Meeting of the Board
1 – 4 July 2018
Songdo, Incheon, Republic of Korea
Provisional agenda item

GCF/B.20/10/Add.03

8 June 2018

Consideration of funding proposals – Addendum III

Funding proposal package for FP084

Summary

This addendum contains the following three parts:

a) A funding proposal summary titled "South Tarawa Water Supply Project";
b) No-objection letter issued by the national designated authority(ies) or focal point(s); and
c) Environmental and social report(s) disclosure;

GREEN CLIMATE FUND

Funding Proposal

Version 1.1

The Green Climate Fund (GCF) is seeking high-quality funding proposals.

Accredited entities are expected to develop their funding proposals, in close consultation with the relevant national designated authority, with due consideration of the GCF's Investment Framework and Results Management Framework. The funding proposals should demonstrate how the proposed projects or programmes will perform against the investment criteria and achieve part or all of the strategic impact results.

Project/Programme Title:	South Tarawa Water Supply Project
Country/Region:	Kiribati
Accredited Entity:	Asian Development Bank
Date of Submission:	26 February 2018

Contents

Note to accredited entities on the use of the funding proposal template

- Sections **A, B, D, E** and **H** of the funding proposal require detailed inputs from the accredited entity. For all other sections, including the Appraisal Summary in section F, accredited entities have discretion in how they wish to present the information. Accredited entities can either directly incorporate information into this proposal, or provide summary information in the proposal with cross-reference to other project documents such as project appraisal document.
- The total number of pages for the funding proposal (excluding annexes) is expected not to exceed 50.

Please submit the completed form to:

fundingproposal@gcfund.org

Please use the following name convention for the file name:
"[FP]-[Agency Short Name]-[Date]-[Serial Number]"

A.1. Brief Project / Programme Information			
A.1.1. Project / programme title		South Tarawa Water Supply Project	
A.1.2. Project or programme		Project	
A.1.3. Country (ies) / region		Kiribati	
A.1.4. National designated authority (ies)		Climate Finance Division, Ministry of Finance and Economic Development (Focal: Jonathan Mitchell)	
A.1.5. Accredited entity		Asian Development Bank	
A.1.5.a. Access modality		☐ Direct ☒ International	
A.1.6. Executing entity / beneficiary		Executing Entity: Ministry of Finance and Economic Development Beneficiary: Kiribati	
A.1.7. Project size category (Total investment, million USD)		☐ Micro (≤10) ☒ Medium (50<x≤250)	☐ Small (10<x≤50) ☐ Large (>250)
A.1.8. Mitigation / adaptation focus		☐ Mitigation ☐ Adaptation ☒ Cross-cutting	
A.1.9. Date of submission		26 February 2018	
A.1.10. Project contact details	Contact person, position	Deborah Robertson, Natural Resources Specialist	
	Organization	Asian Development Bank	
	Email address	drobertson@adb.org	
	Telephone number	+632 683 6329	
	Mailing address	6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines	

A.1.11. Results areas *(mark all that apply)*

Reduced emissions from:

☐ Energy access and power generation
(E.g. on-grid, micro-grid or off-grid solar, wind, geothermal, etc.)

☐ Low emission transport
(E.g. high-speed rail, rapid bus system, etc.)

☒ Buildings, cities and industries and appliances
(E.g. new and retrofitted energy-efficient buildings, energy-efficient equipment for companies and supply chain management, etc.)

☐ Forestry and land use
(E.g. forest conservation and management, agroforestry, agricultural irrigation, water treatment and management, etc.)

Increased resilience of:

☒ Most vulnerable people and communities
(E.g. mitigation of operational risk associated with climate change – diversification of supply sources and supply chain management, relocation of manufacturing facilities and warehouses, etc.)

☒ Health and well-being, and food and water security
(E.g. climate-resilient crops, efficient irrigation systems, etc.)

☒ Infrastructure and built environment
(E.g. sea walls, resilient road networks, etc.)

☐ Ecosystem and ecosystem services
(E.g. ecosystem conservation and management, ecotourism, etc.)

A.2. Project / Programme Executive Summary (max 300 words)

Kiribati is one of the most remote and least developed countries in the world. It faces significant challenges due to its vulnerability to climate change. South Tarawa's water supply is entirely dependent on underground freshwater lenses, the quality and quantity of which are seriously threatened by climate change induced inundation and prolonged drought. Should such events occur simultaneously or in quick succession, they may reduce the lenses yield to zero for periods up to five years. Taking a precautionary approach, the lenses cannot be relied upon as the main source of water in a future with climate change.

This project will provide the entire population of South Tarawa (estimated to be 62,298 people in 2018), more than half of Kiribati's population, with a reliable, safe and climate resilient water supply. To achieve this, the project comprises:

1. A new 4,000 m^3/day seawater reverse osmosis desalination plant powered by a new solar photovoltaic (PV) plant;
2. New and rehabilitated water supply network infrastructure to reduce leakages and ensure that all residents can access the new clean water source;
3. Institutional strengthening, capacity building and long-term performance-based contracts for operation of the new infrastructure; and
4. An intensive 5-year climate change, water, sanitation and hygiene awareness program with strong involvement of local civil society organizations.

The project will lead to avoided GHG emissions through the following: households will no longer need to boil water using kerosene; a reduced need to pump and treat water due to reduced losses from the network; and the solar PV plant as opposed to diesel generators.

