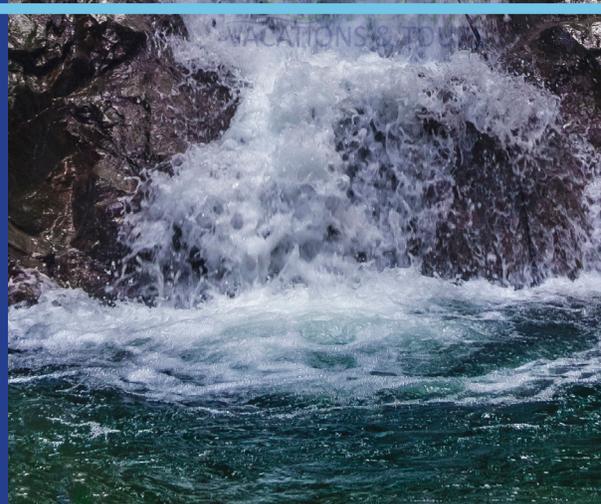


Saint Lucia's Portfolio of Project Concept Notes for the Water Sector 2018-2028

Under the National Adaptation Planning Process



United States In-Country National Adaptation Plan (NAP) Support Program

Gift of the United States Government



Implemented by:



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Saint Lucia's Portfolio of Project Concept Notes for the Water Sector 2018-2028 under the National Adaptation Planning Process

Prepared under the guidance of:

Department of Sustainable Development; and,
Department of Agriculture, Fisheries, Natural Resources and Cooperatives

With the support of:

Government of the United States, through the U.S. In-Country NAP Support Program, implemented via the International Institute for Sustainable Development (IISD). The opinions, findings and conclusions stated herein are those of the author[s] and do not necessarily reflect those of the United States Department of State.

Suggested citation: Government of Saint Lucia. (2018). Saint Lucia's Portfolio of Project Concept Notes for the Water Sector 2018-2028. Department of Sustainable Development, Ministry of Education, Innovation, Gender Relations and Sustainable Development and Department of Agriculture, Fisheries, Natural Resources and Cooperatives, Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Cooperatives.

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Foreword

Saint Lucia's National Adaptation Plan (NAP) has been defined as a ten (10)-year process (2018-2028), consisting of priority cross-sectoral and sectoral adaptation measures for eight key sectors/areas and a segment on the 'limits to adaptation', complemented, incrementally, with Sectoral Adaptation Strategies & Action Plans (SASAPs). Priority sectors for adaptation action include: Tourism; Water; Agriculture; Fisheries; Infrastructure and spatial planning; Natural resource management (terrestrial, coastal and marine); Education; and Health. Other key sectors will be identified through a cyclical, iterative NAP process.

Saint Lucia's NAP process is spearheaded by the Sustainable Development and Environment Division (SDED) of the Department of Sustainable Development, currently housed within the Ministry of Education, Innovation, Gender Relations and Sustainable Development. The NAP process has benefitted from the inputs of multiple stakeholders, comprising public, statutory, academic and private sector bodies. Indeed, this process has involved State and non-State actors, such as media personnel, who play an important role in helping efforts to positively influence thinking, mould outcomes, change behaviour and instigate action across the populace, at all levels.

Saint Lucia's overarching NAP continues to be supplemented by several documents:

- *Saint Lucia's National Adaptation Plan Stocktaking, Climate Risk and Vulnerability Assessment Report*
- *Saint Lucia's National Adaptation Plan Roadmap and Capacity Development Plan 2018-2028*
- *Saint Lucia's Climate Change Communications Strategy*
- *Saint Lucia's Sectoral Adaptation Strategy and Action Plan for the Water Sector (Water SASAP) 2018-2028*
- *Saint Lucia's Sectoral Adaptation Strategy and Action Plan for the Agriculture Sector (Agriculture SASAP) 2018-2028*
- *Saint Lucia's Sectoral Adaptation Strategy and Action Plan for the Fisheries Sector (Fisheries SASAP) 2018-2028*
- *Saint Lucia's Portfolio of Project Concept Notes for the Water Sector 2018-2028*
- *Saint Lucia's Portfolio of Project Concept Notes for the Agriculture Sector 2018-2028*
- *Saint Lucia's Portfolio of Project Concept Notes for the Fisheries Sector 2018-2028*
- *Monitoring and Evaluation Plan of Saint Lucia's National Adaptation Planning Process*
- *Guidelines for the Development of Sectoral Adaptation Strategies and Action Plans: Saint Lucia's experience under its national adaptation planning process*

This process also supported a climate change website, an animated video and training for government entities and journalists in communicating about climate change. A NAP Assembly and Donor Symposium were also all made possible under this process, through the support of several entities.

Specifically, the process has benefited from the financial support of the United Nations Development Programme's (UNDP) Japan- Caribbean Climate Change Partnership (JCCCP). Technical and financial support for Saint Lucia's NAP process has also been provided through the United States (U.S.) In-Country NAP Support Programme (NAP-SP), implemented by the International Institute for

Sustainable Development (IISD). Technical support for the chapter on the 'limits to adaptation' in the NAP was provided under the IMPACT project, funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), as part of the International Climate Initiative (IKI). The IMPACT project is jointly implemented by Climate Analytics, the Caribbean Community Climate Change Centre (CCCCC), Secretariat of the Pacific Regional Environment Programme (SPREP) and Charles and Associates (CAA) Inc. The Department extends its thanks to all of the foregoing and takes this opportunity to recognise the consultant, Ms. Clara Ariza, for her tireless efforts in Saint Lucia's NAP process, under the able guidance of SDED.

Saint Lucia looks forward to forging partnerships and alliances that will assist in developing additional SASAPs and implementing the measures, programmes, projects and activities outlined in its NAP, SASAPs and other support documents. Saint Lucia is prepared to welcome support, that is, finance, technology transfer and capacity building, from a variety of sources, including public, private, bilateral, multilateral and alternative sources, all in an effort to help the country build climate resilience and address the seemingly insurmountable phenomenon of climate change.

SNAPSHOT OF

The Sectoral Adaptation Strategy and Action Plan for the Water Sector 2018–2028

(Water SASAP)



Saint Lucia's water sectoral adaptation strategy and action plan SASAP seeks to drive the implementation of effective adaptation actions across all sectors and at all levels of society to safeguard Saint Lucia's water resources and services under a changing climate.

Climate change threatens water availability and quality.

The increasingly warmer temperatures, lower annual rainfall but stronger rain events, more intense tropical storms, more frequent flooding and landslides, and recurrent drought expected in the coming decades imperil the availability and sustainable provision of the fresh water needed for people and the national economy. Additionally, multiple water-related climate change impacts will bear on all productive sectors and will affect vulnerable groups the most. Examples include malnutrition and food insecurity resulting from decreasing agricultural yields and more frequent health emergency situations brought about by flooding and by water- and vector-borne disease outbreaks.

The cost of inaction on climate change in Saint Lucia has been calculated to be 12.1 per cent of GDP by 2025, rising to 24.5 per cent by 2050 and 49.1 per cent by 2100.¹

STRATEGY

This SASAP consists of **a set of measures** considered essential for adaptation and prioritized by stakeholders in the sector. The SASAP determines for each measure whether its **implementation** should start in the **short term (2018 to 2021)**, **medium term (2021 to 2024)** or **long term (2024 to 2028)**, according to the measure's level of **urgency**, and as funding becomes available, with short term being the most urgent.

The SASAP measures were formulated to:

1. Improve the national policy, legal and regulatory framework to facilitate climate adaptation in the water and water-dependent sectors.
2. Scale-up national human capacity for the design and implementation of water-related climate adaptation projects.
3. Increase public awareness on integrated water resource management.
4. Strengthen integrated watershed management to build climate resilience.
5. Promote the sustainable use of alternative water sources to ensure water availability in a changing climate.
6. Improve wastewater management to reduce pollution and increase water availability in a changing climate.
7. Set and scale up water quality and pollution control in a changing climate.
8. Improve water infrastructure to build climate resilience.
9. Encourage water efficiency under a changing climate by improving water pricing, water utility revenues and water conservation incentives.
10. Promote climate-smart agriculture.
11. Improve hydrometeorological monitoring, emergency planning and decision making.
12. Minimize water-related climate change risks by adopting ecosystem-based adaptation solutions.
13. Promote climate-resilient business development.

¹ Bueno, R., Herzfeld, C., Stanton, E.A., & Ackerman, F. (2008). *The Caribbean and Climate Change: The Costs of Inaction*. Medford, Massachusetts: Stockholm Environment Institute – US Center, Global Development and Environment Institute, Tufts University.

IMPLEMENTATION AND FUNDING

Execution of the SASAP's measures within a ten-year frame is expected to occur mostly as a consequence of their inclusion in projects and programs funded from both national and international sources. However, over time, adaptation is also expected to become immersed in all new development projects in the sector, and that the national institutions involved will be able to generate revenue from their regulatory functions (e.g., user fees, royalties, licences, and other revenue streams), which can possibly be directed to helping supplement other support received for adaptation. **To support fundraising efforts**, the SASAP is complemented by a series of **project concept notes**.

SAINT LUCIA'S WATER CONTEXT

With 37 watersheds, Saint Lucia's freshwater resources are derived mainly from rivers, wetlands, streams and springs. The country produces about 18.9 million cubic metres of water per year.² However, dry-season water production can drop by up to 25 per cent from the wet season, and overall, Saint Lucia suffers from a 35 per cent water-supply deficit.³ While groundwater resources are limited, the country has a major dam, a large reservoir, and other natural and constructed wetlands used for irrigation and aquaculture. Pipe-borne water for consumption is accessible to 87 per cent of the population and about 90 per cent of households; most hotels and farms rely on on-site sanitation facilities.⁴ The domestic and hotel sectors are the largest consumers of water in Saint Lucia.

EXPECTED OUTCOMES

1. Enhanced enabling environment and improved behaviour for water-related climate adaptation action.
2. Increased water access, availability and quality.
3. Increased water efficiency and conservation.
4. Strengthened preparedness for climate variability and extremes.

CHALLENGES OF THE WATER SECTOR AND WATER-DEPENDENT SECTORS

- Reduced river flows with higher temperatures, long dry periods and reduced annual precipitation.
- Intrusion of sea water into freshwater lenses, particularly in low-lying coastal areas.
- Increased water consumption with higher temperatures.
- Higher demand for abstraction of water for agriculture (irrigation and livestock).
- Irrigation with increasingly brackish water, salinizing soils and affecting crop production.
- Destruction or damage of water intakes, dams and reservoirs during extreme weather events, leaving settlements without water, or with poor water quality.
- Increased cost of maintaining water infrastructure.
- Increased cost of treating and supplying potable water.
- Siltation of river systems, dams and reservoirs due to increased soil erosion during heavy rainfall events.
- Heightened risk of agro-chemical contamination of water sources from increased runoff and erosion of farming areas.
- Poor operational performance of inundated drainage infrastructure and on-site sanitation facilities, increasing the risk of flooding in low-lying coastal areas, affecting tourism and risking contamination of water sources.
- Declining health and biodiversity of freshwater and marine ecosystems caused by increasing water pollution from the above causes.
- More frequent water-borne and vector-borne disease outbreaks caused by flooding.
- Increased risk of conflict over the use of water resources.

² GoSL (2010). Water Sector Final Report: V&A Assessment for the Second National Communication on Climate Change. Ministry of Physical Development & Environment.

³ Global Water Partnership Technical Committee. (2014). *Integrated Water Resources Management in the Caribbean: The Challenges Facing Small Island Developing States*. GWP Technical Focus Paper. Stockholm: Global Water Partnership Secretariat. Retrieved from https://www.gwp.org/globalassets/global/toolbox/publications/technical-focus-papers/04-caribbean_tfp_2014.pdf

⁴ Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Co-operatives. (2017). Saint Lucia National Policy on Wastewater Management.



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1. SUMMARY OF CONCEPT NOTES FOR CLIMATE CHANGE ADAPTATION PROJECTS IN SAINT LUCIA'S WATER SECTOR

The Government of Saint Lucia has formulated a National Adaptation Plan, NAP (2018-2028) and Sectoral Adaptation Strategies and Action plans (SASAPs) to ensure that effective steps are taken, in a coordinated and timely manner, to address the challenges posed by climate change and minimise, to the extent possible, damages and losses which could exceed 24.5% of GDP by 2050 and 49.1% by 2100, if no action is taken.

The NAP and SASAPs detail adaptation objectives and priority measures; propose activities and timing for the execution of the measures and offer project concept notes for resource mobilisation and implementation. This document summarises the **project concept notes prepared under the lead of the Water Resources Management Agency** for Saint Lucia's Water SASAP. By allowing the implementation of the measures in the SASAP, the projects proposed will contribute to building national capacities for adaptation planning and integration, while accelerating the implementation of climate adaptation and risk reduction actions that are critical to safeguarding the country's socioeconomic and environmental systems under a changing climate.

