

IGR Document

I. Basic Information for IGR

▪ Country/Region:	BELIZE
▪ TC Name:	Advancing Water Disinfection in Urban and Rural Areas
▪ TC Number:	BL-G1007
▪ Team Leader/Members:	Sturzenegger, German (INE/WSA) Team Leader; Grau Benaiges, Javier (INE/WSA) Alternate Team Leader; Basani, Marcello (INE/WSA); Champi Ticona, Diana Carla (INE/WSA); Gouvea Berto, Maria Eduarda (INE/WSA); Lopez, Liliana M. (INE/WSA); Lugo Moreno, Monica Bibiana (LEG/SGO); Lunstedt Tapia, Christian (VPC/FMP); Orchel Usher (CID/CBL); Ortiz Stradtmann, Silvia (INE/WSA); Sanmartin Baez, Alvaro Luis (LEG/SGO); Watson, Brodrick Raylando (VPC/FMP)
▪ Taxonomy:	N/A
▪ Operation Supported by the TC:	.
▪ Date of TC Abstract authorization:	13 Jun 2022.
▪ Beneficiary:	Belize (Belize Water Services Limited)
▪ Executing Agency and contact name:	Belize Water Services Limited
▪ Donors providing funding:	Cofinancing Special Grants(COF); Multidonor AquaFund(MAF)
▪ IDB Funding Requested:	Cofinancing Special Grants (COF): US\$100,000.00 Multidonor AquaFund (MAF): US\$150,000.00 Total: US\$250,000.00
▪ Local counterpart funding, if any:	US\$25,000.00 (In-Kind)
▪ Disbursement period:	24 months (included execution: 24 Months)
▪ Required start date:	August 2022
▪ Types of consultants:	Firms and Individuals
▪ Prepared by Unit:	INE/WSA-Water & Sanitation
▪ Unit of Disbursement Responsibility:	CID/CBL-Country Office Belize
▪ TC included in Country Strategy:	No
▪ TC included in CPD:	No
▪ Alignment to the Update to the Institutional Strategy 2010-2020:	Gender equality; Productivity and innovation; Social inclusion and equality

II. Objectives and Justification

2.1 Objectives. The general objective of this Investment Grant operation (IGR) is to implement innovative on-site water disinfection technologies in urban and rural areas of Belize. Its specific objectives are: (i) to implement innovative on-site disinfection technologies in Caye Caulker's water distribution system with the aim of increasing tap water consumption and reducing operational costs for Belize Water Services (BWS); (ii) to implement innovative on-site disinfection technologies in rural water systems, namely in the villages of Crooked Tree and San Marcos, with the aim of guaranteeing quality water and increase water consumption; (iii) to build capacity within Belize's water sector to implement these types of technologies; and (iv) to conduct a performance evaluation of these technologies in both urban and rural settings. This IGR will also inform the design of loan operation BL-L1043 (Water Disinfection Program for Belize) currently under approval. Building on the lessons learned from this IGR, loan operation BL-L1043 would provide financing to scale up disinfection technologies in both urban and rural areas.