This project will be transformative for Kiribati and promote a paradigm shift in both the knowledge and practice of how small island developing states can increase the resilience of their water supply systems to climate change. This project will have significant health and socio-economic impacts, with women, children, the elderly and the most disadvantaged households benefiting most. The cost of adapting South Tarawa's water supply to projected climate change impacts, plus the incremental cost of delivering GHG mitigation impacts is US$28.6 million, 49 % of the total project cost, and GCF's contribution is critical for it to proceed.

A.3. Project/Programme Milestone

Expected approval from accredited entity's Board (if applicable)	31/10/2018
Expected financial close (if applicable)	31/12/2024
Estimated implementation start and end date	Start: 01/01/2019 End: 31/12/2024
Project/programme lifespan	6 years

B.1. Description of Financial Elements of the Project / Programme

The project's financing plan is shown in Table 1.

Table 1 - Summary financing plan (including contingencies)

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank (Grant)	15.00	25.83
World Bank (Grant)	12.96	22.31
Government of Kiribati	1.49	2.57
Green Climate Fund (Grant)	28.63	49.30
TOTAL	58.08	100

The Government will provide in-kind contributions to the project including (i) PUB's involvement in pipe-laying works in selected zones; (ii) office space for the project design advance (PDA) and project implementation assistance (PIA) consultants; (iii) land space for the installation of the desalination plant and solar PV system; and (iv) staff from MISE/PUB assigned to the project management unit. Critically, Government is committed to ensuring the on-going financial sustainability of the new water supply system throughout its life, meeting the balance of on-going financial needs, following the implementation of this project.[1]

The climate change component of the total project cost is estimated to be 49 %. The grant financing being requested from the GCF is thus critical to providing a safe, climate-resilient and low-carbon water supply to the people of South Tarawa. South Tarawa hosts an estimated 53.7 % of Kiribati's population in 2018, projected to increase to 59.8 % in 2041.

Kiribati remains at high risk of debt distress due to its limited economic base and vulnerability to external (including climatic) shocks, precluding their ability to access commercial credit on favourable terms. ADB extends 100% grants to Kiribati. The debt sustainability analysis conducted during the IMF's 2017 Article IV mission highlights that public investments for climate change adaptation, a key expenditure area for future development, will remain dependent on development partners' financial support.

Estimated cost breakdowns are presented in Table 2. The financial analysis and disbursement schedules are attached in Annex B.

Table 2 - Total project costs and GCF amount sought by component (millions)

Activity	Sub-activity (if applicable)	GCF	ADB	WB	Counterpart	Total
Component 1. Strengthening climate resilient, low carbon water infrastructure		16.46	6.55	6.53	0.75	30.28
1.1 Construct a Desalination Plant		9.87	0.93	0.93	0.00	11.73
1.2 Upgrade and expand Water Supply Network		0.00	4.95	4.94	0.75	10.64
1.3 Construct a solar PV plant and system		6.59	0.66	0.66	0.00	7.91
Component 2. Institutional strengthening for water supply management		4.62	5.12	3.11	0.47	13.33
2.1 Undertake O&M of desalination plant (5 years)		1.32	0.12	0.12	0.00	1.57
2.2 Implement Institutional Strengthening	2.2.1 Network O&M PBC	1.88	1.57	1.56	0.00	5.00
	2.2.2 Specialist construction oversight	0.00	0.50	0.50	0.00	1.00

[1] It should also be recognized that in parallel to this project, Government is fully financing the provision of rainwater tanks to all households in Kiribati – an important initiative that will further strengthen the resilience of the country's water sector.

	2.2.3 Specialist support to PUB in Key result areas	0.13	0.19	0.19	0.00	0.50
	2.2.4 Vocational Training	0.00	0.25	0.25	0.00	0.50
2.3 Project Implementation and Safeguards	2.3.1 Project Implementation Assistance (3rd party)	1.14	0.50	0.49	0.00	2.13
	2.3.2 Safeguards	0.00	0.00	0.00	0.47	0.47
2.4 Undertake detailed project design		0.00	2.00	0.00	0.00	2.00
2.5 Treat water (additional treatment needs due to climate change for 5 years)		0.16	0.00	0.00	0.00	0.16
Component 3. Outreach and awareness raising		1.29	0.46	0.46	0.00	2.22
3.1 Implement water conservation and WASH awareness program		1.24	0.46	0.46	0.00	2.17
3.2 Construct climate change and water resources visitor education center		0.05	0.00	0.00	0.00	0.05
Component D. Project Management		1.06	0.54	0.54	0.00	2.15
4.1 Project Management Unit		1.06	0.54	0.54	0.00	2.15
Subtotal - base costs		**23.43**	**12.68**	**10.64**	**1.22**	**47.97**
Physical Contingencies		3.26	1.55	1.55	0.19	6.54
Price Contingencies		1.94	0.77	0.77	0.09	3.57
Total		**28.63**	**15.00**	**12.96**	**1.49**	**58.08**

B.2. Project Financing Information

	Financial Instrument	Amount	Currency	Tenor	Pricing
(a) Total project financing	**(a) = (b) + (c)**	58.08	million USD ($)		
(b) GCF financing to recipient	(vi) Grants *	28.63	million USD ($)		

	Justification for request is provided in Section F.1						
	Total requested =	28.63	million USD ($)				
(c) Co-financing to recipient	**Financial Instrument**	**Amount**	**Currency**	**Name of Institution**	**Tenor**	**Pricing**	**Seniority**
	Grant Grant Guarantees	15.00 12.96 1.49	million USD ($) million USD ($) million USD ($)	ADB World Bank Government of Kiribati			
	Lead financing institution: Asian Development Bank						
	Please refer to Annex D for a co-financing letter of commitment from the World Bank. The World Bank is committing $12.96 million in co-financing for this project (as described in the proposal), with an additional $2million allocated to parallel activities in sanitation (described in Section C.3 Box 2). These parallel activities are complementary but outside the scope of this proposal and not reflected in the total project cost						
(d) Financial terms between GCF and AE (if applicable)	Terms as set out in the Accreditation Master Agreement, and to be set out in the Term Sheet and Funded Activity Agreement.						