The project concept extracts listed here are a reflection of the measures and project concept notes contained in Saint Lucia's NAP and Water SASAP. They are not listed in order of priority. Given that these documents are living or organic, it is envisaged that additional project concept notes will be added over time.

While **the lead agency for Saint Lucia's Sectoral Adaptation Strategy and Action Plan for the Water Sector (Water SASAP) 2018-2028 is the Water Resources Management Agency**, the implementation of projects and programmes would require the involvement of multiple agencies and stakeholders. In some cases, collaboration with other lead agencies would be warranted.

No	Title	Summary	Indicative Beneficiaries	Indicative Cost	Private sector involvement	Duration
1	Guiding wastewater interventions under a changing climate: Saint Lucia's Wastewater Master Plan (WMP) and Guidelines	A WMP is a strategic long-term planning instrument to determine future demand for wastewater management. It may be combined with water supply and urban planning, and can cover a village, a town or the entire island of Saint Lucia. The development of guidelines for the different sub-sectors (e.g. greywater management, on-site sanitation facilities, marinas) should be part of, or be done in parallel with, the development of the WMP. The guidelines will raise public awareness and promote discussion about specific issues on wastewater management.	All Saint Lucia sectors and residents	USD 1,000,000	yes	1 year
2	Developing Sea Level Rise-appropriate coastal wastewater management systems: The Canaries village pilot project	To develop and implement integrated and sustainable wastewater management solutions and technologies for all wastewater producers in Canaries village. If successful, the project can be replicated and adapted to suit other coastal towns and villages	Canaries Village, including all wastewater producers	USD 4,000,000	yes	3 years
3	Study for the introduction of climate resilient and sustainable greywater management systems	The implementation of sustainable and integrated water management practices including the appropriate management of greywater is a "no-regrets" adaptation option for increasing the availability of water resources with climate change. It also has the potential to reduce pollution, environmental and health risks This project proposes a study for guiding the effective introduction of greywater management techniques in the Saint Lucian context.	All greywater producers in Saint Lucia	USD 100,000	N/A	1 year (initial project; implementation may last 5 - 10 years)

* Projects with mitigation co-benefits

No	Title	Summary	Indicative Beneficiaries	Indicative Cost	Private sector involvement	Duration
4	Piloting low cost individual climate resilient sanitation systems in coastal areas	Saint Lucia's coastal towns/villages have no communal sewers connecting households as part of an enclosed sewerage network. However septic tanks and pit latrines exist and pose risks of contaminating the high-water table, and subsequently the marine environment in these low lying coastal areas. These risks are exacerbated by climate change. Being affordable and appropriate low-cost and watertight on-site sanitation facilities, the Biofil digester and Canteiro bio-septico, developed in Ghana and Brazil, respectively, are technologies that may provide residents with viable resolutions. If the pilot is successful, the new technologies should be added to the on-site sanitation guidelines and widely disseminated.	Low-lying areas and coast towns/villages: Vieux Fort, Anse la Raye, Canaries, Soufrière, Laborie, Choiseul, Micoud and Dennery	USD 100,000	yes	1 year
5	*Pig farms' wastewater and manure management: Piloting solutions to reduce water pollution under a changing climate	The Beausejour Agricultural Station will initiate a pilot project to optimise the recovery of biogas from pig waste with different sizes of digesters (fixed-dome, tubular digesters). The Centre will support some committed farmers to test composting and vermicomposting systems under Saint Lucia's climatic conditions.	Small, medium and large-scale pig farms in Saint Lucia generating wastewater and manure	USD 100,000	yes	1 year
6	Improvement of existing and development of new Faecal Sludge Treatment Plants (FSTPs) to reduce climate-related health and environmental risks	To optimise the use of existing installations, an upgrading of the existing installation to treat the effluent from FS drying beds should be assessed (e.g. the waste stabilisation ponds from Hewanorra International Airport).	Island wide; all sectors relying on on-site sanitation systems;	USD 400,000	N/A	1.5 years

* Projects with mitigation co-benefits

No	Title	Summary	Indicative Beneficiaries	Indicative Cost	Private sector involvement	Duration
7	Strengthening wastewater management and health under a changing climate : The development of an Industrial Wastewater Ordinance (IWO) for Saint Lucia	To develop a legal instrument to regulate and enforce industrial wastewater management in Saint Lucia to protect the environment and public health from industrial contamination. The IWO shall require every business that intends to discharge industrial wastewater into a public sewerage system or the receiving environment, to first obtain an Industrial Wastewater Discharge Permit. As a condition for approval of an Industrial Wastewater Discharge Permit, an applicant may be subject to participation in the Self-Monitoring Programme.	New and actual industries (manufacturing) on the island	USD 30,000	yes	6 months
8	Characterisation of river water-quality zones in Saint Lucia: Laying the foundation for the sustainable use of watersheds and river waters under a changing climate	This project will lay the foundation for the establishment of a river use policy by clearly demarcating cross sections of rivers and identifying the type of activities which could be undertaken within each cross section. The objective of this classification exercise would be to harmonise the water quality within each cross section with the activities within the area.	River water users	USD 300,000 per watershed and a one-time cost of USD 70,000 for purchase of a monitoring drone.	yes	1 year
9	Increasing water availability during dry periods: Pilot project for Rainwater Harvesting (RWH) systems for farms (poultry farms, small crop farm holdings).	This project proposes the installation of pilot RWH systems in key areas of small-scale crop and livestock farms which rely on raw and potable water for production. The project is set to showcase the effectiveness of RWH technologies in sustaining production during water-related emergencies, including periods of drought when the intermittency of water supply increases.	Livestock and small crop farmers	USD 55,222.25	N/A	6 months per project site

No	Title	Summary	Indicative Beneficiaries	Indicative Cost	Private sector involvement	Duration
10	Enhancement of Saint Lucia's early warning systems and flood emergency response through flood hotspot analysis, guidelines, training plan, procurement and installation of flood level gauges	This project will improve the existing early warning system and hence, inform the adjustment of emergency response measures by enabling (in terms of infrastructure, modelling, and training in data collection and analysis) the National Emergency Management Organisation (NEMO) to correlate rainfall quantity to flood levels and thus monitor the magnitude of flooding in flood-prone community zones.	Community members and households exposed to flooding	USD 215,000	N/A	3 months
11	Enhancement of early warning systems and flood emergency response through the construction of five controlled structures in key watersheds and the installation of staff gauges at stream gauging sites	This initiative would seek to facilitate consistent and accurate automatic data capturing of water levels. The data captured via this initiative is used to support the Flood Early Warning Systems, as well as provide the necessary data for establishing hydrologic models.	Hydrological data users, Water Resources Management Agency (WRMA), engineers and many other users	USD 153,000	N/A	9 months
12	Land acquisition and Public-Private Partnerships (PPPs) for watershed management, protection and infrastructure upgrade in a changing climate	This project would seek the identification and subsequent acquisition of private lands for watershed management and protection and installation of water infrastructure (intakes, storage tanks, wastewater treatment facilities etc.). This will create the requisite land resource to secure the allocation of areas for these necessary resources and contribute to strengthening the country's water sector under a changing climate.	Private residences and businesses in the areas fed by the water watershed and infrastructure	USD 10,500,000	yes	2 years

No	Title	Summary	Indicative Beneficiaries	Indicative Cost	Private sector involvement	Duration
13	Laying the ground for the sustainable management of groundwater resources under a changing climate: The development of a hydrogeological map for Saint Lucia	This project seeks to map out its groundwater resources of Saint Lucia, resulting in a hydrogeological map. This instrument is key for identifying abstraction points, selecting sites for groundwater exploration and establishing site-specific groundwater protection zones (and associated land use regulation and policies) to prevent groundwater contamination.	The entire Saint Lucian population	USD 3,000,000	yes	3 years
14	Public sensitisation towards improving the management, conservation and protection of water resources under a changing climate	This project focuses on exposing Saint Lucians to sustainable land use and water conservation practices and encouraging adoption, in order to reduce river sedimentation and to better manage water supplies during periods of water scarcity.	The entire Saint Lucian population	USD 120,000	yes	4 years
15	Building climate resilience in Saint Lucia through the documentation of effective indigenous soil and water conservation measures for replication and promotion	This project seeks to identify and assess the effectiveness of local and traditional soil and water conservation practices applied in some areas of the Dennery Mabouya valley, an area inhabited by many small-scale farmers and where agriculture often takes place over the surrounding steep slopes.	Farming community (hillside farmers); Extension officers	USD 60,000	yes	2 years

* Projects with mitigation co-benefits

No	Title	Summary	Indicative Beneficiaries	Indicative Cost	Private sector involvement	Duration
16	Building capacities for national monitoring, surveillance and enforcement of control measures for sound chemicals and hazardous wastes to prevent the contamination of critical water resources under a changing climate	This will support the enforcement of existing and planned regulatory control measures, resulting in improved capability to detect and monitor imports of chemicals/chemical products subject to regulation. The detection of illegal imports and implementation of pollution monitoring and surveillance programmes are key elements for ensuring that the risk of exposing residents and sensitive ecosystems to hazardous substances, is minimised.	Direct beneficiaries: Government agencies; Indirect beneficiaries: community members and households	USD 300,000	N/A	1.5 years
17	Digitisation of historical hydro-meteorological data for improving climate change modelling and adaptation planning in Saint Lucia	The project proposes the digitisation of historical hydro-meteorological data that exists in printed records only. This will allow, not only the reduction of the risk of the data being lost due to deterioration, but will increase the amount of digital historic data available for improving (and better downscaling) climate change models for Saint Lucia and the region.	The public and other key stakeholders within the water sector	USD 24,000	N/A	6 months
18	Improving climate observations and monitoring systems to inform adaptation planning and strengthen early warning systems	To improve the hydro-meteorological monitoring capacity of the Water Resources Management Agency (WRMA) through the use of Automated Local Evaluation in Real-Time (ALERT) rainfall stations, acoustic doppler technology, water level sensors and environmental monitoring drones. The data collected would assist with the production of hazard maps and improvement of flood early warning systems.	Water sector, farmers, communities, professional groups and commercial sector (insurance)	USD 444,440	yes	6 months

* Projects with mitigation co-benefits

No	Title	Summary	Indicative Beneficiaries	Indicative Cost	Private sector involvement	Duration
19	* Improving energy efficiency within the Water Sector in Saint Lucia through the introduction of renewable Energy technologies into the operations of the Water and Sewerage Company Inc.	Climate change is projected to reduce the availability and quality of freshwater, cause more frequent damage to water infrastructure and increase water management costs in Saint Lucia, affecting the water security of all Saint Lucians, especially vulnerable groups. This project will introduce new renewable energy solutions and technologies into the operations of the country's only water utility company, the Water and Sewerage Company Inc. (WASCO), to decrease reliance on diesel-powered electricity, which accounts for approx. 20-25% of WASCO's total operational budget. An ongoing Energy Efficiency Audit will identify the most suitable renewable energy interventions for this project.	WASCO and its customers	USD 600,000	yes	2 years

* Projects with mitigation co-benefits

2. CONCEPT NOTES

The project concept notes outlined here are a reflection of the measures contained in Saint Lucia's NAP and Water SASAP. They are not presented in order of priority. Given that these documents are living or organic, it is envisaged that additional project concept notes will be added over time.

While the lead agency for *Saint Lucia's Sectoral Adaptation Strategy and Action Plan for the Water Sector (Water SASAP) 2018-2028*, is the Water Resource Management Agency, the implementation of projects and programmes would require the involvement of multiple agencies and stakeholders. In some cases, collaboration with other lead agencies would be warranted.

