideration of the unique needs of women and men (Output 4.2). A key assumption here is that there is initial interest from the private sector. The final output (4.3) is focused on nation-wide public education and awareness on the nexus between climate change and water availability, wastewater as a resource, wastewater treatment and reuse options and promoting transparency and lessons emerging from this project. There will be targeted PEA activities including school programmes, community consultations, workshops/sensitization sessions for key stakeholders such as farmers and private sector. The PEA campaign will include products such as videos/documentary, press releases of outputs of town hall meetings within communities, case studies, digital flyers, posters), 40 water Wednesdays (8 per year), 20 newsletters (4 per year) and over 5000 combined posts on social media accounts. This output and its activities support the advancement of GCF's outcome ARA 1 and enabling environment related to knowledge generation and learning. It is assumed that the updates are timely, relevant and accessible to a wide cross section of stakeholders - private sector, individuals, tourists, national agencies, civil society, therefore enabling the desired paradigm shift in attitudes for the adoption of wastewater technologies and reuse options.

The project will benefit a wider cross-section of stakeholders. The reclaim water could benefit 186 hectares, 155 farmers, including small scale and women farmers, and 465 wage labourers that work on the farms. The reclaim water will be transfer from BSTP to Waterford (Botanical Gardens) then northwards to recharge point at Trents (Greenwich) (find points or take-offs along the way). 6 injection wells will be included in this option, while the BWA have an indication of where these could be implemented, a sub-activity to confirm the best points for injection. Note, the replenishing of the aquifers will benefit the entire population of Barbados.

The 400 persons refer to the target for the following training is to have 50/50 distribution of males and females, where possible:

- SCADA - 20 operators
- Gender Sensitivity - 300 staff members
- Climate change nexus with biosecurity and wastewater - 300 staff members
- PV training course - 25 members
- Industrial waste inspector - 3 operators
- CCTV equipment - 6 operators
- Operator training - 8 operators
- Lab technician training – 3 technicians
- Decentralized wastewater treatment facilities - 50 staff
- CAS and RO technologies - 50 staff
- SOPs, operational manual and risk management framework - 70 operators
- CMMS - 70 staff members
- Sewer monitoring and instrumentation - 25 wastewater operators
- General wastewater course (safety, no exam) - 45 persons

	Energy generation and access		industries, appliances		people and communities	and water security	Infrastructure and built environment	ecosystem services
Outcome 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Outcome 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Outcome 3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Outcome 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Co-benefit number	Co-benefit					
	Environmental	Social	Economic	Gender	Adaptation	Mitigation
Increased water availability for the agriculture sector	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Improved water quality in the marine environment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Improved air quality	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Increased participation of women in the production and use of reclaimed water	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

B.3. Project/programme description (max. 2500 words, approximately 5 pages)

As set out in Section B.2, the 3R-CReWS project has four (4) components:

- **Component 1** involves upgrading centralized and installing cluster wastewater collection and treatment to achieve a tertiary water-quality. The outputs of this component are: (1) The Bridgetown Sewage Treatment Plant (BSTP) upgraded to treat wastewater to a tertiary water-quality standard; (2) Recycled wastewater being reused to supplement non-potable uses including irrigation and aquifer recharge; (3) Decision making tools implemented to mitigate climate change risks to the wastewater treatment and collection systems; (4) Onsite decentralized package treatment plants or cluster treatment facilities installed (2).
- **Component 2** intends to enhance the climate resilience and carbon-neutrality of the BSTP wastewater treatment system through photovoltaic energy, energy conservation and efficiency equipment. The main output of this component is improved emergency power and energy efficiency and reduction in emission at the BSTP.
- **Component 3** aims to enhance the enabling environment for wastewater management through the development of standard operating procedures manual, flow and water quality monitoring, and institutional human capacity development. This component will result in improved technical capabilities of water technical personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management.

- **Component 4** focuses on educating the public and private sector on the importance of wastewater reclamation and address climate change issues affecting the water sector and enabling policy and legislation. The outputs of this component are: (1) Governance and planning frameworks updated/developed to enable wastewater reuse; (2) Funding mechanism for the adoption of water reuse applications/ systems developed; and, (3) Gender Sensitive Public Education and Awareness Campaign Implemented.

Component 1: Wastewater Reclamation and Reuse

Barbados is almost entirely dependent on groundwater supplies (85% of potable water supply comes from ground water), which is directly impacted by the weather and climate. The overall implication of the available body of work suggests that sustainable aquifer yields could decrease by around 50% by 2050. This is troubling as the indications are that the level of groundwater abstraction is already at between 85-100% of the safe yield. Approximately 57 Mm³/yr is extracted from groundwater resources for domestic potable water distribution and an estimated 11 Mm³/yr is extracted for agricultural irrigation³⁰. The exact amount of water extracted by agriculture is much higher as most points of extraction are un-metered private wells.

The outcome of this component is **enhanced availability, management and use of tertiary level reclaimed water to improve the water sector's resilience to climate change**. The BSTP will be upgraded from a CAS to a CAS- 4Stage Bardenpho system and 2 onsite decentralized treatment plants (cluster) will be installed in 2 communities in Zone A locations to produce a high-quality effluent that is biologically and chemically safe. The effluent from the upgraded plants will be utilized for non-potable water applications including irrigation and aquifer recharge. This is expected to reduce the extraction of groundwater leading to reduced aquifer saltwater intrusion, and increased availability of groundwater during dry periods. This increase in availability of water during dry periods, will have positive impacts on women who predominantly undertake domestic and care roles. There will also be monitoring systems implemented to address data gaps that exist and to facilitate enhanced management of the upgraded BSTP.

The total budget of this outcome is USD39 million, which is principally applied to the upgrades associated with treatment plant (67%). The source of the funding is GCF in the amount of USD29.2 million (grant) and BWA in the amount of USD9.3 million.

Output 1.1: The Bridgetown Sewage Treatment Plant is upgraded to treat wastewater to a tertiary water-quality standard.

The BSTP is currently a secondary level treatment plant with water being released in the marine environment through an outfall. The BSTP will be upgraded to treat wastewater to a tertiary reuse water-quality standard using the existing infrastructure and wastewater treatment process (Conventional Activated Sludge). The upgraded plant will result in tertiary treated wastewater that can be reclaimed and is suitable for non-potable water applications including groundwater augmentation and irrigation. Figure 5 below depicts the existing BSTP and Figure 6 is a schema of the existing and upgraded system that has been agreed to by the GOB (See Feasibility Study for more details on options and assessment). The upgrades will enhance the water security considering the projected climate change impacts on water resources for the island.

Activity 1.1.1³¹: Design, procure and convert/upgrade the existing conventional activated sludge (CAS) biological treatment process at the Bridgetown Sewage Treatment Plant to tertiary filtration and disinfection for achieving national reclaimed water-quality standards.

³⁰ Integrated Sustainability (2021). Feasibility Study See Section 1.1.2

³¹ See Section E.6 for the description on this activity and all other activities listed in this section.



Figure 5: Bridgetown Wastewater Treatment Plant

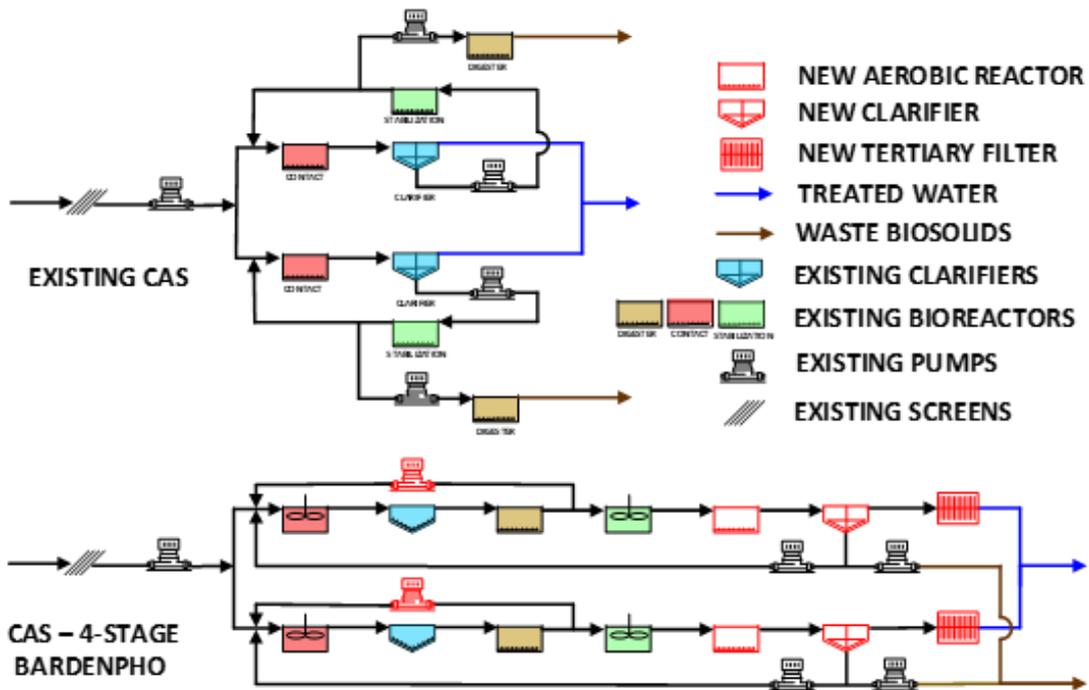


Figure 6: Existing and (Proposed) Upgraded System for BSTP

The total budget of this output is USD25.7.1 million, which will be principally funded with GCF Funding.

Output 1.2: Tertiary treated reclaimed water is available to supplement non-potable use

Sea level rise and salt-water intrusion of potable water aquifers coupled with changing weather patterns (intermittent and higher intensity rainfall) stresses Barbados water resources. In addition, agriculture continues to compete with other sectors for scarce resources such as water, land, labour and capital, and the GoB has increased its call for greater domestic food production through new and improved methods of farming as a response to climate change. Greater water availability, using reclaimed water, for irrigation purposes, should also lead to improved food security.

The supply of treated reclaimed wastewater to support irrigation developments in the Codrington-Neils-Lears-Salters-Constant-Valley was deemed most suitable for this project (See Figure 7) and will provide

benefits to 155 farmers (60% males and 40% males). In motivating and recommending this Option, the GOB stressed that this should be seen as a first Phase of a larger enterprise to extend and expand the use of treated reclaimed wastewater for irrigation purposes on lands along the west coast of Barbados and up to the parish of St Lucy (See Feasibility Study Report). The use of reclaimed water for irrigation purpose requires reverse osmosis membrane filtration to remove total dissolved solids to a concentration less than 450 mg/L required by the Ministry of Agriculture and Food Safety for agricultural irrigation applications.

Activity 1.2.1: Install reverse osmosis (RO) membrane filtration systems to reduce the total dissolved solids concentration of the reclaimed water produced at the BSTP

Activity 1.2.2: Install a 9Km pipeline and 6 aquifer recharge wells (injection wells) going from the BSTP for irrigation and aquifer recharge.

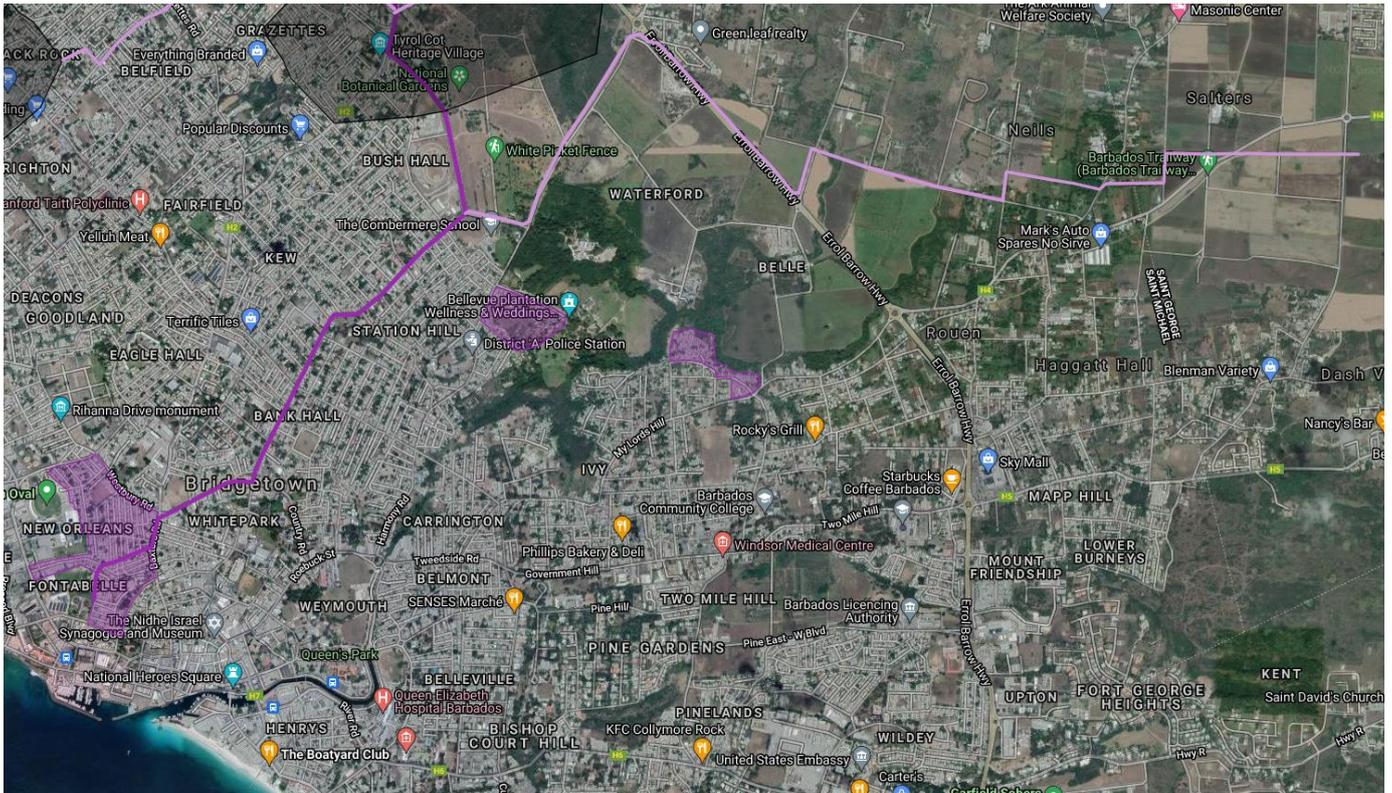


Figure 7: Map of 9km pipeline from BSTP to Waterford (Botanical Gardens) with take-off at Hothersal roundabout to Friendship plantation the turn south along ABC H'way And Then Turn North Along Belle Road up to Lears (Roberts Manufacturing) – irrigation can be done for lands on east and west of that road. Also take in Neil's Plantation, Salters, Constant and Valley Plantation.

The total budget of this output is USD8.6 million, with USD 2.5million to the finance the RO plant using GCF funding and USD6.1 million in funding from the BWA/GOB to finance the installation of the 9Km pipeline.

Output 1.3: Decision-support tools and infrastructure implemented to mitigate potential climate change risks to the wastewater collection and treatment systems

Decision-support tools (DSTs) and infrastructure upgrades are critical to enhance adaptive management to climate change. Storm surges and rising sea levels can cause saltwater entry into the wastewater collection system, which will impact the hydraulic and biological treatment capacities as well as reduce the quality of reuse water, which warrants the need for a sewer monitoring programme. This will allow for greater understanding of flows in the wet and dry season as well as the identification of points of stormwater

infiltration into the collection system, considering the hydraulic capacity of the BSTP to inform remedial actions.

Several decision-support tools and infrastructure are also needed to optimize the preventative maintenance programme of the upgraded BSTP. Recognizing that valuable hard-copy data were destroyed by fire in the past, an electronic Computerized Real-time Management System (CMMS) information system will enable important information to be stored and readily accessed for analysis and will be less susceptible to potential damage. The tools will optimize the electrical components to improve energy efficiency and reduce GHG emissions associated with the operations of the plant

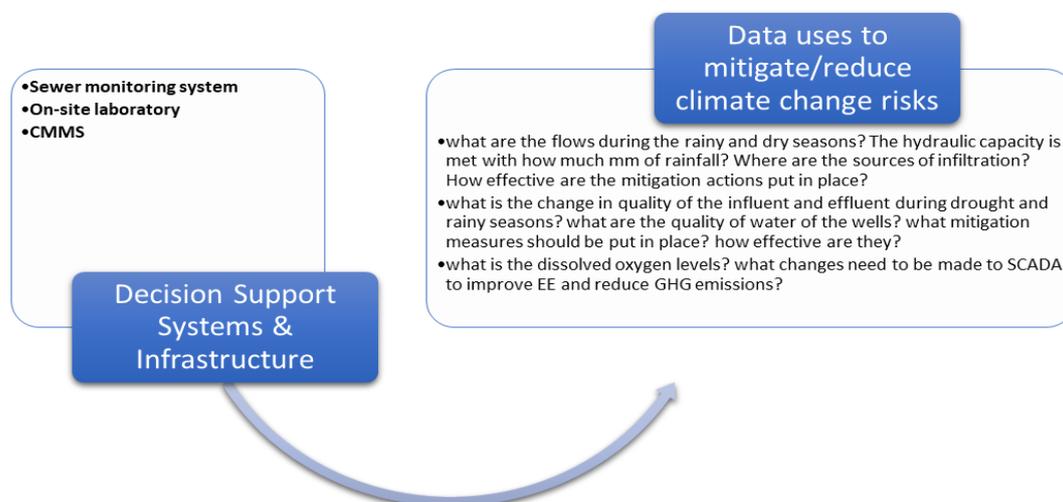
There is also need for periodic monitoring of the quality of the reclaimed water to manage associated environmental and social risks³². Therefore, testing will be done on effluent water quality, through the establishment of a laboratory, to optimize operations control strategies and reduce energy consumption and GHG emissions as well as provide data as part of the public visibility programme to build their confidence and trust in the quality of the treated wastewater. This is also critical element of ensuring that the TDS concentration of reclaimed wastewater is less than 450 mg/L.

Activity 1.3.1: Implement a sewer monitoring programme that will include the installation of flow measurement and rain-gauging equipment at the BSTP to identify and address sources of inflow and infiltration to the sewer. Mechanisms that identify and reduce or mitigate vulnerabilities in the wastewater collection systems will also be investigated.

Activity 1.3.2: Establish on-site laboratory facilities and personnel at the BSTP to generate influent and effluent water quality data to inform operations control strategies that optimize operations and reduce energy consumption and GHG emissions.

Activity 1.3.3: Implement a Computerized Real-time Management System (CMMS) at the BSTP to inform decision making and climate resilient building

The Figure 8 below summarizes how these three activities will inform climate change adaptation and mitigation efforts.



³² As describe later in Section B.6, monitoring of water quality standard will be carried out firstly by BWA at the plant level (operational standards) and the Ministry of Agriculture, in collaboration with Ministry of Health, through the Analytical Services Laboratory will conduct testing and analyses water and wastewater samples. The Ministry of Environment through the Environment Protection Department, in collaboration with the Ministry of Health and Ministry of Agriculture and Food Security, will monitor the water quality and enforce codes governing usage of this treated wastewater.

Figure 8: Linkages between output 1.3 and climate change adaptation and mitigation efforts.

The total budget of this output is USD1.0 million, which is principally applied to the procurement of Computerized Real-time Management System (CMMS) (52%). This output will be funded using GCF proceeds.

Output 1.4: Decentralized treatment systems or cluster treatment systems installed

Under this output climate resilience, water security, safeguarding of groundwater quality and achieving a paradigm shift in the use of reclaimed water will be promoted through the installation of decentralized treatment systems in 2 communities in Zone A locations³³. The decentralized package treatment systems will provide enhanced collection and treatment systems that will produce reclaimed water suitable for agricultural irrigation and that will reduce the health risks associated with intense rainfall (vis-a-vis the current wastewater systems being used). This output will also expand the number of beneficiaries of this project in a cost-effective manner since these communities are not serviced by either of the two STPs currently in operation in Barbados and the cost of distributing reclaimed water from the BSTP into the community is high.

The implementation of the decentralized treatment systems will safeguard groundwater by eliminating the potential risk from contamination associated with onsite wastewater disposal (pit latrines, septic tanks, and soak-away fields). The risk of contamination is exacerbated by rainfall intensive conditions that saturate the soil, reducing the ability of the bacteria in the soil to treat the wastewater, and potentially causing the wastewater in the soak-away fields to reach ground water supplies or surface and come into contact with the public. This output is part of the GOB’s larger programme to expand decentralized treatment systems into other communities to promote the use of reclaimed water, reach households not connected to centralized treatment plant, allow households to be connected to the network of reclaimed water pipeline planned and address public health concerns.

Activity 1.4.1: Construct two small (cluster) decentralized wastewater collection and treatment demonstration systems in Zone A locations to produce reuse quality water for domestic/commercial non-potable water applications.

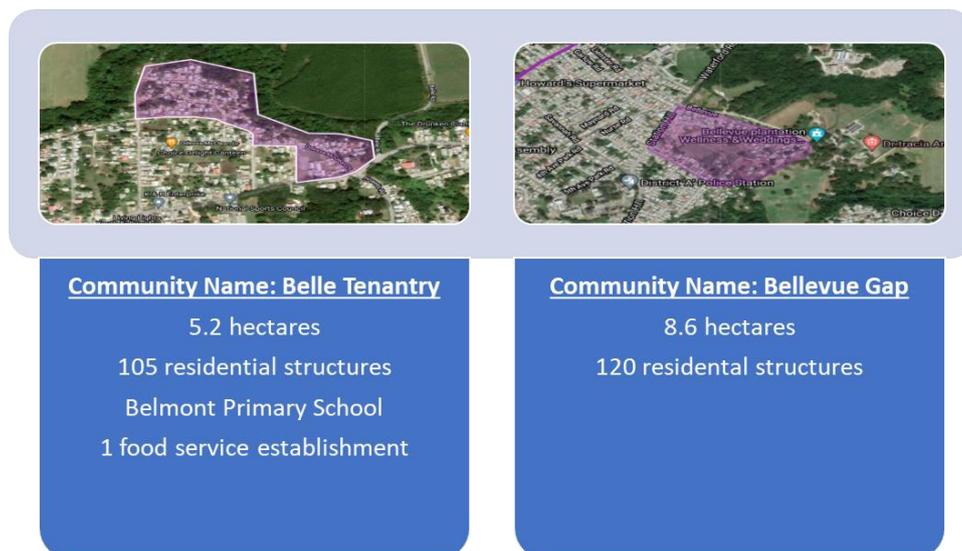


Figure 9: Summary of the 2 Communities in Zone A benefiting from 3 CRWs

³³ The GOB Groundwater Protection Zoning Policy established zones to guard against bacteriological contamination of the public water supply wells. The most stringent regulations are enforced in the Zone A areas, which are located immediately around all existing and potential public water supply sites.

See Annex 24 for details on the two communities selected for the installation of decentralized treatment systems.

The total budget of this output is USD3.3 million and is totally finance by the BWA/GOB.

Component 2: Renewable Energy and Energy Efficiency in Wastewater Treatment

Centralized wastewater management relies on expensive high-emission electricity supplied from conventional power plants that use fossil resources, which not only increases operational costs but also contributes to global warming. The Bridgetown STP currently uses 4,500 kWh of energy per day which equates to energy costs of USD470,000 per year³⁴ and the generation of approximately 17,200 CO₂e of direct GHG emissions from the treatment process (at an average flow of 4,100 m³/day) to approximately 238,000 CO₂e (at an average flow of 56,700 m³/day)³⁵.

The outcome of this component is that **climate resilient low carbon operations achieved at BSTP**. This will be realized by: 1) installing grid-tied Photovoltaic (PV) Renewable Energy Systems to offset increased power consumption associated with the centralized treatment plant process upgrades using Category 3 hurricane resistant solar panels; 2) implementing automated controls and energy efficiency measured within the upgraded centralized treatment processes to reduce the overall energy footprint and reduce GHG emissions; and 3) installing sludge dewatering equipment to improve energy efficiency and reduce the overall GHG and CO₂ emissions associated with the biosolids.

The total budget of this outcome is USD 3.3 million, which is principally applied to the procurement and installation of the 1 MW PV system and the watering technology (81%). The outcome will be funded by GCF.

Output 2.1: Energy efficiency and renewable energy technologies are implemented

Currently 0.18 MW of solar power is in place at the BSTP. An additional 1.8 MW of power is required to accommodate the upgrades to the BSTP and operate the RO plant to achieve the water quality standard set for agriculture reuse purposes. This output will deliver 1MW grid-tied PV system to offset the energy demand of the upgraded BSTP³⁶, which will yield 2063MWh of clean solar power per year leading to an estimated GHG emission reduction of 1,411 tCO₂e per year (or 35,275 tCO₂e over 25 years). For more details, see Feasibility Report). The grid-tied PV system will be equipped with remote management controls, which will automate the supply from the grid to help manage intermittency and switching over between the grid and solar PV system. It is currently envisioned that PV panels will be installed at the BSTP (See Feasibility Study for proposed use of existing space at the BSTP); however, as a last measure the BWA has identified alternative off-site for installation of the PV panel. One such is the Belle Pumping Station. If the latter is pursued, then a net metering agreement will be entered into the Barbados Light and Power Limited. Aligned with previous PV system installation by the BWA, high efficient and durable modules such as monocrystalline modules will be installed. There is an existing inverter room at BSTP but this will need to be retrofitted with additional switch gears, electricity meters and monitoring equipment. AC power from the inverter room will routed to the switch gear at the BSTP. This power will be coupled with the main bus bar system and incorporates an automatic transfer switch (ATS), which will be coupled either with the GENSET or with the Power Utility System. Approvals are required from the Government Electrical Engineering Department (GEED), Barbados Light and Power (BL&P) and the Division of Energy.

Besides the installation of the grid-tied PV system, this output involves the implementation of energy efficient technologies and sludge dewatering equipment. This will further reduce the overall energy footprint and

³⁴ Integrated Sustainability (2021). Feasibility Report for the 3R's for Climate Resilience Wastewater Systems in Barbados (3R's Crew Barbados) Preparation Project. See Section 1.5.6

³⁵ Integrated Sustainability (2021) Feasibility Study

³⁶ The additional 0.8 MW of power will be financed by the GOB but is not counted as part of the co-financing for this project; albeit that government is currently in advanced negotiations to secure financing for this additional 0.8MW.

reduce GHG emissions associated with BSTP. This involves implementing automated controls and energy efficiency equipment and measures, including variable frequency drives (VFDs), EE pumps, blowers, within the upgraded centralized treatment processes. Currently, the dissolved oxygen in all bioreactors (contact chambers, stabilization chambers, aerobic digesters) is controlled manually, which is not optimal. The aeration is one of largest energy demanding component of the plant, typically consuming 40% or more of the total energy demand; as such improvement in dissolved oxygen control will result in significant energy efficiency improvements. To this end, automatic control, which depend on the DO sensor readings in the bioreactors, will be installed. Additionally, the current dewatering, biosolids handling and disposal practice at BSTP is not optimal. By implementing dewatering technology, biosolids will be capture and removed from the treatment process early, hence reducing the energy required to the effluent. Further, this enable the BWA to reduce the water content of biosolids resulting in mitigation co-benefit of reduced GHG emissions associated with the trucking and disposal of sludge on a dedicated sludge spray zone. According to the O&M Manual [of the existing plant], (1982), the current sludge contains about 2% solids. If this sludge can be dewatered by up20% solid, which is very typical with modern sludge dewatering technology, the volume of the sludge needing to be trucked out and disposed of would be reduced by up to 10% of the current volume. The installation of the dewatering technology would result in saving on energy cost and sludge transportation and labour, and the environmental benefits including the reduction in GHG emissions and oil spills etc.

Activity 2.1.1: Install a grid-tied Photovoltaic (PV) Renewable Energy Systems to offset increased power consumption associated with the centralized treatment plant process upgrades using Category 3 hurricane resistant solar panels



Figure 10: Possible locations at the BSTP for the installation of the 1MW of solar panels.

Activity 2.1.2: Implement automated controls and energy efficiency measures within the upgraded centralized treatment processes to reduce the overall energy footprint and reduce GHG emissions.

Activity 2.1.3: Install sludge dewatering equipment to improve energy efficiency and reduce the overall GHG and CO₂ emissions associated with the biosolids.

Since this component has one output, the total budget of this output is as presented at the outcome level.

Component 3: Capabilities to operate, maintain, expand and monitor wastewater and related renewable energy technologies

This component responds to the need for greater understanding among BWA staff of the nexus between climate change and water availability and the impacts of climate change on infrastructure and operational measures to mitigate these impacts. Additionally, over the past few years the maintenance focus at BWA has shifted from Preventative Maintenance (PM) towards emergency breakdown maintenance due, in part to heavy rainfall events, and the lack of dedicated staff and financial resources for PM. Further, the west coast of Barbados is not sewered and the impact of saltwater intrusion into freshwater resources and nutrient loading into the nearshore marine environment are unknown and further investigation will support in bridging this knowledge gap and chart a path for arresting those issues on the west coast.

The outcome of this component is to have **enhanced capacity and capability to support the preventative maintenance and climate resiliency programmes.**

The total budget of this outcome is USD1.6 million, which is principally applied to training and capacity building and knowledge transfer activities. The outcome will be financed using 100% GCF proceeds.

Output 3.1: Improved capabilities of wastewater technical personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management

To complement the upgrades planned for the BSTP (Component 1 and 2), specialized training, enhanced awareness of operational risks and management of same and updated protocols and procedures are needed to be able to effectively manage, monitor and maintain the upgraded system. Not only are these areas important for operational effectiveness, but it is an important element in building BWA's capacity for implementing the preventative maintenance programme and ensuring sustainability of its operations post implementation of this project. See Figure 11 for the key areas that will be targeted for enhancing BWA's capabilities. Notable is that approximately 12 customized courses covering SCADA, gender and climate change, PV systems, laboratory testing, analysis and management, CAS and RO technologies, sewer monitoring and instrumentation and wastewater, to note a few, will be delivered during the project. It is envisaged that approximately 400 individuals will be trained. Where possible, the Project will aim for parity in the number of individuals trained, nevertheless, women will be strongly encouraged to participate in the technical training programs thereby addressing the decision-making gap for women in technical thematic areas.

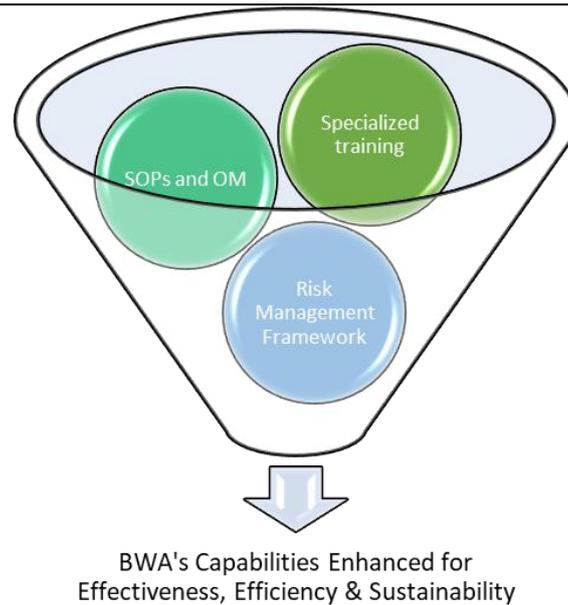


Figure 11: Key areas that will be targeted for enhancing BWA's capabilities

The proposed centralized treatment and decentralized cluster treatment implementation strategy will increase the need for both the number of skilled operators and the operator skill development related to water reuse and renewable energy production. The project will ensure that recruitment processes are gender responsive to address the underrepresentation of women as skilled operators. Similarly, the implementation of the sewer monitoring programme, including the CMMS will require operator training in planning for climate change impacts and the establishment of a robust operations information database, which is readily accessed for analysis and will be less susceptible to potential damage from fires or storm events potentially associated with climate change.

The proposed upgrades require a shift in maintenance focus from emergency breakdown maintenance to preventative maintenance which is also of particular benefit to preparing for and adapting to climate change impacts. A review of current operational and maintenance practices highlighted there is a lack of adequate maintenance, with equipment generally only receiving attention resulting from breakdowns, as opposed to preventative maintenance through a robust, documented, maintenance management system. It also highlighted a lack of updated SOPs and manuals to guide operations. Improvements in documentation, procedures, training, prevention of sexual and gender based violence (SGBV), as well as the health and safety of field staff, will benefit both collection and treatment system performance. The upgrades of the SOPs, manuals and operations need to incorporate gender considerations as appropriate.

There is also a need to develop and mainstream risk management framework into BWA's project management and operations. This framework will encompass the full cycle of risk identification, assessment, and mitigation of impacts, including protection from and prevention of sexual exploitation, abuse and sexual harassment (internal and external). This risk management framework will be developed in consultation with all departments to identify the risk register, existing controls and further actions needed and opportunities for improvement, and train staff in its operation and further development. The latter will be implemented by BWA during the course of the project and assessed at the end of the project as a gauge of the level of sustainability built into the BWA's operations.

Activity 3.1.1: Develop and provide specialized and customized training to support the operations and maintenance of wastewater collection and treatment facilities including photovoltaic equipment

Activity 3.1.2: Update Standard Operating Procedures (SOP) and Operational Manual that addresses the requirements of the upgrades, preventative maintenance, operator safety, and environmental monitoring, including risks posed by climate change and gender and social inclusion considerations.

Activity 3.1.3: Develop and implement a risk management framework to support the sustainable management of BWA's operations.

The total budget of this output is USD1.1 million. This output will be funded using GCF proceeds.

Output 3.2: A strategic plan is developed to guide the replication of water treatment facilities along the west coast

There is future potential for augmenting potable water supply by installing additional RO treatment facilities along the west coast corridor which can intercept and collect brackish groundwater and treat it to potable water standards to supplement drinking water resources. This would support the objectives of this project of enhancing climate resiliency in the water sector. Strategic engagement with community groups, including women's groups and LGBTQIA groups to ensure that the plan considers the needs of women and vulnerable groups a gender-responsive approach and that there is community-wide buy-in.

Activity 3.2.1: Investigate and develop a strategic plan for the installation of water treatment facilities along the west coast corridor for augmenting water supply and protecting the west coast ecosystem.

The total budget of this output is USD0.5 million. This output will be funded using GCF proceeds.

Component 4: Capacities (regulatory, governance, awareness), buy-in and ownership within the private and public sectors are improved for climate resilient development planning for the water sector.

The upgrades to the equipment and training of technical staff to manage them is not enough for a lasting and sustainable impact of this project. Stakeholders buy-in, adequate enforcement of legislative and governance frameworks and expanding leadership and ownership to the private sector are also critical to ensure that a sustainable market transformation occurs for the advancement of wastewater treatment and use of reclaimed water in Barbados. For example, the legal regulatory framework in Barbados was very recently updated to enhance the regulation and scaling-up of wastewater treatment and use of reclaimed water. However, support is required to determine if any gaps, including gender and vulnerability gaps exist among the recently articulated policies and regulations, and the identification of a roadmap for addressing the gaps and enforcing the policies and regulations that are in place.

Further, to ensure the best development outcome of the project, the project and potential impacts should be well communicated with the public and stakeholders, throughout the project cycle, especially those disproportionately impacted by climate change such as youth and gender groups.

The key outcome is that **an enabling environment is created for wastewater technologies and use of reclaimed water**. The enabling environment speaks to the legislation, organizational structures and competency and strategies that need to be put in place. Achieving this outcome will significantly change the culture of the water sector in Barbados, building a level of partnership and professionalism that is needed to continually innovate and adapt to climate change, which in turn promotes sustainability for this project.

The total budget of this outcome is USD1.6 million. The source of the funding is GCF in the amount of USD1.3 million and BWA\GOB in the amount of USD0.3 million.

Output 4.1: Governance and planning roadmaps enhanced to enable use of reclaimed water in a controlled and regulated manner.

Having adequate enforcement of legislation related to wastewater management, as well a long-term strategy in place, are paramount for the sustainability of the impacts of this project.

Activity 4.1.1: Undertake a legislative review to promote the Planning and Development Act, Wastewater Reuse Bill and other related legislations for enhancing wastewater effluent quality, treatment options and re-use requirements and applications (see list below). The review will also include recommendations for strengthening - private sector engagement, public-private partnerships, building codes, resiliency to climate change and equal opportunities and access to males and females.

The following policies/plans/legislation are either recently completed (2021) or in train, that are of relevance to the 3R-CReWS project:

- i. Tabling of the Planning and Development Regulations - General Development Order, Environmental Impact Assessment Regulations and the General Regulations
- ii. Final Revisions to the Physical Development Plan (in train)
- iii. Water Order Bill (Water Zoning) - approved by Cabinet and being prepared for approval of Parliament
- iv. Guidelines and Protocols for Potable Water Storage and Rainwater Harvesting
- v. Updated Integrated Coastal Zone Management Plan - approved by Cabinet
- vi. Guidelines and Protocols for the Operation of Solid Waste Management Facilities - approved by Cabinet
- vii. The Integrated Blue Economy Policy Framework and Strategic Action Plan for Barbados - Approved by Cabinet

Activity 4.1.2: Develop a water and sanitation master plan that includes an optimal combination of decentralized, cluster and centralized water reclamation and reuse applications, with the centralized reclaimed water being transmitted and used for agricultural irrigation and/or industrial use (such as lower cost of reclaimed water transmission). This strategy will also take into consideration the social, gender-related and climate risks in the design and prioritizing of water reuse strategies.

The total budget of this output is USD445,000, which is principally applied to the development of the water and sanitation master plan (66%). The source of the funding is GCF in the amount of USD149,000 and BWA in the amount of USD296,000.

Output 4.2: Mechanisms developed/expanded to encourage the adoption of wastewater treatment and reuse applications by private individuals and businesses.

This output underscores and addresses the importance of individual and private sector buy-in, ownership and adoption of wastewater treatment and reuse applications.

Activity 4.2.1: Develop a strategy and action plan to engage the private sector in the provision and adoption of wastewater treatment technology and the utilization of wastewater by-products such as activated sludge. This includes conducting an assessment to identify opportunities for public-private partnership in the water and wastewater sector, especially for the expansion of the decentralized onsite cluster wastewater systems. The strategy will also promote gender equality and women empowerment.

Activity 4.2.2: Undertake a review and identify recommendations for a gender sensitive and socially inclusive incentive programme to encourage conservation, recycle, re-use. Incentives for water conservation includes demand side management including pricing policies to incentivize reuse practices. Proposed incentives can include: examine willingness to pay disaggregated by male and female headed

households for non-potable reuse water versus payment for potable water as an incentive to use reuse water. This could be done as a stakeholder survey; Consider a scaled water use billing system to encourage water management and conservation; A reward system for individuals coming forward to identify potential non-revenue water (e.g. hydrants leaking, wet areas that shouldn't be wet, illegal water connections, etc.); reduced development cost charges for residential and commercial developments that establish their own water reclamation and reuse system; reducing impact on government infrastructure; reduced potable water rates for residential and commercial developments that establish their own water reclamation and reuse system; reducing impact on government infrastructure; reduced electrical power rates for residential and commercial developments that establish PV systems that feed into the grid (Europe, Canada and the US pay substantially more for green power that is privately produced); examine government fees related to development costs and see if water and energy conservation measures can obtain credits or reduce fees as incentive.

Activity 4.2.3: Expand and promote the Revolving Adaptation Fund Facility (RAFF) to provide resources for the adoption of decentralized onsite wastewater systems.

Barriers to financial inclusion or access to financial resources can prevent vulnerable groups, including female headed households from participating in climate change adaptation and/or mitigation actions. The Barbados Water Authority (BWA) through the Water Sector Resilience Nexus for Sustainability in Barbados (WSRN S-Barbados) Project is establishing the Revolving Adaptation Fund Facility (RAFF). The RAFF aims to mobilise funds for use in the water sector adaptation and mitigation initiatives including those identified as priority in Barbados' Climate Change Adaptation Water Master Plan. The broad objectives of the RAFF are to:

- i. Empower communities to adapt to climate change and variability.
- ii. Mobilise funds for climate change adaptation and mitigation in Barbados.
- iii. Strengthen households and public and private sector entities involvement in climate actions.
- iv. Address the community needs for potable water by building resilience to climate change into the infrastructure of the BWA.
- v. Promote technology transfer by encouraging cost effective, efficient, and appropriate technologies for water consumption and conservation; and,
- vi. Build on existing climate change capacity building and awareness campaigns.

The establishment of the RAFF was initially funded by the BWA and Government of Barbados; however, 3R-CReWS presents an opportunity to expand and promote the RAFF to support the Private Sector's engagement in the wastewater sector. For example, adopting technologies that support the delivery and utilization of tertiary reclaimed water. The RAFF is seen as a critical element to engage the private sector; however, the existing RAFF needs to be examined and expanded to consider how resources could flow in and out to support activities related to the adoption of decentralized treatment systems as well as dual pumping, inter alia. See Annex 23 for the existing RAFF Charter as drafted under the WSRN project funded by the BWA. This Charter is to be updated to cover wastewater treatment systems and reuse options and other water sector considerations. Specifically, the 3R-CReWS project will engage consultant to update the governing instruments, through a gender informed consultative process, identify potential sources for increase the capital inflow, ensure that updates to the governing instrument continue to promote the needs of vulnerable groups including persons living in poverty, and support the knowledge and promotion of the financing facility.

It is important to note that no GCF proceeds will be used to directly capitalise the incentive programme or the RAFF. GCF resources will be used to strengthen the framework and create the knowledge products

needed to guide the Government and BWA in the setting up of the incentive programme(s) and the expansion and the RAFF.

The total budget of this output is USD352,000, which will be financed totally by GCF financing.

Output 4.3: Gender Sensitive Public Education and Awareness Campaign Implemented.

This output is aiming to promote the business case for this project, thereby securing more buy-in and acceptance of this project’s scope and intended results. For instance, the nexus between climate change and water availability, wastewater as a resource, wastewater treatment and reuse options etc. will be the basis of some of the PEA topics that will be targeting a wide cross section of beneficiaries through various mediums of information dissemination.

Activity 4.3.1: Re-educate communities, teachers, students, farmers and businesses about the impact of climate change on water resources and their impact on water quality and quantity (availability as well as the importance of water reuse activities and indirect potable reuse (IPR)) to building climate resilience in the Water Sector. Develop program to provide educational support materials for teachers and participate in the delivery of public education programs and associated events that serve to educate students. This increases the general knowledge within the community about water, so they can make informed decisions, starting with the water cycle and basic facts about water use to protect public safety before addressing water reuse. A change in public perception is required to be able to facilitate IPR. Water reclamation and reuse is practiced globally to address limited water resource conditions and drought. This also includes outreach programmes in schools, community-based organizations, and stakeholders’ groups across customer class as well as a Public Service Announcements and educational materials that addresses best practices for efficient water use, conservation, and reuse. Further, this activity will develop and provide information resources to private individuals and businesses for the adoption of decentralized onsite wastewater systems. The re-education programs will ensure to promote equal opportunities and access to men, women and the LGBTQIA community.

Activity 4.3.2: Develop and implement a Gender Sensitive Public Awareness Campaign for community and visitors (tourists) through workshops, videos, community town hall meetings, site tours (demonstration of the plant technology and by-product reuse) and consultations. Emphasis will be placed on assuring the general public about food safety to ensure there is public acceptance and trust in the agriculture produce from local farms using the treated wastewater as well as the improved resilience of the water sector and the direct and indirect benefits on ecosystem services and ecotourism. Share lessons learnt to spur greater public and entrepreneurial involvement.

Activity 4.3.3: Develop a 3R-CReWS Project Web Page and social media accounts, which is dedicated to transparent measures of reporting, knowledge products, identify/host a link to the Redress Mechanism and provide update to all stakeholders on the project activities. This page will include, to the best extent possible, functions such as audio, sub-titles and/or sign language to encourage social inclusion from disabled population. The project’s webpage will also ensure to report project results disaggregated by gender, where possible.

The total budget of this output is USD0.9 million which will be financed totally by GCF financing.

B.4. Implementation arrangements (max. 1500 words, approximately 3 pages plus diagrams)

3R-CReWS Governance Arrangements

In accordance with the Accreditation Master Agreement between the CCCCC and the GCF, the GCF will enter into a Funded Activity Agreement (FAA) with the Caribbean Community Climate Change Centre (CCCCC or referred to as “the Centre”), in the form of a grant agreement, under which CCCCC, in its capacity as the Accredited Entity, shall administer the relevant GCF Proceeds to be used for the financing of the

Project. The Centre, as the Accredited Entity (AE), will guide implementation of this project in accordance with its accreditation credentials as well as guided by the terms FAA. Guided by the Funded Activity Agreement (FAA) to be entered into once this project is approved and the Accreditation Master Agreement (AMA) between the CCCCC and the GCF, the CCCCC will also ensure gender and social inclusion considerations are mainstreamed as much as possible into the execution of the project activities. All activities will adhere to the CCCCC environmental and social safeguards, which complies with international standards and includes consideration of the most vulnerable peoples and a mechanism and to address any grievance that may arise (see Section G for further details on Grievance Redress).

CCCCC will be the sole administrator of GCF funding and utilise the resources in accordance with the FAA to implement the to implement the activities as described in Section B.3 and detailed budget. The CCCCC will work closely, through its Programme Development and Management Unit (PDMU) and sign subsidiary agreements with the BWA to govern those activities that will be executed by the BWA. The Subsidiary Agreement will be legally binding and outline the details associated financing and accounting, procurement and implementation, as well as contain the relevant provisions for the compliance by BWA with the requirements of the AMA and FAA. The CCCCC and BWA will co-execute this project. As a Co-Executing Entity for this project, BWA will:

- a. Provide technical support to CCCCC for the development of Terms of References and the procurement of equipment, goods and service to realise all Outputs; and,
- b. Be a part of the evaluation team that will review all expressions of interest, and technical and financial proposals related to the Project.
- c. Report to the CCCCC as guided by the terms set out in the Subsidiary Agreement, procurement guidelines of the CCCCC and/or those of the Government of Barbados. This includes reporting to CCCCC on a quarterly basis detailing accomplishments, status of project activities, foreseeable delays and other risk at the time of reporting. These quarterly reports are essential to ensure compliance with CCCCC policies and accreditation credentials. These quarterly reports will also feed into annual and mid-term reports that will be submitted to the GCF. These reports will be coupled with field visit and site monitoring missions, which will include primary data collection and observations. There will be a final report at the end of the period of implementation. This report will also be accompanied by the final project financial audit to be completed by an independent and accredited auditor. All records on this project will be kept for at least five years for review by the GCF or its authorized bodies after project completion.

The Subsidiary Agreement will outline the implementation arrangements for the 3R-CReWS project and constitutes a requirement of the associated Funded Activity Agreement between the GCF and the CCCCC. The Subsidiary Agreement will include clause that span the following areas: Definitions; Description, Activities of the Project and Funding; Implementation of the Project; Additional Obligations of BWA; Reporting Requirements of BWA; Representations, warranties and Covenants of BWA; Intellectual Property and Ownership of Assets; Force Majeure; Duration of Agreement and Termination; Confidentiality; Notices; Governing Law; Dispute Settlement and General Provisions. The schedules will include: Description and Activities of the Project; Project Budget showing the Breakdown of each Party's Contribution; Co-financiers and contribution to Co-financing; Financial Management, Procurement and Implementation Arrangements; Implementation Plan; Proposed Composition and Functions of the Project Steering Committee; GCF Reporting Milestones; and, Events of Default.

CCCCC as, an executing entity, will manage, procure and account for all activities associated with the GCF proceeds as well as monitor and report on the on project activities to the GCF and Government of Barbaos, through the NDA office, in accordance with the FAA and AMA. Table 1 below identified the outputs/activities to be implemented and the EE that will be responsible for the day to day management execution. The CCCCC will continue to work closely with key stakeholders, such as the BWA, NDA, farmers, households,

private sector, government agencies, NGOs, Civil Society and academia, will be kept engaged throughout the project cycle. During the PPF stage of the project stakeholder consultations were carried out and there is a general acceptance of the project and their responsibilities and the readiness to proceed with implementing the project once GCF approves funding. Throughout the implementation phase, the consultant/vendor, executing entities and the CCCCC will continuously liaise and work closely with all relevant parties, in accordance with the Stakeholder Management and Engagement Plan and Gender Action Plan, for the timely and inclusive execution of project activities and to produce quality products that are aligned with the deliverables and outputs of this project.

Table 1: Responsibilities of Executing Entities

Output	Key Activities	EE
1.1 The Bridgetown Sewage Treatment Plant (BSTP) is upgraded to treat wastewater to a tertiary water-quality standard.	Activity 1.1.1: Design, procure and convert/upgrade the existing conventional activated sludge (CAS) biological treatment process at the Bridgetown Sewage Treatment Plant to tertiary filtration and disinfection for achieving national reclaimed water-quality standards.	CCCCC
1.2 Tertiary wastewater is being reused to supplement non-potable use	Activity 1.2.1: Install reverse osmosis (RO) membrane filtration systems to reduce the total dissolved solids concentration of the reclaimed water produced at the BSTP	CCCCC
	Activity 1.2.2: Install a 9Km pipeline and 6 aquifer recharge wells going from the BSTP for irrigation and aquifer recharge	BWA
1.3 Decision-support tools and infrastructure implemented to mitigate potential climate change risks to the wastewater collection and treatment systems	Activity 1.3.1: Implement a sewer monitoring programme that will include the installation of flow measurement and rain-gauging equipment at the BSTP to identify and address sources of inflow and infiltration to the sewer. Mechanisms that identify and reduce or mitigate vulnerabilities in the wastewater collection systems will also be investigated.	CCCCC
	Activity 1.3.2: Establish on-site laboratory facilities and personnel at the BSTP to generate influent and effluent water quality data to inform operations control strategies that optimize operations and reduce energy consumption and GHG emissions.	CCCCC
	Activity 1.3.3: Implement a Computerized Real-time Management System (CMMS) at the BSTP to inform decision making and climate resilient building	CCCCC
1.4 Decentralized treatment systems or cluster treatment systems installed	Activity 1.4.1: Construct two small (cluster) decentralized wastewater collection and treatment demonstration systems in Zone A locations to produce reuse quality water for domestic/commercial non-potable water applications.	BWA
2.1 Energy efficiency and renewable energy technologies are implemented	Activity 2.1.1: Install a grid-tied Photovoltaic (PV) Renewable Energy Systems to offset increased power consumption associated with the centralized treatment plant process upgrades using Category 3 hurricane resistant solar panels	CCCCC
	Activity 2.1.2: Implement automated controls and energy efficiency measures within the upgraded centralized treatment processes to reduce the overall energy footprint and reduce GHG emissions.	CCCCC
	Activity 2.1.3: Install sludge dewatering equipment to improve energy efficiency and reduce the overall GHG and CO2 emissions associated with the biosolids.	CCCCC

<p>3.1 Improved capabilities of wastewater technical personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management</p>	<p>Activity 3.1.1: Develop and provide specialized and customized training to support the operations and maintenance of wastewater collection and treatment facilities including photovoltaic equipment</p> <p>Activity 3.1.2: Update Standard Operating Procedures (SOP) and Operational Manual that addresses the requirements of the upgrades, preventative maintenance, operator safety, and environmental monitoring, including risks posed by climate change and gender and social inclusion considerations.</p> <p>Activity 3.1.3: Develop and implement a risk management framework to support the sustainable management of BWA's operations.</p>	<p>CCCCC</p> <p>CCCCC</p> <p>CCCCC</p>
<p>3.2 A strategic plan is developed to guide the replication of water treatment facilities along the west coast corridor</p>	<p>Activity 3.2.1: Investigate and develop a strategic plan for the installation of water treatment facilities along the west coast corridor for augmenting water supply and protecting the west coast ecosystem.</p>	<p>CCCCC</p>
<p>4.1 Governance and planning roadmaps enhanced to enable use of reclaimed water in a controlled and regulated manner</p>	<p>Activity 4.1.1: Undertake a legislative review to promote the Planning and Development Act, Wastewater Reuse Bill and other related legislations for enhancing wastewater effluent quality, treatment options and re-use requirements and applications.</p> <p>Activity 4.1.2: Develop a water and sanitation master plan that includes an optimal combination of decentralized, cluster and centralized water reclamation and reuse applications, with the centralized reclaimed water being transmitted and used for agricultural irrigation and/or industrial use (such as lower cost of reclaimed water transmission).</p>	<p>CCCCC</p> <p>BWA</p>
<p>4.2 Mechanisms developed/expanded to encourage the adoption of wastewater treatment and reuse applications by private individuals and businesses</p>	<p>Activity 4.2.1: Develop a strategy and action plan to engage the private sector in the provision and adoption of wastewater treatment technology and the utilization of wastewater by-products such as activated sludge.</p> <p>Activity 4.2.2: Undertake a review and identify recommendations for a gender sensitive and socially inclusive incentive programme to encourage conservation, recycle, re-use.</p> <p>Activity 4.2.3: Expand the Revolving Adaptation Fund Facility (RAFF) to provide resources for the adoption of decentralized onsite wastewater systems.</p>	<p>CCCCC</p> <p>CCCCC</p> <p>CCCCC</p>
<p>4.3 Gender Sensitive Public Education and Awareness Campaign Implemented.</p>	<p>Activity 4.3.1: Re-educate communities, teachers, students, farmers and businesses about the impact of climate change on water resources and their impact on water quality and quantity (availability as well as the importance of water reuse activities and indirect potable reuse (IPR)) to building climate resilience in the Water Sector.</p> <p>Activity 4.3.2: Develop and implement a Gender Sensitive Public Awareness Campaign for community and visitors (tourists) through workshops, videos, community town hall meetings, site tours (demonstration of the plant technology and by-product reuse) and consultations.</p> <p>Activity 4.3.3: Develop a 3R-CReWS Project Web Page and social media accounts, which is dedicated to transparent measures of reporting, knowledge products, identify/host a link to the Redress Mechanism and provide update to all stakeholders on the project activities.</p>	<p>CCCCC</p> <p>CCCCC</p> <p>CCCCC</p>

The CCCCC project components will be executed by a Project Management Office (PMO) whilst those components under BWA will be executed under the management of the BWA Project Management Office (PMO), through a dedicated Project Team. More specifically, the CCCCC will secure the services of a Project Manager, a National Project Coordinator, a Project Engineer, a Procurement Officer, a Finance Officer and two (2) Administrative Officers that will work closely with BWA's Project Management Office. The BWA PMO is staffed with Project Coordinators (one of which will be assigned to this project and will liaison closely with CCCCC), Procurement and Accounting Officers, Project Engineer and Engineering Assistant and will also draw upon the available collective resources of the BWA and project implementation partners. In addition, the Project will be monitored by a Project Steering Committee comprising key stakeholders.

The BWA PMO will be required to report to the General Manager of BWA, who in turn will report to the BWA Board of Directors and the Project Steering Committee (PSC). Additionally, the CCCCC PMO will also report to the PSC. The PSC is to provide a mechanism for support, feedback, guidance, stakeholder participation and interagency coordination during project implementation, and to act as a catalyst for an ongoing coordination mechanism after implementation has been completed. The Committee will be required to meet as necessary, but not less than biannually. The duties of PSC shall be as follows:

- (a) familiarisation with the arrangements for project implementation, including the intended project outcome, outputs, scope, financing arrangements, reporting requirements, implementation schedule, and other details contained in the appraisal report and financing agreements;
- (b) monitor progress in implementation of the Project towards achievement of the project output and project outcome;
- (c) ensure that potential threats to timely project implementation are identified and addressed;
- (d) facilitate the taking of policy decisions by the relevant authorities to ensure timely fulfilment of funding conditions;
- (e) review work plans on a semi-annual basis and ensure that recommendations with respect to adequate budgetary allocations are made, procurement activities are executed as scheduled, and that adequate controls;
- (f) ensure that stakeholder participation is appropriate and sustained throughout implementation and that stakeholder expectations are addressed;
- (g) facilitate a grievance redress mechanism that complies with GCF expectations on grievance redress to address concerns and complaints from the stakeholders, including the general public, with regards project implementation;
- (h) ensure that the Project remains aligned to the policy and strategic objectives of the GOB;
- (i) discuss the perspective of the entities from which its members are drawn on various issues, informed by the consultation of PSC members with their respective organisations;
- (j) monitor the performance of the Project Implementation Team; and
- (k) champion the Project, advocating for achievement of the project outcomes.

The PSC will be chaired by the Executive Director of the Caribbean Community Climate Change Centre and co-chaired by General Manager of the BWA, with the Project Manager (PM) or Project Coordinator (PC) serving as Secretary, who will be responsible for taking minutes for each PSC meeting and shared with the relevant stakeholders. In addition, PSC shall comprise the following members:

- (a) Permanent Secretary (PS), Ministry of Transport Works and Water Resources Management, or their nominee;
- (b) PS, Ministry of Agriculture and Food and Nutritional Security or their nominee;
- (c) PS, Ministry of Finance Economic affairs and Investment or their nominee;
- (d) PS, Ministry of Health and Wellness, or their nominee;
- (e) PS, Ministry of Environment and National Beautification, or their nominee;
- (f) PS, Ministry of Energy and Businesses Development and Entrepreneurship
- (g) Director, Environmental Protection Department, or their nominee;
- (h) Director, Planning and Development Department, or their nominee;

- (i) Director, Coastal Zone Management Unit, or their nominee;
- (j) Head of the Bureau of Gender Affairs, or their nominee;
- (k) Representative, Barbados Chamber of Commerce;
- (l) Representative, Barbados Agricultural Development and Marketing Corporation;
- (m) Representative, Barbados Agricultural Society;
- (n) Representative, Government Press and Public Relations
- (o) University of the West Indies (UWI)

Able guided by this PSC, the CCCCC and BWA will have the final decision-making authority with respect to the implementation of the project. The Government of Barbados, through the Ministry of Finance Economic affairs and Investment and Ministry of Transport, Works & Water Resource Management, will be kept abreast of progress of the project. The NDA and the Minister with responsibility for water will serve as a conduit for updating the GOB on the process of the project and, where necessary, providing feedback to the project board from the GOB. The BWA's board of directors is expected to report to the Ministry on the status of various activities identified in this proposal. See Figure 11 presents the project management and reporting structure for the project.

The Technical Working Group is made of representatives from: BWA, Environmental Protection Department, Ministry of Health and Wellness, Ministry of Agriculture and Food Security, Ministry of Finance Economic Affairs and Investment, Coastal Zone Management Unit, Government Analytical Services, and Planning and Development Department. This group guided the development of the proposal and will continue to guide the implementation of the project.

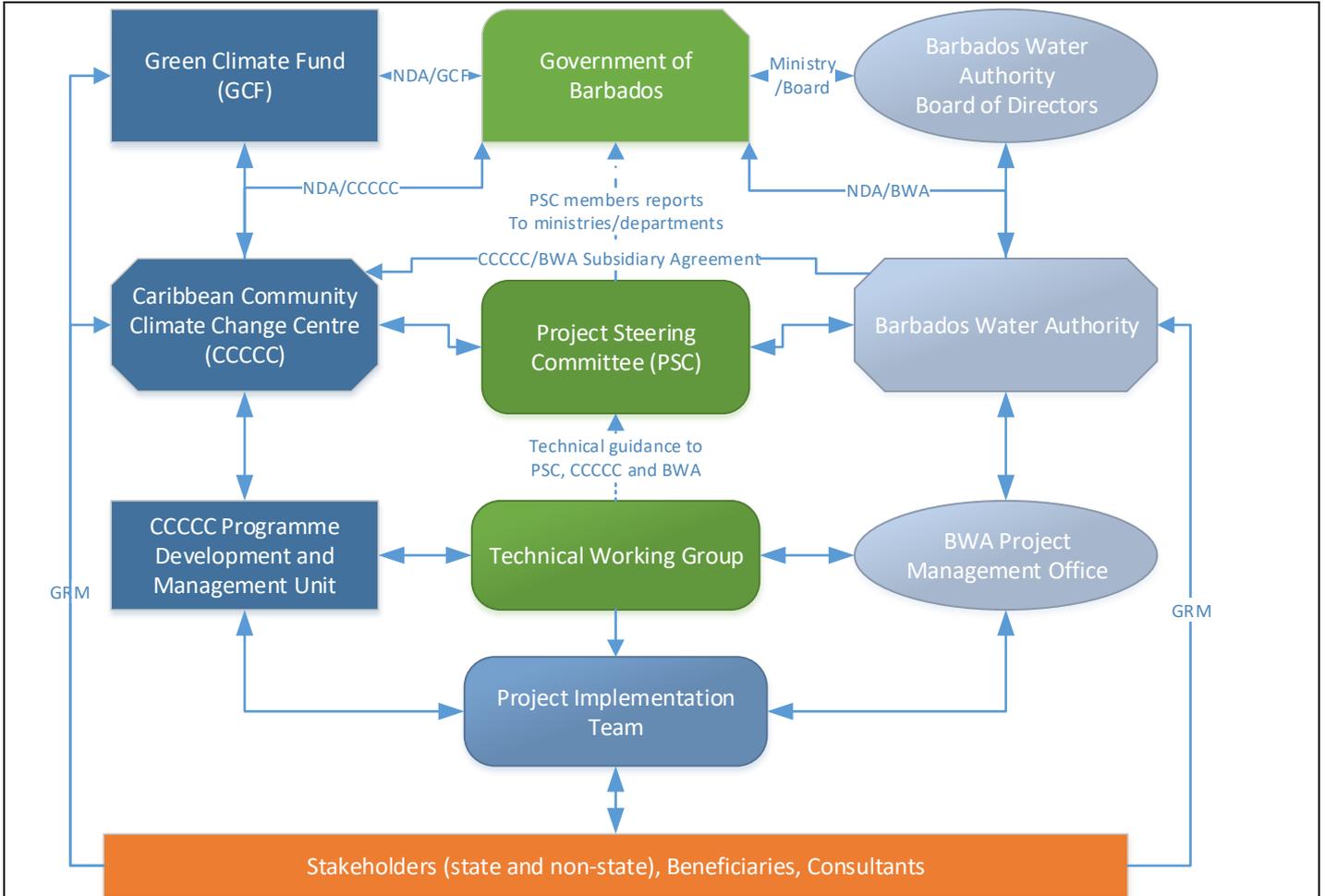


Figure 12a: Project Management and Reporting Structure for the project

Financial Flows and Implementation Arrangements

The funding for the 3R-CReWS project will come from: (1) the Green Climate Fund in the form of a grant; and (2) the BWA in the form of a grant from the Government of Barbados. The BWA contribution will be provided through the Ministry of Finance Economic Affairs and Investment, which has already sourced some of the co-funding required including plans to allocate resources to the BWA from the revenue generated by the Garbage and Sewage Contribution levy to fund the two decentralised wastewater treatment plant (Output 1.4).

CCCCC will not on grant any monies to the BWA nor will BWA on grant monies to the CCCCC. CCCCC will manage, procure and account for all activities associated with the GCF proceeds. The CCCCC will procure all major goods and services for the project using international best practice and the appropriate procurement method in accordance with the procurement plan. The CCCCC in accordance with its Accreditation Master Agreement, financial and accounting manual and procurement guidelines will procure goods, works and services for the realisation of the project outputs. As is CCCCC policy, funding provided by the GCF is kept in a separate project bank account. The partners, providing co-financing, will manage their co-financing activities but will be obligated to the report to the CCCCC on the status of those activities. Those entities are not obligated to transfer any monies to the CCCCC but must provide accounting evidence of transactions and expenditures towards their co-financing obligations. These are essential for monitoring and reporting to the GCF on an annual basis.

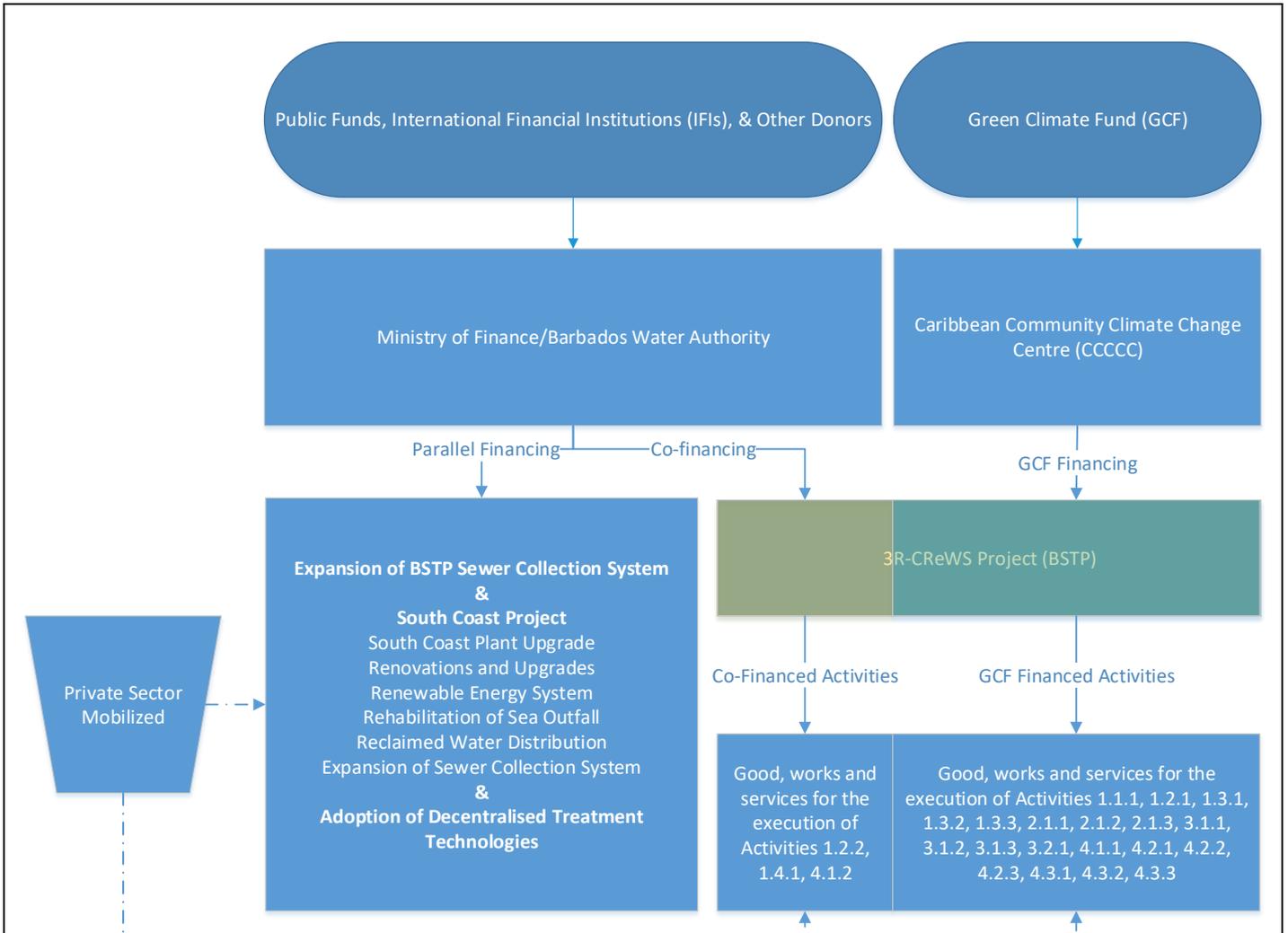


Figure 12b: Financial flows, inclusive of the system upgrades that are parallel financing

Capacity of the AE and EE to Implement

The 3R-CReWs project builds upon the Centre’s more than 15 years of experience as a regional leader implementing catalytic pilot/demonstration type projects in the Caribbean Region, and scaling these up with national governments. It also builds on the Centre’s established track record in implementing projects related to climate change adaptation and mitigation. Further, as an Accredited Entity of the GCF, the Centre does ensure that appropriate due diligence is carried out to ensure that all transactions are executed with minimal transactional risk and all Executing Entities have to date, been assessed at a low or medium risk. The due diligence exercised revealed that the CCCC has sufficient capacity and autonomy to enter into Agreements, with sufficient legal and juridical capacity in doing so (See Annex 9). In terms of institutional due diligence, the CCCC is properly constituted, and with Board approvals, is competent in taking on the tasks assigned in the funding proposal in their various roles. Also, the Centre has an established track record in Barbados and working with the BWA through its PMO that is implementing another GCF funded project (FP060: Water Sector Resilience Nexus for Sustainability in Barbados Project (WSRN S-Barbados)).

The BWA is responsible for managing, allocating and monitoring the water resources of the island with the view to ensuring their best development, utilization, conservation and protection in the public interest. The facilities of the Authority are situated in a number of locations across the country and these include pumping stations, reservoirs and major storage centres at Bowmanston, St John and the Belle, St Michael. The BWA supplies 97% of the island with water and obtains its water supply from twenty-four (24) groundwater wells,

two (2) springs, one (1) main privately owned reverse osmosis desalination plant as well as a small containerized desalination plant. This water is distributed through a network consisting of approximately two thousand five hundred kilometres (2,500 km) of water mains, twenty-eight (28) reservoirs located both under and above ground and seventeen (17) re-pumping stations (booster-pumps). It is also responsible for the designing, construction, acquisition, provision, operation and maintenance of water and sewerage works for the purpose of supplying water for public purposes and the receiving, treating and disposing of sewage, respectively. Though the water system is island-wide, the sewerage works consist of two centralized systems, the Bridgetown Sewerage Treatment Plant, a secondary treatment facility commissioned in 1980, and the South Coast Sewerage Treatment Plant, an advanced preliminary treatment plant commissioned in 2003.

It is important to note that the BWA Act and the Interpretation Act of Barbados notes that the BWA Act establishes the BWA as a Body Corporate and the Interpretation Act outlines that such a body has all the powers of a legal person, which includes the power to enter into contracts in its own name and the power to sue and be sued. It is against this legal standing that the CCCCC and BWA will enter into a subsidiary agreement.

As a strong partner to the CCCCC, the BWA's PMO has a track record of implementing water and wastewater project and is currently managing 5 projects to a total value of USD82 million for the water and wastewater sector running through to 2024. In addition to externally funded projects, the PMO handles internally financed projects, processes payments, liaises with ministries, and prepares progress and financial reports on projects. The BWA therefore has a resourced and experienced team of professionals working within the PMO. It is also worth mentioning that the BWA has built its capacity (knowledge and understanding) of the GCF and its reporting requirements. This was largely achieved through the development of, and ongoing activities of, WSRN S-Barbados Project. Further, a Financial Management Capacity Assessment (FMCA) of BWA's operations was carried out to enable BWA to act as an executing entity for the WSRN S-Barbados (See Annex 27).