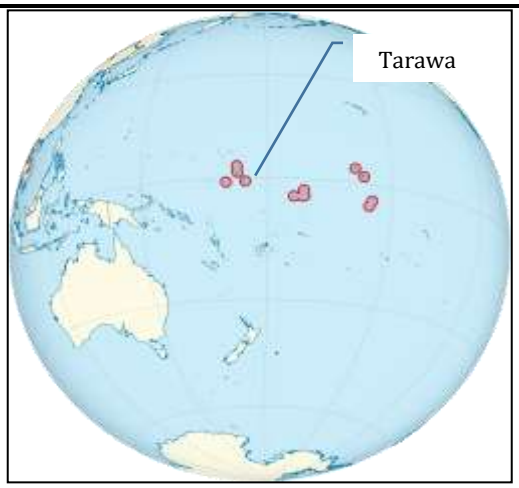
B.3. Financial Markets Overview (if applicable)

The proposal will be 97% grant financed. Financial viability was determined through comparison of the weighted average cost of capital (WACC) and the financial internal rate of return (FIRR), as presented in Annexes B and C.

C.1. Strategic Context

Location and development context

The Republic of Kiribati consists of 33 islands with a total land area of 810 square kilometer (km^2) spread over 3.5 million km^2 of sea in the Pacific (Figure 1A, and Annex H). South Tarawa, the nation's capital, lies on the Tarawa atoll. South Tarawa (the area stretching from Betio to Bonriki – Figure 1B) has a land area of just 15.72 km^2 and at its highest point is only 3 meters above sea level.



A. Location of Tarawa in the Pacific

B. Tarawa Atolls

Figure 1 – Location of South Tarawa, Kiribati

Official population censuses show the population of Kiribati has increased from 92,533 in 2005 to 110,236 in 2015 and is expected to reach approximately 156,000 in 2040 (UN 2017[2]). The Tarawa atoll (comprising both North Tarawa and South Tarawa) accounts for more than half of the population and is growing at a faster rate than the rest of the country, increasing in population by approximately 41% between 2005 and 2015. Over the period 2015-2041, South Tarawa's population is projected to increase by approximately 62.5%.

Kiribati is classified as a Small Island Developing State (SIDS), a Fragile State, and a Least Developed Country (LDC). In 2016, it ranked 169th of countries in the world in terms of GDP per capita, and 137th on the Human Development Index. Kiribati faces significant development challenges due to its geographical remoteness and vulnerability to climate change. Kiribati's vulnerability and need for support is discussed in Sections D.1 and E.4.

Climate change adaptation

Kiribati is making every effort to safeguard their land and territory from climate change impacts and to strengthen the adaptive capacity and resilience of the I-Kiribati. Kiribati's draft Climate Change policy outlines objectives that are aimed at developing bold and innovative engineering solutions to address coastal management issues (coastal protection) and long-term measures to build up the islands through collaborative efforts with potential partners. Government is also about to commence implementation of its GCF Readiness support proposal. A key activity will be to undertake extensive stakeholder consultations to develop a strategic framework and country program to identify adaptation and mitigation priorities. Aside from the overarching and strategic directions that Government is taking on climate change above, there are several sector plans and projects to ensure that Kiribati can adapt and mitigate the impacts of climate change as a nation over the long term. Some that are noteworthy based on the proposal are -

- The Office of the President is currently working with the Kiribati Adaptation Project to develop a long term coastal security strategy.
- Government is working with MFAT in undertaking a feasibility study on the reclamation of Teimaiku swamps and ponds (located in South Tarawa) in elevating it to levels that would be protected from future sea levels and thus providing a model for future adaptation programmes.
- Government's AU$1 million annual disaster fund continues to address coastal issues on South Tarawa through the construction of seawall protection for communities and for protection of public infrastructure.
- Government and NZMFAT have implemented an AU$4 million project to improve housing to ease overcrowding and better suit local needs.
- The AU$70 million Outer Islands Infrastructure Program with funding from Government, World Bank and ADB which is currently in the planning stages and will be utilised to improve key infrastructure such as roads and airstrips.
- The South Tarawa Sanitation Improvement Sector Project already mentioned in this proposal.
- The recently completed road rehabilitation project for South Tarawa amounting to ~AU$96 million with funding from Government, ADB, World Bank, Australia.

[2] United Nations. 2017. World Population Prospects: The 2017 Revision. UN Population Division. Department of Economic and Social Affairs.

- Ongoing Rehabilitation of Nippon Causeway project amounting to ~AU$45 million funded by Japan and Government.
- Government is also working with UNDP to develop a GCF coastal protection and strengthening proposal using an ecosystem-based adaptation approach for up to 20 islands.