PROJECT CONCEPT 1. GUIDING WASTEWATER INTERVENTIONS UNDER A CHANGING CLIMATE: SAINT LUCIA'S WASTEWATER MASTER PLAN (WMP) AND GUIDELINES

PROJECT CONCEPT 1	
Project title	Guiding Wastewater Interventions under A Changing Climate: Saint Lucia's Wastewater Master Plan (WMP) and Guidelines
Objective	To provide guidance for future wastewater interventions in Saint Lucia
Rationale	<p>Saint Lucia's Climate Change Adaptation Policy recognises the challenge of providing freshwater to the country's population and economic activities under a changing climate. Freshwater shortages have already started to be experienced and are expected to increase with time. This will be driven by an increasing demand brought by a growing population, while climate change induces lower annual precipitation and more erratic rainfall, higher evaporation, and saline intrusion into coastal rivers due to sea-level-rise, all of which exacerbate current pressures on the country's fragile water resources.</p> <p>Safeguarding Saint Lucia's water resources and services under a changing climate requires the urgent implementation of sustainable and integrated water management practices, including the appropriate management of wastewater, recognised as a 'no regrets' adaptation option, and calls for well-structured planning mechanisms in the water sector based on ground-level information that is currently incomplete or outdated.</p> <p>A WMP is a strategic long-term planning instrument to determine future demand for wastewater management. It may be combined with water supply and urban planning, and can cover a village, a town or the entire island of Saint Lucia. After the Saint Lucia Wastewater Management Policy and Strategic Plan, completed in 2017, the national WMP is the next step in the hierarchy of strategic documents required to develop the sector and match technical proposals with geographic, climatic and other parameters.</p> <p>Development of guidelines for the different sub-sectors (e.g. greywater management, on-site sanitation facilities, marinas) should be part of, or be done in parallel with, the development of the WMP. The guidelines will raise public awareness and promote discussion about specific issues on wastewater management.</p>
Scope	<p>Domestic wastewater, including faecal sludge from households, hotels, restaurants, commercial areas, car-wash areas, gas stations, ports and marinas.</p> <p>The town of Castries can be included in the national WMP, but due to its specific situation (no Wastewater Treatment Plan, WWTP) a separate WMP and feasibility study could be elaborated.</p>
Activities and Tasks	<p>1. Elaborate a WMP for Saint Lucia that includes, <i>inter alia</i>:</p> <ul style="list-style-type: none"> • An inventory and description of existing water and wastewater systems (e.g. Beausejour WWTP, Castries City Council faecal sludge treatment plant, sewer networks of Castries and Gros-Islet/Beausejour, communal septic tank in Vieux Fort); • The description of geographic, topographic, geotechnical and other environmental conditions for wastewater management and risk mapping (e.g. landslide risk, low-lying and coastal areas);

PROJECT CONCEPT 1**Project title Guiding Wastewater Interventions under A Changing Climate: Saint Lucia's Wastewater Master Plan (WMP) and Guidelines**

- Projections: water supply quantity and quality projections, population projections, service area projections, present and planned land use, water and wastewater demand projections, future water quality demand and wastewater standards;
- An analysis of socio-economic conditions, affordability and willingness-to-pay and impact of wastewater service improvements on rental levels;
- A description of improvements needed to meet future water and wastewater demand based on hydraulic modelling approaches to estimate long-term needs with documentation of each option;
- The justification for the selection of particular centralised, decentralised or individual system improvements or greenfield options (based on needs, cost effectiveness, constructability, reliability, operation, maintenance, stakeholder preferences, etc.);
- Recommendations on system improvements or greenfield options;
- Maps showing improvement components and service areas;
- An institutional set-up and public service model and tariff structure;
- Documentation and description of costs and benefits of system improvements, including a financial feasibility study;
- An implementation plan (establishing priorities, i.e. short-term solutions and others to be implemented in the long-term.).

2. Guidelines

- Elaborate guidelines for on-site and small wastewater facilities, and greywater management for all sectors (e.g. households, small communities, restaurants, hotels, businesses, public offices). The Guidelines should provide: a) information for the design, construction, operation and maintenance of facilities, b) information for retrofitting systems for water saving, and c) contact information for the technical support unit and related services (e.g. technical support unit at the Ministry of Health and Wellness (MoH), sanitary engineers, masons, vacuum tankers).
- Elaborate guidelines for ports and marinas to implement adequate careening activities. These guidelines should include: a) technology description, b) design and costs, and c) operation and maintenance requirements. These guidelines may also consider solutions for car-wash areas and gas stations.

Implementation

- **Leading agency:** Water Resource Management Agency (WRMA)
- **Implementation entities:** WRMA
- **Technical support:** Water and Sewerage Company Inc. (WASCO) and an external consultant
- **Financing:** Government of Saint Lucia (GoSL) and development partners

Indicative Cost USD 1,000,000**Duration** 1 year

PROJECT CONCEPT 1

Project title **Guiding Wastewater Interventions under A Changing Climate: Saint Lucia's Wastewater Master Plan (WMP) and Guidelines**

Additional information

- This project is aligned with the Water SASAP's measures 2, 4, 26, 27, 28, and 48 and can contribute to implementing measures 30, 31, 32, 33 and 63.
- The WMP and Guidelines will support national climate change adaptation efforts; their periodic evaluation and update will be included in, and monitored as part of, the Climate Adaptation Strategy and Investment Plan for the Water Sector, to ensure they keep up with changing needs, technologies and service levels.
- Saint Lucia is finalising a study entitled, "Assessment of soil/geology to inform suitable sewage and liquid waste disposal methods in settlement areas". This study will provide important technical information for the WMP.

PROJECT CONCEPT 2. DEVELOPING SEA LEVEL RISE-APPROPRIATE COASTAL WASTEWATER MANAGEMENT SYSTEMS: THE CANARIES VILLAGE PILOT PROJECT

PROJECT CONCEPT 2	
Project title	Developing Sea Level Rise-appropriate coastal wastewater management systems: The Canaries village pilot project
Objective	To develop and implement integrated and sustainable wastewater management solutions and technologies for all wastewater producers in Canaries village
Rationale	<p>Saint Lucia’s Climate Change Adaptation Policy recognises the challenge of providing freshwater to the country’s populations and economic activities under a changing climate. Freshwater shortages have already started to be experienced and are expected to increase with time. This will be driven by an increasing demand brought by a growing population, while climate change induces lower annual precipitation and more erratic rainfall, higher evaporation, and saline intrusion into coastal rivers due to sea-level-rise, all of which exacerbate current pressures on the country’s fragile water resources.</p> <p>Safeguarding Saint Lucia’s water resources and services with due consideration of climate change requires the urgent implementation of sustainable and integrated water management practices, including the appropriate management of wastewater, recognised as a ‘no regrets’ adaptation option.</p> <p>Most of the coastal towns/villages (i.e. Anse la Raye, Canaries, Vieux Fort, Laborie, Choiseul, Micoud, Dennery, Soufrière) are at or partially below sea level, with serious implications for wastewater management. The hydrogeology conditions with a high-water table make these zones not suited for septic tank and soakaway absorption systems. The saturated zones may facilitate a higher rate of migration of faecal contaminants towards the near shore marine environment due to the presence of advection currents. This challenge may increase as a consequence of climate change. A rise in sea level and natural events causing flooding may lead to more infiltration/exfiltration in sanitation facilities.</p> <p>Also, most of the coastal towns/villages are facing a situation where sea water enters the drains, in particular at high tide, and today, most households discharge their greywater into the drain (even black water in some cases).* This issue should be addressed by proper greywater, storm water and solid waste management.</p> <p>Saint Lucia needs to develop an integrated wastewater management system for its coastal towns and villages, to reduce coastal communities’ exposure to faecal contamination and other harmful chemicals and material.</p> <p>Canaries, with its relatively low population and high tourism potential (namely, village tourism), offers an appropriate starting point to develop a pilot integrated system. A study financed through the Global Environment Facility (GEF), “Assessment of Wastewater infrastructure and go-forward options for the village of Canaries, Saint Lucia” was published in 2016. The study identified feasible and affordable sanitary options to address the inadequate practices and technologies used by the communities of Canaries. Strategies for both short term and long-term visions have been proposed,</p>

* GoSL. (2017). Saint Lucia National Policy on Wastewater Management. Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Cooperatives

PROJECT CONCEPT 2	
Project title	Developing Sea Level Rise-appropriate coastal wastewater management systems: The Canaries village pilot project
incorporating low-complexity, cost effective solutions as well as centralised networks to reduce health and environmental risks, and allow for improved tourism related activities.	
Scope	Canaries Village, including all wastewater producers such as households, offices, businesses, restaurants, hotels, industries, gas stations, car-wash areas, harbour, etc. If successful, the project can be replicated and adapted to suit other coastal towns and villages.
Activities and Tasks	<ul style="list-style-type: none"> • Review study on, “Assessment of Wastewater infrastructure and go-forward options for the village of Canaries, Saint Lucia”; • Identify recent wastewater management development activities in Canaries (if any) and existing wastewater management services in place; • Identify all wastewater producers in Canaries (all sectors); • Develop different scenarios for integrated wastewater management development, including climate change considerations; • Consult with the different stakeholders (e.g. communities, local authority, tourism industry, businesses, industries) to assess their needs, willingness to pay and potential voluntary actions to be undertaken; • Evaluate affordability, financing and cost recovery issues; • Select the most suitable scenario; • Implement and build integrated wastewater management infrastructure; • Conduct awareness-raising campaigns; • Identify gaps and opportunities for improvement.
Implementation	<ul style="list-style-type: none"> • Leading agency: Water Resource Management Agency (WRMA) • Implementation entity: Canaries Village Council • Technical Support: WRMA Water and Sewerage Company Inc (WASCO) and an external consultant • Financing: Government of Saint Lucia supported by development agencies
Indicative Cost	USD 4,000,000
Duration	3 years
Additional information	<ul style="list-style-type: none"> • This project is aligned with the Water SASAP’s measures 26, 27, 28, 29, 30, 32 and 33, and can contribute to implementing measures 2 and 70. Selection and implementation of technologies should also consider drainage and storm water management, as well as solid waste management. • Solutions should consider urban development and resettlement options. Local communities should be actively consulted and strongly involved in the development and decision-making process.

PROJECT CONCEPT 3. STUDY FOR THE INTRODUCTION OF CLIMATE RESILIENT AND SUSTAINABLE DOMESTIC GREYWATER MANAGEMENT SYSTEMS

PROJECT CONCEPT 3	
Project title	Study for the introduction of climate resilient and sustainable greywater management systems
Objective	To develop and promote sustainable greywater management solutions for Saint Lucia
Rationale	<p>With climate change, sea-level rise, lower annual rainfall amounts but more intense rains, and tropical storms in the Caribbean, associated flooding episodes are expected to increasingly affect Saint Lucia’s population, economic activities and environment in the coming decades. This could not only jeopardise development gains but exacerbate the effects of current unsustainable practices and increase the vulnerability of the country’s land, freshwater and marine resources, food production and health systems, with potentially irreparable damage if no timely and effective adaptation measures are implemented. The implementation of sustainable and integrated water management practices, including the appropriate management of wastewater, has the potential to reduce pollution, environmental and health risks and is recognised as a ‘no regrets’ adaptation option.</p> <p>In Saint Lucia, most greywater is discharged untreated into open drains and ultimately enters the marine environment. The main reasons for such practice include existing separation between black and grey water at the household level, the savings on septic tank maintenance, the long-lasting (cultural) practice and to some extent inadequate sanitation education. Inhabitants seem not to link such practices to poor coastal water quality, whether using an on-site facility or connected to a sewer network. The introduction of a new approach about greywater practice is a key challenge to reduce environmental and climate-related risks. It is also a technical challenge since today, most households are still directly connected with pipes to the drains.</p>
Scope	All greywater producers in Saint Lucia (i.e. households, public offices, businesses, restaurants, hotels)
Activities and Tasks	<p>– Conduct a study for guiding the effective introduction of greywater management techniques in the Saint Lucian context. The study should include:</p> <ul style="list-style-type: none"> • Guidelines for greywater management, including both sustainable technologies and practices (catalogue of technologies and practices). The guidelines will provide information/parameters for the design, construction, modification, operation and maintenance of facilities. The guidelines should also include the retrofitting of water-saving systems and should inform users about technical support units and services (e.g. technical support unit at the Ministry of Health and Wellness, sanitary engineers, masons, plumbers, material and equipment providers); • An analysis of the support required to facilitate the private sector to import and distribute the required new technologies and equipment; • The design of public awareness-raising and promotion campaigns for the sustainable management of wastewater and materials and recommendations for the introduction of relevant courses in the curriculum of primary and secondary schools;

PROJECT CONCEPT 3	
Project title	Study for the introduction of climate resilient and sustainable greywater management systems
	<ul style="list-style-type: none"> • The selection of a pilot area to start implementation; • An analysis and test of financial mechanisms (such as, subsidies, incentives, tax credits for early birds) and technical support to encourage the Saint Lucian population to build and adopt appropriate technologies.
Implementation	<ul style="list-style-type: none"> • Leading agency: Water Resources Management Agency (WRMA) • Technical Support: Ministry of Infrastructure, Port, Energy and Labour; Water and Sewerage Company Inc. (WASCO); Ministry of Economic Development, Housing, Urban Renewal, Transport and Civil Aviation; Ministry of Education, Innovation, Gender Relations and Sustainable Development • Financing: GoSL and development partners
Indicative cost	USD 100,000
Duration	1 year (initial project; implementation may last 5 - 10 years, depending on enforcement capacities and political support)
Additional information	<ul style="list-style-type: none"> • This project is aligned with the Water SASAP's measures 29, 30, 32, 33, and 52 can contribute to implementing measures 2, 6 and 53. • This study could be extended to other sources of surface water pollution such as car-wash areas, gas stations, and careening activities. • The study should consider as a first measure for implementation the reduction of pollution at the source (reduction of greywater volume generation). The study should consider the introduction of reduced flow devices and appliances and should promote the adoption of appropriate practices and behaviours. Options for rainwater collection and on-site greywater reuse should be assessed. • The guidelines shall propose solutions to move from existing greywater practice to sustainable greywater management infrastructure; specifically, how to change/modify the existing on-site piping system to move from an unimproved to an improved infrastructure.