B.5. Justification for GCF funding request (max. 1000 words, approximately 2 pages)

Barbados Economic State of Play

Since the financial crisis, 2008, the Barbadian economy remains sluggish and the onset of the COVID-19 pandemic has worsened this plight. Inflation rates have been around 4% per year over the last 4 years and is projected to remain at around 3% per year in the medium term. A combination of economic circumstances and shock from exogenous factors (including international commodities prices, natural disasters and the COVID-19 pandemic) led to a situation where public debt-to-GDP ratio increased consistently from 55% of GDP in 2008 to 148% in 2017³⁷ and although it dropped to 120% in 2019, it increased to 144% by the end of 2020.³⁸ At the end of the first quarter of 2021 Barbados's GDP is estimated to have contracted by 17.3% and the current account deficit is expected to have increased to 7.8%³⁹. The unemployment rate rose to 10.8% as of September 2019 following public sector layoffs of almost 1,000 persons in 2018 stemming from

³⁷ World Bank (April 2021) Poverty & Equity and Macroeconomics, Trade & Investment Global Practices. Pages 92-93

³⁸ Central Bank of Barbados (16, Feb 2021). See <http://www.centralbank.org.bb/news/article/10200/why-barbados-debt-to-gdp-ratio-has-risen-again>. Accessed: 15 December 2021

³⁹ World Bank (April 2021)

the introduction of the Barbados Economic Recovery and Transformation (BERT) Programme^{40 41}. With the onset of the pandemic, unemployment rates increased further^{42 43 44}

Further, Barbados has been increasing in the proportion of the population living in poverty from 15.1% in 2010 to 17.2% in 2016, according to the 2016-2017 Barbados Survey of Living Conditions. While there is no estimate of monetary poverty since then, it is likely that the poverty rate increased in the two years leading to 2020, in line with the observed economic slowdown due to job losses, business closures, and decline in remittances caused by the pandemic. Furthermore, Barbados experienced a rapid spread of COVID-19 in January 2021 and again in August 2021, with the latter rates including the Delta variant that is more contagious. The high level of infectious rate of the delta variant is reflected in that statistics as the number of new daily cases being reported for the month of October 2021 were in the 300s pushing Barbados to be the fourth country in the world for the 7-day incidence rate (rating report for 6 October 2021)⁴⁵.

On March 20, 2020, the Prime Minister announced a complement of social, monetary and financial policy measures in response to the pandemic which increased public expenditure. For instance, a total of USD10 million was allocated for social assistance to allow for an increase in the transfers paid by the Welfare Department, and the Household Survival Program. BWA was asked to reconnect the water supply for households that had it cut off. Monetary policy changes included the Central Bank of Barbados reducing its discount rate for overnight lending from 7% to 2%, it reduced the securities ratio for banks from 17.5% to 5% and eliminated the 1.5% securities ratio for non-bank deposit taking licensees. The Central Bank also announced its intention of collateralizing loans for up to six months as liquidity support for licensees, if required. In terms of financial policy measures, the government requested additional financing support from international financial institutions, which included the possibility of extending the IMF Extended Facility Fund (EFE) envelope by USD100 million, to USD390 million, and disbursing a USD80 million policy-based loan from IDB.

Apart from the recession and the global pandemic, Barbados has experienced two natural hazards in 2021 that has taken an additional toll on the economy. The first is the fallout from the eruption of the La Soufrière Volcano in Saint Vincent and the Grenadines, which erupted in April 2021 resulting in damages and losses of approximately BBD87.1 million from impacts to a majority of the productive sectors; for example, in agriculture, up to 40% of crops are expected to have a reduction in yields and the massive clean-up efforts created significant impact on the water sector, as there was an unprecedented draw on water resources, which put pressure on reservoir levels and compromised water availability to households and industries that depend on water for production⁴⁶.

The second natural hazard was the passage of Hurricane Elsa on 2 July 2021 that resulted in power outages, fallen trees, flash flooding and damaged roofs. Whilst there were no reported deaths, it was the first hurricane to hit Barbados in 65 years. No estimation of damage and losses were found but given that there was significant disruption to businesses during a year where there was already significant disruption to economic activity, it is safe to say that productivity of sectors was further stretched.

40 In June 2018, in response to the worsening fiscal and external liquidity position, the newly elected government announced the home-grown BERT Plan aimed at restoring macroeconomic stability. It included the suspension of debt payments and a comprehensive restructuring of domestic and external debt. The completion of the public debt restructuring in December 2019 reduced economic uncertainty prior to the coronavirus pandemic. Under BERT, debt is targeted to reach 60 percent of GDP by FY2033/34. In addition, in 2018, Barbados entered into an adjustment program under the IMF's Extended Fund Facility. (World Bank (April 2021)

41 Preliminary Overview of the Economies of Latin America and the Caribbean. 2019. Pages 2-3

42 World Bank (April 2021)

43 IADB (2020)

44 World Bank (2021)

45 See OSCOVIDA Open Science COVID Analysis available at: <https://oscovida.github.io/countries-incidence-rate.html> Accessed: 6/10/2021. The rating is based on the total number of cases over the past 7 days/total population

46 Barbados Loop News (July 10, 2021). Available at: <https://barbados.loopnews.com/content/caddle-ashfall-causes-87-million-loss> Accessed: 06/10/2021

Level of Concessionality

Despite these setbacks, the Government has spent significantly and is still looking to further invest in building the water sector’s resiliency due to the serious situation of the water infrastructure in Barbados and its role in underpinning economic activity. The Government of Barbados has utilized funding from its budgetary allotment⁴⁷ (Fiscal), the Tourism Enhancement Fund and regional and international funding, including a USD55 million loan from the IDB, to carry out upgrades and well needed repairs on sections of the systems⁴⁸.

The 3R-CReWS project is one part of the larger endeavour on the part of the GoB to adapt to the impact of climate change. The country is facing a climate crisis in which water availability to support the economy is going to be curtailed and is already impacting food security through the high cost of importation, a situation that is expected to be increasingly aggravated through the global impact of climate change on food and supply chains. To counter this, Barbados is seeking to increase food production as an adaptation measure. This ambition cannot be realised without making water accessible to farmers so it is imperative that means be found to address current and future water scarcity constraints. At present large volumes of precious water resources are going to waste through being disposed in the surrounding ocean after a single use. This linear model of water provision and use has to change to a closed loop through reuse and replenishment.

BWA, the sole water service authority in Barbados, is critical to guaranteeing the water security of Barbados. However, given the impending impacts of climate change, BWA needs to position itself to continue to guarantee this security. It is expected that its function in the future will not only be limited to the production and distribution of water but also demonstrating, raising awareness, and building capacity within localities about water conservation, storage and treatment. The need for this comes against the background that BWA needs to improve its efficiency and build greater resilience to climate variability and change. Here, efficiency refers to minimizing its operation and maintenance costs and increasing the amount of water available to the public whilst at the same time minimizing its impact on the environment. This project support the Government of Barbados and BWA efforts to build resilience in the water sector by closing the cycle of water use and reuse by introducing reuse of reclaim water.

The use of reclaim water is not widespread and there are some reservations by the public to utilise the resource hence the investment in upgrading the plants to generate water to quality reuse must be coupled with enabling environment and public education needed to sustain the paradigm shift in behaviour and attitude.

The GOB is seeking to provide that basic infrastructure and to use it as a platform to launch further expansion of the Circular Economy as envisaged in the (Moore, et al., 2014) and the follow-on Partnership for Action on Green Economy (PAGE) with the United Nations Environment Programme. To this end, the total envisaged capital investment in provisioning infrastructure for the Bridgetown and South Coast System is USD183 million in the short-term rising to USD251 million in the medium term. The Table 2 below captures the relative contributions to capital costs planned for the water sector. Just looking at the capital investments planned for the Bridgetown System – GCF’s proportion is 57% and 37% in the short and medium terms, respectively. At a national scale, GCF’s contribution amounts to 22% in the short-term, falling to 16% in the medium term.. Details on the sources of capital funds is depicted in Table 3.

Table 2: Relative Short- and Medium-Term Contributions to Capital Costs

Item		Green Climate Fund	BWA	GoB	Total	
Bridgetown System	Short-term	Amount	USD39.5m	USD29.9m	-	USD69.4m

47 Government of Barbados has recently pledged USD\$12,000,000 to assist in the emergency operations for the two wastewater treatment facilities in Barbados.

48 Amanda Lynch-Foster (2018), The South Coast Sewage Crisis: A Timeline, Nation News, Bridgetown, Barbados. Retrieved on August 5, 2018 from: <http://www.nationnews.com/nationnews/news/121736/south-coast-sewage-crisis-timeline> .

		%	57%	43%	-	100%
	Medium-term	Amount	USD39.5m	USD29.9m	USD48.0m	USD107.4m
		%	37%	28%	35%	100%
South Coast System	Short-term	Amount	-	USD2.3m	USD111.3m	USD113.5m
		%	-	2%	98%	100%
	Medium-term	Amount	-	USD2.3m	USD131.3m	USD133.6m
		%	-	1.7%	98.3%	100%
Total	Short-term	Amount	USD39.5m	USD32.2m	USD111.3m	USD183.0m
		%	22%	18%	60%	100%
	Medium-term	Amount	USD39.5m	USD32.2m	USD179.4m	USD251.0m
		%	16%	13%	71%	100%

Source: Cashman (2021)

Table 3: Source of Funding for Upgrades and Expansions to the Centralized Systems

Capital Cost Item	Source of Funds			Total
	Green Climate Fund	Govt of Barbados BWA	Govt of Barbados Ministry of Finance	
Capital Costs Bridgetown				
• Bridgetown Plant Upgrade	US\$38.682			US\$38.682
• Renovations and Upgrades		US\$1.770		US\$1.770
• Renewable Energy System				US\$1.770
• Reclaimed Water Distribution	US\$0.840			US\$0.840
• Expansion of Sewer Collection System		US\$7.300		US\$7.300
○ Phase I				US\$7.300
○ Phase II				US\$7.300
○ Phase III		US\$10.070		US\$10.070
○ Phase IV		US\$4.050		US\$4.050
○ Phase V		US\$2.675		US\$2.675
Subtotal		US\$4.050		US\$4.050
		US\$29.915	US\$48.000 ¹	US\$48.000
	US\$39.522		US\$48.000	US\$117.437
Capital Costs South Coast				
• South Coast Plant Upgrade			US\$64.050	US\$64.050
• Renovations and Upgrades		US\$1.410		US\$1.410
• Renewable Energy System				US\$1.410
• Rehabilitation of Sea Outfall		US\$0.840		US\$0.840
• Reclaimed Water Distribution				US\$0.840
• Expansion of Sewer Collection System			US\$12.000	US\$12.000
Subtotal			US\$41.300	US\$41.300
			US\$20.000 ²	US\$20.000
		US\$2.250	US\$131.350	US\$133.600
Total	US\$39.522	US\$32.165	US\$179.350	US\$251.037
	15.7%	12.8%	71.5%	100%

Source: Cashman (2021)

- 1 Future expenditure for expansion of the sewer collection system to service Greater Bridgetown – post 2030.
- 2 Expenditure for the expansion of the sewer collection system to service the South Coast area – 2025.

The planned capital expenditure for the expansion of the sewer collection systems for the South Coast and Greater Bridgetown would occur after the completion of the upgrades to the two Sewage Treatment Plants.

This level of concessional financing, given fiscal space and the programme on which the GOB is embarked upon, is very appropriate when compared to the overall investment being made. It is critical to the realisation of the financial and economic benefits that would flow from the programme. The project risk is being shouldered by the GOB considering that more than 60% of the financing will come from long-term loans. Given the fiscal position of the GOB and the BWA, and the need to provide a platform for low carbon climate resilient development means that minimising the debt burden is imperative. In this light the level of concessionality requested is considered minimal.

The concessionality will benefit the following stakeholders:

- 155 farmers through increased and assured availability of water for irrigation, enabling the expansion of irrigated agriculture for new entrants,
- Communities through increased employment opportunities,
- Local businesses supporting the farming sector through increased economic activity,
- General population through increased food availability and security,
- The BWA through the reduction in the need to exploit additional water resources to support irrigated agriculture and placing addition stress on scarce resources while meeting demand for potable water supply, exacerbated by the impact of climate change,
- Visitors to Barbados through the maintenance and improvement of the marine environment and ecosystems,
- Visitors and the general population through reduced public health risks associated with deterioration in bathing water quality,
- The BWA through improved training and capacity to manage the operation and maintenance of wastewater systems, minimization of the cost of operation and maintenance of the collection systems and sewage treatment plants, and ability to conform to regulatory requirements concerning quality of service and water quality regulations,
- The BWA through increased income generation through the sale of treated reclaimed water,
- The Government of Barbados through increased economic activity contributing to revenue income by maintaining visitor numbers, increased economic activity and employment in the agriculture sector, and stimulation of the circular economy development opportunities,
- The general population through increased awareness of the impacts of climate change and incentives encouraging conservation, recycling and reuse.

B.6. Exit strategy (max. 500 words, approximately 1 page)

Dimensions of Sustainability

The design of this project has strategically included key activities that will foster sustainability even after the project is implemented. A snapshot of the dimensions of sustainability and the key contributing results and/or activities of this project are presented in Figure 13. Additional context is provided below, and for more details on any referenced activity or output, see Section B.3

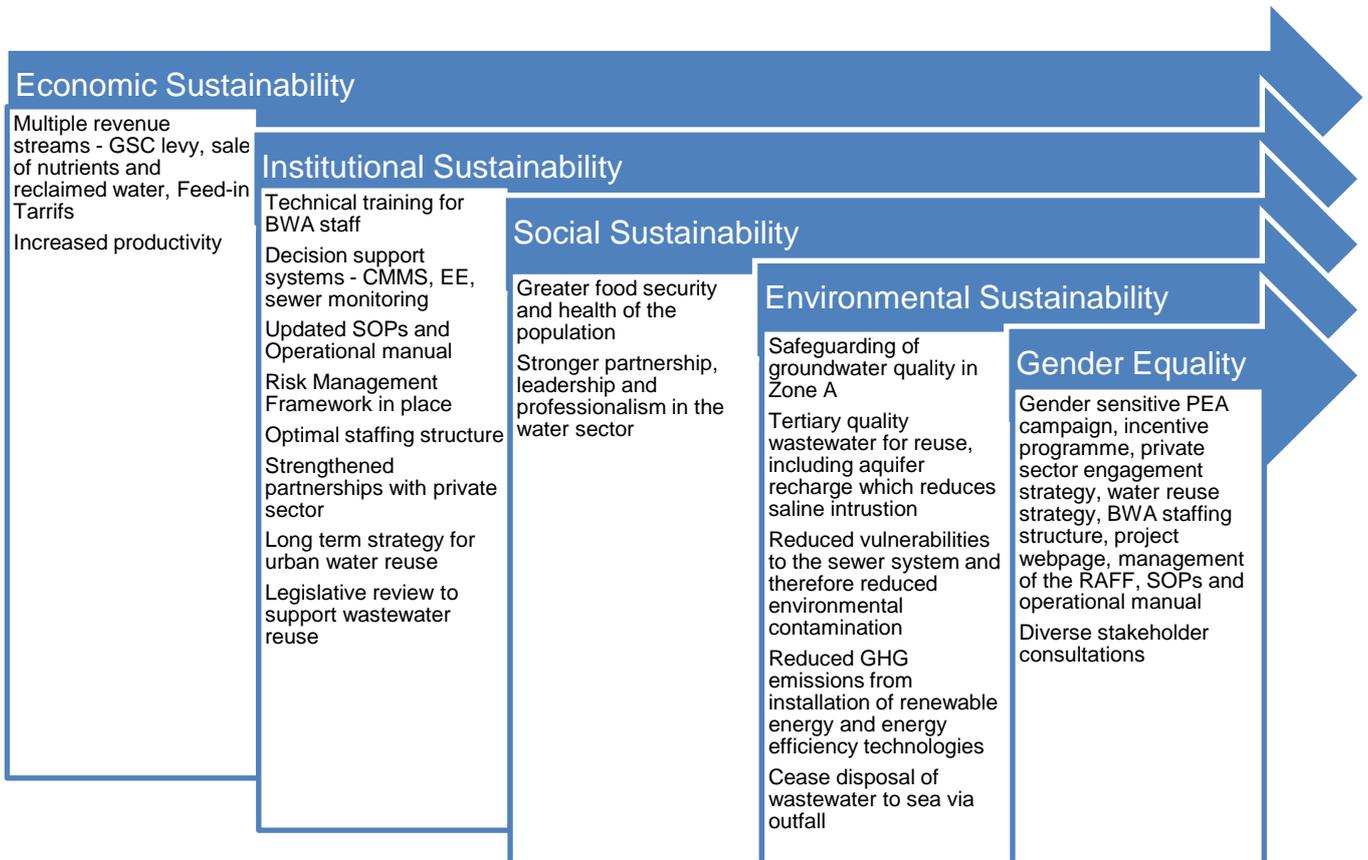


Figure 13: Snapshot of the dimensions of sustainability promoted by 3R-CReWS

Economic/Financial Sustainability

This project recognizes that in the face of adverse climate change related weather conditions, it is important to have systems in place to manage and operate the wastewater infrastructure as efficiently as possible. Therefore, the following monitoring systems will be implemented by this project to reduce damage to the wastewater systems and also promote a culture of preventative maintenance that will extend the lifetime of the equipment, reduce operational costs and increase financial sustainability in the long term: (i) the development of a robust Computerized Real-time Management System (CMMS) to establish a core electronic data collection, operation and maintenance programme (ii) the implementation of a sewer monitoring program to identify sewer segments with a disproportionate amount of wastewater flow to the incremental number of connections along that segment to mitigate against hydraulic surge impacts and load variations as a result of major storm events; and (iii) establish on-site laboratory facilities and personnel at the BSTP to generate influent and effluent water quality data to inform operations control strategies that optimize operations and reduce energy consumption (See output 1.3).

Also, revenue generation will come from the following four sources, all of which will be institutionalized and exist beyond the 5-year timeframe for this project⁴⁹:

⁴⁹ Cashman, 2021

- i. Income generated from GSC levy,
- ii. The sale of nutrients/ fertilizer generated from the treatment of the wastewater,
- iii. From Feed-In Tariffs for renewable energy generated onsite from Photo Voltaic solar panels,
- iv. Sale of reclaimed treated wastewater.

Using the project's investment in the PV system as an example, the PVs to be installed will generate 1MW of PV that will yield 2,063MWh of clean solar power per year. This is enough to power the plant upgrades and contribute to the local power grid, further reducing Barbados' dependence on diesel for power and GHG emissions. The applicable Feed-in Tariff for a PV system of between 1 MW and 5 MW is 23.25 BBD cents/kWh⁵⁰, which equates to earnings of USD479,647.50 per year to offset energy bills and free up resources otherwise used for the electricity bill for maintenance of equipment and staff training, as needed.

Further, the BWA, on behalf of the people and government of Barbados, will take ownership of the major outputs of this project as such it will be responsible for ensuring the sustainability of this assets and their operations. As such revenue generated for these investments will be played back into their operation and maintenance and will be complemented with resources from the Garbage and Sewage Collection Levy (GSC), which was introduced by GOB in 2019 to cover the cost of operating and maintaining the wastewater system. Currently, the GSC collects BD\$0.25 per household/day to support operation and maintenance of wastewater system. See the Feasibility and Financial Model for more details on the O&M costs required for sustainability of this paradigm shift in the utilisation of reclaimed water.

At the national level, it is envisaged that the potential for advancing sustainable development (e.g. see section D.3 for more details on linkages to the SDGs) through this project will be significant and will result in Barbados being a more attractive investment destination for both regional and international tourists. Greater water availability will positively impact residents and businesses throughout Barbados and can directly and indirectly lead to greater employment.

The successful impetus to the private sector both through the envisaged measures under this project (Outputs 4.2 and 4.3) and through the development of a circular economy would catalyse support for the development of business opportunities for the private sector, creating job opportunities and having apposite multiplier effect for government revenues. To expand on the approach and expectation of the private sector investment, it is envisioned that the private sector will play a critical role in scaling up/replicating the decentralized package plants and RO plants along the west coast, implement a waste to energy facility and use by-products of the wastewater in production of fertilizer. The government is committed to de-risking the sector to attract private sector investment, including the farmers (e.g. Agricultural Cooperatives), who may utilise reclaimed water and by-products of wastewater treatment. This Project will expand the RAFF to support the Private Sector's engagement in the wastewater sector. For example, adopting technologies that support the delivery and utilization of tertiary reclaimed water. In addition, the RAFF is seen as critical element to engaging the private sector; however, the existing RAFF needs to examine and expand to consider how resources could flow in and out to support activities related to the adoption of decentralize treatment systems as well as dual pumping, *inter alia*.

Institutional Sustainability

This project addresses institutional strengthening and sustainability through the following key activities:

- i. Ensuring that up-to-date training is provided to all BWA staff to create a skilled and competent human resource pool to manage the upgraded STP (Activity 3.1.1)

⁵⁰ Ibid

- ii. Integrating decision support systems such as the electronic CMMS information system, a sewer monitoring programme, automated controls for improved energy efficiency, on-site laboratory to inform better decision-making and planning by the BWA (All of output 1.3) and a risk management framework (Activity 3.1.3)
- iii. Updating the SOPs and Operational Manual to address the requirements of the upgraded system, preventative maintenance, operator safety etc., and training on same to ensure there is institutional knowledge and understanding of the operational procedures (Activities 3.1.2 and 3.1.1, respectively)
- iv. Strengthening BWA's partnerships with the private sector, civil society and public through a private sector engagement strategy and action plan, PEA programme, expansion of the RAFF and a designated project website (Activities 4.2.1, 4.3.2, 4.2.3 and 4.3.3, respectively)
- v. Establishing a gender responsive water and sanitation master plan to guide long term planning for the sustainable management of the water sector and for further strengthening resilience to climate risks (Activity 4.1.2)

One of the main consideration in the development of the project was the capacity of the BWA to sustainable operate and maintain the outputs of this project. The conclusion to retain a CAS treatment process considered the O&M cost as well as the capacity of existing BWA staff. The feasibility study identify that the CAS had the least O&M cost and the cost of training (re-training) BWA staff would be a fraction of the cost if an another treatment process was to be adopted. Further, the BWA already has some capacity to manage CAS system up to secondary treatment. By updating the SOPs and providing the incremental training the capacity of the BWA will be enhance to support the operations and maintenance of the tertiary wastewater treatment system. The BWA is committed to maintaining the human capacity necessary to sustain the operations of the upgraded plants.

Social sustainability

Enhancing stakeholders' (private sector, farmers, individuals): (i) engagement and buy-in (through the engagement strategy and action plan) (ii) awareness and understanding of climate change and the water sector (through the PEA and training programmes), and (iii) accessibility to funding resources (through the RAFF) will collectively change the culture of the water sector in Barbados towards stronger partnerships, leadership and professionalism that is needed to continually innovate and adapt to climate change, as well as improve individuals' well-being and economic viability. These are key elements for promoting social sustainability after the project's resources are used up. As noted above, the water and sanitation master plan (Activity 4.1.2) to be developed with ensure there is a long-term plan in place to further strengthen the well-being of the population as it relates to the water sector. Also notable is that agriculture continues to compete with other sectors for scarce resources such as water, land, labour and capital, and the GoB has increased its call for greater domestic food production through new and improved methods of farming as a response to climate change. Greater water availability, for irrigation purposes, should also lead to improved food security and health and well-being of the population. The outputs of Component 4 are critical to social acceptance and spur demand. The component target farmers and communities. In particular, the development of incentive programme and public awareness. During consultations with farmers, there was overwhelming consensus coming out of the discussions. Farmers are supportive of the use of treated wastewater. Farmers have been experiencing the impact of prolonged dry periods, which they say are happening more frequently and they are losing income. So having access to water would be a great relief to them. Some cited the benefit of the nutrients in the wastewater (See Baseline Report Wastewater Demand and Market Analysis).

Environmental Sustainability

This project has the potential to significantly increase overall environmental sustainability through the following activities:

- i. Producing tertiary quality reclaimed water that is safer for the environment (Activities 1.1.1 and 1.2.1). Previous studies by Irvine, Oxenford and Suckoo (2021) have demonstrated the positive impact that

the implementation of centralised wastewater systems have on the marine environment. The higher level of treatment and operation to be achieved through the upgrading, training and capacity building will ensure that the two Sewage Treatment Works continue to make a positive contribution⁵¹

- ii. Safeguarding of groundwater quality in Zone A through the installation of two decentralized wastewater collection and treatment systems (Activity 1.4.1)
- iii. Enhancing knowledge for the expansion of wastewater treatment technologies along the west coast for augmenting water supply and protecting the west coast ecosystem (Activity 3.2.1)
- iv. Frequently monitoring effluent characteristics and quality prior to reuse (aquifer recharge and/or agriculture reuse) which will safeguard groundwater quality and agriculture soil quality (Activity 1.3.2)
- v. Implementing a sewer monitoring programme that can reduce or mitigate vulnerabilities from excessive flooding and/or stormwater runoff that can otherwise result in environmental pollution from “overflowing” of the sewage system (Activity 1.3.1)
- vi. Installing renewable energy and energy efficient technologies (PV, automated controls and sludge dewatering) that will reduce GHG emissions (all of output 2.1)
- vii. Promoting water conservation, recycle, re-use options (Activities 4.2.2, 4.3.1 and 4.3.2)

In summary, with respect to Circular Economy, the use of reclaimed water provides a positive means of reducing demands on water resources. If this facility is not developed, then demand for water would have to be met through greater groundwater abstraction, depleting aquifers and enhancing the risk of saline intrusion.

The Government of Barbados through the Ministry of Agriculture and Food Security have determined the TDS concentration of reclaimed wastewater intended for agricultural irrigation applications must be less than 450 mg/L. Ayers and Westcot in 1985 (See Feasibility Study), has been repeatedly re-referenced for the Water Quality for Agriculture guidance, which indicates that regardless of the nature of the soil or application, a TDS of less than 450 mg/L is inconsequential, and TDS concentrations of up to 2000 mg/L may have a slight to moderate impact on soil that can be managed or addressed. This water quality standard takes into consideration the potential impact on existing irrigation systems that minimize the negative impact on the efficiency of the irrigation systems. For example, sprinkler systems are not recommended. However, drip irrigation is recommended and supported due to the characteristics of the TDS standard set by the authorities. This is intended to minimizing the chances of system clogs. As part of the monitoring of water quality process, the follow activities are critical:

- Activity 1.2.1: Install reverse osmosis (RO) membrane filtration systems to reduce the total dissolved solids concentration of the reclaimed water produced at the BSTP
- Activity 1.3.1: Implement a sewer monitoring programme that will include the installation of flow measurement and rain-gauging equipment at the BSTP to identify and address sources of inflow and infiltration to the sewer. Mechanisms that identify and reduce or mitigate vulnerabilities in the wastewater collection systems will also be investigated.
- Activity 1.3.2: Establish on-site laboratory facilities and personnel at the BSTP to generate influent and effluent water quality data to inform operations control strategies that optimize operations and reduce energy consumption and GHG emissions.
- Activity 1.3.3: Implement a Computerized Real-time Management System (CMMS) at the BSTP to inform decision making and climate resilient building
- Activity 1.2.1 is important for bringing down the TDS levels in the water; whereas, Activity 1.3.2 will support real time testing and monitoring of water quality, with protocols for shut off if there are unfortunate contaminants detected. 1.3.3 will allow for real time monitoring and automatic and remote shut-down of the system if need. This include the implementation of meters.

⁵¹ Cashman (2021)

The planning for long-term assessment and monitoring of residual in the soil under irrigation by reclaimed water has already started. The Ministry of Health and Ministry of Agriculture is developing protocol and procedure for monitoring medium to long-term changes in soil chemistry. This aspect was discussed during stakeholder consultation sessions and meetings of the Technical Working Group. Further, the monitoring of water quality standard will be carried out firstly by BWA at the plant level (operational standards) and the Ministry of Agriculture, in collaboration with Ministry of Health, through the Analytical Services Laboratory will conduct periodic testing and analyse water and wastewater samples. The Ministry of Environment through the Environment Protection Department, in collaboration with the Ministry of Health and Ministry of Agriculture and Food Security, will monitor the water quality and enforce codes governing usage of this treated wastewater.

Gender Equality

The issue of gender equality is high on the agenda for this project because issues emerging from the gender analysis point to the fact that a gender gap exists within the BWA related to more men than women being involved in the technical work of the Wastewater Sector Infrastructure and Services and that BWA appears to lack the human resource, institutional and information capacity to identify the causes of vulnerability among women and other vulnerable groups. The youth and community members will be considered beyond consultation for training as they will form an integral part of the Training and outreach activities, which is expected to result in the long-lasting paradigm shift. In addition, the public education plan and campaign being prepared will address all sectors of the community, users of reclaimed water and potential users of the produce or services, with targeted messages and sector specific town hall meetings and training.

The project, especially the co-financing component will continue to conform to the BWA's recruitment policy which does not discriminate based on gender, which is also in line with the GCF's and AE's policies and guidelines on gender and social inclusion. In addition, as an example, the Project will conduct Gender training with BWA staff and key stakeholders linked to Activity 3.1.1, *inter alia*, which aim for a 1:1 proportional representation of both genders engaged in these activities. The SOPs of the AE and the BWA include provisions for representation of both genders as the Gender Action Plan aims to be congruent with the obligations of the established Gender Action Commitments of the Green Climate Fund, which states: "By adopting a gender-sensitive approach in its mandate on climate change, the Fund commits to contributing to gender equality, as enshrined in international agreements and national constitutions, and other human rights agreements."

Therefore, the following key activities are earmarked for this project to strengthen gender equality within BWA's operations and the overall management of the water sector in Barbados:

- i. There will be stakeholder consultations throughout the lifetime of the project that will aim to engage women's groups and other vulnerable groupings (all Components)
- ii. There will be social and gender safeguards to ensure that women, children and the vulnerable are protected during community infrastructure improvements (Activity 1.4.1)
- iii. There will be gender sensitive community engagement to ensure that needs of both female and male headed households are incorporated when installing decentralized wastewater treatment systems in the Belle Zone A area and Bellevue Gap Zone A (Activity 1.4.1)
- iv. There will be a gender sensitivity training programme for BWA staff (Activity 3.1.1)
- v. The updated SOPs and operational manual to include gender and social inclusion considerations, including provisions of the prevention of SGBV (Activity 3.1.2)
- vi. The legislative review will ensure to promote gender equality and limit gender biased legislative provisions (Activity 4.1.1)

- vii. The water and sanitation master plan ^{and the} ~~and the~~ engagement strategy for the private sector will collectively mainstream gender and promote women empowerment, as appropriate (Activities 4.1.2 and 4.2.1)
- viii. A gender sensitive and socially inclusive incentive programme will be developed to encourage water conservation, recycle, re-use (Activity 4.2.2)
- ix. The management of the expanded RAFF will ensure to promote gender equality as a requirement (Activity 4.2.3)
- x. The PEA campaign will be designed to be gender sensitive (Activity 4.3.2)
- xi. The project's webpage will also ensure to report project results disaggregated by gender, where possible (Activity 4.3.3)

See Section G.2 for more details on gender mainstreaming in the 3r-CReWS

C. FINANCING INFORMATION						
C.1. Total financing						
(a) Requested GCF funding (i + ii + iii + iv + v + vi + vii)	Total amount			Currency		
	39,390,913			USD		
GCF financial instrument	Amount	Tenor		Grace period	Pricing	
(i) Senior loans	<u>Enter amount</u>	<u>Enter years</u>		<u>Enter years</u>	<u>Enter %</u>	
(ii) Subordinated loans	<u>Enter amount</u>	<u>Enter years</u>		<u>Enter years</u>	<u>Enter %</u>	
(iii) Equity	<u>Enter amount</u>				<u>Enter % equity return</u>	
(iv) Guarantees	<u>Enter amount</u>	<u>Enter years</u>				
(v) Reimbursable grants	<u>Enter amount</u>					
(vi) Grants	39,390,913					
(vii) Results-based payments	<u>Enter amount</u>					
(b) Co-financing information	Total amount			Currency		
	10,608,150			USD		
Name of institution	Financial instrument	Amount	Currency	Tenor & grace	Pricing	Seniority
Barbados Water Authority (BWA)	<u>GrantGrant</u>	<u>10,608,150</u>	<u>USD (\$)</u>	Enter	<u>N/A</u>	N/A
(c) Total financing (c) = (a)+(b)	Amount			Currency		
	49,999,063			USD		
(d) Other financing arrangements and contributions (max. 250 words, approximately 0.5 page)	Tax Exemptions					
	<p>Goods and Services procured with the GCF Proceeds for the implementation of the Project will be exempt from eligible taxes and duties accorded under Article XIX and Article XXVI of the Caribbean Community Climate Change Centre (CCCCC) Act, 2015 and Article 19 of the Agreement Establishing the Caribbean Community Climate Change Centre (CCCCC). The BWA, as statutory body, also enjoys tax exemptions from eligible taxes and duties. However, any applicable taxes that is not covered under the instrument establishing the respective entities, the project shall be borne these cost and the Fund shall not be required to make any additional contribution for the payment of taxes during the implementation of the Project.</p>					
(d) Other financing arrangements and contributions (max. 250 words, approximately 0.5 page)	Parallel Financing					
	<p>The BSTP is public owned and is managed by the BWA, which is a Statutory Body, charged with supplying the island with potable water as well as the provision of wastewater treatment and disposal services to the sewerred areas of Bridgetown and the South Coast. The BWA is also responsible for the monitoring, assessment, control and protection of the water resources in the public's interest. Recalling Table 3; there is approximately USD133 Million in upgrades planned for the SCSTP. In an effort to mitigate the effects of climate change on the island's potable and non-potable water supply and increase resilience to climate change and reduce the impact of the primary treated effluent on the</p>					

	<p>marine environment, BWA secured funding for the upgrade of the SCSTP to tertiary treatment level that is suitable for crop irrigation and recharge of groundwater aquifers through a newly designed and constructed water reclamation distribution network system. Specifically, non-potable water reclamation involving use of reclaimed water for agricultural food crop irrigation in River Plantation area and for non-potable aquifer recharge in Christ Church aquifer will be advanced. Properly managed water reclamation projects are and will continue to be essential for the island's sustainable water resource management and sustainable development.</p> <p>In-Kind Contributions are not identified in the budget above; however it is envisioned that during implementation, the project will benefit from some in-kind contribution from the Government of Barbados and the BWA through the provisions of meeting/training rooms and the utilities and facilities to facilitate capacity building and sensitization events. Further, the BWA mechanical machinery and equipment are available and required these may be provided to support the smooth implementation of the project activities. The BWA and CCCC will keep track of these in-kind contribution and report on these as deemed necessary.</p>
--	--

C.2. Financing by component

Component	Output	Indicative cost million USD (\$)	GCF financing		Co-financing		
			Amount million USD (\$)	Financial Instrumen t	Amount million USD (\$)	Financial Instrumen t	Name of Institutions
Component 1: Wastewater Reclamation and Reuse	Output 1.1 The Bridgetown Sewage Treatment Plant (BSTP) is upgraded to treat wastewater to a tertiary water-quality standard.	25,672,660	25,672,660	Grants	-		
	Output 1.2 Tertiary wastewater available to supplement non-potable use	8,637,000	2,530,000	Grants	6,107,000.00	Grants	GOB/BWA
	Output 1.3 Decision-support tools and infrastructure implemented to mitigate potential climate change risks to the wastewater collection and treatment systems	1,003,375	1,003,375	Grants			
	Output 1.4 Decentralized treatment plants or cluster treatment facilities installed	3,230,000	-		3,230,000.00	Grants	GOB/BWA
Component 2: Renewable Energy and Energy Efficiency in	Output 2.1 Energy efficiency and renewable energy technologies implemented	3,264,000	3,264,000	Grants			

Wastewater Treatment							
Component 3: Capabilities to operate, maintain, expand and monitor wastewater and related renewable energy technologies	Output 3.1 Improved technical capabilities of waste water technical personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management	1,139,056	1,139,056	Grants	-		
	Output 3.2 A strategic plan is developed to guide the replication of the brackish water RO treatment plant along the west coast corridor	486,000	486,000	Grants	-		
Component 4: Capacities (regulatory, governance, awareness), buy-in and ownership within the private and public sectors improved for climate resilient development planning for the water sector	Output 4.1: Governance and planning roadmap developed to enable wastewater reuse in the public and private sectors.	445,000	149,000	Grants	296,000.00	Grants	GOB/BWA
	Output 4.2: Mechanisms developed/expanded to encourage the adoption of wastewater treatment and reuse applications by private individuals and businesses	352,000	352,000	Grants	-		
	Output 4.3 Gender Sensitive Public Education and Awareness Campaign Implemented.	858,785	858,785	Grants			
Project Management	Project Management Resources	2,220,280	1,750,280	Grants	470,000.00	Grants	GOB/BWA
	Monitoring and evaluative data generation and collection activities	160,000	160,000	Grants			
	Financial Audits	150,000	150,000	Grants			
Indicative total cost (USD)		47,618,156	37,515,155.51		10,103,000.00		
Contingency *		2,380,908	1,875,757.78		505,150.00		
Total		49,999,063	39,390,913.29		10,608,150.00		

* Contingency is expected to cover unforeseeable expenditures and changes related unforeseen adjustment in prices, particularly inflationary pressures that outside the control of the project, and unpredictable events during project implementation which do not constitute a Major Change. Approval, in writing, for the use of contingency on a case by case basis is required from the GCF.

C.3 Capacity building and technology development/transfer (max. 250 words, approximately 0.5 page)

C.3.1 Does GCF funding finance capacity building activities? Yes No

C.3.2. Does GCF funding finance technology development/transfer? Yes No

Capacity Building Activities

Outcomes 3 and 4 of this project will include targeted capacity building activities. Under outcome 3 there will be specialized and customized training for BWA employees to be able to operate, manage and maintain the upgraded systems installed under this project (Activity 3.1.1). This includes training in the PV installations, the CAS equipment upgrades, RO technology implemented, decentralized treatment sites equipment installed, automated systems installed such as the CMMS, the sewer monitoring instrumentation and the updated SOPs, and the operational manual and risk management framework to be implemented (See Activities 3.1.2 and 3.1.3, respectively). There will also be training in SCADA, which is currently in place but not operable since the BWA does not have the technical knowledge or expertise to maintain it. Also, there will be a University of the West Indies Gender Sensitivity Training program developed for BWA that examines climate change and the nexus with the water sector and gender considerations. Notable is that some of these trainings will also be open to the private sector, as appropriate, to support the sustainability of the investments made through the RAFF mechanism. This Project will expand the RAFF to support the Private Sector’s engagement in the wastewater sector. For example, adopting technologies that support the delivery and utilization of tertiary reclaimed water. In addition, the RAFF is seen as critical element to engaging the private sector; however, the existing RAFF needs to examine and expand to consider how resources could flow in and out to support activities related to the adoption of decentralize treatment systems as well as dual pumping, *inter alia*.

Under outcome 4, there will be capacity building at two levels: (i) re-education of communities on how to use reclaimed water and best practice for agriculture and other non-potable uses, teachers, students, farmers and businesses about the impact of climate change on water resources and their impact on water quality and quantity (availability as well as the importance of water reuse activities and indirect potable reuse (IPR)) to building climate resilience (Activity 4.3.1); and (ii) a gender-sensitive public education and awareness campaign examining the same issues of climate resilience and the water sector and the role of wastewater treatment and reuse, conservation, recycling etc (Activity 4.3.2). The key difference is that the first capacity building activity will be more structured, such as short courses, whilst the second will be more mass media type information products. See Section B.3 (Project description) for more details on these activities.

The combined budget for Activities 3.1.1, 4.3.1 and 4.3.2 is USD1.3 million.

Technology Transfer Activities

Majority of outcomes 1 and 2 of this project are heavily focused on technology solutions and innovations that are instrumental for the move towards a low-emission and climate resilient pathway water and wastewater sector in Barbados. Outcome 1 is primarily focused on upgrades to wastewater treatment that will improve its quality to a level that is eligible for reuse functions including aquifer recharge and irrigation of agricultural land. The upgrade option selected is the Conventional Activated Sludge (Activity 1.1.1) with a Reverse Osmosis (RO) Plant (Activity 1.2.1) because of (i) lowest capital cost, (ii) lowest power consumption & least Green House Gas associated emissions, (iii) lowest expected operator staff time (operating cost), (iv) most familiar technology for operations staff, (v) ability to meet the Barbados government’s proposed reuse water quality standard, (vi) and simplest use of existing infrastructure and process components for the upgrade to the BSTP. Outcome 1 also

includes investments in decision support tools, which include a sewer monitoring programme that is equipped with flow measurement and rain-gauging equipment at both the Bridgetown and South Coast Sewage Treatment Plants to identify and address sources of inflow and infiltration to the sewer (Activity 1.3.1) and a Computerized Real-time Management System (CMMS) to inform decision making and climate resilient building (Activity 1.3.3). The final output for outcome 1 (output 1.4) is highly innovative in nature since the GOB will be piloting decentralized wastewater collection and treatment systems at two “Zone A” locations to produce reclaimed water for domestic/commercial non-potable applications. The lessons emerging from this output will be critical for scaling up and replicating this approach to wastewater management in communities not connected to the STPs (i.e. 95% of Barbados) as well as in other Caribbean countries

All of outcome 2 (installations of PV, automated controls for energy efficiency (EE) and sludge dewatering) is about renewable energy (RE) and energy efficient technology transfer, which not only supports the achievement of GCF’s low-emission impact potential, but the GOB’s goal to have zero emission by 2030 as enshrined in the Barbados National Energy Policy (BNEP) 2019-2030.

A key element of technology transfer is having the right incentives and legal framework in place. In this regard, activities 4.1.1 (legislative review) and 4.2.2 (incentive programme) can be considered as key.

The combined budget for Activities 1.1.1, 1.2.1, 1.3.1, 1.3.3, 1.4.1, 4.1.1, 4.2.2, 4.3.2 and all of outcome 2 is USD42.9 million.

D. EXPECTED PERFORMANCE AGAINST INVESTMENT CRITERIA

This section refers to the performance of the project/programme against the investment criteria as set out in the GCF's [Initial Investment Framework](#).

D.1. Impact potential (max. 500 words, approximately 1 page)

Contribution to the Fund's Objectives

The 3R-CReWS project is directly aligned to the Fund's strategic vision of promoting the paradigm shift towards low-emission and climate-resilient development pathways in the context of sustainable development and supporting developing countries, like Barbados, to implement the requirements of the Paris Agreement and the UNFCCC. Overall, the project is anticipated to have an impact on 136,220 direct beneficiaries and indirectly benefit 141,601 persons. Given the importance of water to the health sector and the two main productive sectors of Barbados - agriculture and tourism, the importance of this project for promoting sustainable development is underscored.

Mitigation Impact

It is expected that this project can avoid about 35,275 tCO₂e over 25 years (See Annex 22 for calculations). The policy and regulatory environment in place in Barbados are currently highly conducive for the use of renewable energy technologies. The GOB is pursuing a goal of zero emission by 2030 and the policy for a climate-neutral Barbados is regulated in the Electric Light and Power Act (ELPA), which prescribes feed-in tariffs related to solar, land-based wind, anaerobic digestion and solid biomass. This project will maximize the renewable energy sources that can benefit from feed-in tariffs whilst also facilitating a shift to low-emission sustainable development pathway in Barbados. The noted CO₂ equivalent emission reduction from this project is purely based on the 1 MW of PV to be installed to offset the increased power consumption associated with the upgrades. However, it is also notable that EE will be increased through the installation of variable frequency drives, EE pumps and a sludge dewatering system. There is not adequate information available at the proposal stage, such as characteristics of the sludge, to estimate reduced emissions due to EE; however, the monitoring plan for the project aims to track the changes in EE over the lifespan of the project.

Also notable is that the BSTP is estimated to consume about 4,500 kWh of energy per day which equates to energy costs of USD470,000 per year⁵². Currently there is 0.18MW of PV power installed and through this project, an additional 1MW of PV panels will be mounted to off-set the demands of the upgraded system.

Adaptation Impact

All of the components of this project are designed to contribute to increased climate-resilient sustainable development with emphasis on the water and wastewater sector. The following specific details per component of this project should be noted and how they promote climate-resilient sustainable development in Barbados:

- **Component 1** will not only install wastewater treatment technologies that are energy efficient, but several decision support tools will be implemented to support the management and maintenance of the upgraded STP, particularly for hydrometeorological hazards such as rainfall, including severe storms. The decentralized package collection and treatment systems that will be constructed in two communities located in Zone A will address severe water shortages for approximately 225⁵³ households and is considered to be a "good demonstration" of strengthening the adaptive capacities of individuals and businesses to climate risks associated with water availability

⁵² Cashman, 2021

⁵³ The 225 households are to benefit in terms of "reducing water shortages" entails direct and indirect benefits from the decentralized treatment facilities by establishing access to wastewater treatment facilities, thus resulting in reclaimed water for non-potable purposes and reducing the strain on the potable water resources. In addition, this also increases their resilience to water shortages, as additional non-potable water resources would be available.

- **Component 2** is primarily focused on renewable energy and energy efficiency, however, climate resilience is being promoted in the infrastructure installed, where appropriate, for example the PV systems will utilize solar panels resistant of at least Category 3 hurricane.
- **Components 3 and 4** will collectively create an enabling environment for the implementation of climate-responsive wastewater technologies and the use of reclaimed water. This will be achieved through the strengthening of (i) institutional and regulatory systems (ii) awareness of climate threats and risk-reduction processes and (iii) adaptive capacity and reduced exposure to climate risks. In terms of institutional strengthening, the targeted training for operators will promote awareness of water availability and the nexus with climate variability and change and SOPs to be developed will be mindful of climate risks posted to the upgraded system and measures to mitigate/manage these risks. The legislative review will ensure to promote climate change and the water sector as well as identify any gaps for further strengthening of climate resilience. The public re-education and awareness programmes will also highlight the nexus between water availability, climate change and the role of reclaimed water in building resilience. This critical for enhancing knowledge and attitude toward reclaim water as the famers, schools and communities will be engaged through various medium, including formally organised events, training sessions, structure weekly TV and radio programmes, and social media.

D.2. Paradigm shift potential (max. 500 words, approximately 1 page)

3R-CReWS paradigm shift

This project aims to enable a paradigm shift in the wastewater management practices of Barbados that includes the use of low carbon and climate resilient water and energy management technologies and strategies that ensures water is protected, managed, recycled, reused, and conserved to enhance the health, wellbeing and productivity of Barbadians. Based on the TOC, this will be realized through four outcomes that are inter-dependent and complementary to provide a holistic approach to achieving this goal. The medium-term results (outcomes) of this project will enable the technology transfer required for adaptation to, and mitigation of, climate change and will establish the foundation for sustainability, innovation and market transformation through the strengthening of (i) governance and legislative frameworks, (ii) technical capacities and capabilities among the key stakeholders of the project, and (iii) private sector and public buy-in and leadership. For more details at the output and activity level in Sections B.2 (a) and B.3.

Achieving this paradigm shift required the project design to place emphasis towards putting processes, structures, stakeholders, knowledge and systems in place that would catalyse scalability, replicability, learning, and an enabling environment. The sections below demonstrate how the project addresses these areas to increase the paradigm shift potential.

Scaling-up and replication

In the context of Barbados, the interest in the use of reclaimed water has been documented for some time; for example, the IWRM Road Map for Barbados, which was drafted in 2008, identified the need to encourage reclamation of wastewater as a key recommendation from stakeholder consultations. Further, additional interviews that were undertaken during the PPF phase of this project confirmed that there is still strong support for the use of reclaimed water for non-potable uses. Examples of types of non-potable uses and level of support by interviewees are depicted in the Figure 14 below.

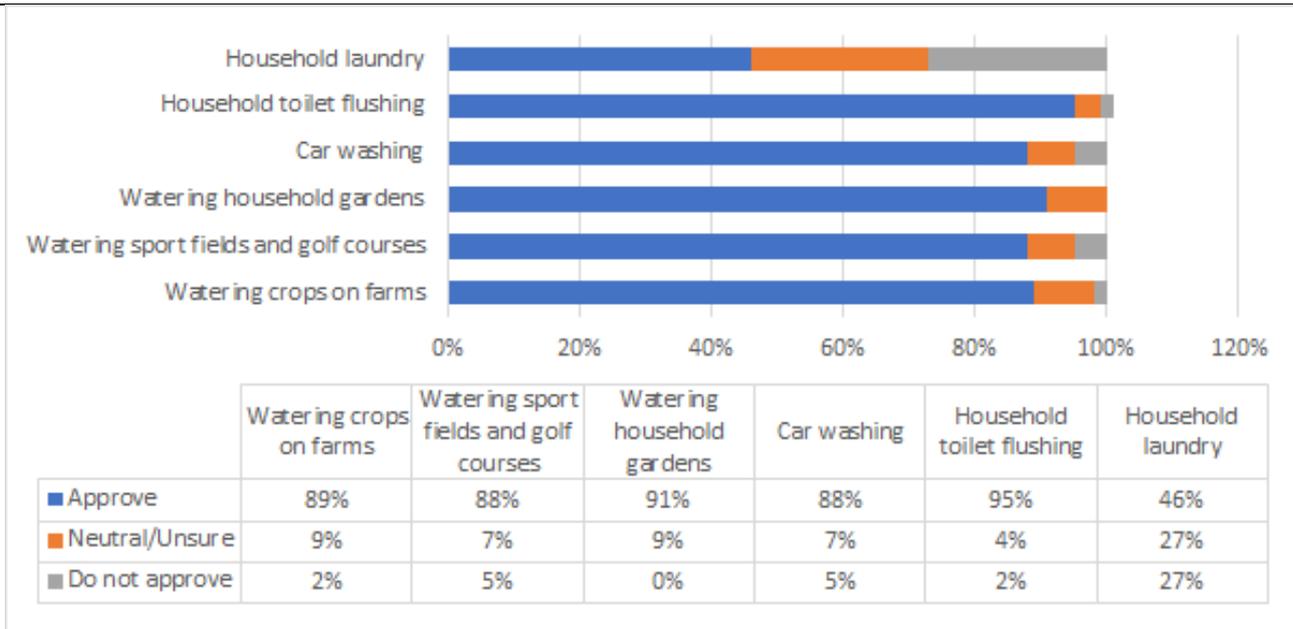


Figure 14: types of non-potable uses and level of support by interviewees
Source: Feasibility Study Report (2021)

Apart from a clear signal of interest, including at the policy level; the demand for reclaimed water from just the perspective of the agriculture sector is high. For instance, the overall estimated volume of reclaimed water that will become available (supply) from the upgrade to the BSTP is 5000 m³/day (baseline scenario) with a projected 21,900 m³/day by 2050 and noting that in the southern part of Barbados alone, there is at least 2,700 hectares⁵⁴ of land eligible for irrigation, and given that the irrigation water needs is between 35 to 50 m³/hectare/day, then a minimum of 94,500 m³/day and a maximum of 118,500 m³/day would be required (demand)⁵⁵. The implication of these figures is that the demand for reclaimed water for agricultural irrigation outweighs the volume that will be made available by this project; this high demand is testament of the urgent need and high potential for scalability and replicability of this project.

Further, this project’s scalability and replicability will be enhanced by specifically targeting a combination of activities targeting private sector engagement (see more details in Section B.3, Output 4.2 and some of Output 4.3) since they can have an important role in scaling the decentralized wastewater collection and treatment systems in areas not serviced by the BSTP or SCSTP. Recalling that these two plants only serve 5% of the population of Barbados, then the scope for scaling this technology is expansive.

Given that there is existing interest in the use of treated wastewater, coupled with the types of activities targeted by this project that will enhance opportunities for the private sector and households to advance the application of wastewater treatment technologies, then this project is further considered to have high potential for scaling up without equally increasing the total costs of implementation.

Further, the highly innovative nature of this project provides strong potential for replication across the Caribbean. It should be underscored that Barbados is a role model for the Caribbean leading in many development areas, in particular, the country’s approach to climate change mitigation and adaptation. A crucial example is the Barbados’ Roof to Reef programme (R2R), which has been recently applauded by the GCF Executive Director, Dr. Glemarec. In a recent mission he stated that *“We are indeed extremely interested in the Roofs to Reefs Programme approach because it could serve as a model to a number of countries on how to integrate water, land, agriculture, energy in a conservative approach. So for me this visit*

⁵⁴ 2,700 is the total hectares of land eligible for irrigation in the southern part of the island; however, this project is delivering water to 235 hectares.

⁵⁵ Cashman, 2021

is worth gold..."⁵⁶. This is to say that lessons and recommendations emerging from this project, which is aligned to the delivery of the R2R, can provide guidance and serve as a model for other Caribbean countries that are also exposed to the same climate risks and effects.

Knowledge Sharing and Learning

A majority of the components of this project have activities to support the creation or strengthening of knowledge, collective learning processes or institutions. Component one will include the installation of several decision-making tools to address data gaps that exist and facilitate enhanced management of the upgraded STP. For example, the on-site laboratory at BWA (Activity 1.3.2) for monitoring influent and effluent will collect data that is important for promoting transparency and accountability in terms of treated wastewater quality, which in turn, will have an important role in building and maintaining consumers' trust in wastewater as a resource and the overall impact of this project and beyond its life. There are also important monitoring systems that will be installed that will provide data on flow rates (Activity 1.3.1) for better managing climate change related risks that can impact on the wastewater system. The resulting datasets from the various monitoring systems will not only address a serious data gap that exists at the BWA, but more importantly, it will allow for enhanced estimations of wastewater characteristics and the performance of the upgraded system, including the impacts of climate change and GHG emissions (from biosolids). Components three and four are heavily focused on training of technical wastewater personnel and Public Education and Awareness (PEA), respectively. The former is important for strengthening institutions and the latter for further strengthening buy-in for the adoption of wastewater technologies and use of reclaimed water. This project will also have a monitoring and evaluation plan and a dedicated webpage (Activity 4.3.3) for reporting and sharing of lessons and best practices.

Also notable is that the President of Barbados, who was the Chair of the Conference of Heads of Government of the Caribbean Community (CARICOM) between January 1st and June 30th, 2020, serves as the Lead Head of Government within CARICOM, bearing responsibility for the CARICOM Single Market and Economy (CSME)⁵⁷. This provides a conduit for the President to share innovative technologies and case studies, such as this project, among other Heads of Government for visibility and replication. In addition, the role of the CCCCC, a CARICOM Specialized Agency, as the Accredited Entity that will implement this project means that they are also well positioned to share lessons on this project for replications in other CARICOM States. The BWA is member of The Caribbean Water and Wastewater Association (CWWA), which is a regional non-governmental organization established by an Act of Parliament in Trinidad & Tobago in 1991. The CWWA is a grouping of water, wastewater and solid waste professionals in the public and private sectors. Through the avenue the BWA will share the lessons learnt. Further, the project will develop a project website, which is critical knowledge management and dissemination tool. Lastly, the CCCCC as regional organization is home to the largest repository of climate change data and information, including lessons learnt, for CARICOM member states. The lessons learnt from this project will be shared with other countries in region.

Creating an Enabling Environment

Primarily components 3 and 4 of this project will have long lasting effects on the sustainability of outcomes and results beyond completion of the intervention. Under component three, investments in technical capacities to operate, maintain and monitor the wastewater and renewable energy technologies being implemented is key for sustainability. This is why customized training certification will be developed by this project in collaboration with academic institutions for access by all BWA employees with considerations for access by contractors, project partners, and other key stakeholders in Barbados. Having a cadre of highly trained operators at the BWA will ensure that there is a well-developed preventative maintenance (PM) program to extend the life of the equipment and to keep it functioning at the design level to maintain effluent

⁵⁶ <https://barbadostoday.bb/2021/10/26/bdos-project-model-hailed-as-best-practice-for-climate-change-mitigation/>

⁵⁷ This is an arrangement among the CARICOM Member States for the creation of a single enlarged economic space through the removal of restrictions resulting in the free movement of goods, services, persons, capital and technology.

quality and reduce any environmental impacts or health and safety issues. Majority of component four is designed to strengthen the enabling environment. Specifically, the outputs will ensure that there is awareness of the up-to-date legislation, mechanisms are in place bolstering private sector engagement in the provision and adoption of wastewater treatment technology through various approaches (engagement strategy, incentive programme, expanding the RAFF and targeted PEA materials). All of these activities are considered to be essential in light of the baseline situation and once implemented successfully, the national capacity would be strengthened to sustain and scale up the use of wastewater technologies and reclaimed water in Barbados.

Regulatory Framework and Policies

The GOB, as an indication of their commitment to advancing water security in Barbados, has updated several legislations (See details in Section B.3, Output 4.1). The aim of this project is to review them and outline a road map for promoting them as well as highlighting recommendations for addressing any gaps identified, particularly as it relates to ensuring sustainability of the results of this project. Further, a water and sanitation master plan will be developed, which is a strategic planning document that will give life to the recently updated legislations. Collectively, these outputs will help to strengthen the overall regulatory and policy frameworks governing wastewater in Barbados.

Contribution to National Climate-Resilient Development Pathways

Component two of this project strongly supports the achievement of the Barbados National Energy Policy (BNEP) 2019-2030, which aims to achieve the 100% renewable energy and zero emission by 2030. Centralized wastewater management relies on expensive high-emission electricity supplied from conventional power plants that use fossil resources, which not only increases operational costs but also contributes to global warming.

This project is also in support of the achievement of the R2RP. The R2RP provides the overarching framework that allows the integrated approach to addressing the negative impacts of climate change. The R2RP is the Government’s sustainable development model for the next decade and represents the country programme for Barbados. The primary focus is on improving the social and environmental circumstances of the people in Barbados. The R2RP will enhance the country’s ability to recover from climatic events and is hinged on six thematic areas: Shelter, Water, Energy, Waste, Land use, and Ecosystems Management. This project is in alignment with 4 (Water, Energy, Waste and Ecosystems Management) of the 6 thematic areas. Notable is that the thematic areas under the R2RP are also aligned to Barbados’ Nationally Determined Contribution (NDC) priority areas.

D.3. Sustainable development (max. 500 words, approximately 1 page)

Linkages between 3R-CReWS and the SDGs

The benefits and priorities of this project are fully aligned with several SDGs. A mapping of the project results to the SDGs shows that there is alignment with 8 out of the 17 SDG goals. See details in the Table 4 below.

Table 4: Linkages of the Project to the SDG Goals and Targets

Benefits and Priorities of 3R-CReWS	Linkage to SDG Goals	Linkage to SDG Targets
Overall, the four components of this project aspire to achieve Goal 6, 13 and 17 through the use of carbon neutral and climate resilient water and energy	Goal 6 CLEAN WATER AND SANITATION	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

<p>management technologies and strategies that ensures water is protected, managed, recycled, reused, and conserved</p>		<p>6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate</p> <p>6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes</p> <p>6. By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies</p> <p>6. B Support and strengthen the participation of local communities in improving water and sanitation management</p>
	<p>Goal 13 CLIMATE ACTION</p>	<p>13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries</p> <p>13. A Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green</p> <p>13. B Climate Fund through its capitalization as soon as possible</p> <p>Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities</p>
<p>The upgrades to the BSTP (achieving tertiary reclaimed water quality and renewable energy use) and the 2 decentralized treatment systems to be installed in Zone A are in support of the transfer and dissemination of environmentally sound technologies</p>	<p>Goal 17. STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT</p>	<p>17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed</p>
<p>Component 1: Wastewater Reclamation and Reuse</p>		
<p>The production of high-quality reclaimed water suitable for reuse by agriculture farms in Barbados will be particularly</p>	<p>Goal 2 ZERO HUNGER</p>	<p>2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for</p>

<p>beneficial during the dry season and drought periods, which are projected to be more severe due to climate change.</p>		<p>adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality</p>
<p>Less wastewater will be sent to the marine environment via outfalls</p>	<p>Goal 11 SUSTAINABLE CITIES AND COMMUNITIES</p>	<p>11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management</p>
<p>Component 2: Renewable Energy and energy efficiency in wastewater treatment</p>		
<p>A high priority of this project is to promote renewable energy to offset the additional energy needs of the upgraded system while contributing to GHG emission reduction</p>	<p>Goal 7 AFFORDABLE AND CLEAN ENERGY</p>	<p>7.2 By 2030, increase substantially the share of renewable energy in the global energy mix</p> <p>7.3 By 2030, double the global rate of improvement in energy efficiency</p> <p>7. B By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries</p>
<p>The upgraded BSTP will be retrofitted with decision making tools and infrastructure that optimizes performance of the upgraded system.</p>	<p>Goal 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p>	<p>9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities</p> <p>9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States</p>
<p>Component 3: Capabilities to operate, maintain, expand and monitor wastewater and related renewable energy technologies</p>		
<p>Component 4: Capacities (regulatory, governance, awareness), buy-in and ownership within the private and public sectors are improved for climate resilient development planning for the water sector.</p>		
<p>Training, PEA and employment opportunities to promote equal opportunities for men and women.</p> <p>The legislative review will include recommendations for enhancing equal opportunities and access to men and women in the water and wastewater sector. Also, the water and sanitation master plan will take into consideration social and gender related risks in the</p>	<p>Goal 5 GENDER EQUALITY</p> <p>GOAL 4 LIFELONG LEARNING OPPORTUNITIES FOR ALL</p>	<p>5.5 Ensure women’s full and effective participation and equal opportunities for leadership at all levels of decision making in political, economic and public life</p> <p>5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels</p>

design and prioritization of water reuse strategies.		
--	--	--

In addition to the foregoing, the impact potential of this project from an environmental, social, economic and gender-sensitive development perspective is highlighted below.

- **Environmental co-benefits**

- This project can avoid approximately 35,275 tCO₂e over the estimated 25 years' lifespan of the PV to be installed
- Improved testing capacities at BWA will ensure effluent meet environmental standards for use by agriculture sector and aquifer recharge
- Improved air quality in the areas in proximity of the plants from the enhanced systems to deal with biosolids.
- Reduced groundwater contamination at the sites within Zone A benefiting from decentralized wastewater treatment systems
- Increase groundwater supply by using the reclaimed water to replenish aquifers thereby creating a greater amount of potable water and increasing water security through indirect potable reuse.
- Reduced wastewater runoff and nutrient loading in the marine environment.

- **Economic co-benefits**

- Construction works to be done under this project at the BSTP and 9km pipeline will create jobs and new opportunities for local business, which will lead to positive impacts on local income, increased trading activities, empowerment of local contractors and suppliers. Construction will create more than 100 temporary jobs which is significant considering the size of Barbados' active population (~100 thousand persons), all of which should be recruited locally. To this number, dozens more temporary jobs will be added from the Consultancies related to baseline studies and strategic plans to be developed under this project. Whilst these will be open to international tender, there are local Universities and technical experts that exist and could potentially secure some of the contracts
- As a statutory institution of the Government of Barbados, the project will reduce, in the short and medium, the demand for foreign exchange and external debt financing. The mix of financing instruments being used for development in the water and wastewater sector (not limited to 3R-CReWS) will aid in easing the fiscal constraints facing the country.
- Increase in energy security and the achievement of low-carbon operations at the BSTP will reduce operational costs
- Training will enhance preventative maintenance, which will extend the life cycle of the equipment and help to reduce breakdown maintenance that can come with a high financial and environmental cost
- There should be increased private sector interest and engagement in the adoption of wastewater management technologies and use of reclaimed water and other by-products. This will promote technology transfer and the emergence of a market related to the wastewater sector that will generate green jobs and have positive impacts on the economy.

- **Social co-benefits**

- There will be an increase in potable water security by eliminating potable water demands for applications that can use non-potable reclaimed water, as well as the increased use of reclaimed water would also allow the agricultural industry to be more resilient to the impacts of climate change.
- Improve awareness and buy-in from the public, farmers, teachers, students, businesses, tourists and stakeholders (including the BWA) associated

- Improved testing capacities at BWA will ensure effluent quality meets health standards.
 - Improved data (from flow meters, laboratory tests, CMMS) will enhance evidence-based decision making as it relates to the management of the BSTP for meeting the needs of its stakeholders
 - The primary use of the water will be for irrigation purposes; however, when the demand for the reclaimed water decreases the water will be used to recharge the aquifer. It is important to note that although the primary use is for agricultural purposes, the recharge of the aquifers is important; however, use for agriculture decreases the demand pressures on the aquifers.
- **Gender-sensitive development impact**
 - Gender-sensitive development is a priority for this project as evident by its investment in long term strategies and plans for the water sector that promote gender equality and women empowerment and/or gender related risks to amplify the project's gender sensitive development impact.
 - A gender sensitive PEA campaign will ensure stakeholders are aware of their gendered impact on water quality and quantity (availability) as well as the gendered effects of climate change on the water sector. Appropriate mediums for information dissemination (including the project's webpage on BWA website) will be utilized to ensure that women and men and specific vulnerable groups have access to the information
 - The project will result in increased participation of women in the production and use of reclaimed water.
 - More details on the gender mainstreaming activities are details at sections B.6 (Exit Strategy and Sustainability) and G.2 (Gender Assessment and Action Plan)

D.4. Needs of recipient (max. 500 words, approximately 1 page)

Vulnerability of Barbados

Barbados exhibits many of the characteristics of Small Island Developing States (SIDS) that makes it vulnerable to the effects of climate change and other extreme hydro-meteorological events. These characteristics include relative geographical location, small physical size, concentrations of population and infrastructure in narrow coastal areas, restricted economic base and reliance on natural resources, combined with inadequate, technical and institutional capacity for adaptation (Mimura et al. 2007). Majority of Barbados's critical infrastructure, population and economic activity is located within the coastal zone. Specifically, over 60% of the island's total population is located in the three coastal parishes of St. James, St. Michael and Christ Church on the west and south coasts. Therefore, the vulnerability of the population and critical infrastructure to sea level rise, storm surge and inundation is high as a result of its location.

Environmental risks: Barbados faces the adverse effects of climate change and natural hazards, with their attendant economic and social challenges, including unsustainable debt levels, arising in part from extreme weather events and slow onset events impacting national income flows, increasing indebtedness and impairing repayment capacity. For those reasons and given that the climate crisis affects both the natural environment as well as the social and economic stability of the country, Barbados considers climate change to be a significant threat to its growth and prosperity. When vulnerability is examined as an aggregate function of demographic and socio-economic inputs, this country is among those Caribbean nations most vulnerable to climate change. Further, there are factors unique to the country that add to or further complicate its environmental risks, and include, among others⁵⁸:

- Water scarcity as a result of Barbados's unique hydrogeology;
- Relatively early socio-economic development compared to other SIDS in the region, which has led to a highly modified natural environment, unsustainable development practices in the past, loss of ecosystem services, lack of green spaces, ageing infrastructure and housing stock, among others; and,

⁵⁸ Stennett-Brown (2019) <https://doi.org/10.1371/journal.pone.0219250.g008>

- High population density, which leads to high demand for already scarce resources, competition for space, exacerbated risk of natural hazards, etc.

Social and economic risks: Climate change will impact already vulnerable groups disproportionately, including youth and women, as well as lower income communities. Alongside the direct environmental effects of climate change, the following social and economic impacts are equally important:

- Health: including increased heat stress and greater prevalence of water and vector-borne diseases;
- Tourism: including damage to coastal tourism infrastructure, biodiversity and landscape. Any negative change in the quality of these tourism products will impact on the sector's desirability, demand and competitiveness.
- Water resources: reduced water availability for the population of Barbados resulting from drought or groundwater contamination from flooding, soil or pollutant infiltration or saline intrusion; and Fishery and agricultural industries: loss of domestic and/or international competitiveness resulting from drought, flooding and storm damage, saline intrusion, pest and invasive species outbreaks and spread, and ecosystem destruction.

This project directly addresses the risks of reduced water resources, which are further amplified by climate change, through wastewater recycling and reuse, associated with climate change in Barbados. This is a dilemma currently being faced by all persons in Barbados, albeit the vulnerable groups that this project will address include farmers. The island's drinking water supply is used extensively by small farmers as their irrigation water supply. There is extensive use of conventional sprinkler systems and drip irrigation systems since the government offers rebate incentives for the use of sprinkler and drip irrigation systems but there is no surface irrigation (basin, furrow, flood recession) in the conventional sense, but the term is used to include the use of garden-hose flooding and hand-watering; and there is little reuse of wastewater for irrigation. It should further be recognized that women, who are among the most vulnerable to climate change, comprise majority of the labour force involved in land preparation, weeding, crop protection and irrigation⁵⁹.

Economic and Social Development Level of the Country

The Inter-American Development Bank's Barbados Survey of Living Conditions 2016/2017 found that overall levels of poverty were rising, up from 15% in 2010 to 17%. A further 11% of the population was considered to be vulnerable. The Survey estimated that 21% of women were poor while 14% of men were poor. In addition, 13% of women were considered vulnerable while 10% of men were considered vulnerable. Female poverty and vulnerability stems both from direct and indirect discrimination, in the workplace and in social contexts. The 2010 Country Assessment of Living Conditions found that 32% of children in Barbados live in poverty. The child poverty rate was nearly double for those households in which females were the main income earners than in those in which a male was the highest income earner: 41% compared to 22%⁶⁰. The overall unemployment rate is estimated to be around 10%, with female unemployment rate at 8.5% and male unemployment rate at 11.6%. Women were also more likely than men to be under-employed: 1.7% of employed women would work more hours, compared to 1.6% of employed men. Unpaid family workers tend to be exclusively female⁶¹. This situation has been exacerbated since the onset of the COVID pandemic, as evident by the findings of a rapid assessment survey undertaken by the IDB in June 2020 which indicated that almost half of respondents that were employed before the pandemic reported losing their job (IDB 2020). Not surprisingly, the shock affected low-income households more harshly (5 % reported job losses) compared to middle and high-income ones (40% and 28%, respectively)⁶². The adverse fiscal and GDP impact of the pandemic has been significant. While the government achieved the targeted primary balance surplus equivalent to 6% of GDP for the fiscal year 2019/20, the current account deficit increased to 6.2% and real economic activity contracted by some 18% during 2020 and 3% in the first quarter of 2021, as the

⁵⁹ FAO. 2015. AQUASTAT Country Profile – Barbados. Food and Agriculture Organization of the United Nations (FAO). Rome, Italy

⁶⁰ UNDP, UNICEF, UNWomen (2020). Barbados Covid-19 Heat Report. Human and Economic Assessment of Impact

⁶¹ Ibid

⁶² World Bank, Poverty & Equity and Macroeconomics, Trade & Investment Global Practices.

sharp decline in tourism negatively impacted the economy as a whole⁶³. With a global economic recession extending well into 2021, the outlook is negative.

Also notable is that between 2020 and 2021 alone, Barbados has had to manage the impacts suffered from the synergies between the pandemic and two other crises: (1) the volcanic ash crisis, following the eruption of La Soufrière in neighbouring St. Vincent and the Grenadines in early 2021, which has severely affected Barbados' agricultural sector, and more temporarily business and health and (2) the passage of Category 1 Hurricane Elsa on July 1, 2021 that was the first in 65 years causing widespread housing stock damage and loss of key utilities such as power, internet and water causing further reduced productivity of key sectors during the pandemic. The effect of these three shocks to the economy of Barbados coupled with its high level of indebtedness will stymie the GOB's capacities and resources to adapt to the further climate impacts that will inevitably follow. This project is considered to be timely in advancing the much-needed adaptation to climate change, as well as enabling Barbados to meet its aspirational goal to achieve a fossil fuel-free economy and to reduce GHG emissions across all sectors to as close to zero as possible by 2030.

Furthermore, a recent assessment of the water and wastewater sector in Barbados revealed that there is limited human and financial resources which limit the ability to monitor and enforce compliance with legal and regulatory requirements pertaining to water and wastewater management in Barbados. Further, there is need for better policy coordination across sectors particularly with respect to economic development planning; tourism and agricultural development planning need to consider water availability and wastewater management issues⁶⁴. As such, a key component of this project is to provide the requisite training to the operational staff at the BWA to ensure they can operate and maintain the new technologies to be installed.

