

Please fill in the form in the grey spaces, by following the instructions in italic.

Requesting country:	<i>Grenada</i>
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Request title:	<i>Improvement of water supply management through a GIS-based monitoring and control system for water loss reduction</i>
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Contact information:		
<i>{Please fill in the table below with the requested information. The request proponent is the organization that the request originates from, if different from the National Designated Entity (NDE).}</i>		
	National Designated Entity	Request Applicant
Contact person:	Mr. Kevin Andall	Christopher Husbands
Position:	Permanent Secretary (AG) w.r.f.	Managing Director
Organization:	Ministry of Education, Human Resource Development & The Environment	National Water and Sewerage Authority (NAWASA) Utility Management
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Fax:		
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Technology Needs Assessment (TNA):
<i>{Select one of the three boxes below:}</i>
<input type="checkbox"/> <i>The requesting country has conducted a TNA in (please insert date of TNA completion)</i>
<input checked="" type="checkbox"/> <i>The requesting country is currently conducting a TNA</i>
<input type="checkbox"/> <i>The requesting country has never conducted a TNA</i>
<i>{If the requesting country has completed a TNA, please indicate what climate technology priority this request directly relates to. Please indicate reference in TNA/TAP/Project Ideas.}</i>

CTCN Request Incubator Programme:
<i>{Please indicate if this request was developed with support from the Request Incubator Programme:}</i>
<input type="checkbox"/> <i>Yes</i>
<input checked="" type="checkbox"/> <i>No</i>

Geographical focus:

{Select below the most relevant geographical level for this request:}

- Community-based
 Sub-national
 National
 Multi-country

{If the request is related to the sub-national or multi-country level, please indicate here the areas concerned (provinces, states, countries, regions, etc.)}

Theme:

{Select below the most relevant theme(s) for this request:}

- Adaptation to climate change
 Mitigation to climate change
 Combination of adaptation and mitigation to climate change

Sectors:

{Please indicate here the main sectors related to the request. e.g. energy, industry, transport, waste, agriculture/fisheries, forestry, water, ecosystem/biodiversity, coastal zones, health, education, infrastructure/human settlement, tourism, businesses, early warning/disaster reduction, institutional design and mandates, cross-sectorial}

Water supply and Water Resources Management (Reducing water losses, efficient resource utilization, efficient utility management, leakage management control, detection and repair in piped systems with a Geographical Information System - GIS)

Water, Energy, Environment, Health, Infrastructure, Institutional design

Problem statement (up to one page):

{Please describe here the difficulties and specific gaps of the country in relation to climate change, for which the country is seeking support from the CTCN. Please only provide information directly relevant to this request, and that justifies the need for CTCN technical assistance.}

As a small island developing state (SIDS), Grenada is one of the world's most at-risk countries for climate change. These changes to the global climate system include warmer temperatures, rising sea levels, and potentially more frequent and severe extreme weather events such as hurricanes storms which caused extensive disruption to key infrastructure like electricity, tourism, agriculture and the water sector. In the last years, the island experienced two major drought events in 2010 and 2012 which significantly affected the water supply sector and decreased in the peak time up to 75% of normal production on certain water supply systems in Grenada¹.

Grenada is likely to be affected by changing and increasingly erratic temporal rainfall patterns and overall trends towards higher temperatures, higher evapotranspiration, and longer and more severe dry

¹ NAWASA Annual Report: <http://nawasa.gd/about-us/annual-reports>

seasons. Projections are that rainfall will be reduced by the end of the century between 25 percent- 30 percent of current climatologically mean values². Research reports forecast in one scenario for Grenada, water demand will exceed water supply by the year 2025.³

The National Water and Sewerage Authority (NAWASA) is responsible for the provision of potable water and sanitation services for the whole of Grenada. Due to the prevailing hydrologic and climatic conditions, sustainable water supply is a major challenge. Grenada is divided into 71 watersheds, which are well defined due to the steep, hilly topography. The entire population (rural and urban) has access to domestic water supply. About 80% of the island is connected to the public water supply, 7% to standpipes while the remainder is supplied by rain water catchments ((2009) Water profile of Grenada⁴.