PROJECT CONCEPT 4. PILOTING LOW COST INDIVIDUAL CLIMATE RESILIENT SANITATION SYSTEMS IN COASTAL AREAS

PROJECT CONCEPT 4	
Project title	Piloting low cost individual climate resilient sanitation systems in coastal areas
Objective	To develop low-cost, on-site sanitation technologies for low-lying areas to decrease the risk of coastal water contamination by faecal matter
Rationale	<p>Saint Lucia is highly vulnerable to the impacts of climate change and associated hazards. Poor water and sanitation infrastructure and services add to the country’s vulnerability as with global warming, sea-level rise, extreme weather events and flooding episodes - linked to increasing rates of pollution and water and vector disease outbreaks - are expected to increasingly affect the island in the coming decades. Investment in climate-resilient water and sanitation infrastructure has the potential to minimise these risks and is recognised as a ‘no regrets’ adaptation option.</p> <p>Saint Lucia’s coastal towns/villages do not have sewer systems. Limited space and high-water tables hamper the construction of proper on-site sanitary facilities such as septic tanks and soakaway systems. Many inhabitants depend on public toilets. In Canaries, for example, many households do not have toilets. In some cases, the poor management and restricted opening hours of public toilets cause open defecation practices, especially during the night.</p> <p>The isolated coastal towns and villages border the vulnerable marine environment. Soil is mostly clayey and saturated with a high-water table, which disrupts the absorption function of septic tank and soakaway. The areas are also prone to flooding.</p> <p>A high unemployment rate and limited financial capacities within the communities make investments and cost recovery very challenging. Up to 2017, no affordable and appropriate low-cost and watertight on-site sanitation facilities had been proposed or tested in Saint Lucia. Biofil digester and Canteiro bio-septico, developed in Ghana and Brazil, respectively, are such technologies worthy of being tested.</p> <p>The Biofil Digester system operates on the principle of aerobic decomposition. The digester is a simple compact onsite organic waste treatment system. The three principles of this system are: 1) Rapid separation of solid and liquid, 2) Aerobic decomposition of solid, and 3) Bio-filtration of wastewater.</p> <p>The system is easy to install, its space requirement is low, usually operates without odour and is feasible in areas with a high-water table. The system requires minimum maintenance; since the system does not produce faecal sludge, it does not need to be de-sludged. The digester gets full after 10 years of operation and the top soil can be removed easily (no truck needed).</p> <p>The Canteiro bio-septico works with a flush toilet system. It can also receive domestic greywater. It is a single chamber where organics are decomposed by microorganisms through both aerobic and anaerobic digestion. Plants are planted on top of the structure. The water is absorbed by the roots then eliminated through evapo-transpiration. Some organics are also consumed by the plants. There is no effluent or sludge to be emptied.</p>
Scope	<p>Low-lying areas and coast towns/villages: Vieux Fort, Anse la Raye, Canaries, Soufrière, Laborie, Choiseul, Micoud and Dennery</p> <p>Use of new technologies can be extended to other areas of the island.</p>

PROJECT CONCEPT 4	
Project title	Piloting low cost individual climate resilient sanitation systems in coastal areas
Activities and Tasks	
<ul style="list-style-type: none"> • Identify and select technologies to be imported and piloted (study tours to Brazil and Ghana); • Identify and select households in coastal towns/villages for building, operating and maintaining the facilities (at least 10 households, is recommended); • Conduct a workshop with the household owners and the technical unit to share information about the objectives of the project, the rules and behaviour, to operate the facilities; • Conduct regular field visits for sampling and data collection (effluent quality, solids decomposition, infrastructure conditions); • Identify issues, gaps and improvement measures. 	
Implementation	
<ul style="list-style-type: none"> • Leading agency: Water Resource Management Agency (WRMA) • Implementation entities: Town Councils and selected households • Technical Support: Technical unit from Water and Sewerage Company Inc. or WRMA • Financing: GoSL and development partners 	
Indicative cost	USD 100,000
Duration	1 year
Additional information	
<ul style="list-style-type: none"> • This project is aligned with the Water SASAP's measures 26 and 30 and can contribute to implementing measures 2 and 28. • Special attention should be given to the material used to build the facilities. Saturated soil and seawater may accelerate erosion of the superstructure. • Special attention should also be given to building the climate resilience of the structures. • If the pilot is successful, the new technologies should be added to the on-site sanitation guidelines and widely disseminated. 	

PROJECT CONCEPT 5. PIG FARMS' WASTEWATER AND MANURE MANAGEMENT: PILOTING SOLUTIONS TO REDUCE WATER POLLUTION UNDER A CHANGING CLIMATE

PROJECT CONCEPT 5	
Project title	Pig farms' wastewater and manure management: Piloting solutions to reduce water pollution under a changing climate
Objective	To develop and test technologies for the safe treatment of pig farm wastewater and manure in the Saint Lucian context to prevent coastal, surface and groundwater contamination
Rationale	<p>Saint Lucia's Climate Change Adaptation Policy recognises the challenge of providing freshwater to the country's populations and economic activities under a changing climate. Freshwater shortages have already started to be experienced and are expected to increase with time. This will be driven by an increasing demand brought by a growing population, while climate change induces lower annual precipitation and more erratic rainfall, higher evaporation, and saline intrusion into coastal rivers due to sea-level-rise, all of which exacerbate the effects of current pressures on the country's fragile water resources. Untreated pig-farm waste is a major source of pollution and a cause of concern for Saint Lucia's water systems, particularly when swine farms are located close to river banks and above water intakes. Making use of simple and well-tested waste and wastewater treatment technologies to eliminate this form of pollution is a valid adaptation measure and key to securing the quality of freshwater resources under a changing climate.</p> <p>The manure production from swine farms is the result of a mix of urine, faeces, water used for cleaning activities and wasted potable water. The wastewater (manure slurry) contains a high organic load, high nitrogen content and can be highly pathogenic.</p> <p>Saint Lucia has a significant number of registered pig farms with a few equipped with biogas digesters; thus, wastewater from swine farms still remains largely untreated in Saint Lucia, causing contamination of the watershed.</p> <p>The volume of manure and wastewater is estimated to be close to the overall production of domestic Faecal Sludge (FS) of the island. The poor management of the manure and liquid waste and the location of a few farms above Water and Sewerage Company Inc.'s drinking water intakes make this sector a key challenge to be addressed by the Government of Saint Lucia.</p> <p>If properly managed, wastewater and manure generated by pig farms can also result in highly valuable products. Thus, pig farm wastewater management shall focus on resource recovery of waste.</p> <p>Different (low-cost) technologies are available for effective waste management such as composting, vermicomposting, bio digesters, waste stabilisation ponds/lagoons and constructed wetlands.</p> <p>It is recommended that the Beausejour Agricultural Station initiate a pilot project to optimise the recovery of biogas from pig waste with different sizes of digesters (fixed-dome, tubular digesters). The Centre shall support some committed farmers to test composting and vermicomposting systems under Saint Lucia's climatic conditions.</p>
Scope	Wastewater and manure generated by small, medium and large-scale pig farms in Saint Lucia

PROJECT CONCEPT 5

Project title **Pig farms' wastewater and manure management: Piloting solutions to reduce water pollution under a changing climate**

Activities and Tasks

- Identify and select the technologies to be imported and piloted (study tours in Korea or Vietnam for bio-digesters, in Cuba for vermicomposting);
- Preliminary study to determine the design and capacity of the systems that will be constructed;
- Construct the bio digesters on the Beausejour Agricultural Station site;
- Select farmers to host the composting and vermicomposting pilot projects (at least 5 farms for each system);
- Design of on-site data collection, sampling and analysis procedures (identification of key parameters);
- Recommendation for improvements and scaling up.

Implementation

- **Leading agency:** Government agency with responsibility for Agriculture
- **Implementation entities:** Beausejour Agricultural Station
- **Financing:** Government of Saint Lucia and development partners

Indicative cost USD 100,000

Duration 1 year

Additional information

- This project is aligned with the Water SASAP's measures 30 and 32 can contribute to implementing measure 36. Given that pig farming is one of the major agricultural activities in Saint Lucia and today's management of manure and wastewater is poor, it is recommended that Saint Lucia develops an Agricultural Competence/Reference Centre to support and enforce the sector (mainly individual farmers) to implement appropriate technical, cost-effective solutions to reduce water and environmental contamination, and create secondary revenue sources from the production of valuable by-products (soil amendment, biogas). The Beausejour Agricultural Station is an ideal location to host such reference activity.
- Saint Lucian personnel could seek training in Cuba. Cuba is a specialist in vermicomposting for waste from farming. Vermicomposting centres are numerous in Cuba and vermicomposting has been the largest single input used to replace commercial fertiliser. In 2003, an estimated one million tons of vermicomposting were produced in Cuba.

PROJECT CONCEPT 6. IMPROVEMENT OF EXISTING AND DEVELOPMENT OF NEW FAECAL SLUDGE TREATMENT PLANTS TO REDUCE CLIMATE-RELATED HEALTH AND ENVIRONMENTAL RISKS

PROJECT CONCEPT 6	
Project title	Improvement of existing and development of new Faecal Sludge Treatment Plants (FSTPs) to reduce climate-related health and environmental risks
Objective	To provide safe treatment and disposal of Faecal Sludge (FS)
<p>Rationale</p> <p>With climate change, sea-level rise, lower annual rainfall amounts but more intense rains, and tropical storms in the Caribbean, associated flooding episodes are expected to increasingly affect Saint Lucia’s population, economic activities, and environment in the coming decades. This could not only jeopardise development gains but exacerbate the effects of current unsustainable practices and increase the vulnerability of the country’s land, freshwater and marine resources, food production, and health systems, with potentially irreparable damage if no timely and effective adaptation measures are implemented. The implementation of sustainable and integrated water and waste management practices, including the appropriate management of wastewater, has the potential to reduce pollution, environmental and health risks and is recognised as a ‘no regrets’ adaptation option.</p> <p>The disposal and treatment of FS is critical in Saint Lucia. 81% of FS is collected, but only partially treated (Beausejour and Union FS Treatment Plants) and probably 19% is dumped directly onto open land, causing environmental and human health risks, which will only increase with climate change-induced, more frequent weather extremes. Since most of the population relies on on-site sanitation facilities, safe FS treatment and disposal services should be provided and enforced for all areas of Saint Lucia.</p> <p>To optimise the use of existing installations, an upgrading of the existing installation to treat the effluent from FS drying beds should be assessed (e.g. the waste stabilisation ponds from Hewanorra International Airport).</p> <p>Beausejour Wastewater Treatment Plant (WWTP) offers an ideal location to build a state-of-the-art Faecal Sludge Treatment Plant (FSTP). Land is available and the existing waste stabilisation ponds in operation could be used for secondary treatment of the effluent from faecal sludge drying beds. Given Saint Lucia’s climate (temperature, air moisture, rainfall and tropical storms), planted drying beds for FS treatment may be the most appropriate technology. Local climate is ideal for the growth of macrophytes, and even if the operation of such a plant requires qualified staff, it provides better treatment than unplanted drying beds. This technology requires very little operation and maintenance. The products are potentially highly valuable if culturally accepted.</p>	
<p>Scope</p> <ul style="list-style-type: none"> • Island wide; all sectors relying on on-site sanitation systems (households, public offices, businesses, industries/factories, restaurants, hotels); • Small scale WWTP mainly operated by hotels; • Existing large-scale WWTP. 	
<p>Activities and Tasks</p> <ul style="list-style-type: none"> • Conduct a study to determine the FS volume to be treated annually and determine the peak flow production if any (e.g. rainy season); • Conduct a FS quantification study (annual volume to be emptied and treated in the Northern 	

PROJECT CONCEPT 6	
Project title	Improvement of existing and development of new Faecal Sludge Treatment Plants (FSTPs) to reduce climate-related health and environmental risks
	<p>and Southern parts of the island, seasonal peak flow);</p> <ul style="list-style-type: none"> • Conduct a FS characterisation study (FS sampling and analysis of total solids, total suspended solids, chemical oxygen demand); • Assess the feasibility to connect the sludge drying beds to Beausejour and Hewanorra International Airport WWTPs for secondary treatment of the effluent; • Identify and select the most appropriate technology for FS treatment for Saint Lucia specific context (planted or unplanted drying beds with or without settling tank); • Design the FSTPs; • Conduct a study on affordability, cost structure and recovery; • Contract a local construction company to construct the FSTPs. • Conduct staff training on FSTPs.
Implementation	<ul style="list-style-type: none"> • Leading agency: Water Resources Management Agency (WRMA) • Implementation entities: Construction sector • Technical Support: External consultant • Financing: GoSL and development partners
Indicative cost	USD 400,000
Duration	1.5 years
Additional information	<ul style="list-style-type: none"> • This project is aligned with the Water SASAP's measures 28, 30 and 31, and can contribute to implementing measures 26, 27 and 32. A market assessment study should be conducted to evaluate the potential demand for dried FS (e.g. agriculture, farming, greenery). The market assessment should include a cultural assessment component to address public acceptance in using products from planted drying beds. • The World Health Organization requires at least 6 months of storage duration of dried sludge from unplanted drying bed. For both planted and unplanted drying beds, the dried sludge should be analysed to ensure they are pathogen-free and thus safe for reuse. • Possibility of discharging the sludge from the WWTP (Beausejour WWTP, WWTPs from private hotels) on the planted drying beds should be assessed. • The FSTPs will be built for climate resilience from the design stage. • The FSTPs can be operated by WASCO, the town/village councils or operation can be delegated to private companies through a PPP scheme. It is recommended that workshops/consultations be held with FS emptying service providers to agree upon, among other things, the FS discharge tariffs and the opening hours to decrease uncontrolled FS discharge into the environment. • BOD5 concentration is often required to design a FSTP, but results from analyses are often inaccurate and unreliable with heterogeneous substrate such as FS.