- 2.2 **Justification.** Access to water services in Belize varies significantly between regions. In the two largest districts, Belize and Caye, more than 80% of households have access to piped water. However, in smaller and poorer districts, only about 60% of households have access to piped services. In districts such as Toledo, 11% of households extract water from wells and 10% from open sources, such as rivers, creeks, or springs¹. Access to quality water services is critical given Belize's dependence on tourism. In January of 2020, the electrical and water supply shortages that affected tourist destinations such as Caye Caulker affected tourist inflow².
- 2.3 BWS is the autonomous provider of water and wastewater services in Belize's major urban areas, including Belize City, Belmopan City, San Ignacio, Santa Elena, Benque Viejo Del Carmen, Caye Caulker, San Pedro, Dangriga, Placencia, Punta Gorda Town, Corozal and Orange Walk, and some 44 neighboring rural villages. As of April 2022, BWS had an active customer base of 64,000 water connections and 11,654 sewer connections. It provided water services to approximately 70% of Belize's population. Despite the company's good performance in most critical indicators³, in late 2021, the Water and Sanitation Division (INE/WSA) of the Inter-American Development Bank conducted a sample-based assessment to: (i) identify water disinfection challenges at the national level; and (ii) identify disinfection technologies (alternatives) that could address those challenges and reduce operating costs⁴. The assessment identified that all BWS's distribution systems, including water treatment plants, use Calcium Hypochlorite (CH) for disinfection purposes, which requires transportation of the CH and trained personnel to prepare the specific dosage.
- 2.4 BWS is not the only water service provider in Belize. Village Water Boards (VWBs) manage and operate water supply systems in approximately 190 rural villages, each with less than 4,000 inhabitants, and representing one third of the country's population. Service provision in rural areas faces several challenges such as lack of water disinfection processes, lack of resources for operating and maintaining the system, lack of staff capabilities, lack of standard procedures, and rapid and premature infrastructure deterioration. A 2012 study showed that only 38% of the VWBs are chlorinating water⁵. A total of 92 VWBs have chlorinators, but only 44 of them are chlorinating water. Some of the reasons for not chlorinating are: (i) the fear of using chlorination system incorrectly; and (ii) concerns raised by consumers about the taste and smell of water (high chlorine smell and taste especially in households close of the water distribution tank). The Ministry of Rural Transformation, Community Development, Labour and Local Government (MRD), which is responsible for the monitoring of water services in rural areas, also found that 26 water systems have

¹ Castalia. "Belize – Case Study of the Water and Sanitation Sector", 2017.

² [Water and Electricity crisis has Caye Caulker Village tourism industry and livelihoods in jeopardy.](#)

³ In FY 2020/2021, 98% of tests met the required standards, from 94% in 2010, including 100% bacteriological passes (e-coli presence); water pressure averaged a psi of 40 in 2016 from a value of 36 in 2010; service continuity averaged 23.99 hours of service per day in 2016 from 22.21 in 2011. BWS also improved its non-revenue water (NRW) level from 52% in 2002 to 23.7% in 2019, being one of the lowest in the Caribbean.

⁴ The assessment was carried out in seven locations. Namely: Placencia and Caye Caulker (Managed by BWS); and Hopkins, Sarteneja, Chunnox, Independence and Monkey River (Managed by Rural Water Boards and supervised by the Ministry of Rural Transformation, Community Development, Labour and Local Government).

⁵ Ministry of Labour, Local Government, Rural Development, and National Emergency Management. "Draft: Study of Rudimentary Water Systems of Belize (RWS)." 2012

chlorinators that are not working. The report also identified low participation of women in the operation and maintenance of rural water systems.

- 2.5 The assessment highlighted that most small towns and rural villages face several challenges in terms of water quality: (i) deficiencies or lack of water disinfection processes; (ii) lack of financing for new project development and disinfection infrastructure maintenance; (iii) lack of staff capabilities; (iv) premature infrastructure and equipment deterioration, and (v) inadequate standard procedures. To identify the most appropriate disinfection solution for Belize, different factors were considered: (i) disinfection capacity of the technology; (ii) residual disinfection effect (guarantees residual chlorine in the distribution network); (iii) improvement capacity on water quality and organoleptic properties (odor and taste); (iv) ease of purchase in Belize; (v) installation complexity for the operator; (vi) need to handle dangerous substances; and (vii) investment and Operation & Maintenance (O&M) costs. Based on these criteria, it was concluded that the most appropriate technology for Belize was the On-Site Generation (OSG) option, with two alternatives depending on water supply conditions: (i) OSG Sodium hypochlorite (NaClO), recommended when there are no quality problems detected in raw water, such as the presence of iron, manganese, organic matter, etc.; and (ii) OSG mixed oxidants ($\text{NaClO} + \text{H}_2\text{O}_2$), recommended when water quality problems are detected in raw water.
- 2.6 The Government of Belize and BWS successfully completed a joint project to provide residents of Caye Caulker access to potable water in 2010. BWS owns and operates a Water Desalinization Plant, currently capable of producing 150,000 gallons per day. The plant is supplied from two beach wells. Concentrate water is disposed via deep well injection. Permeate water is then chlorinated and stored in a 150,000-gallon reservoir and then distributed to customers. As of April 2022, there were 874 customer connections with 843 of these in the south and 31 in the north.
- 2.7 An essential part of the assessment was to estimate capital investment costs (CAPEX) and operating costs (OPEX) for the recommended technologies. It was found that even though CAPEX is higher than other disinfectants options such as calcium hypochlorite, the one most used in Belize, the recommended options have significant lower OPEX. Table 1 shows that even though CAPEX is higher for on-site generation technologies, OPEX for the on-site options is significantly lower than the predominant Calcium Hypochlorite (CH) technology.