D.5. Country ownership (max. 500 words, approximately 1 page)

The GOB ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 and the Kyoto Protocol in 2000. In September 2015, Barbados communicated its first Intended Nationally Determined Contribution (INDC) to the UNFCCC Secretariat, then on 22 April 2016, Barbados signed and ratified the Paris Agreement, which entered into force on 4 November 2016. The ambitions of the Paris Agreement to limit the average temperature increase to 1.5 °C compared to pre-industrial temperatures meant that the overall level of ambition in 2015 INDCs would be too low⁶⁵. Notwithstanding Barbados' historically low level of responsibility for the increase of greenhouse gas concentrations in the atmosphere, the GOB, in its 2019 Barbados National Energy Policy (BNEP) and Implementation Plan, have set the aspirational goal to achieve a fossil fuel-free economy and to reduce GHG emissions across all sectors to as close to zero as possible by 2030.

In the area of climate change adaptation, Barbados maintains several important legal frameworks. Broadly speaking, adaptation in Barbados is framed within the following legal tools: The Proclamation of the Planning and Development Act, and the 2021 Physical Development Plan (PDP), which includes climate change considerations for the first time and has been already approved by the Cabinet. The 2021 PDP addresses the critical impacts of climate change on Barbados through policies and strategies that enable the people to thrive and remain resilient under changing climate conditions. The Roofs-to-Roofs Programme (R2RP) operationalizes the PDP and provides the vehicle through which public investment will be directed. R2RP objectives are to:

- (i) Make low- and middle-income homes more resilient to extreme weather events as well as possible loss of the electricity grid and potable water distribution systems;
- (ii) Increase freshwater storage capacity and water use efficiency;

⁶³ 2021 Barbados NDC Update (July 2021)

⁶⁴ GEF (2019). National Package for Barbados under the CREW+: an integrated approach to water and wastewater management using innovative solutions and promoting financing mechanisms in the Wider Caribbean Region (RG-G1016) Project

⁶⁵ GOB (2021). Barbados 2021 Update of the First Nationally Determined Contribution. Available at: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Barbados%20First/2021%20Barbados%20NDC%20update%20-%2021%20July%202021.pdf>. Accessed 20 November 2021

- (iii) Reduce carbon emissions through the deployment of distributed renewable energy generation;
- (iv) Decrease land-based sources of marine pollution;
- (v) Implement more sustainable land (and marine space) use practices;
- (vi) Make critical utility, water and sanitation and road infrastructure climate resilient; and
- (vii) Restore the reduced coral reef ecosystem services particularly on the west and south coasts of the island.

This project directly supports the achievement of objectives 3, 4 and 6 of the R2RP.

Also, the **Barbados Growth and Development Strategy 2013-2020** analysed structural, systemic and external factors that influence and impede sustainable growth in the Barbadian economy and proposes a series of adjustments aimed at achieving reform, recovery and sustainability in the Barbadian economy through new development pathways. The following sections of this Strategy have been identified to be critically addressed by this project: section 2.1 Tourism, 2.2 Agriculture, 2.6 Reduction of GHGs, 3.1 Education and Training, 3.8 Environmental Sustainability and Green Economy. These sections are also aligned with the **Barbados' National Climate Change Policy (NCCP)**, which was approved by Cabinet in May 2012. The primary goal of the NCCP is to establish a national process for adapting to climate change effects and minimizing greenhouse gas emissions over the short, medium and long term, in a manner that is coordinated and consistent with the broader sustainable development aspiration which was one of the mitigation demonstration measures approved by the National Climate Change Committee.

In addition, climate change adaptation and mitigation actions are incorporated into the following: White Paper on the Development of Tourism in Barbados and National Adaptation; Coastal Zone Management Plan; Storm Water Management Plan. Important to note that recent Cabinet Papers have included approval to upgrade the South Coast Sewage Treatment Works to tertiary level treatment and a water reuse policy paper. Green papers under development include a revision of the Groundwater Zoning Policy to change the definition and extent of the existing zones, the development of an integrated wastewater management policy, a stormwater management policy and a nearshore management policy. The aim of these initiatives is to create a framework for the integrated management of water resources (IWRM). In addition to this, the BWA has received funding to develop a Water and Wastewater Management Master Plan. Overall, there is an impetus to overhaul the management of the water sector and to address the institutional challenges brought to the fore by the 2015-16 drought and sewerage crisis on the South Coast that had become manifest over the last five years. In 2020, a Government Green Paper "Water Protection and Land Use Zoning Policy" (MEWR, 2020) set out proposals for changes in the Zoning taking into account the emerging threats, proposing changes to the zoning and requirements for treatment of wastewaters. The Green Paper marks a move towards a system where contamination of the groundwater is controlled at source. This entails: 1) prohibiting suck wells as the primary means of wastewater treatment, 2) development of communal wastewater treatment facilities, and 3) provision of guidance for wastewater treatment. Further, the Government of Barbados (GOB) enacted a National Water Reuse Policy (NWRP), which states that "*the traditional interpretation of the term water must expand beyond conventional freshwater sources to encompass treated wastewater (reclaimed water), storm water and other sources as part of the total water resources*". These policies coupled with significant investment that the Government of Barbados is channelling towards this sector are evident of the Government commitment to seeing a paradigm shift in the how reclaimed water is managed and utilized.

The following are relevant legislation and policies from the water sector perspective: The Barbados Water Authority Act (1980): establishes the Barbados Water Authority; Underground Water Control Act (1953): provides for the control and use of the underground sources of water supply in the island. It establishes a Water Board for the purpose of this Act. Licenses from the Board are required for the sinking of wells and for the obstruction of underground water; Heath Services Act (1969): allows the Minister to divide Barbados into health and sanitation districts. The Minister has the power to construct sewers. This Act also prohibits

taking water from public taps without permission; Irrigation Act (1967): allows the Chief of Agriculture to carry out surveys, investigation or research for irrigation purposes, to distribute water and to control or operate waterworks; Prevention of Floods Act (1951): makes provision for measures for the prevention of floods; National Water Conservation Plan: comprises two parts: long-term ongoing measures such as leakage reduction and universal metering and short-term measures such as temporary shutdown of parts of the system on a rotational basis or temporary licence restrictions on private abstractions (UN, 2004); Groundwater Zoning Policy: implemented through the Town and Country Planning Office in collaboration with the BWA, it controls development in areas of groundwater abstraction as a way of protecting groundwater resources (2008). Most recently, the BWA established a Wastewater Department (WWD) to properly manage Barbados' wastewater problems, including building resilience into the country wastewater systems. Also, a National Water Reuse Policy was enacted in October 2018, which sets as the vision that water is a national resource which shall be used to improve the quality of life for citizens, maintain the natural biodiversity of the land, and promote domestic, agricultural and industrial activities in support of sustainable development and a green economy. The policy objective is to promote the safe use of reclaimed, storm and non-potable water in urban, agricultural and the industrial sectors such that human health and environmental quality is not compromised. Collectively, these policy and legal frameworks provide the basis for the implementation of this project, which will also seek to strengthen gaps that exist, especially for expanding/scaling-up wastewater reuse in Barbados.

Other notable policies which this project is aligned with include:

The **Barbados Sustainable Development Policy (2004)** sets out the landscape for sustainable development from a Barbadian perspective. Embedded within the Policy are the adopted sustainable development principles namely: quality of life, conservation of resources; economic efficiency; equity; and participation. In the context of water resources management, the policy sought to conserve available freshwater and within the agricultural sectors it encouraged the use of organic fertilizers and promoted natural resources recycling and reuse, where possible.

The **National Strategic Plan of Barbados 2006-2025** recognises that protecting and preserving our natural and built environment is vital to achieving sustainable development. Goal four of the document sought to promote and facilitate the sustainable use of our renewable resources, including the maintaining a safe and reliable water supply, and the wise management of our non-renewable natural resources. The strategic plan proposes a series of strategies which are designed to kindle the development of a green economy.

The foregoing indicates that there is strong political will and country ownership for implementing the results of this project. Whilst Barbados does not have a finalized GCF country programme (currently being undertaken through a readiness proposal with the GCF), technical capacities exist and are continually being built for the management of GCF funded projects through the implementation of one project and two readiness projects. The project, called the Water Sector Resilience Nexus for Sustainability in Barbados (WSRN S-Barbados), has a value of USD45.2 million (USD27.6 million financed by GCF) was launched in May 2019 with a finalization date in 2024. This project is also focused on increasing the climate resiliency of the water sector and has the CCCCC and the BWA as Executing Entities and are under the supervision of the NDA.

The CCCCC coordinates the Caribbean region's response to climate change, working on effective solutions and projects to combat the existing and projected environmental impacts of climate variability, climate change and extreme weather events. Guided by its Regional Strategic Framework – Achieving Development Resilient to Climate Change (2009 – 2015), and its accompanying Implementation Plan (2011-2021) to actualize the Framework, the Centre provides climate change related policy advice and guidelines to the Caribbean Community (CARICOM) Member States through the CARICOM Secretariat and to the United Kingdom (UK) Caribbean Overseas Territories. In its role as a Climate Centre, the entity is recognised by

the UNFCCC, the United Nations Environment Programme (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognised by the United Nations Institute for Training and Research (UNITAR) as a Centre of Excellence, one of an elite few. Further, the CCCCC has an established and proven track-record as the leader in climate change adaptation planning and management studies throughout the Caribbean and have implemented substantial climate change response initiatives projects funded by donors such as the European Union, the German Development Bank, UN-ECLAC and IDB, to note a few. This proven track record will ensure effective and efficient project delivery and guarantee the sustainability of programme outcomes and impacts. More importantly, the CCCCC is the repository of current state-of-the-art climate change models in the Caribbean region.

As the AE, the CCCCC will provide overall management for the project and facilitate information sharing and marketing via its online portal. Its role as an AE also includes having overall responsibility and oversight for the project, which involves project implementation and supervision, financial management, and project monitoring and reporting. The partners will share equally in the implementation of the respective portions of the programme. Further, for better project coordination, and taking a programmatic approach, the CCCCC has established the Programme Development and Management Unit (PDMU). The PDMU is comprised of a Project Manager, a National Project Coordinator, a Project Engineer, a Procurement Officer, a Finance Officer and two (2) Admin Officers and will draw upon the other collective expertise within the Centre to carry out the Project Implementation function. All activities will be scrutinized alongside the Centre's approved Environmental and Social Safeguard (ESS), Gender, Stakeholders' Consultation and Anti-Money Laundering and Countering Financing for Terrorism (AML/CFT) Policies to ensure they are in consonance with the objectives of those Policies. Furthermore, gender and no-discriminatory considerations and strict adherence to financial best practices will be pursued.

The NDA has and continue to support the development of this project and is committed to leading the charge to see this project approved and implemented in Barbados. The NDA has provided a letter of no-objection to accompany this projects submission to the GCF (See Annex 1). The NDA has also signal the willing lead effort to ensure continued political buy-in and support at the highest levels of government and will function as the GCF's contact person in country. The NDA will provide in-kind support, through the Public Investment Unit, to assist with the implementation of the project activities under the project, in particular those activities that require coordination among line ministries and engagement with the GCF on reporting and verification. Further, the technical-working group⁶⁶, which is a cross-sectoral group of high-level technical officers, will continue to provide technical guidance during implementation and draft cabinet papers for reporting the cabinet on matter pertaining to the project.

Country ownership through stakeholder engagement and consultations is the cornerstone of the 3R-CReWS project. Since its inception, even more so during the PPF stage, several stakeholders were engaged and consulted. These consultations were critical to arrive at final proposal that response to needs of the people of Barbados. The list of stakeholders consulted can be found in the stakeholder analysis as well as the Feasibility Study. Going forward, as is demonstrated by the activities outline in Component 3 and 4, this project will continue to engage all relevant national and community level stakeholders of Barbados, which will encompass both the public and private sector. This is critical for the outputs to resulting in outcomes and outcomes into desired paradigm shift, sustainability and impact beyond the life of the 3R-CReWS Project.

D.6. Efficiency and effectiveness (max` . 500 words, approximately 1 page)

Adequacy of Financial Structure

The instrument of funding requested for the implementation of this project is a combination of grants from the GCF and co-financing from the BWA. These funds will be used for creating a paradigm shift in the

⁶⁶ The Technical Working Group has representatives from: BWA, Environmental Protection Department, Ministry of Health and Wellness, Ministry of Agriculture and Food Security, Ministry of Finance Economic Affairs and Investment, Coastal Zone Management Unit, Government Analytical Services, and Planning and Development Department.

wastewater management practices of Barbados through the deployment and transfer of appropriate technologies and the promotion of an enabling environment that promotes institutional, financial, social and environmental sustainability (See Section D.3).

A spreadsheet-based Dynamic Economic and Financial Model (DEFM) was developed for this project (See Annex 3), which was premised on four development cases ranging from: a 'base case' of no development, no reuse, and no climate change; a 'no growth' case with planned developments, climate change and reuse of reclaimed water; a 'business as usual' case with more planned developments incorporated, climate change, the reuse of reclaimed water, and modest population and economic growth, and; a 'growth and development' case in which there is significant expansion of the wastewater collection systems and hence flows through the treatment plants, climate change, the reuse of reclaimed water and moderate population and economic growth (See more details in Annex 2). This model considered the programmatic approach that is being utilised to transform the management of wastewater. The model considers the investments to be made at the South Coast Sewage Treatment Plant (SCSTP) and a similar pipeline that is being considered for delivery of reclaimed water associated with the SCSTP to farmers on the east of the island (see Table 2 and 3 in Section B.5). The results of the DEFM are shown in the Table 5 below.

Table 5: Model Output Results

	Base case USD million	No growth USD million	Business as usual USD million	Growth & development USD million
Total NPV Capital & Operational Costs	US\$209.70	US\$302.76	US\$302.76	US\$372.89
NPV Benefits	US\$73.37	US\$139.60	US\$195.17	US\$451.53
Benefit Cost Ratio	0.34	0.46	0.64	1.21
IRR	-	-	-	9.1%
GHG emissions				
• Tonnes avoided	42,800	75,155	90,971	164,713
• NPV Avoided costs	US\$0.45	US\$0.78	US\$1.82	US\$3.10
Net farm revenues generated	-	US\$121.578	US\$148.866	US\$258.877
Multiplier effect of farming employment	-	US\$5.601	US\$6.858	US\$11.926
Import substitution	-	US\$21.75	US\$43.50	US\$72.49
Public health benefits	US\$0.34	US\$0.34	US\$0.34	US\$0.34
Environmental benefits	US \$581.46	US \$581.46	US \$581.46	US \$581.46
Social Cost Benefit Ratio	3.1	3.1	3.5	4.1

Source: Cashman, 2021

The results indicate the sensitivity of outcomes to the volume of wastewater flow generated and supporting irrigated agriculture. Financial viability improves due to a combination of increased treated water flows supporting irrigated agriculture and the generation of additional income to farmers. The Cost-Benefit ratio and Internal Rate of Return improve as more wastewater is generated. The results indicate that whilst the capital and operational costs increase from the "Business as Usual" to the "Growth and Development" case by 23%, the benefits increase by over 130%. When the economic benefits are taken into account, the Social Cost-Benefit Ratio improves across the board due to the role a healthy marine environment plays in supporting Barbados' tourism sector. The positive Social Cost-Benefit ratios reflects the wider social and environmental benefits that would flow from implementation of the project.

Also notable is that the DEFM also explored 5 sets of sensitivity analyses (i) alternative assumptions of inflation and discount rates, (ii) the impact of water savings technology, (iii) the effect of Climate Change, (iv) alternative tariffs for water supplied to agriculture, and (v) alternative Development Scenarios. Findings

reconfirm the importance, from a financial standpoint, of having sewerage systems that are able to collect and treat sufficient volumes of wastewater for reclamation and onward provision for reuse. The onward provision for reuse of treated wastewater is critical to generating income to offset the capital and operational costs. The initial costs of establishing the sewage and distribution infrastructure will be high, but the marginal capital cost of treating wastewater and supplying reclaimed water decreases with each addition unit of volume. At the same time the marginal benefit of having an extra unit of volume increases. The financial Benefit-Cost ratios become positive as more water is collected and provided for irrigation. The Benefit-Cost ratio increases to greater than 1 when the benefits from the development of irrigated agriculture are added for the Business-as-usual case. The ratio continues to increase as more water is made available for reuse. Hence, investment in the capital works that on the one side increase the volume of wastewater collected and on the other make it available for productive reuse is a necessity in order to realise the potential benefits. Secondly, the financial outcome is sensitive to the assumption of the tariff for the provision of irrigation water. Whilst changes in tariffs have a similar effect as increasing wastewater collection volumes, increasing tariffs is less desirable due to the likely substitution and income effects (Hicksian substitution). Increases in tariffs might affect the level of economic activity by irrigation farmers with other effects on the local economy and food imports.

In summary the DEMF found that the project will be financially sustainable given that with the investments proposed the income revenue streams will be greater than the capital and operational expenses. This assumes that GCF grant funding is made available and other complementary projects to 3R-CReWS project are implemented. If it is not the case and debt financing instruments are used, then this will have a negative effect on financial performance indicators. And the project has the capability of increasing revenues through opportunities to expand collection coverage. In addition, the project will benefit the BWA through institutional strengthening and capacity building improving its planning and management capabilities. It supports initiatives within the BWA of structuring its activities towards a greater emphasis on forward planning and the proposed implementation of an Innovations Division and a Strategic Planning and Regulation Division.

Use of Best Practices and Available Technologies

In additional to the findings of the financial and economic model, efficiency and effectiveness will be promoted by this project through the following:

- The final upgrade considerations that were selected for this project met several criteria that were hinged on efficiency and effectiveness. The evaluation criteria included: land area requirement, operator skill level requirement, technology adaptability, capital cost, operating labour cost, energy requirement, process robustness (including ability to accommodate wastewater variability), water quality achieved and water reuse applications (See Integrated Sustainability 3R-CReWS Conceptual Design Report: Section 3.5).
- The construction of smaller decentralized sewage collection and treatment sites with a cluster of connections within sensitive groundwater extraction zones (Zone A) is a lower cost strategy that focuses financial resources for wastewater management on areas with the greatest potential to impact groundwater resources (environmental costs) and be impacted by climate change either due to the need for additional water resources due to drought (social and economic costs)
- The PV systems to be installed will withstand of at least category 3 hurricanes thereby promoting both climate change adaptation and mitigation benefits.
- Strengthening the engagement of the private sector through various avenues (RAFF mechanism, training, engagement strategy, incentive programme)

E. LOGICAL FRAMEWORK

E.1. Project/Programme Focus

- Reduced emissions (mitigation)
- Increased resilience (adaptation)

E.2. GCF Impact level: Paradigm shift potential (max 600 words, approximately 1-2 pages)

Assessment Dimension	Current state (baseline)		Potential target scenario (Description)	How the project/programme will contribute (Description)
	Description	Rating		
Scale	<p>The interest in wastewater reuse has been documented for some time; for example, the IWRM Road Map for Barbados, which was drafted in 2008, identified the need to encourage wastewater reuse as a key recommendation from stakeholder consultations (CEHI, 2008). Further, the legal regulatory framework in Barbados has been recently updated to better inform wastewater management and reuse options, quality and standards. These include the Zoning Policy, Planning and Development Act, Wastewater Reuse Bill to note a few. This signal of interest in the use of treated wastewater is an important precondition for scaling up the scope and impact of this project. However, there are no pipelines installed to date to transport reclaimed water for irrigation and aquifer recharge purposes.</p>	<u>Low</u>	<p>An additional 235 Hectares of agriculture land available to implement irrigation, aquifer recharge and other non-potable water uses. An increase in the volume of wastewater captured and treated to tertiary levels for non-potable water uses. The marginal capital cost of treating and supplying reclaimed water decreases with each additional unit of volume of wastewater that becomes available. An enabling environment is strengthened for wastewater treatment technology deployment, dissemination and innovation</p>	<p>The 9km pipeline to be installed will enable the distribution of reclaimed water to farmers located in the parish of St. Michael, which is one of four options investigated in the feasibility study. The option selected (9km pipeline) is considered by the GOB to be the first phase of a larger enterprise to extend and expand the use of reclaimed water for irrigation, aquifer recharge and non-potable water uses. It is envisioned that the distribution pipeline should be extended further north along the west coast of Barbados and up to the parish of St Lucy to irrigate an additional 235 hectares of agriculture land. The extension of the pipeline coupled with the expansion of the decentralized wastewater treatment systems approach will increase the volume of wastewater collected, treated and reclaimed for irrigation, aquifer recharge and non-potable water uses. The latter will also be supported through the legislative review, the water and sanitation masterplan and public education and awareness activities planned under this project. For instance, the promotion of dual system plumbing in households and businesses to facilitate the use of reclaimed water for non-potable purposes in households and businesses. Also notable is that this project is specifically targeting a combination of activities targeting private sector engagement since they can have an important role in scaling-up the decentralized wastewater treatment systems approach. Specifically, this</p>

				<p>project has earmarked the following activities that will enhance the ability of the private sector to scale-up the decentralized wastewater treatment systems approach: (i) development of an action plan for the engagement of the private sector in the provision and adoption of wastewater treatment technology and the utilization of wastewater by-product, (ii) expansion of the Revolving Adaptation Fund Facility (RAFF) to provide resources to private individuals and businesses for the adoption of decentralized onsite wastewater systems (iii) development and implementation of a gender sensitive and socially inclusive incentive programme to encourage wastewater reuse applications (iv) undertaking a review of the legislative framework to support enforcement of what is in place and to identify gaps that needs attention for the use of reclaimed water, including in the engagement of the private sector (v) the PEA campaign will include materials to encourage, promote and train the private sector to take advantage of the potential markets opportunities for the expansion of decentralized onsite and cluster wastewater systems and the adoption of water reclamation technologies</p>
<p>Replicability</p>	<p>As of 2018, there were sixty-eight (68) private wastewater treatment plants of which eighteen (18) used the treated wastewater for reuse applications. However, there is no treatment of wastewater and reuse in any of the identified Zone A locations. There is 1 RO plant installed along Spring Garden on the west coast of Barbados, which also happens to be privately owned. A review by the GEF CReW+ initiative found that participating countries (Antigua and Barbuda, Belize, Guyana, Saint Lucia, Trinidad and Tobago, Barbados, Jamaica, St. Vincent and the Grenadines and Suriname) show evidence of establishing wastewater as a national priority. However, activity towards implementation of the Protocol Concerning Pollution from Land-Based Sources and Activities (LBS Protocol) provisions is limited.</p>	<p><u>Low</u></p>	<p>An additional 16 Zone A communities to benefit from the installation of decentralized wastewater treatment systems 2 -3 RO plants installed along the west coast corridor Replication of this project in at least 2 CARICOM member states</p>	<p>Recalling that the BSTP and the SCSTP plants only serve 10 to 15% of the population of Barbados, then the scope for replicating the decentralized wastewater treatment systems is expansive. Recently the Government of Barbados has identified 18 Zone A locations as priority areas for the installation of decentralized wastewater treatment systems. Zone A areas are identified as locations most sensitive to groundwater contamination as a result of wastewater and are most sensitive to climate related risks with a limit to water resources. Therefore, the decentralized wastewater treatment systems to be installed in the Belle Zone A area and Bellevue Gap Zone A area under this project will serve as an opportunity to learn lessons for replication in the other 16 Zone A locations in the near future. It is envisaged with strengthened private sector engagement through the activities planned under this project, the decentralized wastewater treatment systems will be replicated across</p>

	<p>These countries have pointed to the limited availability of financial resources for infrastructure, capacity-building, appropriate technology and research and development needed to make the much-needed improvements in the wastewater sector</p>			<p>the country. Further, based on lessons learned from the Spring Garden Reverse Osmosis Plant (See Feasibility Study), which is the first of its kind in Barbados, this project will support investigations and strategic planning for the installation of water treatment facilities along the west coast corridor for augmenting water supply and protecting the west coast ecosystem (Activity 3.2.1). Finally, the role of the CCCC as the AE coupled with their role as a CARICOM Specialized Agency implies that they are ideally positioned to promote the lessons emerging from the use of reclaimed water and creation of a wastewater market to other CARICOM Member States. The likelihood of replication in other SIDS is also increased by the fact that the fourth and fifth IPCC reports indicated that there will be increased water stress due to increasing temperatures, reduced annual rainfall and salinization of freshwater resources.</p>
<p>Sustainability</p>	<p>Policy, incentives and Legislation - the legal regulatory framework in Barbados has been recently updated to better inform wastewater management and reuse options, quality and standards. These include the Zoning Policy, Planning and Development Act, Wastewater Reuse Bill to note a few.</p> <p>Technical Capacity - a recent internal discussion paper (at BWA) noted that the managerial span of control at BWA was too wide and is inefficient and ineffective, particularly for the wastewater section. This is coupled with the fact that external training opportunities are very limited, and an internal training program is lacking at the BWA.</p> <p>Operations and equipment - the maintenance focus at BWA has shifted from Preventative Maintenance (PM) towards emergency breakdown maintenance due to lack of dedicated staff and financial resources for PM. The operational manuals are very dated. There are no functional automated control systems</p>	<p><u>Low</u></p>	<p>Paradigm shift in the use of reclaimed water among the entire population of Barbados (demand side) Green jobs created and sustained in the medium to long term through the expansion of the knowledge and skills capacity and the creation of a market related to wastewater sector (supply side).</p> <p>The project will make a positive contribution to the achievement of Sustainable Development Goals, specifically Goals 2, 5, 6, 7, 9, 11, 13, 17</p>	<p>Under component three, enhancement of capabilities (technical and operations management) to operate, maintain and monitor the wastewater and renewable energy technologies will be advanced which is key for sustainability. Having a cadre of highly trained operators at the BWA will ensure that there is a well-developed preventative maintenance (PM) program to extend the life of the equipment and to keep it functioning at the design level to maintain effluent quality and reduce any environmental impacts or health and safety issues. Majority of component four was designed to strengthen the enabling environment for promoting sustainability. Specifically, the outputs will ensure that there is adequate legislation related to wastewater reuse and adoption of treatment technologies, bolstering private sector engagement in the provision and adoption of wastewater treatment technology through various approaches (engagement strategy), putting in place a long-term water and sanitation masterplan to guide long term planning for the sustainable management of the water sector and for further strengthening its resilience to climate risks, recommending options for an incentive programme for</p>

	that optimizes energy efficiency of the current water treatment systems. The SCADA system installed at the lift stations and the flow are not operational at this time.			promoting the use of wastewater technologies and use of reclaimed water by households and businesses, expanding the RAFF and targeted PEA materials.
--	---	--	--	--

E.3. GCF Outcome level: Reduced emissions and increased resilience (IRMF core indicators 1-4, quantitative indicators)

GCF Result Area	IRMF Indicator	Means of Verification (MoV)	Baseline	Target		Assumptions / Note
				Mid-term	Final ⁶⁷	
<u>Total amount of GHG emission reduction</u>	<u>Core 1: GHG emissions reduced, avoided or removed/sequestered</u>	<p>Reports of Solar Photovoltaic Energy (PV) generation, BLP monthly electricity bills and statements of credit (from Feed in Tariffs) and BWA Engineering in Operations and Maintenance Report</p> <p>BLP monthly electricity bills and statements of credit (from Feed in Tariffs) and BWA Engineering in Operations and Maintenance Report</p>	0	No change from baseline by 2026.	<p>1,635 tCO₂e avoided by 2028</p> <p>40,875 tCO₂e avoided over 25 years</p>	<p>Plant upgrades and PV system implemented one year before project closure.</p> <p>Co2 grid emission factor is 0.684.</p> <p>Quantity of net electricity generation by the 1MW PV is 2,063 MWh per year</p> <p>Assume life term of PV system is approximately 25 years.</p> <p>Energy efficient technology and controls are operating optimally and reduction in energy consumption</p>

⁶⁷ The final target means the target at the end of project/programme implementation period. However, for core indicator 1 (GHG emission reduction), please also provide the target value at the end of the total lifespan period which is defined as the maximum number of years over which the impacts of the investment are expected to be effective.

						of 328.5 MWh achieved.
<u>MRA1 Energy generation and access</u>	<u>Core 1: GHG emissions reduced, avoided or removed/sequestered</u>	Reports of Solar Photovoltaic Energy (PV) generation, BLP monthly electricity bills and statements of credit (from Feed in Tariffs) and BWA Engineering in Operations and Maintenance Report	0	No change from baseline by 2026.	1,411 tCO ₂ e avoided by 2028 35,275 tCO ₂ e avoided over 25 years	Plant upgrades and PV system implemented one year before project closure. Co2 grid emission factor is 0.684. Quantity of net electricity generation by the 1MW PV is 2,063 MWh per year Assume life term of PV system is approximately 25 years.
<u>MRA1 Energy generation and access</u>	<u>Supplementary 1.3: Installed renewable energy capacity</u>	Site inspections, equipment specifications, procurement reports, BWA Supervising Engineer's Certification of Completion, BWA Engineering in Operations and Maintenance Report	0.18 MW of solar panels in place at BSTP	No change from baseline by 2026.	1.18 MW of solar power installed by 2028	Conditions are favourable for the installation of the PV panels. The PV panels are routinely monitored and maintained/ repaired to ensure they function optimally.
<u>MRA3 Buildings, cities, industries and appliances</u>	<u>Core 1: GHG emissions reduced, avoided or removed/sequestered</u>	BLP monthly electricity bills and statements of credit (from Feed in Tariffs) and BWA Engineering in Operations and Maintenance Report	0	No change from baseline.	224 tCO ₂ e avoided by 2028 5,600 tCO ₂ e avoided over 25 years	Energy efficient technology and controls are operating optimally and reduction in energy consumption of 328.5 MWh achieved.

<u>MRA3 Buildings, cities, industries and appliances</u>	<u>Supplementary 1.1: Annual energy savings</u>	BLP monthly electricity bills and statements of credit (from Feed in Tariffs) and BWA Engineering in Operations and Maintenance Report	0 (Power consumption at BSTP 2017-2020 averaged approximately 1,642.5 MWh per year.)	No change from baseline.	Annual energy savings of 328.5 MWh per year relative to the baseline by 2028.	BSTP fully upgraded and operational at least one year before project closure. Energy efficient technology and controls are operating optimally.
<u>Total number of direct and indirect project beneficiaries</u>	<u>Core 2: Direct and indirect beneficiaries reached</u>	Ministry of Agriculture database/records on Farmers in target areas, registration forms for training events/workshops/consultations, website analytics for project website and social media accounts, site visits, survey/questionnaire reports.	0	20,500 direct beneficiaries by 2026 (10,045 males and 10,455 females) 16,500 indirect beneficiaries by 2026 (8,085 males and 8,415 females)	277,821 (136,132males and 141,689 females) (excluding tourists) direct and indirect beneficiaries reached (1,377,200 if average annual tourists arrival is included) ⁶⁸ by 2028 136,220 direct beneficiaries by 2028 (66,748 males and 69,472 females) 141,601, indirect beneficiaries by 2028 (69,384 males and 72,217 females)	Assume successful education and communication programs for communities and water sector technical staff; Participation in awareness workshops and campaign, and buy-in Assume policies and legislation change to promote the use of reclaimed water for non-potable water uses including urban irrigation of landscaped areas, toilet and urinal flushing, vehicle, and road surface washing, building cooling, etc.
<u>ARA1 Most vulnerable</u>	<u>Core 2: Direct and indirect</u>	Ministry of Agriculture database/records on Farmers in	0	20,000 direct		Assume successful education and

⁶⁸ Direct beneficiaries are considered to be all households connected to the STPs, users of reclaimed water, population benefiting from the decentralized system, participants of training, fishermen and the tourism sector (through reduced impact from ocean outfalls). Individuals connected to the STP is estimated to be approximately 15% of the population. Using the median, of 15% of 277,821 = 41,674; Individuals benefiting from the decentralized wastewater systems = 646; Users of the reclaimed water (total trained) = 155 (280) farmers; 400 employees at BWA from customized training; 750 students from school programme; 92,250 persons engaged at the community level consultations and public education and awareness efforts; 120 private businesses engaged and 100 new jobs created. wastewater Tourists = 1,237,200 average between 2014-2018 (WorldBank Data). Direct and indirect stakeholders: all of Barbados or 277,821 persons (based on the 2010 census of a total population of 277,821)

<p><u>people and communities</u></p>	<p><u>beneficiaries reached</u></p>	<p>target areas, registration forms for training events/workshops/consultations, website analytics for project website and social media accounts, site visits, survey/questionnaire reports.</p>		<p>beneficiaries by 2026 (9,800 males and 10,200 females)</p> <p>16,500 indirect beneficiaries by 2026 (8,085 males and 8,415 females)</p>	<p>93,300 direct beneficiaries by 2028 (47,583 females, 45,717 males)</p> <p>141,601, indirect beneficiaries by 2028 (69,384 males and 72,217 females)</p>	<p>communication programs for communities and water sector technical staff; Participation in awareness workshops and campaign, and buy-in</p> <p>Assume policies and legislation change to promote the use of reclaimed water for non-potable water uses including urban irrigation of landscaped areas, toilet and urinal flushing, vehicle, and road surface washing, building cooling, etc.</p>
<p><u>ARA2 Health, well-being, food and water security</u></p>	<p><u>Core 2: Direct and indirect beneficiaries reached</u></p>	<p>Ministry of Agriculture database/records on Farmers in target areas, site visits, survey/questionnaire reports, census reports, by parish. BWA water supply records.</p>	<p>0</p>	<p>120 persons (farmers directly) benefiting (72 males and 48 females) by 2026.</p> <p>0 persons indirectly benefiting</p>	<p>280 persons directly benefiting (168 males and 112 females) by 2028</p> <p>116,000 indirect beneficiaries by 2028 (56,850 males and 59,150 females) by 2028</p>	<p>The 2010 census is still reflective of the population today</p> <p>Assume policies and legislation change to promote the use of reclaimed water for non-potable water uses including urban irrigation of landscaped areas, toilet and urinal flushing, vehicle, and road surface washing, building cooling, etc.</p> <p>Persons will access the RAFF and implement wastewater</p>

						<p>treatment technologies and utilise reclaimed water on farms.</p> <p>1000 private entities will benefit from lessons learnt and strategy for involving private sector in the wastewater sector.</p>
<p><u>ARA3 Infrastructure and built environment</u></p>	<p><u>Core 2: Direct and indirect beneficiaries reached</u></p>	<p>BWA Reports, Survey/questionnaire reports for Zone A areas, Training workshop report and evaluation survey, Project Documents Report, site visit and observations.</p>	<p>0</p>	<p>550 individuals (275 males and 275 females) directly benefiting by 2026.</p> <p>0 persons indirectly benefiting</p>	<p>42,880 individuals (21,121 males and 21,759 females) directly benefiting by 2028</p> <p>129,249 indirect beneficiaries by 2028 (63,332 males and 65,917 females) by 2028</p>	<p>41,746 is approximately 15% of the population of Barbados</p> <p>Average household size in Zone A areas is 2.87 persons.</p> <p>Number of jobs created is estimated based on procurement plan and estimate number persons required to exclude the works contract. 26 individual contracts, 6 consulting firm contracts (3 persons per contract) and 8 works and non-consulting services contracts (average 7 persons per contract).</p> <p>13,410 individuals (4624 Zone A</p>

						<p>households) will indirectly benefiting from knowledge and lessons learnt for implementation of the two decentralise plants.</p> <p>SOP and Training of BWA Staff will benefit BWA entire customer base.</p> <p>Upgrade to the plant will indirectly benefit the population (100,000 less direct beneficiaries) of Bridgetown.</p>
<p><u>ARA2 Health, well-being, food and water security</u></p>	<p><u>Supplementary 2.3: Beneficiaries (female/male) with more climate-resilient water security</u></p>	<p>Ministry of Agriculture database/records on Farmers in target areas, site visits, survey/questionnaire reports, census reports, by parish. BWA water supply records.</p>	<p>0</p>	<p>120 persons (farmers directly) benefiting (72 males and 48 females) by 2026.</p>	<p>280 persons directly benefiting (168 males and 112 females) by 2028</p>	<p>The 2010 census is still reflective of the population today Assume policies and legislation change to promote the use of reclaimed water for non-potable water uses including urban irrigation of landscaped areas, toilet and urinal flushing, vehicle, and road surface washing, building cooling, etc.</p>
<p><u>ARA3: Infrastructure and built environment</u></p>	<p><u>Supplementary 2.5: Beneficiaries (female/male) adopting</u></p>	<p>BWA Reports, Survey/questionnaire reports for Zone A areas, Training workshop report and evaluation</p>	<p>0</p>	<p>550 individuals (275 males and 275</p>	<p>42,880 individuals (21,121 males and 21,759 females)</p>	<p>41,746 is approximately 15% of the population of Barbados</p>

	<p><u>innovations that strengthen climate change resilience (number of individuals)</u></p>	<p>survey, Project Documents Report, site visit and observations.</p>		<p>females) directly benefiting by 2026.</p>	<p>directly benefiting by 2028.</p>	<p>Average household size in Zone A areas is 2.87 persons.</p> <p>Number of jobs created is estimated based on procurement plan and estimate number persons required to exclude the works contract. 26 individual contracts, 6 consulting firm contracts (3 persons per contract) and 8 works and non-consulting services contracts (average 7 persons per contract).</p> <p>13,410 individuals (4624 Zone A households) will indirectly benefiting from knowledge and lessons learnt for implementation of the two decentralise plants.</p>
--	---	---	--	--	-------------------------------------	--

E.4. GCF Outcome level: Enabling environment (IRMF core indicators 5-8 as applicable)

Core Indicator	Baseline context (description)	Rating for current state (baseline)	Target scenario (description)	How the project will contribute	Coverage
<p><u>Core Indicator 5: Degree to which GCF investments contribute to strengthening institutional and regulatory frameworks for low emission climate-resilient development pathways in a country-driven manner</u></p>	<p>Policy, incentives and Legislation - the legal regulatory framework in Barbados has been recently updated to better inform wastewater management and reuse options, quality and standards. These include the Zoning Policy, Planning and Development Act, Wastewater Reuse Bill to note a few. Barbados has adopted an incentive approach, using market instruments to achieve sustainable tourism practices. The Tourism Development Act (2002), states that an operator who incurs expenditure in improving the wastewater disposal system be allowed a tax credit of 20% of the capital cost of fittings, pipes and pumps used in the improvement of the wastewater system. The policy and regulatory environment</p>	<p><u>medium</u></p>	<p>High degree to which the GCF investment strengthens institutional and regulatory frameworks for low emission climate-resilient development pathways in a country-driven manner</p>	<p>The overall aim of the project's emphasis on the legislative framework is to create a roadmap that (i) promotes what is now being institutionalized for the wastewater sector, as well as (ii) strengthening any gaps identified (See Activity 4.1.1). Hence, this project will play a key role in strengthening the legislative framework. Further, the project will be developing a long-term water and sanitation master plan that will be based on international best practice and takes into consideration the current water protection, land use and water reuse policies, recent studies and assessments in the water and sanitation sectors as well as current and planned capital expenditure projects, including the 3R-CReWS, when approved. Hence, this master plan will support and promote a coherent and comprehensive planning approach to the management of the water and sanitation sector. There will be a high attainment on institutional strengthening given the project's contribution to building technical capacities of BWA through targeted and customized training (SCADA, operator, CAS, RO, CMMS etc.), enhancing operational effectiveness</p>	<p><u>National level (one country)</u></p>

	<p>in place in Barbados are currently highly conducive for the use of renewable energy technologies. The GOB is pursuing a goal of complete decarbonisation by 2030 and the policy</p>			<p>and efficiency (automating control systems, updating SOPs and operational manuals, establishing an onsite laboratory, implementing sewer monitoring and risk management protocols etc,) and providing sustainable financing streams from the expansion of the RAFF whilst reducing operational costs through the implementation of 1.0 MW of solar power and establishing a preventative maintenance programme.</p>	
<p><u>Core Indicator 6: Degree to which GCF investments contribute to technology deployment, dissemination, development or transfer and innovation</u></p>	<p>Currently both STPs are only able to achieve secondary water quality and hence limiting the use of reclaimed water.</p> <p>Further, there is a recurring issue of breakdown of equipment and limited interoperability due to dated equipment being used or some not functioning e.g. the dissolved oxygen sensors in the tanks do not work, the pump is dated and cannot communicate with the SCADA computerized real-time management system that is in place.</p> <p>A very small number of businesses and none of the communities in the 18 Zone A locations utilize decentralized</p>	<p><u>low</u></p>	<p>High degree to which GCF investments contribute to technology deployment, dissemination, development or transfer and innovation</p>	<p>There will be a high attainment of technology deployment and innovation by this project that will not only increase resilience to climate change, but will also aid in the mitigation of climate change. Firstly, currently there is no tertiary level wastewater treatment facility on the island. The primary objective of this project is to achieve tertiary level reclaimed water quality for building resilience to climate change. The technologies that will be adopted for the upgrades are of international standards. Also notable is that decentralized wastewater treatment systems to date is only being done by a few private sectors, for instance, the Coverly Housing Development, which integrated this technology from the design stage. This project will allow the Government of Barbados and the BWA to further deploy decentralized wastewater treatment systems across the island, particularly to existing housing developments/communities not served by the centralized</p>	<p><u>National level (one country)</u></p>

	<p>wastewater treatment systems.</p> <p>There is 1 RO plant installed along Spring Garden on the west coast of Barbados, which also happens to be privately owned.</p>			<p>wastewater treatment facilities (i.e. SCSTP and BSTP). Based on lessons learned from the Spring Garden Reverse Osmosis Plant (See Feasibility Study), which is the first of its kind in Barbados, this project will support investigations and strategic planning for the installation of water treatment facilities along the west coast corridor for augmenting water supply and protecting the west coast ecosystem (Activity 3.2.1). A climate responsive management of the centralized wastewater systems will be implemented by this project. This project is deploying technologies that will strengthen response to short term and long terms climate related hazards by implementing decision-support tools and infrastructure such as the sewer monitoring programme and CMMS (Output 3.1).</p>	
<p><u>Core indicator 7: Degree to which GCF Investments contribute to market development/transformation at the sectoral, local, or national level</u></p>	<p>The legal regulatory framework in Barbados has been recently updated to better inform wastewater management and reuse options, quality and standards. Barbados has also adopted an incentive approach, using market instruments to achieve sustainable tourism practices. The Tourism Development Act (2002), states that an operator who incurs</p>	<p><u>medium</u></p>	<p>High Degree to which GCF Investments contribute to market development/transformation at the sectoral, local, or national level</p>	<p>This entire project can be considered as a key driver for market development/transformation as it pertains to wastewater treatment and reuse options within the water sector context but will have national ramifications given the importance of water to our daily lifestyles, not to mention Barbados' agriculture sector.</p> <p>The first two components of this project showcase the technologies that can make water reclamation viable whilst reducing risks to climate variability and change and also contributing to GHG emission reduction. The latter of which</p>	<p><u>National level (one country)</u></p>

	<p>expenditure in improving the wastewater disposal system be allowed a tax credit of 20% of the capital cost of fittings, pipes and pumps used in the improvement of the wastewater system.</p> <p>Yet, a very small number of businesses and none of the communities in the 18 Zone A locations utilize decentralized wastewater treatment systems.</p> <p>There are limited PEA campaigns on wastewater technologies and non-potable reuse options as well as on any of the legislative and incentive frameworks in place.</p>			<p>contributes to significant savings from use of renewable energy, which provides contributions for the expansion of the RAFF mechanism that will in turn be used to support local investment (individuals and businesses) in the adoption of wastewater treatment and reuse technologies.</p> <p>The engagement of the private sector is a key feature of this project. There will be a strategic plan for the engagement of the private sector in the provision of wastewater treatment services (e.g. the replication of replication along the west coast corridor and the implementation of decentralized wastewater treatment systems in new developments) and the utilisation of wastewater by-products (e.g. energy recovery and organic fertilizers). Further, there will be incentives for small businesses through the development of an incentive programme (Activity 4.2.2) and the expansion of the RAFF (Activity 4.2.3).</p> <p>Market transformation is further strengthened through the creation of an enabling and an investor friendly environment. This project's investment in building technical capacities of wastewater personnel (Activity 3.1.1), promoting public and targeted stakeholders (businesses, schools) buy-in and support for the use of reclaimed water (output 4.3)</p>	
--	---	--	--	--	--

				and undertaking a legislative review and gap analysis related to wastewater reuse in Barbados (Activity 4.1.1).	
<p><u>Core indicator 8: Degree to which GCF investments contribute to effective knowledge generation and learning processes, and use of good practices, methodologies and standards</u></p>	<p>Knowledge generation and learning is currently limited at the BWA due to limited financial capacities and to some extent technical capacities. For example: valuable hard-copy data was destroyed by fire in the past. There is limited to no historical information on flow and raw or treated wastewater constituents. There is no laboratory at the BSTP to provide information on influent and effluent qualities.</p> <p>These fundamental data sets would be imperative to better understand the baseline situation of the wastewater sector and to inform the use of appropriate technologies and setting standards.</p>	<p><u>low</u></p>	<p>High degree to which GCF investments contribute to effective knowledge generation and learning processes, and use of good practices, methodologies and standards</p>	<p>The generation of knowledge and building of learning processes are important elements for this project since they are key to the sustainability strategy of the project. Under component 1, there are a number of decision support tools, as noted at core indicator 6 above, that will be put in place to enhance the management of the BSTP that not only enhance cost effectiveness of the BSTP operations (reduced energy consumption, preventative maintenance programme) but also builds resilience to climate change. Under component 3, the project will provide targeted and specialised training for BWA and other key agencies to manage, monitor and maintain the upgraded system as well as on key outputs of the project such as updated manuals, SOPs, the risk management framework to be put in place etc. Further, the risk management framework (Activity 3.1.3) itself is considered to contribute to effective learning since it calls for an iterative process to identify the risk register, existing controls and further actions needed and opportunities for improvement. Component 4 will have a gender sensitive public education and awareness campaign that includes targeted training for teachers, students, farmers and</p>	<p><u>National level (one country)</u></p>

				<p>businesses and the general public, including tourists on the impact of climate change on water resources and their impact on water quality and quantity (availability as well as the importance of water reuse activities and indirect potable reuse (IPR)) to building climate resilience in the Water Sector. There will also be a dedicated project webpage with an associated knowledge management strategy to effectively share information and promote learning or awareness building regarding the various outputs of the project.</p> <p>In terms of the use of good practices, methodologies and standards, the feasibility studies that informed the design of this project ensured that international best practices and standards are being met for technologies being implemented.</p> <p>Further, the highly innovative nature of the project, the scale at which it is being implemented and the urgent need for adaptation to climate change risks for the water sector, as demonstrated by the climate rationale (Section B1), makes the learning potential and opportunity for identifying good practices and standards a high priority for this project. This is why the M&E plan for this project sets out a mid-term and end-of-term evaluation and the project team will include M&E specialisation to ensure that case studies on best</p>	
--	--	--	--	--	--

				practices can be documented. Further, the role of the CCCCC, a CARICOM Specialized Agency, as the Accredited Entity that will implement this project means that they are also well positioned to share lessons on this project for replications in other CARICOM States.	
--	--	--	--	--	--

E.5. Project/programme specific indicators (project outcomes and outputs)

Project/programme results (outcomes/ outputs)	Project/programme specific Indicator	Means of Verification (MoV)	Baseline	Target		Assumptions / Note
				Mid-term by 2026	Final by 2028	
Outcome 1: Enhanced availability, management and use of tertiary level reclaimed water to improve the water sector's resilience to climate change	Volume of treated wastewater (reclaimed water) utilized for aquifer recharge and/or agricultural irrigation per year	BWA consumption figures (water meters installed at farms along the 9km pipeline and at infiltration wells)	0 Currently the secondary treated wastewater from BSTP is piped to a sea outfall	No change from baseline	2.25 million m ³ per year being utilize for aquifer recharge and/or agricultural irrigation	There is public buy-in for the use of treated wastewater
	Quality of the reclaimed water	BWA laboratory reports, interviews with farmers and other users	There is no wastewater flow or influent/effluent water quality data available for the BSTP. This challenge is complicated by the fact that there is no onsite laboratory or lab technician	No change from baseline. Plant upgrade ongoing.	Reclaim water meeting the required total dissolved solids of less than 450 mg/L (established by the Barbados Ministry of Agriculture) Onsite laboratory	The on-site laboratory is operational and able to monitor the quality of the effluent regularly

					being utilise to monitor water quality and producing reports.	
	# of direct beneficiaries (Disaggregated by type and sex). Type: farmers (by sex), households (by sex of HH head)	BWA project reports, BWA consumer reports for decentralized locations and farms, MOA reports on farmer beneficiaries	0	No change from baseline. Pipeline and plant upgrade ongoing.	155 farmers (60% males and 40% females) along the 9k pipeline route, 225 households (approximately 646 HHS(from the 2 communities benefiting from reclaimed water and utilizing decentralized wastewater systems	There is public buy-in for the use of reclaimed water for augment groundwater supplies, and the future indirect potable reuse of same
Output 1.1: The Bridgetown Sewage Treatment Plant is upgraded to treat wastewater to a tertiary water-quality standard	# of STPs that can treat water to tertiary water quality standard	Laboratory reports, reports of contractors hired to upgrade the BSTP, BWA progress reports, site visits/observation, Supervising Engineer's Certification of Completion	BSTP and SCSTP are currently secondary treatment plants that are not suitable for wastewater reuse such as aquifer recharge and agricultural irrigation.	No change from baseline. Upgrade should be ongoing.	1 Tertiary Level STP (BSTP)	GOB authorities remain committed to the upgrades and co-financing materialize, as committed. Expertise exists for the installation of the required upgrades. Favourable conditions exist for the construction works to be done.

Output 1.2: Tertiary treated reclaimed water is available to supplement non-potable use	Km of pipeline installed for transporting tertiary treated wastewater	Site visits/observation, Supervising Engineer's Certification of Completion	0 km of pipeline	3 km pipeline installed	9 km pipeline installed	GOB authorities remain committed to the upgrades and co-financing materialize, as committed. Continued stakeholder buy-in
	Volume (m3) tertiary treated waste water made available per day	Reports from flow meter installed at BSTP, laboratory reports on water quality	0	0	5000 m3 of treated wastewater per day	There is public buy-in for the use of reclaimed water for augment groundwater supplies, and the future indirect potable reuse of same
Output 1.3: Decision-support tools and infrastructure implemented to mitigate potential climate change risks to the wastewater collection and treatment systems	# of decision-support tools and equipment implemented to mitigate potential climate change risks (Disaggregate by type - CMMS, flow meters, laboratory)	Consultant/contractors reports, equipment purchase orders, site visits/observation, Supervising Engineer's Certification of Completion for Laboratory, BWA Monthly flow rate reports	There are limited functional decision support tools at the BSTP. The influent and effluent flow meters are not working. In December 2021 a flow meter was installed at the BSTP. The SCADA system that operates that is in place is not fully automated since some of the equipment it should manage are too old to be linked to the SCADA, e.g. the pumps at the	10 flow meters installed	1 CMMS in place 10 flow meters installed 1 on-site laboratory retrofitted	Appropriate technical skillsets exist to conduct flow measurements and gather and analyse samples; adequate testing and reporting is enforced. Willingness and ability of staff to utilize/adopt CMMS system, update regularly, ensure all documentation is completed and filed/stored properly.

			BSTP, and the lift station do not have automated valve. Further, there is also need for more computers and training for technical staff to better interface with SCADA			
Output 1.4: Decentralized treatment systems or cluster treatment systems installed	# of decentralized treatment plants operational	site visit/observation, photographs, interviews with neighbouring communities, reports of contractors hired to build the decentralized systems, Supervising Engineer's Certification of Completion	No decentralized wastewater treatment plants currently managed by BWA.	2 decentralized wastewater treatment plants implemented in 2 communities	2 decentralized wastewater treatment plants implemented in 2 communities	GOB authorities remain committed to the upgrades and co-financing materialize, as committed. Continued stakeholder buy-in
Outcome 2: Climate resilient low carbon operations achieved at BSTP	Energy intensity of the BSTP (energy consumption/total water treated per year)	BSTP energy bills, influent and effluent flows, equipment horsepower and model information	TBD - the technologies in place are about 40 years old for the BSTP, in particular, the aerobic digesters in the plant are energy intensive. Also, there is no preventative maintenance programme and basic decision support tools are	No change from baseline.	Energy consumption/total water treated per year reduce by at least 20%	System will operate at full capacity within the projected life term of approximately 25 years.

			either inoperable or not in place.			
Output 2.1: Energy efficiency and renewable energy technologies are implemented	# of MV of PV installed	BSTP electricity bill, License to operate the PV system from the Division of Energy, GOB Electrical Engineering Department (GEED) certificate of compliance, site visits/observation	0.18 MW of solar panels in place at BSTP	0.18 MW	Additional 1.0 MW of solar panels installed = 1.18 MW of solar power installed at BSTP	Technical expertise exists to install the PV panels,
	# of EE technologies implemented (disaggregate by type - sludge dewatering, automated controls)	site visits/observation, Supervising Engineer's Certification of Completion	BSTP does not undertake sludge dewatering. The SCADA is operational but there are limited control capabilities.	No change from baseline. Upgrades should be advancing.	Sludge dewatering system installed	Technical expertise exists to design and install EE technologies
Outcome 3: Enhanced capacity and capability to support a preventative maintenance (PM) and climate resiliency programme	% of persons trained are directly involved (utilizing knowledge from training) in the implementation, maintenance, operations and management of the BSTP	BWA HR information system, work sheets/work assignments, Post and Pre workshop evaluation	0	20% of persons trained are directly involved (utilizing knowledge from training) in the implementation, maintenance, operations and management of the BSTP	80% of persons trained are directly involved (utilizing knowledge from training) in the implementation, maintenance, operations and management of the BSTP	Funding is identified by BWA to remedy the issues detected early by the CMMS and risk management framework as well as other systems implemented such as the sewer monitoring programme. These systems function effectively. BWA staff understand how to use the systems implemented and follow-up accordingly
Output 3.1: Improved capabilities of wastewater technical	# of customized trainings developed/adopted	Final course materials/training package	BWA completed the following training courses	Customised courses developed/ado	12 customised courses developed/ado	Skilled trainers are available to lead course design and execution

<p>personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management</p>			<p>during 2021: UWI/BWA Gender Sensitivity Training - 500 staff members Occupational Health and Safety Certification Training - 25 people Occupational Health and Safety short course online available for all staff (749) Media Training for staff to present effectively - TBC by HR Heavy equipment operator/Defensive driver training - TBC by HR Diploma in Procurement and Supply (CIPS) - 1 staff member enrolled Diploma in Insurance - 1 staff member from legal and</p>	<p>pted for: SCADA system UWI/BWA Gender Sensitivity Training program and climate change adapted and delivered for BWA operations. Climate change nexus with biosecurity and wastewater PV refresher training course offerings from CVQ & NVQ (Caribbean and National Vocational Qualifications) Industrial waste inspector CCTV equipment</p>	<p>pted covering topics such as: SCADA system UWI/BWA Gender Sensitivity Training program (including SGBV prevention) and climate change adapted and delivered for BWA operations. Climate change nexus with biosecurity and wastewater PV refresher training course offerings from CVQ & NVQ (Caribbean and National Vocational Qualifications) Industrial waste inspector CCTV equipment</p>	
---	--	--	---	--	--	--

			<p>compliance dept. Annual Fraud Conference participation via IDB Non-revenue water training via IDB Supervisory management training Executive Development course Personal Development core skills course Customer services Working at elevated heights - 12 persons MSC in Water and Environmental Management - 1 person</p>		<p>Operator training program based on upgraded systems Laboratory testing, analysis and management Management of the decentralized wastewater treatment plants CAS and RO technologies SOPs and operational manual updated as well as the risk management framework developed to meet the needs of the upgraded system CMMS Sewer monitoring and instrumentatio n General wastewater</p>	
--	--	--	---	--	--	--

					course (safety, no exam)	
	# of persons trained (disaggregated by sex)	registration forms for trainings, certificates of completion	<p>BWA Staff members completed the following training courses during 2021:</p> <p>UWI/BWA Gender Sensitivity Training - 500 staff members</p> <p>Occupational Health and Safety Certification Training - 25 people</p> <p>Occupational Health and Safety short course online available for all staff (749)</p> <p>MSC in Water and Environmental Management - 1 person (ongoing)</p> <p>No staff member has been trained in any of the following - SCADA,</p>	<p>The target for the following training is to have 50/50 distribution of males and females where possible:</p> <p>SCADA – 20 operators/technicians</p> <p>Gender Sensitivity – 200 staff members (new staff and staff lost by attrition)</p> <p>PV course – 25 members from electrical section</p> <p>Industrial waste inspector - 3 operators</p> <p>CCTV equipment - 6 operators</p>	<p>The target for the following training is to have 50/50 distribution of males and females:</p> <p>SCADA - 20 operators</p> <p>Gender Sensitivity - 300 staff members</p> <p>Climate change nexus with biosecurity and wastewater - 300 staff members</p> <p>PV training course - 25 members</p> <p>Industrial waste inspector - 3 operators</p> <p>CCTV equipment - 6 operators</p> <p>Operator training - 8 operators</p>	<p>Willingness and availability of BWA staff to participate in training opportunities. Assumes a total of 400 individuals trained (no double counting)</p> <p>There are equal number of men and women working the areas of specialized training, therefore achieving parity in training targets.</p>

			<p>Climate change nexus with biosecurity and wastewater, PV training, industrial waste inspector, CCTV equipment, operator training, lab technician training, decentralized wastewater treatment facilities, CAS and RO technologies, SOPs, operational manual and risk management framework, CMMS, Sewer monitoring and instrumentation.</p>		<p>Lab technician training – 3 technicians Decentralized wastewater treatment facilities - 50 staff CAS and RO technologies - 50 staff SOPs, operational manual and risk management framework - 70 operators CMMS - 70 staff members Sewer monitoring and instrumentation - 25 wastewater operators General wastewater course (safety, no exam) - 45 persons</p> <p>Assumes a total of 400 individuals trained (no</p>	
--	--	--	---	--	--	--

					double counting)(50% males and 50% females)	
	# of documents updated/developed (disaggregate by type - SOPs, operational manual, risk management framework)	Final risk framework, SOPs. O&M manual and project document	0 manuals updated. The O&M manual currently being utilized was published in 1982 when the BSTP was commissioned. Risk management framework not adopted by BWA. The SOPs are also dated.	1 updated set of SOPs 1 updated O&M manual 1 risk management framework	1 updated set of SOPs 1 updated O&M manual 1 risk management framework	Expertise available to support the updating of documents. Stakeholders are available and actively participate.
Output 3.2: A strategic plan is developed to guide the replication of water treatment facilities along the west coast	# of plans completed for the replication of the brackish water RO treatment plant along the west coast corridor	Final strategic plan	0 plans exist	1 strategic plan completed	1 strategic plan completed	Expertise available to undertake the study
Outcome 4: An enabling environment is created for wastewater technologies and use of reclaimed water and promote ownership and leadership in the private sector	# of private businesses (by ownership Male/Female) and individuals (by sex) adapting wastewater technologies for enhanced treatment and/or use of wastewater	MOUs/agreements, interviews with private businesses and individuals.	As of 2018, there were sixty-eight (68) private wastewater treatment plants recorded for Barbados.	No change from baseline.	20 private businesses and individuals adapting/utilizing wastewater technologies for enhanced treatment and/or use of wastewater	Businesses and individuals are interested in wastewater systems and its benefits and leverage the mechanisms available (incentives and RAFF) and provide co-financing, if needed

	<p>Level of effectiveness of the re-education and public education programme</p> <p>Number of persons aware about wastewater reuse and technologies.</p>	<p>Interviews with training beneficiaries, training evaluation reports</p> <p>Post workshop evaluations</p>	<p>TBC - KAP survey planned for activity 4.3.1 to establish baselines and training needs</p> <p>Limited Awareness and public outreach</p>	<p>Training material developed and available.</p> <p>1000 persons heighten awareness after training and public outreach</p>	<p>Statistically significant differences in KAP from the baseline KAP survey.</p> <p>10,000 persons heighten awareness and public outreach</p>	<p>Trainees find the training relevant and apply the knowledge gained.</p>
<p>Output 4.1: Governance and planning roadmaps enhanced to enable use of reclaimed water in a controlled and regulated manner</p>	<p># of roadmaps/action plans, with recommended actions, completed (Disaggregate by type: legislative review, master plan)</p>	<p>Final master plan, legislative review report and knowledge products</p>	<p>There is a long list of policy and legislation relevant to wastewater management in Barbados. The most recent include the Planning and Development Act, Water Reuse Bill and Regulations.</p>	<p>1 Legislative review completed; knowledge products (video, booklet, infographic) developed 1 water and sanitation master plan completed</p>	<p>1 Legislative review completed; knowledge products (video, booklet, infographic) developed 1 water and sanitation master plan completed</p>	<p>Expertise available to undertake review. National technical authorities provide timely input and recommendations in the review process. There is buy-in to implement the recommendations of the legislative review</p>
<p>Output 4.2: Mechanisms developed/expanded to encourage the adoption of wastewater treatment and reuse applications by private individuals and businesses.</p>	<p># of stakeholder engagement tools/mechanisms developed. (Disaggregate by type: engagement strategy/action plan, incentive programme, RAFF)</p>	<p>consultant reports, final tools - strategy, action plan, incentive programme, interviews with relevant Ministry, Department or Agency (MDA), RAFF documentation, MOUs/Agreement with</p>	<p>No incentive programme in place for wastewater reuse, no private sector engagement strategy in place and the RAFF is</p>	<p>1 private sector engagement strategy completed, RAFF documentation reflects wastewater reuse, report</p>	<p>1 private sector engagement strategy completed, RAFF documentation reflects wastewater</p>	<p>Stakeholders are receptive to the engagement strategies and are interested in wastewater reuse.</p>

		private sector, marketing and educational materials on the RAFF	not operationalized as yet (to be done by WSRN project)	on recommendations for incentive programme completed	reuse, report on recommendations for incentive programme completed	
Output 4.3: Gender Sensitive Public Education and Awareness Campaign Implemented.	# of persons benefitting from education and training activities (Disaggregated by sex)	social media analytics, website analytics, registration forms, photos	BWA hosts the following types of PEA related activities: Water Wednesdays - 5 minutes on TV talking about water related issues General Town Hall meetings Community Outreach - open discussions/conversations between individuals and Senior Staff at BWA in Churches Community Walk Through - open discussions/conversations between individuals and Senior Staff at BWA BWA also has	6 schools (mix of primary and secondary) per year for 2 years = 12 schools x 25 students per school= 300 students(50% males and 50% females). 4-8 community consultations (Town halls, outreach, walk through etc) per year = 8-16 communities over 2 years x 75 persons per community = 600-1200 community persons(50% males and 50% females) 3 sessions (workshops,	6 schools per year for 5 years = 30 schools x 25 students per school = 750 students (50% males and 50% females) 6 community consultations per year for 5 years = 30 communities over 5 years = 2250 community persons (50% males and 50% females) (assuming attendance of 75 persons per consultation) 14 sessions (workshops, meetings,	MIBPA and BWA will be involved in the communication strategy. Communication about this Project, in suitable formats and inclusive of all stakeholders, will be ongoing throughout the life of the Project. There is the willingness of people to attend and share feedback at the consultation activities planned.

			Instagram and Facebook that provides of updates.	meetings, training etc) each targeting 15 farmers convened = 45 farmers (60% males and 40% females) 3 sessions (workshops, meetings, training etc) each targeting 15 private sector = 45 private businesses	training etc) each targeting 20 farmers convened = 280 farmers. This will include targeted training for the 155 farmers (60% males and 40% females) along the 9km pipeline benefiting from reclaimed water for primarily agriculture (and possible other reuse purposes) 8 sessions (workshops, meetings, training etc) each targeting 15 private sector = 120 private businesses	
	# of project updates available on the	website analytics, project webpage review/observation, BWA	0	At least 150 updates comprising the	At least 300 updates comprising the	Updates are timely, relevant and accessible to a wide cross section

	dedicated 3R-CReWS project webpage	progress reports to CCCCC		following formats: Videos/documentary, press releases of outputs of town hall meetings within communities, case studies, digital flyers, posters), 20 water Wednesdays (8 per year), 10 newsletters (4 per year)	following formats: Videos/documentary, press releases of outputs of town hall meetings within communities, case studies, digital flyers, posters), 40 water Wednesdays (8 per year), 20 newsletters (4 per year)	of stakeholders - private sector, individuals, tourists, national agencies, civil society
	# of project updates available on the dedicated social media accounts	social media account hits, views, likes - YouTube, Instagram, Twitter and Facebook	0	At least 1500 combined posts on the social media accounts	At least 5000 combined posts on the social media accounts (expected to reach over 90,000 persons)	Followers find the information useful and return frequently for updates
Project/programme co-benefit indicators						
More water available for the agriculture sector	% of the total ground water resources extracted and used for agricultural	BWA consumption data, flow meters measuring reclaimed water produced, BWA reports, site visit and observations. On farm survey/meter readings	16% of total extractions is used for agriculture purposes,	No change from baseline	10% of total extractions is used for agriculture purposes.	BSTP upgrades completed and distribution system in place.

	purposes. purposes ⁶⁹ .					
Improved water quality in the marine environment	Amount of wastewater discharged into marine environment	BWA Reports and flow meters data, Research, project documents, site visit, survey of plant employees.	An estimated 2.25 million m3 per year of treated wastewater discharged into marine environment.	No change from baseline	Less than 10% of treated wastewater discharged into marine environment.	BSTP upgrades completed and distribution system in place.
Improved air quality in the proximity of the plant	Level of H2S emissions Number odour complaints from communities surrounding of the BSTP and lift stations received per year	Survey in surrounding communities and plant employees, Environmental Protection Department (EPD) reports, Ministry of Health reports.	TBD ⁷⁰	TBD	TBD	BSTP fully upgraded and operational.
Increased participation of women in the production and use of reclaimed water	Number of persons (by sex), , involved in the production reclaimed water Number of persons (by sex) involved in the use of reclaimed water	BWA Human Resource Department, Ministry of Agriculture Database, Project reports, surveys.	8.6 males to 1 female working at the BSTP 0	No change expected No change expected	5 males to 1 female working at the BSTP 62 female farmers utilising of reclaimed water	BWA increases female staff by 3 females holding current males staff of 26 constant. Women have and or gain access to agriculture lands and financing and training needed to participate in the

⁶⁹ Approximately 57 Mm3/y is extracted from groundwater resources for domestic potable water distribution and an estimated 11 Mm3/y is extracted for agricultural irrigation (See Feasibility Study).