PROJECT CONCEPT 7. STRENGTHENING WASTEWATER MANAGEMENT AND HEALTH UNDER A CHANGING CLIMATE: THE DEVELOPMENT OF AN INDUSTRIAL WASTEWATER ORDINANCE (IWO) FOR SAINT LUCIA

PROJECT CONCEPT 7	
Project title	Strengthening wastewater management and health under a changing climate: The development of an Industrial Wastewater Ordinance (IWO) for Saint Lucia
Objective	To develop a legal instrument to regulate and enforce industrial wastewater management in Saint Lucia to protect the environment and public health from industrial contamination
Rationale	<p>Saint Lucia’s Climate Change Adaptation Policy recognises the challenge of providing freshwater to the country’s populations and economic activities under a changing climate. Freshwater shortages have already started to be experienced and are expected to increase with time. This will be driven by an increasing demand brought by a growing population, while climate change induces lower annual precipitation and more erratic rainfall, higher evaporation, and saline intrusion into coastal rivers due to sea-level-rise, all of which exacerbate current pressures on the country’s fragile water resources.</p> <p>Safeguarding Saint Lucia’s water resources and services under a changing climate requires the urgent implementation of sustainable and integrated water management practices, including the appropriate management of wastewater, recognised as a ‘no regrets’ adaptation option.</p> <p>Among the 122 industries/manufacturers registered in Saint Lucia, only one operates a wastewater treatment plant package. The absence of technical support and the lack of legal and regulatory framework for industrial wastewater management (e.g. no standards in terms of effluent quality discharge for industries), is a key challenge. The results are large quantities of industrial wastewater entering untreated into water courses. The sector needs to develop an IWO, taking into consideration the new international trend, such as the cleaner production approach.</p> <p>The IWO shall require every business that intends to discharge industrial wastewater into a public sewerage system or the receiving environment to first obtain an Industrial Wastewater Discharge Permit. The issuing Authority shall agree on the proposed measures to minimise the impact of the industrial wastewater discharge (e.g. waste minimisation procedures, requirements for on-site wastewater (pre-) treatment and safe disposal for wastewater sludge).</p> <p>Because of the increasing evidence of the environmental and economic benefits associated with reducing waste at the source, rather than managing such waste after it is produced, industrial companies/factories should be required to submit a Waste Minimisation Plan with every demand for a new permit or extension, to be combined, for example, with the operational/occupation permit.</p> <p>As a condition for approval of an Industrial Wastewater Discharge Permit, an applicant may be subject to participation in the Self-Monitoring Programme. This Programme shall require a company to provide chemical and biological analyses of its industrial wastewater to the enforcement Authority on a regular basis.</p>
Scope	New and actual industries (manufacturing) on the island
Activities and Tasks	<ul style="list-style-type: none"> Consult with the industrial sector representatives (industry representatives, Saint Lucia

PROJECT CONCEPT 7

Project title **Strengthening wastewater management and health under a changing climate: The development of an Industrial Wastewater Ordinance (IWO) for Saint Lucia**

Chamber of Commerce, Industry and Agriculture, Manufacturers' Association) to identify the issues and challenges;

- Draft the IWO (requirements for obtaining a Discharge Permit, Waste Minimisation Plan);
- Draft the Self-Regulation Plan;
- Validate the IWO through a national workshop with key stakeholders;
- Establish effluent standards for discharging industrial wastewater either into a public sewer system or directly into the environment. It should differentiate the categories of industries according to the wastewater strength and characteristics;
- Introduce specific and affordable wastewater treatment technologies for the different industrial sectors.

Implementation

- **Leading agency:** Water Resources Management Agency (WRMA)
- **Implementation entity:** Government agency with responsibility for Environmental Health
- **Technical Support:** Saint Lucia Bureau of Standards, National Conservation Authority, Saint Lucia Chamber of Commerce and Industry, and Manufacturers' Association
- **Financing:** GoSL, development partners and industries

Indicative cost USD 30,000

Duration 6 months

Additional information

- This project is aligned with the Water SASAP's measures 2 and 27 and can contribute to implementing measures 3, 15 and 37.
- The development of IWO should be done by using a participatory approach with the industries. It will facilitate cooperation between public authority and industries and ultimately encourage compliance.
- Explicit climate change adaptation considerations should be integrated in the IWO.
- The IWO must be realistic and should consider that high standards lead to high treatment costs that can jeopardise or stymie the economic viability of industries. Development of incentives mechanisms, and long adaptation periods may be investigated.
- Standards may be adjusted for small businesses (for example implementation of standards proposed over a certain time frame such as 5 years), to facilitate progressive investments and improvements.
- Industries will need technical support to apply a cleaner production approach as well as to choose, build and operate adequate sanitation systems. The approach may need qualified international consultants to provide technical support to specific industries.
- Industrial wastewater regulation may be linked to regulations for safe management of hazardous material.

PROJECT CONCEPT 8. CHARACTERISATION OF RIVER WATER-QUALITY ZONES IN SAINT LUCIA: LAYING THE FOUNDATION FOR THE SUSTAINABLE USE OF WATERSHEDS AND RIVER WATERS UNDER A CHANGING CLIMATE

PROJECT CONCEPT 8	
Project title	Characterisation of river water-quality zones in Saint Lucia: Laying the foundation for the sustainable use of watersheds and river waters under a changing climate
Objectives	<ul style="list-style-type: none"> • To set the basis for establishing usage zones along rivers for improving management of abstraction, discharge and other activities which may impact water quantity and quality • To minimise negative impacts of users on each other • To zone the activities that can take place along watersheds by their minimum water quality requirements
Rationale	<p>This project will lay the foundation for the establishment of a river use policy by clearly demarcating cross sections of rivers and identifying the type of activities which could be undertaken within each cross section. The objective of this classification exercise would be to harmonise the water quality within each cross section with the activities within the area. This will help resolve water-related conflicts by facilitating stakeholder activities being managed in such a way that they have minimal negative impacts on each other. The demarcation and implementation of water usage zones along river basins of key watersheds will optimise the use of raw water resulting in reduced treatment costs for public utilities and bottling companies and will reduce their risk of contamination of water supplies during extreme weather events (floods) which are expected to more frequently affect Saint Lucia under a changing climate.</p>
Beneficiaries:	River water users
Activities and Tasks	<ul style="list-style-type: none"> • Identify river water monitoring points within watersheds to establish water quality baseline values (BOD, Bacterial, pH, suspended solids, etc.); • Characterise the river basins according to water quality (determined in monitoring points); • Establish usage zones based on characterisations; • Identify appropriate uses and activities for each usage zone; • Monitor water quality at transition points between zones; • Survey each zone to identify impacting activities to the water quality within the cross section; • Where necessary, act to ensure that activities within zones are congruous with the zoning requirements.
Main outputs/products	<ul style="list-style-type: none"> • Establishment of water quality zones along the river. • Periodic aerial images of zones.
Implementation	<ul style="list-style-type: none"> • Leading agency: Water Resources Management Agency (WRMA) • Financing: Government of Saint Lucia and development partners
Indicative cost	USD \$300,000.00 per watershed

PROJECT CONCEPT 8

Project title **Characterisation of river water-quality zones in Saint Lucia: Laying the foundation for the sustainable use of watersheds and river waters under a changing climate**

One-time cost of USD \$70,000.00 for purchase of a monitoring drone.

Duration 24 months

Additional information

- This project is aligned with the Water SASAP's measures 2 and 7 can contribute to implementing measures 5, 8, 9,10, 15, 16, 18, 19 and 68. This is a multi-thematic initiative having elements of watershed management and land use planning.

PROJECT CONCEPT 9. INCREASING WATER AVAILABILITY DURING DRY PERIODS: PILOT PROJECT FOR RAINWATER HARVESTING (RWH) SYSTEMS FOR FARMS (POULTRY FARMS, SMALL CROP FARM HOLDINGS).

PROJECT CONCEPT 9	
Project title	Increasing water availability during dry periods: Pilot project for Rainwater Harvesting (RWH) systems for farms (poultry farms, small crop farm holdings).
Objective	To pilot the effectiveness of RWH and storage systems in ensuring the availability of water to small livestock and crop holdings especially during dry periods or droughts
Rationale	<p>Climate change in Saint Lucia is expected to reduce the total annual precipitation and induce more intense and unpredictable rainfall events. Along with higher temperatures, longer and more frequent dry periods and recurrent drought will lead to water stress, which will decrease crop and livestock production in areas with no alternative water sources, affecting food security and farming livelihoods in the island. RWH has been proposed as a ‘no regrets’, simple and effective adaptation measure to enhance water availability during dry periods.</p> <p>Currently, the main water utility company in Saint Lucia rations water during the dry season and as a result, farmers who rely heavily on this resource for maintaining crop and animal production are significantly impacted. This project proposes the installation of pilot RWH systems in key areas of small-scale crop and livestock farms which rely on raw and potable water for production. The project is set to showcase the effectiveness of RWH technologies in sustaining production during water-related emergencies, including periods of drought when the intermittency of water supply increases.</p> <p>This initiative would assist in maintaining agricultural production levels during the dry season; or in drought conditions, reduce reliance on the water utilities company for supplying water to farms; and directly support food security.</p>
Beneficiaries	Livestock and small crop farmers
Activities and Tasks	<ul style="list-style-type: none"> • Identify areas vulnerable to low water supply for agriculture production and number of persons affected; • Retrofit existing or construct new RWH infrastructure, including water storage tanks; • Perform an assessment of farming infrastructure such as farm houses and greenhouses; • Identify suitable location for water storage area per farm; • Perform an assessment of the water supply and potential demand per farm; • Identify the mean rainfall total for the location; • Create a maintenance plan and sustainability of the system project.
Main outputs/products	<ul style="list-style-type: none"> • RWH systems installed and used in key farming areas of five (pilot) livestock and small crop holdings. Reduced water stress on crop and animal production during water-related emergencies and droughts, hence maintaining production yields.

PROJECT CONCEPT 9	
Project title	Increasing water availability during dry periods: Pilot project for Rainwater Harvesting (RWH) systems for farms (poultry farms, small crop farm holdings).
Implementation	<ul style="list-style-type: none"> • Leading agency: Water Resources Management Agency (WRMA) • Financing: GoSL and development partners
Indicative cost	<p>Water tanks: 25 x 1000 gallon water tanks = USD 20,000</p> <p>Plumbing materials: 25 X USD 500 = USD 12,500</p> <p>Labour: 5 HRS X 25 = USD 500 X 15 = USD 12,500</p> <p>Transportation: USD 963</p> <p>Consultancy/Contractor's fee per site/farm = USD 1,851.85 x 5 = USD 9,259.25</p> <p>Indicative total cost: USD 55,222.25</p>
Duration	6 months per project site
Additional information	<ul style="list-style-type: none"> • This project is aligned with the Water SASAP's measures 20, 22 and 55 and can contribute to implementing measures 24, 58, 62 and 70. The project is proposed as a pilot in five farms. It is expected that the successful trials can be replicated and scaled-up by farmers in areas with similar conditions.