Table 1.- OPEX and CAPEX estimations for sample villages (US dollars)

			Good water quality		Good water quality		No treatment process		No treatment process		Brackish, coliforms, H ₂ S		Good water quality		Water without disinfection	
WITH PHOTOVOLTAIC ENERGY INVESTMENT			OSG MIXED OXIDANT	OSG SODIUM HYPOCHL.	OSG MIXED OXIDANT	OSG SODIUM HYPOCHL.	OSG MIXED OXIDANT	OSG SODIUM HYPOCHL.	OSG MIXED OXIDANT	OSG SODIUM HYPOCHL.	OSG MIXED OXIDANT	OSG SODIUM HYPOCHL.	OSG MIXED OXIDANT	OSG SODIUM HYPOCHL.	OSG MIXED OXIDANT	OSG SODIUM HYPOCHL.
OPEX	Salt + Maintenance	USD/year	421	561	1,173	1,565	178	237	518	237	283	378	607	809	54	54
CAPEX	Equipment	USD	60,893	28,789	131,726	39,603	27,391	28,789	60,893	28,789	60,893	28,789	60,893	39,603	28,789	28,789
	Photovoltaic energy	USD	70,042	47,846	86,170	95,539	37,363	31,450	55,334	31,450	55,334	39,091	91,584	48,872	21,504	21,504
	TOTAL CAPEX	USD	130,935	76,636	217,896	135,142	64,755	60,239	116,228	60,239	116,228	67,881	152,477	88,475	50,293	50,293
WITHOUT PHOTOVOLTAIC ENERGY INVESTMENT																
OPEX	Salt + Maintenance+ energy (SALT 0.27 USD/KG+ KWH 0.17 USD KWH)	USD/year	1,036	956	2,887	2,666	438	405	518	405	697	644	1,494	1,379	438	92
CAPEX	Equipment	USD	60,893	28,789	131,726	39,603	27,391	28,789	60,893	28,789	60,893	28,789	60,893	39,603	27,391	28,789
	Photovoltaic energy	USD	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL CAPEX	USD	60,893	28,789	131,726	39,603	27,391	28,789	60,893	28,789	60,893	28,789	60,893	39,603	27,391	28,789
CALCIUM HYPOCHLORITE SCENARIO																
OPEX	OPERATION COST CALCIUM HYPOCHLORITE	USD/day	13	13	35	35	5	5	16	16	8	8	18	18	1	1
		USD/year	4,606	4,606	12,844	12,844	1,949	1,949	5,669	5,669	3,100	3,100	6,643	6,643	443	443