⁷⁰ H2S levels to be baseline at the beginning of the project. Similarly, the mid-term and final targets will be determined at the beginning at the project relative to the baselined. The BWA recently made some adjustments to the plant's operations as such it would be best to baseline the complaints using January to December 2022.

					production and use of reclaimed water.
E.6. Project/programme activities and deliverables					
<p><i>All project activities should be listed here with a description and sub-activities. Significant deliverables should be reflected in annex 5 implementation timetable. Add rows as needed.</i></p> <p><i>Please number the activities as shown below to indicate association of activities to the related outputs provided above in section E.5. Similarly, please number sub-activities as shown below to associate to the related activity.</i></p>					
Activities	Description	Sub-activities	Deliverables		
Activity 1.1.1: Design, procure and convert/upgrade the existing conventional activated sludge (CAS) biological treatment process at the Bridgetown Sewage Treatment Plant to tertiary filtration and disinfection for achieving national reclaimed water-quality standards.	<p>The CAS represents the simplest process configuration to operate and the least expensive to implement (similar in operation to the existing BSTP Contact Stabilization CAS process) and will achieve a high tertiary water quality suitable for reuse applications. As no expansion of the sewer or additional is contemplated that would need to increase the treatment capacity beyond the current CAS process capabilities, the existing contact stabilization could be upgraded by reconfiguring the existing aerobic, contact stabilization, sludge digestion and clarifiers into a pre-anoxic/aerobic configuration to achieve complete nitrification and high efficiency denitrification to meet the maximum total nitrogen concentration requirement of 5 mg-N/L, along with the addition of two new clarifiers, tertiary filtration and disinfection. Recirculation pumps, mixers and disinfection will also need to be added to achieve a water quality suitable for water reuse applications.</p> <p>The first step of a CAS system is the</p>	<p>1.1.1.1. Contract for detailed engineering design 1.1.1.2. Prepare tender package including the detailed drawings and specifications and bidding documents 1.1.1.3. Public consultations 1.1.1.4. Procure, Construct & Install Earthwork and Foundation, Mech. Equipment, Tanks & Infra., Piping and Aeration, Electrical and Instrumentation 1.1.1.5 Commissioning & Reinstatement</p>	<p>1.1.1.1 - 1 engineering design report 1.1.1.2 - 1 tender package detailed drawings, specifications and bidding documents 1.1.1.3 - 1 report on public consultations 1.1.1.4 - 1 CAS 4-stage Bardenpho installed at the BSTP location 1.1.1.5 - 1 Supervising Engineer's Certification of Completion</p>		

	<p>eration tank, where the wastewater is mixed with air to activate micro-organisms. The aeration basin is followed by a secondary clarifier or settling tank. During this step, micro-organisms with their adsorbed organic material settle. Water from the clarifier is transported to installations for disinfection and final discharge or to other tertiary treatment units for further purification.</p>		
<p>Activity 1.2.1: Install reverse osmosis (RO) membrane filtration systems to reduce the total dissolved solids concentration of the reclaimed water produced at BSTP</p>	<p>The reverse osmosis is a water separation technology where dissolved contaminants in water are physically removed by passing under pressure through a semipermeable, thin film membrane. The process is similar to the way your body's cells absorb water. Reverse osmosis will remove up to 98% of dissolved contaminants such as: minerals, salts, metals and organic matter that may be present in a water supply. Pores in the reverse osmosis membrane are so small that only water molecules pass through. The contaminants are rejected and discarded as wastewater.</p> <p>RO treatments will be required to remove total dissolved solids (TDS) to meet TDS <450 mg/L</p>	<p>1.2.1.1. Prepare tender package including the detailed drawings and specifications and bidding documents 1.2.1.2. Contract for detailed engineering design and installation 1.2.1.3. Construction of Earthwork and Foundation and installation of RO plant including, Piping, Electrical and Instrumentation 1.2.1.4 Commissioning of 7,200 m³/d capacity RO System</p>	<p>1.2.1.1 - 1 tender package with detailed drawings, specifications and bidding documents 1.2.1.2 - 1 engineering design report 1.2.1.3 - 1 RO plant installed and operationalized 1.2.1.4 - 1 Supervising Engineer's Certification of Completion</p>
<p>Activity 1.2.2: Install a 9Km pipeline and 6 aquifer recharge wells going from the BSTP for irrigation and aquifer recharge</p>	<p>Length of pipeline is 9 kms that will go from BSTP to Waterford (Botanical Gardens) with take-off at Hothersal roundabout to Friendship plantation the turn south along ABC H'way And Then Turn North Along Road up to Lears (Roberts Manufacturing) – irrigation can be done for lands on</p>	<p>1.2.2.1. Contract for detailed engineering design for pipeline and aquifer recharge wells including surveying geotechnical investigation, traffic management plan and easement 1.2.2.2. Prepare tender package including the detailed drawings and</p>	<p>1.2.2.1 - 1 engineering design report and management plan 1.2.2.2 - 1 tender package detailed drawings, specifications and bidding documents 1.2.2.3 - 1 public consultation report 1.2.2.4 - 9km pipeline installed and operationalized</p>

	<p>east and west of that road. Also take in Neil's Plantation, Salters, Constant and Valley Plantation. Assume 6 aquifer recharge wells will be included in this option</p>	<p>specifications and bidding documents 1.2.2.3. Gender Sensitive Public consultations 1.2.2.4. Procure, Construct & Install Earthwork and Foundation, Piping and Instrumentation 1.2.2.5. Construct & install aquifer recharge wells 1.2.2.6 Commissioning</p>	<p>1.2.2.5 - 6 aquifer recharge wells installed and operationalized 1.2.2.6 - 1 Supervising Engineer's Certification of Completion</p>
<p>Activity 1.3.1: Implement a sewer monitoring programme that will include the installation of flow measurement and rain-gauging equipment at the BSTP to identify and address sources of inflow and infiltration to the sewer. Mechanisms that identify and reduce or mitigate vulnerabilities in the wastewater collection systems will also be investigated.</p>	<p>Monitoring includes the installation of flow measurement and rain gauging systems at the BSTP, within manholes, and visual (qualitative) observations during wet and dry weather. Installation of sensors with alarms that detect when the water levels are at or above a critical height in the area of the manholes to act as an early detection system that will help the BWA/drainage division to respond to potential flooding early will also be undertaken. BWA will implement real-time evaluation of climate-related risks by establishing a routine data analysis program based on inputs provided from the flow meters and rain-gauging stations to be able to take mitigation/response actions in a timely manner</p>	<p>1.3.1.1. Prepare tendering package for detailed design, equipment specification and bidding requirements 1.3.1.2. Select vendor and procure equipment 1.3.1.3. Install equipment and test</p>	<p>1.3.1.1 - 1 engineering design reports with equipment specifications 1.3.1.2 - 1 tender package detailed drawings, specifications and bidding documents 1.3.1.3 - Sewer monitoring equipment installed and operationalized</p>
<p>Activity 1.3.2: Establish on-site laboratory facilities and personnel at the BSTP to generate influent and effluent water quality data to inform operations control strategies that optimize operations and reduce</p>	<p>An on-site laboratory will be established at the BSTP to analyse influent and wastewater treatment effluent quality for BSTP and the Zone An area cluster wastewater treatment plants, when they have been established. There will also be routine</p>	<p>1.3.2.1. Contract for engineering design 1.3.2.2. Prepare tender package including the detailed drawings and specifications and bidding documents 1.3.2.3. Select vendor, retrofit and equip laboratory at BSTP for</p>	<p>1.3.2.1 - 1 laboratory design report and equipment specifications that meet the needs of the upgraded system - location, layout, equipment, reagents, protocols, staffing etc. 1.3.2.2 - 1 tender package detailed drawings, specifications and bidding</p>

<p>energy consumption and GHG emissions.</p>	<p>(monthly) testing of groundwater wells that have been identified for aquifer recharge (among others managed by BWA).</p>	<p>analysing influent and effluent quality 1.3.2.4. Recruit laboratory technicians 1.3.2.5 Commissioning</p>	<p>documents 1.3.2.3 - 1 on-site laboratory established and analysing influent and effluent quality 1.3.2.4 - 2 laboratory technicians in place and managing the on-site laboratory 1.3.2.5 - 1 Supervising Engineer's Certification of Completion</p>
<p>Activity 1.3.3: Implement a Computerized Real-time Management System (CMMS) at the BSTP to inform decision making and climate resilient building</p>	<p>Develop a computer model-based simulation and control program to enable operations staff to track and interpret operations data and determine appropriate process changes. BWA currently uses SCADA that requires some additional equipment to enhance its capacity to function as an automated CMMS.</p>	<p>1.3.3.1. Contract for system design and equipment specification 1.3.3.2. Prepare tender package with detailed drawings, specifications and bidding documents 1.3.3.3. Procure, install and configure a reporting software program, sensors for the tanks to monitor dissolved oxygen content and sludge, brackets for mounting sensors and displays for sensors installed. 1.3.3.4. Establish a scheduled triggering system to ensure that when PM is due on a piece of equipment the Supervisor assigned to the equipment is alerted so they may assign the work to a staff member, or other team member 1.3.3.5. Track the performance for a minimum of one year to confirm and verify calibration under seasonal operating conditions and to ensure that PM tasks are being completed</p>	<p>1.3.3.1 - 1 CMMS design report and equipment specifications 1.3.3.2 - 1 tender package detailed drawings, specifications and bidding documents 1.3.3.3 - a) 1 SCADA reporting software installed, b) 8 DO sensors and brackets installed and working, c) 2 sludge sensors installed and working, d) 3 displays installed and working 1.3.3.4 - 1 triggering system manual developed 1.3.3.5 - 1 annual CMMS performance report with recommendations completed</p>
<p>Activity 1.4.1: Construct two small (cluster) decentralized wastewater collection and treatment systems in Zone A locations to produce reuse quality water for domestic/commercial non-potable water applications.</p>	<p>The decentralized wastewater systems will address the collection, treatment and disposal of the sewage in each area. The designs will consider the reuse of treated effluent generated within the service area and the safe disposal or use of excess</p>	<p>1.4.1.1. Contract for engineering design for collection, treatment, and disposal of sewage in the areas. This should include: Drone and topographic survey of the areas, social survey for the areas to determine extent of existing sanitary</p>	<p>1.4.1.1 - 1 engineering design report 1.4.1.2 - 1 tender package detailed drawings, specifications and bidding documents 1.4.1.3 - 1 report on public consultations 1.4.1.4 - 2 small decentralized</p>

	<p>treated effluent, if applicable. The design will continuously and reliably meet effluent and biosolids requirements that are in full compliance with GOB Environmental Protection Department Regulations</p>	<p>facilities, pit latrines, existing methods of wastewater disposal, Horizontal alignment of roads (for access and maintenance), Design of drainage and other infrastructure and Effluent reuse or disposal systems 1.4.1.2. Tender package including the detailed drawings and specifications and bidding documents 1.4.1.3. Public consultations 1.4.1.4. Procure, Construct & Install Earthwork and Foundation, Mech. Equipment, Tanks & Infra., Piping and Aeration, Electrical and Instrumentation 1.4.1.5 Commissioning</p>	<p>wastewater collection and treatment systems installed and operationalized 1.4.1.5 -1 Supervising Engineer's Certification of Completion</p>
<p>Activity 2.1.1: Install a grid-tied Photovoltaic (PV) Renewable Energy Systems to offset increased power consumption associated with the centralized treatment plant process upgrades using Category 3 hurricane resistant solar panels</p>	<p>To reduce the amount of emissions generated from energy consumption the PV system, with battery storage, will be ground-mounted in close proximity to the BTSTP WWTP. The installation of the PV systems will require civil and electrical work. Approvals are required from the Government Electrical Engineering Department (GEED), Barbados Light and Power (BL&P), and the Division of Energy. MESBE (Ministry of Energy, Small Business and Entrepreneurship) would have an interest in reviewing proposed renewable energy design options, such as solar.</p>	<p>2.1.1.1. Contract for engineering design and specifications for the PV system 2.1.1.2. Application to Division of Energy, BLPC, GED and Town and Country Planning for PV system (including ESIA, if deemed necessary) 2.1.1.3. Preparation of tender document for the installation of the grid-tied PV 2.1.1.4. Select vendor and install 2.1.1.5. Undertake certification and licensing process for the commissioning of the PV system</p>	<p>2.1.1.1 - 1 engineering design report 2.1.1.2 - 1 application to Division of Energy, BLPC, GED and Town and Country Planning completed 4) 1 tender package detailed drawings, specifications and bidding documents 5) 1 MW of PV equipment installed 6) 1 Certificate and License of 1MW of PV</p>
<p>Activity 2.1.2: Implement automated controls and energy efficiency measured within the upgraded centralized treatment processes to reduce the overall energy footprint and reduce GHG emissions.</p>	<p>The power for aeration is normally the largest energy consumption within the plant, typically consuming 40% or more of the total energy demand, even a small improvement in dissolved oxygen control can result in</p>	<p>2.1.2.1. Undertake engineering assessment of control systems to minimize power consumption 2.1.2.2. Prepare tender package including the detailed drawings and specifications and bidding documents</p>	<p>2.1.2.1 -1 engineering assessment report 2.1.2.2 -1 tender package detailed drawings, specifications and bidding documents</p>

	significant energy efficiency improvements. Hence, the installation of variable speed blower controls will allow BWA to minimize energy input at the BSTP	2.1.2.3. Select mechanical-electrical contractor and install variable frequency drives (VFDs), EE pumps, blowers and other EE equipment	2.1.2.3 - EE equipment installed and operating
Activity 2.1.3: Install sludge dewatering equipment to improve energy efficiency and reduce the overall GHG and CO2 emissions associated with the biosolids.	The wet sludge contains about 2% solids according to the O&M Manual, (1982). If the sludge can be dewatered to have 15% to 20% solids content, which is very typical with modern sludge dewatering technology, the volume of the sludge needing to be trucked out and disposed of would be reduced to only roughly 15% to 10% of the current volume.	2.1.3.1. Engineering design and specifications including assessment of quantity of biosolids 2.1.3.1. Prepare tender package including the detailed drawings and specifications and bidding document 2.1.3.3. Select vendor to provide WAS Pump, centrifuge package, solids dewatering, holding tank and chemical equipment 2.1.3.4. Construct and Install sludge dewatering technology including piping and electrical E&C	2.1.3.1 - 1 engineering design report 2.1.3.2 - 1 tender package detailed drawings, specifications and bidding documents 2.1.3.3 - Goods received report 2.1.3.4 - 1 sludge dewatering system installed and operationalized
Activity 3.1.1: Develop and provide specialized and customized training to support the operations and maintenance of wastewater collection and treatment facilities including photovoltaic equipment	Before launching the CMMS, all staff must be educated and trained on the system. Training will also be extended to other Ministries, Departments and Agencies, as appropriate. The following training topics have been deemed a priority given the scope of this project and being cognizant of BWA's training needs: SCADA, Gender Sensitivity, PV installations, Sewer monitoring instrumentation installed (flow meters, rain gauges), SOPs and operational manual updated, CAS and RO upgrades, CMMS, decentralized treatment system maintenance, lab technician training, industrial waste inspector training, CCTV equipment,	3.1.1.1. Conduct an assessment to develop and implement customised courses 3.1.1.2. Prepare training materials 3.1.1.3 (a). Pre-workshop evaluation 3.1.1.3 (b) Convene training sessions/workshops and prepare reports for the following areas - SCADA, Gender Sensitivity, PV installations, Sewer monitoring instrumentation installed (flow meters, rain gauges), SOPs and operational manual updated, CAS and RO upgrades, CMMS, decentralized treatment system maintenance, lab technician training, industrial waste inspector training, CCTV equipment,	3.1.1.1 - 1 Assessment report 3.1.1.2 - Training materials for the various courses/workshops developed 3.1.1.3 (a) - pre workshop evaluation reports, 3.1.1.3 (b) - 12 Training reports with registration forms and training evaluations completed 3.1.1.3 (c) - post workshop evaluation reports

	and operator training. These are approximately 12 training topics which might be merged pending contractors used.	and operator training 3.1.1.3 (c) Post workshop evaluation	
Activity 3.1.2: Update Standard Operating Procedures (SOP) and Operational Manual that addresses the requirements of the upgrades, preventative maintenance, operator safety, and environmental monitoring, including specific risks posed by to climate change and gender and social inclusion considerations adaptation and preventative maintenance.	Update Standard Operating Procedures (SOP) and Operational Manual with operational duties and responsibilities that are reflective of the requirements of the upgraded systems and technologies, and that promote an optimal preventative maintenance programme, operator safety, and environmental monitoring, including specific risks posed by to climate change and gender and social inclusion considerations adaptation and preventative maintenance.	3.1.2.1. Develop baseline report to review or develop standard operating procedures and operational manuals to reflect the requirements of the upgrades 3.1.2.2. Convene consultations with relevant stakeholders to review and feedback on the draft SOP and operational manual 3.1.2.3. Finalize SOP and operational manual 3.1.2.4. Develop knowledge products on the SOP and OM 3.1.2.5. Convene workshops on the SOP and OM	3.1.2.1 - 1 baseline report for the updating of the SOP and OM 3.1.2.2 - 1 stakeholder consultation report based on sessions with stakeholders to update the SOP and OM 3.1.2.3 - 1 updated SOP and OM 3.1.2.4 - knowledge products on SOP and OM 3.1.2.5 - 1 workshop report
Activity 3.1.3: Develop and implement a risk management framework to support the sustainable management of BWA's operations.	This risk management framework will be developed in consultation with all departments to identify the risk register, existing controls and further actions needed and opportunities for improvement, and train staff in its operation and further development. The latter will be implemented by BWA during the course of the project and assessed at the end of the project as a gauge of the level of sustainability built into the BWA's operations.	3.1.3.1. Develop baseline report on the existing risk management framework for BWA's operations 3.1.3.2. Convene consultations with BWA staff to elaborate the risk register and other key sections of the risk management framework 3.1.3.3. Finalize the risk management framework 3.1.3.4. Convene training on risk management framework 3.1.3.5. Evaluate/Review and update the risk management framework annually to ensure it is current/relevant to the existing operational environment	3.1.3.1 - 1 baseline report 3.1.3.2 - 1 consultation report of sessions with BWA staff to elaborate the risk management framework (RMF) 3.1.3.3 - 1 final updated risk management framework 3.1.3.4 - 1 training report 3.1.3.5 - 1 evaluation/review report on the suitability of the RMF and recommendations
Activity 3.2.1: Investigate and develop a strategic plan for the installation of water treatment facilities along the west coast corridor for augmenting	This will promote indirect potable reuse options for wastewater. This increases the utility and beneficiaries of treated wastewater since it can be	3.2.1.1. Conduct a situation and gap analysis of the wastewater disposal practices and its effects on ground water supply along the west coast	3.2.1.1 - 1 situation and gap analysis report 3.2.1.2 - 1 report on stakeholder consultations convened (for validation

<p>water supply and protecting the west coast ecosystem.</p>	<p>treated by an existing RO plant and be distributed through the existing water network to all consumers.</p>	<p>corridor. 3.2.1.2. Conduct stakeholder consultations (for validation and sensitization) 3.2.1.3. Develop a Strategic Master Plan to construct reverse osmosis water treatment plants to extract and treat brackish groundwater, extracted from areas impacted by decentralized onsite wastewater ground disposal practices along the west coast corridor, to produce drinking water.</p>	<p>and sensitization) 3.2.1.3 - 1 Strategic Master Plan</p>
<p>Activity 4.1.1: Undertake a legislative review to promote the Planning and Development Act, Wastewater Reuse Bill and other related legislations for enhancing wastewater effluent quality, treatment options and re-use requirements and applications. The review will also include recommendations for strengthening - private sector engagement, public-private partnerships, building codes, resiliency to climate change and equal opportunities and access to males and females.</p>	<p>There has been legislative advancement of the wastewater agenda in Barbados during the conceptualisation of this project. Hence, the project will support the advancement of wastewater related provisions through knowledge management products and the elaboration of a road map with key actions.</p>	<p>4.1.1.1. Baseline assessment of legislations and recommendations of what is required to advance wastewater treatment and reuse in Barbados 4.1.1.2. Convened interviews/stakeholder consultations 4.1.1.3. Develop road map with key actions to advance wastewater treatment and reuse in Barbados 4.1.1.4. Convene workshops on validation and stakeholder sensitization 4.1.1.5. Prepare knowledge management products such as videos, booklet, infographics etc., to promote awareness of what is required.</p>	<p>4.1.1.1 - 1 baseline report with recommendations 4.1.1.2 - 1 report on interviews and consultations with key stakeholders 4.1.1.3 - 1 road map (strategic action plan) 4.1.1.4 - 1 report on workshops (validation and sensitization) 4.1.1.5 - Knowledge products developed (video, booklet, infographic)</p>
<p>Activity 4.1.2: Develop a water and sanitation master plan that includes an optimal combination of decentralized, cluster and centralized water reclamation and reuse applications, with the centralized reclaimed water</p>	<p>The lessons emerging from this project can provide key input into the shaping of this strategy based on the combination of centralized and decentralized wastewater treatment technologies being implemented, as</p>	<p>4.1.2.1. Undertake situational analysis on the water and sanitation sector in Barbados, including a review of water resources planning and governance in Barbados, generated by BWA, similar studies in the Caribbean region from</p>	<p>4.1.2.1 - 1 situational analysis with recommendations report based on literature review and stakeholder consultations 4.1.2.2 - 1 report on stakeholder consultations</p>

<p>being transmitted and used for agricultural irrigation or industrial use (such as lower cost of reclaimed water transmission). This strategy will also take into consideration the social, gender-related and climate risks in the design and prioritizing of water reuse strategies.</p>	<p>well as lessons from the use of renewable energy technologies and engaging the private sector.</p>	<p>other international institutions and consideration of implications and recommendations of the current water protection and land use policy and the water reuse policy. 4.1.2.2. Convene meetings/consultations with key stakeholders 4.1.2.3. Develop a water and sanitation Master Plan 4.1.2.4. Convene high level meetings to validate and promote awareness of the findings and recommendations and foster commitment to implement the strategy</p>	<p>4.1.2.3 - 1 water and sanitation master plan 4.1.2.4 - 1 validation and stakeholder sensitization report</p>
<p>Activity 4.2.1 : Develop a strategy and action plan to engage the private sector in the provision and adoption of wastewater treatment technology and the utilization of wastewater by-products such as activated sludge. This includes conducting an assessment to identify opportunities for public-private partnership in the water and wastewater sector, especially for the expansion of the decentralized onsite cluster wastewater systems. The strategy will also promote gender equality and women empowerment</p>	<p>Private sector buy-in is essential for sustainability, scalability and replicability; therefore, strategic approaches for engaging and collaborating with these important stakeholders during, and after this project, will be identified. There is a potential role for the private sector to collaborate with BWA to utilize the dewatered sludge from the STPs and sludge the decentralized locations and process it for energy recovery, the recovery of nutrients and/or the production of bio-solids which could be sold as a fertilizer or soil conditioner. Such a facility would also accept other forms of waste from other industries and that this would be needed to be able to achieve input volumes to make such a facility commercially viable.</p>	<p>4.2.1.1. Undertake a baseline analysis of the private sector capacity and needs for engaging in the provision and adoption of wastewater technologies and use of wastewater by-products. 4.2.1.2. Convene consultations/meetings with key stakeholders 4.2.1.3. Prepare strategy and action plan 4.2.1.4. Develop knowledge products 4.2.1.5. Convene stakeholder validation and sensitization workshop (s)</p>	<p>4.2.1.1 - 1 baseline analysis report 4.2.1.2 - 1 report of stakeholder consultation 4.2.1.3 - 1 private sector strategy and action plan 4.2.1.4. Knowledge products available 4.2.1.5. 1 report on stakeholder validation and sensitization</p>

<p>Activity 4.2.2: Undertake a review and identify recommendations for a gender sensitive and socially inclusive incentive programme to encourage conservation, recycle, re-use.</p>	<p>Incentives for water conservation includes demand side management including pricing policies to incentivize reuse practices. Proposed incentives can include:</p> <ul style="list-style-type: none"> -Examine willingness to pay for non-potable reuse water versus payment for potable water as an incentive to use reuse water. This could be done as a stakeholder survey -Consider a scaled water use billing system to encourage water management and conservation -A reward system for individuals coming forward to identify potential Non-Revenue water (e.g. hydrants leaking, wet areas that shouldn't be wet, illegal water connections, etc.) -Reduced development cost charges for residential and commercial developments that establish their own water reclamation and reuse system – reducing impact on government infrastructure -Reduced potable water rates for residential and commercial developments that establish their own water reclamation and reuse system – reducing impact on government infrastructure -Reduced electrical power rates for residential and commercial developments that establish PV systems that feed into the grid (Europe, Canada and the US pay substantially more for green power 	<p>4.2.2.1. Conduct a desk review of best international gender-oriented practices and strategies for consideration in producing education and promotional materials and programs "best" suited to Barbados.</p> <p>4.2.2.2. Convene wide stakeholder consultations and surveys to inform the design of the incentive programme. This includes community level reach.</p> <p>4.2.2.3. Develop the framework for the gender sensitive and socially inclusive incentive programme</p> <p>4.2.2.4. Convene high level meetings to validate and promote awareness of the findings and recommendations and foster commitment to implement the incentive programme</p>	<p>4.2.2.1 - 1 report on desk review</p> <p>4.2.2.2 - 1 report on stakeholder consultations</p> <p>4.2.2.3 - 1 framework for the gender sensitive and socially inclusive incentive programme</p> <p>4.2.2.4 - 1 validation and stakeholder sensitization report</p>
--	---	---	---

	<p>that is privately produced) -Examine government fees related to development costs and see if water and energy conservation measures can obtain credits or reduce fees as incentive</p>		
<p>Activity 4.2.3: Expand the Revolving Adaptation Fund Facility (RAFF) to provide resources for the adoption of decentralized onsite wastewater systems.</p>	<p>RAFF to provide financing for retrofitting, plumbing and the installation of treatment systems. The RAFF will also be expanded to provide resources for enabling end users of reclaimed water to adapt the necessary technology to utilize available reclaimed water supply (such as small-scale irrigation and drainage systems, renewable energy and energy efficiency technologies and water conservation technologies). Energy savings accruing to the BWA associated with the PV systems in Component 2 will be used to expand the RAFF, which is being implemented as part of WSRN S-Barbados.</p>	<p>4.2.3.1. Convene consultations with private and public sector to determine scope of support to be covered by the RAFF finances. 4.2.3.2. Update of the RAFF charter 4.2.3.3. Sensitization on the updated RAFF to provide an overview of the resources available for the adoption of decentralized onsite wastewater systems. 4.2.3.4. Production of marketing and educational materials on the RAFF re: availability of resources for the adoption of decentralized onsite wastewater systems and modalities for accessing resources</p>	<p>4.2.3.1 - 1 report of stakeholder consultation and recommendations for the operationalisation of the RAFF to provide resources to private individuals and businesses for the adoption of decentralized onsite wastewater systems. 4.2.3.2 - 1 updated RAFF charter 4.2.3.3 - 1 report on RAFF sensitization activities 4.2.3.4 - RAFF marketing and educational materials developed</p>
<p>Activity 4.3.1: Re-educate communities, teachers, students, farmers and businesses about the impact of climate change on water resources and their impact on water quality and quantity (availability as well as the importance of water reuse activities and indirect potable reuse (IPR)) to building climate resilience in the Water Sector.</p>	<p>Develop program to provide educational support materials for teachers and participate in the delivery of public education programs and associated events that serve to educate students. This increases the general knowledge within the community about water, so they can make informed decisions, starting with the water cycle and basic facts about water use to protect public safety before addressing water reuse. A</p>	<p>4.3.1.1. Undertake KAP survey to establish baselines and training needs of schools, farmers, communities and the private sector. 4.3.1.2. Produce grade-appropriate educational materials regarding limited groundwater resources, understanding of hydrogeology related to water quality protection on Barbados, and other water conservation aspects. Consultant to also identify optimal modalities for</p>	<p>4.3.1.1 - 1 KAP survey report 4.3.1.2 - Grade-appropriate educational materials 4.3.1.3 - Training programmes for communities, farmers and businesses 4.3.1.4 - Training session convened and reports for 30 school session, 30 community sessions, 14 sessions targeting farmers and 8 sessions targeting private sectors convened 4.3.1.5 - final evaluation report of the</p>

	<p>change in public perception is required to be able to facilitate IPR. Water reclamation and reuse is practiced globally to address limited water resource conditions and drought. This also includes outreach programmes in schools, community-based organizations, and stakeholders' groups across customer class as well as a Public Service Announcements and educational materials that addresses best practices for efficient water use, conservation, and reuse. Further, this activity will develop and provide information resources to private individuals and businesses for the adoption of decentralized onsite wastewater systems. The re-education programs will ensure to promote equal opportunities and access to men, women and the LGBTQIA community.</p>	<p>implementation 4.3.1.3. Develop training programmes for communities, farmers and businesses on the nexus of climate change and water sector and options for conservation, recycle, re-use. Consultant to also identify optimal modalities for implementation 4.3.1.4. Implement training sessions through mediums deemed most suitable 4.3.1.5. Final evaluation of effectiveness of training and lessons learned</p>	<p>effectiveness of the training and lessons learned</p>
<p>Activity 4.3.2: Develop and implement a Gender Sensitive Public Awareness Campaign for community and visitors (tourists) through workshops, videos, community town hall meetings, site tours (demonstration of the plant technology and by-product reuse) and consultations. Emphasis will be placed on assuring the general public about food safety to ensure there is public acceptance and trust in the agriculture produce from local farms using the</p>	<p>Campaigns tend to be more successful when citizens are genuinely included in the decision-making process. This includes public opinion regarding the water utility or other agencies that promote the reuse project, and early public outreach to build trust in the community, with the dissemination of factual information beginning at the highest levels in the community. By engaging the support of key stakeholders, they can be later</p>	<p>4.3.2.1. Develop a communication strategy to address the public information needs surrounding all the activities of the project – pipeline works, upgrades to the BSTP, decentralised plant installation etc. 4.3.2.2. Implement the activities of the PEA that should include: videos/documentary, town hall meetings within communities, multi-media (social, newspaper, Radio and TV), demonstration sites, case</p>	<p>4.3.2.1 - 1 communication strategy 4.3.2.2 - At least 300 updates comprising the following formats: Videos/documentary, press releases of outputs of town hall meetings within communities, case studies, digital flyers, posters), 40 water Wednesdays (8 per year), 20 newsletters (4 per year) 4.3.2.3 - 1 report on the effectiveness of the PEA campaign</p>

<p>treated wastewater as well as the improved resilience of the water sector and the direct and indirect benefits on ecosystem services and ecotourism. Share lessons learnt to spur greater public and entrepreneurial involvement.</p>	<p>called upon to provide endorsements of water reuse.</p> <p>Develop and implement educational materials that gain public acceptance of climate-related risks and water conservation measures. Include broader awareness campaign to address issues to manhole covers as a result of human interference. Create demonstration sites at the end user location sites to showcase the benefits of reusing treated wastewater for irrigation.</p>	<p>studies, educational materials (flyers, posters)</p> <p>4.3.2.3. Final evaluation of effectiveness of the PEA programme and lessons learned</p>	
<p>Activity 4.3.3: Develop a 3R-CReWS Project Page and social media accounts, which is dedicated to transparent measures of reporting, knowledge products, identify/host a link to the Redress Mechanism and provide update to all stakeholders on the project activities.</p>	<p>Develop a project dedicated website to serve as an education, awareness and transparency tool that provides news/updates on the implementation of the project activities (iii) publishes education and awareness products and (iv) serves as a redress mechanism among others</p> <p>This page will include, to the best extent possible, functions such as audio, sub-titles and/or sign language to encourage social inclusion from disabled population. The project's webpage will also ensure to report project results disaggregated by gender, where possible.</p> <p>There will be a Knowledge Management Strategy that identifies that goal/vision for knowledge management the project, provides a</p>	<p>4.3.3.1. Develop a knowledge management strategy (KMS) that will utilize the web page.</p> <p>4.3.3.2. Develop project web page.</p> <p>4.3.3.3. Implement KMS including custom materials for the project website and update social media accounts to extend the reach of the PEA materials. This includes YouTube, Twitter, Instagram and Facebook accounts.</p>	<p>4.3.3.1 - 1 knowledge management strategy</p> <p>4.3.3.2. - 1 project web page</p> <p>4.3.3.3. - 1 KMS and 5000 posts on social media - YouTube, Twitter, Instagram and Facebook accounts combined</p>

	roadmap that highlights the approach that will be taken to implement this strategy, identifies key persons for implementing KMS, identifies and describes how the different project components will be addressed under the KMS, and required resources (time, budget and expertise) for executing each activity		
--	---	--	--

E.7. Monitoring, reporting and evaluation arrangements (max. 500 words, approximately 1 page)

Project M&E Arrangements

Indicators underpin an M&E system’s practical applicability as they serve to help practitioners know when outcomes or results have or have not been achieved and inform adjustments to current interventions and decision making toward future interventions. The performance indicators for the 3R-CReWs comprise a mix of GCF core and supplementary indicators as well as project specific indicators. The M&E plan identifies the data source, data collection tools, frequency, and budget requirements for monitoring all the indicators of the project. The detailed logframe for the project contains the baselines and targets associated with the indicators. Collectively these tools (M&E Plan and Logframe) will provide the guidance required to monitor and periodically evaluate the performance of the project and identify key lessons. There will also be a dedicated project officer assigned with the M&E responsibilities given that this project spans a wide cross section of direct beneficiaries and stakeholders including communities, farmers, government agencies and businesses. Hence, consultations and follow-up with them on the quality of products or services developed and lessons will be extensive.

Two types of evaluations will be undertaken during the lifetime of the 3R-CReWS project – a formative and summative evaluation. Notable is that a key requirement of the GCF is that an assessment of the level of achievement of the paradigm shift potential be undertaken during these stages of the project using a three-point scale scorecard template (to be developed by the Secretariat).

Formative evaluation is generally undertaken during a project’s implementation for trying to understand why a program works or doesn’t, and what other factors (internal and external) are at work during a project’s life to improve the project’s design and chance of successfully achieving the desired outcomes. The formative evaluation will complement the final summative evaluation. The summative evaluation of 3R-CReWS will use a balance of both quantitative and qualitative methods to get a better understanding of what the project has achieved, and how or why. There will also be emphasis on unintended consequences, the evaluation drivers of accountability and will be more outcome-focused than process focused.

CCCCC-GCF Reporting Arrangement

CCCCC reporting to the GCF fund will be guided by GCF Monitoring and Accountability Framework for Accredited Entities, its Accreditation Master Agreement and terms to be agreed in the funding agreement. Aligned with GCF's Monitoring and Accountability Framework for Accredited Entities, CCCCC will undertake continuous monitoring of the project through site visits and quarterly reports, which will feed into semi-annual performance reports and an annual performance report.

The Annual Performance Reports (APRs) will include the financial management reports and progress report on all activities. It will identify potential risk to project activities and remedial action(s). These reports will also evaluate the activities against the targets set out in the logical framework, which are in accordance with the GCF investment framework criteria. CCCCC monitoring and reporting will consider feedback from direct beneficiaries: communities, farmers, businesses, and government agencies. This approach allows for a bi-directional flow of information that is not only important for monitoring their satisfaction with the products and allowing them to continually feedback on design elements but also to ensure that buy-in and ownership for relevant products and services are being built at the national level for sustainability, replicability, and scalability purposes.

At the mid-term of the project the formative evaluation report will be submitted to the GCF for review. There will also be a final report at the end of the period of implementation, which will provide a holistic view of the achievements of the project, impact, effectiveness, and efficiency (financial and economic), financial records, stakeholder feedback and lessons learnt. This report will also be accompanied by the final project financial audit to be completed by an independent and accredited auditor. All records on this project will be kept in accordance with Clause 15.01(c) of the CCCCC's Accreditation Master Agreement. The CCCCC will submit in English the final project report, including the final evaluation report, to the GCF within 6 months of the completion of the project.

BWA-CCCCC Reporting Arrangements

To ensure the project continue to be both viable and sustainable, detailed timely reporting, monitoring and evaluation will be carried out. The BWA, through the project implementation unit, will provide CCCCC with (i) quarterly progress reports in a format consistent with CCCCC project management and performance reporting system; (ii) consolidated annual reports including (a) progress achieved by output as measured through the indicator's performance targets, (b) key implementation issues, solutions and lessons; (c) status of implementation of the ESMP (d) updated procurement plan and (e) updated implementation plan for next 12 months; and (iii) a project completion report within 6 months of physical completion of the Project. Financial audits of all accounts will also be conducted on a yearly basis. Within 3 months of physical completion of the Project the BWA will submit a project completion report to Government of Barbados and CCCCC.

The Figure 15 below shows the key M&E elements, processes and relationships at play. The middle of the figure shows that there are 2 monitoring and evaluation processes happening; monitoring will be done continuously, and evaluation is slated for the mid and end-of term. Importantly, the tools and processes will be similar, except for the frequency of occurrence. At the top is the demand side, that is, the key persons or institutions that are demanding transparency and accountability. As can be seen from the Figure, the demand side provides the impetus for the need for M&E (yellow

arrows) and are the primary recipients of the M&E information (blue arrows). At the lower end of the supply side, that is persons with information and leadership for the M&E processes.

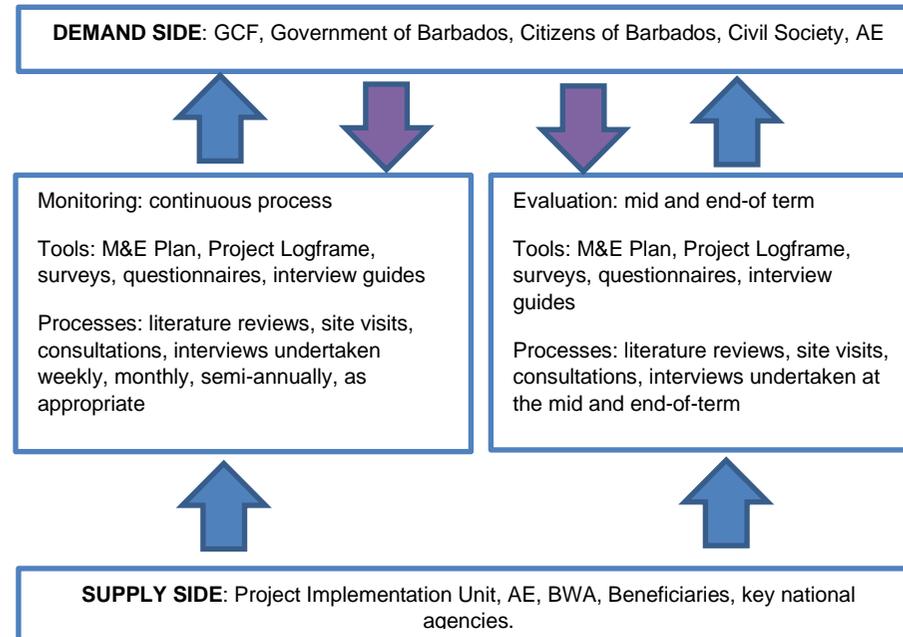


Figure 15: Interactions of key M&E elements, processes and relationships

F. RISK ASSESSMENT AND MANAGEMENT

F.1. Risk factors and mitigations measures (max. 3 pages)

As part of output 3.1 (activity 3.1.3), a comprehensive technical and operational risk assessment, including climate change risks, will be undertaken as a central element of the paradigm shift and sustainability of the investments. A risk monitoring and management system will be established in BWA as a permanent management capacity. An overview of this output can be found in the relevant sections of this document (e.g., B.2, B.6 and E), with details provided in the Feasibility Study (Annex 2) in particular includes a detailed list of technical and operational risks of the wastewater treatment operation. In this section a brief summary of the technical and operational risks will be provided, with an emphasis on risks associated with project management and implementation.

Selected Risk Factor 1

Category	Probability	Impact
<u>Technical and operational</u>	<u>Low</u>	<u>Low</u>

Description

Wastewater treatment is a crucial public service that needs to be available at all times. The introduction of new infrastructural facilities for the treatment of wastewater carries risks associated with interruptions during construction, starting up the new procedures and staff experience.

Mitigation Measure(s)

BWA staff are very familiar with the current facilities at the WTPs that will see facility upgrades. They will be engaged in the planning of the installation works from the beginning and be fully consulted and engaged during the implementation of the works. The suppliers of the new facilities will be required to install and start operation of all facilities, fine-tune installations over an initial operating period, as well as training of BWA staff.

Infrastructure works will be undertaken during the season when there is relatively little flow going through the system (e.g. outside of the main tourist season and when rains are typically low). The built-in capacity of the system will be utilized to buffer flows during any planned disruptions (such as disconnecting and reconnecting pipes between sub-systems), such that the system overall remains functional. Considering that the planned investments are for new modules to be added to the existing facilities, such planned disruptions are expected to be few. In the event that unexpected disruptions do occur, possibly due to external events, ocean outfall of raw sewage may be required as a solution of last resort, but it is not expected that this will be necessary.

Further details on the facilities to be installed and their integration with existing facilities can be found in Annex 2.

Selected Risk Factor 2

Category	Probability	Impact
<u>Technical and operational</u>	<u>Medium</u>	<u>Low</u>

Description

Climate change forecasts indicate a reduction of rainfall of about 9% by 2050 compared to current rainfall. The incidence of severe storms with high rainfall events, however, is expected to increase. Such storms have the potential to overwhelm the wastewater treatment, as a result of surface run-off of rain entering the sewerage system.

Mitigation Measure(s)

The sewerage system in Barbados is designed to only convey wastewater but storm water enters the sewerage system during episodes of high rainfall nonetheless. Two main sources of stormwater entry have been identified: (1) manhole covers of the sewerage system are lifted by local neighbours to alleviate surface

flooding; and (2) contrary to the building code, several larger residential buildings have connected downspouts to the sewerage connection.

The project includes activities under output 1.3 to (1) identify areas where excessively large inflows generate from and to notify non-compliant building owners of their violation of the building code with an instruction to remediate the situation; and (2) to remove or restrict operating access to the manhole covers.

If ocean outfall of raw sewage occurs, the impacts are mitigated due to the fact that the concentration of waste is strongly reduced by the large volume of stormwater in the effluent.

Selected Risk Factor 3

Category	Probability	Impact
<u>Technical and operational</u>	<u>Low</u>	<u>Medium</u>

Description

Geologically speaking, Barbados is a limestone dome, largely formed from coral reefs over millennia. As a result, the subsoil is relatively porous due to significant karstification. Infiltration of tertiary treated effluent from the WTPs may reach the aquifer rapidly through crevasses and caves, rather than permeate slowly through the soil, which could lead to contamination of the aquifer.

Mitigation Measure(s)

Barbados has a world-class geological survey, with special emphasis on the porosity of the limestone formations. This is driven by the importance of the limestone formation for the water supply of Barbados – being the only reservoir of freshwater on the island – as well as for the structural integrity of all buildings and infrastructure (mapping of sink holes).

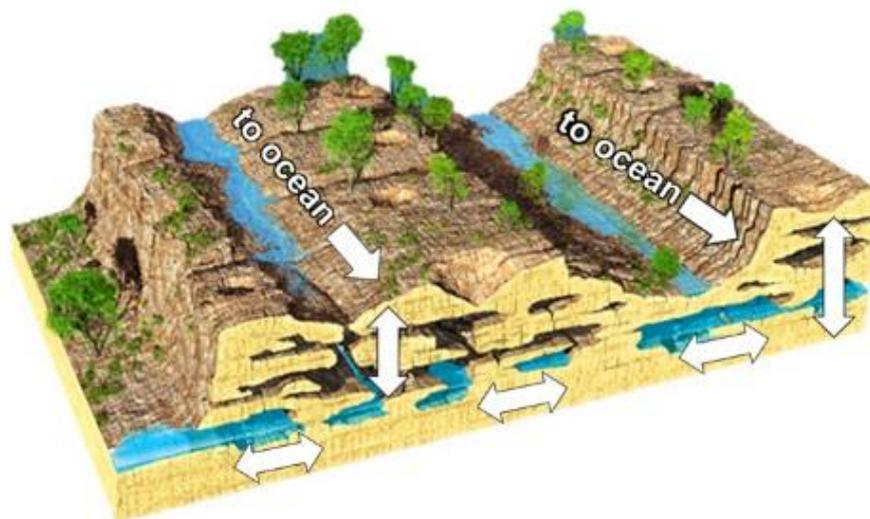


Figure 16: Typical karstic sub-soil in Barbados. Source: <https://climatechangebarbados.com/water-resources/>

The effluent from the WTPs is regularly tested to ensure compliance with regulations, particularly in relation to bio-safety and dissolved nutrients. The infiltration zones for the treated wastewater will be selected on the basis of expert knowledge of the limestone formation in BWA and other relevant government agencies. Given that the Environmental Protection Department runs regular tests on the water quality to ensure that it meets World Health Organization standards for drinking, any contamination will be observed quickly and addressed immediately.

Selected Risk Factor 4		
Category	Probability	Impact
<u>Governance</u>	<u>Medium</u>	<u>Low</u>
Description		
<p>In general, Barbados has a well-developed regulatory system, for natural environments, built-up areas, economic activities (such as tourism), infrastructure, and others. Compliance and enforcements, however, are not always effective.</p>		
Mitigation Measure(s)		
<p>Regulatory gaps will be addressed through the project and BWA will be supplied with monitoring tools to support enforcement of regulations.</p> <p>Behavioural change, such as on water use and misuse of the sewerage system, in the general population and government staff will take time to materialize. The project has several activities focused on sensitization and awareness-raising. In combination with a growing awareness of the impacts of climate change on Barbados in the general population, it is expected that the irrational use of water and the sewerage infrastructure will reduce over time.</p>		
Selected Risk Factor 5		
Category	Probability	Impact
<u>Governance</u>	<u>Medium</u>	<u>Low</u>
Description		
<p>Inadequate incorporation of gender, and environmental and social safeguard (ESS) considerations into the implementation of the proposed activities as well as its management.</p>		
Mitigation Measure(s)		
<p>The project has been assessed according to the GCF's environmental and social protection standards and associated risks and mitigation measures have been identified (sections G.1 and G.2 and relevant annexes). A Gender Action Plan has been developed (annex 8) and will be implemented to ensure that gender equality is incorporated into all interventions. An Environmental and Social Management Plan (ESMP) has also been designed based on a detailed analysis of the proposed activities. The ESMP will provide a framework for ensuring that project activities do not have a negative impact on the environment, women, or disadvantaged groups.</p>		
Selected Risk Factor 6		
Category	Probability	Impact
<u>Prohibited practices</u>	<u>Low</u>	<u>Medium</u>
Description		
<p>Procurement process may be compromised by application of sanctioned entities to tenders.</p>		
Mitigation Measure(s)		
<p>Procurement of goods and services for the project will be undertaken by CCCCC. CCCCC has in place a procurement system that complies with international standards. In particular, CCCCC will not contract any party who is on the United Nation sanctions list.</p> <p>Barbados is a participant in FATF and its regional body CFATF.</p>		

There are no United Nations Security Council (UNSC) sanction regimes currently under implementation for Barbados. In addition, no individual, entity or other group listed on the UNSC sanctions list, including the consolidated list, will be involved in any manner with the project or its activities, either as a counterparty, implementer or beneficiary.

Selected Risk Factor 7

Category	Probability	Impact
<u>Forex</u>	<u>Low</u>	<u>Medium</u>

Description

Currency fluctuations may impact the budget of the project.

Mitigation Measure(s)

All international services will be procured in USD, hence there are no forex risks. The Barbadian Dollar is pegged to the USD at a rate of 1USD = 2BBD and has been stable for at least 10 years – domestically procured services are therefore also free of currency exchange risk.

Procurement of goods for the facility upgrades at the WTPs, however, will be internationally tendered and may be subject to price fluctuations when specified in a currency other than USD. The tender documents will require bidders to quote the goods in USD as well as local currency, if relevant, such that factoring of currency fluctuations are visible to both parties.

G. GCF POLICIES AND STANDARDS

G.1. Environmental and social risk assessment (max. 750 words, approximately 1.5 pages)

Initial screening of the project activities indicates that the project has an ESS category B rating. This is because while construction is taking place, it is as an expansion of existing facilities and without generating significant levels of waste or other environmental impacts. No land acquisition or displacement of peoples or assets is foreseen. Nevertheless, and in compliance with government regulations, a full ESIA and an associated ESMP have been developed as part of this funding proposal. The ESIA and ESMP are annexed to this document as annexes 6A (ESIA, 2 volumes) and 6B (ESMP). The ESMP follows the Environmental and Social Safeguards Policy and Performance Standards (2015) of CCCCC.

The ESIA reports on the area that comprises the project intervention areas, as well as their surroundings, specifically defined according to each environmental issue's characteristics. Direct and indirect influence areas were defined for most of the project components. The general direct influence areas include the area for the implementation of the water reclamation facilities and other areas attached to the construction works (such as construction sites and temporary support structures). Indirect influence areas correspond to a buffer around the different direct influence areas where effects from the construction activities or during the exploration phase may be felt.

Most of the project's impacts will arise during the **construction phase**, due to construction activities: land clearance, demolition, trenching and excavation, operation of heavy machinery, truck traffic, among others. These are likely to cause temporary to short-term negative impacts such as soil erosion, pollution (noise, dust, and possible spillages) and disturbance of the local people's everyday life. Mitigation is usually possible for most of these impacts, meaning that most of them should be of low significance after adequate action and management. No high significance negative impact was identified; the two "moderate" negative impacts are alteration / destruction of terrestrial habitats and traffic disruption and congestion. The alteration / destruction of terrestrial habitats occurs when habitats like forested rangeland areas (in the area with the aquifer recharge wells and service areas) are affected. Traffic disruption and congestion will occur due to circulation of heavy-duty vehicles transporting materials to and from the working sites as well as heavy machinery circulation, in addition to works occurring next to roads (pipe laying). Chapter 3 in the ESMP contains mitigation measures for these two moderate impacts, as well as for a host of other risks and impacts.

The **operational phase** will bring the major expected positive impacts, with the most relevant ones being in different domains, such as: improved resilience to climate change effects; reduction of polluting pressures potentially affecting groundwater quality; increase quantity and quality of groundwater resources in the St. Thomas – St. Michael aquifer; reduction of sewage pollution in the Constitution River; improvement of water quality in Carlisle Bay; improvement of air quality and reduced GHG emissions; energy recovery from waste; enhancement of the ecological quality of the marine environment; project according with urban and territorial planning; employment opportunities; improved conditions for the agricultural sector and increased water availability for domestic purposes; increased attraction of tourists; improved public health; education of the general public and awareness.

Avoiding negative impacts during the operational phase requires diligent and efficient facility management, including maintenance and timely replacement of critical components prior to failure. BWA developed and applies operation and maintenance (O&M) plans, which will be amended to include the facilities implemented under the project. Elements to be covered in the O&M plans include monitoring of groundwater; BSTP influent and effluent; marine water; odour; coral reef health. All these monitoring programmes will result in periodic reports delivered to the competent government agencies (and CZMA in the case of the coral reef monitoring), including the ESIA authority.

Overall, the ESIA does not identify any significant negative environmental and social impacts from the implementation of the project, specifically due to the upgrade of the Bridgetown STP, the implementation of the aquifer recharge facility, the reclaimed water pipeline and the two onsite decentralized treatment plants and associated wastewater collection areas. Some negative impacts of low and moderate significance have been identified in the construction and operation phases, but these can be adequately mitigated by the

suggested measures, alongside a rigorous implementation of the ESMP. On the other hand, the project will generate multiple important positive impacts, affecting different spheres such as climate change resilience, ecology and socioeconomics, actively contributing to a general development of the region, and more specifically to an improved water supply management and a safer and more reliable water provision. Concretely, the project will improve resilience to climate change effects on water scarcity through the increase of quantity and quality of groundwater resources in the St. Thomas – St. Michael aquifer and by improving conditions for the agricultural sector. In fact, adopting systems that enhance the wastewater systems enables the country to access water resources that otherwise would not have been put into productive use. This helps to alleviate some of the water scarcity issues affecting Barbados, which are exacerbated by climate change. These actions will also complement ongoing activities aimed at building climate resilience in the water sector of Barbados. Indeed, some positive impacts from this project are cumulative with those arising the upgrade of the South Coast STP also foreseen in the near future. The project will enhance the ecological quality of the marine environment and the water quality of the Carlisle Bay. At the same time, it will help to improve air quality and reduce GHG emissions through enhanced resources management, specifically through the production of renewable energy (through solar energy and biogas).

Executing Entity capacity to implement the ESMP

BWA, as the promoter of the project and the governmental institution responsible for water supply and wastewater treatment in Barbados, as well as being an executing entity of the project, has a central role in the implementation of the ESMP and ensuring that all the enhancement and mitigation measures, and monitoring activities are communicated to and carried out by trained BWA staff or other competent authorities. The management of public concerns and external information requests also falls under the responsibility of BWA. Additionally, the BWA will be responsible for the approval of changes to the ESMP, as well as the approval and adoption of additional mitigation measures that were not foreseen during the ESIA and ESMP stages but that may be deemed necessary as the project progresses.

BWA shares some responsibilities with the Planning and Development Department and the Environmental Protection Department, the central government entities that coordinate and advise on all environmental issues, including ESIA procedures and requirements. Shared responsibilities include ensuring that the findings and recommendations of the ESIA are integrated in the overall project design, costing, cost-benefit analyses, project management and implementation arrangements. This will be accomplished by the revision of submitted documentation as well as periodical site visits and issuance of recommendations.

CCCCC, in its capacity as accredited entity to the GCF, will ensure that the implementation of the ESMP complies with GCF policies and guidelines.

Reporting on the implementation of the ESMP will be undertaken jointly by BWA and CCCCC, in compliance with GCF policies. Further details are provided in Annex 11. Chapter 8 in the ESMP (Annex 6B) provides more details on the institutional arrangements related to safeguards monitoring and reporting.

Stakeholder consultations and grievance redress

Grievance redress is a critical component of this project for both the CCCCC and the GCF and it is intended that stakeholders will have a plethora of options to express grievances. It is known that projects having strong grievance redress mechanism are usually less exposed reputational risk, less disruptions and more importantly it increases in buy-in and ownerships for projects. Not only is a GRM important for those affected by the project, even if it was unintended, but more importantly it provides a genuine opportunity to for the AE and IE to hear the complaints as it relates to the nature and extent of grievances. It clearly articulates the process through which anyone being affected by the project can submit a grievance and is confident that it

will be addressed in a systematic, fair, transparent and timely manner. Furthermore, it will seek to ensure that the complainant identity is protect, in so far as to prevent any change of victimization. Operationalization of the grievance or complaints mechanism will be layered in this regard. There will be three levels offered by the AE. The first level is at the EA level the second by the AE and the third by the funder. In the community communication strategy information will be shared on what are grievance and the avenues available to the communities for their voices their concerns.

The CCCCC in is ESP&SP outlines considerations for grievance redress. The centre allows for all complaints, concerns, queries, and clarifications regarding projects/programmes supported by the Centre can also be filed with the Centre using the following address: complaints@caribbeanclimate.bz; or via the following website link <https://www.caribbeanclimate.bz/contact-us/complaints/>. Project will be monitored during implementation and will proactively check on the risk that were identified at the project development stages as it related to activity that were likely to cause interruptions to the communities. The centre goes even further by allowing complainants to lodge their grievance in another format they are comfortable.

This proposed project has been developed through extensive consultations will all stakeholders involved. Consultations have taken place with, *inter alia*:

- Government agencies that are mandated in fields where water management is relevant, including infrastructure development, agriculture, environmental protection, and environmental health.
- Private sector entities that use and/or discharge large quantities of water.
- University of the West Indies, gender related issues
- Climate change experts from the Government and related agencies, such as the Caribbean Institute for Meteorology and Hydrology.
- Farmers, on their willingness to use reclaimed wastewater for irrigation of crops.
- General population, on their willingness to consume agricultural produce grown with reclaimed wastewater.

A full account of stakeholder consultations and a stakeholder management and engagement plan for the implementation of the project is included in Annex 7.

Barbados has an Office of the Ombudsman, established by an Act of Parliament in 2009. All government agencies, including the BWA, are subject to investigations by the Ombudsman in response to complaints from members of the public after having received a written complaint. This is the principal grievance redress mechanism of Barbados, and all activities of the project are covered under this arrangement. Additionally, the project will establish an internal grievance redress mechanism, managed by the PSC, as a first-level mechanism to address complaints and concerns from all stakeholders.

Disclosure of the applicable safeguards reports will follow the requirements of the GCF Information Disclosure Policy and Environmental and Social Policy.

Indigenous Peoples

Barbados has no Indigenous Peoples communities and the GCF Indigenous Peoples Policy therefore does not apply.

G.2. Gender assessment and action plan (max. 500 words, approximately 1 page)

Gender Assessment, Findings and Recommendations

A gender assessment and action plan were completed in a participatory manner. Focused discussions with Key informants, including from the BWA was undertaken. The assessment examined the gender equality

challenges facing Barbados and the BWA as an institution. The Gender Analysis Process Model used to conduct the gender equality assessment comprised of four main parts, namely Gender Screening, Gender-Related Data Collection, Gender Impact Assessment and Mainstreaming Gender in the Project Cycle in conformity with the GCF standards and the CCCCC Gender Policy. Key findings emerging from the four phases are that:

1. Barbados has made significant human development gains, the results have not always translated to improvement in gender equality. revealed that at the national level, there is a 60% gender gap among parliamentarians, a 14% gender gap among, and a 60% gender gap among the Cabinet Ministers. Import to note is that Barbados has a female prime minister.
2. There still remains gender segregation of roles, except in technical professions and among legislators/managers, where there are still marginally more men than women. However, A Gender Analysis of Labour Force Data and Policy Frameworks in Six Caribbean Countries” stated that Barbados has been recognized as one of the Caribbean countries leading the way on closing the gender gap in the workplace.
3. The BWA has more men involved in the technical aspects of the Wastewater Division management role, while women serve in more administrative capacities.
4. There are many issues where both men and women share similar views on wastewater collection and treatment among the stakeholders in Barbados. However, men seemingly more concerned with paying for wastewater improvement.
5. Men and Women in Barbados are concerned that climate change will affect the quantity of drinking water. In a perception survey conducted on , 85% of women and 58% of men rated as very concerned. This is reflective of the statistical data showing that in general, women engage in more water related tasks within the household, such as cooking, cleaning, and washing, and therefore tend to report greater amounts of water usage (Suchorski, 2009). Expansion of decentralized sewage treatment systems will have increased benefit for women as a result.
6. Some of the legal instruments governing the wastewater sector are outdated because they have been in force for over forty years and as such, they are likely to limit the ability of the BWA to upgrade its systems and operations and do not necessarily reflect the needs of the wastewater sector and the Project at this time. The project will provide the avenue to update the legislation, including gender responsive considerations.
7. It is necessary for the BWA Board of Directors to adopt appropriate policies for maintaining Project standards to ensure gender issues are considered and to guide the decisions made and actions taken by Project personnel to ensure gender issues are considered in the implementation process. Therefore, Stakeholder Engagement processes carried out by the BWA needs to be gender responsive to adequately respond to the needs of male and female headed households.
8. Members of the BWA Board, and BWA staff, require continued training and awareness of gender sensitivity especially so that they can recognize privileges and discrimination around gender.

The key recommendations emerging are the need to:

1. Encourage the GOB to create an enabling legal environment that amends the BWA legislation with a gender and vulnerability lens;
2. Establish a gender-balanced PSC;;
3. Appoint a Project Manager who is skilled in gender sensitivity issues;
4. Appoint a Social and gender Specialist to ensure that project actions are gender responsive;
5. Approve guidelines for the preparation of annual project operational plans and budgets;
6. Approve mechanisms for quality assurance in the procurement of products/services;
7. Adopt gender-related policies to guide decisions and actions associated with project activities like staffing, administration, and activity monitoring, evaluation, and reporting;
8. Collect, store, retrieve, and analyse gender disaggregated empirical data for use in making critical decisions;

9. Set up a project office with office facilities to cater for gender differences of the staff;
10. Conduct training for the project staff to build their gender sensitivity capacity; and
11. Establish a mechanism to ensure gender sensitivity in all stakeholder engagement processes.

Gender Mainstreaming Action Plan

The intended impact of the gender mainstreaming action plan is to (i) increase the participation of women and LGBTQIA persons in decision making and raise the awareness of men, women and vulnerable communities on gender issues to minimize discrimination against vulnerable groups including LGBTQIA; and (ii) improve the quality of life for vulnerable residents, especially women, and children of Barbados in the areas of health, agriculture, and employment.

The following outputs and activities have been included in the project to advance these gender mainstreaming goals:

- Output 1.4: Decentralized treatment plants or cluster treatment facilities installed
- Activity 1.4.1: Construct two small (cluster) decentralized wastewater collection and treatment demonstration systems in Zone A locations to produce reuse quality water for domestic/commercial non-potable water applications. This activity will ensure that consultative processes capture the views of both male and female headed households in a manner that informs the roll out and connection of services to these two communities. Mixed methods of engagement will be employed, including focused conversations with women's groups and female farmers. Additionally, in the implementation of this activity the project will ensure that **communities are protected from sexual and gender-based violence and gender-based discrimination**. The Project will therefore set up mechanisms to capture community concerns in a gender sensitive manner and that will prohibit exploitative, abusive and harassing conduct by workers of the BWA, contractors and subcontractors.
- Output 3.1: Improved capabilities of water technical personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management
 - Activity 3.1.1: Develop and provide specialized and customized training to support the operations and maintenance of wastewater collection and treatment facilities including photovoltaic equipment. This activity will include **gender sensitivity and climate change training** for BWA employees and private sector
 - Activity 3.1.2: Update Standard Operating Procedures (SOP) and Operational Manual that addresses the requirements of the upgrades, preventative maintenance, operator safety, and environmental monitoring, including risks posed by climate change and **gender and social inclusion considerations**.
- Output 4.1: Governance and planning roadmaps enhanced to enable use of reclaimed water in a controlled and regulated manner.
 - Activity 4.1.1: Undertake a legislative review to promote the Planning and Development Act, Wastewater Reuse Bill and other related legislations for enhancing wastewater effluent quality, treatment options and re-use requirements and applications. The review will also include recommendations for strengthening - private sector engagement, public-private partnerships, building codes, resiliency to climate change and **equal opportunities and access to males and females**.
 - Activity 4.1.2: Develop a water and sanitation master plan that includes an optimal combination of decentralized, cluster and centralized water reclamation and reuse applications, with the centralized reclaimed water being transmitted and used for agricultural irrigation and/or industrial use (such as lower cost of reclaimed water transmission). This strategy will also take into consideration the **social, gender-related and climate risks in the design and prioritization of water reuse strategies**.

- Output 4.2: Mechanisms developed/expanded to encourage the adoption of wastewater treatment and reuse applications by private individuals and businesses.
 - Activity 4.2.1: Develop a strategy and action plan to engage the private sector in the provision and adoption of wastewater treatment technology and the utilization of wastewater by-products such as activated sludge. This includes conducting an assessment to identify opportunities for public-private partnership in the water and wastewater sector, especially for the expansion of the decentralized onsite cluster wastewater systems. The strategy will also promote **gender equality and women empowerment**
 - Activity 4.2.2: Undertake a review and identify recommendations for a **gender sensitive and socially inclusive incentive programme** to encourage conservation, recycle, re-use.
 - Activity 4.2.3: Expand the Revolving Adaptation Fund Facility (RAFF) to provide resources for the adoption of decentralized onsite wastewater systems. The **management of the expanded RAFF will ensure to promote gender equality and social inclusion as a requirement**
- Output 4.3: Gender Sensitive Public Education and Awareness Campaign Implemented.
 - Activity 4.3.2: Develop and implement a **Gender Sensitive Public Awareness Campaign** for community and visitors (tourists) through workshops, videos, community town hall meetings, site tours (demonstration of the plant technology and by-product reuse) and consultations. Consultations will include, but will not be limited to representative groups of vulnerable communities, including with the Association of Women in Agriculture.
 - Activity 4.3.3: Develop a 3R-CReWS Project Web Page and social media accounts, which is dedicated to transparent measures of reporting, knowledge products, identify/host a link to the Redress Mechanism and provide update to all stakeholders on the project activities. **This page will include, to the best extent possible, functions such as audio, sub-titles and/or sign language to encourage social inclusion from disabled population. The project's webpage will also ensure to report project results disaggregated by gender, where possible.**

Implementation arrangements of the project that will promote gender mainstreaming

In addition to the gender sensitive results and activities flagged above, the following implementation strategies will be utilized by the project implementation unit to further strengthen gender considerations in the day-to-day operations of the project:

1. There will be gender sensitive stakeholder consultations throughout the lifetime of the project that will aim to engage women's groups and other vulnerable groupings (all Components)
2. CCCCC Procurement policies, which promote adherence to the Centre' gender policy and action plan
3. Monitoring of indicators will disaggregate information by sex, where possible
4. The AE's gender specialist is available to provide technical advice and quality control for the mainstreaming of gender in the results and activities identified above, as well as to support the analysis of the sex disaggregated monitoring and evaluation information collected routinely to inform planning and decision making on gender mainstreaming, including the early identification of possible unplanned negative gender issues emerging because of the project's activities.
5. The Project PSC will strive to ensure gender balance and will include a representative from the Barbados Gender Bureau.
6. The Project Manager will present to the PSC a report on the Project's Gender Action Plan annually.
7. All members of the Project Management Team will receive gender sensitivity training on an annual basis.

G.3. Financial management and procurement (max. 500 words, approximately 1 page)

Financial Management and Accounting

As an accredited GCF entity, CCCCC's Financial Management, Accounting and Procurement procedures are aligned with the standards required by the GCF. This project will be subjected to the same financial management and accounting standards, unless otherwise agreed with the Donor. These are detailed in the CCCCC Financial Manual and summarized below.

It is the CCCCC's practice to open a new foreign currency bank account for all externally funded projects. The utilisation of an old or existing bank account for a new project is prohibited. The signatories for the new bank account are authorised by the Executive Director of the CCCCC. Closure of the project's bank account takes place within 180 days of a final financial audit or the last disbursement if a financial audit is not undertaken within those 180 days.

Project budgets are prepared and agreed during the conceptualization and form part of the final proposal and project agreement between the CCCCC, an Executing Agency and a Donor. All project budgets are uploaded to the accounting software to form the budget baseline required for accounting and financial tracking and reporting, which is necessary for variance analysis and time-specific analysis. The Project Manager/Coordinator is responsible for the provision of detailed budgets to the Financial Administrator.

The financial year for the project is dependent on the stipulations within the Project Agreement including the official commencement date of the project; however, Project Financial Reports are generated on a periodic basis (monthly, quarterly, and annually) or as otherwise required by the Project Manager/Coordinator or stipulated in the Project Agreement. Financial reports include the following information to date (in both currency and percentages):

- Commitments
- Expenditure
- Un-committed funds
- Undisbursed
- Variance
- Counterpart (if applicable)

Project payments and disbursements must be executed in alignment with the approved Project Agreement and related budget (or its most current amendment). All payments are initiated by the Project Manager/Coordinator and request for payments are signed by the Project Manager /Coordinator and clearly outline the following:

- The Name of the Project (as per Agreement)
- The name and code of the budget line(s) and against which the payment(s) should be made
- The amount to be paid
- Approved signed supporting documents which verify delivery or acceptance of the item to be paid (such as invoice, approved deliverable, and signed deliverable slip)

CCCCC financial records are audited annually by an independent accounting firm, which is selected using a competitive bidding process every 5 years. To allow for a smooth and timely audit, CCCCC provides assistance to the independent auditors in the following areas of planning, involvement, interim procedures as well as provide schedules, documents and information requested by the auditors in a timely manner. Upon receipt of the completed audited financial statements and accompanying report(s), the CCCCC reviews and responds in writing to all management letter or other internal control and compliance report findings and recommendations made by the independent auditor. These audited financial statements and accompanying reports are subject to review and scrutiny by members of the broad of directors who form the Finance Committee.

Procurement

As the AE, the CCCCC will manage the funding garnered for the implementation of the project and would be responsible for providing and contracting the goods and services associated the activities that are directly

funded by the GCF; whereas, the BWA will conduct procurement related to the cofinanced activities. The CCCCC will periodically reporting on the progress of the project's implementation, including the co-financed activities, in close coordination and BWA the NDA. The procurement will be processed in accordance with the procurement guidelines and policies of CCCCC. Information on the process and the results of procurement activities undertaken are usually included in the APRs mid-term progress and completion reports. Further, as a key stakeholder co-executing partner, the inputs of the BWA are critical to the completion of any procurement package. .The Procurement Plan (See Annex 10) utilizes the following methods of procurement:

- International Competitive Bidding
- Limited International Bidding
- Regional Competitive Bidding
- Shopping
- Direct Contract
- Community Participation

The methods selected are determined by a threshold model. These thresholds are detailed in CCCCC procurement manual.

The Centre's Procurement Policies and Manuals is implemented in aligned with other policies, include:

- (i) Money Laundering and Financing of Terrorism Policy.
- (ii) Gender Policy and Action Plan
- (iii) Financial & Accounting Policy Manual,
- (iv) Environmental and Social Safeguards Policy and Performance Standards
- (v) The CCCCC Manual for Project Formulation
- (vi) The CCCCC Manual for Project Monitoring, Review, Reporting and Evaluation.
- (vii) The CCCCC Standard Operating Procedures for Project Cycle Management
- (viii) Employee Protection (Whistle-blower) Policy.

To support the Centre's Procurement Principles, a Code of Conduct governs the actions of (i) all the Centre's staff and others in their direct or indirect involvement in the procurement and (ii) Bidders and Vendors who must adhere to the Centre's Code of Conduct for Bidders and Vendors and comply with all legal requirements related Prohibited Practices (See the CCCCC Procurement Policy and Manual⁷¹).

AML/CFT

Barbados has in place a sophisticated legal, regulatory and institutional framework to ensure compliance with Financial Action Task Force (FATF) regulations. The Anti-Terrorism Act of 2002 is the main legal instrument in this context.⁷² Barbados is a participant in the FATF, as well as its regional body the Caribbean Financial Action Task Force (CFATF). The Financial Services Commission is the lead government agency for the implementation of AML/CFT regulations, making available guidelines for specific target groups and sectors.⁷³

The CCCCC is committed to full compliance with international standards, the Money Laundering and Terrorism (Prevention) Act, Chapter 104 of Belize and any other applicable legislation in the territories of its Members. This commitment is set forth in this Policy which defines the guiding principles for adequate prevention and control. The CCCCC identifies, seeks out and accepts funding ONLY from established reputable and legitimate sources, which themselves have pledged strict compliance with the standard international legal framework governing prevention of ML and TF. The institution upholds the Rule of Law to

⁷¹ <https://www.caribbeanclimate.bz/ccccc-procurement-manual/>

⁷² <http://www.fsc.gov.bb/attachments/article/12/Anti-Terrorism%20Act%20Cap.158.pdf>

⁷³ <https://barbadosfiu.gov.bb/Topic/aml-cft-guidelines/>

ensure that its work and that of its partners and beneficiaries is free from criminal interference and that resources are used for the intended purpose.

The CCCCC, by its inherent construct, mandate and corresponding geographic location has to be ever vigilant against criminal elements intent on exploiting the vulnerabilities of the Caribbean Region. Identified susceptibilities of CARICOM Member States include: law enforcement constraints, location, free trade, cash-culture and offshore financial industry. Recognizing these predispositions is the first step by the CCCCC in instituting necessary systems to maintain a high degree of transparency, integrity and public confidence in the management and functioning of the Centre to ensure it cannot be misused for ML and TR.

The CCCCC does not associate with terrorist organizations nor distribute or allocate funds to partners who support, carryout or advocate terrorist activity. The CCCCC is committed to ensuring that the risk of its business machinery being exploited for the purpose of money laundering and of our donor funds being diverted to terrorist activity is abated.

The CCCCC has a mandate to serve the Member States of CARICOM in coordinating Climate Change response. While the Centre's focus is on Climate Change as per its mandate, it can ill afford to protect the climate system and ignore the corrosive effect of ML and TF on the social and political institutions of the Caribbean. To effectively contribute in the detection and prevention of ML and TF, the CCCCC is committed to ensuring that its business apparatus is transparent, distinguishable and trustworthy. All the business processes of the CCCCC are therefore operated upon the principle of economy, efficiency, integrity and transparency.

In this regard, the CCCCC has instituted robust procurement and accounting procedures that ensure:

- (i) A system to conduct due diligence on new clients
- (ii) meticulous management and accounting of all financial transactions.
- (iii) appropriate controls are in place to ensure that all funds are fully accounted for and are spent in a manner that is consistent with the purpose and objectives of grant agreement and/or the CCCCC's mandate.
- (iv) annual internal and external audits are performed and comprehensive financial statements are prepared and available for review by Members and submitted to donors, as required
- (v) compliance with the accountability measures required by its significant donors.

As part of its transparency framework, the CCCCC also maintains information on the purpose and objectives of its stated activities as well as the identity of its, Board of Governors and Executive Director of its Technical Secretariat. This information is available directly from the Technical Secretariat and is accessible to the public on its website.

G.4. Disclosure of funding proposal

No confidential information: The accredited entity confirms that the funding proposal, including its annexes, may be disclosed in full by the GCF, as no information is being provided in confidence.

With confidential information: The accredited entity declares that the funding proposal, including its annexes, may not be disclosed in full by the GCF, as certain information is being provided in confidence. Accordingly, the accredited entity is providing to the Secretariat the following two copies of the funding proposal, including all annexes:

- full copy for internal use of the GCF in which the confidential portions are marked accordingly, together with an explanatory note regarding the said portions and the corresponding reason for confidentiality under the accredited entity's disclosure policy, and
- redacted copy for disclosure on the GCF website.

The funding proposal can only be processed upon receipt of the two copies above, if containing confidential information.

H. ANNEXES

H.1. Mandatory annexes

- Annex 1 NDA no-objection letter(s) ([template provided](#))
- Annex 2 Feasibility study - and a market study, if applicable
- Annex 3 Economic and/or financial analyses in spreadsheet format
- Annex 4 Detailed budget plan ([template provided](#))
- Annex 5 Implementation timetable including key project/programme milestones ([template provided](#))
- Annex 6 E&S document corresponding to the E&S category (A, B or C; or I1, I2 or I3):
 - Environmental and Social Impact Assessment (ESIA) or
 - Environmental and Social Management Plan (ESMP) or
 - Environmental and Social Management System (ESMS)
 - Others (please specify – e.g. Resettlement Action Plan, Resettlement Policy Framework, Indigenous People’s Plan, Land Acquisition Plan, etc.)
- Annex 7 Summary of consultations and stakeholder engagement plan
- Annex 8 Gender assessment and project/programme-level action plan ([template provided](#))
- Annex 9 Legal due diligence (regulation, taxation and insurance)
- Annex 10 Procurement plan ([template provided](#))
- Annex 11 Monitoring and evaluation plan ([template provided](#))
- Annex 12 AE fee request ([template provided](#))
- Annex 13 Co-financing commitment letter, if applicable ([template provided](#))
- Annex 14 Term sheet including a detailed disbursement schedule and, if applicable, repayment schedule

H.2. Other annexes as applicable

- Annex 15 Evidence of internal approval ([template provided](#))
- Annex 16 Map(s) indicating the location of proposed interventions
- Annex 17 Multi-country project/programme information ([template provided](#))
- Annex 18 Appraisal, due diligence or evaluation report for proposals based on up-scaling or replicating a pilot project
- Annex 19 Procedures for controlling procurement by third parties or executing entities undertaking projects financed by the entity
- Annex 20 First level AML/CFT (KYC) assessment
- Annex 21 Operations manual (Operations and maintenance)
- Annex 22a Assessment of GHG emission reductions and their monitoring and reporting (for mitigation and cross cutting-projects)
- Annex 22b Adaptation Beneficiaries

- Annex 23 Final RAFF Charter
- Annex 24 Decentralised Treatment Plant Site Information
- Annex 25 Risk Register and Framework for Monitoring
- Annex 26 CCCCC Board Resolution for Entity Work Programme
- Annex 27 BWA FMCA 2018
- Annex 28 Feasibility Study - South Coast Project

** Please note that a funding proposal will be considered complete only upon receipt of all the applicable supporting documents.*



GOVERNMENT OF BARBADOS

The Hon. Ryan Straughn, M.P.