Water resources originate from a system of perennial streams and rivers, with some groundwater available from limestone areas along the north-western coast. Surface water systems such as rivers, streams and ponds are the major sources of fresh water for human consumption and agriculture.

In association with the Ministry of Health, the water authority NAWASA has adopted the drinking water quality standards proposed by the World Health Organization (WHO). A regular programme of sampling and bacteriological analyses of treated waters is carried out by the Authority. The quality of the potable water supplies at the national level is monitored by NAWASA on a monthly basis. All tests are implemented by the NAWASA's laboratory facility.

NAWASA is estimating its Non-Revenue-Water (NRW) at 30-35%, however a water balance according to international standards (IWA⁵) to provide evidence for that estimate has not yet been established. The direct cost for water production at NAWASA is around 1.4 XCD/m (= 0.4 €/m³). Considering an annual production of 11 Mio m³, some 3.3 Mio m³ of water are lost for NAWASA each year and cost for NRW are at around 4.5 Mio XCD (1.4 Mio €) annually (data of 2014).

In order to be effective, NAWASA's overall NRW management lacks a structured and systematic approach. Good industrial standard is to apply a Geographical Information System as the information backbone on customer, pipelines and other elements of relevance for the management of Non-Revenue –Water, and to accordingly structure management processes to support the information and data flow between the different divisions which are part of a water utility's NRW management process.

NAWASA's current structure of the data model, as well as of the linked management processes, requires a complete review and redesign. The required GIS data model has to allow systematic and automated data analysis and therefore has to follow examples of internationally recommended systems.

Past and ongoing efforts (up to half a page):

{Please describe here past and on-going processes, projects and initiatives implemented in the country to tackle the difficulties and gaps explained above. Explain why CTCN technical assistance is needed to complement these efforts, and how the assistance can link or build on this previous work.}

The Grenada Water Stakeholder Platform (G-WASP) of the global International Water Stewardship Programme (IWASP) is jointly implemented by the Land Use Division of the Ministry of Agriculture, Lands, Forestry and Fisheries in Grenada and the German Agency of International Cooperation (GIZ). The aim of G-WASP is to identify, develop and implement joint initiatives to reduce the water risk for

²Grenada- Strategic Program for Climate Resilience (SPCR), Grenada, 2011 Grenada (Source: https://www.cif.climateinvestmentfunds.org/sites/default/files/final%20grenada%20_SPCR_%20mar%204%202011.pdf)

³An Assessment of the Economic Impact of Climate Change on the Water Sector in Grenada, UN-ECLAC: Economic Commission for Latin America and the Caribbean, 2011

(Source: <http://www.cepal.org/en/publications/38580-assessment-economic-impact-climate-change-water-sector-grenada>)

⁴ Retrieved from <http://www.eoearth.org/view/article/156945>

⁵ <http://www.iwa-network.org/>

companies and communities, improve water availability and reduce pollution and flood events. As part of these efforts, a fact-finding study on *NAWASA Utility Management Support with a Focus on Non-Revenue Water* has been developed in 2016. It serves as a comprehensive strategy proposal (roadmap) on improved utility management (Identification of short -, medium-, and long-term measures to be undertaken in order to strengthen NAWASAs management capacities) with a focus on reducing non-revenue water significantly. Within that study, an assessment of the key problems and the cause for Non-Revenue-Water (NRW) has been undertaken and a brief roadmap has been outlined to prepare the ground for larger scale measures over a time frame of approximately one year. This roadmap provides the basis for this proposal and to allow NAWASA to develop capacity of their engineers and technicians and to initiate a comprehensive approach to improve NRW.

The study recommended establishing a sound Geographical Information System (GIS) as the backbone of all operations, including the water loss reduction activity. Linked to that should be improved procedures for billing and collection, repair and maintenance, leak detection and emergencies.

Assistance requested (*up to one page*):

{Please describe here the scope and nature of the technical assistance requested from the CTCN and how this could help address the problem stated above and add value vis-à-vis the past and on-going efforts. Please note that the CTCN facilitates technical assistance and is not a project financing mechanism.}

Geographical Information Systems (GIS) have proven to be an exceptionally strong management tool to avoid water losses and associated municipal revenue losses. GIS modelling and data analysis increases efficiency in services management and delivery, data processing, calculations, reporting and decision making, thus creating a powerful platform for water loss management interventions.