Water sector, resources and supply

As with all Pacific states, the sourcing and provisioning of water to the population is a priority and a challenge. The Government of Kiribati (Government) is committed to providing a climate resilient potable water supply to its people, including the population of South Tarawa. In 2008, Government adopted the *National Water Resources Policy* and the *National Water Resources Implementation Plan*. Demonstrating the importance attached to this sector and reflecting the service demand created by South Tarawa's growing population, Government has further developed the *Tarawa Water Master Plan 2010-2030* (Government, 2010) and the *Tarawa Water and Sanitation Roadmap 2011-2030*. These planning documents have concluded that seawater desalination is the most practical, cost-effective and climate-resilient approach to meet South Tarawa's future water needs.

The existing sources of fresh water for consumers on South Tarawa are: (i) the Bonriki and Buota lenses located at the eastern end of the island, away from the main population centers; (ii) rainwater harvesting by households and by small community groups; (iii) household groundwater wells (drawing from small lenses located below residential areas); (iv) small-scale desalination plants and; (v) imported water. The proportional use of these sources varies between households, islands, seasons and year. The following can be observed (Government, 2010):

- **Bonriki and Buota lenses**. Combined, these two lenses can currently provide an estimated 2,000 m^3/day of good quality freshwater, based on empirical observations and estimates of long term average rainfall recharge. They are by far the largest source of freshwater available. Water is abstracted from a grid of 22 galleries on Bonriki lens and 3 galleries on Buota lens. The water from each individual gallery is pumped to the main trunk and then into the reticulated water supply network;
- **Rainwater harvesting**. This is considered a useful but small-scale source of freshwater. It is estimated to provide up to 93 m^3/day of good quality freshwater. However, in recent years, collection tanks have often been left empty for a period of weeks or even months due to low rainfall;
- **Groundwater wells** near people's homes from local lenses. In recent decades, rapid population growth on the land over these lenses, and localized animal farming, have led to the contamination of the water in these lenses. In most cases, the lens water is saline due to over-abstraction and highly polluted due to domestic waste. It is generally estimated that the water from the local groundwater wells is unsafe to use and continues to deteriorate;
- **Small-scale private desalination plants**. These provide good quality water. However, the existing plants are very small scale and can only meet a very small proportion of overall demand. Further, the plants have proven unreliable (typically due to insufficient operation and maintenance (O&M)), and the water produced is too costly for most of the population; and,
- **Imported water (bottled)**. This provides good quality water. However, this remains a very marginal source, notably because it is too expensive for almost all of the population.

At the operational level, the main actor is the Public Utilities Board (PUB) - a state-owned enterprise. PUB was established in 1977 to coordinate and manage power generation, water supply and sewage disposal in urban South Tarawa. PUB operates the infiltration gallery pump stations in Buota and Bonriki, the water treatment plant and the transfer pumps. PUB is responsible for the maintenance of these assets, and the provision and regulation of water supply throughout South Tarawa.

PUB supplies the water from Bonriki and Buota lenses through a reticulated water network. This includes pumps, treatment facilities, storage facilities, transmission and distribution pipes. It is estimated that the network currently reaches around 69% of the population in South Tarawa.[3] However, the quantity of water supplied is insufficient to meet even a basic level of demand. The limited sustainable yield from the lenses, as well as very high physical losses from the network, mean that the quantity of water reaching customers from PUB's network is below 20 liters per person per day. Customers receive an intermittent service, typically for two hours every two days. The water is delivered at a very low pressure and there is much tampering, illegal connections and leakages. One consequence is that the water delivered is generally unfit for human consumption. A large majority of residents therefore boil water from the network.

[3] The International Benchmarking Network for Water and Sanitation Utilities (IBNET): https://www.ib-net.org/ Country Profile: Kiribati

Population projections suggest that the population of South Tarawa may grow from approximately 56,388 in 2015 to 94,501 in 2041. Due largely to increased per capita demand and population growth, the **demand for water** on South Tarawa is projected to grow significantly in coming years. Depending on the scenario adopted, the demand will grow to reach approximately between 6,000 – 14,000m3/day by 2041 (see Annex B).

C.2. Project / Programme Objective against Baseline

Climate change characterization of the water sector on South Tarawa

Climate change adaptation and mitigation interact with the water sector in many ways, at many points:

1. Climate change will affect both the supply of and the demand for water.
2. The sector's infrastructure – pumps, reservoirs, treatment plants, pipes, electricity supply, etc. - is physically exposed to climate variability and climate change.
3. The production and distribution of clean water requires energy – hence the sector can be a significant contributor to greenhouse gas (GHG) emissions.

After a summary of relevant projected climate change, the following sections describe the three points above. Full details are provided in Annex F.

Climate, wave climate and climate change

Climate. Kiribati has a hot and humid tropical climate. Kiribati's climate varies considerably from year to year, driven largely by the El Niño-Southern Oscillation (ENSO).

Air temperatures are closely related to the temperature of the surrounding oceans. Average temperatures are relatively constant year-round, with changes in the temperature from season to season no greater than approximately 1°C (PACCSAPP 2015[4]).

Rainfall in Kiribati is affected by the movement of the South Pacific Convergence Zone and the Intertropical Convergence Zone. These bands of heavy rainfall are caused by air rising over warm water where winds converge, resulting also in thunderstorm activity. Mean annual rainfall at Betio (South Tarawa) over the period 1947-2016 was estimated to be 2,063 millimeter (mm).[5] These observations show a slight upward trend during this period. However, there is significant inter-annual variability - from a minimum of 398 mm in 1950 to a maximum of 4,356 mm in 1993.