Source: IDB's Water and Sanitation Division

- 2.8 The assessment indicated that the implementation of a pilot project would validate the recommendations regarding CAPEX, OPEX, water quality, technology robustness and reliability, among other factors. In that context, the Government of Belize requested the Bank grant resources to finance potential water disinfection projects to test these solutions.
- 2.9 The report also highlighted the potential of these technologies in public spaces such as schools. Given that this type of infrastructure is typically relatively small, a solution was proposed that would produce the on-site mixed oxidant in a centralized point and then distribute it using 25-liter containers. In the case of large facilities, such as a school with 1000 or more students, disinfection equipment could be located within the facility.
- 2.10 The piloting of disinfection technologies in Belize's urban and rural areas will be financed by the Multi-Donor AquaFund (MAF) and by the Source of Innovation: A Facility for Fostering Innovation in the Water, Sanitation and Solid Waste Sector in Latin America and the Caribbean (RG-O1693). The present operation is aligned with the general objective of the Facility, which is to enable the development and integration of innovative solutions in the Water, Sanitation, and Solid waste (WSS) sectors to contribute to the universal provision of safely managed water and sanitation services. In particular, the operation aligns with the specific objectives to: (i) strengthen the demand-side of innovative solutions and products (through the financing of pilots); (ii) boost the supply of innovative solutions that support the improvement of water utilities' procurement systems by enhancing their information systems and contributing to savings by increasing the offer of products and services necessary for their operations; (iii) stimulate productive partnerships among service providers and suppliers; and (iv) promote a culture and an enabling environment for innovation in the sector through training and capacity building.
- 2.11 **Strategic Alignment.** This IGR is aligned with the Bank's Update to the Institutional Strategy (AB-3190-2) with the development challenges of "Social Inclusion and Equality", given that it supports the improvement of water system that aims to increase access to services in unserved tourist populations that have been greatly affected by the current pandemic; and "Productivity and innovation" because this operation will

finance the deployment of innovative disinfection technologies in Belize that will improve water quality and reduce operational costs. The IGR is also aligned with the crosscutting topic of (i) Gender equality and diversity, as it will promote the participation of women in the operation and maintenance of water systems. The operation is consistent with the IDB's Country Strategy with Belize 2022-2025 (GN-3086) as it will contribute to tourism by financing investments in resilient infrastructure and public goods and services, namely access to quality water services. The operation is consistent with the objectives of the Multi-Donor AquaFund (MAF) and of the Source of Innovation Facility (RG-O1693) by piloting small scale investment that have potential for scaling-up and by testing innovative disinfection technologies for the water sector. Finally, this operation is also aligned with two medium-term strategic goals of the Bank's 2025 Vision. Namely, (i) promote social progress by contribution to the sustainable access to water services; and (ii) strengthen good governance and institutions by strengthening BWS and Village Water Boards.

III. Description of activities/components and budget

- 3.1 **Component 1: Water Disinfection in Caye Caulker (US\$87,000).** The goal of this component is to improve water quality, increase tap water consumption and reduce operational costs for BWS. This component will finance the implementation of disinfection equipment in Caye Caulker's water treatment plant, including the purchase and installation of equipment, technical assistance to BWS, and the design and implementation of an information campaign for BWS's users. Information campaign will include specific products focused to target households led by women.
- 3.2 **Component 2: Water Disinfection in Rural Areas (US\$159,000).** The goal of this component is to improve water quality, increase tap water consumption and reduce operational costs in rural areas. This component will finance the implementation of disinfection equipment in rural water systems, including the purchase and installation of equipment, technical assistance to VWBs, and the design and implementation of an information campaign for users. Technical assistance will target women to promote their participation in the operation and maintenance of the water systems and disinfection equipment. The villages of Crooked Tree and San Marcos have been selected by MRD and BWS to deploy the disinfection technologies. Crooked Tree is a village of about 1400 people located in Orange Walk District. San Marcos is a village of about 750 people located in Toledo District.
- 3.3 **Management & Audit (US\$ 29,000).** The remaining resources will be allocated to cover management, audit and final evaluation costs.
- 3.4 The total cost of this operation is US\$275,000, which will be financed with resources from the Multi-Donor AquaFund (MAF) for US\$150,000, and the Source of Innovation Facility: A Facility for Fostering Innovation in the Water, Sanitation and Solid Waste Sector in Latin America and the Caribbean (RG-O1693) for US\$100,000. BWS will contribute with in kind resources for US\$25,000 to cover a percentage of the management costs. The budget breakdown by component is as follows:

Indicative Budget (US\$)

Component	IDB/Source Innovation Facility	IDB MAF	Local Counterpart	Total Funding
Component 1	75,000	-	-	75,000
Component 2	14,000	150,000	-	164,000
Management, Final Evaluation & Audit	11,000		25,000	36,000
TOTAL	100,000	150,000	25,000	275,000