With this request Grenada seeks to improve its limited technical resources in regard to its ‘capacities for the establishment of a GIS-based monitoring and control system for water loss reduction and leakage detection in Grenada with the aim to efficiently and effectively reduce the currently high Non Revenue Water (NRW). Therefore, Grenada requests the CTCN to source the equipment and provide technical assistance to conduct the implementation to establish a GIS-based monitoring and control system and respective management processes for water loss reduction and leakage detection in Grenada with NAWASA.

In order to sustainably reduce NAWASA’s water losses and hence ensure effective use of scarce water resources in times of climate change, sound management systems would need to be introduced in addition to the investment in infrastructure and equipment.

The four basic work processes identified in the study are:

1. GIS implementation and customer management
2. Improved NRW calculation and water balancing
3. Repair and preventive maintenance, focused rehabilitation
4. Water consumption metering

Two additional modules to improve the economic viability are:

- a. Improved energy efficiency in water production and distribution
- b. Electricity generation

Consequently the technical assistance will focus on the

- setup of a and GIS data model
- development of schematic drawings of water supply networks
- establishment of a pilot DMA

- development and implementation of a concept and program for electricity generation using in-conduit turbines within NAWASA's piped network system

The below chart shows individual modules of each work process plus the two additional modules.

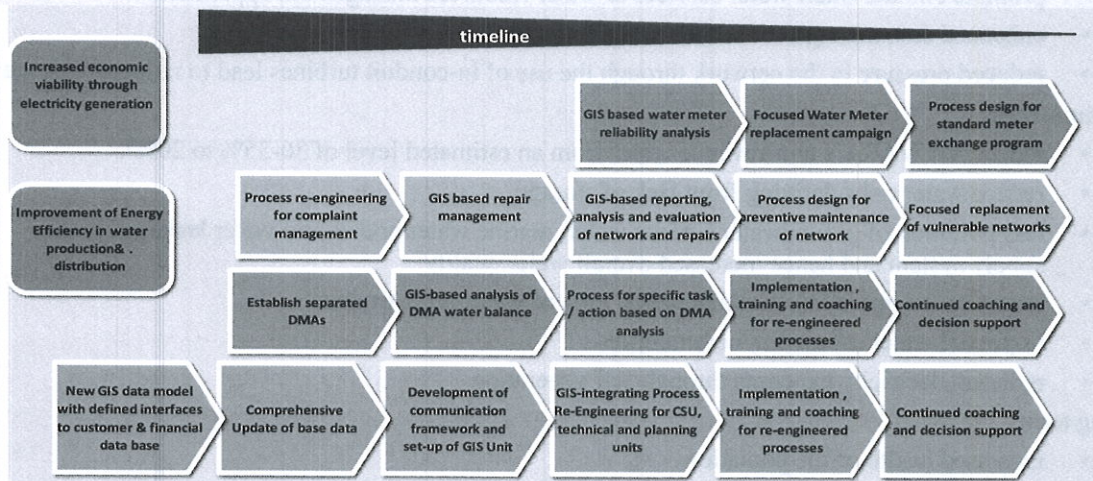


Figure 1: Work processes with work packages to improve NAWASA's NRW

Expected benefits (up to half a page):

{Please outline here the medium and long-term impacts that will result from the CTCN technical assistance, including how the assistance will contribute to mitigate and/or adapt to climate change.} specific key results will include but not limited to the following:

Tackling water loss is one of the critical solutions that can enable water utilities in the medium and long-term better adapt to climate change and variability, in particular regarding increasingly severe water resource scarcity. The technical assistance from CTCN regarding a GIS-based monitoring and control system for water loss reduction and leakage detection will result in improved capacity to develop and implement a comprehensive Smart Water Resources Management in Grenada.

The Geographical Information System (GIS) allows visualization and analysis of the vulnerable water resources and human activity data in Grenada by linking geographic information with descriptive information.

Other issues such as the flooding, for example in the economical very important Grand Anse Watershed, can also be mitigated by the use of geographical information, by helping to identify critical areas that are at risk. This is necessary in the development of hazard maps, as well as in the planning of emergency responses during hurricanes. GIS utilization offers more robust analysis, increased efficiency and reduced costs to adapt to the impacts of climate change for the vulnerable water supply system in Grenada.