**MINISTER IN THE MINISTRY OF FINANCE & ECONOMIC AFFAIRS
MINISTRY OF FINANCE, ECONOMIC AFFAIRS & INVESTMENT**

Government Headquarters,
Bay Street, St. Michael, BB11156, Barbados, W.I.

Tel.: (246) 535-5300 **Fax:** (246) 535-5629

Our Ref.: 5634/1 Vol. 1

18 July, 2022

Bridgetown, BARBADOS

Re: Funding proposal for the GCF by Caribbean Community Climate Change Centre (CCCCC) regarding THE R's (REDUCE, REUSE AND RECYCLE) FOR CLIMATE RESILIENCE WASTEWATER SYSTEMS IN BARBADOS (3R-CReWS).

Dear Sir/Madam

We refer to the project titled **THE R's (REDUCE, REUSE AND RECYCLE) FOR CLIMATE RESILIENCE WASTEWATER SYSTEMS IN BARBADOS (3R-CReWS)** in Barbados as included in the funding proposal submitted by The Caribbean Community Climate Change Centre (CCCCC) to us on 24 February 2022.

The undersigned is the duly authorized representative of Ministry of Finance, Economic Affairs & Investment, the National Designated Authority of Barbados.

Pursuant to GCF decision B.08/10, the content of which we acknowledge to have reviewed, we hereby communicate our no-objection to the project as included in the funding proposal.

By communicating our no-objection, it is implied that:

- (a) The government of Barbados has no-objection to the project as included in the funding proposal;
- (b) The project as included in the funding proposal is in conformity with the national priorities, strategies and plans of Barbados;
- (c) In accordance with the GCF's environmental and social safeguards, the project as included in the funding proposal is in conformity with relevant national laws and regulations.

We also confirm that our national process for ascertaining no-objection to the project as included in the funding proposal has been duly followed.

We acknowledge that this letter will be made publicly available on the GCF website.

Kind regards,

A handwritten signature in black ink, appearing to read 'Ryan Straughn', written over a horizontal line.

Hon. Ryan Straughn M.P.
Minister
Ministry of Finance, Economic Affairs and Investment
BARBADOS

Environmental and social safeguards report form pursuant to para. 17 of the IDP

Basic project or programme information	
Project or programme title	The R's (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados (3R-CReWS)
Existence of subproject(s) to be identified after GCF Board approval	No
Sector (public or private)	Public
Accredited entity	Caribbean Community Climate Change Centre (CCCCC)
Environmental and social safeguards (ESS) category	Category B
Location – specific location(s) of project or target country or location(s) of programme	Barbados
Environmental and Social Impact Assessment (ESIA) (if applicable)	
Date of disclosure on accredited entity's website	Friday, September 16, 2022
Language(s) of disclosure	English
Explanation on language	English is the official language of Barbados
Link to disclosure	<p>ESIA Volume 1: https://cccccbbze-my.sharepoint.com/:b:/g/personal/weblink_caribbeanclimate_bz/EYEivJMLvSJKnClvvnioEl4BwXJlIlgSFzG5de6MqrHQezQ?e=sQ3LrH</p> <p>ESIA Volume II: https://cccccbbze-my.sharepoint.com/:b:/g/personal/weblink_caribbeanclimate_bz/EZaMO5IbNeRDtan7E3jg51QBc9TqzWbJ0vV0JFCd8mpLCQ?e=FC0gOz</p> <p>Off-shore Assessment: https://cccccbbze-my.sharepoint.com/:b:/g/personal/weblink_caribbeanclimate_bz/EZ84el-xC0VCIP-A7CNFm6oB1H1R0C6DwJt7gUVurmgYfw?e=1Mpw2N</p> <p>Annexes: https://cccccbbze-my.sharepoint.com/:u:/g/personal/weblink_caribbeanclimate_bz/ESwuDQzm5jhEvLz7aDaHiDYBDV5WWxOE5lqA37TyQSVSIQ?e=gi2HHI</p>

Other link(s)	<p>Project Page: https://www.caribbeanclimate.bz/gcf/2022/09/13/3r-crews/</p> <p>Baseline Study: https://cccccbbze-my.sharepoint.com/:b:/g/personal/weblink_caribbeanclimate_bz/EXg06jjOqhhIn3suOUtvSCkB70T2sBU8BoWgzbluu71sg?e=nUvBy0</p>
Remarks	An ESIA consistent with the requirements for a Category B project is contained in the “Environmental and Social Impact Assessment (ESIA) for 3R-CReWS Volume 1 and 2”. Additional information can be found in the Baseline Study for the ESIA and Appendix 4 Off-Shore Modeling and Assessment. These can be access via the link provided above.
Environmental and Social Management Plan (ESMP) (if applicable)	
Date of disclosure on accredited entity’s website	Friday, September 16, 2022
Language(s) of disclosure	English
Explanation on language	English is the official language of Barbados
Link to disclosure	https://cccccbbze-my.sharepoint.com/:b:/g/personal/weblink_caribbeanclimate_bz/Efjb_c2hadREtZMEwxYc5yUBZgIsrn6P8Oscmp12wugNlw?e=l5t9Nw
Other link(s)	<p>Project Page: https://www.caribbeanclimate.bz/gcf/2022/09/13/3r-crews/</p>
Remarks	An ESMP consistent with the requirements for a Category B project is contained in the “Environmental and Social Management Plan (ESMP) for 3R-CReWS”.
Environmental and Social Management System (ESMS) (if applicable)	
Date of disclosure on accredited entity’s website	N/A
Language(s) of disclosure	N/A
Explanation on language	N/A
Link to disclosure	N/A
Other link(s)	N/A
Remarks	N/A
Any other relevant ESS reports, e.g. Resettlement Action Plan (RAP), Resettlement Policy Framework (RPF), Indigenous Peoples Plan (IPP), IPP Framework (if applicable)	
Description of report/disclosure on accredited entity’s website	Friday, September 16, 2022
Language(s) of disclosure	English
Explanation on language	English is the official language of Barbados

Link to disclosure	<p><u>Stakeholder Analysis and Action Plan:</u> https://cccccbe-my.sharepoint.com/:b:/g/personal/weblink_caribbeanclimate_bz/Ea77c5IweVtCimz5s2ipuUwBcr_yDT2ax4bhvQuA7xjHew</p> <p><u>Gender Analysis and Action Plan:</u> https://cccccbe-my.sharepoint.com/:b:/g/personal/weblink_caribbeanclimate_bz/EWC50lyMbcREizItzf8tMJcBtNhRkQpD5u5W5nAADycrSA?e=IvQaj9</p>
Other link(s)	N/A
Remarks	The Stakeholder Analysis and Action Plan and Gender Analysis and Action Plan can be accessed via the links above.
Disclosure in locations convenient to affected peoples (stakeholders)	
Date	Friday, September 16, 2022
Place	<p>CCCCC HQ (hard copies), 3rd Floor, David L. McKoy Business Center Bliss Parade, P.O. Box 563 Belmopan, Belize, Central America</p> <p>Barbados Water Authority (website and hard copies) Pine Commercial Estate The Pine, St. Michael Barbados</p> <p>Office of the Prime Minister (hard copies) Government Headquarters Bay Street St. Michael Barbados, W.I.</p> <p>Ministry of Transport, Works and Water Resources (hard copies) Pine East/West Boulevard The Pine St. Michael Barbados, W. I</p> <p>Ministry of Environment and Natural Beautification (hard copies) 10th Floor Warrens Tower II Warrens St. Michael, BB12001 Barbados, W. I.</p> <p>Environmental Protection Department (hard copies) LV Harcourt Lewis Building Dalkeith St. Michael</p> <p>Government Information Service (hard copies) Old Town Hall, Cheapside, Barbados</p>

	Public Library Fairchild Street Bridgetown St. Michael Barbados, W.I. Other locations include Bridgetown Sewage Treatment Plant, Project Launch Event, Town Hall Meetings
Date of Board meeting in which the FP is intended to be considered	
Date of accredited entity's Board meeting	Monday, October 17, 2022
Date of GCF's Board meeting	Monday, October 17, 2022

Note: This form was prepared by the accredited entity stated above.

Secretariat's assessment of FP192

Proposal name:	The R's (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados (3R-CReWS)
Accredited entity:	Caribbean Community Climate Change Centre (CCCCC)
Country/(ies):	Barbados
Project/programme size:	Small

I. Overall assessment of the Secretariat

1. The funding proposal is presented to the Board for consideration with the following remarks:

Strengths	Points of caution
The project design addresses the identified financial, social, technological and regulatory barriers for Barbados (a water-stressed country facing climate threats) in taking up wastewater treatment to diversify its water sources by moving from a linear model of water use to a circular economy mode using best practices and technologies.	Social acceptance towards wastewater and reclaimed water as a resource could be a concern, so implementation of component 4 would be key.
The GCF grant contribution is the only way to make the project viable (regardless of the level of tariff) for a fiscally constrained country with a debt to GDP ratio standing at 140% in 2020 and a poverty rate of 20%. In addition, the dynamic economic and financial model results are sensitive to the volume of treated wastewater. The results indicated that while the capital and operational costs increase by 23%, from a business-as-usual level to a growth-and-development phase, the benefits increase by over 130%.	

2. The Board may wish to consider approving this funding proposal with the terms and conditions listed in the term sheet and addendum XIII, titled "List of proposed conditions and recommendations", respectively.

II. Summary of the Secretariat's assessment

2.1 Project background

3. The impact of climate change is already evident in Barbados. Barbados is experiencing "absolute water scarcity". Approximately 310 m³ of water is available per person per year,

placing Barbados among the most water scarce countries in the world, and this problem is likely to become worse due to climate change. The country is facing a climate crisis:

- (a) Average temperatures are anticipated to rise by about 1.0 °C by 2041–2060 under the SSP2-4.5 scenario, with daily minimum temperatures increasing by 1.3 °C;
 - (b) The number of consecutive hot days (i.e. heatwaves) has already increased and is likely to continue to do so; and
 - (c) Annual mean precipitation is projected to decrease by about 9%, extending the dry season by two months and impacting rainwater run-off and groundwater recharge and salinity.
4. Water availability is essential to support the economy, and the climate crisis is already impacting food security through the high cost of importation, a situation that is expected to be increasingly aggravated. To counter this, Barbados is seeking to increase food production as an adaptation measure. This ambition cannot be realized without making water accessible under current and future water scarcity constraints.
5. At present, large volumes of precious water resources are going to waste because of disposal in the surrounding ocean after a single use. This linear model of water provision and use must change. Investment in the collection and treatment of wastewater is necessary to provide the basic infrastructure needed to move from a linear to a circular economy model where water can be reused for productive purposes.
6. The circular economy maximizes the use of scarce resources and minimizes the necessity to find and then dispose of additional resources. This can only happen if the basic infrastructure is put in place to provide the foundation on which the circular economy can take off. The proposed activities promote water security through engineering works (including software use) and through the creation of an enabling environment. The proposed activities are likely to be an effective adaptive response to the risk.
7. The goal of 3R-CReWS is to facilitate the enhancement of the health, well-being and productivity of Barbadians by using carbon neutral and climate-resilient water and energy management technologies and strategies that ensure water is protected, managed, recycled, reused and conserved. This will be achieved through four outcomes and ten output-level results, as described in more detail in section 2.2 of this assessment.
- (a) Outcomes 1 and 2 of this project are the largest, in terms of budget, as they are focused on infrastructure works and transfer of technology:
 - (i) Specifically, outcome 1 aims to achieve a climate-resilient pathway through the upgrade of the Bridgetown sewage treatment plant (STP) to a tertiary treatment system and the installation of decentralized wastewater treatment systems in two Zone A locations in Barbados to harness reclaimed water, which will be used for aquifer recharge and agricultural irrigation through the installation of a 9 km pipeline. Climate resilience is also built into various phases of the water reclamation process through the installation of decision support tools and infrastructure; and
 - (ii) Outcome 2, which spans the installation of renewable photovoltaic (PV) energy systems, automated controls such as variable frequency drives, and a sludge dewatering system, will contribute to achieving the low-emission pathway. Currently 0.18 MW of solar power is in place at the Bridgetown STP. An additional 0.8 MW is proposed, delivering 1MW of renewable energy;
 - (b) Outcomes 3 and 4 are “soft” developmental measures that primarily aim to:

- (i) Create an enabling environment for achieving a paradigm shift in the approaches used for managing water resources (specifically wastewater), and thereby enhancing water security in the face of a changing climate. Specifically, outcome 3 aims at enhancing capacities and capabilities, primarily at the Barbados Water Authority (BWA), for managing, monitoring and operating the upgraded system; providing customized training; updating the standard operating procedures and the operational manual; and implementing a risk management framework;
- (ii) Outcome 4 further strengthens the enabling environment through a legislative review, strengthening buy-in, ownership and leadership in the private sector for the adoption of wastewater technologies and reuse options; having nation-wide public education and awareness on the nexus between climate change and water availability, wastewater as a resource, wastewater treatment and reuse options; and promoting transparency and lessons emerging from this project; and
- (iii) Outcomes 1 and 4 are expected to yield co-benefits related to the social, economic, adaptation, mitigation and environmental sectors.

8. The project is expected to reduce greenhouse gas (GHG) emissions by 40 kilotonnes of carbon dioxide equivalent (ktCO₂eq) over its 25-year lifespan, resulting from the PV installation. It will directly benefit 136,220 residences (almost half of the total population of Barbados) by provision of accessible and reliable water.

9. The total project cost is around USD 50 million with a request to GCF to finance USD 39.4 million (78.8 per cent) in the form of grant. The remaining cost will be covered by BWA. It is worth noting that the total envisaged capital investment in providing infrastructure for the Bridgetown and South Coast System is USD 183 million in the short term, rising to USD 251 million in the medium term. At a national scale, the GCF contribution amounts to 22% in the short term, falling to 16% in the medium term. The economic and efficiency analysis and assessment found that the grant provided by GCF is the only case where the project is profitable regardless of the value of the water reuse tariff.

10. The environmental and social safeguards category of the project is Category B, and the accredited entity (AE) has submitted relevant documentation (environmental and social management framework) as part of the funding proposal package. Disclosure on the AE's website is also completed in accordance with the Information Disclosure Policy of the Fund.

2.2 Component-by-component analysis

Component 1: Wastewater reclamation and reuse (total cost: USD 38.54 million; GCF cost: USD 29.21 million)

11. Component 1 involves installing centralized and decentralized cluster wastewater collection and treatment systems to achieve tertiary¹ water quality for multiple non-potable water reuse applications that will increase water availability and the water sector's resilience to climate change. The key interventions are:

- (a) Installing conventional activated sludge biological treatment process;
- (b) Installing a run-off membrane filtration system;
- (c) Constructing a 9 km pipeline for irrigation and aquifer recharge;
- (d) Implementing a sewer monitoring programme (involving flow measurement and rain gauging equipment);

¹ There are three levels of water treatment: primary removes heavier solids; secondary degrades the remaining biological contents in the water; and tertiary removes pathogens and results in potable (drinkable) water.

- (e) Establishing an on-site laboratory;
- (f) Implementing the computerized real-time management system; and
- (g) Constructing two decentralized treatment facilities in Zone A – Belle Vue and Belle Tenantry.

12. This component aims to enhance **availability, management and use of tertiary-level reclaimed water to improve the water sector's resilience to climate change**. Upgrading the Bridgetown STP to treat wastewater to a tertiary water quality standard, including the two on-site decentralized treatment plants, will benefit the groundwater system by reducing the extraction of groundwater and thus reducing aquifer saltwater intrusion; increasing availability of groundwater during dry periods; and enhancing water security considering the projected climate change impacts on water resources for the island. In addition, it will increase water availability for agricultural/irrigation purposes and support irrigation developments in the Codrington-Neils-Lears-Salters-Constant-Valley, which should also lead to improved food security. It will provide benefits to 155 farmers (60% males and 40% females).

13. Regarding paradigm shift, this component offers scalability and replicability: it should be seen as the first phase of a larger enterprise to extend and expand the use of treated reclaimed wastewater for irrigation purposes on lands along the west coast of Barbados and up to the parish of St Lucy (see Feasibility Study Report). Activities 1.2.1 and 1.2.2 would make it feasible through the installation of reverse osmosis to ensure the appropriate water quality for irrigation purposes and groundwater injections, and the pipeline and six aquifer recharge wells for transferring the water for agricultural development and augmenting the groundwater system.

14. Component 1 will upgrade and install wastewater treatment technologies that are energy efficient (mitigation benefits), but it will also implement several decision support tools to help with managing and maintaining the upgraded STP, particularly for hydrometeorological hazards such as rainfall, including severe storms. These decision support tools will optimize the preventative maintenance programme of the upgraded Bridgetown STP and protect data during hazards. The decentralized package collection and treatment systems that will be constructed in two communities located in Zone A will address severe water shortages for approximately 225 households, and is considered to be a “good demonstration” of strengthening the adaptive capacities of individuals and businesses to climate risks associated with water availability (adaptation benefits). The decentralized package treatment systems will provide enhanced collection and treatment systems that will produce reclaimed water suitable for agricultural irrigation and that will reduce the health risks associated with intense rainfall (compared with the current wastewater systems being used). This output will also expand the number of beneficiaries of this project in a cost-effective manner, because these communities are not serviced by either of the two STPs currently in operation in Barbados and the cost of distributing reclaimed water from the Bridgetown STP into the community is high. Furthermore, these two sites will safeguard groundwater by eliminating the potential risk from contamination associated with on-site wastewater disposal.

15. In addition, implementing the sewer monitoring programme and the water quality monitoring system by establishing on-site laboratory facilities will inform operations control strategies that optimize operations and reduce energy consumption and GHG emissions and inform decision-making and climate-resilient building. Finally, the proposal addresses a number of Sustainable Development Goals (e.g. SDGs 2, 6 and 11).

16. The total budget of this outcome is USD 39 million, which is principally applied to the upgrades associated with treatment plant (67 per cent). The source of the funding is GCF in the amount of USD 29.2 million (grant) and BWA in the amount of USD 9.8 million.

Component 2: Renewable energy and energy efficiency in wastewater treatment (total cost: USD 3.26 million; GCF cost: USD 3.26 million)

17. Component 2 focuses on enhancing the climate resiliency and carbon-neutrality of the Bridgetown STP wastewater treatment system through the installation of renewable PV energy; and energy conservation and improved efficiency measures through installing grid-tied PV, installing automated controls and installing sludge dewatering technologies. The main outputs of this component are improved emergency power and energy efficiency, and reduction in emission at the Bridgetown STP.

18. The outcome of this component is achieving climate-resilient low carbon operations at Bridgetown STP. This will be realized by:

- (a) Installing grid-tied PV renewable energy systems to offset increased power consumption associated with the centralized treatment plant process upgrades using category 3 hurricane-resistant solar panels. A 1 MW grid-tied PV system will be delivered to offset the energy demand of the upgraded Bridgetown STP,² which will yield 2,063 MWh of clean solar power per year, leading to an estimated GHG emission reduction of 1,635 tCO₂eq per year (or 40,875 tCO₂eq over 25 years);
- (b) Implementing automated controls and energy efficiency measures (including variable frequency drives, and energy-efficient pumps and blowers) within the upgraded centralized treatment processes to reduce the overall energy footprint and reduce GHG emissions; and
- (c) By installing and implementing dewatering technology, biosolids will be captured and removed from the treatment process early, hence reducing the energy required to process the effluent. Further, this will enable BWA to reduce the water content of biosolids resulting in a mitigation co-benefit; namely, reduced GHG emissions associated with the trucking and disposal of sludge at a dedicated sludge spray zone. Installing the dewatering technology would result in savings on energy costs and sludge transportation and labour, and environmental benefits including the reduction in GHG emissions and oil spills.

19. A strategic plan is provided in the funding proposal to guide the replication of water treatment facilities along the west coast. There is future potential for augmenting the potable water supply by installing additional run-off treatment facilities along the west coast corridor, which would intercept and collect brackish groundwater and treat it to potable water standards to supplement drinking water resources. This would support the project objectives enhancing the climate resiliency of the water sector.

20. The total budget of this outcome is USD 3.3 million, which is principally applied to the procurement and installation of the 1 MW PV system and the sludge dewatering technology (81 per cent). The outcome will be funded by GCF.

Component 3: Capabilities to operate, maintain, expand and monitor wastewater and related renewable energy technologies (total cost: USD 1.63 million; GCF cost: USD 1.63 million)

21. Component 3 focuses on enhancing options for scaling up wastewater reuse and enhancing the capabilities of technical personnel at BWA (and other ministries, department and agencies, as applicable) to promote sustainability and the enabling environment for wastewater management through the development of standard operating procedures and an operations

²The additional 0.8 MW of power will be financed by the Government of the Bahamas but is not counted as part of the co-financing for this project; albeit that Government is currently in advanced negotiations to secure financing for this additional 0.8 MW.

manual, flow and water quality monitoring, and institutional human capacity development. In short:

- (a) Update the standard operating procedures and the operations manual;
- (b) Develop and implement a risk management framework at BWA; and
- (c) Investigate and develop a strategic plan for the installation of run-off treatment facilities along the west coast.

22. This component will improve the technical capabilities of water technical personnel to operate, maintain and monitor, and implement climate change adaptation planning strategies for wastewater management and related renewable energy technologies. It will improve the knowledge of the BWA staff of the links between climate change and water availability and the impacts of climate change on infrastructure and operational measures to mitigate these impacts.

23. This component will deliver training to approximately 400 individuals. In addition, it will investigate and develop a strategic plan for the installation of water treatment facilities along the west coast corridor for augmenting water supply and protecting the west coast ecosystem (see para. 19 above). This would support the objectives of this project of enhancing climate resiliency in the water sector.

24. The outcome of this component is to have enhanced capacity and capability to support the preventative maintenance and climate resiliency programmes and to ensure sustainability after implementing this project.

25. The total budget of this outcome is USD 1.63 million, which is principally applied to training and capacity-building and knowledge transfer activities. The outcome will be financed using 100 per cent GCF proceeds.

Component 4: Capacities (regulatory, governance, awareness), buy-in and ownership within the private and public sectors improved for climate-resilient development planning for the water sector (total cost: USD 1.66 million; GCF cost: USD 1.40 million)

26. Component 4 focuses on enhancing the enabling environment for wastewater management by advancing and educating the public and private sector on the importance of wastewater reclamation and of addressing climate change issues affecting the water sector and enabling policy and legislation. This component will achieve that through:

- (a) Undertaking a legislative review and providing a road map;
- (b) Developing a water and sanitation master plan;
- (c) Developing private sector engagement strategies;
- (d) Undertaking a review and providing recommendations on an incentive programme to encourage conservation, recycling and reuse;
- (e) Expanding the Revolving Adaptation Fund Facility (RAFF) for the adoption of wastewater treatment technologies;
- (f) Re-educating key stakeholders and implementing public education and awareness campaign; and
- (g) Developing a project web page and social media accounts to share progress on the project.

27. The outputs of this component are: (1) governance and planning frameworks updated/developed to enable wastewater reuse; (2) a funding mechanism for the adoption of water reuse applications/systems developed; and (3) implementation of a gender-sensitive public education and awareness campaign implemented.

28. The key outcome is that an enabling environment is created for wastewater technologies and use of reclaimed water. The enabling environment refers to the legislation, organizational structures and competency and strategies that need to be put in place. Achieving this outcome will significantly change the culture of the water sector in Barbados, building a level of partnership and professionalism that is needed to continually innovate and adapt to climate change, which in turn promotes sustainability for this project.

29. This component is critical for supporting the replicability and scalability of the project by providing mechanisms to encourage the adoption of wastewater treatment and reuse applications by private individuals and businesses. The expansion and promotion RAFF to provide resources for adopting decentralized on-site wastewater systems are key to addressing inclusion and/or access to financial resources so that vulnerable groups are not prevented from participating in climate change adaptation and/or mitigation actions. BWA, through the Water Sector Resilience Nexus for Sustainability in Barbados (WSRN S-Barbados) project is establishing the RAFF, which will focus on the public sector. The RAFF aims to mobilize funds for use in water sector adaptation and mitigation initiatives, including those identified as priorities in Barbados' Climate Change Adaptation Water Master Plan. Establishing the RAFF was initially funded by the BWA and the Government of Barbados; however, 3R-CReWS presents an opportunity to expand and promote the RAFF to support private sector engagement in the wastewater sector (e.g. adopting technologies that support the delivery and utilization of tertiary reclaimed water). It is important to note that no GCF proceeds will be paid to or made available under the RAFF.

30. In addition, this component includes implementing a gender-sensitive public education and awareness campaign, which will be promoting the business case for this project, thereby securing more buy-in and acceptance of this project's scope and intended results. For instance, the nexus between climate change and water availability, wastewater as a resource, wastewater treatment and reuse options, and so on will be the basis of some of the public education and awareness topics that will be targeting a wide cross-section of beneficiaries using various information dissemination methods.

31. The total budget of this outcome is USD 1.66 million. The source of the funding is GCF in the amount of USD 1.40 million and BWA/the Government of the Bahamas in the amount of USD 0.26 million.

Project management and monitoring and evaluation (total cost: USD 2.53 million; GCF cost: USD 2.06 million)

32. The project management, including the monitoring and evaluation cost will be solely covered by GCF.

III. Assessment of performance against investment criteria

3.1 Impact potential

Scale: N/A

33. As a cross-cutting project, it is expected that the project will bring both adaptation and mitigation benefits, although with a focus on the former (over 90 per cent).

34. The project is expected to avoid emissions of 40,875 tCO₂eq over the 25-year lifespan of the 1 MW PV to be installed to offset the increased power consumption associated with the upgrades of the Bridgetown STP. Additional GHG emission reductions may be also result from using sludge and sludge dewatering technology, and energy-efficient pumps (with the detailed contribution of those to be determined after the detailed design is set during implementation).

35. On the adaptation side, the project will directly benefit 136,220 people resulting from an increase in the availability of climate-resilient sustainable, and indirectly benefit 141,601 persons, excluding the projected increase in tourists to the region.

3.2 Paradigm shift potential

Scale: N/A

36. The project will address the primary barriers to public and private investments in wastewater treatment in Barbados, including high capital cost, lack of expertise, unfamiliarity with technologies and associated risks, and the immature regulatory environment. It will create a paradigm shift in the approaches to managing and diversifying water resources (specifically wastewater) and thereby the project will promote water security in the face of climate change. It serves as a demonstration for the nation's future wastewater projects and private sector participation and interest in the water sector, thereby scaling up the decentralized wastewater collection and treatment. The model can also be expanded and replicated in the Caribbean region where water systems are becoming more vulnerable to climate threats

3.3 Sustainable development potential

Scale: N/A

37. In addition to achieving increased climate resilience for the water sector of Barbados and reducing GHG emissions by deploying renewable energy, the project brings about positive social, economic, environmental and gender co-benefits and is aligned with 8 out of the 17 Sustainable Development Goals (2, 5, 6, 7, 9, 11, 13, 17).

38. The project will deliver environmental co-benefits through reducing the amount of wastewater that will be discharged to rivers, thereby reducing water pollution and improving the quality of soil for agriculture and other land-use activities. In terms of economics, providing GCF grants will ease the fiscal constraints facing the country, create jobs through the project construction and expansion of economic activities in the water consumption industry (e.g. tourism and agriculture). It is expected to increase private sector interest and participation in the adoption of wastewater technologies and the use of reclaimed water and other by-products (e.g. nutrients and fertilizers). The gender-sensitive approach taken by this project will ensure that concerns and challenges from women, children and marginalized groups are taken into consideration throughout the project implementation. It will also result in increased participation of women in the production and use of reclaimed water.

3.4 Needs of the recipient

Scale: N/A

39. This project is designed to address the specific financial, social, institutional and technological barriers that have hindered the Government of Barbados so that it can transform its wastewater sector by moving away from a linear water "use to waste" model to a circular economy model of water use. In recognition of the projected effects of climate change on water quality and availability, coupled with the growing population and economy, the country needs to develop wastewater management practices, implement new technologies that are climate resilient and low carbon, and identify new sources of water to recharge the underground aquifers for supply augmentation.

40. Barbados currently has a high debt to GDP ratio that stood at 144 per cent at the 2020 year end and is expected increase due to the Government's spending on the health sector to combat the prolonged impact of the COVID-19 pandemic. This indicates a very limited fiscal capacity to borrow from the international capital market; therefore the GCF grant is much needed to cover the capital costs for this project and its national programme, through parallel finance.

41. In addition, wastewater treatment and reuse is a relatively new concept in the country, so Barbados lacks trained staff, both in BWA and the private sector, with expertise in designing, managing and maintaining wastewater systems. Necessary legislation on the use of wastewater treatment systems and reclaimed water has not yet been approved by the Cabinet. The design of the proposal reflects these identified barriers, and the project is much needed to create the paradigm shift in the wastewater sector and thereby build the country's resilience to climate change.

3.5 Country ownership

Scale: N/A

42. The interventions proposed under this project are aligned with the country's nationally determined contribution and relevant national plans, including the 2021 Physical Development plan, the Barbados Growth and Development Strategy 2013–2020, the National Climate Policy, the Development of Tourism in Barbados and the national adaptation plan, all of which noted the importance of improving climate resilience to water security through diversifying the sources of water, which this project aims to achieve through investment in wastewater treatments and its use for agricultural and supply augmentation.

43. The AE, the Caribbean Community Climate Change Centre (CCCCC) is a GCF direct access entity and as such has been recognized as the focal point for climate change issues in the Caribbean. It has a proven track record in the planning, management and implementation of climate change adaptation and mitigation. The AE can further benefit from GCF's dedication in supporting direct access entities through its direct access strategy.

44. The proposal design is a result of collective efforts among stakeholders, including government agencies (e.g. the Ministry of Transport, Works and Water Resources, the Ministry of Environment and National Beautification, the Ministry of Tourism and International Transport, and the Ministry of Economic Affairs and Investment), private sector agencies, non-governmental organizations and affected communities. The project will continue to engage with the wider stakeholders at the national and community level during the implementation and make sure their needs and concerns are addressed. The national designated authority also provided a letter of no objection and expressed its willingness to lead efforts for continued political buy-in and support at the highest levels of government.

3.6 Efficiency and effectiveness

Scale: N/A

45. The mitigation cost is estimated at USD 98 per tonne CO₂ which excludes the undetermined quantity of GHG emissions avoided owing to the use of sludge to generate energy and energy-efficient pumps in the wastewater treatment plant. This mitigation cost is on the high side resulting from GCF being sole financier to cover the costs of mitigation activities, the small scale of PV installation, and the intensive capital investment into upgrading of the automated controls and energy efficiency measures.

46. The results of the financial analysis with and without GCF scenarios (50:50 grant/high-concessional loans; 100 per cent grant) show that GCF providing in full grant is the only case where the project is profitable regardless of the considered water reuse tariff. The current tariff level for irrigation/agricultural uses stands at USD 0.6/m³ so the project would have to double the figure to make it viable without the GCF grant. However, with the level of poverty increasing from 15.1 per cent in 2010 to almost 20 per cent in 2020, an increase in tariffs would affect the level of economic activity by irrigation farmers with other effects on the local economy and food imports.

47. GCF concessionality would deliver benefits for the following beneficiaries:

- (a) Farmers, through **increased and assured availability of water** for irrigation, enabling the expansion of irrigated agriculture for new entrants, and through **reduction** in the need to use **additional water resources** to support irrigation;
- (b) Communities, through **increased employment** opportunities, and **local businesses** supporting the farming sector;
- (c) General population through increased food availability and security;
- (d) Visitors to Barbados through the maintenance and improvement of the marine environment and ecosystems through reduce contamination;
- (e) Visitors and the general population, through **reduced public health risks**;
- (f) The BWA, through improved training and capacity development and increased income generation; and
- (g) The Government of Barbados through **increased economic activity**.

IV. Assessment of consistency with GCF safeguards and policies

4.1 Environmental and social safeguards

48. **Project overview.** The project aims to contribute to the enhancement of the health, well-being and productivity of Barbadians by using carbon neutral and climate-resilient water and energy management technologies and strategies that ensure water is protected, managed, recycled, reused and conserved. It involves upgrading the Bridgetown STP and installing cluster wastewater collection and treatment to achieve a tertiary water quality. The project will also install PV energy, energy conservation and efficiency equipment and renewable bioenergy at the Bridgetown STP. In addition, it will provide institutional capacity-building by developing standards for water quality monitoring and training of personnel. Expected environmental and social co-benefits include reduced air and water pollution, and improved access to water for irrigation and other non-potable uses.

49. **Environmental and social risk category.** The project falls under Category B of the GCF environmental and social categorization system. The project is essentially an environmental mitigation project and hence its environmental risks/impacts are mostly positive with only moderate environmental and social risks. The inherent risks of using recycled wastewater for aquifer recharge and irrigation have been greatly reduced by the adoption of several key design features including, principally, the upgrading of wastewater treatment to achieve tertiary quality wastewater, and further treatments such as subjecting reclaimed water to a reverse osmosis process and the application of additional measures to control for alkalinity and hardness prior to recharge.

50. **Safeguard instrument.** The AE has undertaken an environmental and social impact assessment (ESIA) and has prepared an environmental and social management plan (ESMP) for the project. Detailed site-specific environmental and social assessments and management plans will be prepared for various aspects of the project during the engineering design phases, namely the installation of (a) pipelines; (b) PV systems; (c) decentralized wastewater treatment plants; (d) reverse osmosis filtration systems; and (e) upgrading of the Bridgetown STP. A condition is included in term sheet for the AE to deliver and disclose these studies.

4.1.1. Compliance with the GCF environmental and social safeguards (ESS) standards

51. **ESS1 (Assessment and management of environmental and social risks and impacts).** An ESIA was conducted on the basis of the general specifications from the project

feasibility study. In general, since the designs and locations of the facilities have not yet been specified, the impacts and risks, and the mitigation measures identified, are still mostly generic and not site-specific. It is recommended that the detailed site-specific assessments that will be prepared at the design phase discuss the presence of residents and establishments near and around the project sites, their socioeconomic status, presence of any disadvantaged or vulnerable groups (e.g. homeless people, informal settlers, itinerant vendors) and whether and how they will be impacted by or benefit from the project.

52. **ESS2 (Labour and working conditions).** ESS2 is relevant in the project because workers will likely be hired during construction by contractors, while additional workers and staff are likely to be hired by BWA during the operation of the upgraded sewerage system. Based on the information provided by the AE, construction activities will create approximately 100–125 temporary jobs at peak including labourers and skilled personnel. The project management is also expected to directly hire 10 people with qualifications and training in specific fields and 20 skilled personnel at the peak of the project.

53. The ESIA has determined the occupational health and safety risks of the project to be moderate for the construction phase and a detailed plan is presented in the ESMP. Safety hazards associated with construction personnel are presented in the ESMP, along with the proposed measures to be implemented by the contractor following national and international standards. To ensure those measures are followed effectively by all people involved, a manual outlining them will be distributed in an appropriate format and made accessible at the workplace. This will also include measures that will be taken if the regulations are violated. Moreover, the contractor will appoint a person/team who will be responsible for the implementation of the health and safety measures. Strict implementation of the country's labour laws will address any potential violations of labour standards in the project. It is recommended that the AE establish a process for assessing risks related to labour in supply chains and mitigate them accordingly.

54. **ESS3 (Resource efficiency and pollution control).** The project is expected to improve efficiency in the use of water and energy resources, and ambient air and water quality. Water use efficiency is increased by recovering and recycling wastewater for non-potable uses, while energy efficiency is achieved through the installation of PV panels, automated control systems, and a biodigester using sludge and food wastes. River and marine water pollution is expected to decrease because direct discharges of raw sewage and treated wastewater to these water bodies are intended to be reduced. The plume dispersion simulation indicates that under normal discharge scenarios, which occur 90 per cent of the time, only approximately 900m³ per day of reverse osmosis discharge is released at designated sea outfalls: the release will not present any significant faecal coliform and total suspended solids plumes in the sea.

55. The project is also expected to improve groundwater quality because the expansion of sewerage services displaces some of the pit latrines in critical zones, while direct use of reclaimed water for irrigation reduces the need for underground water abstraction, and aquifer recharge of tertiary water reduces intrusion of salt water and contaminated water into the aquifer. Moreover, emissions of odorous compounds, which had been the subject of complaints by communities around the Bridgetown STP are expected to be reduced with the rehabilitation/improvement and proper maintenance of the facility's odour-control systems. The ESMP also provides a comprehensive environmental monitoring plan, which includes the quality of influent and effluents of the STPs, groundwater quality, surface water quality and ambient air quality.

56. **ESS4 (Community health, safety and security).** Communities near the project will be exposed to construction-related safety hazards during the construction phase, including risks of accidents and exposure to harmful substances. During the operations phase, they may also be exposed to risks associated with possible infrastructure failure due to natural disasters or industrial accidents resulting in catastrophic release of untreated wastewater. The ESIA

includes the impact of construction on the safety and mobility as well as nuisance and health of communities. These impacts, although likely to occur, have a magnitude of low to moderate, which can be readily brought down to negligible to low levels with standard mitigation measures. The ESIA considered the vulnerability of the system from natural disasters and the provision of various measures, including structural resistance to earthquakes, alternative power supply, alternative discharge routes, and stormwater drainage. The project design includes features such as drainage improvements, the installation of back-up generator, and emergency discharge of wastewater, which minimizes the risk of catastrophic failure.

57. The ESIA determines that the overall impact of the recharge on underground water quality will be positive, given current contamination from pit latrines coupled with excessive water abstraction. In case of malfunction/failure of the Bridgetown STP and decentralized sewage treatment plants, raw wastewater will be discharged via the outfall through the computerized real-time management system which, together with the monitoring programme envisioned and made possible under Output 1.3, is a failsafe system to prevent low quality wastewater from leaving the plant. The tertiary wastewater intended for irrigation will undergo reverse osmosis treatment prior to conveyance into the fields. This process will remove total dissolved solids and thus also harmful pathogens from the wastewater. The Ministry of Health and the Ministry of Agriculture will also carry out crop and soil monitoring to identify any potential adverse accumulation over the medium to long term.

58. The BWA is currently completing the groundwater models and carries out periodic groundwater quality monitoring. These efforts will be enhanced with the establishment of the laboratory. A vulnerability analysis of the aquifer was done in Burnside (2009) using the DRASTIC method, which rated the island as having high to extremely high vulnerability. The system provides monitoring and control to minimize the risk of long-term deterioration.

59. **ESS5 (Land acquisition and involuntary resettlement).** Although the ESIA indicated that the project will exclude activities that “would require involuntary physical and economic displacement of people”, new structures will be built on lands outside of current plant perimeters. These include the expansion of the sewerage service in the Bridgetown STP, the two new decentralized sewage collection and treatment plant systems, the reclaimed water pipelines, the injection and monitoring wells, and installation of solar PV power plants, among others. Aside from these, the project could potentially require temporary facilities and easements during construction that may entail lease or temporary possession of private lands. Lastly, the establishment of project facilities may impose encumbrances to private lands in terms of permanent restrictions of access and/or changes or restriction in land use. Given that the project area is densely populated and may contain informal settlers, the project may involve compulsory land acquisition/land use restriction, and/or displacement of dwellers/occupants. The term sheet includes a request for a detailed survey of the ownership status and occupancy profiles of the lands to be used or affected by the project and a resettlement action plan in case acquisition of private properties or displacement of occupants cannot be avoided.

60. **ESS6 (Biodiversity conservation and sustainable management of living natural resources).** The project’s impacts on terrestrial biodiversity and natural habitat will be very minimal. The physical activities are planned for areas mainly occupied by agriculture, pasture and cities/urban areas. The current conditions of coral reefs around the project’s designated outfalls have been assessed by the Barbados Coral Reef Monitoring Program as “poor” to “very poor”. The natural ecology of Carlisle Bay is expected to improve as the pollution load is reduced.

61. **GCF Indigenous Peoples Policy and ESS7: Indigenous peoples.** The AE notes that the standard is not applicable to the project and represents that it has conducted due diligence in accordance with the GCF Indigenous Peoples Policy.

62. **ESS8 (Cultural heritage).** According to the ESIA, construction works for the reclaimed water pipeline (RWP) will take place within the limit of the UNESCO World Heritage Conservation Area's buffer and there is a listed building located close to the projected construction sites, about 30 metres from the planned RWP alignment. Also, near the construction zone, one Cultural Heritage Conservation Area has been identified that contains buildings of special architectural and historical importance. However, the ESIA does not indicate whether and how these buildings will be affected by the construction or the operation of the RWP. Given that the routes of the pipelines are yet to be finalized, it is recommended that the AE undertake due diligence on locations of final sites and alignments of facilities and their possible impacts on cultural heritage structures in project areas as part of the detailed design studies.

63. **Stakeholder engagement and information disclosure.** The project underwent stakeholder consultations during the preparation of the ESIA between December 2020 and December 2021. The consultations consisted of meetings, workshops, presentations and informal discussions involving members of Barbadian civil society, including non-governmental organizations and community groups, institutional representatives in the water sector and the general public. A stakeholder engagement plan was provided with the funding proposal. It identifies the various stakeholders, their key interests in relation to the project, methods of information dissemination and information expected to be provided. The plan will be updated and adjusted throughout the project implementation period. It is recommended that the AE disclose the detailed environmental and social assessments and management plans that will be prepared as part of the detailed design phase of the project.

64. **Grievance redress mechanism.** The ESMP outlines the mechanisms for feedback and adjustment. As described, the mechanism provides the means for stakeholders to air questions, complaints, and compliments/suggestions about the project, by mail, email, fax, site or by other means of communication during construction and operation phase. However, contact details have not been provided in the documentation. The mechanism is linked with the site inspections, monitoring and audits to confirm proper implementation of the ESMP, as well as effectiveness of mitigation. The grievance redress mechanism is also described in the stakeholder engagement plan. An external communication plan with an independent grievance redress mechanism will be designed and will include actors from each of the relevant groups.

65. **Implementation arrangements.** The ESMP provides detailed discussions of the institutional arrangements for the implementation of the environmental and social management measures, including the roles and responsibilities of the various authorities and offices, and an analysis of the capacity-building needs for the implementation of the ESMP as well as the responsibilities for reporting and review.

66. **Sexual exploitation, sexual abuse and sexual harassment safeguarding.** The revised GCF Environmental and Social Policy adopted by decision B.BM-2021/18 requires safeguarding from sexual exploitation, abuse and harassment (SEAH) in GCF-financed activities. The 3R-CReWS ESIA highlights section 154 of the Barbados Law on sexual offences and further states that in cases of SEAH the AE will consult and work with the relevant government ministry, department or non-governmental organizations to ensure that the survivors are placed in a safe location and protected from further victimization. As required and mentioned in the term sheet, the AE is required to undertake or incorporate due diligence on SEAH as part of the environmental and social due diligence of the proposed project. It is recommended that the AE should conduct first level due diligence on SEAH to ensure that the activities proposed for GCF financing adhere to the SEAH provisions of the GCF Revised Environmental and Social Policy.

4.2 Gender policy

67. The AE has provided a gender assessment and gender action plan (GAP) and therefore complies with the requirements of the Updated Gender Policy of the GCF. The gender

assessment was prepared using primary data collected from sources such as a stakeholder survey and two key informant interviews and desk review of available secondary information.

68. Barbados has ratified a number of international conventions. Among them are the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and the Beijing Platform for Action. At the regional level the Caribbean Community has a gender equality strategy to assist member countries with full implementation of the Beijing declaration. Barbados has a draft national gender policy that is yet to be approved. National laws for fostering better gender equality include the Employment Act and the Employment Sexual Harassment Act for preventing the discrimination of women in the workplace. A national bureau of gender affairs has been established to monitor and evaluate the government's gender equality policies, plans and programmes, and to integrate gender in all national development policies and programmes to advance equity and equality.

69. The gender assessment provided by the AE analyses gender issues at the BWA as the entity responsible for delivering water and wastewater services in the country. It mostly employs men, with few women in technical positions (in line with the national gender imbalance in science, technology, engineering and mathematics sectors) or in leadership roles, as reflected in their lower participation in decision-making spaces.

70. Women are more likely to be affected by lack of wastewater treatment, reuse and poor management than men due to their gender roles as caregivers and homemakers, which means that they are dominant water users and have more direct contact with food and waste. In addition, women are more likely to suffer from the effects of contaminated water. These issues are compounded by the fact that there is a low percentage of Barbadians currently able to access the BWA wastewater collection and treatment facilities, many of whom are low-income households comprising women and vulnerable peoples. Furthermore, reduced water availability owing in part to climate effects disproportionately affects women and increases their unpaid domestic workloads.

71. In the agricultural sector, women engage in farming activities on small subsistence plots and farms to support their families, while men are mainly involved in cash crop production. Women are faced with barriers in accessing finance for improving irrigation technologies due to lack of collateral.

72. The GAP includes activities, performance indicators, sex-disaggregated targets, timelines, responsibilities, and estimated costs for implementation. The GAP includes activities that are mainly focused on participation of women and men in the project, namely: stakeholder consultations involving women and women's groups on the water and sanitation plan; inclusion of gender considerations in the Wastewater Reuse Bill and other related legislation for enhancing wastewater requirements and applications; training of BWA staff on gender sensitivity; a public education and awareness campaign on the impact of climate change on water resources; and an internship programme for women at BWA wastewater division in collaboration with training institutions to improve their representation in technical positions. In addition, access to project benefits is demonstrated through female and male-headed households who will gain connection to decentralized wastewater treatment systems in Zone A as part of the project.

73. The project will have a social and gender specialist who will be responsible for supervising the implementation of the GAP as well as reporting on its progress.

74. The AE is recommended to take into consideration the following issues and submit a revised GAP. The GAP can be improved by including more activities that demonstrate access to the project's benefits by both women and men. For example, access to reclaimed wastewater by women and men for irrigation purposes, and access to the RAFF for decentralized on-site wastewater systems, including by businesses owned by women and female-headed households. Measures that will be taken to reduce costs of connection and tariffs to reclaimed water,

especially for female small scale subsistence farmers, and decentralized wastewater treatment services for female-headed households given their limited resources to pay can also be included in the GAP. Additionally, expected outcomes from participation and access to benefits from the project can be included in the GAP, such as increased availability of water and wastewater treatment services, and how stakeholder engagement will be used to address the reservations that women and men may have regarding the use of wastewater for non-potable purposes as well as barriers that impede payment for water and wastewater services. Targets in the GAP will also need to be rationalized against baseline information. It is not clear whether the baseline study undertaken for the project includes information on gender or how such information was used to set the current targets in the GAP. s.

4.3 Risks

4.3.1. Overall programme assessment (medium risk)

75. The total financing is USD 49,999,063 of which USD 39,390,913 is GCF grant financed. Co-financing of USD 10,608,150 is a grant provided by BWA. Co-financing is at a ratio 1:0.27 and 21 per cent of total financing.

4.3.2. Accredited entity/executing entity capability to execute the current programme (low risk)

76. CCCCC will act in its capacity as the AE, and also the executing entity (EE) with BWA as the co-executing entity for some of the activities. We view positively that CCCCC has a track record of working with BWA in Barbados in another GCF project currently under implementation (FP060 Water Sector Resilience Nexus for Sustainability in Barbados (WSRN S-Barbados)); and that BWA is both EE and co-financier, given its strong implementing capability in water and wastewater sector in Barbados.

4.3.3. Programme-specific execution risks (medium risk)

77. Capacity-building activities under components 3 and 4 represent 7 per cent of the total GCF funding requested and may not result in realizing long-term benefits as expected, in particular the benefit of creating an enabling environment as part of exit strategy and sustainability beyond the project. Execution delays could occur as capacity-building activities require buy-in from the private sector and local communities.

78. Co-financing from BWA will be provided ultimately by the Government of Barbados through the Ministry of Finance, Economic Affairs and Investment (USD 10,608,150 in the form of a grant) and may not be realized. The Government of Barbados (rated Caa1 stable by Moody's: unchanged since July 2019) is constrained by high debt levels and weak economic growth. The COVID-19 pandemic has also weakened the Government's balance sheet and delayed its ambitious reform agenda. However, relatively high income levels and low exposure to foreign-currency-denominated debt support creditworthiness. We derive comfort from the Ministry of Finance, Economic Affairs and Investment, which has already sourced some of the co-financing required to BWA; the Government's recent debt restructuring has significantly improved its fiscal position and we expect debt metrics to improve gradually over the next few years as the economy opens up and the Government rebuilds its primary surplus; and existing covenants in the term sheet.

4.3.4. Compliance risk (high risk)

79. The beneficiary country, Barbados, is not subject to United Nations Security Council restrictive measures. The AE has confirmed that project activities and its related counterparties do not pose significant risks with respect to United Nations Security Council sanctions. The AE, along with BWA (a state-owned company) will act as the EE. The AE has performed a comprehensive capacity assessment on the BWA and the results did not include any major issues in relation to an EE's ability to carry out the planned activities. The AE has assessed that money laundering, terrorist financing, prohibited practices and sanctions related risks are of low probability and medium impact. Throughout the project – inclusive of procurement matters – , the AE will apply its standard set of controls to manage all fiduciary risks. The GCF Office of Risk Management and Compliance (ORMC) and the Compliance Team note that Barbados continues to be listed by the Financial Action Task Force as a jurisdiction with strategic deficiencies in its anti-money-laundering and countering the financing of terrorism regime. Taking into consideration this high exposure, it is recommended that the AE embed enhanced due diligence and controls in all project activities. ORMC/Compliance has conducted a review of the project in accordance with relevant GCF Board approved policies and does not find any material issue or deviation with respect to compliance issues. Based on available information for this funding proposal, the ORMC/Compliance Team have determined a risk rating of “high” and has no objection to this request proceeding to the next steps for processing.

4.3.5. Project viability and concessionality

80. With regards to component 2: Renewable energy and energy efficiency in wastewater treatment, one of the intended outputs is about the adoption of energy efficiency and renewable energy technologies. There are established business models in terms of adoption of energy efficiency and renewable energy technologies and, once installed, these provide relatively predictable and stable revenue streams. The use of GCF grants represents 8 per cent of total GCF funding requested for component 2. The proposed concessionality level is justified on the understanding that the project will create a circular economy, the enabling environment to be more attractive for the private sector as part of exit strategy and sustainability beyond the project, and treating water assets as a new asset class. As a result, the project will ultimately generate adaptation benefits for the population of Barbados. In addition, financial analysis results show that GCF providing in full grant is the only case there the project is profitable.

4.3.6. GCF portfolio concentration risk (low risk)

81. If approved, the impact of this proposal on the GCF portfolio concentration in terms of result area and single proposal is not material.

4.3.7. Recommendation

82. It is recommended that the Board consider the above factors in its decision.

Summary risk assessment	
Overall programme	Medium
Accredited entity (AE)/executing entity (EE) capability	Low
Project-specific execution	Medium
GCF portfolio concentration	Low
Compliance	High

4.4 Fiduciary

83. CCCCC is the AE and the EE of the project. BWA will co-execute the project as the EE. CCCC, as the AE, will administer the relevant GCF proceeds to be used for the financing of the project and will guide implementation in accordance with its accreditation credentials as well as guided by the terms of the funded activity agreement (FAA). In addition, CCCCC, as the EE, will manage, procure and account for all activities associated with the GCF proceeds, as well as monitor and report on the project activities to the GCF and the Government of Barbados, through the office of the national designated authority, in accordance with the FAA and accreditation master agreement (AMA).

84. BWA, as the co-EE, will provide technical support to CCCCC for the development of terms of reference and the procurement of equipment, goods and service; and will be part of the evaluation team and report to the CCCCC as guided by the terms set out in the Subsidiary Agreement, the procurement guidelines of the CCCCC and/or those of the Government of Barbados.

85. The CCCCC project components will be executed by a project management office (PMO), while those components under BWA will be executed under the management of the BWA PMO through a dedicated project team. In addition, the project will be monitored by a project steering committee comprising key stakeholders.

86. Funding for the project will come from: (1) a grant from GCF; and (2) the BWA in the form of a grant from the Government of Barbados through the Ministry of Finance, Economic Affairs and Investment. CCCCC will not on-grant any monies to the BWA, nor will BWA on-grant monies to the CCCCC. The CCCCC will procure all major goods and services for the project using international best practices and the appropriate procurement method in accordance with the procurement plan. The CCCCC, in accordance with its AMA, financial and accounting manual and procurement guidelines, will procure goods, works and services for the realization of the project outputs.

87. Funding provided by the GCF will be kept in a separate project bank account. The partners providing co-financing will manage their co-financing activities but will be obligated to report to the CCCCC on the status of those activities. Those entities are not obligated to transfer any monies to the CCCCC but must provide accounting evidence of transactions and expenditures towards their co-financing obligations.

88. The project will be audited annually by an independent accounting firm, which is to be selected using a competitive bidding process every five years.

4.5 Results monitoring and reporting

89. As a cross-cutting project, 3R-CReWS aims to generate mitigation and adaptation results targeting five GCF results areas. In terms of mitigation impact, the project is estimated to reduce GHG emissions by 40,875 tCO₂eq over the lifespan of 25 years. Regarding adaptation impact, the project will benefit 277,821 beneficiaries, the country's total population, out of which 136,220 are direct, and 141,601 are indirect. The ex-ante estimates are in accordance with the GCF core indicators and further details regarding calculation methodology has been submitted in annex 22 of the funding proposal. Please find detailed assessment regarding monitoring and evaluation below:

- (a) The theory of change adequately explains how the results chain will cascade from the goal statement of the project to the proposed activities and also identifies the linkages between outputs, barriers and risks. Articulating the goal statement and outcomes helps readers to understand the project intervention's climate impact and ancillary benefits (co-benefits);
- (b) The logical framework has been well designed in accordance with the GCF integrated results management framework. The project is expected to realize the paradigm shift by building the necessary infrastructure to scale wastewater treatment and use in the intervention area, implementing a replicable solution for other Caribbean states and achieving sustainability through knowledge generation and capacity-building focused outputs;
- (c) The quantitative integrated results management framework indicators are identified well, cover all the applicable GCF results areas, and include the necessary details about monitoring instruments and baseline/mid-term/final target values. For the GCF results are on enabling environment, all four core indicators are selected with a low and medium baseline level. The project is expected to build a comprehensive enabling environment for water security and other climate change projects at the national level;
- (d) The project has listed relevant project-specific indicators for project outcomes and outputs to enable all-round monitoring of the project's results. For co-benefit indicators "Level of H₂S emissions" and "Number of odour complaints from communities surrounding of the Bridgetown STP and lift stations received per year", the baseline and target will be submitted at the end of the inception phase of the project implementation; and
- (e) Annex 5 (implementation timetable) has been provided in a format allowing tracking of implementation progress and milestones at the output and activity level. The monitoring and evaluation plan provided in annex 11 is beneficial in understanding the indicator-level breakdown of the monitoring budget.

4.6 Legal assessment

90. The AMA was signed with the AE on 25 May 2016 and it became effective on 23 January 2018. The Accredited Entity's first term of accreditation is due to lapse on 22 January 2023, and the re-accreditation of the Accredited Entity has not yet been approved by the Board. The GCF can execute an FAA with an accredited entity that is (1) is under a valid Accreditation term and (2) has an executed and effective AMA (including an amended and restated AMA) for accreditation terms following the initial term.

91. The AE has provided a legal opinion/certificate confirming that it has obtained all internal approvals and it has the capacity and authority to implement the project.

92. The proposed project will be implemented in Barbados. The GCF has signed a bilateral agreement on privileges and immunities with Barbados.

4.7 List of proposed conditions (including legal)

93. In order to mitigate risk, it is recommended that any approval by the Board is made subject to the following conditions:

- (a) Signature of the FAA in a form and substance satisfactory to the GCF Secretariat within 180 days³ from the date of Board approval; and
- (b) Completion of the legal due diligence to the satisfaction of the GCF Secretariat.

³The GCF can only execute a funded activity agreement with an Accredited Entity that has an executed and effective AMA (including an amended and restated AMA).

Independent Technical Advisory Panel's assessment of FP192

Proposal name:	The R's (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados (3R-CReWS)
Accredited entity:	Caribbean Community Climate Change Centre (CCCCC)
Country/(ies):	Barbados
Project/programme size:	Small

I. Assessment of the independent Technical Advisory Panel

1.1 Impact potential *Scale: Medium to high*

1.1.1. Adaptation Impact

1. Barbados is among the most densely populated and water-scarce countries in the world, with a population density of 660 people per km² and a water availability estimated at approximately 305–310 m³ per person per year.

2. The proposal argues that climate change would increase water stress through the following impacts, expected for 2040–2060:

- (a) The mean annual daily maximum temperature would increase by about 1.0 °C and the mean annual daily minimum temperature would increase by about 1.3 °C;
- (b) The number of heatwaves has already increased over the period 1991–2020 and is expected to increase further with increasing temperatures; and
- (c) Annual mean precipitation would decrease by about 9 per cent, especially in the May–July season, extending the dry season by two months.

3. The decreasing amount and increasingly skewed pattern of precipitation and increasing evapotranspiration due to higher temperatures will set the stage for increased drought, which will further decrease underground recharge rates and increase salinization of aquifers, which provide 95 per cent of the island's potable water supply. The overall implication of the available body of studies suggests that sustainable aquifer yields could decrease by around 50 per cent by 2050. This is troubling for Barbados as the level of groundwater abstraction is already between 85 and 100 per cent of the safe yield.

4. The proposed project aims to enhance water-related climate resiliency through the following main activities:

- (a) Upgrade of the existing Bridgetown Sewage Treatment Plant (BSTP) to achieve water quality for reuse: conversion to Bardenpho configuration, and installation of tertiary filters and a reverse osmosis unit;
- (b) Construction of a distribution system and injection wells, to allow for irrigation reuse and aquifer recharge;
- (c) Installation of two pilot treatment plants;

- (d) Installation of a 1 MW photovoltaic (PV) system in the BSTP to meet energy requirements of the upgrade;
- (e) Implementation of energy efficiency measures and sludge dewatering at the BSTP; and
- (f) Provision of technical and institutional capacity-building and support including, among other things: the operation and maintenance of the BSTP; a strategic plan to guide the replication of water treatment facilities; a review of water-related legislation; the development of a water and sanitation master plan and an action plan to engage the private sector; the expansion and promotion of the Revolving Adaptation Fund Facility (RAFF) to provide resources for the adoption of decentralized on-site wastewater systems; and a public education and awareness campaign.

5. Direct beneficiaries are estimated at 136,000 people, which is roughly half the population of the island. Indirect beneficiaries comprise the rest of the population, who would benefit from the strengthened institutional capacity including, among other things, legislation review, development of a water and sanitation master plan and an action plan to engage the private sector, and a public education and awareness campaign.

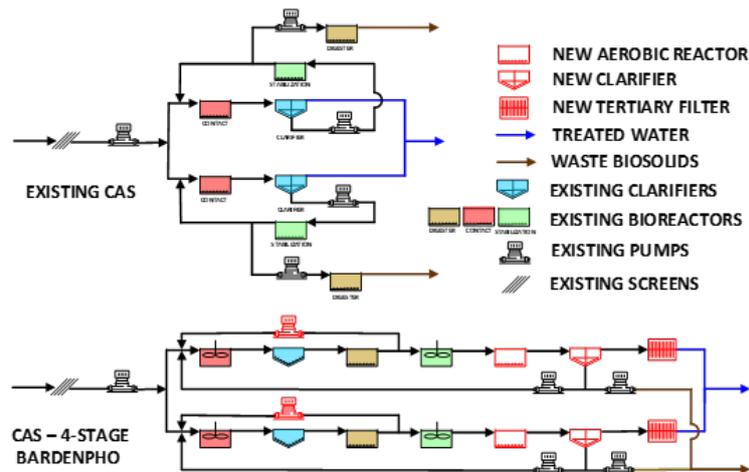
6. The BSTP is a conventional activated sludge system, with a design capacity of 9,000 m³/day. There is no available data on current wastewater flow and quality. Hence, the proposal estimated the flow based on water consumption, national average per capita consumption and number of properties connected to the sewer in Bridgetown. Only 5 per cent of the properties in Bridgetown are assumed to be connected to the sewer. According to this estimation, the plant would be currently receiving an average dry weather flow of approximately 1,400 m³/day. On the other hand, the proposal states that “This [flow] is significantly lower than the flow operations staff indicate is received by the plant, who indicated wastewater flows approach the plant capacity at times”, and that the system also receives commercial sources of wastewater. For these reasons, a nominal flow of 9,000 m³/day was assumed to assess upgrading costs.¹ In the opinion of the independent TAP, uncertainty in plant influent characteristics (i.e. flow rate pattern and concentrations of incoming pollutants) at the design stage is a major cause of plant failure and inefficient design, with potentially severe implications during the operation and maintenance of the facility.

In a meeting with the independent TAP, the proponent further clarified that subsequent to the preparation of the baseline report, a water meter was installed to collect the daily flow data, and that samples have already been taken to characterize the raw influent, and are being analysed.

7. In spite of the clear lack of knowledge on current average and peak flows, the upgrade of the BSTP to a four-stage Bardenpho configuration was designed to increase the treatment capacity to 15,000 m³/day.² The proposed upgrade includes two new aerobic reactors, two new secondary clarifiers and two new tertiary filters.

¹ Feasibility Report, pages 5 and 6.

² Feasibility Report, page 32.



8. An assessment of wastewater flows and quality should have been carried out prior to investment decision-making. The accredited entity indicates that “As there is no historical wastewater quality analysis data available, the wastewater characteristics were estimated based on typical North American wastewater characteristics”. The four-stage Bardenpho process is a biological nitrogen removal (BNR) process. Extensive experience in BNR wastewater treatment plants indicates that having adequate influent characterization is key for successful design. BNR success depends to a large extent on the influent flow characteristics, namely the ratios of readily biodegradable chemical oxygen demand and total Kjeldahl nitrogen. Every municipality has a distinct wastewater characteristic and so sampling campaigns should have been made to make a proper influent characterization.

9. Upgrades to Bardenpho with tertiary filters and reverse osmosis would be necessary for achieving reuse standards. But the high uncertainty in future influent flows, and the very high treatment capacity proposed (15,000 m³/day) seems exaggerated based on the current situation.

10. In response to the independent TAP’s comments on plant capacity and sewer connections, the proponent stated that “Efforts are being made to install equipment to undertake measurements to determine what the inflow rates actually are...” and that 15,000 m³/day is not the future capacity but the current “peak daily flow that the plant can cope with”. However, the Feasibility Report clearly states that the current peak flow capacity of the BSTP is 36,000 m³/day, and that the proposed modifications would “...increase the design capacity of the system from existing 9,000 m³/d to 15,000 m³/d...”.³

11. The proponent also responded that “It is expected that over the medium-long term the Government of Barbados and BWA [Barbados Water Authority] will realise significantly greater sewer coverage in the Bridgetown area”, and that expanding the wastewater collection system would entail connecting a maximum of 16,000 additional properties (approximately 41,000 people), with an estimated budget for the expansion of the collection system of USD 48 million. It provided no details on how the expansion would be scheduled.

12. The proponent also described other specifics related to the extension of the sewer coverage: (a) there are areas that suffer from overflow of the septic tanks when the groundwater level rises, and for this reason are already identified and prioritized for connecting them to the sewerage system (750 households); and (b) there are two hotels planned for construction that would be connected to the system. These would contribute an additional 600,000–800,000 US gal/day (2,300–3,000 m³/day). The government would pay for the intra-domiciliary connections, including all the works that need to be done inside the households. The

³ Feasibility Report, pages 8 and 32.

independent TAP considers this an adequate means to increase people's connectivity to the sewer networks, thereby guaranteeing higher flow rates to the plant and less pollution.

13. The funding proposal recognizes that potable water losses in the distribution network of Barbados (lost to bursts and leakage) have been reported as approximately 20.0 Mm³/year, or roughly 38 per cent of production, and states that "Even removing all losses from the distribution system, which is unrealistic, would not be sufficient to offset the projected impact of climate change on aquifer yields". However, the percentage of loss is still sufficiently high to be taken into account as a priority for Barbados water management.

14. Questioned by the independent TAP, the proponent clarified that 38 per cent is the total non-revenue water (NRW) at the national level, and that it corresponds to: unbilled authorized consumption – 3,195,820 m³ (6 per cent); unbilled unauthorized consumption – 639,164 m³ (1 per cent); meter errors – 1,597,910 m³ (3 per cent); and real losses – 14,548,218 m³ (28 per cent). The proponent also included a brief description of recently completed, ongoing and planned actions to reduce NRW, which include:⁴

- (a) An ongoing BWA programme to install smart water meters to enable the identification and correction of meter reading errors, expected to be operational by 2023;
- (b) The BWA and the Government of Barbados have been investing in a mains replacement programme, with a total of 29.4 km of pipelines replaced in 2021;
- (c) "NRW equipment" was installed within the NRW Unit of the BWA, by the Water Supply Upgrade Network Project (WATSNUUP);
- (d) The Water Infrastructure Rehabilitation Project is replacing 16 km of pipeline, expecting to finalize this work in 2024;
- (e) The Water Sector Resilience Nexus for Sustainability project is replacing 16 km of pipelines;
- (f) The Production and District Metering Programme, funded by the Government of Barbados, is installing metering and NRW software, complemented by the SMART Meter Transformation project installing Automatic Infrastructure Metering, including smart meters, software, analytics, reporting and connectivity to Management Information Systems; and
- (g) Other planned projects include the Highway 7 Mains Replacement programme and the Major Cities Programme, which includes replacement of mains and upgrading of the distribution networks.

15. The water distribution network is currently equipped with water meters at the user level, which are being gradually replaced by smart water meters. Residential and commercial tariffs are based on increasing block tariffs, which penalize excess water use.

16. The two small (cluster) decentralized wastewater collection and treatment demonstration systems to be installed under activity 1.4.1 are not described in the proposal. Questioned by the independent TAP, the proponent pointed out that this activity is fully funded by the Government of Barbados and that it is currently under implementation, at the detailed design stage, and submitted a schedule of institutional actions taken up to now.

17. Given that the primary use of reclaimed water would be for agricultural purposes, and that the reclaimed water would be used to recharge the aquifer only when the demand for irrigation decreases,⁵ and that the estimated demand for reclaimed water for agricultural irrigation is approximately ten times the volume that would be made available by this project,⁶

⁴ The independent TAP Qs CCCCC Water Reuse BWA_CCCCC Responses 25_08_2022_Rev1, answer to question 4.

⁵ Funding proposal, page 63.

⁶ Funding proposal, page 57.

it was not clear why the proposal included the construction of six injection wells. Questioned by the independent TAP, the proponent clarified that the injection wells would be used during the rainy season, when the water requirement for irrigation is at its minimum. Thus, in the independent TAP's opinion, the construction of six injection wells makes sense.

18. The project expects to achieve a greenhouse gas (GHG) emission reduction of 40,875 tCO₂e over 25 years, or 1,635 tCO₂e/year. This reduction comes from the installation of the PV system. The project scenario used for calculations does not consider the emissions related to the upgrade of the BSTP (additional reactors, secondary decanters, tertiary filters and reverse osmosis), nor the emissions related to treatment of a higher wastewater flow rate (energy for pumping, blowers, filtration, aquifer recharge system, irrigation distribution system, methane emitted by additional sludge generated, etc.). No doubt the proposed PV system would reduce energy requirements during the operation of the proposed upgrade, but the independent TAP questions the GHG emission reductions claimed in this funding proposal.

1.2 Paradigm shift potential

Scale: High

1.2.1. Potential for knowledge and learning

19. Concerning knowledge and learning, activity 4.3 is focused on nationwide public education and awareness, which would include school programmes, community consultations, and workshops for key stakeholders such as farmers and the private sector. Knowledge products include videos and documentary films, press releases of outputs of town hall meetings within communities, case studies, digital flyers, posters, 40 "water Wednesdays" (8 per year), 20 newsletters (4 per year) and over 5,000 combined posts on social media accounts. The project would also have a dedicated web page (activity 4.3.3) for reporting and sharing lessons learned and best practices.

20. Project monitoring, reporting and evaluation arrangements are clearly described in the funding proposal.

1.2.2. Contribution to the creation of an enabling environment

21. In order to enhance post-project sustainability, the project would include monitoring systems and promote preventive maintenance through: (i) the development of a Computerized Real-time Management System (CMMS) to establish a core electronic data collection, operation and maintenance programme; (ii) the implementation of a sewer flow monitoring programme to mitigate flow and load variations that could occur as a result of major storm events; and (iii) the establishment of an on-site laboratory at the BSTP to generate influent and effluent water quality data.

22. The main revenue generation for the financial sustainability of the upgraded BSTP would come from the Garbage and Sewage Collection Levy and the sale of the reclaimed treated wastewater to farmers for irrigation. Other potential income would be the sale of dewatered sludge to be used as fertilizer.

23. The private sector engagement in the adoption of wastewater management technologies and use of reclaimed water and other by-products would promote the emergence of new markets related to the wastewater sector.

1.2.3. Contribution to the regulatory framework and policies

24. Component 4 is mainly focused on providing support to improve the regulatory framework and governance. Under this component, the project would carry out a legislative review of the Planning and Development Act, the Wastewater Reuse Bill and other related

legislation including the Planning and Development Regulations, the Physical Development Plan, the Water Order Bill, the Guidelines and Protocols for Potable Water Storage and Rainwater Harvesting, the Integrated Coastal Zone Management Plan, the Guidelines and Protocols for the Operation of Solid Waste Management Facilities, and the Integrated Blue Economy Policy Framework and Strategic Action Plan for Barbados.

1.2.4. Scalability and replicability

25. To promote replication efforts, output 3.2 involves investigating and developing a strategic plan for the installation of reverse osmosis water treatment facilities along the west coast corridor, to collect brackish groundwater and treat it to potable water standards to supplement drinking water resources.

26. The expansion and promotion of the RAFF would provide resources for the adoption of decentralized on-site wastewater systems. The RAFF, currently being established by the BWA, aims to mobilize funds for adaptation and mitigation initiatives in the water sector, including those identified as a priority in the Climate Change Adaptation Water Master Plan of Barbados.

27. As described in the funding proposal, the estimated demand for reclaimed water for agricultural irrigation is approximately ten times the volume that would be made available by this project, demonstrating the high potential for scalability and replicability of this project.

28. Institutional and technical strengthening would also support replication and scalability.

29. The independent TAP fully recognizes the urgency and importance of this funding proposal for Barbados. However, it would like to express concern regarding the business-as-usual approach applied in the wastewater treatment process, not considering methane capture and utilization as a renewable energy source or flaring at the site. Therefore, the paradigm shift criterion is assessed as medium.

1.3 Sustainable development potential

Scale: High

1.3.1. Environmental co-benefits

30. Environmental co-benefits include:

- (a) GHG emission reduction from reduced sludge transportation (which is not calculated in the funding proposal and for this reason is considered as a co-benefit);
- (b) Improved environmental conditions, including reduced groundwater pollution, on the land where the sludge is currently being sprayed, which is reportedly presenting “clogging problems” (saturated land);
- (c) Reduced odour problems in the proximity of the BSTP from the enhanced sludge management system;
- (d) Reduced groundwater contamination at the sites benefiting from decentralized wastewater treatment systems; and
- (e) The improvement of the operation of the BSTP that would ensure higher effluent quality, and the reduced discharge flow to the ocean, could potentially enhance water quality at the coast near the discharge point.