IV. Executing agency and execution structure

- 4.1 **Executing Agency:** The executing agency for this IGR will be BWS, which is the authorized utility mandated by the Government of Belize to provide water services in Belize. BWS has executed and completed several IDB funded projects in the past, including, most recently, the Belmopan Sewerage Expansion Project under a Global Environmental Facility GEF-IDB project (Establishment of a Revolving Fund for Financing Water Projects in Belize - GRT/FM-12724-RG) as well as BL-T1148; ATN/OC-19183-BL (Detailed Design of a Wastewater Collection and Treatment System in Placencia). BWS is also successfully executing Technical Cooperation BL-T1125; ATN/OC-18380-BL (Design of Wastewater Treatment Solutions in Coastal Areas for US\$250,000).
- 4.2 **Execution Structure.** The disbursement period, which includes the implementation period, shall be 24 months. For execution purposes, the IDB and BWS will sign a non-reimbursable financing agreement. BWS will be responsible for the administration and supervision of the resources provided by the Bank, in accordance with the Bank's policies and procedures. BWS will appoint a Project Coordinator (PC), a Technical Focal Point (TFP), a Procurement Specialist (PS) and a Financial Specialist (FS). The appointment of the PC, TFP, PS, and FS will be a condition for first disbursement.
- 4.3 **Procurement.** All activities implemented under this IGR have been included in the Procurement Plan. For execution purposes, BWS will follow IDB's procurement policies, namely GN-2349-15 and GN-2350-15. The Procurement Plan (PA) indicates the procedures to be used for the procurement processes, the selection method, the estimated cost of each contract, and the requirement for ex ante or ex post review by the Bank.
- 4.4 **Financial supervision, audit, and evaluation.** Technical and fiduciary supervision will be carried out by requesting from BWS a semi-annual progress report that must contain at least: (i) the physical and financial progress of the operation; (ii) outputs and outcomes achieved during that period and on a consolidated basis; (iii) a summary of the activities carried out during that period; and (iv) a workplan for the following period. These reports will be submitted to the Bank within 60 days of the close of each semester. Financial supervision will require, prior to each advance of funds (except the first one), a justification of expenses of at least 80% of the total accumulated balance, accompanied by the corresponding bank reconciliation, and the financial reports established in the Financial Management Guide for Projects Financed by the IDB (OP-273-12). A dedicated bank account for the use of the IGR's resources must be created. The creation of this account will be a condition for first disbursement. BWS will submit, within 120 days of the date of last disbursement, the Audited Financial Statements of the operation, which will be prepared according to Terms of Reference (ToRs) previously agreed between the Bank and BWS and carried out by an

independent audit firm acceptable to the Bank. An independent final evaluation of the operation will be conducted.

V. Major issues

- 5.1 Three risks have been identified: (i) low local capacity, among rural water boards, to operate and maintain the water disinfection equipment. To mitigate this risk, the project will include training activities to build capacity at the local level to properly operate and maintain the disinfection equipment; (ii) low implementation capacity by BWS. To mitigate this risk, BWS will appoint a dedicated team consisting of a project manager, a technical specialist, and a financial specialist to support the implementation of the project; (iii) lack of coordination between BWS and MRD, which is the agency responsible for the supervision of rural water systems. BWS will have to coordinate with MRD the deployment of the disinfection equipment in rural areas. A Coordination Group (CG) will be established to facilitate coordination. MRD and BWS will appoint a focal point to the CG. Also, the possibility of signing specific agreements between BWS and the Village Water Boards will be explored to guarantee coordination and buy-in from these local organizations and to ensure the proper operation and maintenance of the new equipment; and (iv) price increases, due to inflation, of the disinfection equipment to be purchased. A 10% price increase in the equipment was budgeted to mitigate this risk.

VI. Exceptions to Bank policy

- 6.1 This operation does not include any exception to Bank policies.

VII. Environmental and Social Strategy

- 7.1 According to the Bank's Environmental and Social Policy Framework (MPAS), this operation was classified as Category "C", as it is expected to cause minimal environmental and social impacts.

Required Annexes:

[Request from the Client - BL-G1007](#)

[Results Matrix - BL-G1007](#)

[Terms of Reference - BL-G1007](#)

[Procurement Plan - BL-G1007](#)