Furthermore the assistance contributes to the following short, medium and long term impacts:

Short term:

- better understanding of the reasons for the losses in the water system and the factors that influence these losses
- faster response times for providing solutions in case of leakage, etc. Due to improved

management systems and data and information flow

- Support for preventive maintenance and exchange of pipelines
- skill development of technical staff: knowledge about techniques and procedures to address NRW
- promote climate smart water services & water resources management approaches
- enhanced data management in the water sector
- reduced pressure in the network through the use of in-conduit turbines lead to reduced leakage

Medium term:

- reduce NAWASA's non-revenue water from an estimated level of 30-35% to 20%⁶.
- reduce water risks deriving from lack of storage
- less pollution of groundwater surface water, marine water bodies and water leakages in the supply system and hence increased overall water quality
- reduction on operation & maintenance cost of water infrastructure.
- improved water access for communities
- reduced electricity expenses through self generation

Long term:

- increased health of the population
- contribute towards improved infrastructure development
- efficient resource utilization,
- efficient utility management,
- enhanced consumer satisfaction
- contribute towards increased local employment
- contribute towards reduction in poverty levels
- providing a model for innovative renewable energy generation while improving the water supply system
- postponement of capital-intensive additions to capacity in Grenada.

Post-technical assistance plans (*up to half a page*):

⁶ "Fact-finding Study on NAWASA Utility Management Support with a Focus on Non-Revenue Water", conducted by GIZ, 2016

{Please describe here how the results of the CTCN technical assistance will be concretely used by the applicant and national stakeholders, to pursue their efforts of resolving the problems stated above after the completion of the CTCN intervention (list specific follow-up actions that will be undertaken).}

The basis of all improvement processes is a functioning and updated GIS database and related work procedures and management processes. Building on the GIS information, the definition and establishment of District Metered Area (DMAs) will be implemented in the field and documented, also in the GIS system, as part of the CTCN support. This information will be used by NAWASA for strategic decision making on the structuring of the water supply network and for ongoing, improved monitoring of water pressure and water losses. The calculation of an IWA water balance of the DMA's will be based on data analysis of the customer data base, linked to the GIS system will be used as a monitoring tool to assess the effectiveness of the new NRW strategies.

The improvement of the repair and maintenance system relies on availability and correctness of the network infrastructure documentation in the GIS data base. Preventive maintenance requires full documentation of maintenance manuals and schedules, as well as availability of historical data on leakage and pipe burst. The focused replacement of highly vulnerable and often leaking parts of the network as well relies on a good documentation of the network infrastructure and a spatial documentation of leaks and repairs.

With the successful completion of the technical assistance the government of Grenada plans to feed the data and findings into national strategies and policies. Concrete plans could, for example address, the tourism sector. The expectation is that with the involvement of key stakeholders from the tourism sector (e.g. hotels) the water utility receives support and input from end consumer level to translate the proposed follow up measures of the technical assistance into actions, such as incentive programs for rainwater and grey water use in hotels or the leak reduction in pipelines, as well as use of more efficient water appliances with the hotel premises. The capacity building component of the technical assistance is expected to enable the stakeholders to follow up on the implementation and introduce sustainable monitoring instruments.

Key stakeholders:

{Please list in the table below the main stakeholders who will be involved in the implementation of the requested CTCN technical assistance, and what their role will be in supporting the assistance (for example, government agencies and ministries, academic institutions and universities, private sector, community organizations, civil society, etc.). Please indicate what organization(s) will be the main/lead counterpart(s) of CTCN experts at national level, in addition to the NDE.}

Stakeholder	Role to support the implementation of the assistance
National Water and Sewerage Authority (NAWASA), Grenada	Primary contact for request and stakeholder coordination; technical input
Mr. Kevin Andall, Permanent Secretary (AG) w.r.f. Human Resource Development & The Environment, Ministry of Education, Botanical Gardens, St. George Grenada.	NDE, overall process consultation regarding CTCN process
Environment Division of the Ministry of Education Human Resource Development and the Environment	Information sharing, consultation and coordination in regard to national climate policies, TNA process and