PROJECT CONCEPT 10. ENHANCEMENT OF SAINT LUCIA’S EARLY WARNING SYSTEMS AND FLOOD EMERGENCY RESPONSE THROUGH FLOOD HOTSPOT ANALYSIS, GUIDELINES, TRAINING PLAN, PROCUREMENT AND INSTALLATION OF FLOOD LEVEL GAUGES

PROJECT CONCEPT 10	
Project title	Enhancement of Saint Lucia’s early warning systems and flood emergency response through flood hotspot analysis, guidelines, training plan, procurement and installation of flood level gauges
Objective	To improve strategic flood response measures and early warning systems by enhancing flood event data collection and analysis
Rationale	<p>With climate change, sea-level rise, lower annual rainfall amounts but more intense rains and tropical storms in the Caribbean, associated flooding episodes are expected to increasingly affect Saint Lucia’s population, economic activities and environment in the coming decades. This could not only jeopardise development gains, but exacerbate the effects of current unsustainable practices and increase the vulnerability of the country’s land, freshwater and marine resources, infrastructure, food production and health systems, with potentially irreparable damage if no timely and effective adaptation measures are implemented. Saint Lucia’s Climate Change Adaptation Policy calls for the set-up and promotion of integrated early warning and response systems as a climate change adaptation measure required to reduce risks and losses associated with flooding and landslide episodes. This includes those experienced in the country with the impact of Hurricane Thomas in 2010, which amounted to 43.4% of the island’s Gross Domestic Product, or of the 2013 unseasonal low-level trough system which crossed the island and produced greater than 224 mm of rainfall in a matter of two to three hours, impacting 2,600 persons directly, killing 6, and causing USD 89.2 million in damages. Developing flood prediction models to set up the integrated early warning systems requires the systematic and consistent collection of a broad range of quality data, with the appropriate geographical coverage in Saint Lucia.</p> <p>Currently, there is an island-wide flood early warning system that requires improving, as data limitations do not allow for the calculation of the magnitude of flooding, hampering the prioritisation of areas of intervention during emergencies. This project will improve the existing early warning system and hence, inform the adjustment of emergency response measures by enabling (in terms of infrastructure, modelling, and training in data collection and analysis) the National Emergency Management Organisation (NEMO) to correlate rainfall quantity to flood levels and thus monitor the magnitude of flooding in flood-prone community zones.</p> <p>Proposed location/site(s) for installing flood level gauges and collecting data for the hotspot analysis: Anse La Raye Village, Castries (central business district), Canaries Village, Dennery Village, Bois D’Orange, Soufrière (New Development), Cul De Sac and Bexon</p>
Beneficiaries	Community members and households exposed to flooding
Activities and Tasks	<ul style="list-style-type: none"> • National flood hotspot analysis; • Installation of flood level indicators for reporting and emergency response.
Main outputs/products	<ul style="list-style-type: none"> • Mapped flood hotspots. • Improved community flood emergency response (improved early warning system).

PROJECT CONCEPT 10	
Project title	Enhancement of Saint Lucia’s early warning systems and flood emergency response through flood hotspot analysis, guidelines, training plan, procurement and installation of flood level gauges
Implementation	
<ul style="list-style-type: none"> • Leading agencies: National Emergency Management Organisation (NEMO), Met Office, Water Resources Management Agency (WRMA) • Financing: Government of Saint Lucia and development partners 	
Indicative cost	
Consultancy fees (Flood hotspot analysis, guidelines, training plan): USD 200,000 Procurement of flood gauges: USD 10,000 Installation of gauges: USD 400 Training of community members of reading gauges: USD 3,000 Total: USD 215,000	
Duration	3 months
Additional information	
<ul style="list-style-type: none"> • This project is aligned with the Water SASAP’s measures 14, 63, 64, 65 and 66. 	

PROJECT CONCEPT 11. ENHANCEMENT OF EARLY WARNING SYSTEMS AND FLOOD EMERGENCY RESPONSE THROUGH THE CONSTRUCTION OF FIVE CONTROLLED STRUCTURES IN KEY WATERSHEDS AND THE INSTALLATION OF STAFF GAUGES AT STREAM GAUGING SITES

PROJECT CONCEPT 11	
Project title	Enhancement of early warning systems and flood emergency response through the construction of five controlled structures in key watersheds and the installation of gauges at stream gauging sites
Objective	To create a conducive data collection environment for flood prediction through the installation of required river structures
Rationale	<p>With climate change, sea-level rise, lower annual rainfall amounts but more intense rains and tropical storms in the Caribbean, associated flooding episodes are expected to increasingly affect Saint Lucia’s population, economic activities and environment in the coming decades. This could not only jeopardise development gains but exacerbate the effects of current unsustainable practices and increase the vulnerability of the country’s land, freshwater and marine resources, infrastructure, food production, and health systems, with potentially irreparable damage if no timely and effective adaptation measures are implemented.</p> <p>Saint Lucia’s Climate Change Adaptation Policy calls for the promotion of integrated early warning and response systems as a climate change adaptation measure required to reduce risks and losses associated with flooding and landslide episodes. This includes those experienced in the country with the impact of Hurricane Thomas in 2010, which had a total cost of 43.4% of the island’s GDP, or of the 2013 unseasonal low-level trough system which crossed the island and produced greater than 224 mm of rainfall in a matter of two to three hours, impacting 2,600 persons directly, killing 6, and causing USD 89.2 million in damages.</p> <p>However, developing flood prediction models for setting up the integrated early warning systems requires the systematic and consistent collection of a broad range of quality data, with the appropriate geographical coverage in Saint Lucia and appropriate predictive models.</p> <p>This initiative would allow for the placement of controlled structures within rivers which would facilitate the calculation of river rating / stage discharge curves, demarcating floodplain areas and providing necessary data for establishing hydrologic models. The collection of hydrologic data currently provides a huge challenge because of the unpredictable pathing behaviour of rivers in Saint Lucia.</p> <p>This initiative would seek to facilitate consistent and accurate automatic data capturing of water levels. The data captured via this initiative would be used to support the Flood Early Warning Systems (FEWS) as well as develop informational resources for the Flood and Drought Management Committee, the Water and Sewerage Company Inc. (WASCO) and other stakeholders.</p> <p>Proposed location/site(s):</p> <p>Near existing bridges, intakes and John Compton Dam</p>
Direct Beneficiaries	Hydrological data users, Water Resources Management Agency (WRMA)

PROJECT CONCEPT 11

Project title **Enhancement of early warning systems and flood emergency response through the construction of five controlled structures in key watersheds and the installation of gauges at stream gauging sites**

Activities and Tasks

- Discuss with the Ministry with responsibility for Infrastructure and the Water and Sewage Company (WASCO) to incorporate the design of weirs during their construction of bridges and intakes.;
- Find suitable location where weirs can be erected;
- Procure staff plates;
- Conduct civil works to create controlled structures where they are needed;
- Undertake installation of staff plates using levelling technique.

Main outputs/products

- Creation of hydrograph and rating curves which can be used in the design of bridges, culvert and other critical infrastructure. This will also aid in flood modelling for predicting floods/flash floods based on rainfall intensities.

Implementation

- **Leading agencies:** Water Resources Management Agency (WRMA)
- **Technical Support:** National Emergency Management Organisation (NEMO), Met Office
- **Financing:** Government of Saint Lucia and development partners

Indicative cost

Five controlled structures: USD 150,000

Procurement of staff plates: USD 2,000

Installation of staff plates: USD 1,000

Indicative total cost: USD 153,000

Duration 9 months

Additional information

- This project is aligned with the Water SASAP's measures 18 and 65 and can contribute to implementing measures 1, 2, 8, 63 and 66. The initiative is proposed as a collaboration among Ministries.

PROJECT CONCEPT 12. LAND ACQUISITION AND PUBLIC-PRIVATE PARTNERSHIPS (PPPS) FOR WATERSHED MANAGEMENT, PROTECTION AND INFRASTRUCTURE UPGRADE IN A CHANGING CLIMATE

PROJECT CONCEPT 12	
Project title	Land acquisition and Public-Private Partnerships (PPPs) for watershed management, protection and infrastructure upgrade in a changing climate
Objectives	<ul style="list-style-type: none"> • To protect and restore lands in critical watersheds (especially privately-owned lands) • To obtain lands for the installation of requisite water infrastructure (water tanks, intakes, wastewater treatment facilities etc.) • To establish a registry of lands available for water resource management/administration
Rationale	<p>Deforestation and unsustainable land use are diminishing the capacity of Saint Lucia’s watershed ecosystems to deliver fundamental water provision and regulation services. These processes lead to increased runoff, landslides and the siltation and pollution of freshwater resources. The loss of these services is of particular concern as it is expected that in the coming decades, a growing country population will increase the demand for freshwater, while climate change reduces annual rainfall amounts but intensifies rainfall events, which could lead not only to more prolonged dry periods and drought -and consequent water shortages- but also to more frequent and potentially devastating floods. To safeguard Saint Lucia’s water resources and reduce disaster risks in a changing climate, it is imperative to immediately reduce human pressures on, and restore key forested watershed areas (e.g. deterring the encroachment of agriculture and other unsustainable practices into forest reserves and water intake areas and reducing unplanned residential development along river/ravine buffer zones). However, many of the environmentally critical areas in watersheds are privately owned. The acquisition of these lands by the state would facilitate their sustainable management. Failing to reserve them early means they may be compromised, or difficult to obtain them later.</p> <p>This project would seek the identification and subsequent acquisition of private lands for watershed management and protection and installation of water infrastructure (intakes, storage tanks, wastewater treatment facilities etc.). This will create the requisite land resource to secure the allocation of areas for these necessary resources and contribute to strengthening the country’s water sector under a changing climate.</p> <p>Proposed location/site(s): As identified by the relevant stakeholders (i.e. the Water Resources Management Agency (WRMA), the Forestry Department, the Water and Sewerage Company Inc. (WASCO) and others)</p>
Beneficiaries	Private residences and businesses in the areas fed by the water watershed and infrastructure
Activities and Tasks	<ul style="list-style-type: none"> • Identify suitable lands (both through preliminary desktop and technical studies); • Determine ownership; • Explore PPP options for ecosystem restoration, reforestation and other activities; • Request Cabinet approval to acquire;

PROJECT CONCEPT 12	
Project title	Land acquisition and Public-Private Partnerships (PPPs) for watershed management, protection and infrastructure upgrade in a changing climate
	<ul style="list-style-type: none"> • Conduct Surveys (land and valuation); • Carry out acquisitions of lands; • Generate a land register.
Main outputs/products	<ul style="list-style-type: none"> • Registration of lands for watershed management/protection and infrastructure improvement. • Land bank (to ensure that lands are available for the use before the need arises).
Implementation	<ul style="list-style-type: none"> • Leading agencies: WRMA, Forestry Department, Physical Planning (Development Control Authority, Surveys, Valuation, Crown Lands) • Financing: GoSL and development partners
Indicative cost	Intakes (10): Land per watershed/intake: USD 1,000,000 Protection (fences): USD 50,000 Indicative total cost: USD 10,500,000
Duration	2 years
Additional information	<ul style="list-style-type: none"> • This project is aligned with the Water SASAP's measures 10, 15 and 68 and can contribute to implementing measures 8, 9, 11, 12, 19, 25 and 69. The initiative is proposed as a collaboration among Ministries.

PROJECT CONCEPT 13. LAYING THE GROUND FOR THE SUSTAINABLE MANAGEMENT OF GROUNDWATER RESOURCES UNDER A CHANGING CLIMATE: THE DEVELOPMENT OF A HYDROGEOLOGICAL MAP FOR SAINT LUCIA

PROJECT CONCEPT 13	
Project title	Laying the ground for the sustainable management of groundwater resources under a changing climate: The development of a hydrogeological map for Saint Lucia
Objectives	<ul style="list-style-type: none"> • To develop a hydrogeological map for Saint Lucia • To identify groundwater abstraction points • To identify groundwater resources • To populate a database of groundwater sources
Rationale	<p>Saint Lucia suffered the worst drought in forty years in 2009-2010 and has experienced drought conditions each year since 2012. Water stress has affected crop and livestock production and the living conditions of all Saint Lucians, as the entire island has been periodically placed on water rationing. The levels of the country’s largest freshwater reservoir, the John Compton Dam, have fallen critically during these drought events and the dam’s storage capacity has been severely compromised by sedimentation, delivered by landslides and triggered by hurricanes and heavy storms.</p> <p>Exploring alternative water sources and planning their sustainable management and use is critical for securing availability and supply of freshwater in Saint Lucia under a changing climate. Climate projections for the country indicate that in the coming decades, Saint Lucia will see an overall reduction in annual precipitation, more frequent and intense dry spells and more intense and unpredictable rainfall events, all detrimental to the availability, quality and supply of water from current surface water sources.</p> <p>In view of the above considerations, Saint Lucia has started to explore and use, to a limited extent, its groundwater resources. However, data and financial limitations still hamper the planning process for the sustainable exploitation of groundwater on the island. One major gap is the absence of a hydrogeological map. This instrument is key for identifying abstraction points, selecting sites for groundwater exploration and establishing site-specific groundwater protection zones (and associated land use regulation) to prevent groundwater contamination.</p> <p>Proposed location/site(s): Island-wide</p>
Beneficiaries	The entire Saint Lucian population
Activities and Tasks	<ul style="list-style-type: none"> • Consult stakeholders; • Conduct an accurate ground field survey at several scales; • Collect and review water related documents (policy, legislation, regulation); • Collect, review and update existing geographical information (soils, topography, land use, etc.); • Collect and review historical information on existing groundwater wells; • Conduct a public notification campaign of the project (print and digital media); • Collect historical meteorological and hydrological data and information;

PROJECT CONCEPT 13

Project title **Laying the ground for the sustainable management of groundwater resources under a changing climate: The development of a hydrogeological map for Saint Lucia**

- Geotag confirmed groundwater abstraction points;
- Generate groundwater database;
- Generate maps;
- Inform policy;
- Conduct training.