1.3.2. Social co-benefits

31. The reduction in the consumption of irrigation water from natural sources would increase water availability for domestic uses, thus potentially enhancing the health standard of the population.

1.3.3. Economic co-benefits

32. The increased availability of water for irrigation and of treated sludge for use as soil amendment has the potential to increase agricultural productivity, and consequently the income of the people who depend on agriculture.

33. It is estimated that the construction works included under this project at the BSTP and the 9 km pipeline would create 100 temporary jobs and new opportunities for local business, which could have positive impacts on local income. Consultancies related to baseline studies and strategic plans would also create additional jobs.

34. The private sector engagement in the adoption of wastewater management technologies and the use of reclaimed water and other by-products would generate green jobs and have positive impacts on the economy.

1.3.4. Gender-sensitive development impact

35. Gender equality would be considered in the project activities as follows:

- (a) Stakeholder consultations throughout the lifetime of the project would aim to engage women's groups and other vulnerable groupings;
- (b) Community infrastructure improvements would include social and gender safeguards to ensure the protection of women, children and the vulnerable;
- (c) Community engagement would ensure that the needs of both female- and male-headed households are incorporated when installing decentralized wastewater treatment systems;
- (d) All training activities would aim to achieve a 50/50 balance in the participation of men and women;
- (e) The BWA staff would undergo a gender sensitivity training programme;
- (f) The update of the standard operating procedures (SOPs) and operational manual would include gender and social inclusion considerations;
- (g) The legislative review would consider gender equality;
- (h) The water and sanitation master plan and the engagement strategy for the private sector would promote women's empowerment;
- (i) The management of the expanded RAFF would ensure that gender equality is promoted as a requirement;
- (j) The public education and awareness campaign would be designed to be gender sensitive; and
- (k) When possible, project results would be disaggregated by gender.

1.4 Needs of the recipient

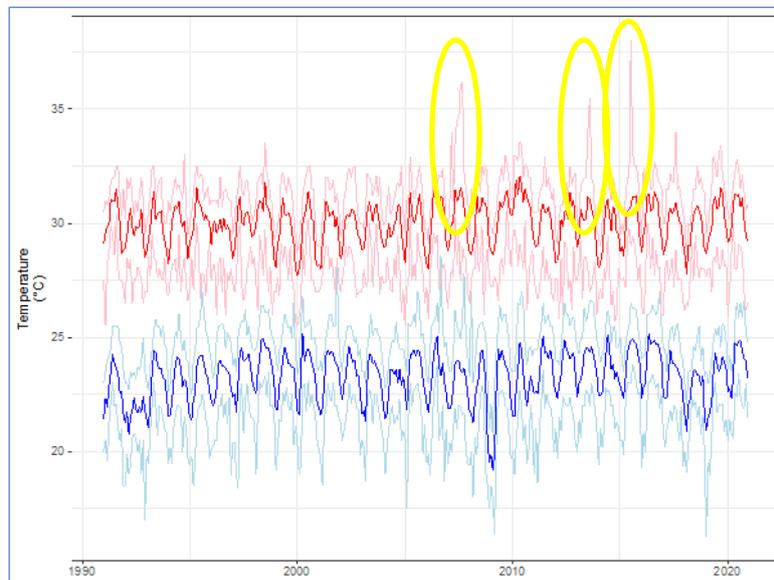
Scale: High

1.4.1. Vulnerability of the country and vulnerable groups

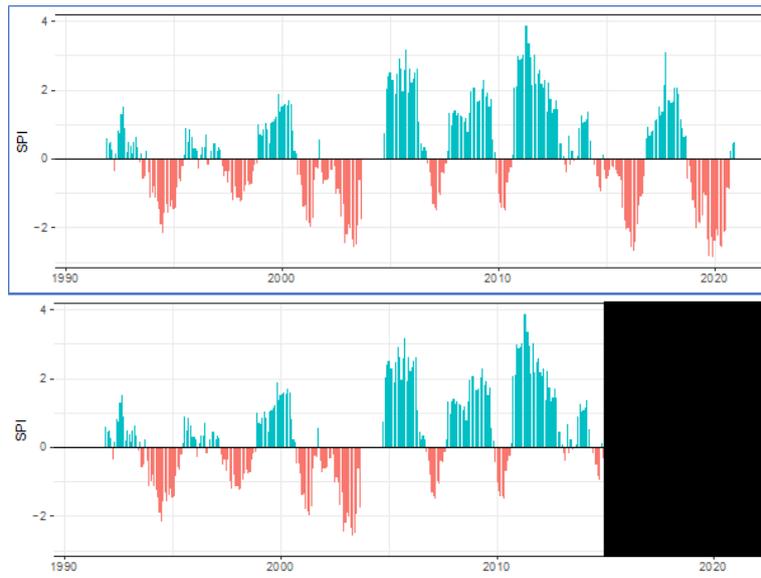
36. The proposal includes a climate historical data analysis, based on data for the period 1991–2020, from four weather stations located on the island, one of them having data on daily observations (station of the Caribbean Institute for Meteorology and Hydrology) (CIMH), and the other three with only monthly averages.⁷

⁷ C1 Climate and Climate Change in Barbados, page 2.

37. The historical trend analysis, based on the CIMH data, was carried out using the Climpack software, and arrived at the following conclusions:
- (a) The minimum daily temperature has increased during the last three decades, at a pace of 0.19 °C per decade;
 - (b) The maximum daily temperature has increased at a rate of 0.29 °C per decade;
 - (c) There is no significant change in the number of small to medium precipitation events;
 - (d) The total precipitation over consecutive days is increasing, especially during September to November; and
 - (e) There were no significant changes in monthly precipitation during the period 1991–2020.
38. Additionally, the evaluation includes a visual trend analysis of temperature and precipitation time series, which is evaluated in the following paragraphs.
39. The temperature chart shows the increase in the lowest daily minimum temperature and the monthly average of the daily minimum. However, the trend is not gradual throughout the 30 years of historical data: it presents no visible trends for 1991–2010, and presents a somehow higher median for the period 2010–2020.
40. The monthly maximum temperatures show an increase in peak temperatures for 2006–2020 as compared to 1991–2005. However, rather than a trend, this is based on only three hotter summers during the period 2006–2020. If those three events are disregarded, there is no significant visual trend in maximum temperatures.



41. The proposal argues that the incidence of dry periods is increasing, with the two most severe dry periods (Standardized Precipitation Index (SPI) < -2) occurring in 2017 and 2019–2020. However, it can be seen that even though these two dry periods did occur in 2017 and 2019–2020, if one looks at the chart disregarding the last five years, a clear positive trend of the SPI can be observed for the period 1991–2015. This suggests that even if there is a change in precipitation, the SPI time series does not demonstrate a clear relationship between these changes and anthropogenic climate change. These two severe dry periods can be regarded as anecdotic.



42. There is a weak statistical signal of an increase in the incidence of days with heavy rainfall (>100 mm per day). However, this trend appears to be statistically insignificant.⁸

43. For climate projections, the climate rationale makes use of the model ensemble of phase six of the Coupled Model Intercomparison Project (CMIP6), and specifies which models were used. However, the validation process for the applied models is not described in the proposal, and thus it can be assumed that the models were not validated against historical data. In response to the questioning of the independent TAP, the proponent presented an analysis of the correlation between CIMH historical data and CMIP6 results for monthly and seasonal precipitation, for the period 2015–2020. The chosen period is very short for validation purposes. In addition, far from validating the results of the model ensemble, the charts show poor correlations (high dispersion), and demonstrate that projections significantly underestimate monthly and seasonal rainfall.⁹

44. Also regarding projections, although the proposal states that historical data show that the average daily maximum temperature has remained relatively constant during the period 1991–2020, the models predict that it would increase by approximately 1 °C in average for the period 2041–2060.¹⁰

45. The models also predict that average annual precipitation will decrease by 18 per cent for the period 2041–2060. However, climate trends show that there have been no significant changes in average precipitation during the period 1991–2020. This can be observed in the SPI chart that includes past records (1991–2020) and future projections (2021–2060).¹¹ This fact reveals the lack of validation of the models used to make forecasts.

46. The following charts, taken from the submitted document “C1 Climate and climate change in Barbados”, show the SPI index for 1991–2020 derived from monthly averaged daily observations of precipitation from a weather station in Barbados (up) and the SPI index for 1991–2060 as projected by an ensemble of CMIP6 models with the SSP2-4.5 scenario (down). The date axes are aligned to allow visual comparison. In the chart for 1991–2060 projected SPI, the data in the period 1991–2013 is a hindcast; CMIP6 forecasts start in 2014. In this case, it can

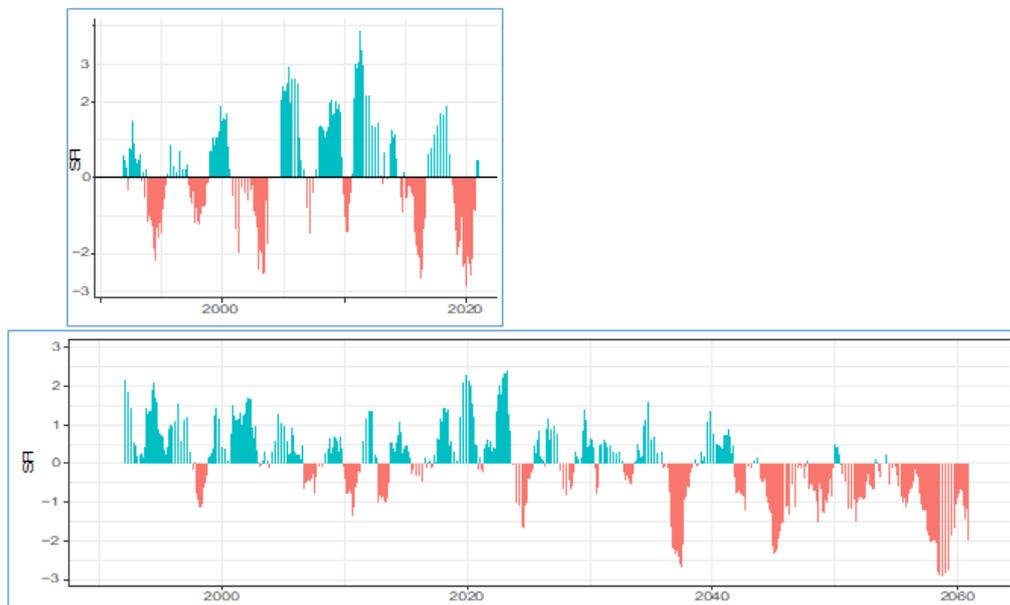
⁸ C1 Climate and Climate Change in Barbados, figure 7.

⁹ The independent TAP Qs CCCCC Water Reuse BWA_CCCCC Responses 25_08_2022_Rev1.

¹⁰ C1 Climate and climate change in Barbados, figure 9.

¹¹ C1 Climate and climate change in Barbados, figure 11.

be seen that there is a poor correlation between the SPI based in observations and the SPI based in CMIP6 results.



47. Despite the funding proposal not having a clear data analysis (probably due to lack of local information and funding to perform additional analyses), the water availability in Barbados (estimated at approximately 305–310 m³ per person per year) makes Barbados a highly stressed country from a hydrological standpoint. Water stress is likely to increase over time due to climate change. Thus, the independent TAP considers that this is a climate-driven funding proposal.

1.4.2. Economic and social development

48. According to an Inter-American Development Bank survey, 17 per cent of the population of Barbados is poor, and a further 11 per cent is considered vulnerable. The overall unemployment rate is estimated to be around 10 per cent.

49. The significant decline in tourism due to the COVID-19 pandemic impacted the economy as a whole, increasing the account deficit to 6.2 per cent, and contracting the real economy by approximately 18 per cent during 2020 and 3 per cent in the first quarter of 2021.

50. During 2020 and 2021, Barbados faced other two crises: the eruption of the volcano La Soufrière in Saint Vincent and the Grenadines in early 2021, which severely affected the agricultural sector of Barbados, and the passage of Category 1 Hurricane Elsa, which caused widespread housing stock damage and loss of key utilities such as power, Internet and water, further reducing the productivity of key sectors.

1.4.3. Absence of alternative sources of financing

51. Barbados's public debt-to-GDP ratio increased consistently from 55 per cent in 2008 to 144 per cent by the end of 2020.

1.4.4. Need for strengthening institutions and implementation capacity

52. The need for institutional and technical strengthening is recognized in the proposal and address through a set of activities, which include providing training to all BWA staff concerning

the operation of the upgraded BSTP, implementing decision support systems such as the CMMS, a sewer monitoring programme, automated controls for improved energy efficiency, an on-site laboratory, a risk management framework, updating the SOPs and operational manual, and training to ensure there is institutional knowledge and understanding of the operational procedures.

53. The project would also strengthen BWA's partnerships with the private sector, civil society and the general public through a private sector engagement strategy and action plan, a public education and awareness programme, the expansion of the RAFF and a designated project website.

1.5 Country ownership

Scale: High

1.5.1. Alignment with national climate strategy and policies

54. The proposal is fully aligned with the 2021 Physical Development Plan and the Roofs to Reefs Programme (R2RP), which provide the relevant framework for Barbados to achieve its climate resilience goal and are, in turn, based on the Barbados National Climate Change Policy.

55. The National Water Reuse Policy states that the traditional interpretation of the term "water" must expand beyond conventional freshwater sources to include, among others, reclaimed water and rainwater, as part of the total water resources.

56. The installation of the PV systems is aligned with the National Energy Policy and Implementation Plan, which set the goal to achieve a fossil fuel-free economy by 2030.

57. The funding proposal also presents a list of other relevant legislation and policies with which the present project is aligned.

1.5.2. Capacity of accredited entities or executing entities to deliver

58. The project would be co-executed by the Caribbean Community Climate Change Centre (CCCCC) and the BWA, under the supervision of the national designated authority (NDA). The accredited entity is the CCCCC, a direct access entity.

59. The CCCCC is a regional non-profit organization among member States of the Caribbean Community (CARICOM), which provides climate change related policy advice and guidelines to the CARICOM member States and to the United Kingdom Caribbean Overseas Territories, and it is recognized by the United Nations Framework Convention on Climate Change and the United Nations Environment Programme as the focal point for climate change issues in the Caribbean, and by the United Nations Institute for Training and Research as a Centre of Excellence.

60. The NDA would assist with the implementation of project activities and provide in-kind support, in particular for those activities that require coordination among ministries and engagement with GCF on reporting and verification.

1.5.3. Engagement with civil society organizations and other relevant stakeholders

61. The stakeholder engagement plan presents a list of key stakeholders consulted during the inception phase, which include several government and private agencies and non-governmental organizations.

62. Key stakeholders to be engaged during the implementation phase include agricultural associations and farmers, and the Association of Women in Agriculture.

1.6 Efficiency and effectiveness

Scale: Medium to high

1.6.1. Cost-effectiveness and efficiency

63. The economic and financial analysis assumes a sale price for water for irrigation reuse of USD 1.22/m³ (BBD 2.48/m³). There is no willingness-to-pay study regarding agricultural use. The feasibility study for the Provision of Reclaimed Water for Irrigation in the South, states that the current rate for irrigation water is USD 0.60/m³. The uncertainty on willingness-to-pay could potentially reduce the long-term sustainability and economic efficiency of the project.

64. The proponent further clarified that discussions were held with the agricultural community through the Barbados Agricultural Society and by approaching individual and commercial farmers. Some farmers are currently using reclaimed water and are paying the commercial rate that is higher than the rate being considered by the project. Farmers are more concerned with the consistency and quality of the supply than with the rate. Taking this into consideration, the uncertainty on willingness-to-pay for reuse water for irrigation is eliminated or, at least, considerably reduced.

65. The estimation of operation and maintenance costs for the PV system at USD 10,000 per year is based on literature review, being in the lower end of the range. This assumption is applied for 29 consecutive years (2022–2050), which seems excessive considering that the calculations do not include replacement costs. Although good quality solar panels can last up to 30 years, the inverters, which make up a significant part of the total capital cost, have a lifespan of 10–15 years. This should have been taken into account in the operation and maintenance costs.

1.6.2. Amount of co-financing

66. Considering the activities expressly included in the funding proposal, the co-financing ratio is quite low: ~0.2. GCF would be financing USD 39.4 million, out of a total of USD 50 million. However, when the ongoing investments for the South Coast Sewage Treatment Plant and the expansion of the sewer collection systems, which are not expressly part of the funding proposal, are taken into account, the total investment adds up to approximately USD 250 million, and the co-financing ratio becomes significantly larger (~6.4).

1.6.3. Financial viability

67. The capital expenditure, operational expenditure and revenues from the South Coast Sewage Treatment Plant are included in the economic and financial analyses presented as annex 3a. However, the upgrade and expansion costs of the plant are not taken into account in the funding proposal's main document (i.e. not part of the present proposal), nor in the detailed budget. An adequate cost-benefit analysis should have been carried out considering only the costs and revenues from the activities included in the funding proposal.

68. Questioned by the independent TAP, the proponent answered that "...It was important to demonstrate that the 3R-CReWS is nested in a much larger programme being implemented by the Government of Barbados and the BWA. The 3R-CReWS, SCSTP and other development phases are complementary as such ignoring the other development phases would not allow the author to paint to full picture of why grant funding, which is 20% of total planned medium investment, is being requested from the GCF. See Annex 28 for more information on the SCSTP. It is important to note the Government of Barbados is taking a loan to complete the proposed actions for the SCSTP. The grant, which is needed given the fiscal constraints of the country, is being requested from the GCF is complementary to those loans being taken for other development phases. Annex 3a covers the financial model for the programme but is dynamic enough to allow the user to switch off different development phases to observe the NPV...".

1.6.4. Best practices

69. The selection of the BSTP upgrade option was based on efficiency and effectiveness: land area requirement, operator skill level requirement, technology adaptability, capital cost, operating labour cost, energy requirement, process robustness, water quality achieved and water reuse applications.
70. The selection of the construction site of the two small decentralized treatment plants and sewage collection was based on the vulnerability of groundwater resources and on the potential to positively impact groundwater resources.
71. The PV systems to be installed will withstand at least Category 3 hurricanes, thereby promoting both climate change adaptation and mitigation benefits.

II. Overall remarks from the independent Technical Advisory Panel

72. Water availability in Barbados (estimated at approximately 305–310 m³ per person per year), makes Barbados a highly stressed country from a hydrological standpoint. Water stress is likely to increase over time due to climate change. The proposed wastewater reuse project represents a sustainable measure to adapt to climate change and its impact on water resources. Also, being part of a larger initiative that includes another wastewater treatment facility, this project represents a paradigm shift for Barbados. This initiative has the potential to be replicable in other Caribbean countries.

73. Thus, the independent TAP endorses this funding proposal with the following recommendations:

- (a) To continue and, if needed, increase the effort in characterizing the influent wastewater (both flow rates and concentrations of pollutants), thereby reducing the risk of inefficient design and plant failure;
- (b) To keep monitoring influent, effluent and operational conditions once the plant is commissioned. This information will be very valuable for future upgrades;
- (c) To estimate the amount of emissions related to the proposed increase in wastewater treatment, for example additional energy for blowers, pumping (within and outside the sewage treatment plant), sludge treatment, etc.; methane emitted from increased amounts of sludge; emissions of nitrous oxide inherent to the nitrification-denitrification within the Bardenpho process; and to report these emissions and compare them to GHG emission reductions claimed for the PV generation;
- (d) To monitor emissions of GHG in the upgraded sewage treatment plant;
- (e) To look for private sector parties interested in installation of methane capture and cogeneration of energy within the facility (which would reduce GHG emissions both at Scope 1 and Scope 2); and
- (f) To re-evaluate and make more realistic estimations of the operation and maintenance costs for the PV system.

Response from the accredited entity to the independent Technical Advisory Panel's assessment (FP192)

Proposal name:	The R's (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados (3R-CReWS)
Accredited entity:	Caribbean Community Climate Change Centre (CCCCC)
Country/(ies):	Barbados
Project/programme size:	Small

Impact potential

The AE is thankful for the iTAPs overall rating of this criterion as medium to high for the impact potential. Specifically on the adaptation impact, the AE also thanks the iTAP for its consideration and recommendations that can be taken onboard immediately with the current Project's design during implementation. In addition, the AE also wishes to express thanks for the encouragement from the iTAP to continue with the ongoing (through the co-executing entity, the BWA) implementation of augmented influent characterization, which will be characterized more intensely, to inform the detailed design of the proposed wastewater facility upgrades. These have been identified based on the best available local and international technical knowledge and from regional experience to be the four-stage Bardenpho configuration, understanding the limitations of the historical data. It is encouraging that the iTAP views the Project design as a step in the right direction towards the increased monitoring of the influent characteristics that will be incorporated to determine the final detailed design of the proposed interventions. Through the iTAPs comments on characterization, this recommendation is fully supported in the Project design and the AE is appreciative of the iTAPs recognition of the clarifications provided.

The AE thanks the iTAP for the recognition of the positive potential impacts on Barbados' water security through the increased people's connectivity to the sewer networks, thereby guaranteeing higher flow rates to the plant and less pollution. The current NRW strategy being implemented by the BWA is multifaceted and takes a multi-step approach towards the reduction of its NRW, and the AE thanks the iTAP for the positive encouragement and recognition of the works completed by the Government of Barbados through the BWA to reduce its NRW. With the Project design they are various cross-sectoral issues that are to be addressed, which focus mainly on wastewater management: sewer network; wastewater treatment onsite, off-site, and decentralised wastewater; water re-use; water recycling, which are all analogous with the GCF's water security sectoral approaches.

The AE further thanks the iTAP for the recommendations provided through this process and highlights the responses from the iTAP on the clarifications provided. The various Project components are all interconnected to provide solutions to the impact of climate change on the available potable water in Barbados. In addition, the AE thanks the iTAP for the support of the re-use of the treated water for cross-sectoral use in agriculture. A critical element of the Project design made provision for the potential uptake with the increase in demand for the reused water, thus reducing the uptake (thus increasing the availability, of the already scarce potable water sources.

Paradigm shift potential

The AE thanks the iTAP for the overall rating of high for the Paradigm Shift Potential of the proposed Project. The AE is also thankful for the comments received on the (a) Potential for knowledge and learning criterion, which articulates the major aims of the criterion Project-wide and provides a roadmap to the interconnections of the various Project sub-activities across the Components. From the experience of the AE, the dissemination of lessons learnt through public consultation, contribution and engagement has been vital to any successful paradigm shift campaign and this also provides a direct interest to the general population, which assists with the public ease of implementation as the various knowledge products are shared. Through the various mediums, such as videos and documentary films, press releases of outputs of town hall meetings within communities, case studies, digital flyers, posters, 40 “water Wednesdays” (8 per year) educational and current news programme, 20 newsletters (4 per year) and over 5,000 combined posts on social media accounts, serve as the various platforms to engage and to promote media literacy within the general Populus.

With the Project considered holistically, the aims demonstrate, and carryout, the willingness of its management to promote public accountability through public monitoring, which therefore compliments the Project’s monitoring, reporting and evaluation arrangements. The AE also thanks the iTAP for the recognition of the measures that the Project seek to put in place in an effort to assist in the provision or capacity for transformational interventions to be developed to meet the paradigm shift in water security, as identified in (b) Contribution to the creation of an enabling environment. Moreover, as also identified in sub-criterion (c) Contribution to the regulatory framework and policies, there is an emphasis on the preservation of existing water resources, “new” water supply sources, both with a major focus to catalyse Barbados’ action on protection (implemented mechanisms) from water related hazards and enhanced resilient water supply and sanitation services. It is in this manner that the AE is thankful to the iTAP for the recognition of the vital importance of Component 4 to address the water governance and management approach to assist in the development of frameworks to promote new water initiatives and water infrastructure systems.

Taking into account the sub-criterion (d) Scalability and replicability, the AE recognizes that as a Caribbean SIDS, Barbados can share its Project innovation and development pillars that can be utilized in both the scaling-up and replication of this Project, both globally and regionally where similar water scarcity conditions exist, based on the negative impacts of climate change. Thus, the Project, promotes a national public RAFF to provide opportunities at the grassroots to SMSE to become engaged. It is critical that the implementation and importance of this Project be considered to be much more than a business-as-usual and thus with the various Project components for the various monitoring of potential resources, the Project design allows for the capturing of any additional resources, through resource recovery, to maximize on the renewable energy (chemical) that can be utilized. Once more, the AE is thankful to the iTAP for their recognition of how the proposed Project intends to catalyse its impact beyond a one-off project or programme investment.

Sustainable development potential

The AE thanks the iTAP for the overall rating of high for the Sustainable Development Potential of the proposed Project. The Project considered the results area for the enhancement of water conservation and water efficiency and water re-use – in alignment with the GCF investment criteria. As the iTAP articulated in the (a) Environmental co-benefits, the GHG emissions reduction, reduced groundwater pollution, reduced odours, reduced groundwater contamination and reduced discharge flow to the ocean (reduced nutrient loading in the nearshore environment) were all considered. The value-added environmental benefits and co-benefits could in the future also provide a preliminary pathway towards the overall number of sustainable water-food-energy security nexus solutions that can now be considered with the aforementioned-benefits. Moreover, with the (b) social co-benefit being linked to potentially have a positive impact to enhance the health standard of the population.

Following these co-benefits, it is therefore worthy to also comment on the (c) Economic co-benefits which were incorporated to provide opportunities through the increased availability of water for

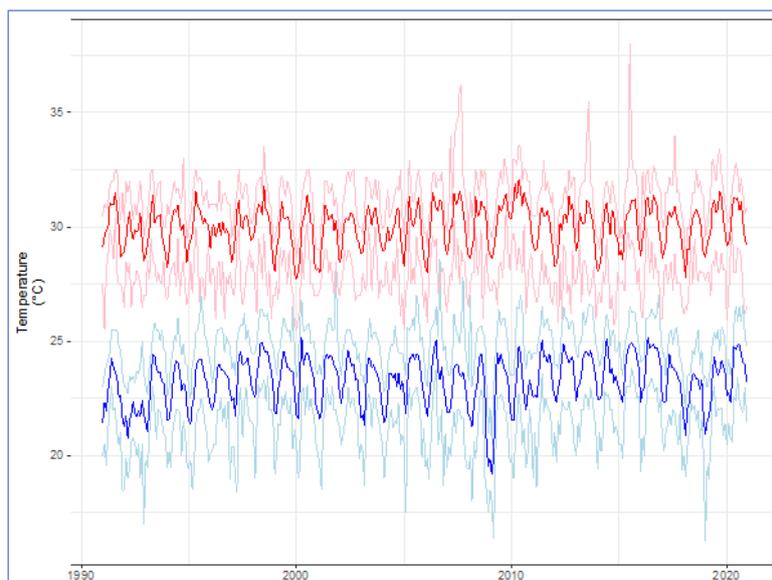
irrigation and of treated sludge for use, as soil amendment has the potential to increase agricultural productivity. The iTAP's assessment provided a clear indication of the importance and relevance of these interconnected activities of the Project and thus, their meaningful contribution and engagement are both critical and necessary in the adoption of wastewater management technologies and the use of reclaimed water and other by-products. Thus, aiming to generate green jobs and have positive impacts on the local economy.

The AE has always considered the (d) Gender-sensitive development impact to be very vital, especially with Projects that have a direct positive impact on the households, which in Barbados, are mainly managed by the Females, especially with the rearing of children. As such, there was a focused approach in the design to engage women's groups and other vulnerable groupings. In addition, through the engagement of these groups, it is also important that the Project considered the GCF's social and gender safeguards (as standards) to ensure the protection of women, children and the vulnerable in implementing gender-inclusive climate and disaster resilience capacity development initiatives. The AE thanks the iTAP for the comments on the innovativeness of incorporating these social and gender elements in the various aspects of the Project proposal that include Project specific activities such as the standard operating procedures (SOPs) and operational manual, legislative review, water and sanitation master plan and the engagement strategy for the private sector would promote women's empowerment, the expanded RAFF, public education, and awareness campaign, inter alia.

Needs of the recipient

The AE is thankful for high rating given to this investment criterion and the recognition that Barbados is a highly stressed country from a hydrological standpoint. Despite limited climate data availability, the AE was able to demonstrate that this is a climate driven funding proposal. Further, AE is grateful for acknowledgement given to how the project responds to needs related to economic and social development, financing, institutional capacity.

Paragraph 35 indicated that if the three temperature records that breach 35 Degrees Celsius in the summers between 2006-2020 are disregarded then there is no significant visual trend in maximum temperatures. This is not entirely accurate as pre-2005 temperature rarely surpassed 32.5 Degrees Celsius; however, post 2005 there are several times 32.5 Degrees Celsius was surpassed.



The AE knowledge that there is limited climate data for building the climate rationale, which is challenge faced by many Caribbean SIDs, not just Barbados; However, the AE welcome the GCF's board approval/endorsement at B.33 of "Steps to enhance the climate rationale of GCF-supported



activities [GCF/B.33/05]”, which is intended to strengthen the ability of AEs to clearly demonstrate the climate impact potential of proposals.

Country ownership

The AE thanks the iTAP for its review and comments on this criterion.

This project is country owned and led and is an integral part of the Government of Barbados Roofs to Reefs Programme (R2RP).

Stakeholder dialogue is corner stone of the development of the proposal and will continue to be for the rest of project cycle. In fact, stakeholders at the community level are critical for the realisation of the intended paradigm shift and hence the success of this project.

Efficiency and effectiveness

The AE thanks the iTAP for its review and comments on this criterion.

Nested in the US\$2 billion R2RP, this project is one aspect of a larger programme to transform wastewater into a resource. The US\$50 million for 3R-CReWS represents 20% of the already identified medium term investments in the wastewater sector of Barbados. This investment has the potential to impact 136,220 (66,748 males and 69,472 females) direct beneficiaries and 141,601 (69,384 males and 72,217 females) indirect beneficiaries and mitigation co-benefit of 40,875 tCO₂e avoided over 25 years.

The Government of Barbados must be applauded for being a shining example and playing her part to combat climate change for people, even when faced with COVID-19 recovery efforts and high public debt-to-GDP ratio that has increased consistently from 55 per cent in 2008 to 144 per cent by the end of 2020.

Overall remarks from the independent Technical Advisory Panel:

The AE thanks the iTAP of its endorsement and recommendations.

The recommendations presented are being taken on board and some will form part of the Standard Operating Procedures (SOP) for the upgrade Bridgetown Sewage Treatment Plant (BSTP). Further, the AE will develop an Operations Manual which, among others, shall include: (i) methods for characterizing the influent wastewater (both flow rates and concentrations of pollutants); (ii) definitions of the monitoring influent, effluent and operational conditions; (iii) methods to estimate the amount of emissions related to the proposed increase in wastewater treatment and how it will be conducted; and (iv) a framework and method to monitor emissions of GHG in the upgraded sewage treatment plant.

Further, efforts are on the way to assess the feasibility for implementing a waste to energy technologies (centralised and/or decentralised).

As note by the iTAP, this initiative has the potential to be replicated in other Caribbean countries. AE [CCCCC]as mandated by the Caribbean Community (CARICOM) heads of government intends to continue to coordinate the region’s response to climate change, which includes developing and implement transformative and impactful projects and programmes for addressing climate change.



Caribbean Community
Climate Change Centre

Gender Analysis & **Action Plan**



September 2022

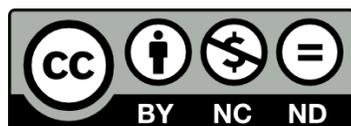
Copyright © 2022 by Caribbean Community Climate Change Centre
Published by Caribbean Community Climate Change Centre, Belmopan, Belize

Digital Edition (September 2022)
Printed Edition (September 2022)

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) and may be downloaded and shared as long as the Centre is credited. No use of this publication may be made for resale or for any other commercial purpose whatsoever. The Caribbean Community Climate Change Centre (CCCCC) would appreciate a copy of any publication that uses this report as a source. The views and interpretations in this document are those of the authors and do not necessarily reflect the views of the CCCCC, its Board of Executive Directors, or the governments they represent. Caribbean Community Climate Change Centre, Ring Road, P.O. Box 563, Belmopan, Belize

Visit our website at <http://www.caribbeanclimate.bz>

ISBN-13 978-976-8317-16-2 (paperback)
ISBN-13 978-976-8317-17-9 (pdf)



Document Revision History

Rev	Rev Description	Author	Reviewer	Approver	Rev Date
A	Issued as a Draft	Dr. Virginia Albert Poyotte	 Nick St-Georges	 Stuart Torr	Mar. 7, 2021
0	Issued as Final	 Dr. Virginia Albert Poyotte	Nick St-Georges	Stuart Torr	Sept. 20, 2021
1	Issued as a Revised Final	Dr. Virginia Albert Poyotte	Nick St-Georges	Stuart Torr	Oct. 18, 2021

This Document was further revised following its October 18th, 2021 Submission to the CCCCC in August 2022, by Elishah St. Luce. The August 2022 revision was done to reflect changes made to the Project Proposal following October 2021. This revision builds on existing body of work presented in October 2021 and where necessary, augmented information is presented following further research conducted for the purpose of this revision.

Rev No.	Rev Description	Author	Revision Date
2	Issued as Draft Final	Elishah St. Luce	Aug 19 th , 2022

Contents

ACRONYMS AND ABBREVIATIONS7

EXECUTIVE SUMMARY10

INTRODUCTION.....15

 2.1 Objectives and Associated Outcomes 15

 2.2 Project Background 16

 2.3 Methodology..... 18

GENDER ANALYSIS22

 2.4 Legislative, Regulatory and Institutional Frameworks..... 22

 2.4.1 International Framework.....22

 2.4.2 Regional Framework27

 2.4.3 National Framework29

 3.1 Contextual Analysis 38

 3.2 Stakeholder Mapping 51

 3.2.1 Internal Stakeholders.....51

 3.2.2 External Stakeholders52

 3.2.3 Stakeholder Feedback.....53

FINDINGS.....60

 4.1 Gender Context 60

 4.2 Gender Roles 62

 4.3 Resources..... 64

 4.4 Decision Making 66

 4.5 Beneficiaries 67

MAINSTREAMING GENDER INTO THE PROJECT CYCLE69

 5.1 Project Initiation Stage..... 69

 5.2 Implementation Stage 69

 5.3 Monitoring and Evaluation Stage 82

 5.4 Project Accountability Stage 82

 5.5 Project Closure Stage 82

 5.6 Project Organizational Structure 82

 5.7 Project Plans, Budgets, Reports 83

 5.8 Project Data Management 83

 5.9 Building Gender Sensitivity Capacity 84

CLOSURE.....85

REFERENCES.....86

Appendix 1 - Results of Stakeholder Surveys and Interviews88
Appendix 2 -Interview with Mrs. Shelley Parris, Senior Engineer, BWA (Feb 19, 2021)..90
Appendix 3 - 3R-CReWS Project Gender Risk Matrix91
Appendix 4 - Gender Action Plan93

ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
BCRWSP	Barbados Climate Resilience Wastewater Systems Project
BGIS	Barbados Government Information Service
BSTP	Bridgetown Sewage Treatment Plant
BWA	Barbados Water Authority
BPfA	Beijing Platform for Action
CARICOM	Caribbean Community
CARIWN	Caribbean Water Institute
CBD	Convention on Biological Diversity
CCCCC	Caribbean Community Climate Change Centre
CDB	Caribbean Development Bank
CEDAW	Convention on the elimination of all forms of Discrimination against Women
CERMES	Centre for Resource Management and Environment Studies
CGA	Country Gender Assessment
CRF	Caribbean Resilience Facility
CRWSP	Climate-Resilient Water Safety Planning
DPR	Direct Potable Reuse
DRM	Disaster Response Management
DRR	Disaster Risk Reduction
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	Environmental Impact Assessment
EPD	Environmental Protection Department
ESIA	Environmental and Social Impact Assessment
GAF	Gender Analysis Framework
GAP	Gender Action Plan

Acronym/Abbreviation	Definition
GCF	Green Climate Fund
GEF	Global Environmental Fund
GEF-CReW	Global Environment Facility Caribbean Regional Fund for Wastewater Management
GEI	Gender Equality Indicators
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Green House Gases
GOB	Government of Barbados
GWP	Global Water Partnership
GW21	Global Water 21
IDB	International Development Bank
IGDS	Institute of Gender Development Studies
ILO	International Labour Organization
IPR	Indirect Potable Reuse
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
LWPG	Lima Work Programme on Gender
LGBTQIA	Lesbian, Gay, Bisexual, Transgender, Queer and/or Questioning, Intersex, and Asexual and/or Ally
MCO	Multi-Country Office
MHH	Men Headed Households
MOU	Memorandum of Understanding
NGO	Non-Government Organizations
PSC	Project Steering Committee
SAMOA	SIDS Accelerated Modalities of Action
SDG	Sustainable Development Goal
SIA	Social Impact Assessment

SGBV	Sexual and Gender Based Violence
SIDS	Small Island Developing States
TOR	Terms of Reference
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-MCO	United Nations Managed Care Organization
UN-WMCO	United Nations Women Multiple Country Office
UN-SDG	United Nations Sustainable Development Goal
UWI	University of the West Indies
UWI-IGDS	University of the West Indies- Institute of Gender and Development Studies
WHH	Women Headed Household
UNEP	United Nations Environmental Programme
3R-CReWS	Reduce, Reuse and Recycle for Climate Resilience Wastewater Systems in Barbados

EXECUTIVE SUMMARY

The objectives of this report are to provide an assessment of the potential gender sensitivity issues associated with this Project and to provide the GOB with information that would influence the adoption of policies necessary to ensure men, women and LGBTQIA persons have equal opportunity to participate in the process of wastewater system development in Barbados. The issue of gender equality continues to be high on the development agenda in Barbados because gender indicators show that although more women attain higher levels of education there are still more women than men in the lower socio-economic bracket. Barbados has achieved significant human development gains, and while there have been advancements to achieve gender equality, there are still areas of pervasive inequality.

The introduction covers objectives and associated outcomes of the project and provides a background which examines the international, regional, national and wastewater sector frameworks.

Next the report clarifies issues of gender and gender analysis, by focusing on targeted areas of investigation with relevance for the conceptualized 3R-CReWs Project. In undertaking this analysis, components of the Gender Analysis Process Model were used to conduct the gender equality assessment of the project. The model comprises of four main parts, namely Gender Screening, Gender-Related Data Collection, Gender Impact Assessment and Mainstreaming Gender in the Project Cycle in conformity with the GCF standards.

Barbados has made recognizable Human Development gains and has made improvements in legislation that promote gender equality. However, societally, and institutionally, there remain recognized inequities. Linked to those, is the unequal power relationships that are often detrimental to the promotion and protection of women and girls.

Mapping of the internal stakeholders revealed that out of the ten-member BWA Board; seventy percent of directors are men and thirty percent are women. This indicates the Board decisions relating to project policy, oversight, and approval of project plans, budgets and reports are influenced more by men. At the BWA, more men are employed in technical and engineering fields. Conversely more women are employed in clerical professions. This is reflective of wider underrepresentation of women in Science, Technology, Engineering and Mathematics (STEM) fields across Barbados. Given the technical nature of the wastewater project, it is likely to attract more men than women. There is however, a need to address the gender gap that exist within the BWA, at the level of the Board of Directors, and the professional and technical support staff of the Authority: There is also a need to address the gender gap that exist with aspects related to more men than women are involved in the technical work of the Wastewater Sector Infrastructure and Services while more women serve in administrative capacities. Of note is that KII at the BWA revealed that there are no discriminatory policies in terms of recruitment and pay. A Labour union equally represents the needs of male and female employees. The

BWA's gender sensitivity training for its employees in collaboration with the UWI-IDGS is ongoing and is seen as a way to reduce the existing high percentage gender imbalance among employees. Training however, should be made mandatory for certain categories of staff, including Project staff. The project also, therefore proposes as a low hanging fruit, a STEM Internship programme over its five years of implementation at the BWA. The Project also proposes a gender balanced Project Steering Committee, PSC, to the extent possible, and the representation of the Bureau of Gender Affairs on the PSC.

Mapping of the external stakeholders also revealed that there is also a 60 % gender gap among the 30 parliamentarians, a 14% gender gap among the 21 senators, and a 60 % gender gap among the 30 Cabinet Ministers. Consequently, decisions taken at levels of the political directorate, the Cabinet of Ministers, and the BWA Board are influenced by more men.

This report includes primary data collected from sources such as a stakeholder survey and two key informant interviews as well as secondary data collection. Brief abbreviated details of the findings follow. Stakeholder responses to a survey on climate change and wastewater collection and treatment indicated that generally, there are many issues where both men and women share similar views on wastewater collection and treatment among the stakeholders in Barbados. There are, however, instances where the views of men and women differ especially when it comes to discharging untreated wastewater to the ground. Men appear to differ from women on willingness to pay for wastewater improvement, in the sense that men are seemingly more concerned with paying for wastewater improvement. Women typically need more water during their daily activities and might be willing to pay more to satisfy their needs. Note, a limited "Willingness to Pay" survey was conducted but the survey was cancelled early, due to unfavourable conditions in the country. Limited trends were examined from this data and analysed in this report. Importantly is that Barbados experiences a feminization of poverty where more female headed households are represented in poverty brackets than male headed households. Therefore, despite the results from limited stakeholder survey which are not statistically significant, the ability of women to pay for services given socio-economic challenges needs to be actively considered in project incentivisation activities as well as in rearticulating the RAFF.

As indicated in a case study on Understanding Unequal Relations of Gender in the Caribbean (Bobb, 2019), on average men spend longer hours a week doing paid work away from the home while women spend longer hours doing unpaid domestic work including cooking, gardening, collecting, and storing water for domestic use, caring for children and the elderly and the animals. Even when women spend the same number of hours a week doing paid work away from the home, they still are expected to do most of the unpaid domestic work. Stakeholder consultative processes must reflect the challenges on time availability of women to respond to surveys and to participate in community level meetings. Therefore, unique approaches including door to door consultations or carefully

selected time periods for stakeholder consultations need to be reflective of the realities of women in Project communities.

Women in the Eastern Caribbean region experience various gaps in access to health, social protection, vocational and technical education, productive resources, economic opportunities, as well as voice and agency. All of these are associated with their increased vulnerability to disasters and climate change hazards. The Analysis found that climate change impacts on the wastewater sector is a serious challenge to the national development in Barbados, including wastewater management. Drought conditions resulting from climate change are likely to cause serious water shortages in Barbados which can pose great challenges for women who are primarily care givers for children and the elderly. Women are very vulnerable in the time of disaster. However, any effort to reduce exposure to climate risk to allow speedy recovery by victims.

The review of non-potable water re-use found that while reclaimed water is not safe for drinking it can be recycled for specific non-potable purposes such as irrigation and aquifer recharge. The review also found that as the 15th most water-stressed country in the world per-capita, Barbados should consider the reuse of treated stormwater, greywater, and blackwater to tackle the issue of water scarcity. The review of Wastewater and its Relevance to Sanitation and the Environment (Witmer, 2017), found that women are more likely to be affected by lack of wastewater treatment, reuse, and poor management than men because they are more in direct contact with food, faeces, childcare, and healthcare. They are also more likely to suffer from the amount of pesticide, hormones, medication, chemicals in wastewater. This is compounded by the fact that there is a low percentage of Barbadians currently able to access the BWA wastewater collection and treatment facilities. The Legislative and Policy environment is also absent to ensure smooth implementation of the wastewater priorities. Some of the legal instruments governing the wastewater sector are outdated because they have been in force for over forty years and as such, they are likely to limit the ability of the BWA to upgrade its systems and operations and do not necessarily reflect the needs of the wastewater sector and the Project at this time. The project will provide the avenue to update the legislation, including gender responsive considerations.

The GOB has the option of offering subsidies to deprived and vulnerable groups of the society, or promoting collaboration between public and private sectors to develop innovative models for the generation of water. Vulnerable groups, which comprise of a larger percentage of women and girls, stand to benefit from opportunities that facilitate stronger and less biased decision-making.

This Gender Analysis highlights an absence of mechanisms to foster greater stakeholder participation in the design, implementation, monitoring and evaluation of project activities. Additionally, the BWA appears to lack the human resource, institutional and information capacity to identify the causes of vulnerability among women and other vulnerable groups. The project presents an opportunity to strengthen legislative framework

by also including gender equality considerations. The Project through the support of a Social and Gender Specialist will improve stakeholder engagement and provide a resource to ensure that the Project actively responds to the needs of vulnerable populations, including female headed households that are in poverty. Given the importance of water for human survival, the BWA should make every effort to secure adequate financial and human resources to provide high quality service in the water and wastewater sector.

The prevalence of SGBV, though higher in intimate partner relationships is still present outside of the private sphere in Barbados. Therefore, projects such as these need to promote a preventative approach to SGBV. This includes zero tolerance policy to SGBV and code of conduct for project staff and all personnel interacting with communities. In addition, there has to be gender responsive complaint mechanisms that prove useful for victims of SGBV, if prevention is not achieved. Gender sensitivity training is useful as well in addressing SGBV risks, however these are to be made mandatory to staff based on roles and functions.

A review of this project's Stakeholder Engagement Report found that it is necessary to educate the public on the positive social impacts of the project. The project's public education campaign, like the stakeholder engagement efforts needs to be carefully crafted to effectively target diverse groups on their relevant needs, reservations and expectations. Project personnel should equally ensure gender issues are mainstreamed in the implementation process. Therefore, Stakeholder Engagement processes carried out by the BWA needs to be gender responsive to adequately respond to the needs of male and female headed households.

Successful implementation of this project will be beneficial to several stakeholders, if not the entire country, including the marine environment. The Project across all its components directly targets 136,220 people in Barbados. 66,748 (49%) men and 69,472 (51%) women are likely to be direct beneficiaries from the implementation. There is a similar distribution of indirect beneficiaries Important to note is that this is reflective of the overall population of Barbados. A more detailed look at the beneficiaries of the Project by component suggest that the project is taking an approach of leave no one behind. More specifically, the Project positions that 100% of female headed households and 100% of male headed householder respectively will benefit from the installation of decentralized wastewater management systems in zone A. It is however important to identify the recurrent costs that are associated with the connection to improved wastewater services. Given that women do most of the domestic and care work, they are greater users of water and wastewater services and will benefit more than men from the implementation of the project at the Domestic Level. On the other hand, a key beneficiary group identified by the Project are farmers, in this regard, there will be higher numbers of male beneficiaries than male beneficiaries given the share participation of male to female in Agriculture. The Tariff structure for water used for irrigation should be mindful of the often-small scale agricultural activities performed by women vis-a vis larger commercialised agriculture often headed by men. Important is that the project works along with the Association of Women in Agriculture to ensure that women farmers (including for subsistence) receive information on the benefits of using reclaimed water and are also

supported with access to reclaimed water services and other by-products of treated waste water.

This report summarises the gender issues and draws specific conclusions pertaining to key areas of the project activities that require attention. It also recommends actions required to align with Project goals and stakeholder gendered needs of the project. Finally, the actions recommend to mainstream gender within all stages of the project cycle have been used to compile a Gender Action Plan. A copy of the GAP is listed as Appendix 3 to this report.

INTRODUCTION

The purpose of this report is to present a Gender Analysis and Gender Action Plan related to this “Consultancy to Produce Requisite Design, Studies and Plans for the Green Climate Fund Proposal” that examines “The 3R’s (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados” (the “Project”). This introduction commences with a brief background and justification to the gender analysis and action plan.

Conceptually, gender refers to the economic, social, political, and cultural attributes and opportunities associated with not only the female and male gender but also LGBTQIA persons. The social definitions of what it means to be a woman, or a man vary among cultures and has changed over time. Gender is a socio-cultural expression of characteristics and roles that are associated with certain groups of people with reference to their sex and sexuality.

“Gender analysis/assessment refers to methods used to understand relationships between men and women, their access to resources, their activities, and the constraints they face relative to each other. A comprehensive gender analysis/assessment entails the examination of the different roles, rights, needs, and opportunities of women and men, boys, and girls in a given project/program context. It is a tool that helps to promote gender – relevant entry points, policies and identify opportunities for enhancing gender equality in a particular project/program. In the case of climate change projects/programs, a well-done gender analysis/assessment helps to identify multiple causes of vulnerability, including gender inequality. It also helps to identify and build on the diverse knowledge and capacities within communities/households that can be used to make them more resilient to climate related shocks and risks.”¹¹

A gender analysis is a useful tool to identify points of intervention in a project cycle at which existing or potential disparities in gender impacts can be compensated for or eliminated. Gender analysis is a methodology that describes the existing gender relations in a particular environment, ranging from within households, or firms, to a larger scale of community, ethnic group, or nation. It involves collecting and analysing sex-disaggregated data and other qualitative and quantitative information. The analysis involves the process of organizing and interpreting, in a systematic way, information about gender relations to make clear the importance of gender differences for achieving development objectives.

2.1 Objectives and Associated Outcomes

The main objectives of this report are to provide an assessment of the gender sensitivity issues associated with this Project. Another objective is to provide the GOB with information that would influence the adoption of policies necessary to ensure men, women and vulnerable groups (including the poor, elderly, people with disabilities, LGBTQIA people etc) have equal opportunity to participate in the process of wastewater development in Barbados.

2.2 Project Background

The goal of 3R-CReWS project is to facilitate the enhancement of the health, wellbeing, and productivity of Barbadians through the use of carbon neutral and climate resilient water and energy management technologies and strategies that ensures water is protected, managed, recycled, reused, and conserved.

The goal of 3R-CReWS is to facilitate the enhancement of the health, wellbeing, and productivity of Barbadians through the use of carbon neutral and climate resilient water and energy management technologies and strategies that ensures water is protected, managed, recycled, reused, and conserved.

Wastewater management strategies using reclaimed water will be a critical component to help mitigate impacts on groundwater levels, tightly linked to overall island water resources. Tertiary treatment of wastewater will allow for the reuse of water for non-potable sources, such as agriculture, landscaping, turf maintenance, and recharging the aquifer. The Project proposes that secondary treated sludge can be used as fertilizer for the agricultural community and activated sludge can be used in landscaping, turf maintenance of lawns, reclamation, soil erosion, and dump covering.

To this end, the main objectives of the 3R-CReWS project are to:

1. increase knowledge of wastewater generation including sources of wastewater and the quantity and quality impacts, as well as optimize treatment and minimize energy consumption and associated GHG emissions;
2. build resilience into Barbados' wastewater management systems, which results in increased water availability, production, distribution, and access thereby improving the community's resilience, health and wellbeing, and water and food security;
3. produce a treated wastewater effluent quality so that it can be reused for agricultural purposes, reducing stress on diminishing groundwater resources and potable water supplies as a result of climate change;
4. enable the use of reclaimed water for aquifer recharge thereby reducing saline intrusion and contamination of ground water resources while enhancing water security, particularly during period of droughts for Barbados;
5. reduce GHG emissions, increase self-sufficiency, contribute to the electricity grid

and to contribute to the frequency stabilisation of the electricity grid and act as a power shortfall filler;

6. Increase supply of locally sourced renewable energy that allows for a long-term source of revenue through a feed-in tariffs program;
7. provide a standard and formal guidance to regulate and promote the use of reclaimed water and obtain greater buy-in from stakeholders;
8. build capacity and re-train BWA staff, including the private sector, to conduct preventive maintenance and adopt climate-risk related adaptation strategies to increase the wastewater collection and treatment systems resiliency; and
9. promote and demonstrate actions that encourage all water users in Barbados, including tourists, to conserve and efficiently use water resources.

For achieving the goal and specific objectives, the 3R-CReWS is organised into four (4) key components. These 4 components are synonymous with the following 4 outcomes of the project:

1. Enhanced availability, management and use of tertiary level reclaimed water to improve the water sector's resilience to climate change
2. Climate resilient low carbon operations achieved at BSTP
3. Enhanced capacity and capability to support a preventative maintenance (PM) and climate resiliency programme
4. An enabling environment is created for wastewater technologies and use of reclaimed water

Collectively, these four outcomes/components are designed in consideration of the barriers that exist in achieving a paradigm shift in the adoption of wastewater treatment technologies and reuse options in Barbados. These barriers include the limited fiscal space that exist in a highly indebted country, limited technical capacities in the public and private sectors to fully maintain and advance the adoption of wastewater technologies, limited knowledge and awareness about the usefulness of reclaimed water as a resource, and the absence of comprehensively developed and mainstreamed policy and regulatory frameworks that promote the adoption of wastewater treatment technologies and reuse options, particularly at the household level.

This report assesses the gender equality challenges facing the GOB, that includes the BWA, as it pursues the development and implementation of this Project. It also examines gender sensitivity issues of a social, economic, political, and cultural nature that policy analysts and policy makers should take into consideration when planning, preparing the

following phases of this Project, including the Detailed Design and implementing the Construction of this Project. The report also describes the application of a gender responsive approach, adopted by the GCF, to assess the processes and operations of the Project. The GCF has a clear mandate to enhance a gender responsive approach in its process and operations as it seeks to maximize the impact of its funding for adaptation and mitigation in promoting environmental, social, economic development co-benefits globally. The GCF also seeks to engage with in-country driven projects that promote involvement of relevant stakeholders including vulnerable groups and addressing gender aspects.

Climate change is posing challenges to the national development of Barbados, and therefore should be considered in all aspects of development, especially in water and wastewater management. However, when considering climate change initiatives, it is imperative that we focus on issues that will result in projects being more sustainable and equitable. Gender equality plays a role in resolving problems associated with climate change in our societies. Governments and agencies should ensure that they effectively engage the broader society, including all genders, in discussions and decisions that affect them and ensure that their policies are aligned to the UN SDGs, especially SDG-5 that relates to gender equality that cuts across all the other SDGs. An objective of a government plan should be to enhance gender equality in its governing structures and operations and to foster greater stakeholder involvement in the design, implementation, and evaluation of their projects. The GOB also seeks to provide a working environment that facilitates balance and offers a safe working environment for all.

2.3 Methodology

The Gender Analysis and Gender Action Plan related to this “Consultancy to Produce Requisite Design, Studies and Plans for the Green Climate Fund Proposal” that examines “The 3R’s (Reduce, Reuse and Recycle) for Climate Resilience Wastewater Systems in Barbados” (the “Project”) seeks to provide a baseline for gender responsive action and inclusion within the Water Sector of Barbados. The Assessment and analysis will be used to inform the scale up and/or enhancement of gender-responsive interventions that seeks to address the identified gaps for achieving gender equality both from the perspective of the service provider and consumers.

The assessment included a desk review of available secondary data from Barbados and the wider Caribbean; assess the gender perceptions of wastewater stakeholders through stakeholder consultations, questionnaires and key informant interviews; and the analysis of data to determine gendered indicators baseline.

i. Desk Review

- Literature Review: This stage included literature review including existing

international, regional and national frameworks for gender equality and the extent to which national water management legislation, policies and procedures included these agreed international and regional gender equality considerations and commitments. During this stage, the review sought to identify relatable regional and international gender indicators that the project can contribute to, including the indicators aligned with SDGs 5 and 6.

- Secondary data review: Data collected from secondary sources include several reports, on the findings of case studies related to gender and research papers on various aspects of gender relations, wastewater management and climate change. These include but are not limited to:
 - GOB Records on Social, Political and Economic and Climate Change Issues
 - Understanding Unequal Relations of Gender in the Caribbean
 - Barbados Agriculture Sector on Gender, Climate Change and Water
 - Barbados Fisheries Sector on Gender, Climate Change and Water
 - Country Gender Assessment, Barbados (2017)

Additionally, the secondary data review analysed data as it relates to regional and national response to climate change, including:

- Gender Responsive Disaster Preparedness and Recovery in the Caribbean
- Non-Potable Water Generation, Distribution and Re-use
- WSRN Gender Assessment- water use and women
- Impacts of Climate Change on Women and Men in the Caribbean
- UN SDG's Related to Human Rights of Gender, Water and Sanitation

The review of secondary data provided an opportunity for a deeper situational analysis of how gender is reflected in the water sector as a comparison of the Country Gender Assessment, which has articulated some barriers and gaps to the participation of women in technical employment as well as issues of access to essential services, including water for the most vulnerable groups which includes women, children, LGBTQIA and persons with disabilities.

ii. Exploring Perceptions

The collection of qualitative data was done through stakeholder consultations, questionnaires and key informant interviews to help the consultant to understand the extent of awareness and impact of gender inequalities on the water sector, including the extent of inclusivity within the BWA and the responsiveness of the delivery of water services for men and women. It is important to note that data collection for this Gender Study was done in tandem with the Stakeholder Engagement Report.

iii. Stakeholder Consultations:

Two (2) stakeholder workshops were held to disseminate information on baseline information identified and conceptual design of project. Stakeholders include key water and climate change agencies, private sector actors, community leaders, and representatives from CCCCC.

iv. Stakeholder Surveys:

Following a stakeholder mapping a questionnaire was designed and administered to 49 key stakeholders in Government Ministries, the private sector, community associations, the University of the West Indies Gender Studies Department and NGOs. It resulted in 24 respondents completing the questionnaire (either partially or fully).

To further substantiate the gendered perceptions as it relates to wastewater collection and management, the consultant reviewed and included data from the Willingness to Pay Survey (administered in 2020). The survey was administered to 75 respondents (19 females, 56 males) across the country representing heads of household. While all 75 respondents did not answer each question, the analysis utilized a ratio of 8:4.75 male/female to assess each question. These responses, presented a rich primary source of perceptions of males and females on key wastewater issues in Barbados.

Key Informant Interviews (KII): Interviews were conducted with representative from University of the West Indies Institute for Gender and Development Studies (UWI IGDS) to evaluate the gender perception of BWA staff. Another KII was a Senior Engineer from the BWA to capture views on progress and barriers for women within the wastewater sector.

v. Analysis

This stage of the assessment process took into consideration both primary and secondary quantitative and qualitative data to determine perceptions, trends and attitudes of the sector towards gender equality. It included a review of statistical data from the Barbados Country Gender Assessment 2016. To carry out this gender analysis, and in keeping with the GCF template, the assessment used components of the Gender Analysis Process Model which is comprised of four main elements namely: Screening, Data Collection, Gender Impact Assessment and Gender Mainstreaming of the Project cycle. Each element involves carrying out several gender-related activities in a one-step or two-step exercise. The model helped to examine the different roles, rights, needs and opportunities of women, men, and LBGTQIA persons who are key stakeholders of the project. Table A provides a description of each component of the Gender Analysis Process Model and by activities to be carried out under each step.

Table A. Description of the Gender Analysis Process Model

No	Component	Step 1	Step 2
----	-----------	--------	--------

1	Screening	Categorization of gender dimensions of the Project goals to identify areas for in-depth analysis.	Mapping the key internal and/or institutional and external Project stakeholders.
2	Data Collection	Collection of evidence of gender differences in stakeholder interaction with existing and planned water and wastewater sector infrastructure and services.	Review of existing national and water and wastewater sector policies, strategies, and action plans for integration of gender considerations.
3	Gender Impact Assessment	Analysis of data to determine gendered needs of the wastewater sector infrastructure and services.	Assess impacts (main/ ancillary), risk perception, and equality of distribution of Project benefits.
4	Mainstreaming Gender in the Project Cycle	Recommend actions align with Project goals and stakeholder gendered needs.	

vi. Limitations

The gender analysis process had several constraints that limited the extent of the data collection and analysis processes.

- The review of secondary data was constrained from deeper gendered analysis as most data on usage collected was not disaggregated. Additionally, it was not possible to identify vulnerable groups including, LGBTQIA people and persons with disabilities from the data.
- The assessment was carried out during the peak of the COVID-19 pandemic, as a result most consultations were conducted in the virtual space, including questionnaires which limited the opportunity to assess and adjust questions and contents for clarity, especially with community representatives. It also affected the ability to adjust for greater inclusivity of vulnerable groups.
- The Willingness to Pay survey as a key data source to inform the analysis was cut short due to high level political decision making. The information gathered is analysed in this report, however there cannot be statistical significance in the analysis of data collected.

GENDER ANALYSIS

2.4 Legislative, Regulatory and Institutional Frameworks

2.4.1 International Framework

This Gender analysis looks at the international frameworks and institutions in place the administration of conventions, protocols and agreements related to gender equality and wastewater which will have bearing on the implementation with this project. A number of relevant gender equality conventions and Protocols as highlighted in Table B, have been ratified by the GOB and applied by the BWA Wastewater Division.

Table B GOB Ratified International Conventions and Protocols on Gender Equality and Wastewater

No	Convention	Purpose	Operating Practices
1	Convention on the Elimination of All Forms of Discrimination against Women 1979 ¹	Require signatory governments to take action to promote and protect the rights of women by including the principle of equality in legislation and operationalizing it in their country. Article 14, pays special attention to discrimination against rural women, and to ensure their access to rural benefits.	BWA currently promotes equity as it seeks to achieve gender sensitivity and balance between male and female staff.

2	Beijing Platform for Action 1995 ²	The platform encourages governments to collect data on the impact of environmental degradation on women, as well as develop gender-sensitive databases. The Declaration calls for ensuring that ‘women's priorities are included in public investment programmes for economic infrastructure, such as water and sanitation.	BWA will collect use dis- aggregated to cater for gender difference in the wastewater sector. The project will undertake gender sensitive consultations to ensure that women and men’s needs are reflected in infrastructural development. Similarly, the adjustments to RAFF should ensure that women’s needs and those of the vulnerable to inform rearticulation of the RAFF.
3	Agenda 21, UN-SDG-5 2015 ³	Calls for sex-disaggregated data, and gender-sensitive databases and promotes the empowerment of women and gender equality regarding land ownership, resource stewardship, education, and employment issues.	BWA in collaboration with the UWI-IGS is currently training staff on gender sensitivity issues to create greater awareness among employees in the work environment.
4	The CBD 1993 ⁴	CBD has adopted a Gender Plan of Action and update it for the period 2015-2020. It requires countries to implement integrated actions to enhance the monitoring framework and indicator system for gender mainstreaming at national level.	A GAP (see Appendix 5) in the Project is indicative of commitment to the convention.

5	The UN Convention to Combat Desertification 1996 ⁵	Recognizes the important role and participation of women in combatting desertification and mitigating the effects of drought. Monitors whether parties have integrated gender into the implementation of the	This Project is designed to respond to conventions with Gender Analysis and a GAP.
---	---	--	--

There are also several international institutions involved in the design and implementation of wastewater projects in the Caribbean that require gender equality issues be taken into consideration. Among them include:

1. The UN which has a mandate to implement the SDG-5 agenda which focuses on “Empowering Women and Promoting Gender Equality;”
2. IFI’s, such as the World Bank have a mandate to assist with the protection of the global environment to promote environmentally sound and sustainable economic development in member countries. The CDB has a mandate to promote economic growth and systematic reduction of poverty through social and economic development;
3. The GCF and GEF which have a mandate to support on international projects, provide new and additional grant and concessional funding for approved projects, assist developing countries by investing in projects to implement climate change adaptation and mitigation measures to strengthen national capacity to cope with the damaging effects of climate change while they overcome the fiscal constraints of COVID-19. It should also be noted that the CCCC, supporting the GCF by providing project management services to this (and other) Project, has a mandate to implement climate change projects requiring gender-related analysis in the Caribbean; and
4. The UNEP which has a mandate to coordinate responses to environmental issues within the UN system by implementing programmes on sustainable development, climate change, disasters and conflict, ecosystem management and environmental governance.

The Sustainable Development Goals

SDG 6 Water and Sanitation

SDG 6 speaks to achieving (by 2030) access to adequate and equitable sanitation and hygiene for all, paying special attention to the needs of women and those in vulnerable situations, including LGBTQIA persons.

A safely managed central wastewater treatment facility is one where excreta is safely treated and disposed or treated on-site using soak away fields. Globally more than 80% of

wastewater, resulting from human activities, is discharged into rivers or the sea without any form of treatment, and therefore a target for this Project should be to improve the amount of wastewater that is treated and reused as reclaimed water.

The issue of water availability for hygiene proved critical during the COVID-19 pandemic. The Barbados Today Newspaper published that some residents at Boscobelle, in St. Peters, experienced conditions that had them wondering how they are to effectively sanitize with poor water service, where days go by without water coming from their taps. This further emphasizes the importance the residence attached to water in combating the spread of this pandemic. There is now a greater opportunity for Barbados to promote and implement SDG-6 on water and sanitation and all the other SDGs by 2030.

SDG-5 Achieve gender equality and empower all women and girls

Gender equality promotes basic human rights and is therefore foundational for achieving the other SDGs¹. The principle of leaving no one behind requires gender-transformative water and sanitation programmes. The 3R-CReWs project will benefit from mainstreaming SDG Targets into project activities. More particularly:

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision making in political, economic and public life;

5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women and;

5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.

Water and sanitation, like gender equality, are human right issues that the GOB has a responsibility to enforce for the advancement of the society. By enforcing these rights, communities, and vulnerable groups, which comprise a larger percentage of women and girls, will benefit from opportunities that facilitate stronger and less biased decision-making.

The UN standards, on access to clean water, indicated that lack of access to clean water, (at least 5 litres a day) represents one tenth of the daily average amount used by developed countries to flush toilets. Also, lactating mothers who engage in moderate physical activity use up to 7.5 litres of water per day. Ensuring safe sanitation also requires substantial hygiene education and promotion².

³ Oxfam, 2020 Achieving Sustainable Development Goals 5 and 6

⁴ www.jamaicaobserver.com/latestnews/CARICOM_developing_regional_gender_equality_strategy

² ibid

“SDG 5 speaks to gender equality and empowerment of women being a fundamental human right and calls for legislation to promote gender equality and empowerment of all women and girls.”

Therefore, the importance of water for human survival should drive the BWA to make every effort to secure adequate financial and human resources to provide high quality, gender responsive and socially inclusive service in the water and wastewater sector.

2.4.2 Regional Framework

At the regional level there are several institutions with policy and legal mandates to address gender equality issues relating to wastewater projects being implemented on behalf of Caribbean member states. Brief details of the current work of regional institutions that is relevant to this Project follow.

The mandate of the CARICOM Regional Secretariat is to implement regional plans, programs, and projects beneficial to member states. In March 2019, the Secretariat in collaboration with the UN- MCO, developed a Regional Gender Equality Strategy to accelerate the effective implementation of key priority actions that member countries have signed on to, following the BPfA conference. The strategy is designed to assist those countries which are yet to fully implement the Beijing declaration that includes women's economic empowerment and freedom from violence.³ In 2015, the CARICOM Secretariat, also developed and supported the adoption by member states of a Gender Equality Indicators model, to measure the advancement of gender equality, including the status of women, men and LGBTQIA persons, as well as a strategy for measuring these indicators at the regional and national level. Some of these relevant indicators were used to address gender equality issues related to this Project.

As part of its mandate, the UN ECLAC has developed a model Gender Equality Plan for use by member countries in Latin America and the Caribbean. According to ECLAC, the plan has been customized and adopted by most countries in the region, but Barbados is not listed as one of the countries with such a plan or policy.⁴

GWP-Caribbean also has a mandate to implement gender-related projects in the Caribbean. The institution undertakes regional case studies and maintains project databases which member states are given full access to. Barbados is a member of the GWP-Caribbean, and as such has access to databases and case studies of GWP projects in the water and wastewater sector. This partnership represents another opportunity for the BWA to access specific information that includes gender mainstreaming recommendations related to the wastewater sector.

The CCCCC has a mandate to implement climate change projects requiring gender-related analysis in the Caribbean. In keeping with its mandate, the CCCCC has adopted a Climate Change Framework, that includes a Gender Policy for the coordination of the Caribbean's response to climate change, which involves working on effective solutions and projects to combat environmental impacts and global warming.

The CDB has a mandate to promote economic growth and systematic reduction of poverty through social and economic development. The GCF has accredited the bank to provide financing for regional projects in various sectors on its behalf and in this capacity, the CDB has funded several BWA infrastructure projects which requires that the

Authority complies with provisions of the bank's gender policy to ensure consideration of projects submitted for financing (Isaacs, 2017). In 2008, the bank adopted a Gender Equality Policy and Operational and Project Strategy to support its project financing strategy. In January 2016, the CDB commissioned a CGA, for Barbados to inform the implementation of gender equality strategies of the bank and its partners in the country.⁵ According to the CGA report, several persons interviewed stated that "law and policy in Barbados facilitates equal opportunities and those institutions are gender neutral in their treatment of women and men," (Allen and Maughan, 2016).

The CGA proposed certain strategies that are relevant to this Project, such as it requires Barbados to engage in research that would generate disaggregated data to implement programmes to enable men, women and LGBTQIA persons to overcome many social issues such as poverty alleviation, gender stereotypes and on vulnerability to and impact of environmental disasters. Barbados is also expected to engage in training stakeholders through workshops to increase the capacity of women in the leadership of government department and the wastewater sector.

Finally, UWI has a mandate to spearhead the training and research efforts in the Caribbean region. To fulfil its mandate, UWI established CERMES based at UWI Cave Hill, Campus in Barbados with the capacity to undertake studies focusing on areas such as gender and climate change, and on disaster risk management in the Caribbean. CERMES can also undertake studies aimed at integrating gender concerns in water and wastewater infrastructure projects in Barbados. Additionally, UWI has also established the IGDS which conducts regular programs on gender, climate change and disaster risk reduction. The UWI IGDS recruit students to pursue post-graduate research in the fields of water and wastewater (Isaacs, 2017), and has been collaborating with the BWA, to implement gender sensitivity a training for BWA employees.

Given that Barbados is a member of all six regional institutions, the BWA can have access to the CARICOM list of GEIs and the Gender Equality strategy as well as the UN ECLAC Model Gender Equality Plan. BWA should also be able to access case study reports and project data from the GWP-Caribbean and take advantage of support provided by CCCCC on climate change adaptation and mitigation. It is also noted that BWA is already collaborating with UWI- IGDS on training and research relating to the wastewater project and is seeking financing from GCF through the CDB for the implementation of this project.

2.4.3 National Framework

At the national level, there are institutions with policy and legal mandates to address gender equality. The GOB has taken several steps to improve the framework for wastewater policy, legislative instruments, and institutional arrangements. A description of the national initiatives relevant to this Project follows, but further discussion on proposed policy reform related to this project is also included in the Conceptual Design report.

1. National Sustainable Development Policy

In 2004, the GOB adopted a National Sustainable Development Policy to guide decisions and actions at all levels in the country.

2. Draft National Gender Equality Policy

Although the GOB has a revised Draft National Gender Equality Policy, it is yet to be approved by the Cabinet of Ministers and tabled in parliament for discussion and endorsement (Isaac, 2017). While this Policy is not endorsed, Barbados has been recognized as making steps to improve legislation that fosters increased equality.

3. National Climate Change Policy

The Government of Barbados approved a National Climate Change Policy in 2012. The country's Intended Nationally Determined Contribution (now known as NDC) as communicated to the United Nations Framework Convention on Climate Change in 2015, lists 6 national plans and strategies for which climate change adaptation would be incorporated³. These include:

- Medium Term Growth and Development Strategy 2013 – 2020;
- Physical Development Plan;
- White Paper on the Development of Tourism in Barbados and National Adaptation Strategy to Address Climate Change in the Tourism Sector in Barbados;
- Coastal Zone Management Plan;
- Storm Water Management Plan;
- Other sectoral plans including for agriculture, fisheries, water and health.