	<i>National Adaptation Plan</i>
<i>Land Use Division, Ministry of Agriculture, Lands, Forestry & Fisheries</i>	<i>Information sharing and consultation in regard to water usage in the sectors aagriculture, lands, forestry & fisheries</i>
<i>Grenada Water Stakeholder Platform (G- WASP) of the global International Water Stewardship Programme (IWASP), jointly implemented by the Land Use Division of the Ministry of Agriculture, Lands, Forestry and Fisheries in Grenada and the German Agency of International Cooperation (GIZ).</i>	<i>Information sharing and consultation regarding the fact-finding study on NAWASA Utility Management Support with a Focus on Non-Revenue Water</i>
<i>Pilot Programme "Integrated Climate Change Adaptation Strategies" (ICCAS), funded by the German Federal Ministry of Environment (BMUB) and implemented by GIZ and UNDP.</i>	<i>Information sharing and consultation and link to Grenada's Climate Policy and National Adaptation Plan processes.</i>
<i>Stakeholders from Grenada's tourism sector</i>	<i>Hotel owners and businesses from the tourism sector are key stakeholders in implementing water resource management on the ground; they play a crucial role in information sharing and hence play a role as resource persons and multipliers.</i>

Alignment with national priorities (up to half a page):

{Please demonstrate here that the technical assistance requested is consistent with documented national priorities (examples of relevant national priorities include: national development plans, poverty reduction plans, technology needs assessments (TNAs), LEDS, NAMAs, TAPs, NAPs, sectorial strategies and plans, etc.). For each document mentioned, please indicate where the priorities specifically relevant to this request can be found (chapter, page number, etc.).}

Based on the predicted impacts of climate change, the water sector has been identified in a number of national policies and strategies as a key sector being affected by Climate Change. This includes:

- the National Adaptation Plan (NAP), which dedicates a whole programme of action (No.3) to water availability with the goal to establish a climate-responsive water governance structure
- Grenada's Second National Communication to the UNFCCC, which is currently conducted and will address water resource management.
- The Technology Needs Assessment, which is currently conducted and will address water resource management as a key sector.
- The 2012 UNDESA/ Ministry of Environment strategy document⁷ "Climate Change Adaptation in Grenada" (p.5-31)
- the National Climate Change Policy and Action Plan (2007)
- Grenada's First National Communication to the UNFCCC (chapter 3.2.1. Impact on Water Resources)
- Intended National Determined Contribution (page 10) on improving water resource management

⁷ <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=635&menu=1515>

- National Adaptation Strategy and Action Plan for the Water Sector (NASAP)
- Grenada's Strategic Program for Climate Resilience (Technical Assistance 1: Grenada Water Resources Assessment and Management Study, p. 61)
- the Vulnerability Assessment for the Chemin Watershed
- Climate change policy and action plan (2007-2011) (throughout whole document)
- National Action Plan to Combat Desertification and Drought (throughout whole document)

1. The Government of Grenada approved a National Water Policy in November 2007, the goal of which is to provide a framework to maximize the contribution of the water sector to sustainable economic, social and environmental development in an efficient and equitable manner (GOG, 2007a). The Policy is based on the results of a situational analysis of Grenada's water sector (GOG, 2007b) and consultations with stakeholders.

2. The 'Water Sector Reform' process in Grenada owes its genesis to a commitment given at the 2001 World Summit on Sustainable Development in South Africa by all countries, including Grenada, to develop integrated water resources management (IWRM) and Water Efficiency plans by 2005⁸. Outputs of the process, which was facilitated by several regional and international agencies, included the following documents: *IWRM 'Roadmap' for Grenada* (GOG, 2007c); *Grenada Water Sector Review* (GOG, 2007b); *Draft National Water Policy* (GOG, 2007a); *Framework for Water Policy Implementation* (GOG, 2007d); *A Concept Brief for the Establishment of the Water Resources Unit* (Madramootoo, 2008); and *Review of Legislation With Respect to the Water Sector* (Sealey-Browne, 2008).