Main outputs/products

- Hydrogeological map
- Geophysical map
- Land use regulation and policy
- Legislation
- Procedures and standards for sustainable groundwater exploration and use

Implementation

- **Leading agency:** Water Resources Management Agency (WRMA)
- **Financing:** GoSL and development partners

Indicative cost USD 3 million

Duration 36 months

Additional information

- This project is aligned with the Water SASAP's measures 19 and 25 and can contribute to implementing measures 1, 17 and 67.

PROJECT CONCEPT 14. PUBLIC SENSITISATION TOWARDS IMPROVING THE MANAGEMENT, CONSERVATION AND PROTECTION OF WATER RESOURCES UNDER A CHANGING CLIMATE

PROJECT CONCEPT 14	
Project title	Public sensitisation towards improving the management, conservation and protection of water resources under a changing climate
Objectives	<ul style="list-style-type: none"> • To increase public awareness of the role played by each individual in causing and solving water resource management problems • To increase public participation in improving water resource management • To jump-start the public education/sensitisation activities within the water sector and establish a product which would be able to draw corporate sponsorship
Rationale	<p>Saint Lucia relies heavily on the abstraction of surface water to meet water consumption demands. However, poor land use and conservation practices have exacerbated soil erosion and increased the risk of landslides, which result in large sediment loads reaching the country's rivers, particularly during heavy rain events and tropical storms preceded by dry periods. This affects river water quality, reduces the capacity of freshwater reservoirs and ultimately compromises water supply in the island. This situation could worsen in the future if no action to improve farming and other land-use practices is undertaken, as with climate change, Saint Lucia is expected to experience an overall reduction in annual precipitation, more frequent and intense dry spells and more intense and unpredictable rainfall events in the coming decades.</p> <p>In view of the above considerations, it is crucial to raise public awareness on the role farmers and citizens in general play in securing the quality and provision of water in the future and to spark changes in the attitudes and unsustainable practices that currently compromise land and surface water resources. This project focuses on exposing Saint Lucians to sustainable land use and water conservation practices and encouraging to adopt them, in order to reduce river sedimentation and to better manage water supplies during periods of water scarcity.</p> <p>Proposed location/site(s): Island-wide</p>
Beneficiaries	The entire Saint Lucian population
Activities and Tasks	<ul style="list-style-type: none"> • Organise an annual exhibition during the week of World Water Day; • Conduct water-themed school competitions, including quizzes; • Design and conduct conservation activities (tree planting, river/wetland clean ups) • Conduct panel discussions; • Develop animated public service announcements for broadcast on radio and television (English and Creole); • Consider an annual award for communities illustrating best water management practices.
Main outputs/products	<ul style="list-style-type: none"> • Quarterly news bulletin (electronic publication) highlighting local actions (success stories) • Informational video productions • Jingles and animated comic series

PROJECT CONCEPT 14	
Project title	Public sensitisation towards improving the management, conservation and protection of water resources under a changing climate
	<ul style="list-style-type: none"> • Population behavioural change
Implementation	<ul style="list-style-type: none"> • Leading agency: Water Resources Management Agency (WRMA) • Financing: GoSL and development partners
Indicative cost	USD 120,000
Duration	36 months
Additional information	<ul style="list-style-type: none"> • This project is aligned with the Water SASAP's measures 6, 20, 22, 29, 54 and 55 and can contribute to implementing measures 16 and 32. The project is also aligned with and contributes to the implementation of Saint Lucia's Climate Change Communications Strategy (2018). • This project is also of relevance for the Agriculture SASAP and thus, this concept note is also included in it.

PROJECT CONCEPT 15. BUILDING CLIMATE RESILIENCE IN SAINT LUCIA THROUGH THE DOCUMENTATION OF EFFECTIVE INDIGENOUS SOIL AND WATER CONSERVATION MEASURES FOR REPLICATION AND PROMOTION

PROJECT CONCEPT 15	
Project title	Building climate resilience in Saint Lucia through the documentation of effective indigenous soil and water conservation measures for replication and promotion
Objectives	<ul style="list-style-type: none"> • To identify and document soil and water conservation measures used in Dennery and Mabouya Valley • To assess the effectiveness of indigenous soil and water conservation measures under current and expected future climate conditions
Rationale	<p>The Saint Lucia Climate Change Adaptation Policy (2015) calls for close attention to be paid to the traditional technologies and skills that have allowed the country’s communities to cope successfully with climate variability in the past and to combine these with modern knowledge and technologies, where appropriate. While there are several examples of indigenous adaptation and coping strategies in the country’s agricultural sector, these have not been rigorously documented or assessed, missing the opportunity of utilising the local knowledge in planning and implementing adaptation responses for the sector at the national level.</p> <p>This project seeks to identify and assess the effectiveness of local and traditional soil and water conservation practices applied in some areas of the Dennery Mabouya valley, an area inhabited by many small-scale farmers and where agriculture often takes place over the surrounding steep slopes. In this region, soil erosion has become a very serious problem, triggered by the recent shift in cultivation from bananas to cash crops not suitable for local conditions. Documenting effective local strategies to address this problem is highly relevant now and not only for this area, but also for all agricultural regions in the country as with climate change, more frequent and extended dry periods and more intense rainfall events are projected. These are expected to exacerbate land degradation processes and to reduce water availability for agriculture. This initiative is proposed as the first of a series of projects to document and map local effective strategies to respond to environmental and climate change in Saint Lucia.</p> <p>Proposed location/site(s): Pilot in the Dennery Mabouya valley area and application island-wide</p>
Beneficiaries	<ul style="list-style-type: none"> • Farming community (hillside farmers) • Extension officers
Activities and Tasks	<ul style="list-style-type: none"> • Select sites for information collection; • Collect local information and farmers’ perspectives; • Collect socio-economic information; • Document measures; • Establish database of traditional and effective land and water conservation measures.
Main outputs/products	<ul style="list-style-type: none"> • Description of measures

PROJECT CONCEPT 15

Project title **Building climate resilience in Saint Lucia through the documentation of effective indigenous soil and water conservation measures for replication and promotion**

- Identification of soil and water conservation measures
- Description of the environmental conditions where the measures have been applied
- Assessment of indigenous soil and water conservation measures

Implementation:

- **Leading agency:** Government agency with responsibility for Agriculture (Extension Department)
- **Technical Support:** Engineering Department, Research Department
- **Financing:** Government of Saint Lucia and development partners

Indicative cost USD 60,000

Duration: 2 years

Additional information

- This project is aligned with the Water SASAP's measures 16 and 60 and can contribute to implementing measures 2, 3, 6, 12, 13, 14 and 15. This project is also of relevance for the Agriculture SASAP and thus, this concept note is also included in it.

PROJECT CONCEPT 16. BUILDING CAPACITIES FOR NATIONAL MONITORING, SURVEILLANCE AND ENFORCEMENT OF CONTROL MEASURES FOR SOUND CHEMICALS AND HAZARDOUS WASTES TO PREVENT THE CONTAMINATION OF CRITICAL WATER RESOURCES UNDER A CHANGING CLIMATE

PROJECT CONCEPT 16	
Project title	Building capacities for national monitoring, surveillance and enforcement of control measures for sound chemicals and hazardous wastes to prevent the contamination of critical water resources under a changing climate
Objective	To strengthen/develop capacity for monitoring, surveillance and enforcement of regulatory measures related to sound chemicals and hazardous waste management
Rationale	<p>Saint Lucia’s population, economic activities and environment will be increasingly affected by climate change in the coming decades. Climate projections indicate that the country will experience the effects of sea-level rise, lower annual precipitation, recurrent drought, stronger and more erratic rainfall events and more intense tropical storms (and associated flooding episodes). These effects are also expected to exacerbate current land degradation processes and, along with higher temperatures, reduce the availability and quality of freshwater resources. This will occur while water demands for all activities in the island increase with population growth.</p> <p>In view of the above considerations, reducing potential sources of water pollution is clearly a priority for safeguarding the quality and availability of freshwater in Saint Lucia under a changing climate. This includes reducing risks associated with <i>inter alia</i>:</p> <ul style="list-style-type: none"> • Agro-chemical contamination of water sources from increased runoff and erosion of farming areas. • Poor operational performance of inundated municipal and household septic systems contaminating drainage and water supplies. <p>At present, an assessment of the existing institutional and regulatory environment for the sound management of chemicals and hazardous wastes is underway with the aim of making recommendations for strengthening national regulatory capacity. Weak enforcement of existing legislation has emerged as one of the main barriers to implementing a national programme for chemicals management and safety and in particular, the reduced ability of the Customs and Excise Department to effectively monitor the import of chemicals and chemical products of global and national concern.</p> <p>The proposed project is expected to support the enforcement of existing and planned regulatory control measures, resulting in improved capability to detect and monitor imports of chemicals/chemical products subject to regulation. The detection of illegal imports and implementation of pollution monitoring and surveillance programmes are key elements for ensuring that the risk of exposing residents and sensitive ecosystems to hazardous substances is minimised.</p> <p>The Customs and Excise Department, the Ministry of Health, Department of Agriculture, Fisheries and Natural Resources, and the Department of Sustainable Development are proposed as the main project partners.</p>
Beneficiaries	<ul style="list-style-type: none"> • Direct beneficiaries: Government agencies with responsibility for the control and life-cycle management of chemicals and products with chemicals of concern (Pesticides and Toxic Chemicals Control Board/Government agency with responsibility for Agriculture, Ministry of

PROJECT CONCEPT 16	
Project title	Building capacities for national monitoring, surveillance and enforcement of control measures for sound chemicals and hazardous wastes to prevent the contamination of critical water resources under a changing climate
	Health and Wellness, Customs and Excise Department, Saint Lucia Bureau of Standards) <ul style="list-style-type: none"> • Indirect beneficiaries: community members and households exposed to contaminated drinking water and recreational water bodies
Activities and Tasks	
<ul style="list-style-type: none"> • Develop and establish an effective mechanism for updating and including chemicals and/or chemical products of global and national concern into existing national legislation and/or enacting new legislation where appropriate; • Undertake the revision/strengthening of existing legislation (External Trade Act, Pesticides and Toxic Chemicals Control Act, Public Health Act); • Conduct the identification and provision of resource and training needs. 	
Main outputs/products	
<ul style="list-style-type: none"> • Mechanism/system established for updating and including chemicals and/or chemical products of concern into existing legislation • Capacity to implement the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) assessed and developed • Equipment to support monitoring and surveillance efforts (for imports and pollution control) and requisite training 	
Implementation	
<ul style="list-style-type: none"> • Responsible institutions: Government agency with responsibility for Agriculture, Customs and Excise; Department of Sustainable Development; Ministry of Health 	
Indicative cost 300,000USD	
Duration 18 months	
Additional information	
<ul style="list-style-type: none"> • This project is aligned with the Water SASAP's measures 39 and 40 and can contribute to implementing measures 37 and 38. 	