While the Climate Change Policy makes mention of gender issues, there was limited presentation of strategies for mainstreaming gender in relevant sectoral climate change interventions. The Policy however states that that vulnerable groups, including women and young men, should be targeted and participate in action to address environmental threats

³ <https://www.greenclimate.fund/document/gender-assessment-fp060-water-sector-resilience-nexus-sustainability-barbados-wsrn-s>

and damage⁴.

4. Wastewater Tariff Policy

In July 2009, BGIS reported that the GOB had approved a new tariff policy and structure for the BWA in which the minimum charge moving from \$20.00BBD (US\$10) to \$32.00BBD (US\$16) for both domestic and commercial metered customers. However, it is noted that there was no change in the rate for the sewage tariffs which remained at 1/3 of the water bill for domestic customers and 2/3 of the water bill for commercial customers.⁵ Given that the tariff policy and structure has been in place for twelve years, it is recommended that the GOB consider engaging key stakeholders with a view to examine cost recovery challenges and measures needed to update this policy. The GOB should update the tariff policy to support a BWA cost recovery for its wastewater services taking into consideration gender equality issues affecting the poor and vulnerable. Such a consideration may include reduced rates for identified vulnerable persons.

5. National Legal Instruments

In October 1980, the GOB enacted the **Barbados Water Authority Act** as the primary legal instrument to govern the operations of water and wastewater services in Barbados. The Act is accompanied by the BWA (Sewerage Regulations), 1980, (S.I. No. 151 of 1980), to regulate sewage, effluent wastewater, discharge, water charges, authorization, permit, equipment, and inspection; including the sewerage treatment plants, packaged plants of hotels and businesses, or household's septic tanks and suck-wells (Isaac, p-100). In 1985, the GOB enacted the Barbados Authority Act, 274a, L.R.O., with Part IV of the Act making provision for the establishment of a Water and Sewerage Division to be responsible for wastewater management. In 2009, the GOB also enacted the BWA Act (Validation of Water and Sewerage Rates), to validate the increase in water and sewerage rates levied and collected by the BWA from 1st January 2005 to the date of the BWA (Water and Sewerage Rates) Regulations, 2009, (S.I. No. 69 of 2009).

The BWA Act of October 1980, is the primary legislation governing the provision of water and wastewater services in Barbados. The Act is supported by the BWA (Sewerage Regulations), (S.I. No. 151 of 1980), introduced to regulate sewage, effluent wastewater, discharge, water charges, authorization, permit, equipment, and inspection including the sewage treatment plants, packaged plants of hotels and businesses, and household septic systems and suck-wells (Isaacs, 2017).⁶ This legal instrument should be placed high on the BWA agenda for revision since it has been implemented for over forty years and the BWA should improve its efforts to lobby the GOB to amend the Act, as the current instrument does not reflect present day gender issues.

In 2020, the Government of Barbados enacted the **Employment (Prevention of**

⁴ ibid

⁵ <https://gisbarbados.gov.bb/blog/new-watertariff>

⁶ <https://www.ecolex.org/details/legislation/barbados-water-authority-act-1980-lex-faoc>

Discrimination) Act, 2020⁷. This Act prevents discrimination in an employment context in over fifteen (15) areas⁸. Including sexual orientation, gender, family responsibility, age and physical features. The Act prevents discrimination in recruitment and selection; even where these functions are executed by recruitment agencies⁹. The Act identifies that an act of discrimination can occur, “directly or indirectly, whether intentionally or not, makes a distinction, creates an exclusion or shows a preference, the intent or effect of which is to subject the other person to any disadvantage, restriction or other detriment.” The Act also identifies an act of discrimination may occur where “the person, directly or indirectly, whether intentionally or not, subjects the other person to any disadvantage, restriction or other detriment” ... in identified circumstances. This legislation has identified a tribunal where complaints of discrimination can be made.

In 2017, The Government of Barbados enacted the **Employment Sexual Harassment (Prevention) Act, 2017**¹⁰. The Act makes provision for the protection of employees in both the public sector and private sector from sexual harassment at their workplace; provides a framework for the reporting of sexual harassment cases by employees and a method of resolving such cases; establishes a procedure for the hearing and determination of matters related to sexual harassment; and provide for related matters.

6. National Collaborating Institutions

As indicated earlier, in 1985, the GOB in keeping with Part IV of the of the Barbados Authority Act, 274a, established the Water and Sewage Division within the BWA to be responsible for wastewater sector management. Currently, in addition to the BWA Wastewater Division, Barbados has several public institutions with mandates that have a direct impact on gender equality issues relating to the wastewater sector. They are as follows:

1. The Barbados Poverty Alleviation Bureau and the Office of the Director of Poverty established in 1998 with a responsibility to examine and report on the living conditions of the poor and vulnerable¹¹;
2. The Bureau of Gender Affairs, Ministry of Youth, and Family and Sports responsible for monitoring and evaluating gender equality policies, plans and programs of government. The Bureau is responsible for the integration of gender in all national development policies and programs to achieve gender equity and equality.; and
3. The Environmental Protection Department (EPD), has completed a wastewater reuse policy to facilitate the treatment of wastewater for reuse in drip irrigation, toilet

⁷ https://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=110880 Accessed: September 5, 2022

⁸ <https://barbadostoday.bb/2021/03/18/btcolumn-discrimination-in-the-workplace-can-be-covert/> Accessed: September 5, 2022

⁹ Ibid.

¹⁰ chrome-

extension://efaidnbmnnnibpcajpcglclefndmkaj/https://oig.cepal.org/sites/default/files/2017_brb_employmentsexualharassmentpreventionact.pdf
Accessed: September 5, 2022

¹¹ <https://www.gov.bb/State-Bodies/poverty-alleviation>

flushing, decentralized sanitation systems including septic tanks, sewage packaged plants and suck-wells (Isaacs, 2017).

The above-mentioned institutions collaborate with each other to bring greater synergy between gender equality and wastewater issues.

Overall data collected from government records indicates that the GOB has made some progress on social, political, and economic issues relating to gender equality. However, during the implementation of the Project it is necessary that the BWA ensures compliance with provisions of relevant conventions, policies, agreements, and laws. Where there are gaps identified, BWA needs to lobby the government authorities to make the appropriate improvements.

Gender Equality Indicators Adopted by Barbados

Gender Equality Indicators refer to sixteen measures adopted by the United Nations to track progress made by member states towards achieving the goals of SDG 5. CARICOM has adopted a regional list comprising thirty-three GEIs. This gender analysis applied some of the gender equality indicators adopted by the GOB from the CARICOM list of GEIs.

Table C National List of Gender Equality Indicators Applied by Category

No	Category	CARICOM	CARICOM/National Indicator
1	Economic Activity	Indicator 1 Indicator 8 Indicator 10 Indicator 11	<ul style="list-style-type: none"> ▫ More of the persons in poverty are women ▫ 15.7% of Barbados population lives in poverty ▫ Poor women 21%, Poor men 13,96% Extreme poor women:4.7%, Extreme poor men: 2.7% (Beuermann 2017)
2	Education	Indicator 14	Barbados Population statistics: <ul style="list-style-type: none"> ▫ 90.68% completed tertiary education ▫ 93.4% completed primary education²¹ ▫ 89.5% and 87.6% females and males respectively with at least secondary education (Allen et al. 2016) More women, 40 years and under have university education 50% of emigrants as against 30% of locals have university

3	Public Participation	Indicator 28 Indicator 29	Parliament has 30 seats. Women including the Prime Minister, holding 6 seats or 20% compared to 24 seats or 80% held by men. ¹²
		Indicator 30	Head of State: Governor General is a woman.
		Indicator 31	The Cabinet comprises nineteen (19) or (73%) men and seven (7) or 27% women ¹³

2.4.4 BWA Framework for Wastewater Sector Services

The BWA is the primary entity, supported by the Ministry of Transport, Works and Water Resources, with a mandate to deliver satisfactory water and wastewater services to citizens of Barbados, and as such, is responsible for applying the gender equality policy at the level of the wastewater sector. For the delivery of wastewater services, BWA is required to maintain an appropriate organizational structure to exercise utility oversight, a system for data collection and analysis, and wastewater treatment facilities. Details of the several gender equalities issues to be addressed for effective implementation of the project.

2.4.5 BWA Organizational Structure

The configuration of the organizational structure of the BWA makes provision for several functional departments including Finance, Human Resource and Customer Service. The structure also includes a Wastewater Division which is specifically responsible for wastewater management. As of August 2022, the Barbados Water Authority had 753 employees. 556 (73.8%) were men and 197 (26.2%) were women. This represents a 3% drop in total employees from 2016, when a Gender Analysis for the GCF Funded WSRN Project was undertaken. Important to note, is female employment dropped from 28.1% of the BWA workforce to 26.2%. In 2016, The workforce age ranged from 20–67 years with a mean age of 39 years. Approximately half of the BWA employees (61 %) are aged 40-59 years, with the majority of men being 50-59 years (23%) and women 40-49 years (9.9%)¹⁴. The BWA staff are almost equally employed in technical (48.5%) and non-technical roles (51.5%), with technical being defined as all job titles related to project management,

²² ¹² <https://caribbeanelections.com> Barbados Election Results 2018

²² ¹³ <https://www.gov.bb> Barbados Current Cabinet of Ministers

¹⁴ file:///C:/Users/Admin/Downloads/BP20-CCC-01-00-RPT-Gender-Analysis-Report-Rev1.pdf

engineering, science, vocational, heavy equipment operation and field work activities of the utility, and non-technical referring to all other capacities. “Men and women are almost evenly represented in non-technical roles (26.8% and 24.6% respectively), while there is a significantly greater proportion of the BWA staff that are men (45%) versus women (3.5%) employed in technical roles”¹⁵. In the Legal and Compliance Unit, The Customer Service Unit, as well as the Human Resource Unit, there is an over representation of women (100%, 89%, 72%) respectively. On the other hand, the Engineering Unit (75%), the Distribution Unit (95%) and the Drawing Office (100%) has over representation of men.

From interviews conducted during this gender analysis, the perception is that the BWA has demonstrated that as an employer, it provides equal opportunities to men, women, and LGBTQIA persons in the recruitment of employees and this unwritten policy is maintained in staff training, deployment, compensation, and mobility. One KII respondent stated that the BWA employees are unionised and as such, the BWA is committed to implementing provisions of the collective agreement which addresses the gender equality issues highlighted earlier. Important to note is that this is in keeping with the findings of the Country Gender Assessment (CGA) conducted in 2016 by the CDB. The CGA ¹⁶ highlighted that ...

“A number of interviewees stated that law and policy in Barbados facilitate equal opportunities and that institutions are ‘gender neutral’ in their treatment of women and men. They saw differences in economic and social outcomes for men and women (if acknowledged to exist) as resulting from individual choice and tradition rather than systematic impediments. A few interviewees were actively opposed to developing actions based on gender considerations. Others acknowledged gender-related constraints, but most said that gender was not something they generally took into account while working”.

Despite outcomes demonstrating gender imbalances in participation and representation, the views that BWA is an equal opportunity employer remains relatively constant. Important to address however are the institutional cultural biases that may perpetuate inequality. Gender sensitivity training, encouraging more young women in STEM and having more women in leadership roles may help in shifting cultural nuances over time. While there are no recognized formal impediments to gender equality in the workplace, culture and stereotypes may influence how policies and laws are implemented.

2.4.6 BWA Board Governance

The BWA ten-member Board of Directors is appointed by the Ministry of Transport, Works, and Water Resources for a three-year period. At the commencement of this Gender Analysis, it was noted that the BWA Board of Directors comprised of two women one of whom was the chairperson of the Board, and eight men, an arrangement which reflects

¹⁵ file:///C:/Users/Admin/Downloads/BP20-CCC-01-00-RPT-Gender-Analysis-Report-Rev1.pdf

¹⁶ Caribbean Development Bank Country Gender Assessment Barbados, 2016

a gender-imbalanced in the gender make-up of the Board. Since the execution of this study, the Board changed leadership. The BWA Board is therefore male headed. Increase in women’s participation in prominent decision-making spaces provides an opportunity not only for equality of representation bur equality of decision-making outcomes. Women’s participation in water governance is essential for achieving SDGs 5 and 6 as is a target of both¹⁷.The Beijing Platform for Action calls for guaranteeing that ‘women's priorities are included in public investment programmes for economic infrastructure, such as water and sanitation’. Women’s voices are increasingly strengthened when women have a seat at the decision-making table, and moreover, when women who fill those seats: i. have the technical competence to contribute meaningfully to decision making and, ii. are empowered to do so. As predominant water users within the household, and increasingly present users of water in private sector, it is imperative that female representation on boards such as the BWA is prioritized.

Table D: Composition- BWA Board of Directors

Stakeholder	Total	Male	Female
BWA Board of Directors	10	7 or (70%)	3 or (30%)

2.4.7 BWA Wastewater Division

The current wastewater management system, used by the BWA to provide wastewater services to the citizens of Barbados, comprises of two treatment plants that are the Bridgetown Sewage Treatment Plant (BSTP) and the South Coast Sewage Treatment Plant (SCSTP). Disaggregated data obtained from a January 2021 staff survey of the BWA indicated that out of a total staff complement of fifty-eight that work at the treatment plants, forty-nine employees or 85% of them are men while only nine, or 15%, are women. The above data confirms the high level of gender-imbalance among the technical staff of the Wastewater Division. This situation is not unique to Barbados, The World Bank’s Water Global Practice published a report highlighting that “women make up less than 1 in 5 of the water workforces (in water utilities) and constitute only 23% of engineers and managers in the sector”.¹⁸¹⁹

In an assessment of the gender segmentation of labour within the BWA, Issacs and Trotz (2017) identified that of technical fields within the BWA, the greatest disparity in employment was in the vocational area, 26.8% men to 0.8% women. This category comprised artisan electricians, fitters, masons, plumbers, welders, heavy equipment operators, sewage inspectors and workshop employees. According to disaggregated staff data of January 2021, there is a 68% gender imbalance in favour of men on the staff of the BWA Wastewater Division confirming that more men are employed doing paid

¹⁷ Ibid
¹⁸ <https://openknowledge.worldbank.org/handle/10986/32319>
¹⁹ Oxfam, 2020 Achieving Sustainable Development Goals 5 and 6

work in the wastewater sector. Therefore, in addition to the gender sensitivity which it has already initiated, BWA needs to create greater opportunities to attract more women to the sector. This imbalance in representation at the wastewater division is reflective of: i. the nature of work performed at treatment plants; and ii. the entry level requirements for the jobs available at the division. More men are drawn to vocational and engineering educational and training programmes than women. Work undertaken at the treatment plans are viewed as heavily laborious and physical and may therefore draw more men than women to apply and take up vacant positions. There is however also the room for expectation that cultural norms may deter women with an interest in performing in this sector to take on open positions.

Data from The Barbados Vocational Training Board (BVTB) (2013) revealed the male-female ratio of graduates as 62.7 to 37.3, very similar to 2003 ratios²⁰. A review of 2019-2022 Graduates suggests a similar pattern. Training areas such as plumbing, electricals, machinery operators were male dominated, while programmes such as sewing, cosmetology and international cooking had greater female graduates²¹. Similarly, The University of the West Indies Vice Chancellor’s report 2020-2021, demonstrated overall a higher enrolment rate of females (68.7%) to males (31.3%)²². However, the report identified the male dominated faculties to be Engineering (65.67%) and Sports (65.7%). Employees with the requisite technical skills will be the most eligible, and first to benefit from potential jobs created by projects of this nature²³. There is therefore a need for stronger affirmative action policies to increase women’s representation across the water sector.

Table E. Gender Distribution and Gap of Wastewater Division Staff, 201

Stakeholder	Total	Male	Female	Gender Gap
Division Staff by Location				
BSTP/SCSTP	6	4 or (67%)	2 or (33%)	34%
BSTP	29	26 or (90%)	3 or (10%)	80%
SCSTP	23	19 or (83%)	4 or (17%)	66%
	58	49 or 84%	9 or 16%	86%

2.4.8 BWA Gender Equality Strategy

The BWA does not have a written Gender Equality Strategy. The organization has unwritten practices of non-discrimination, and equal pay for equal work as was cited by one KI. Unionization has helped in this regard. However, a well-defined Gender Equality Strategy is not elaborated. The Project provides the space to document policies of non-discrimination

²⁰ *Ibid.*

²¹ <https://www.youtube.com/watch?v=YPdpiMj4WD4>

²² <https://uwi.edu/vcreport/>

²³ <https://www.greenclimate.fund/document/gender-assessment-fp060-water-sector-resilience-nexus-sustainability-barbados-wsrn-s>

through upgrades of SOPs. Important is that the Employment (Prevention) of Discrimination Act of 2020 applies to the BWA, including as it relates to recruitment and provides an avenue for complaints to a tribunal where the BWA violates the law.

2.4.9 BWA Gender Sensitivity Training

With Support from the Water Sector Resilience Nexus for Sustainability in Barbados (WSRN) Project, The BWA is undertaking Gender Sensitivity Training which started in October 2020, and was facilitated by UWI-Gender Studies Department (UWI-IGDS). The programme was designed to train 500 BWA employees to help them develop a better understanding of gender sensitivity issues within the Authority. The programme contains several modules of video presentations and three case studies which include gender components on water and wastewater issues, fish processing and farming topics. It also includes a component on the water and energy nexus and covered areas like drought management, rainwater harvesting and increased water storage. In an interview with UWI-IGDS, it was confirmed that the training involved six workshops with up to 22 participants in each session and was delivered over five days. The training uses videos, case studies, handouts, small group activities and facilitator-led plenary presentations and discussions. The programme was designed to redress the personal and urgent relations of gender. Table F shows the disaggregated data on BWA employees who participated in the gender sensitivity training.

Table F: Disaggregated Data on Staff Attendance in the BWA/UWI-IGS Gender Sensitivity training

Session Date 2020	Total	Male	Female
8 th October	23	14 or 61%	09 or 39%
9 th October	24	10 or 42%	14 or 58%
15 th October	21	8 or 38%	13 or 62%
16 th October	23	13 or 57%	10 or 43%
22 nd October	16	9 or 56%	7 or 44%
23 rd October	19	11 or 58%	8 or 42%
29 th October	18	12 or 67%	6 or 33%
30 th October	17	8 or 47%	9 or 53%
Total	161	85 or 53%	76 or 47%

At the end of the programme all successful employees will receive a Certificate in Gender Equality Issues. Participation in trainings is encouraged, but not made mandatory for staff. Trainings have had varying degrees of success in terms of participation. Incentives for attending training often results in increased attendance.

An interview with a female Senior Manager at the BWA revealed that the training is a necessary initiative to expose BWA employees to gender sensitivity and to encourage gender equality relating to co-workers, customers, and clients. The gender sensitivity programme, is ongoing within the framework of the WSRN Project. Training for gender

equality can be a transformative process that provide knowledge, techniques and tools to develop skills and changes in attitudes and behaviours. However, the effectiveness of these programmes is often a result of a continuous and long-term process that requires commitment of all parties²⁴. Similarly, as posited by the European Institute for Gender Equality, if implemented systematically gender training facilitates more efficient actions and a positive change in attitudes²⁵. Likewise, there are certain categories of employee, depending on job functions, who should be mandatorily trained in relevant areas of gender sensitivity.

3.1 Contextual Analysis

3.1.1 Gender Equality and Diversity

This report examines gender equality from a broad perspective which embraces the human rights of all citizens in Barbados, in relation to how climate change is impacting the wastewater systems in the country. It is worthy to note that this contextual analysis centre on key equality pillars that are considered relevant to this 3R-CReWS Project.

It addresses equality among men, women and the LGBTQIA community, to avoid discrimination in the society regardless of gender identity. It is important to address gender equality from this perspective to bring parity between genders and persons of LGBTQIA orientation thereby, respecting their rights as humans. The ILO has taken initiatives to address issues relating to women and LGBTQIA on the sex-based discrimination by advancing the rights of low-waged women and families of the LGBTQIA community. Much has been achieved in terms of human rights of women and people of LGBTQIA community. Also, a case can be made for the inclusion of women and social minorities in the gender equality debate (Johnson 2019). Johnson argues:

“...that gender equality, gender management and gender mainstreaming approaches overlook most problems faced by people from LGBTQIA community and from women of colour. Gender equality is done in a framework which includes vulnerable groups like LGBTQIA integrated in the project with no discrimination.¹”

A large percentage of gay and lesbian adults face some form of discrimination especially on the job although it is argued that there has been progress over the last two decades legally. However, the LGBTQIA community still experience gender bias in Barbados. For example, LGBTQIA persons currently do not have the same rights as non-LGBTQIA people. Intimate acts performed by LGBTQIA persons in Barbados are still considered to be illegal and there is a penalty where the maximum sentence is life imprisonment although it is

²⁴ <https://www.unwomen.org/en/how-we-work/capacity-development-and-training#:~:text=It%20helps%20women%20and%20men,equal%20human%20rights%20for%20all.>

²⁵ <https://eige.europa.eu/gender-mainstreaming/toolkits/gender-equality-training/why-invest-gender-equality-training>

not enforced. The (Barbados Today Newspaper, Dec. 2014) reported that;

“... stigma and discrimination, forms a property damage, ostracism and verbal abuse from strangers and family alike, unjustifiable denial of employment, denial of housing, reflection and abandonment by family, friends and society at large.²⁶”

Every effort is made to advance the cause of all vulnerable groups of all genders, to avoid any form of discrimination and ensure that everyone’s needs are adequately addressed in the Project cycle.

3.1.2 Gender Equality and Climate Change

The Project’s Proposal puts forward in its climate rationale that “the climate change risk profile of Barbados is dominated by coastal and weather effects, especially sea level rise, storm surge, increased tropical storm and hurricane intensity and frequency; and other more slow-onset environmental impacts, such as flooding and drought, which is a very important and specifically Barbadian nuanced issue, as the country already suffers from water scarcity, and changes in rainfall patterns exacerbate this considerably²⁶. Climate models show that conditions will be warmer and drier in the Caribbean, resulting in water availability issues. As Cited in the Project’s Proposal, it has been reported by the BWA that Barbados has been experiencing less rainfall recently than the mean rainfall amount of 1,270 mm/year measured at the GAIA²⁷. Barbados experienced an annual rainfall of 736.5 mm in 2019²⁸.

...Shifting climatic conditions are leading to increasing interruptions in potable water availability. Water scarcity can cause a variety of health problems by reducing the amount of water available to practice basic hygiene which increases the risk of chemical and microbial contamination (Halcrow, 2011); these can lead to gastrointestinal diseases and other health risks. Studies in the Caribbean show an association between climate variability and increasing incidence of dengue fever. Rainwater storage is being promoted as an adaptation option to increase availability of freshwater; however, environmental health officers report an increase in the *Aedes aegypti* (mosquito that carries yellow fever) index due to mosquito breeding in domestic rainwater storage tanks. These health issues often affect women as primary caregivers and homemakers; children and elderly are also at greater risk. Men in formal work tend to have greater access to clean water and therefore

²⁶ Integrated Solutions, Funding Proposal -3R-CReWs Project, 2021

²⁷ Barbados Weather Climate Data: <http://www.barbadosweather.org/barbados-weather-climate-data.php>

²⁸ Barbados Weather: <http://www.barbadosweather.org/index.php>

at lesser risk for vector borne diseases²⁹.

Many studies have highlighted that women are more vulnerable to the effects of climate change than men. In countries such as Barbados, women and men in rural areas are vulnerable when they are highly dependent on local natural resources for their livelihood. It is therefore important to identify gender-sensitive strategies to respond to environmental and humanitarian crises caused by climate change as women are not only vulnerable to climate change, but they are also effective actors or agents of change in relation to both mitigation and adaptation.

There are many researchers³⁰ who support the idea that gender inequity is making the impacts of climate change worse. They suggest that by bringing the voices of more women/LGBTQIA persons into responses to climate change will help all countries. Gender inequalities affect the abilities of men and women to adapt to climate change particularly in areas of services, decision-making and access to and control of assets. Women are further limited by gender norms, roles and biases across the ecology of Caribbean countries. For women, their role as caregivers and homemakers can be challenged by effects of climate change on availability of food and water and fuel scarcity. These may force women to spend more time trying to access these resources and thereby affects their expected roles as homemakers and breadwinners. Such challenges increase stress and tension within the home and can subsequently lead to manifestations of gender-based violence. Men are also susceptible to negative impacts of climate change. High levels of stress due to unavailability of resources, compromised land and assets, and loss of income can lead to anger which can further encourage self-harm and substance abuse. Loss of income and resources due to climatic events may also lead to sexual and domestic violence against partners or children.

Climatic events inflict deep and lasting impacts on the poor and vulnerable who are least able to withstand their onslaught³¹The Economic Commission for Latin America and the Caribbean (ECLAC) has published technical reports on the environmental vulnerability of Caribbean SIDS and Barbados in particular³². The position of ECLAC is that “vulnerability is, in part, a function of gender”. Barbadian strategies to address climate change identifies the need to support the poor and disadvantaged who have fewer resources or buffers against climate change or other shocks³³. These strategies do not explicitly present strategies to advance gender equality in addressing issues of climate change sectorally, nor systematically. Poverty data in Barbados reveals that, a larger percentage of women are represented and affected in the poor and vulnerable groups because more women find themselves in poverty brackets. As stated in the CDB Gender Assessment Report, “In

²⁹ Integrated Solutions, Funding Proposal -3R-CReWs Project, 2021

³⁰ <https://www.weforum.org/agenda/2020/07/gender>

³¹ Government of Barbados (2012), Barbados Growth and Development Strategy 2013–2020, Economic Affairs Division, Ministry of Finance and Economic Affairs, Bridgetown, p. 2.; as cited in CDB CGA (2017)

³² Ibid, Pg 73

³³ Ibid, Pg 73

Barbados there is a high rate of poverty among female-headed households. 19.4%, of female-headed households are poor, compared to 11.5% of male headed households, and 15% of all households” (Baksh & Associates, 2016B)³⁴.

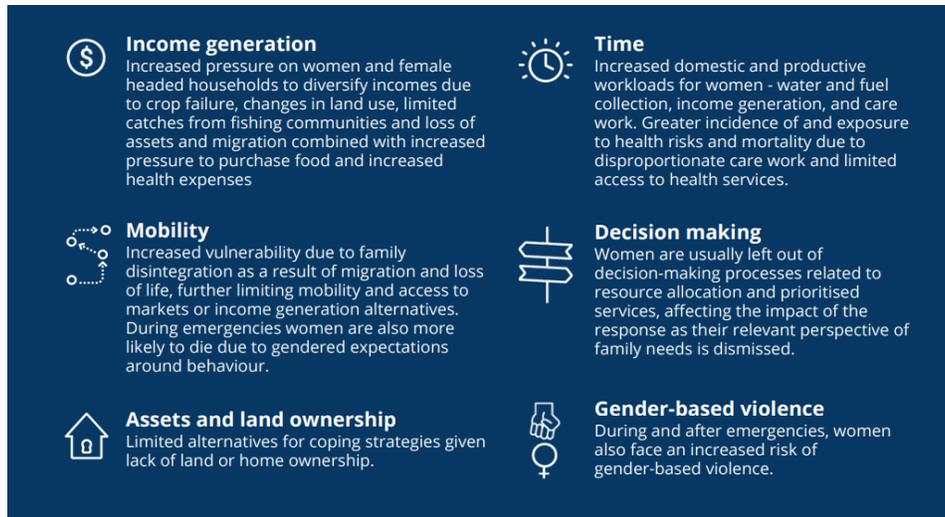


Figure 1 Gendered Impact of Climate Change in the Caribbean³⁵

The IUCN believes that it is possible to strengthen climate action by promoting gender equality and that since women and men experience climate change differently, gender inequalities will persist around the world, affecting the ability of individuals and communities to adapt. They posit the view that by recognizing the important contributions of women, as decision makers, stakeholders, educators, carers, and experts across sectors and at all levels, can lead to successful, long-term solutions to climate change. Women have also proven to be leading the way towards more equitable and sustainable solutions to climate change.³⁶

3.1.3 Gender Responsive Disaster Preparedness and Recovery in the Caribbean

The World Bank’s Global Facility for Disaster Reduction and Recovery GFDRR and the Caribbean Resilience Facility (CRF), published a desk review on Gender Responsive Disaster Preparedness and Recovery in the Caribbean (as cited in footnote)³⁷. The main findings of the desk review are:

³⁴ Ibid, Pg 73

³⁵ Study of the Impacts of Climate Change on the Women and Men of the Caribbean. Pilot Programme for Climate Resilience Countries (Informed by FAO 2017b)

³⁶ <https://www.iucn.org/resources/issues-briefs/gender-and-climate-change>

³⁷ [https://openknowledge-worldbank.org/bitstream/handle/10986/35215/Gender-Responsive-Disaster-Preparedness and Recovery in the Caribbean](https://openknowledge-worldbank.org/bitstream/handle/10986/35215/Gender-Responsive-Disaster-Preparedness%20and%20Recovery%20in%20the%20Caribbean)

- Women in the CRF countries experience various gaps in access to health, social protection, vocational and technical education, productive resources, economic opportunities, and voice and agency, all of which are associated with their increased vulnerability to disasters and climate change hazards;
- Although indicators for educational attainment—measured as the number of years of education—are almost the same for men and women in the CRF countries, a significant gender gap persists at the level of technical and vocational programs that might prevent women from improving their access to income-earning opportunities, particularly in the recovery and reconstruction programs in post-disaster settings;
- Strong evidence shows that in resource-poor nations, disasters make women more vulnerable to reproductive and sexual health problems, suggesting the necessity to include women’s health as a critical component of disaster relief programs;
- An analysis of social indicators in the CRF countries demonstrates various gender gaps in social protection, all of which make women more vulnerable to disaster impacts due to their lower safety nets compared to men;
- Women’s domestic burdens and their primary responsibility for the well-being of their families limit their economic opportunities and increase burdens imposed on them in disaster situations;
- Higher unemployment rates, access to fewer economic opportunities, lower wages, vulnerable employment, and insufficient social support systems for domestic workers result in women’s limited access to safety nets compared to men, making them more vulnerable in disaster situations;
- Although there are no exact statistics about the number of women in DRM and climate change related decision-making positions, a general trend, based on the number of women in national parliaments, and ministerial and managerial positions, points to significant decision-making gender gaps.
- Country reports from the CRF countries provide evidence of persistent violence due to inadequate protection measures for GBV victims, limited responsive care, treatment, psychosocial and other supportive services, and sub-culturally institutionalized violent practices. Importantly, the trend exacerbates during disasters and in post-disaster settings; and
- A lack of focus prevails with men and boys’ vulnerability and capacity analyses, compounded by limited efforts to engage men and boys adequately as allies to achieve gender equality in disaster preparedness and recovery ³⁸

³⁸ [https://openknowledge-worldbank.org/bitstream/handle/10986/35215/Gender-Responsive-Disaster-Preparedness and Recovery in the Caribbean](https://openknowledge-worldbank.org/bitstream/handle/10986/35215/Gender-Responsive-Disaster-Preparedness%20and%20Recovery%20in%20the%20Caribbean)

3.1.4 Unpaid Work

A case study undertaken (Bobb, 2019), describes the challenges faced by persons of different gender when it comes to their access to clean water. Based on its findings, the study concludes that access to water is critical to one's quality of life and affects men and women differently. The case highlights the challenges of Wendy, a 34-year-old married mother of two children who resides in St. John, Barbados. For half of the year, Wendy's household comprises of herself and her two children: a single parent due to her husband, Bernard, who works overseas on the farm labour program and contributes financially to the household.

In summary, this case study (Bobb, 2019) indicates that the woman spends at least thirty-two hours a week doing paid work, and twice that time doing unpaid domestic work at home including, cooking, washing, gardening, caring for her children and the animals and fetching and storing water for domestic use. Men, on the other hand, spend approximately forty hours a week doing paid work but very little time doing unpaid domestic chores. Although this case study does not necessarily represent the situation throughout all of Barbados it does highlight, what appears to be, a common trend in the country. The CGA (2016), similarly identified that studies in Barbados have shown that women, in part because many are single parents, participate in income-generating activities in both the formal and informal economies as well as carrying out the majority of unpaid care activities.

3.1.5 Sexual and Gender Based Violence

The CGA identified that “patriarchal gender norms are often used to justify violence against women who do not ‘know their place’ with regard to remaining within the private, domestic sphere. These norms also support male control over the bodies of women and girls and entitlement to sexual pleasure, justifying sexual violence”³⁹. These findings were advanced as a result of studies conducted by the Bureau of Gender Affairs/ Caribbean Development Research Services in 2009 which found a prevalence of violence of 27% among adult women over the previous year. Correspondingly, A study on interpersonal violence in three Caribbean countries: Barbados, Jamaica, and Trinidad and Tobago, revealed that violent acts are most commonly perpetrated by a partner within a relationship (59.0% on male victims and 66.7% on female victims)⁴⁰. Important to note is that the study found that the levels of any violence decreased as the victim's ages increased—falling from 72.4% among the 15–18-year-olds to 67.3% among the 27–30-year-olds ($p = 0.03$). Reported physical violence fell from 66.2% among the 15–18-year-olds to 49.0% among the 27–30-year-olds ($p < 0.001$). Reported sexual coercion fell from

³⁹ *Ibid.*

⁴⁰ Le Franc E, Samms-Vaughan M, Hambleton I, Fox K, Brown D. Interpersonal violence in three Caribbean countries: Barbados, Jamaica, and Trinidad and Tobago. *Rev Panam Salud Publica*. 2008;24(6): 409–21.

60.3% among the 15–18-year-olds to 50.1% among the 27–30-year-olds ($p < 0.001$)⁴¹. For Barbados, of survey respondents 50.0% of women compared to 44.7% of men revealed experience of physical aggression within an intimate partner relationship. Similarly, 52.8% of women and 39.6% of men reported sexual coercion in Barbados. Reports of Domestic Violence across the Organization of Eastern Caribbean States increased during the COVID-19 lockdown. The UN Women identifies that Barbados, in particular, experienced an approximately 38 per cent increase in reported cases of domestic violence, many of which were intimate partner violence.”⁴²

While Gender Based violence is found to be more prevalent in intimate partner settings, it is also recognizably present in public spaces as well. There is however, limited information and no comprehensive study on Sexual and Gender Based Violence in the workplace in the Caribbean and specifically, in Barbados. The IFC identifies though, that 30%-50% of women in Latin America and the Caribbean have experienced sexual harassment at work⁴³. Positively, Barbados is one of three Caribbean Countries, also including Belize and the Bahamas with specific legislation which addresses sexual harassment⁴⁴.

In addition to CEDAW, Barbados has ratified key international and regional human rights instruments related to gender equality, namely the Inter-American Convention on the Prevention, Punishment and Eradication of Violence against Women. It has also ratified the eight core International Labour Organization (ILO) Conventions. In 2016, there were amendments to the domestic violence laws providing for more powers to the police as well as changes to the definitions of forms of domestic violence, including physical, emotional and financial abuse and harassment and the expanded scope to use of electronic means to perpetuate violence. The Employment Sexual Harassment (Prevention) Act was passed 2017⁴⁵ and provides an avenue for complaints where harassment occurs in the workplace.

The prevalence of violence against women, and in particular young women and girls, warrants a cautious approach to implementing community-based intervention under the 3R-CReWS Project. Importantly, is that the BWA recognizes the risks that may arise from infrastructure works within communities. Projects like the 3R-CReWs bring people and social transformation to the communities in which they operate. They may therefore invariably exacerbate existing risks of Sexual and Gender Based Violence. Addressing gender-based violence, including exploitation and harassment, in infrastructure projects

⁴¹ *Ibid*

⁴² <https://gisbarbados.gov.bb/blog/domestic-violence-increased-with-covid-19/#:~:text=In%20the%20first%20two%20quarters,reported%20incidents%20of%20domestic%20violence>. Accessed: August 15 2022

⁴³ www.ifc.org/wps/wcm/connect/42b50ce3-3867-48b2-9818-acfbc4080ea2/202007-IFC-GBV-COVID+D.pdf?MOD=AJPERES&CVID=ndOei13

⁴⁴ <https://www.world-psi.org/en/barbados-pilot-study-gender-based-violence-public-sector> accessed August 15th, 2022

⁴⁵ *ibid*

is important because construction sites can become spaces where female workers, people with diverse gender identities and those who live or work in the vicinity are victimized⁴⁶. SGBV must be prevented to ensure wellbeing of vulnerable groups in project vicinity. Similarly, if not intentionally addressed, sexual and gender-based violence can easily be ignored⁴⁷. Women working in traditionally male-dominated contexts, in isolated workspaces, or in occupations or shifts in which they constitute a small minority may be at increased risk of SGBV⁴⁸.

The Project's Environmental and Social Impact Assessment puts forward that

“Section 154 of Barbados law is implicit about Sexual Exploitation, Abuse, and Harassment (SEAH) but covers all aspects. By interpretation, it articulates that the government will not tolerate SEAH in any form. This is also the commitment CCCCC and GCF. Therefore, stringent policies and safeguards are instituted at all levels of projects funded by CCCCC and the GCF. In instances where it has been determined that a person has been a victim of SEAH the AE/IE/IA will consult and work with the relevant government ministry, department, or NGO to ensure that the victim is placed at a safe location and protected from further SEAH”.

The project must also be cognizant that while prevention of SGBV is the most effective strategy, it must also provide an avenue for victims of SGBV to complain and to receive redress for their victimization. Therefore, the Project's Grievance Redress Mechanism must be sufficiently responsive to allow for internal and external filing of SGBV and SEAH related complaints.

3.1.6 Barbados Agriculture Sector -Gender, Climate Change and Water

The 3R-CReWs Project identifies that agriculture continues to compete with other sectors for scarce resources such as water, land, labour and capital⁴⁹. With the GOB's increased call for greater domestic food production through new and improved methods of farming as a response to climate change, there is identified need for greater water availability, for irrigation purposes. The Project conceptualizes that this should lead to improved food security and health and well-being of the population. The outputs of Component four (4) are critical to social acceptance and to spur demand. The component targets farmers and communities. In particular, the development of incentive programme and public awareness. During consultations with farmers, including with the Association of Women in Agriculture, there was overwhelming consensus that Farmers are supportive of the use of treated wastewater. According to the Baseline study for the project, farmers have been experiencing the impact of prolonged dry periods. This has resulted in loss of income.

⁴⁶ <https://atalayar.com/en/blog/infrastructure-works-without-gender-based-violence> access August 15th, 2022

⁴⁷ <https://blogs.iadb.org/sostenibilidad/en/the-many-faces-of-sexual-and-gender-based-violence-in-development-projects/>

⁴⁸ <https://blogs.iadb.org/sostenibilidad/en/the-many-faces-of-sexual-and-gender-based-violence-in-development-projects/>

⁴⁹ Integrated Solutions, Funding Proposal -3R-CReWs Project, 2021

Farmers were equally cited as seeing benefits of nutrients in the water for the crop.

Farmers, particularly small farmers, are significantly impacted by both increased production costs and lacking rainfall for rainfed crops⁵⁰. Further to this point, an article was published recently in the Barbados Advocate (2020), pleading with the government to give farmers financial support for their water bills. Specifically, Mr. James Paul, the Chief Executive Officer of the Barbados Agricultural Society, expressed concern for farmers, explaining that the garbage and sewage contribution, imposed through BWA utility bill, has resulted in a spike in agriculture operational costs (Barbados Advocate 2020). This, in combination with the increase in cost for irrigation, profit decrease from lost crops, places farmers and the agricultural industry at a heightened risk.

Agriculture is more than a job for many women in the Caribbean. Women engage in subsistence agriculture to support their families, while men are more likely to engage in cash crop production⁵¹. The CGA puts forward that “although much of subsistence agriculture is not captured in employment or GDP statistics and is carried out by the so-called ‘economically inactive’ population, it is nevertheless a critical contributor to the livelihoods of poorer people and is also important for food security”. Many of the small subsistence plots and smallest farms in Barbados are female owned. Larger farms tend to be owned by males. Close to 80% of all farms in Barbados are owned by men (79.7%)⁵².

The UNWOMEN’s 2017 gender analysis of employment in six (6) CARICOM countries provided data on share of women’s employment in a number of standardized occupations in Barbados. The Analysis utilised the ILO’s International Standard Classification of Occupations (ISCO) definition “a set of tasks and duties performed, or meant to be performed, by one person, including for an employer or in self-employment”, in the classification and computation of the share of women’s participation in occupational categories. Correspondingly, the analysis found that men are more likely than women to be employed in agriculture in Countries like Barbados, although this disparity is not as glaring as in other CARICOM countries like Jamaica and Guyana.

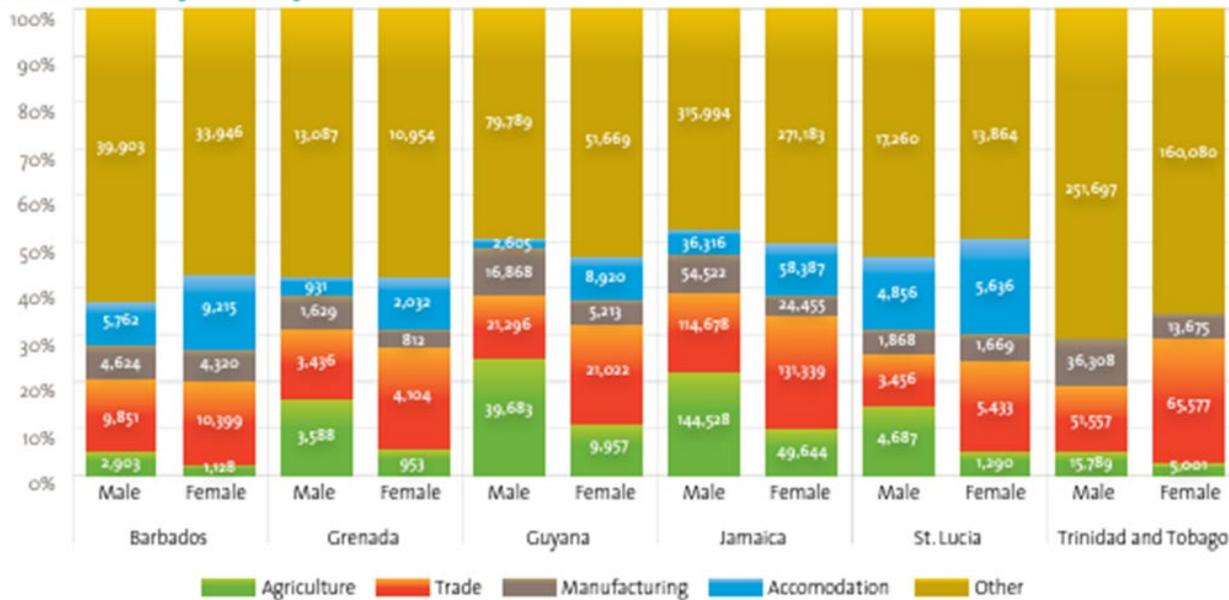
Figure 2: Share of women and Men by Occupation in Six Caribbean Countries

⁵⁰ <https://www.fao.org/americas/noticias/ver/en/c/419202/>

⁵¹ CGA Barbados, 2016

⁵² *Ibid.*

Distribution by industry and sex, 2017



Source: Taken from Status of Women and Men Report: A Gender Analysis of Labour Force Data and Policy Frameworks in Six Caribbean Countries, UNwomen, 2017

Women’s non-ownership of resources, like land and proof of formal work, that could be used for collateral constrains their access to credit for agriculture and also for productive work in other sectors. For some women, they rely on a male relative with collateral to apply on their behalf, others, like unmarried women, are not able to do so⁵³. Facilities that allow for farmers to access credit to improve irrigation or access to reclaimed water should therefore be aware of barriers that women often face to formally access finance for upgrade to their agricultural production.

The Association of Women in Agriculture in Barbados was consulted as part of larger stakeholder engagement process during the development of this 3R-CReWS Project. This representative group is seen as a critical stakeholder for the project in soliciting further acceptance of women farmers of use and reuse of wastewater and by-products. Similarly, this group is identified as a conduit for sharing information and opportunities with women farmers so that they can benefit from access to information on use of reclaimed water, but also access to reclaimed water for irrigation.

3.1.7 Barbados Fisheries Sector - Gender, Climate Change and Water

A case study undertaken by the Gender in Fisheries Team and UWI Centre for Resource Management and Environmental Studies as part of the 2014 Barbados Green Economy Scoping Study for the GOB argued that the fishing sector is an important water user. The

⁵³ *Ibid.*

activities of the fisheries sector along with the value change would be significantly affected by any changes in water quantity and quality. The main findings of the study were:

- 3.1.2.1 In Barbados, fisheries have been an important part of the national economy and culture from the earliest recorded times;
- 3.1.2.2 Men typically dominate the harvest sector in Caribbean small-scale fisheries while women play a critical role in the post-harvest sector in fish processing and trade, and in ancillary activities, such as financing;
- 3.1.2.3 Post-harvest processing activities consume and waste large quantities of water; and
- 3.1.2.4 The fisheries sector provides vital benefits to society and is also an important water user.

Climate change presents key challenges for small-scale fisheries and mariculture and is projected to have significant impacts on the lives of people dependent on these activities. Changes in ocean temperature and chemistry are already affecting the distribution and abundance of marine organisms. The precise magnitude of future impacts of climate change on fisheries, in particular small-scale fisheries, are still poorly understood, since they involve numerous interactions with fragile and complex ecosystems that are often already affected by other stressors such as overfishing or pollution⁵⁴. Assessing and managing risks to increase resilience and decrease poverty, inequality, and food insecurity are thus a priority of international cooperation⁵⁵.

3.1.8 Non-Potable Water Generation, Distribution and Re-use

The overall implication of the available body of work suggests that sustainable aquifer yields could decrease by around 50% by 2050. Approximately 57 Mm³/yr is extracted from groundwater resources for domestic potable water distribution and an estimated 11 Mm³/yr is extracted for agricultural irrigation⁵⁶. The exact amount of water extracted by agriculture is much higher as most points of extraction are un-metered private wells. A study on Non-Potable Water Generation, Distribution and Re-use: Analysis of Alternatives, which was published in May 2021. The study identified that wastewater that is not safe for drinking but can be recycled or reclaimed for specific non-potable purposes. The study examined three forms of non-potable water namely; a) stormwater which is water from precipitation such as rain; b) greywater which is wastewater generated in households or office buildings from sinks, showers, baths, washing machines or dishwashers. It is easy to treat and reuse

⁵⁴ Climate change and small-scale fisheries: A climate risk management perspective for the Caribbean 17 December 2021 - <https://reliefweb.int/report/haiti/climate-change-and-small-scale-fisheries-climate-risk-management-perspective-caribbean>

⁵⁵ *Ibid*

⁵⁶ Integrated Sustainability (2021). Feasibility Study See Section 1.1.2

greywater for the purposes of flushing toilets, landscaping, crop irrigation and other non-potable uses; and c) blackwater which is wastewater generated from toilets and contains pathogens such as faeces, urine water and toilet paper from flushed toilets. The paper identified at least three ways to tackle the issue of water scarcity such as; a) increase water rates, to encourage less water wastage; b) offer subsidies to deprived and vulnerable groups of the society; and c) promote collaboration between public and private sectors to develop innovative public-private partnership project models for the generation of water.

It is understood that approximately 8% of the properties in Barbados are connected to a wastewater collection system that directs their sewage to a wastewater treatment plant. This means that approximately 92% of the population, that are not connected, use some form of on-site wastewater disposal and treatment system. Most of these low-income persons comprise of women and vulnerable groups.

It is recognized that the BWA, and the GOB, are currently initiating a project to develop more wastewater collection and treatment systems, especially in Zone A areas that are located over sensitive aquifer and groundwater well abstraction locations. This initiative will most likely positively impact some of the vulnerable communities, including low-income households and women in particular.

Reuse of wastewater produced by the Project should increase the water supply and consequently minimize the negative impact of climate change on women and vulnerable groups with respect to social and economic issues. Therefore, Women and other vulnerable groups stand to benefit from the recycling and reuse of reclaimed water because this will be contributing to a reduction in water scarcity and make more quantities of water available to women as the larger consumers of water domestically.

While the potential benefit to women and vulnerable groups is noted, it is also important to note the financial, informational, and unpaid work barriers that may impede women heads of households and women led enterprises, including those in agriculture from benefiting equally from access to reclaimed water. The 3R-CReWS Project cannot work on the assumption that increased connections automatically translate to increased access. Barriers that impede payment for wastewater services at the domestic level and connection to services that allow for use of reclaimed water for small business, including small farmers is an important consideration in costing wastewater service provision and also in determining the parameters for the RAFF support. Wastewater Strategies, Operational plans and policies must equally consider these barriers to sustained access to services by vulnerable groups.

Although wastewater is not always at the top of the agenda when discussing gender issues, women are more likely to be affected by lack of wastewater treatment, reuse, and poor management than men because they are more in direct contact with food, faeces, childcare, and healthcare.

There are concerns about the amount of pesticide, hormones, medication, and chemicals in wastewater which could seriously affect the health of all genders (Witmer, 2017).

3.1.9 Disaggregated Data for Wastewater

Other gender related issues associated with the wastewater sector are the absence of adequate sex disaggregated data. At both the national and international levels, there is a lack of sex-disaggregated data on water and sanitation. “As early as 1995, the Beijing Declaration called on international organizations, NGOs and the private sector to develop ‘gender-sensitive databases, information and monitoring systems’ on ‘the impact on women of environmental and natural resource degradation, deriving from, inter alia, unsustainable production and consumption patterns, drought, poor quality water, global warming, desertification, sea-level rise [...]’”.⁵⁷ This absence of data results in a gap in service delivery and in ensuring equitable access to water and sanitation services. This gap was demonstrable during the development of this Gender Assessment. Based on roles performed by men and women, and resources accessible to them, the analysis has hypothesized that in the domestic sphere, the availability of affordable reclaimed wastewater can be beneficial for women in their performance of care roles and may lessen the load of their double duty as breadwinners and as carers. The dearth of research and data on the wastewater sector, and more specifically, the absence of sex-disaggregated data, makes it difficult to present strong evidence-based actions.

3.1.10 Social Impact of Upgrading Wastewater Systems

It is recognized that a full ESIA was developed for this Project. As such, this section is meant to highlight some of the high-level issues related to how this Project may impact the public, but further details should be drawn from the full ESIA and ESMP.

SIDS generally lack the capacity to establish and utilize legal and administrative frameworks that define the responsibilities for the various government departments with a mandate to design and execute projects having a need for environmental impact and social assessment. The discharge of primary treated wastewater into the ocean has the potential to cause marine environment and health problems resulting in a negative impact on citizens, tourism, and the economy in Barbados.

Upgrading the wastewater systems also has several positive impacts, such as improved wastewater collection, while higher treatment should result in improved health conditions for the people especially women and other vulnerable groups. Reducing the amount of wastewater discharged into the ocean should also have a positive effect on the marine environment that relates to tourism as the main economic sector. “An increase in potable water security by eliminating potable water demands for applications that can use non-potable reclaimed water, as well as the increased use of reclaimed water would also allow the agricultural industry to be more resilient to the impacts of climate change”⁵⁸.

⁵⁷ United Nations. (1995). Beijing Declaration and Platform for Action. Op. cit. As cited in 3 Oxfam, 2020 Achieving Sustainable Development Goals 5 and 6

⁵⁸ Integrated Solutions, Funding Proposal -3R-CReWs Project, 2021

If energy can be generated from the waste, this helps the country's 2030 renewable energy goals, that should lead to a better quality of life for all citizens of Barbados. Also, if farmers benefit from using reclaimed water, that contains nutrients as fertilizer, for irrigation, then farmers, of all genders, could lower operating costs. Finally, if reclaimed water (from the treatment plants) is used to recharge the aquifer, then this provides more water reliability to all the people in this country - which helps businesses, and residents and tourists. This would provide farmers with a more reliable water source, as the level of water in the wells are often negatively impacted during droughts.

There are many social benefits to be derived from the implementation of this Project including short-term employment during the preparatory and construction phases of the project as part of efforts to upgrade the wastewater systems in Barbados. It will also allow for the integration of gender across all adaptation and mitigation initiatives, build long-term partnerships among stakeholders and improve capacity building and research for informed climate action and training for BWA employees (Tortz et al., 2018). In this regard women stand a great opportunity to be included in the implementation of the project to address issues of concern to them because there are many more men employed in the wastewater sector.

Educating the public on the positive social impacts of this Project is recommended by inviting the public, like schools, to visit the Project and gain first-hand knowledge of the positive activities. Every effort should be made to avoid discrimination on the Project as noted by (Husbands and Dey, 2002). A lack of communication and negative media coverage could affect the outcomes of the project (Husbands and Dey, 2002). One of the prerequisites for the Project success are good appraisal processes in conjunction with management and/or Contractors who possess the necessary motivation.

3.2 Stakeholder Mapping

The BWA Wastewater Division, is the primary authority with the responsibility to provide potable water and manage the collection, treatment, and disposal process of wastewater in Barbados (Isaacs, 2017). The Gender mapping identified individuals or organizations with an interest or concern about the Project. These individuals or organizations, as outlined within the Projects' Stakeholder Engagement report, are categorized as internal and external stakeholders of the Project.

3.2.1 Internal Stakeholders

The internal stakeholders include all persons operating within the BWA, who have a vested interest in the outcome of the Project. They contribute to the internal functions of the authority and affect its overall performance. The key internal stakeholders include the Board of Directors which is responsible for approving the strategic and operational plans, programs, projects along with their budgets, monitor implementation, evaluate, and

approve reports. Other internal stakeholders include the management and support staff of the BWA Wastewater Division which is responsible for developing the annual work plans and budgets, implement approved activities and reporting on progress. The BWA also reports directly to the Ministry of Transport, Works, and Water Resources.

Mapping of the internal stakeholders revealed that there is a gender imbalance in the ten-member Board with eighty percent of directors being men and twenty percent women. Therefore, the Board decisions relating to policy, oversight, and approval of Project plans, budgets and reports are influenced by men more than woman. Similarly, as highlighted in Section 2, there is a gender gap of more men and women performing technical functions at the BWA management level.

3.2.2 External Stakeholders

In Accordance with the Project’s Stakeholder Engagement Plan, the 3R-CReWS Project’s external stakeholders include all persons or organizations with a vested interest in the outcome of the project but operate outside of the BWA. On the one hand, they express opinions on the operations of the BWA and in this way can influence its performance while on the other hand, they can be influenced by the work and the performance of the Authority.

At the national level, decisions relating to wastewater policy and legislation are made by the Parliament and the Executive. Therefore, the mapping of key external stakeholders covered parliamentary representatives, senators, and ministers. Mapping of the external stakeholders revealed that at the national level, there is a 60% gender gap among the 30 parliamentarians, a 14% gender gap among the 21 senators, and a 60% gender gap among the 30 Cabinet Ministers. Although it should be stated that not all ministries have direct influence or involvement over this Project. To see the full list of parliamentarians that are involved in this project (including a measure of their involvement in this Project), refer to Table B in the Stakeholder Engagement report. Consequently, decisions taken by the political directorate and the Cabinet of Ministers involved in this Project are influenced by men.

Table G: below, shows the gender distribution of the members of the Legislature and Executive branches of the Government of Barbados.⁵⁹

Table G. Gender Distribution and Gap of the Barbados Legislature and Executive

Institution	Total	Male	Female
House of Assembly			
Government Parliamentarian	29	23 or 77%	6 or 20%
Opposition Parliamentarian	01	1 or 3%	-
Total	30	24 or 80%	6 or 20%

⁵⁹ <https://www.barbadosparliament.com>

The Senate			
Government Senator	12	7 or 58%	5 or 46%
Independent Senator	7	4 or 57%	3 or 33%
Opposition Senator	2	1 or 5%	1 or 11%
Total	21	12 or 57%	9 or 43%
The Cabinet			
Cabinet Minister*	30	24 or 80%	6 or 20%

*It is noted that Barbados appointed its first female Prime Minister to head the Government in 2018 and was re-elected in 2022.

There are several other important external stakeholder organizations in the public sector, the private sector, and the civil society sector. The country first female Prime Minister was elected to a second term in 2022. Additionally, the country has its second female Governor General. In addition to social assistance, the Government places strong emphasis on facilitating and supporting women entrepreneurship and business development as one way of responding to rising levels of unemployment, retrenchment and to assist with the economy's recovery. Included are incentives for micro and small businesses such as grants, loans, technical assistance.⁶⁰

3.2.3 Stakeholder Feedback

As part of Stakeholder Engagement process, a questionnaire was administered to key stakeholders in Government Ministries, the private sector, community associations, the University of the West Indies Gender Studies Department and NGOs. In total, the survey was sent by email to 49 key stakeholders. With only 24 responding. Table H presents the disaggregated data on a survey among stakeholders to obtain their views on the questions relating to climate change and wastewater collection and treatment in Barbados. A comparison is made regarding the views expressed by men and women to identify similarities or differences between the genders. The acronyms used are shown at the bottom of this table for quick reference.

Table H Results from key Stakeholder Surveys

No.	Questions	Women's Response %		Men's Response %	
Q1	Is your home or business connected to a sewer and waste/water treatment plant?	Y:43	N:57	Y:43	N: 57
Q2	Do the current wastewater collection systems and treatment plants adequately protect the environment?	Y:43	N:57	Y:43	N: 57
Q3	Does the general practice of discharging untreated wastewater to the ground protect the island ground water quality?	Y:29	N:71	Y: 71	N: 29

⁶⁰ 2021 Barbados NDC Update – July 2021

Q4	All homes, offices, businesses and industries should be connected to a sewer and wastewater treatment plant?	Ag:43	D:57	Ag: 86	D:14
Q5	How concerned are you that climate change could reduce the quantity of drinking water available?	VC:85	MC:15	VC:58	MC: 42
Q6	How concerned are you that climate change could reduce the quality of drinking water?	MC:57	NC: 43	VC:57	MC:43
Q7	How concerned are you that climate change could increase the cost of drinking water?	VC: 42	SC:57	VC:86	SC:14
Q8	How concerned are you that climate change could increase the cost of wastewater collection and treatment?	VC: 71	NC:29	VC:43	NC:57
Q9	How concerned are you that decreased drinking water availability could affect Barbados' economy?	MC:86	SC:14	MC:71	SC:29
Q10	How concerned are you that lack of sewage collection and treatment could affect Barbados' economy?	MC:57	SC:43	MC: 71	SC:29
Q11	Do you think wastewater treatment benefits the environment?	AL: 86	MoC:14	AL:71	MOC:29
Q12	How important do you think it is for the government to invest more money to increase water supply?	VI: 85	Y:29	VI:71	Y:29
Q13	How important do you think it is for the government to invest more money to provide wastewater collection and treatment?	VI: 71	Y: 29	VI:71	Y:29
Q14	How concerned are you about using reclaimed treated wastewater to satisfy non potable (eg. Irrigation) water demands?	MC:14	NC:71	MC:29	NC:71
Q15	How concerned are you about using highly treated reclaimed water to recharge groundwater?	HC: 14	NC: 86	HC:14	NC:86
Q16	There are inadequate government standards and regulations in place to safely enable reclaimed water to be used to satisfy non-potable water demands.	Ag: 29	D: 71	Ag: 14	D: 86
Q17	How much in favor are you of implementing treatment technologies to recover water, energy and nutrients for wastewater?	Ag: 71	D:	29	Ag:

Q18	For the following statement please indicate how strongly you agree or disagree with it? (Only BWA customers connected to the sewer should pay for the cost of wastewater collection and treatment)	Ag: 57	D:	43	Ag:
-----	---	--------	----	----	-----

*Acronyms

Y: Yes/ N: No	VC: Very Concerned	SC: Somewhat	NC: Not Concerned	VI: Very Important
Ag. Agree D: Disagree	MC: Much Concerned	MoC: Moderately	HC: Highly	AL: A lot

The survey demonstrated that the opinions of men and women stakeholders who responded varied on the effects of climate change related to the wastewater management system in Barbados. Men and women shared similar views on the numbers and adequacy of sewer connection to treatment plants as a protection to the environment, reduction of quality of water through climate change, economic impact, benefits of wastewater to the environment, government greater investment to increase water supply and treatment, use of reclaimed treated wastewater for irrigation, inadequate government standards and regulations to enable reclaimed water to be used for non-portable water and agreed to recover water, energy and nutrients from wastewater. These views reflect a lack of understanding of the extent of the wastewater problem in the country. This calls for greater public education in this regard.

All respondents expressed concern that climate change would affect the quantity of drinking water with 85% of women and 58% of men rated as very concerned. This is reflective of the statistical data showing that in general, women engage in more water related tasks within the household, such as cooking, cleaning, and washing, and therefore tend to report greater amounts of water usage (Suchorski, 2009). 78.5% of respondents expressed concern that climate change could reduce the quality of drinking water, although the responses show that women are on the two extremes of this response with 57% of women very concerned, while the remaining 43% are not concerned about drinking water quality. At the community level, households are concerned with the impact of water scarcity, including availability of quantity and quality water to households, interruptions in water supply, costs associated with improved wastewater collection systems, and environmental impacts of using wastewater. With the high number of female-led households, and given that women, children and elders are primary users of water, a concerted effort to address these concerns from a gendered and rights-based approach is paramount. Strengthened capacities of BWA technical and administrative staff on application of gender-sensitive/responsive approach to implementation would seek to mitigate the concerns of the primary water users, including other vulnerable groups.

All respondents felt that the impacts of climate change would affect the cost of drinking

water in Barbados with 64% expressing they are very concerned (33% females, 67% males). It is important to note, that of the survey respondents, 43% of females and males respectively, indicated that they are connected to a sewer and/or wastewater collection plant. These, respondents felt that the current system adequately protects the environment and felt that all homes should be connected to a sewer and/or wastewater collection plant. More men than women agreed all homes, offices and businesses should be connected to a sewer treatment plant. However, more women are of the view that only BWA customers connected to sewer should pay for the cost of wastewater collection treatment plant.

Neither men nor women appear to be concerned about using highly treated reclaimed water/wastewater to satisfy non portable water demands like irrigation. The reaction is positive and project strategies can capitalize on this general acceptance to increase connection to waste water treatment systems and eventual non-potable use of reclaimed water.

In summary, there are many issues where both men and women share similar views on wastewater collection and treatment among the stakeholders in Barbados. There are, however, instances where there are differences in the views of men and women, especially in the area of discharging untreated wastewater to the ground. Another area where men appear to differ from women is in the area of willingness to pay for wastewater improvement. Men are seemingly more concerned with paying for wastewater improvement. Women typically need more water during their daily activities and might be willing to pay more to satisfy their needs.

Willingness to Pay

A Limited Willingness to Pay Survey was initiated in 2021 where 75 individuals (19 females, 56 males) participated. All respondents indicated that they were representing households (there were no business responses). The administration of this survey was halted as GOB requested a hold on the process due to unfavourable economic conditions. Trends were examined from this data and are included in the 3R-CReWs Project Feasibility Study. From the information gleaned, the data collected can provide some perspective on the impact of cost and willingness to pay for upgrades to the current system to address gaps in wastewater collection and treatment. 45% of respondents (8:4.75 male to female) provided responses regarding increasing the monthly costs for upgrading the wastewater management system in Barbados including for planning, construction, operation and maintenance. The average cost respondents were willing to pay was BDS \$15.94 monthly. The data showed no glaring differences in women's and men's willingness to pay. A gendered analysis of cost must take account for the wage gap between males and females, especially considering the 8:4.75 male/female ratio in the willingness to pay survey. Similarly, it is important to emphasize that the findings of the willingness to pay survey does not bare statistical significance given its limited number of respondents relative to the population of Barbados. Therefore, strategies to expand connectivity to treatment systems must ensure prior, gender responsive consultations with male and female headed households and must document their views whether divergent or

similar. The UWI IGDS put forward in a KII that the Welfare Department periodically makes provisions to supply water to those who can't afford to pay their water bills. The bills have doubled recently as a levy for wastewater was added now. Management is now included on the water and wastewater bill. It was confirmed that the minimum charge is now (\$37.5) United States dollars per month which includes solid waste.

Consistent with survey issued to key stakeholders, 75% of respondents agreed that Barbados was experiencing a shortage of clean water. While 93% felt that Barbados would benefit from improved wastewater management. UWI-IGDS identified that there are several households that do not have flushable toilets and some people are squatters making sanitation a big issue. There are still several people who use pit latrines.

The UWI-IGDS opined in a KII that using reclaimed water may be difficult for people to accept. It might be a hard sell for many. Recently several blue pipes were replaced by black pipes. Although the use factor was identical a lot of people resisted because they thought the black pipes were giving dirtier water. Interestingly the limited Willingness to Pay survey revealed that 82.8% of respondents agreed that if wastewater was treated to the highest level, it could be distributed in a pipe system for uses other than drinking, including watering household gardens (91%) and household toilet flushing (95%). Of note is that only 46% agreed that this type of water is useful for laundry. There was no noticeable divergence in views of men and women. It remains important however that the project utilized gender sensitive communication campaign to address reservations that men and women may have regarding the use of wastewater for non-potable purposes.

Table I Survey Responses on Awareness of Wastewater System Improvement Needs and Cost

No.	Questions	Responses	Participants %	Gender Renonse
1	Where does wastewater go when it leaves your home?	-Into a septic tank or hole/well (that does not connect to a soak-away field) -Into a septic tank or hole/well that connects to a soak-away field (that soaks into the ground) - Other	37% of 62 =23 21% of 62=13 42% of 62=26	M=13, F=10 M=7, F=6 M=14, F=12
2	How often is water supply interrupted?	-Rarely once or twice for the year -Only a few times per year -Other	38%of60=23 35% of 60=21 27% of 60=16	M=13, F=10 M=12, F=09
3	How satisfied are you with the water flow?	-Satisfied -Neutral/Unsure -Dissatisfied	53% of 58=31 29% of 58=16 18% of 60=11	M=17, F=14 M=09 F=07 M=06
4	Aware of Water conditions	Aware Not aware	66% of 60=38 34% of 60=20	M=21, F=17
5	Water aspects that are very important	-Very important -Not important	93% of 57=53 7% of 57=4	M=29, F=24
6	Average amount from respondents	Willingness to pay \$15.94 Bds monthly Willingness to pay below \$15.94 Bds monthly	100% of 34=34 67% of 34=23	M=19, F=15 M=13,
7	Maximum in additional amount	Willingness to pay above \$15.94 Bds monthly	33% of 34=11	M=06 =05
8	Do you agree/disagree with these statements: -Barbados has a shortage of available clean Water -Discharging wastewater into sea	Average agreed 84 % of total responses Average Neutral 14%, of total responses Average Disagree 2%, of total responses	84% of 56=47 14% of 56=8 2% of 56=2	M=26, F=21 M=04F=0 M=01, F=01

9	Use of treated wastewater for non-drinking purposes Use of wastewater for crops	Approve 82%, of total responses Neutral 11%, of total responses Disapprove 7%, of total responses	82% of 56=46 11% of 56=6 7% of 56=4	M=25, F=21 M=03, F=03 M=02, F=02
---	---	---	---	---

Ability to Pay

Labour force participation is lower among women than men, but similar percentages are classified as unemployed (8%). The difference in labour force participation is accounted for by the consistently higher participation of men in formal employment and of women in the so-called ‘economically inactive’ population⁶¹. The CGA identified the stratification of labour based on sex. Men and women are mostly economically active in distinct work areas, albeit having some areas of congruence. This may account for gender wage gap identified to be 18.9% (average male wage 18.9% higher than average female wage). Men are mostly employed in the areas of construction, mining and quarrying; wholesale and retail; transportation and storage; and public administration and defence. The largest numbers of female employees are in wholesale and retail; accommodation and food services (tourism); health and social work; education; and public administration and defence.

A UN women study (2017) in six Caribbean countries, including Barbados found that in all countries, the rate of employment increases with increasing education. The differences in employment vis a vis educational level was largest for women in St. Lucia and Barbados, where fewer than a fifth of women with primary education are employed as against approximately seven in every ten women with tertiary education. In Barbados only 19% of women and 33% of men respectively with a primary education were employed compared to 69% of women and 72% of men with a tertiary education being employed⁶². The 2017 study revealed a constant pattern across countries is that the employment rate is lower for women than men at each of the three levels of education. The study put forward that “The gender difference in this respect tends to be smaller for those with tertiary education than for those with only primary education. Given that women tend to be more highly educated than men in these six countries, the lower employment rates for women suggest the economy is not taking full advantage of the available human resources. Conversely, many women are not reaping the full potential”.

In addition, studies have identified that poverty is concentrated among households headed by women, which account for 47.5% of all households. The rate of poverty in female-headed households is 19.4%, compared with 11.5% in male-headed households and 15% in all

⁶¹ Country Gender Assessment (CGA) Barbados – Caribbean Development Bank, January 2016

⁶² A Gender Analysis of Labour Force Data and Policy Frameworks in Six CARICOM Member States- STATUS OF WOMEN AND MEN REPORT-PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR All, UNWomen, 2017

households. Poor female-headed households also have the highest dependency ratio, with 74.8% non-earners per household compared with 68.6% in poor male-headed households and 49.9% in the total population⁶³. The UWI-IGDS confirms that single women head 57% of households in Barbados. Among the households, these include migrant women caring for critically ill relatives or those with disabilities⁶⁴.

To this end, strategies for expanding access to sewage treatment systems and associated cost, need not only take into account male and female headed household differences but should also consider the educational level of household heads in determining the ability to pay for services. Consideration of Gender intersectionality in this regard is important and may serve to inform the articulation of national wastewater strategies, legislation and RAFF.

FINDINGS

The Gender Impact Assessment is the third part of the gender analysis process model which involved determining the gendered needs of the wastewater sector and services as well as an assessment of the impacts (main/ancillary), risk perception, and equality of distribution of the Project benefits. Using the GCF's Gender Assessment template, the results of the gender analysis have been organized in a manner to respond to five key questions; What is the context? Who does what? Who has what? Who decides? and Who benefits? Details of responses received are presented under separate headings in the subsections that follow.