Monthly rainfall is also characterized by extreme variability with monthly rainfall ranging from 0 to 825 mm. The overall monthly mean is 171 mm. The mean monthly rainfall varies from between approximately 116 mm for October to 277 mm in January. Typically, there is a wet season from December to about April and a longer, drier season from May to November (White 2011[6]).

Drought. White (2011) provides a definition of drought in the Tarawa context as a function of rainfall in the preceding 12 months. Using this definition, a drought period may be sustained over several months or even years. There were 9 severe droughts between 1947 and 2010 with an average duration of 23.6 months. The most severe drought occurred in April 1974 when only 217.0 mm of rain had fallen in the preceding 12 months. The time between successive severe droughts also varies widely, with the shortest gap being 2.8 years and the longest 16.3 years.

Wind-waves in Kiribati are strongly influenced by both north-easterly and south-easterly seasonal trade winds, and the location of the South Pacific Convergence Zone, and by the El Niño–Southern Oscillation from year to year. In Tarawa, waves consist of locally generated trade wind waves from the east and northeast from December to March, and from the east and southeast from June to September. In this latter period there are also trade wind induced swell waves, and some swell propagating from extra-tropical storms in the North Pacific and Southern Ocean (PACCSAPP 2015).

A key parameter is over-topping – whereby seawater flows onto the island and ultimately into the island's groundwater, damaging freshwater resources, contaminating water in the lenses. NIWA (2008) assessed and modeled meteorological and oceanic parameters in order to determine how wave height, wave direction, wave periods, storm surge, storm tides, wave set-up and wave run-up could lead to overtopping under diverse conditions. NIWA had the following findings:

[4] *Pacific-Australia Climate Change Science and Adaptation Planning Program* (PACCSAPP). 2015. Current and Future Climate of Kiribati. BOM (Government of Australia)/CSIRO.
[5] Source: A. Falkland, personal communication.
[6] White, I. 2011a. *Tarawa Water Master Plan: Te Karau, Rainwater Harvesting Storage and Use*.

- Sea level: the astronomical tide is by far the dominant influence on sea levels in Tarawa, followed by fluctuations in the mean level of the sea (e.g. due to ENSO), with storm surge having a relatively minor affect. As a result: the higher the sea level, the higher the risk and the intensity of over-topping;
- Waves: models show that swell conditions will cause the most significant occurrences of wave set-up, wave run-up and subsequent overtopping[7]. Wind waves are far less significant. Hence, over topping is also a function of swell wave conditions.

Climate change. The most recent comprehensive assessment of projected climate change on Kiribati was undertaken in 2015 within the context of the PACCSAP project (PACCSAP 2015). PACCSAP 2015 considered 3 representative concentration pathways (RCP): RCP2.5, RCP6 and RCP8.5. Relevant projections include:

- Sea level is projected to rise by between 13 to 33 centimetres (cm) by 2050, depending on the scenario adopted;
- Air temperatures will continue to rise with a projected increase ranging between 0.6°C and 2.2°C by 2050;
- The number of very hot days and hot nights will continue to rise[8];
- Sea surface temperature is expected to rise by a similar amount to air temperatures (but slightly less);
- Average annual rainfall and seasonal rainfall will increase, as will the number and intensity of extreme precipitation events;
- Ocean acidification is expected to increase, and this could affect the performance of desalination equipment. The aragonite saturation state has declined from about 4.5 in the late 18th century to an observed value of about 3.9±0.1 by 2000 and is expected to decline to under 3 in the 2030's (RCP8.5);
- Wind wave height is projected to decrease during the months of December to March. Wind driven waves may be more directed from the south the month of October. Wind wave height is projected to increase slightly in the month of September;
- The wave climate is also affected by swells caused by distant typhoons, and so is affected by the path and intensity of the distant typhoons. There is no consensus on how these paths and intensity will change with climate change;
- Frequency and intensity of drought: see section below on drought.

Climate change will reduce the supply of water

This is the most significant impact on the water sector. Recent studies, of which details are provided below, have found that climate change threatens to temporarily reduce, or even potentially eliminate, Bonriki lens' freshwater yield for periods of up to five years, through increased sea overtopping inundating the lens and/or increased drought. Although there is an absence of rigorous studies on the Buota lens, it is reasonable to assume that it is similarly vulnerable to the projected impacts of climate change.

Sea overtopping. Several factors contribute to the risk of sea overtopping and contaminating the lenses. These include (i) storm surges in which low atmospheric pressure leads to a temporary rise in sea level, possibly exacerbated by local winds; (ii) swells, or large, low-frequency waves driven by winds from distant weather formations (including cyclones); (iii) tide level – with the possibility of very high tides in certain seasons; and (iv) long-term sea level rise, such as that caused by climate change. At any given time, the risk of overtopping is a function of all these factors – if all four factors combine to drive a high sea there is a very high risk of overtopping. Climate change will most significantly affect (iv), sea level rise, thereby progressively increasing the risk of overtopping. Due primarily to sea level rise, by the year 2050, most of the land over the lenses should be considered vulnerable to overtopping and seawater flooding.