PROJECT CONCEPT 17. DIGITISATION OF HISTORICAL HYDRO-METEOROLOGICAL DATA FOR IMPROVING CLIMATE CHANGE MODELLING AND ADAPTATION PLANNING IN SAINT LUCIA

PROJECT CONCEPT 17	
Project title	Digitisation of historical hydro-meteorological data for improving climate change modelling and adaptation planning in Saint Lucia
Objective	To rescue hydro-meteorological data from risk of being lost due to deterioration and store the recovered data To have the historic rainfall, watershed and river evaluations digitised and stored on media into computer compatible form for easy access
Rationale	<p>Historical climate data is fundamental for improving the climate change projections and for producing models at a scale that is useful for making decisions on adaptation options at the subnational level.</p> <p>The Water Resources Management Agency (WRMA) is the local authority charged with the responsibility of collecting, monitoring, analysing and storing of hydrological data. Before the existence of the WRMA however, the responsibility for collecting hydro meteorological data fell upon the agricultural engineering division’s irrigation unit. Thus, a lot of historic hydro meteorological data resides within the Department of Agriculture as printed reports. To avoid the potential loss of such valuable data and increase its accessibility, it was concluded that the like should be digitally preserved.</p> <p>WRMA maintains a network of 17 conventional and automatic weather stations spread across the country, two soil moisture probes, four water level sensors and conducts stream flow and water quality data collection at 21 sites on a monthly basis. Data collected from these field stations and data collection activities are essential to the resultant information that is provided to the public and other key stakeholders within the water sector. These include but are not limited to Agriculture, Tourism, Civil Engineers, Public Utilities, Physical Planning Agencies, Environmental Agencies, Researchers and the National Emergency Management Office. Additionally, climate data is useful to analyse current and projected trends in surface water availability. This information is crucial to identify climate impacts and vulnerability for effective adaptation strategies in various climate-sensitive sectors. Apart from having a good observation network for hydrology, steps must be taken to ensure that the vast amount of hydrological data collected are properly preserved in an easily accessible useful form.</p> <p>Two of the components of the Global Framework for Climate Services (GFCS) of the World Meteorological Organization (WMO) include:</p> <ol style="list-style-type: none"> i. Climate Services Information System: the mechanism through which information about climate (past, present and future) will be routinely collected, stored and processed to generate and deliver products and services that inform often complex decision-making across a wide range of climate-sensitive activities and enterprises; ii. Observations and Monitoring: to ensure that climate observations and other data, including metadata, required to meet the needs of end users are collected, managed, disseminated and its utility assessed.
Beneficiaries	The public and other key stakeholders within the water sector
Activities and Tasks	<ul style="list-style-type: none"> • This project will be executed with WRMA staff or other qualified personnel on their off hours/days;

PROJECT CONCEPT 17

Project title **Digitisation of historical hydro-meteorological data for improving climate change modelling and adaptation planning in Saint Lucia**

- Search and locate the data;
- Inventory of data in one central location;
- Preservation and storage of data;
- Validating the imaged files;
- Key entry of the climate data;
- Quality check of the climate data;
- Analysis and climate products;
- All metadata and relevant station information will also be collected and documented.

Implementation

- **Leading agency:** Water Resources Management Agency (WRMA)

Indicative cost USD 24,000

Duration 6 months

Additional information

- This project can contribute to implementing Water SASAP's measures 8, 63, 66 and 67.

PROJECT CONCEPT 18. IMPROVING CLIMATE OBSERVATIONS AND MONITORING SYSTEMS TO INFORM ADAPTATION PLANNING AND STRENGTHEN EARLY WARNING SYSTEMS

PROJECT CONCEPT 18	
Project title	Improving climate observations and monitoring systems to inform adaptation planning and strengthen early warning systems
Objective	To improve the hydro-meteorological monitoring capacity of the Water Resources Management Agency (WRMA) through the use of Automated Local Evaluation in Real-Time (ALERT) rainfall stations, acoustic doppler technology, water level sensors and environmental monitoring drones
Rationale	<p>Climate change projections indicate that with climate change, Saint Lucia will experience lower annual rainfall amounts, higher intensity of rainfall events, more unpredictable weather patterns and more frequent flooding and drought episodes. In this context, the generation and use of reliable climate information, drought and flood models as well as their application in early warning systems and other climate services is fundamental to transmit to all sectors and regions of the country. This will provide relevant parties with the information they need to prepare for weather extremes in a timely and reliable manner.</p> <p>Automated Local Evaluation in Real-Time (ALERT) was developed by the United States National Weather Service in the 1970's. It is intended to be a local flood warning system for local agencies. ALERT systems are fairly low cost and provide important real-time rainfall and flow/stage information to evaluate the potential for flooding. Although the intended application was for local flood warning systems, the Water Resources Management Agency (WRMA) recognises that this type of data network is an ideal tool for gathering the data it requires to fulfil its mandate. The Meteorological Services currently has 17 weather stations deployed on an ALERT network. The WRMA is very familiar with both the weather stations and the software package that are utilised in the Meteorological Services ALERT network, particularly since officers within the Agency have assisted in the installation of these stations, and under the AusAid project, WRMA facilitated the upgrading of the software package and the addition of two stations to this network.</p> <p>The WRMA currently collects data from 17 rainfall stations (seven inoperable for three months), and four soil probes. Data from these stations are collected by monthly station visits. Upgrading the WRMA stations so that they could integrate into the ALERT network would allow for real time access to data as well as real time monitoring of each station. This real time monitoring will enable the WRMA to identify and respond more quickly to stations that become inoperable, since identifying issues at a given station currently takes up to one month. Additionally, the WRMA intends to expand the data collection capacity of the rainfall stations so that additional variables such as temperature, sunlight, humidity, atmospheric pressure, wind speed, soil saturation and in some cases, water levels in rivers would also be captured. This will allow for the creation of more accurate water availability, flood, and drought models that leverage more meteorological and environmental data variables. The ALERT data network is also a more resilient data network than the current WRMA rainfall and water level stations since, barring physical damage to the stations, data will continue to be transmitted irrespective of the conditions of the road network or telecommunications service providers.</p> <p>The use of acoustic Doppler velocimeters will improve the efficiency of field data collection by reducing the need for manpower without compromising data quality. It would also allow river flows to be assessed in real time while in the field (hence improving on-site decision making).</p> <p>Drones equipped with sensors specific to water resources management needs will serve as a vital</p>

PROJECT CONCEPT 18

Project title **Improving climate observations and monitoring systems to inform adaptation planning and strengthen early warning systems**

tool to allow the Agency to undertake difficult tasks such as monitoring soil erosion, water balance, flood, drought, water quality, runoff, soil moisture, wetlands and reservoir content. Specialised drone sensors (RGB, IR, Multispectral and Thermal sensors) which are attached to these drones would assist the Agency in acquiring imagery more conveniently and at a finer geographic scale than more costly satellite and conventional aerial photography.

Data collected from water level stations when correlated with rainfall and stream flow data can assist in developing baselines specific to a watershed which could be used as thresholds for flood warnings. Additionally, abnormal changes in water level data can be an indication of upstream changes that the WRMA may need to investigate. Collecting such data thus enhances the Agency's ability to improve the accuracy of early warning systems as well as identify potential issues within a given watershed.

It is recommended that under the project, officers within the WRMA are fully trained in the configuration, maintenance and repair of the associated data loggers and ultra-high frequency (UHF) radios within the stations. Training on the use and maintenance of the acoustic doppler velocimeters and drones would also be required as well as training in image processing and analysis. This will ensure that moving forward, the WRMA can sustainably support these new technologies, thereby reducing data gaps. With the implementation of the proposed technologies and the appropriate training of officers in their configuration and upkeep, the environment to collect and provide quality data in a timely fashion will be enhanced. These datasets can then be leveraged for decision making, preparation of risk\hazard maps, and design of flood early warning systems.

WRMA has monthly stakeholder meetings during the dry season where updates on water availability are presented in an attempt to predict hydrological, meteorological and agricultural droughts. This information is also used to advise the public on proper water conservation practices due to pressures on the water availability within the watersheds.

Beneficiaries Vulnerable populations in low lying flood prone areas

Activities and Tasks

- Upgrade WRMA stations;
- Integrate into the ALERT network;
- Provide real time access to data as well as real time monitoring of each station;
- Identify and respond more quickly to stations that become inoperable;
- Expand the data collection capacity;
- Monitor soil erosion, water balance, flood, drought, water quality, runoff, soil moisture, wetlands and reservoir content;
- Train on the use and maintenance of the acoustic doppler velocimeters and drones;
- Train in the configuration, maintenance and repair of the associated data loggers and UHF radios within the stations.

Main outputs/products

- Reduced occurrence of data gaps in rainfall data, to capture high level flows and improve the quality of rainfall data.
- Additional variables logged to assist in creation of hydrological models
- Built capacity within WRMA to ensure cost effective and sustainable maintenance of rainfall stations
- Improved efficiency of stream flow data collection through the use of acoustic doppler velocimeters and water level sensors

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- Improved capacity for watershed monitoring and river assessments using drone technology
- Stronger flood and drought early warning systems
- Provided data for use in updating flood and landslide hazard maps

Implementation:

Leading agency: Water Resource Management Agency

Indicative cost USD 444,440

Duration 6 months

Additional information

- This project is aligned with the Water SASAP's measures 63, 65 and 66 and can contribute to implementing measures 8 and 18.

PROJECT CONCEPT 19. IMPROVING ENERGY EFFICIENCY WITHIN THE WATER SECTOR IN SAINT LUCIA THROUGH THE INTRODUCTION OF RENEWABLE ENERGY TECHNOLOGIES INTO THE OPERATIONS OF THE WATER AND SEWERAGE COMPANY INC.

PROJECT CONCEPT 19	
Project title	Improving energy efficiency within the water sector in Saint Lucia through the introduction of renewable energy technologies into the operations of the Water and Sewerage Company Inc.
Objective	To improve energy efficiency within the operations of the Water and Sewerage Company Inc. by introducing appropriate renewable energy technologies into the operations of the Water and Sewerage Company Inc.
Rationale	<p>Climate change is projected to reduce the availability and quality of freshwater, cause more frequent damage to water infrastructure and increase water management costs in Saint Lucia, thereby affecting the water security of all Saint Lucians, especially vulnerable groups. Anticipating these impacts, the Water and Sewerage Company Inc. (WASCO) is making efforts to improve its operations, strengthen its infrastructure and reduce its operational costs.</p> <p>WASCO is wholly owned by the Government of Saint Lucia, with responsibility for the provision of water supply and wastewater management services throughout the island. WASCO is the only company engaged in the business of supplying water services to households and businesses in Saint Lucia, and it services approximately 58,000 connections. WASCO’s potable water distribution system is heavily dependent on pumps which are mostly electrically powered, with the electricity being supplied by Saint Lucia’s lone electricity supplier, the St. Lucia Electricity Services Limited (LUCELEC). The cost of energy represents a significant proportion of the operating costs of WASCO, and electricity costs account for approximately 20-25% of WASCO’s total operational budget.</p> <p>WASCO has identified improvement in energy efficiency within its operations as a priority, and in that regard, with assistance from the Caribbean Development Bank, an Energy Efficiency Audit (EEA) of WASCO’s overall operations is being conducted within the first half of 2018. The EEA will, among other things, identify Energy Efficiency Opportunities (EEOs) and Renewable Energy Options (REOs) related to, but not limited to, improvements in motor drives and pumps energy efficiency, pumping system controls, power factor; lighting, ventilating and air conditioning; building envelopes; and building control systems. WASCO will wish to pursue implementation of the recommendations relating to EEOs and REOs which will come out of the EEA, and this proposed project is intended to support the implementation of these recommendations, particularly those relating to REOs.</p> <p>WASCO has, to date, introduced small solar panels to assist in powering selected equipment in some remote locations. However, these have not had a major impact on the company’s overall energy use. It is expected that by undertaking this proposed project, new renewable energy solutions and technologies will be introduced into WASCO operations on a larger scale and in a manner that will increase the level of reliance on renewable energy sources and decrease reliance on diesel-powered electricity, thereby reducing WASCO’s carbon footprint. It is also expected that in the medium to long-term, further EEAs will be conducted so that assessments could be made of the impact of the renewable energy solutions and technologies on overall energy efficiency of the company.</p>
Beneficiaries	The Water and Sewerage Company Inc. and its customers

PROJECT CONCEPT 19	
Project title	Improving energy efficiency within the water sector in Saint Lucia through the introduction of renewable energy technologies into the operations of the Water and Sewerage Company Inc.
Activities and Tasks	<ul style="list-style-type: none"> • Review recommendations of the 2018 Energy Efficiency Audit of WASCO, with a view to identifying recommendations and options for introduction of renewable energy technologies into WASCO operations; • Develop detailed designs for priority renewable energy technologies to be introduced into WASCO operations; • Procure and commission the selected renewable energy technologies; • Train WASCO staff in the operation and maintenance of the renewable energy technologies; • Report on the commissioning of the renewable energy technologies and develop recommendations for related follow-up actions; • Create detailed designs of renewable energy technologies to be introduced into WASCO operations; • Procure and commission selected renewable energy technologies; • Train WASCO staff in the operation and maintenance of the renewable energy technologies; • Report on the commissioning of the renewable energy solutions and develop recommendations for related follow-up actions.
Implementation	<ul style="list-style-type: none"> • Leading agency: The Water and Sewerage Company Inc. (WASCO)
Indicative cost	Consultancy on design of renewable energy solutions and training of staff: USD 100,000 Procurement and commissioning of renewable energy solutions: USD 500,000 Total: USD 600,000
Duration	9 months
Additional information	<ul style="list-style-type: none"> • This project is aligned with measure 48 in the Water SASAP. • This project has climate change mitigation co-benefits