Development of the request (*up to half a page*):

{Please explain here how the request was developed at the national level and the process used by the NDE to approve the request before submitting it (who initiated the process, who were the stakeholders involved and what were their roles, and describe any consultations or other meetings that took place to develop and select this request, etc.)}

The request were developed together with the National Designated Entity of Grenada, the National Water and Sewerage Authority (NAWASA), the Climate Focal Point, the Environment Division of the Ministry of Education, Human Resource Development and the Environment, supported by extensive consultations with all relevant stakeholders and input from the Pilot Programme "Integrated Climate Change Adaptation Strategies" (ICCAS), funded by the German Federal Ministry of Environment (BMUB) and implemented by GIZ and UNDP and the Grenada Water Stakeholder Platform (G-WASP) of the global International Water Stewardship Programme (IWASP), jointly implemented by the Land Use Division of the Ministry of Agriculture, Lands, Forestry and Fisheries in Grenada and the German Agency of International Cooperation (GIZ). The activities listed above are those identified within the report from 2016, conducted by GIZ "*Fact-finding Study on NAWASA Utility Management Support with a Focus on Non-Revenue Water*".

Expected timeframe:

⁸ IWRM is defined as a process which promotes the coordinated development and management of water, land and related resources, in order to maximize economic and social welfare in an equitable manner, without compromising the sustainability of vital ecosystems (Agarwal et al., 2000).

{Please propose here a duration period for the assistance requested.}

10 – 12 months beginning in January 2017.

Activities	Starting week	Duration (weeks)
Establish GIS data structure and procedures , update GIS data base	1	10
Development of GIS-data model according to GIS SW prescriptions; needs; link options to O&M, to customer and financial data base	2	16
Update GIS data	17	4
Collect all available network and infrastructure data within the NAWASA (Survey Department, Drawing/Planning Department), e.g. as built drawings, AutoCAD	17	4
Convert sets of available data into GIS with geographic address (lon./lat.) according to GIS data model including all available attributes	21	2
Identify missing information and establish task force to fill missing info	22	2
Follow up new GIS data updating procedures (customer management/repair teams) via installation of a help desk	17	23
Develop campaign to collect and update base map (houses, other infrastructure and Point of Delivery) and connect to customer data base	15	2
Acquisition of recent satellite images and import to the GIS system	15	2
Field check for the new base map	17	23
Schematic drawings	24	4
Establishment of pilot DMA	14	8
Identification of a pilot zones for DMA	14	4
Water balance according IWA standard	37	2
concept and program for electricity generation	3	3

Background documents:

{Please list here relevant documents that will help the CTCN understand the context of the request and national priorities. For each document, provide weblinks if available, to attach to the submission form while submitting the request. Please note that all documents listed/provided should be mentioned in this request in the relevant question(s), and that their linkages with the request should be clearly indicated.}

- Fact-finding Study on NAWASA Utility Management Support with a Focus on Non-Revenue Water (available on request)
- Draft National Water Policy (www.gov.gd/egov/docs/other/draft-water-policy.pdf)
- Grenada's Growth and Poverty Reduction Strategy (GPRS), 2014-2018

- Grenada iNDC Report of the UNFCCC on Climate Change

Monitoring and impact of the assistance:

{Read carefully and tick the boxes below.}

By signing this request, I affirm that processes are in place in the country to monitor and evaluate the assistance provided by the CTCN. I understand that these processes will be explicitly identified in the Response Plan in collaboration with the CTC, and that they will be used in the country to monitor the implementation of the CTCN assistance.

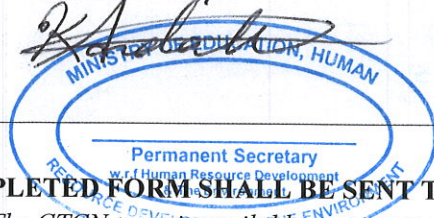
I understand that, after the completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short, medium and long-term impacts in the country.

Signature:

NDE name: **KEVIN PETER ANDALL**

Date: **17/2/2017**

Signature: 



THE COMPLETED FORM SHALL BE SENT TO THE CTCN@UNEP.ORG

Need help? The CTCN team is available to answer questions and guide you through the process of submitting a request. The CTCN team welcomes suggestions to improve this form.

>>> Contact the CTCN team at ctcn@unep.org