The *Bonriki Inundation Vulnerability Assessment 2015* (BIVA) modelled overtopping and found:[9]

- *Without climate change* - the return period for an overtopping event that leads to a temporary reduction in the available yield from Bonriki lens is 100 years or more;
- *With climate change* - there are several reasonable scenarios where an overtopping event would lead to a significant reduction in the available yield from the Bonriki lens. The yield may be reduced by 54%, and this

[7] This applies to ocean facing coasts, not to the inner coasts which face the lagoon
[8] Warm nights or hot days are those exceeding the 90th percentile of temperature. See https://www.pacificclimatechangescience.org/wp-content/uploads/2014/07/PACCSAP_CountryReports2014_RefGlossApp_WEB_140710.pdf for full glossary
[9] The BIVA project was implemented within the PACCSAPP program. It was undertaken during 2013-2015 as a partnership between the Government of Kiribati, the Australian Government and the Secretariat of the Pacific Community (SPC).

reduction may persist for up to five years, depending on conditions. In some scenarios, such overtopping events have a return period of 20 years or less.

As an example, Figure 2 illustrates a sea overtopping event that would impact the Bonriki lens catchment after climate change. It shows that under RCP8.5, with a sea level rise of 28cm, an overtopping event with a return period of 20 years renders 9 out of the 22 infiltration galleries unusable for a significant period of time. This event corresponds to a 41% reduction in yield. The duration of this reduction will depend on rainfall in the years before and after the event.

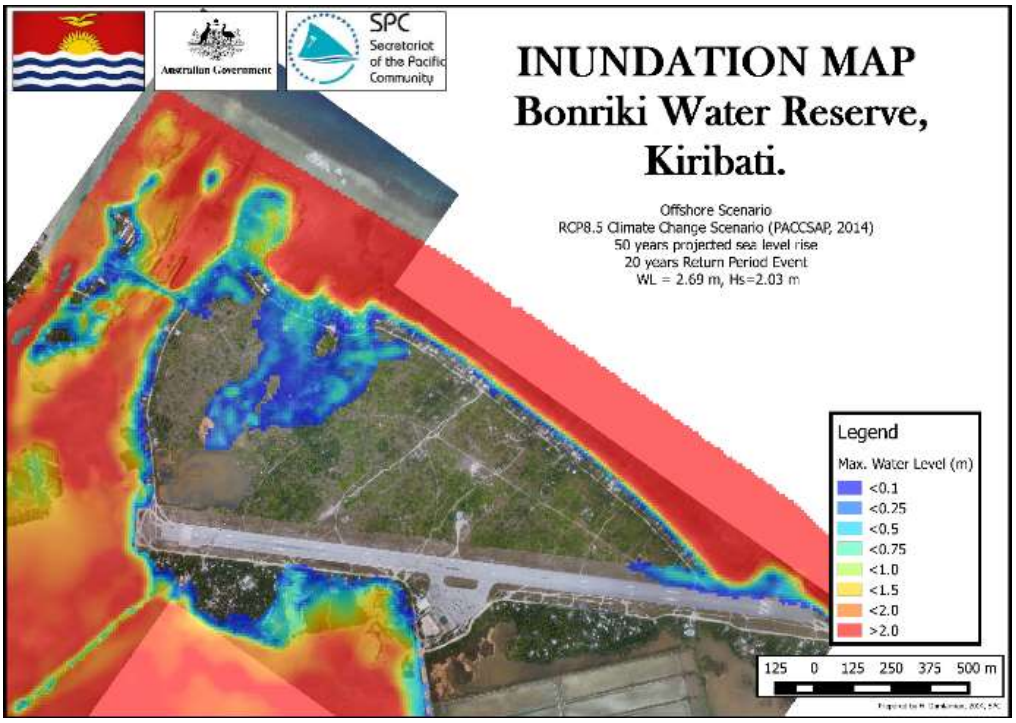


Figure 2 – Example overtopping event impacting Bonriki lens catchment

Drought. There is far less certainty with regards to how climate change may affect the occurrence and intensity of future droughts. Although the climate change models (PACCSAP 2015) project overall that droughts will be less frequent, there is *low confidence* in these projections, and this relates only to short and medium-term droughts. Long-term droughts (those lasting more than one year) on Tarawa are understood to be almost entirely driven by ENSO, and there is no consensus or agreed understanding of how climate change will impact ENSO. There is the possibility that, due to climate change, droughts caused by ENSO will be longer or more intense, even if the *average* length and intensity of droughts is reduced.

Climate and Abstraction Impacts in Atoll Environment (CAIA, 2016) modelled the impacts of droughts on the available yield from Bonriki lens. CAIA modelled (i) the impact of a drought with the same intensity as the 3-year drought that actually occurred in 1998 – 2000 but persisting for six years and (ii) the impact of two droughts equivalent to the 1998 – 2000 drought repeated in quick succession. The models showed that these extreme drought conditions would lead to a 40% reduction of the available yield from the lens that would last for several years. Although these prolonged and repeated drought scenarios are not projected by the climate change models, they are realistic scenarios given existing knowledge of climate change and how it may affect droughts on Tarawa.

Finally, it is important to note that the two extreme scenarios described above - of sea overtopping and extreme drought – could occur simultaneously or in quick succession after climate change. Such a catastrophic combination would probably reduce the freshwater yield from the Bonriki lens to close to zero for several years. In summary, the Bonriki lens, which has **no previously recorded** incidents of climate events affecting its yield, may, after projected climate change, have its yield catastrophically reduced by overtopping, drought or a combination of both.

Climate change will increase the demand for water

In the baseline, water demand (and therefore production) on South Tarawa in the coming decades depends on the following parameters: (i) population; (ii) water demand per capita; and (iii) non-revenue water. Climate change is anticipated to affect the first two of these.