4.1 Gender Context

The GOB seeks to develop and implement this climate resilience wastewater systems Project to address several national development challenges facing the country. Some of the factors that are regarded as relevant to the Project include:

- Citizens of Barbados generally experience limited access to the wastewater collection and treatment facilities of the BWA;
- The absence of an approved national gender policy and lack of provisions in wastewater legislation currently in force makes it imperative for the GOB to intensify efforts to create a more enabling legal environment for implementation of the project. Moreover, the project provides an opportunity for update of the wastewater legislation and masterplan in a gender responsive manner that includes meaningful consultation with women and women's representative groups;
- The Project presents an opportunity to expand the availability of sex-disaggregated data for water and sanitation services. The increased availability of data may help

63 Country Gender Assessment (CGA) Barbados – Caribbean Development Bank, January 2016
64 KII- UWI IGDS

close policy and practice gaps in providing equitable access to water services;

- The BWA and other public agencies with mandates to provide wastewater services to citizens are expected to give due consideration to address the social, political, and economic problems that citizens face and to collaborate with each other to resolve them;
- Authorities operating in the wastewater sector, such as the BWA, have a responsibility to consult citizens, as key stakeholders, on issues that affect them to ensure that national wastewater policies are aligned to the UN-SDGs. More, specifically, these institutions are also expected to highlight SDG-5 by adopting appropriate strategies and plans which promotes gender equality in the wastewater sector;
- Given that climate change impacts on the wastewater sector is a serious challenge to national development in Barbados, it is imperative that efforts to improve wastewater management focus on initiatives to achieve more sustainable and equitable services. It is also important for the Project to identify the various causes of vulnerability and take steps to build on the diverse knowledge and capacities within the communities/households that can be used to make wastewater services more resilient to climate-related shocks and risks.;
- Citizens would appreciate if the Project would include governing structures and operating mechanisms to foster gender sensitive stakeholder participation in the design, implementation, and evaluation of the Project. The project should refrain from operating under the assumption that initial connection to wastewater services immediately translates to benefits for more women than men. It is important to consider sustainability of access by reviewing wastewater costing structure and incentive programmes.
- Stakeholders should also be offered opportunities to better understanding the gender roles and power relations among different men and women involved the Project. An examination of the different roles, rights, needs, and opportunities of men and women, boys, and girls will help provide guidance on measures required to promote the gender equality using relevant gender entry points, policies, and identify opportunities for enhancing gender equality within the project
- Barbados has made recognizable Human Development gains and has made improvements in legislation that tend to gender equality. However, there remains inequities. Linked to those, is the unequal power relationships often detrimental to the promotion and protection of women and girls. The prevalence of SGBV, though higher in intimate partner relationships is still present outside of the private sphere. Therefore, projects such as these need to promote a preventative approach to SGBV. This includes zero tolerance policy and code of conduct for project staff and staff interacting with communities. In addition, there has to be gender responsive complaint

mechanisms that prove useful for victims of SGBV, if prevention is not achieved. Gender sensitivity training is useful as well in addressing SGBV risks, however these are to be made mandatory to staff based on roles and functions.

- As an employer, the BWA should also seek to provide a non-discriminatory working environment that facilitates gender-balance in appointments and gender sensitivity in the decisions and actions of the project staff. The BWA also seeks to offer a safe working environment for its managerial, technical, and administrative staff and those assigned to the Project; and
- The project provides key stakeholders with a unique opportunity to undertake a stakeholder review of the existing policy and legal instruments as well as the main institutions making up the operating environment. It also allows the opportunity to strengthen policies related to gender equality and update and enact wastewater legislation and introduce regulations to guide the decisions and actions of staff within the BWA, the Wastewater Division, and the Project.
- During the Project implementation, it recommended that the GOB take steps to create an enabling legal environment by providing appropriate policy, legislative and institutional support where needed. The primary legislation that governs the operations of the BWA, is the BWA Act, of October 1980, Cap. 274a LRO, 1985. The Act is supported by the BWA (Sewerage Regulations), 1980, (S.I. No. 151 of 1980), and the BWA (Validation of Water and Sewerage Rates) Act, 2009.
- It is noted that some of these legal instruments are outdated because they have been in force for over forty years and as such, they are likely to limit the ability of the BWA to upgrade its systems and operations and do not necessarily reflect the needs of the wastewater sector and the Project at this time. Efforts by the relevant Ministries and Bureau of Gender Affairs of the GOB to advance gender equity and equality are commendable but more is still needed to be done.
- The BWA, and the Ministry of Transport, Works and Water Resources, should encourage the GOB, through the Ministry of Legal Affairs, the Bureau of Gender Affairs and the Department of Labour, to undertake a comprehensive review of the legal instruments and take steps to strengthen provisions for gender equity and equality. These Ministers should table an updated wastewater legislation that is gender sensitive in Parliament for enactment and should introduce updated supporting regulations as required.

4.2 Gender Roles

- With regards to the division of labour between men, women, there are more men than women employed in the technical professions (Allen et.al., 2016). In the case of the technical professions, this pattern is also reflected in the wastewater sector as a January 2021 staff survey indicates that the staff complement of the Wastewater Division is currently made up of 83% men and 17 % women.

- Currently, the BWA has more men involved in the technical aspects of the Wastewater Division management role, while women serve in more administrative capacities. It is therefore important for the BWA to conduct a gender needs assessment of its wastewater services team and adopt an employment promotion strategy to bring about a more gender balance among BWA wastewater employees;
- Generally, there appears to be more women employed in the informal economy as vendors, speculators, janitors, baby-sitters, shop operators and in the service industry and professions such as nursing and teaching. In the labour force, there are more men employed in the formal economy while conversely more women are in the ‘economically inactive’ population which is classified as the informal economy. Women are typically selected to care for children and the elderly. Among the elderly, men are more likely to live alone than women.⁶⁵.
- In general, more men are employed in the formal economy as information technologists, technicians, professionals such as engineers and occupy top managers or chief executive. Most of these jobs require long hours of specialized training, they are also more competitive, require high level of knowledge and skills and they are generally more secured and are high paying jobs. Given the technical nature of this wastewater Project, it is expected that it will attract more men than women. While the BWA’s gender sensitivity training for its employees in collaboration with the UWI-IDGS is commendable, there are more steps required to increase participation of underrepresented groups in technical fields and in leadership positions at the BWA. Trainings are voluntary and may not be as impactful in ensuring transformational change if intended recipients do not participate. The BWA making trainings mandatory for certain staff, such as those in HR and even for members of Management, will go further to ensuring that cultural challenges to gender equality are addressed. Additionally, if the BWA acts as a champion for women in STEM, this may influence female youth, who have not selected career paths, to view STEM as a viable career option for them.
- There are more men involved in providing wastewater services and importantly in waste water decision making. On the other hand, women are the dominant users of water in the Domestic Sphere. Improved wastewater services, resulting from this Project, should result in more women having access to water to carry out daily chores efficiently and effectively. However, how provision of services is rolled out and the cost of services may be impacted by who makes decisions. Therefore, it is important for the BWA to ensure that women are consulted and provided opportunities for sustained access to water. Also important is that at the Project Board level, women and women’s representatives should have equal participation in determining how the benefits of the project are ascribed.

⁶⁵ Allen, C. F & Maughan, J. & Baksh, J & Associates, January (2016). Gender Situation in Barbados CDB Country Assessment (CGA)

- With respect to household management, most poor households are headed by women, and therefore women stand to benefit from any treatment in wastewater and increase in the quantities of non-potable water, if it is within their ability to pay for it. Women are usually the ones who spend longer hours doing unpaid domestic work such as cooking, gardening, collecting, and storing water for domestic use, caring for children and the elderly, and the animals.⁶⁶

4.3 Resources

- Despite the general acceptance of the principle of comparable worth, more men than women are likely to be employed in positions related to finance, technology, information services, and the legislature, management, and technical professions⁶⁷. Consequently, more men than women are likely to have greater control over and benefit from resources. There are some women whose economic status also improve because they gain access to resources through marriage, common law relationships and inheritance.

- The CGA identifies that the majority of self-employed persons, employers and owners/managers of businesses are men. Research from the University of the West Indies (UWI) as cited by the CGA, revealed the following difficulties for women's entrepreneurship and ownership:
 1. Lack of access to credit, especially because of lack of collateral to secure loans;
 2. Weaker professional networks than men;
 3. Lack of knowledge about procedures for incorporation, registration and the taxation system;
 4. Care roles

- The inability to produce job letters is also a greater barrier to access to finance for women than for men as women have lower levels of employment in the formal sector. The CGA posits that the formality of credit institutions and a history of discrimination may make women, specifically socio-economically deprived women feel uncomfortable to access services⁶⁸. Risk taking aversion may compound vulnerable women's comfort in accessing services that are necessary to acquire resources such as land or for enterprise start up or expansion.

- Barbados has universal access to primary and secondary education such that 90.6%

⁶⁶ Bobb, D., (2019), Understanding Unequal Relations of Gender in the Caribbean, Wendy Water Woes: A Barbados Case Study, UWI-IGDS, BWA, GCF, CCCCC.

⁶⁷ Allen, C. F & Maughan, J. & Baksh, J & Associates, January (2016). Gender Situation in Barbados CDB Country Assessment (CGA)

⁶⁸ CGA Barbados, 2016

of attendees' complete tertiary education while 93.4% complete primary education. As well, more young women 40 years and below, have completed university education and 50% of immigrants as against 30% locals have university education (Beuermann, 2017). While education is accessible to both women and men, in recent years, more women tend to pursue higher education continuously for a longer period through distance learning to help them secure better paying jobs. The UN Women's gender analysis on employment trends in six Caribbean countries identified that women need to have higher educational levels than men if they want earnings at the same level as those of men. Students who stay longer in the education system are likely to begin doing economic work later, however, once employed the nature of the jobs secured ensures increased earning potential.

- Conversely, data shows that more men than women enrol for technical programmes than women. Trotz and Issacs (2017) posits that low enrolment of women in technical programmes can be linked to gender norms, roles and perceptions that act as a barrier for women's greater participation in these fields. "Water and wastewater treatment usually fall under the field of Civil and Environmental Engineering. In the Caribbean, the main training institutions with this program are the University of the West Indies St. Augustine Campus in Trinidad and Tobago, the University of Technology in Jamaica, and the University of Guyana. The percentages of females have remained constant over nearly a decade with ~30% and ~45% enrollment between 2006 and 2014 for undergraduate and graduate engineering programs. This is significantly different from the overall UWI enrollment which showed the proportion of females to males was 68.5% to 31.5% for total University enrolment, with the St Augustine campus having 63% female enrolment for 2013/2014"⁶⁹.
- There are Policies and laws that provide for equal access for women and men to land holdings and tenure in Barbados. These have been in place since 1968⁷⁰. "The Town and Country Planning Act (1968) (Amended 2003) provides for land and water rights and legal security of tenure for all individuals irrespective of gender"⁷¹. However, available evidence according the Country Gender Assessment suggests that men own the bulk of land and other productive resources.
- The fact that men predominantly own land is much linked to the fact that the majority of large agricultural land holdings are male owned and therefore men are predominantly large-scale farmers, while women farm at a smaller scale and for subsistence. Mechanisms used to target farmers for information sharing about the use of reclaimed water needs to take this into consideration. Similarly, efforts at engaging the private sector as partners and as potential beneficiaries of RAFF resources similarly need to consider the needs of small-scale farmers. This has bearing of livelihood and

⁶⁹ <https://www.greenclimate.fund/document/gender-assessment-fp060-water-sector-resilience-nexus-sustainability-barbados-wsrn-s>

⁷⁰ CGA Barbados, 2016

⁷¹ *ibid*

food security for vulnerable populations.

- Access to monetized resources has impact on this project since the persons with more financial resources are better able to pay for wastewater services⁷². Therefore, it is reasonable to advance that more men than women will be able to afford water and wastewater services⁷³. Men also tend to have greater access to technical knowledge and skills upgrading in wastewater because there are fewer women employed in the sector. Incentives for development of domestic reuse and reclaimed water systems may benefit more men as a result.

4.4 Decision Making

There are several levels of decision making associated with the implementation of this 3R-CReWS Project. Brief discussions on the different categories of decision makers and the type of project decisions they are required to make follows.

- Parliamentarians as policymakers decide on the laws that influence gender equality practices in Barbados. At present, parliament has 20% female and 80% male representation with a first woman Prime Minister and a first woman Senate President. In the twenty-six members Cabinet of Ministers, 73% of them are men and 27% are women including the Prime Minister. Since there are more men than women in Parliament, most of the decisions taken are likely to reflect the thinking of men. In the absence of gender sensitivity training, male parliamentarians are slow to recognize the need and urgency of making provisions for gender equality in legislation;
- Cabinet ministers make public policy decisions to address issues relating to gender equality and wastewater infrastructure and services. They may encourage men and women as key stakeholders in the wastewater sector to participate in formulating wastewater or gender policies in so far as these will affect them;
- The current ten member BWA Board, which was appointed in 2018 for a three-year term, comprise 7 men or directors and 3 women directors. With the current gender imbalance, the Board decisions will be influenced by the male directors. Women and girls are key water and sanitation stakeholders, but this has not translated to practice within the sector in Barbados. Of the fifty-eight staff attached to the Wastewater Division 49 (or 84%) of them are men while only 9 (or 16%) are women. Similarly, with the gender imbalance, support level decisions will also be influenced by the male staff;
- In the households, men normally make most of the decisions as the bigger contributor to the household income. Although women have made strides through education and in gaining paid employment in management and supervisory levels in the public and

⁷² Ibid.

⁷³ Ibid

private sector, they are relied upon in doing most of the domestic work and making decisions in the household. However, like much of the English-Speaking Caribbean, there is a substantial number of single female heads of households. Therefore, consultation processes need to be mindful that stakeholder engagement activities reach and document needs and decisions of these households.

4.5 Beneficiaries

- The Project across all its components targets 136,220 people in Barbados. Appendix 22b of the Funding proposal breaks down the project beneficiaries and identifies that 66,748 (49%) men and 69,472 (51%) women are likely to be direct beneficiaries from the implementation of this Project because those who stand to benefit directly include users of water wastewater services, which include the entire country. There is a similar distribution of indirect beneficiaries Important to note is that this is reflective of the overall population of Barbados. A more detailed look at the beneficiaries of the Project by component suggest that the project is taking an approach of leave no one behind. More specifically, the Project positions that 100% of female headed households and 100% of male headed householder respectively will benefit from the installation of decentralized wastewater management systems in zone A. It is however important to identify the recurrent costs that are associated with the connection to improved wastewater services. Given that women do most of the domestic and care work, they are greater users of water and wastewater services and will benefit more than men from the implementation of the project at the domestic level. On the other hand, a key beneficiary group identified by the Project are farmers, in this regard, there will be higher numbers of male beneficiaries than male beneficiaries given the share participation of male to female in Agriculture. The Tariff structure for water used for irrigation should be mindful of the often-small scale agricultural activities performed by women vis-a vis larger commercialised agriculture often headed by men. Important is that the Project works along with the Association of Women in Agriculture to ensure that women farmers (including for subsistence) receive information on the benefits of the used of reclaimed water and are also supported with access to reclaimed water services and other by-products of treated waste water.
- The GOB will also benefit directly from the project because it will bring about long-term savings in energy cost (through the implementation of a possible related biogas facility) and would be able to take credit for improving the lives of citizens. Though not a direct benefit, savings may translate to improvement of services for customers of the BWA.
- As the people/customers connected to the BWA wastewater collection system benefit from the improved quality of wastewater services delivered to them, so should the BWA, considering they will have a more satisfied customer base. This should also lead to more customers paying their utility bills consistently. The BWA Wastewater Division should also handle fewer breakdowns in the infrastructure (if the

recommendations for an improved operation and maintenance programme that involves a more proactive approach is initiated, as outlined in the Conceptual Design report) and should receive fewer complaints from customers.

- Several institutions from public, private, and civil society sectors, such as the Bureau of Gender Affairs, the Office of Poverty Alleviation, the UWI-IGDS, the Barbados Union of Teachers Union, and the Barbados National Women’s Organization, with mandates to address gender-equality issues should benefit indirectly from implementation of this Project. These institutions will benefit from participation in stakeholder consultations, information sharing, improved wastewater services and greater organizational productivity. Conversely the Project should facilitate the advancement of the mandates of these institutions by ensuring their input into project activities for the benefit of vulnerable groups, including women.

MAINSTREAMING GENDER INTO THE PROJECT CYCLE

In keeping with the requirements of the Gender Analysis Process Model, part four will focus on mainstreaming gender into this Project cycle and giving a gender perspective to the activities highlighted at the initiation, formulation, implementation, monitoring and evaluation and closure stages of the project. This exercise entails clarifying the Project goals and activities planned to be implemented at the different stages of the project, examining the level of access/control that women, men and LGBTQIA persons have over Project resources, examining the distribution of Project benefits to ensure that is equity and equality among women, men and LGBTQIA persons, and their level of participation in making important Project decisions.

5.1 Project Initiation Stage

- At the initiation stage, the focus of mainstreaming gender in this Project cycle is to clarify the main goals, assumptions, priorities, roles and responsibilities, schedule, deadlines, and risks of the Project. This should make sure that the Project team has made every effort to review and revise where necessary, the stakeholder engagement plan for the project to ensure that key stakeholders, including representative groups of vulnerable people, and women are engaged on wastewater services and gender equality issues.
- In terms of priorities, it is noted that the Project comprises of several components, as outlined in the Logical Framework. With respect to the Project governance function, the BWA should pay attention to the establishment of a PSC that is gender-balanced and the appointment of members to it who are gender sensitive. Similarly, the BWA should apply the principles of gender-balance and gender sensitivity when considering appointments to the positions of Project Manager and technical/administrative support staff.

5.2 Implementation Stage

Project management should entail executing activities in accordance with the Project Planning Frameworks. The implementation of the actions in the Gender Actions of the projects are to be systematically mainstreamed into project activities to ensure meaningful implementation. This stage also requires the Project Manager to hold status review meetings to ensure that the Project is on schedule, and to document all changes to the Project plan. It is also significant to undertake Project research to gather empirical data for the purpose of making evidence-based decisions on matters relating to planning, budgeting, staffing, and coordinating the implementation of Project activities. Additionally, empirical data also provides the basis to evaluate the gender sensitivity practices of Project officials and advocating for changes in gender equality policies and laws.

The 3R-CReWS Project has by design set the foundation for implementation of gender responsive actions and ultimately gender mainstreaming. Gender Considerations are mainstreamed across all four components of the project, but are more strongly visible in Components 1, 3 and 4. These considerations have informed the Gender Action Plan (Appendix 3).

The Project’s proposal puts forward that “the intended impact of the gender mainstreaming action plan is to (i) increase the participation of women and LGBTQIA persons in decision making and raise the awareness of men, women and vulnerable LGBTQIA communities on gender issues to minimize discrimination against vulnerable groups including LBTQIA; and (ii) improve the quality of life for vulnerable residents, especially women, and children of Barbados in the areas of health, agriculture, and employment”.

The following outputs and activities have been included in the project to advance these gender mainstreaming goals⁷⁴:

Output 1.4: Decentralized treatment plants or cluster treatment facilities installed

Activity 1.4.1: Construct two small (cluster) decentralized wastewater collection and treatment demonstration systems in Zone A locations to produce reuse quality water for domestic/commercial non-potable water applications. This activity will ensure that consultative processes capture the views of both male and female headed households in a manner that informs the roll out and connection of services to these two communities. Mixed methods of engagement will be employed, including focused conversations with women’s groups and female farmers. Additionally, in the implementation of this activity the project will ensure that communities are protected from sexual and gender-based violence and gender-based discrimination. The Project will therefore set up mechanisms to capture community concerns in a gender sensitive manner and that will prohibit exploitative, abusive and harassing conduct by workers of the BWA, contractors and subcontractors. Under this activity, the project will ensure that a code of conduct that includes prohibitions for SEAH and SGBV is developed. This will apply to design consultants’ staff, BWA staff, as well as contractors and their staff. Under this activity, there is opportunity to open spaces for female employment in traditionally underrepresented areas. The Project should ensure therefore, that hiring practices in decentralized treatment facilities include non-discriminatory actions and promotes female employment.

Output 3.1: Improved capabilities of water technical personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management

Activity 3.1.1: Develop and provide specialized and customized training to support the

⁷⁴ Sourced Directly from Project Funding Proposal

operations and maintenance of wastewater collection and treatment facilities including photovoltaic equipment. This activity will include gender sensitivity and climate change training for BWA employees and private sector

Activity 3.1.2: Update Standard Operating Procedures (SOP) and Operational Manual that addresses the requirements of the upgrades, preventative maintenance, operator safety, and environmental monitoring, including risks posed by climate change and gender and social inclusion considerations.

Output 4.1: Governance and planning roadmaps enhanced to enable use of reclaimed water in a controlled and regulated manner.

Activity 4.1.1: Undertake a legislative review to promote the Planning and Development Act, Wastewater Reuse Bill and other related legislations for enhancing wastewater effluent quality, treatment options and re-use requirements and applications. The review will also include recommendations for strengthening - private sector engagement, public-private partnerships, building codes, resiliency to climate change and equal opportunities and access to males and females.

Activity 4.1.2: Develop a water and sanitation master plan that includes an optimal combination of decentralized, cluster and centralized water reclamation and reuse applications, with the centralized reclaimed water being transmitted and used for agricultural irrigation and/or industrial use (such as lower cost of reclaimed water transmission). This strategy will also take into consideration the social, gender-related and climate risks in the design and prioritization of water reuse strategies.

Output 4.2: Mechanisms developed/expanded to encourage the adoption of wastewater treatment and reuse applications by private individuals and businesses.

Activity 4.2.1: Develop a strategy and action plan to engage the private sector in the provision and adoption of wastewater treatment technology and the utilization of wastewater by-products such as activated sludge. This includes conducting an assessment to identify opportunities for public-private partnership in the water and wastewater sector, especially for the expansion of the decentralized onsite cluster wastewater systems. The strategy will also promote gender equality and women empowerment

Activity 4.2.2: Undertake a review and identify recommendations for a gender sensitive and socially inclusive incentive programme to encourage conservation, recycle, re-use.

Activity 4.2.3: Expand the Revolving Adaptation Fund Facility (RAFF) to provide resources for the adoption of decentralized onsite wastewater systems. The management of the expanded RAFF will ensure to promote gender equality and social inclusion as a requirement.

Output 4.3: Gender Sensitive Public Education and Awareness Campaign Implemented.

Activity 4.3.2: Develop and implement a Gender Sensitive Public Awareness Campaign

for community and visitors (tourists) through workshops, videos, community town hall meetings, site tours (demonstration of the plant technology and by-product reuse) and consultations. Consultations will include, but will not be limited to representative groups of vulnerable communities, including with the Association of Women in Agriculture.

Activity 4.3.3: Develop a 3R-CReWS Project Web Page and social media accounts, which is dedicated to transparent measures of reporting, knowledge products, identify/host a link to the Redress Mechanism and provide update to all stakeholders on the project activities. This page will include, to the best extent possible, functions such as audio, sub-titles and/or sign language to encourage social inclusion from disabled population. The project's webpage will also ensure to report project results disaggregated by gender, where possible.

The Project's Implementation arrangements will promote gender mainstreaming in the management and governance structures.

In addition to the gender sensitive results and activities flagged above, the following implementation strategies will be utilized by the project implementation unit to further strengthen gender considerations in the day-to-day operations of the project:

1. There will be gender sensitive stakeholder consultations throughout the lifetime of the project that will aim to engage women's groups and other vulnerable groupings (all Components)
2. CCCCC Procurement policies, which promote adherence to the Centre' Gender Policy and Action Plan
3. Monitoring of indicators will disaggregate information by sex, where possible
4. The AE's gender specialist will be available to provide technical advice and quality control for the mainstreaming of gender in the results and activities identified above, as well as to support the analysis of the sex disaggregated monitoring and evaluation information collected routinely to inform planning and decision making on gender mainstreaming, including the early identification of possible unplanned negative gender issues emerging because of the project's activities.
5. The Project PSC will strive to ensure gender balance and will include a representative from the Barbados Bureau of Gender Affairs. The Project Manager will present to the PSC a report on the Project's Gender Action Plan annually.
6. All members of the Project Management Team will receive gender sensitivity training at the inception of the project and thereafter mandatorily participate in Gender Sensitivity training sessions.

Table J Gender Implications of Project Component Activities

Components and Outputs	Activities	Gender Considerations
<p>Component 1: Wastewater Reclamation and Reuse</p> <p>Outcome 1: To enhance availability, management and use of tertiary level reclaimed water to improve the water sector’s resilience to climate change. The BSTP will be upgraded from a CAS to a CAS-4Stage Bardenpho system and 2 onsite decentralized treatment plants (cluster) will be installed in 2 communities in Zone A locations to produce a high-quality effluent that is biologically and chemically safe. The effluent from the upgraded plants will be utilized for non-potable water applications including irrigation and aquifer recharge. This is expected to reduce the extraction of groundwater leading to reduced aquifer saltwater intrusion, and increased availability of groundwater during dry periods.</p>		<ul style="list-style-type: none"> - This will enhance the capacity of persons who are the greatest victims of climate change. Many more women stand to benefit from any increased resilience of infrastructure in the wastewater sector.
<p>Output 1.1: The Bridgetown Sewage Treatment Plant is upgraded to treat wastewater to a tertiary water-quality standard.</p>	<p>Activity 1.1.1: Design, procure and convert/upgrade the existing conventional activated sludge (CAS) biological treatment process at the Bridgetown Sewage Treatment Plant to tertiary filtration and disinfection for achieving national reclaimed water-quality standards.</p>	<ul style="list-style-type: none"> - Efforts to reduce energy cost and conserve wastewater treatment capacity for sanitary sewage will enhance the conditions of vulnerable persons particularly households headed by women and those in poverty. This is best done by ensuring that these persons are engaged and that costing structure allows for continued access to services by vulnerable people.
<p>Output 1.2: Tertiary treated reclaimed water is available to supplement non-potable use</p>	<p>Activity 1.2.1: Install reverse osmosis (RO) membrane filtration systems to reduce the total dissolved solids concentration of the reclaimed water produced at the BSTP</p> <p>Activity 1.2.2: Install a 9Km pipeline and 6 aquifer recharge wells (injection wells) going from the BSTP for irrigation and aquifer recharge.</p>	<ul style="list-style-type: none"> - Ensure that a code of conduct that includes prohibitions for SEAH and SGBV is developed. This will apply to design consultants’ staff, BWA staff, as well as contractors and their staff. - Ensure that hiring practices in decentralized treatment facilities include non-discriminatory actions and promotes female employment. - Ensure that small farmers and female farmers have equitable access to water for irrigation and are informed of opportunities for access. - Ensure that 2 communities in zone A are consulted appropriately and that they are aware of redress options if affected by the project.
<p>Output 1.3: Decision-support tools and</p>	<p>Activity 1.3.1: Implement a sewer monitoring programme that will include the installation of</p>	<ul style="list-style-type: none"> - This includes redress options for victims of SGBV.

Components and Outputs	Activities	Gender Considerations
<p>infrastructure implemented to mitigate potential climate change risks to the wastewater collection and treatment systems</p>	<p>flow measurement and rain-gauging equipment at the BSTP to identify and address sources of inflow and infiltration to the sewer. Mechanisms that identify and reduce or mitigate vulnerabilities in the wastewater collection systems will also be investigated.</p> <p>Activity 1.3.2: Establish on-site laboratory facilities and personnel at the BSTP to generate influent and effluent water quality data to inform operations control strategies that optimize operations and reduce energy consumption and GHG emissions.</p> <p>Activity 1.3.3: Implement a Computerized Real-time Management System (CMMS) at the BSTP to inform decision making and climate resilient building</p>	<ul style="list-style-type: none"> - Vulnerable women and girls in communities where decentralization plants are to be installed should be protected from exploitation and violence. - The low-income sector of the population stands to benefit from the major outcomes of the project, and this will improve their quality of live and bridging the gap between high and low-income earners. Many women living in poverty will benefit the most. This is done where costs are kept minimal to ensure continued access to service. - This will contribute to improvements in the quality of life for women and other vulnerable persons. - Women play a critical role in climate activities and additional knowledge and skills in this area will minimize risks in response to adverse effects of climate change. - A reduction in energy requirements will be of great benefit to women who form the larger percentage of persons living in poverty. - A saving for men who are heads of their households.
<p>Output 1.4: Decentralized treatment systems or cluster treatment systems installed</p>	<p>Activity 1.4.1: Construct two small (cluster) decentralized wastewater collection and treatment demonstration systems in Zone A locations to produce reuse quality water for domestic/commercial non-potable water applications.</p>	<ul style="list-style-type: none"> - Any increase in the water supply will enhance the quality of life for more women in their domestic and care roles. - Women spend a great deal of their time fetching water for domestic use and use large quantities in the field of work. - Ensure increased participation of women in the production and use of reclaimed water, Women should benefit from any improvement in the efforts by BWA to collect and measure wastewater influent and effluent water samples to implement control strategies as these efforts could improve the quality of wastewater service - Women have been experiencing great challenges to maintain a clean environment in the home and the workplace. An improvement in the quality of life and reduce time lost to collect and store water for use. - Drought conditions resulting from climate change are likely to cause serious water shortages in Barbados which can pose great

Components and Outputs	Activities	Gender Considerations
		challenges for women who are primarily care givers for children and the elderly.
<p>Component 2: Renewable Energy and Energy Efficiency in Wastewater Treatment</p> <p>Outcome 2: Climate resilient low carbon operations achieved at BSTP. This will be realized by: 1) installing grid-tied Photovoltaic (PV) Renewable Energy Systems to offset increased power consumption associated with the centralized treatment plant process upgrades using Category 3 hurricane resistant solar panels; 2) implementing automated controls and energy efficiency measured within the upgraded centralized treatment processes to reduce the overall energy footprint and reduce GHG emissions; and 3) installing sludge dewatering equipment to improve energy efficiency and reduce the overall GHG and CO2 emissions associated with the biosolids.</p>		<ul style="list-style-type: none"> - Women are very vulnerable in the time of disaster. However, any effort to reduce exposure to climate risk to allow speedier adaptation by victims. - Regular power outages could disrupt water supplies at critical moments which could negatively affect the quality of life for women consumers who rely on the service for sanitation and consumption. - Potential lowered energy requirements, that could result in lower customer fees, will be of great benefits to persons who have challenges with paying utility bills. Even if utility fees are not lowered for most customers, considerations should be made to lower utility costs to vulnerable communities. Lower operational costs for the BWA, through means such as biogas and more solar, will certainly provide service to accelerate recovery from these disasters.
<p>Output 2.1: Energy efficiency and renewable energy technologies are implemented</p>	<p>Activity 2.1.1: Install a grid-tied Photovoltaic (PV) Renewable Energy Systems to offset increased power consumption associated with the centralized treatment plant process upgrades using Category 3 hurricane resistant solar panels</p> <p>Activity 2.1.2: Implement automated controls and energy efficiency measures within the upgraded centralized treatment processes to reduce the overall energy footprint and reduce GHG emissions.</p> <p>Activity 2.1.3: Install sludge dewatering equipment to improve energy efficiency and</p>	<ul style="list-style-type: none"> - An increase in water supply will improve productivity in agriculture by having access to adequate water for irrigation. - Preventing the contamination of ground water will make it possible to increase the supply of water and generate economic activities among the more vulnerable persons like women headed poor households. - Energy efficiency if translated to cost savings may have positive impacts on the cost of wastewater and water service provision, therefore having positive benefits for poor households (the majority of which are female headed)

Components and Outputs	Activities	Gender Considerations
	reduce the overall GHG and CO2 emissions associated with the biosolids.	
<p>Component 3: Capabilities to operate, maintain, expand and monitor wastewater and related renewable energy technologies</p> <p>Outcome 3: Enhanced capacity and capability to support the preventative maintenance and climate resiliency programmes.</p>		<ul style="list-style-type: none"> - Increases in women’s participation in the sector at technical levels and managerial levels may help advance policy options that are more favorable to vulnerable households and small enterprises
<p>Output 3.1: Improved capabilities of wastewater technical personnel to operate, maintain and monitor and implement climate change adaptation planning strategies for wastewater management</p>	<p>Activity 3.1.1: Develop and provide specialized and customized training to support the operations and maintenance of wastewater collection and treatment facilities including photovoltaic equipment</p> <p>Activity 3.1.2: Update Standard Operating Procedures (SOP) and Operational Manual that addresses the requirements of the upgrades, preventative maintenance, operator safety, and environmental monitoring, including risks posed by climate change and gender and social inclusion considerations.</p> <p>Activity 3.1.3: Develop and implement a risk management framework to support the sustainable management of BWA’s operations.</p>	<ul style="list-style-type: none"> - Develop a specialised Women in STEM Internship programme relative to the 3R-CReWS Project. - SOPs should ensure that it is reflective of the needs of vulnerable people and underrepresented groups within and outside of the BWA. - Strategic engagement with community groups, including women’s groups and LGBTQIA groups to ensure that Strategic and Operational plans consider the needs of women and vulnerable groups a gender-responsive approach and that there is community-wide buy-in. - The low energy requirements will be of great benefits to persons who have challenges with paying utility bills. - Risk management framework for the BWA should include risks of gender-based violence, as well as other social and gender related risks. - Women should be exposed to the benefits to be derived by the initiatives in the wastewater so they can have a greater awareness and appreciation of this project. - There will be the need for greater involvement of women in the wastewater for them to make meaningful contributions and help expedite the process by lobbying for changes in the sector. - Where possible, the Project will aim for parity in the number of individuals trained, nevertheless, women will be strongly encouraged to participate in the technical training programs thereby addressing the decision-making gap for women in technical thematic areas.

Components and Outputs	Activities	Gender Considerations
		<ul style="list-style-type: none"> - The education materials should be designed with gender sensitivity in mind so all persons will be made aware of the groups which should be given priority. - The staff in the sector should be trained with a focus on gender equality to minimize the level of resistance that could hamper the progress of the project. - those directly affected. - The Wastewater sector will need to continue its gender sensitivity training to ensure that there is gender balance in the content and application of the policies and legislation. - Efforts should be made to secure the financial and human resource with gender balance as part of its focus to enhance the skills of technical professionals in combating climate change. - Data collection should be disaggregated for easy access and use in ongoing works in the project.
<p>Output 3.2: A strategic plan is developed to guide the replication of water treatment facilities along the west coast</p>	<p>Activity 3.2.1: Investigate and develop a strategic plan for the installation of water treatment facilities along the west coast corridor for augmenting water supply and protecting the west coast ecosystem.</p>	<ul style="list-style-type: none"> - Develop a specialised Women in STEM Internship programme relative to the 3R-CReWS Project. - SOPs should ensure that it is reflective of the needs of vulnerable people and underrepresented groups within and outside of the BWA. - Strategic engagement with community groups, including women's groups and LGBTQIA groups to ensure that Strategic and Operational plans consider the needs of women and vulnerable groups a gender-responsive approach and that there is community-wide buy-in. - The low energy requirements will be of great benefits to persons who have challenges with paying utility bills. - Risk management framework for the BWA should include risks of gender-based violence, as well as other social and gender related risks.

Components and Outputs	Activities	Gender Considerations
		<ul style="list-style-type: none"> - Women should be exposed to the benefits to be derived by the initiatives in the wastewater so they can have a greater awareness and appreciation of this project. - There will be the need for greater involvement of women in the wastewater for them to make meaningful contributions and help expedite the process by lobbying for changes in the sector. - Where possible, the Project will aim for parity in the number of individuals trained, nevertheless, women will be strongly encouraged to participate in the technical training programs thereby addressing the decision-making gap for women in technical thematic areas. - The education materials should be designed with gender sensitivity in mind so all persons will be made aware of the groups which should be given priority. - The staff in the sector should be trained with a focus on gender equality to minimize the level of resistance that could hamper the progress of the project. - those directly affected. - The Wastewater sector will need to continue its gender sensitivity training to ensure that there is gender balance in the content and application of the policies and legislation. - Efforts should be made to secure the financial and human resource with gender balance as part of its focus to enhance the skills of technical professionals in combating climate change. <p>Data collection should be disaggregated for easy access and use in ongoing works in the project.</p>
<p>Component 4: Capacities (regulatory, governance, awareness), buy-in and ownership within the private and public sectors are improved for climate resilient development planning for the water sector.</p> <p>Outcome 4: An enabling environment is created for wastewater technologies and use of reclaimed water. The enabling environment speaks to the legislation, organizational structures and competency and</p>		<p>Enabling Environment:</p> <ul style="list-style-type: none"> - The absence of legislation that make provision for standards to regulate the discharge of effluent in marine water poses a health risk for women who are the ones most likely to care for the sick.

Components and Outputs	Activities	Gender Considerations
	<p>strategies that need to be put in place. Achieving this outcome will significantly change the culture of the water sector in Barbados, building a level of partnership and professionalism that is needed to continually innovate and adapt to climate change, which in turn promotes sustainability for this project.</p>	<ul style="list-style-type: none"> - It also creates a unique opportunity for the GOB to introduce appropriate water reuse policies and to enact legislation that make provision for gender equality in their contents. - Mechanisms should be put in place to improve regulatory systems to respond to climate change in a timely manner. These mechanisms must have gender balance in its composition. Public education must play a central role in the awareness building across sectors and government agencies. <p>Awareness Raising and Capacity Development</p> <ul style="list-style-type: none"> - BWA should design and implement an ongoing public education program to create awareness of wastewater issues. The unique issues for men and women should be highlighted. The BWA should continue with presentations by participants in Gender Sensitivity training. - Communication campaign should include varied strategies that appeal to demographic differences of the population.
<p>Output 4.1: Governance and planning roadmaps enhanced to enable use of reclaimed water in a controlled and regulated manner.</p>	<p>Activity 4.1.1: Undertake a legislative review to promote the Planning and Development Act, Wastewater Reuse Bill and other related legislations for enhancing wastewater effluent quality, treatment options and re-use requirements and applications</p> <p>Activity 4.1.2: Develop a water and sanitation master plan</p>	<ul style="list-style-type: none"> - A strategic awareness campaign on climate change and its impact on vulnerable persons is critical. Policies which will empower persons in authority in the sector to take the necessary actions to promote gender equality in the wastewater sector and climate change issues. - Ensure that campaign to gather acceptance on use of treated wastewater for non-potable purposes will need gender sensitive messages and targeting approaches. - The government Ministers need to be sensitized to be made aware of the importance of the legislation and how the project could positively impact the lives of women and the vulnerable in the society.
<p>Output 4.2: Mechanisms developed/expanded to encourage the adoption of wastewater treatment and reuse applications by private individuals</p>	<p>Activity 4.2.1: Develop a strategy and action plan to engage the private sector in the provision and adoption of wastewater treatment technology and the utilization of wastewater by-products such as activated sludge.</p>	<ul style="list-style-type: none"> - The education materials should be designed with gender sensitivity in mind so all persons will be made aware of the groups which should be given priority.

Components and Outputs	Activities	Gender Considerations
and businesses.	<p>Activity 4.2.2: Undertake a review and identify recommendations for a gender sensitive and socially inclusive incentive programme to encourage conservation, recycle, re-use.</p> <p>Activity 4.2.3: Expand and promote the Revolving Adaptation Fund Facility (RAFF) to provide resources for the adoption of decentralized onsite wastewater systems.</p>	<ul style="list-style-type: none"> - The staff in the sector should be trained with a focus on gender equality to minimize the level of resistance that could hamper the progress of the project. - Policy makers need to be made aware of the importance of the project and this should be driven from community-based groups and those directly affected. - The Wastewater sector will need to continue its gender sensitivity training to ensure that there is gender balance in the content and application of the policies and legislation. - Data collection should be disaggregated for easy access and use in ongoing works in the project. - Ensure that the update of the governing instruments of the RAFF is done through a gender informed consultative process. - Ensure that updates to the governing instrument continue to promote the needs of vulnerable groups including persons living in poverty. the adjustments to RAFF should ensure that women’s needs and those of the vulnerable to inform rearticulation of the RAFF. - Efforts at engaging the private sector as partners and as potential beneficiaries of RAFF resources need to consider the needs of small-scale farmers.
Output 4.3: Gender Sensitive Public Education and Awareness Campaign Implemented.	<p>Activity 4.3.1: Re-educate communities, teachers, students, farmers and businesses about the impact of climate change on water resources and their impact on water quality and quantity (availability as well as the importance of water reuse activities and indirect potable reuse (IPR)) to building climate resilience in the Water Sector.</p> <p>Activity 4.3.2: Develop and implement a Gender Sensitive Public Awareness Campaign for community and visitors (tourists)</p>	<ul style="list-style-type: none"> - Greater awareness of climate threats and risk reduction will impact positively on women who carry the bulk of the burdens of the negative effects of natural disasters. - Raising awareness among consumers should contribute in bridging the gender divide and equality in the society. Women are very sensitive to the issues of wastewater reuse and careful consideration should be given on the advantages to national development and advancement. - The re-education program should target all sectors in the society especially those who are not in the traditional line of

Components and Outputs	Activities	Gender Considerations
	Activity 4.3.3: Develop a 3R-CReWS Project Web Page and social media accounts	<p>communication. Those with lower levels of literacy, limited access to ICT and low income and classified as poor will benefit the most.</p> <ul style="list-style-type: none"> - The materials prepared must be gender sensitive and cater for inclusion of a cross section of the society also aiming at visitors. - All mediums should be used especially electronic, social and print. Persons who are differently able need to be catered for and this will ensure that the vulnerable persons are considered. The emphasis on educating the youthful population for futuristic development and the older population to break from tradition is critical in the re-education campaign. - Ensure focus on unique gender issues on webpage. - Ensure results presented on webpage are disaggregated by sex.

5.3 Monitoring and Evaluation Stage

At this stage of the Project, the focus of mainstreaming gender equality should be to involve stakeholders on observing and documenting the status of Project procurement services and control quality activities as they are being carried out and providing feedback to maintain the desired standards and to ensure that gender equality issues are not compromised. Stakeholders are expected to comment on the outcome of milestone reviews conduct periodically on the Project. Monitoring should ensure that Project deliverables bear demonstration of gender mainstreaming and that all relevant data produced by the project is gender sensitive.

5.4 Project Accountability Stage

During the multi-year life of the Project, it is expected that at the end of each Project year, stakeholders provide feedback on the Draft Annual Progress and Financial Report which gives an update on the status of the Project activities as they are being carried out. The stakeholder team should focus on disaggregated data on the gender categories, an assessment of the distribution of resources relative to men, women and LGBTQIA persons and any actions required to improve gender equality and equity. Such feedback should be incorporated in the final Annual Report before it is submitted to the PSC for initial endorsement and then to the BWA for consideration and approval.

5.5 Project Closure Stage

At the Project closure stage, the Project Management team is also expected to provide feedback on the Draft Project Completion Report on whether the Project achieved its and confirm whether the activities were carried out in accordance with the requirements of the Gender Action Plan, in addition to the Log frame. Results presented should show disaggregated data, assessment of the distribution of resources relative to men, women and LGBTQIA persons and any actions taken to improve gender equality and equity encountered.

5.6 Project Organizational Structure

The Project should have an organizational structure that incorporates both the project governance, and the project management functions.

The PSC should be trained in gender sensitivity issues at the project initiation stage. It is important to ensure that the board has equitable representation of male and female members. The aim is to have representatives who are empowered make decisions for the benefit of all. The PSC should have specific representation from the Barbados Bureau of Gender Affairs. This representative is important to ensure that the needs of vulnerable populations, including women are fore fronted for consideration.

A suitable structure for project management should include and Social and Gender Specialist to champion the Project's gender sensitive stakeholder engagement exercises and to ensure that identified activities of the project is meaningfully mainstreaming gender in the implementation. The Specialist will also support in gender-based budgeting, monitoring and evaluation and reporting. This approach will assist the PSC in ensuring gender equality in the composition of each of these mechanisms and in demonstrating gender sensitivity when handling complaints lodged against the Project team. The Project Management Team should all mandatorily be trained in Gender mainstreaming at the initiation stage of the Project. The team should also participate in gender sensitivity trainings for BWA employees throughout the life of the Project.

5.7 Project Plans, Budgets, Reports

A prerequisite for ensuring effective gender mainstreaming in this Project cycle is the preparation of a Gender Action Plan (GAP). The actions recommended to mainstream gender equality are outlined in the (GAP) annexed to this Analysis. Complementarily, the Project should include provisions for clear identification of gender actions in the preparation of annual project plans and budgets to support the execution of approved gender-related activities each year. Additionally, the Project Manager should ensure budgetary allocations to support the execution of approved gender-related activities are in keeping with the GAP.

The Project's PSC should set guidelines for the Project Manager to prepare Annual reports on the progress of implementation of the Gender Action Plan in keeping with the approved scope, goals, specific objectives, and deliverables. They should include statements on gender sensitivity issues and provide dis-aggregated data on changes in project personnel, wastewater service users and external stakeholder participation.

5.8 Project Data Management

Members of the PSC the Project Manager and other project personnel require technical and general data on a continuous basis to make evidence-based decisions. The Project officials should therefore collect, store, and retrieve the data for analysis and manage data throughout the Project lifecycle. They should ensure that key stakeholders have the right data at the right time and are able to gain access to accurate and reliable Project information on a timely and consistent basis. With respect to Project personnel, it is necessary for the data to be disaggregated or broken down into gender categories relative to men, and women. Such data helps to ensure that project resources are used where they are needed most and to measure issues of gender equality and equity.

Limited disaggregated data, related to gender and wastewater currently available in Barbados hindered the process of conducting a comprehensive gender sensitivity

analysis for this Project. There is need for the BWA, and other relevant government agencies like the Barbados Statistics Department and Bureau of Gender Affairs, to put systems in place to collect, store and retrieve disaggregated data for use in planning and decision making throughout the Project cycle.

5.9 Building Gender Sensitivity Capacity

In recent years, the BWA has collaborated with the UWI IGDS on gender sensitivity training for its staff. There are also opportunities for the two institutions to work together on capacity building activities to address climate change adaptation and mitigation in the future. Specific tasks and activities that the UWI IGDS should undertake to build capacity to address climate change adaptation and mitigation are as follows:

- Engage regional climate change experts to undertake research with a focus on the impact of climate change on gender and wastewater;
- Collaborate with the BWA to assist with the collection of disaggregated data on climate change and wastewater management and publish online annual reports for wider circulation;
- Continue to collaborate with the BWA to deliver an expanded gender training, including on sexual and gender-based violence for employees of the Authority;
- Collaborate with the BWA to engage in outreach and advocacy activities using multi-media approach to reach a wide cross section of individuals at the national level.
- Collaborate with the BWA to engage in gender responsive stakeholder consultations.

Given the nature of this Project, the BWA Board and staff, particularly those from the Wastewater Division, should be made aware of how gender plays a role in the way they treat Project personnel and beneficiaries throughout the life of the Project. Gender relations are present in participating public, private and civil society institutions that are involved in this Project. Members of the BWA Board, and BWA staff, require continued training and awareness of gender sensitivity especially so that they can recognize privileges and discrimination around gender.

The BWA should continue to collaborate with the UWI IGDS to train and educate persons serving on the PSC, in project management and as support personnel to become more aware of and sensitive to gender issues arising from Project activities. Training for Project Staff and for identified staff of the BWA should be mandatory.

CLOSURE

Integrated Sustainability would like to thank the Caribbean Community Climate Change Centre for your support in developing this document. We trust that this report meets your needs and expectations. If you have any questions, please contact the undersigned at any time.

Sincerely,

A handwritten signature in black ink, appearing to read 'V. Albert Poyotte', with a long horizontal flourish extending to the right.

Dr. Virginia Albert Poyotte

REFERENCES

- Allen, C. F & Maughan, J. & Baksh, J & Associates, January (2016). Gender Situation in Barbados CDB Country Assessment (CGA).
- Baksh & Associates, R. (2016). Country Gender Assessment Synthesis Report, CDB.
- Beuermann, D., (2017). Methodological Report on the consumption Aggregate and Poverty Lines based on the Barbados Survey of Living Conditions
- Bobb, D., (2019), Understanding Unequal Relations of Gender in the Caribbean, Wendy Water Woes: A Barbados Case Study, UWI-IGDS, BWA, GCF, CCCCC.
- CARICOM Gender Equality Indicators <https://caribbean.unwomen.org/en/materials>
- Consultations on CARICOM Gender Equality Strategy Begins in Antigua & Barbuda retrieved from https://www.today.caricom.org/2019/02/07_consultation_on_CARICOM_Gender_Equality
- Henry, A., (Jan 27, 2021). Barbados today.bb Boscobelle Residents want BWA to address long standing water woes
- Husbans, C & K. Dey, P. (2002). Impact assessment of a sewerage project in Barbados <https://doi.org/10.3152/147154602781766708>.
- Isaacs, W. (2017). Opportunities to Mainstream Gender in water and wastewater Infrastructure Project: A Case Study in Barbados: University of South Florida, pg. 26
- Johnson, C.P.G, (2019). Better Together: A Model for Women & LGBTQIA Equality.
- Schuhmann, et al, (2019) Visitors' Willingness to Pay Conservation Fee in Barbados, tourism Management, 71,315-326
- Suchorski, A., (2009). Socio-economic and Physical Development Influence on water use in Barbados, Caribbean Water Initiative (CARWIN) McGill University Document CARWIN, retrieved from https://www.mcgill/carwin/saw_09_Scuchorski.pdf.
- Tortz, M. et al, (2018). Water Sector Resilience Nexus for Sustainability in Barbados WSRN- Barbados environmental and Social Assessment.
- UN-ECLAC& Cooperacion Espaniola (March 2017) Report. Gender Equality Plans in Latin America & the Caribbean: Road Map to Development

- UN Partnerships for SDGs platform
<https://www.sustainabledevelopment.un.org/partnerships>.
- UN-water Joint Statement https://www.womenforwater.org/unwater-joint_statement_covid-19.pdf.
- Witmer, L. (2017). Women of water Partnership
<https://www.womenforwater.org/waste-water-is-a-she-waste-water>.

Appendix 1 - Results of Stakeholder Surveys and Interviews

Outcome of Zoom Interview with UWI Institute of Gender and Development Studies, Dr.

Tonya Haynes, October 25th, 2020

Question	Response
Q-1: What is the nature of the joint training undertaken by the UWI Institute of Gender Development Studies and the	It is a training programme customized for the BWA in October 2020 to help 500 employees to obtain a certificate in Gender sensitization and infrastructure.
Q-2: Who are the participants enrolled in the	All five hundred (500) employees of the BWA are expected participate in the training.
Q-3: What is the duration of the training?	The training is for 1-5 contact days over 6 workshops with 16-22 participants in each cohort.
Q-4: Who organized the training?	The BWA HR Department is responsible for organizing and scheduling the workers to undertake the training.
Question 5: What are the contents of the course?	The course contains several modules of video presentations and three case studies.
Question 6: What will be the benefits to the BWA employees?	Each successful employee will receive a Certificate in Gender Analysis.
Q-7: What has happened to the training since the COVID-19 Pandemic?	With the advent of COVID-19 the training sessions have been suspended.
Q-8: What has been the participants' response or attitude to the training?	Employees have responded positively to the training although initially there was some resistance by men who later realized the gender equity meant equalization for women and men.
Q-9: Do you think the participants would want to continue the training?	There is great demand for future training by the participants many of whom have requested follow up workshops including the month-long program offered by UWI which reflects a high level of motivation on the part of the employees.
Q-10: Are there women participating in other gender-sensitivity training?	The UWI Centre for Research and Management (CERMES) offers a six-month course on gender studies. Several women graduate from this programme and enter into the water and
Q-11: What are the challenges women experience in the wastewater sector?	There was one case study which reveals the challenges of a woman whose entire day revolves around water. She lives in a community that does not have taps water and has no personal storage tank. She has property which is not accessible to a water truck so she has to walk to meet the truck. She has a small farming income but had to abandon it due to lack of
Q-12: What is the economic status of women in Barbados?	The department confirms that single women head 57% of households of which 20% of the women are categorized as poor. These include migrant women caring for critically ill

<p>Question 13: What has been the experience of participants with water supply?</p>	<p>They revealed that due to a combination of drought and very, very old infrastructure, many people have water shortages fairly constantly especially during the dry season. This of course affects the poor the most. Some of the highest poverty areas are in Saint Joseph and St John but Saint Thomas and the north of Barbados also experience problems which make it worse for wastewater. It is not just a case of having a water connection, but it is beyond the connection</p>
<p>Q-14: What are the challenges people experience in the water/wastewater sector?</p>	<p>People cope by storing water in whatever containers they have such as bottles and saucepans. Some may have a tank, but it is often not adequate or safe. The dry season is now longer, and the days are hotter which exacerbates the water shortages and limits capacity to dispose of wastewater where health and sanitation becomes a huge problem for the vulnerable.</p>
<p>Q-15: What are the current water/wastewater treatment issues referenced by the participants?</p>	<p>There are several households that do not have flushable toilets and some people are squatters where sanitation becomes a big issue. There are still several people who use pit latrines. The welfare department periodically makes provisions to supply water to those who can't afford to pay their water bills. The bills have doubled recently as a Levy for wastewater. Management is now included on the water and wastewater bill. It was confirmed that the minimum charge is now (\$37.5) United</p>
<p>Q-16: What was the level of acceptance of the use of wastewater?</p>	<p>The response to the level of acceptance if wastewater becomes available for reuse for irrigation it was felt that this has been a difficult issue for the people to accept. It might be a hard sell for many. Recently several blue pipes were replaced by black pipes. Although the use factor was identical a lot of people resisted because they thought the black pipes were giving dirtier water. There is evidence that there has been poor communication with the general public.</p>
<p>Question 17: What suggestions do you have to improve the quality of water?</p>	<p>The curriculum and content of the training involves video presentations in 3 different case studies. One of the main outcomes of the training is that it will have a positive impact on the future work of BWA.</p>

Appendix 2 -Interview with Mrs. Shelley Parris, Senior Engineer, BWA (Feb 19, 2021)

Questions	Responses
Q-1: How many men, women and LGBTQIA persons are at the management level in the BWA Wastewater Department?	There is an equal number of men and woman managers at the BWA, although the women that are managers tend to have more administrative roles, while men have more technical roles. The Chairperson of the Board of Management BWA is a woman. The presence of the trade union representing the employees of BWA there is no possibility to
Q-2: Is the level of pay for men and women equal in BWA wastewater department?	There is equal pay for employees as agreed in the collective agreement between BWA and the union as the bargaining body for the workers
Q-3: What legislations in Barbados are used by BWA to protect women and their employment?	Women have equal opportunities to participate in any activity of their choice. For example, there are woman in parliament including a woman as the first Prime Minister.
Q-4: Has BWA developed specific strategies in its programme implementation to address the needs of men, women and LGBTQIA persons in the wastewater department?	There are no specific strategies developed as all the employees are treated equally. There are some heavy- duty work to be done which could be strenuous for women. They are not assigned these responsibilities. A first-time woman plumber is currently working with BWA.
Q-5: What challenges are the BWA facing in implementing any gender sensitive programmes in the wastewater department?	No major challenges are being experienced, aside from current challenges being faced because of this pandemic. However, the BWA has taken the initiative to introduce its employees to gender sensitivity training, from the UWI, to encourage gender equality relating to co-workers, customers, and clients. COVID19 has posed new challenges,
Q-6: Are there clear policies for the recruitment of women, men and LGBTQIA persons and mentoring programs for recruits in BWA?	There are general documented policies but none relating specifically to women and LGBTQIA persons. However, the BWA has taken the initiative to introduce its employees to gender sensitivity training to encourage gender
Q-7: What are the specific focused areas in the BWA gender training for employees at UWI?	Gender sensitivity issues and the infrastructural needs of the BWA. There attendees of this course will be awarded with a certificate at the end of the training programme.

Appendix 3 - 3R-CReWS Project Gender Risk Matrix

Gender Risk	Probability⁷⁵ From 1 (Low)- 5 (High)	Impact⁷⁶ From 1 (Low)- 5 (High)	Mitigating Action
1. Limited will at the Project Governance and Management level to mainstream gender into project activities.	3	5	<ul style="list-style-type: none"> i. Ensure Gender Sensitivity training for Project Steering Committee (PSC) and Project Management (PM) team. ii. CCCCC Project Development and Management Unit as AE closely monitor Gender Action Plan (GAP) and provide guidance and instruction to PM team on mainstreaming, where activities are implemented using a gender-blind approach. iii. Ensure annual reporting on GAP to the PSC. iv. Ensure annual budgetary process cost GAP actions to be undertaken annually.
2. Increased connections to decentralized systems lead to increased financial burdens, on vulnerable people, including Female Headed Households to cover sewage costs treatment.	2	3	<ul style="list-style-type: none"> v. Ensure that the review of Water and Sanitation Master Plan consider cost implications/price structure that does not create economic hardship for vulnerable groups.
3. Incentive programme does not benefit small female owned business, including female farmers who may not have infrastructural or financial inputs compared to large businesses, who are predominantly male owned.	3	4	<ul style="list-style-type: none"> i. Develop recommendations for incentive programme that identifies opportunities that will benefit female headed households and socio-economically deprived households.
4. Small female owned business, including female farmers and	3	3	<ul style="list-style-type: none"> i. Ensure gender inclusive consultations in reformulating RAFF and provide windows, where

⁷⁵ Probability (how likely the risk is to occur)

⁷⁶ Impact (if the risk takes place, how seriously will it impact your project)

<p>female headed households are excluded from benefiting from the Revolving Adaptation Fund Facility (RAFF) Charter after its update.</p>			<p>possible, for access to support for small business owners, (including those that are female led), small scaled farmers and female heads of households.</p>
<p>5. Discrimination against women and LGBTQI+ populations who work, or are interested in working in the wastewater sector.</p>	3	3	<ul style="list-style-type: none"> i. Ensure development of Project Code of Conduct that applies to project Staff, Consultants, Contractors, BWA employees who are interacting with communities under the framework of this project. ii. Ensure continuous training and reminders on Discrimination and its impacts. iii. Ensure relevant staff participate in Gender Sensitivity Training. iv. Ensure frequent check in with Interns (Women in STEM) with BWA Human Resource Department and Project Social and Gender Specialist.
<p>6. Gender Base Violence (GBV) and Sexual Exploitation and Harassment (SEAH) against workers, interns, and community members under the framework of this project.</p>	3	4	<ul style="list-style-type: none"> i. Ensure development of Project Code of Conduct that applies to project Staff, Consultants, Contractors, BWA employees who are interacting with communities under the framework of this project. ii. Ensure that the GRMs designated to receive complaints for this project are able to effectively receive complaints and provide redress to victims. iii. Ensure frequent check in with Interns (Women in STEM) with BWA Human Resource Department and Project Social and Gender Specialist. iv. Ensure Procurement Documents and contracts explicitly prohibit practices of GBV and SEAH consistent with AE’s Policies, including Gender Policy 2021-2026.

Appendix 4 - Gender Action Plan

Impact:

- Improved resilience of male and female headed households, small farmers, small business owners and vulnerable populations to the impacts of climate change on water supply.

Outcome:

- Waste Water sector improves its capacity to respond to gender issues by implementing at least four (4) gender-responsive interventions by the end of the Project (Outputs 1, 2, 3, 5 and 7)
- 50% increase in the use of reclaimed water for non-potable uses by male and female heads of households, small farmers and small business owners in two low-income communities (Belle Tenantry , and Bellevue Gap) by end of Project. (Outputs 4 & 6)

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
Output 1: Gender specific gaps and requirements are identified and incorporated in legislative and planning frameworks for wastewater management.				
1.1 Hire a Gender Expert to conduct a Gender Gap Assessment, including consultations with key stakeholders as part of the Review of Wastewater Reuse Bill, Planning and Development Act, and other related legislations for enhancing wastewater effluent quality, treatment options and re-use requirements and applications	Legislative review notes include gender specific gaps and recommendations. (Yes/No)	Complete by year 3	-the BWA Board -3R-CReWS PSC -Project Manager - Project Social and Gender Specialist	\$6,000.00 (Gender Expert as part of legal review team)
1.2 Ensure findings of gap assessment are captured in overarching legislative review.				

⁷⁷ Targets are reflected in Brackets.

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
1.3 Ensure that water and sanitation master plan promote gender sensitive actions as it relates to the water and wastewater sector.	<p>Number of specific actions targeting gender equality and inclusion of vulnerable people in Water and Sanitation Master Plan (3)</p> <p>Number of Women's Groups, consulted in development of Water and Sanitation Action Plan (10)</p> <p>Number of groups representing vulnerable populations consulted in development of Water and Sanitation Action Plan (10)</p>	Complete by year 2	<ul style="list-style-type: none"> -The BWA Board -3R- CReWS PSC - Project Social and Gender Specialist 	\$5,000.00 (Gender Expert to review and provide recommendations as well as participate in consultations)
1.4 Ensure update to Standard Operating Procedures (SOP) and Operational Manuals of the BWA address the requirements of gender and SGBV.	<p>Number of BWA SOPs and manuals developed to include gender needs of wastewater section (3)</p> <p>(1 updated set of SOPs 1 updated O&M manual 1 risk management framework))</p>	Completed by year 3	<ul style="list-style-type: none"> -3R- CReWS PSC - Project Manager - Project Social and Gender Specialist -BWA Wastewater Manager 	\$10,000.00 (Gender Expert as part of Team updating Documents)
Output 2: Improved capacity of BWA staff to integrate gender considerations into their provision of wastewater services				
2.1 Roll out UWI/BWA Gender Sensitivity Training programme #2 for existing BWA employees.	<p>Number (disaggregated by sex) of BWA staff members participating in the UWI/BWA Gender Sensitivity Training program (300) (150 M, 150F)</p>	Completed by end of project	<ul style="list-style-type: none"> BWA Human Resource Department - Project Social and Gender Specialist -Project Manager 	\$45,000.00 (Trainers, developers for online training and Logistics)
2.2 Develop online self-paced mandatory SGBV training for all BWA employees	<p># Of SGBV Trainings Developed (2)</p> <p>% of BWA employees by sex who have taken SGBV training (80%M, 80%F)</p>			

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
2.3 Conduct training for BWA staff on the updated SOPs and OM that include gender considerations.	# Of operators (disaggregated by sex) exposed to the training on the SOPs and OM (70)			
Output 3: Increased participation of women performing technical roles in waste water sector				
3.1 Develop in collaboration with relevant training institutions Women in STEM Internship Programmes at Wastewater division. 3.2 Implement in collaboration with relevant training institutions a Women in STEM Internship Programme at Wastewater division, including the recommendations from interns on potential measures to increase participation of women in STEM and to increase equality for women in waste water management.	# of Women in STEM Internship Programme developed (1) # of female interns participating in Women in STEM internship programme (8) # of reports including recommendations for improvement of gender equality within wastewater sector (8) # of recommendations implemented (4)	End of Project	-Project Manager -BWA HR Department -BWA Wastewater Department - Project Social and Gender Specialist	\$ 10,000 (stipend co-financing)
3.3 Ensure equal participation of men and women in Ratio of Males and females participating in Caribbean Vocational Qualification (CVQ)/ National Vocational Qualification (NVQ) courses offered under the Project.	Ratio of Males and females participating in CVQ/NVQ programmes offered from 3R-CREWS (1:1)	Throughout the Project	-Project Manager -BWA HR Department -BWA Wastewater Department Project Social and Gender Specialist	Cost subsumed under technical training line.
3.4 BWA female staff to participate in public education campaigns encouraging girls	# Of targeted outreach by BWA female Managers, Technicians and Engineers to	Throughout the project	-BWA Public Relations Department -Project Social and	\$5,000.00 (\$1,000.00 per outreach session)

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
and young women to aspire to leadership and technical roles in the waste water sector	spaces with girls and young women, including schools (5).		Gender Specialist -Project Manager	

Output 4: Gender sensitive stakeholder consultations and awareness programmes instituted to ensure public knowledge and buy-in on the use of wastewater services and potential impacts.

4.1 Convene gender informed stakeholder consultations to inform and solicit input from community members (heads of households, small farmers, small business owners and vulnerable populations) into the design, implementation and monitoring phases of the Project,	# of consultations held with community members (heads of households, small farmers, small business owners and vulnerable populations) who offer inputs and receive information on the project from design to M&E 4-8 community consultations (Town halls, outreach, walk through etc) per year = 8-16 communities over 2 years x 75 persons per community = 600-1200 community persons (50% males and 50% females.	At least quarterly until end of Project	BWA Public Relations Department Project Manager Social and Gender Specialist PSC BWA Wastewater Division	Cost subsumed under stakeholder engagement lines
4.2 Develop communication strategy that is informed by Gender sensitive KAP Survey. KAP Survey must therefore ensure that results are easily disaggregated by sex and that analysis of knowledge, attitudes and practice is gender responsive.	% of women and men administered KAP instruments (51%, 49% respectively) KAP Study reveals gender differences in analysis (Yes/No) Communication strategy tailors messaging and channels to men and women based on feedback from KAP surveys (Yes/No)	Year 1 of the Project	Project Manager Project Social and Gender Specialist BWA Public Relations Department 3R-CReWs PSC	No Additional Cost (SGS salary to review KAP TOR and documents for gender analysis)

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
	# Of persons benefitting from education activities (Disaggregated by sex) (10000 (4,900M, 5,100F))			
4.2 3R-CReWS Project webpage will report on project results disaggregated by sex where possible. Webpage will include communication messaging including of gendered impacts of climate change on water supply and messaging encouraging use of reclaimed water targeting female farmers, heads of households, small business owners and small business owners.	<p>% of applicable project results based on Project Log frame disaggregated by sex on Project website (100%)</p> <p>Number of stories communicating gendered impact of climate change on water supply and access (4)</p> <p>Number of Communication messages messaging encouraging use of reclaimed water targeting female farmers, heads of households, small business owners and small business owners (4)</p>	Throughout the project	<p>-BWA Public Relations Department</p> <p>-Project Social and Gender Specialist</p> <p>-Project Manager</p>	\$50,000.00 (webpage consultancy design and establishment as well as communication messages))
Output 5. Increased capacity of BWA to respond to SEAH complaints from community and staff members				
5.1 Update the Wastewater Division Complaints Management System to ensure complaints system is capable of capturing SGBV complaints, publicized (including on Project webpage), accessible for directly impacted communities and has mechanisms for external referral, including the CCCCC GRM.	<p>Existence of mechanism for reporting on SGBV as part of Wastewater Management Division Complaints Management System (Yes/No)</p> <p>% of stakeholder engagement community events that publicises the SEAH /SGBV complaints process (100%)</p> <p>Complaints systems accessible</p>	Within 6 months of project inception	BWA Human Resource Department. Project Social and Gender Specialist	\$6,,000.00 (update and publicity of Complaints system)

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
	on Project webpage (Yes/no) CCCCC GRM Publicized as source for receiving SGBV related complaints (Yes/No)			
5.2 Develop and implement complaints procedure for addressing SEAH/SGBV complaints in waste water sector	# of SEAH/SGBV complaints procedures developed (1) # of SEAH/SGBV complaints procedures developed (1)	Within 6 months of project inception	BWA Human Resource Department. Project Social and Gender Specialist	\$7,000.00 (Part of the consultancy to develop and support implementation complaints procedure)

Output 6: Male and female heads of households, small farmers, small business owners and vulnerable populations have increased opportunities to connect to wastewater treatment systems.

6.1 Update RAFF charter to include wastewater treatment and reuse options to promote gender equality.	Review of charter includes assessment of needs of male and female business and households (Yes/No)	6.1- 4.3- By end of year 3 6.4- 6.7 By end of year 4	Project Manager, Project Social and Gender Specialist, 3R-CReWS PSC BWA Board of Directors	6.1-\$5,000.00
6.2Develop recommendations for incentive programme provide opportunities that will benefit female headed households and socio-economically deprived households.	Existence of report providing recommendations for a gender sensitive incentive programme to benefit FFH and socio-economically disadvantaged households (Yes/No) # of recommendations for incentive programme implemented that benefit female headed households and socio-economically deprived households. (4)			6.2- \$5,000.00 (consultant to develop recommendations
6.3Undertake re-education programs targeting farmers	Number of sessions (workshops, meetings,			6.3 No additional costs outside of BWA Co-

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
<p>particularly women, to enhance capabilities and leadership for the adoption of wastewater treatment technologies and reuse options in two communities</p> <p>6.4 Small scale female farmers who participate in re-education [programmes receive subsidies to adopt waste water treatment technologies and reuse options in two communities</p> <p>6.5 Male and Female headed households in Two communities in Zone A provided with connections to decentralized waste water treatment systems.</p>	<p>training) targeting farmers, especially female small farmers (8)</p> <p>Ratio of Female to Male Farmers participating in re-education programme (2:3)</p> <p>% of small scale female farmers participating in the re-education programs that adopt wastewater treatment tec</p> <p>% of small scale female farmers who participate in re-education programs receiving subsidies to adopt waste water treatment technologies and reuse options in two communities (50%)</p> <p># Of Households with connections to waste water treatment system (Disaggregated by sex of head of households). (225) (115 FHH, 110 MHH)</p> <p>Volume of reclaimed water is available for non-potable use disaggregated by male/female HH. (2.25 million m³) (1.114 m³ FHH) (1.113m³ MHH).</p>			<p>finance and stakeholder engagement.</p> <p>6.4Subsumed under existing Project costs</p>

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
6.5 Workshop held to encourage small and women owned businesses to leverage the mechanisms available (incentives and RAFF) for access to wastewater services.	<p>% of small and women owned businesses participating in workshop on leveraging the mechanisms available (incentives and RAFF) for access to wastewater services. (30%)</p> <p>% of small and women owned businesses attending workshop that use information to access incentives/ RAFF in order to access waste water services (30%)</p>			6.5 subsumed under existing Project costs for stakeholder engagement

Output 7: Enabling a gender responsive project management and governance environment for the duration of the Project

7.1 Ensure contractors, BWA Staff and project staff interacting with community signs Code of Conduct to be developed under this project.	<p>Existence of COC that prohibits SEAH/SGBV (Yes/No)</p> <p>% Of Staff, consultants working in communities who have signed COC (100%)</p>	Throughout the life cycle of the project	BWA HR Department BWA Procurement Department Project Social and Gender Specialist 3R-CReWS PSC	No additional cost (staff time)
7.2 Select a gender balance Project Team	<p>Ratio of Male to Female Project Team (1:1)</p> <p>% of men on project team in female dominated roles (20%)</p> <p>% of women on project team in male dominated roles (20%)</p>	Throughout the life cycle of the Project.	BWA HR Department CCCCC	Advertise & Interview applicants Applicant Orientation. No standalone costs identified.

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
7.3 Develop a gender balance PSC.	Ratio of Male to Female on PSC (1:1)	Throughout the life cycle of the Project.	CCCCC BWA Board of Directors	No Standalone cost identified (Staff time)
7.4 Ensure representation of Bureau of Gender Affairs on PSC.	Existence of representative from Bureau of Gender Affairs on PSC (yes/No)			
7.5 Recruit and retain Social and Gender Specialist for the Project. The specialist will be responsible for stakeholder related activities to ensure gender mainstreaming, update of the complaints system, gender mainstreaming in all components of the project and reporting on gender progress.	# Of qualified Gender Specialist working on the project. (1)	Throughout the Project	-BWA Human Resource Department - CCCCC	\$192,000.00
7.6 Present annually to PSC, report on Progress of implementation of GAP.	# Of Reports on Gender Progress of Project presented to PSC (5)	Annually	-Project Manager -CCCCC -Project Social and Gender Specialist	No Standalone cost identified (Staff time)
7.7 Table annually, a discussion on the Progress of GAP Implementation as an agenda item of the PSC.	# Of discussion on Gender report held at Project PSC (5)			
7.8 Ensure mandatory participation of Project staff in Gender Sensitivity and SEAH/SGBV Training sessions	% Project staff participating in gender sensitivity training disaggregated by sex (100%) % of Project staff participating in SEAH/SGBV training (disaggregated sex) (100%)	Annually	BWA Human Resource Department Project Manager -CCCCC -Project Social and Gender Specialist	No Standalone cost identified (Staff time)
7.9 Collect, store, and retrieve data disaggregated by sex and other vulnerability indicators for planning and decision making throughout the Project cycle, including during stakeholder engagement.	% of applicable data collected, stored and is disaggregated by sex and other vulnerability (indicators (100%)).	First six months of project	BWA Wastewater Division Project Manager Project Social and Gender Specialist PSC	No Standalone cost identified (Staff time)

Focus Area/Activity	Indicators/Targets ⁷⁷	Timeline	Responsibilities	Estimated Cost (in USD)
	# of baseline report on sex disaggregated data produced (1)			