(i) Population on South Tarawa is growing due to natural growth and from internal population movements from remote islands to Tarawa. Because of this latter factor, the population on South Tarawa is projected to increase faster than the national average. There is emerging evidence that suggests climate change contributes to this movement into South Tarawa (Oakes et al, 2016).[10] The analysis by Oakes et al. suggests that a fraction of the projected higher population growth of South Tarawa (relative to the national average) may be directly or indirectly related to climate change. For the purpose of assessing the possible impacts of climate change on water demand, it has been assumed that a small percentage (20%) of the more rapid population growth rate in South Tarawa relative to the national country-wide population growth rate is accounted for by climate change. Details of this assessment are presented in Annex F. The outcome of the calculations are summarized in Table 3.

Table 3 – Population projections for South Tarawa

	2015	2020	2025	2030	2035	2040
South Tarawa Population	56,388	65,230	72,397	79,331	86,056	92,700
Increment due to climate change	0	379	792	1,215	1,647	2,114

(ii) Per capita water demand. Research on domestic water use has long established a positive relationship between daily (or seasonal) water consumption and daily (or seasonal) temperature (see Annex F for a brief overview of this empirical literature). However, no studies have been found on the relationship between temperature and water consumption in any of the small islands of the Pacific. Data availability in many countries of the Pacific may not allow such data intensive analysis.

For Kiribati, the Tarawa Water Master Plan (White 2011) adopts the figure of 2 liters per capita per day (l/c/d) for climate change starting in 2020 – i.e. due to climate change water demand will increase by 2l/c/d as of 2020. This is a notional amount based on an assumption that daily demand would increase in response to increased temperature through climate change. This is in line with international findings (see Annex F). Subsequent reports (notably Fraser Thomas 2012 and Posch and Partners 2016) have adopted this same figure.

The combined impacts of (i) and (ii) on required water demand and required water production[11] are summarized in Table 4. By 2041, due to climate change, it will be necessary to produce an additional 414m^3 per day.

Table 4 – Climate change impacts on water demand and production

	2020	2025	2030	2035	2040	2041
Estimated water demand	3,718	4,127	4,522	4,905	5,303	6,768
Required water production for South Tarawa (m3/day)	4,823	5,010	5,483	5,588	6,035	7,182
Additional water production requirement due to climate change (m3/day)	202	251	301	350	403	414

Assumptions: domestic consumption 50 l/c/d; industrial and commercial consumption 5 l/c/d; South Tarawa population growth rate higher than national average; network losses declining to 15% by 2035; climate change as described in previous paragraphs.

Water sector infrastructure must be climate proofed

The water sector infrastructure consists of galleries, pumps, storage reservoirs, electricity supply and the reticulated network. In the baseline, due to climate change, this infrastructure may be threatened by storms, flooding or sea surge. However, the analysis in Annex F suggests that this threat is very limited, even negligible.[12]

[10] Oakes et al. (2016) conducted a survey of 377 households in 2015 to provide an increased understanding of population movement in Kiribati and the role that climate change may play as a contributing factor to these movements. Over 70% of interviewed households believe that migration will be necessary if there is sea level rise, saltwater intrusion, or worsening agricultural yields or floods. The report finds that there is likely to be a significant increase in human mobility in the future as a result of a combination of population growth and the increasing impact of climate change. The authors estimate the number of internal (within Kiribati) movements (mainly to South Tarawa) is estimated to increase threefold.

[11] Water production needs takes into account (i) water demand and (ii) lost water through leakages and other inefficiencies.

[12] The Annex actually assesses the '*with project'* scenario, not the baseline. However, the approach and findings for this climate proofing would equally apply to the baseline scenario.

GHG emissions from water supply and treatment processes

Households boiling water. As mentioned previously, due to the low water pressure and other factors, the water delivered is generally unfit for human consumption, and a large majority of households on South Tarawa currently boil water before consumption. A survey (Annex L) of the practices of 200 households showed that fifty-eight households reported using between 0.3-1.5L of kerosene per boil, and boiled on average 1.7 times per day. Collectively, these 58 households use 91.7L of kerosene per day. As shown in section E.2, in this baseline, the use of kerosene to boil water leads to the emission of 107,409 tons of CO2 between 2018 and 2041.

Currently, PUB pumps approximately 2,000 m3 of water per day from the Bonriki and Buota lenses. Currently water loss rates are estimated at approximately 65%. A rough estimate of the pumping and transportation energy index is around 0.37 kWh per m3 of water pumped. At constant rates, over current years, this pumping will require 5.34 GWh of electricity. With current practices, over 20 years, this will lead to the emission of 3,914 tons of CO2.

C.3. Project / Programme Description

Objectives

The overall objective of the project is to provide South Tarawa's population with reliable access to a safe, resilient and low carbon water supply under a changing climate.

Description of project

The project addresses both climate change adaptation and climate change mitigation objectives. First, a desalination plant will be constructed to provide a reliable, climate resilient source of fresh water for South Tarawa. Second, the water supply reticulated network will be renovated and expanded to ensure that there is constant supply of safe water to households on South Tarawa. Associated activities to improve governance and public outreach will ensure that the households quickly regain trust in the public network water and reduce or stop current practices of boiling water – thereby reducing GHG emissions. Finally, a PV power plant will be constructed to offset almost all the GHG emissions associated with running the desalination plant and the increases in water treatment and distribution. These physical infrastructure improvements will be supported by the necessary capacity building, technical assistance and consumer outreach to meet both climate change and basic water supply objectives.

The Project's theory of change – illustrating how the project Outputs address the climate impacts and other challenges, thereby delivering GCF impacts - is illustrated in Figure 3. Full details of the Outputs and Activities are provided in the subsequent sections.

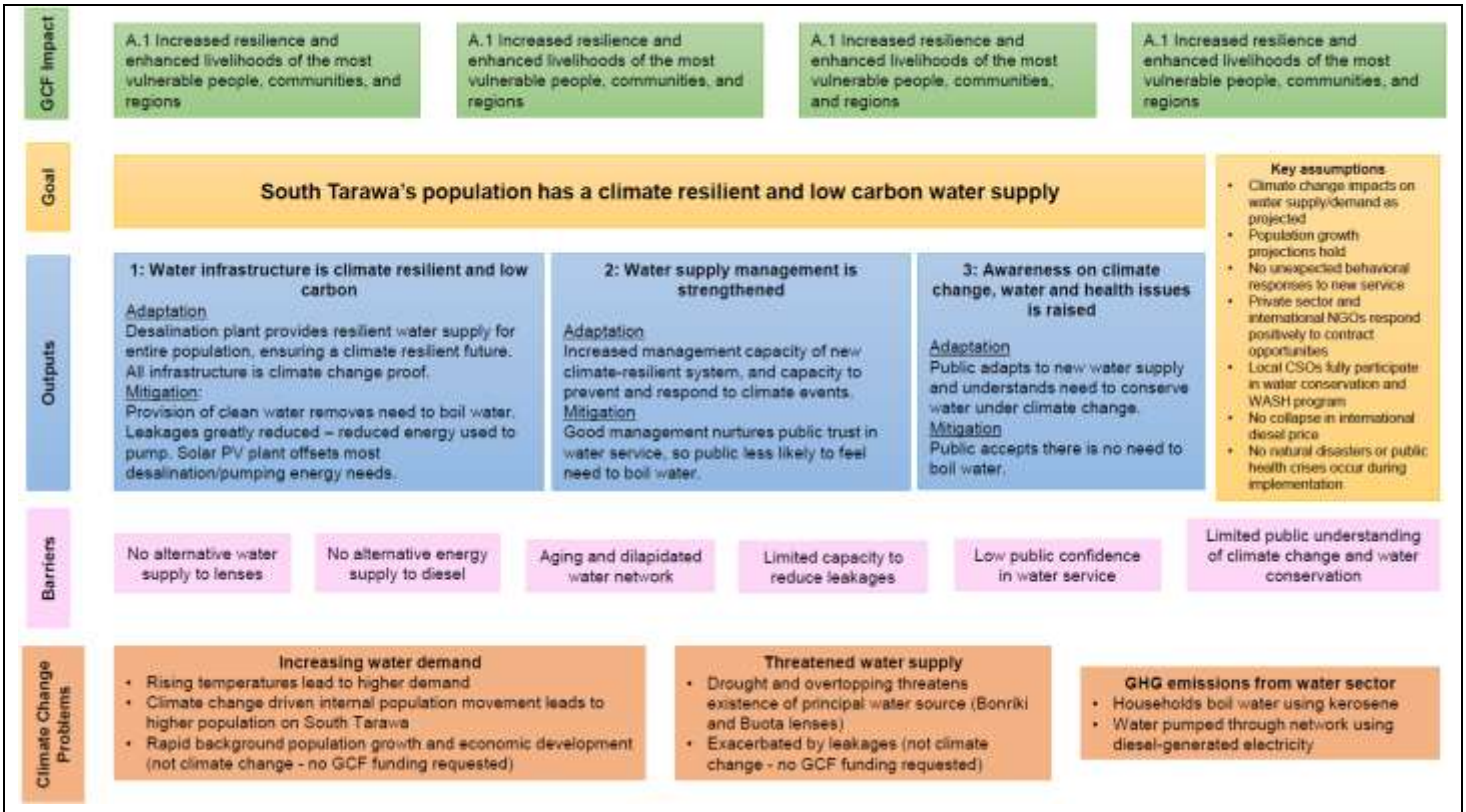


Figure 3 – Project Theory of Change

Component 1. Strengthening climate resilient, low carbon water infrastructure

Output 1: Water infrastructure is climate resilient and low carbon

This leads to three main infrastructure sub-outputs: a new desalination plant; a new solar PV plant to power the desalination plant; and new and rehabilitated climate-resilient water supply network infrastructure.

Activity 1.1 – Construct desalination plant. Based on projected climate impact (see Box 1) and other factors, water demand forecasts until the year 2041 have been prepared (refer Annex B). To meet the projected demand, the single most climate-secure, reliable and cost-effective water supply option for South Tarawa is desalination (refer Section F.2). This activity will install a seawater reverse osmosis desalination plant with an initial capacity of 4,000 m^3/day in Te Makin, West Betio in South Tarawa. The first 2,000 m^3/d capacity will replace existing lenses with a resilient water source, while the balance 2,000 m^3/day will cover increasing demand.

The plant's capacity (4,000 m^3/day) is based on supplying a minimum of 57 liters per capita per day (l/c/d) for consumption in the year 2022, taking into account projected physical losses following network rehabilitation (which will drop from 67% down to around 25% or below). The project has adopted World Health Organization (WHO) recommendations of a minimum 50 l/c/d for domestic consumption to ensure low levels of health concern. To this minimum standard, an additional 5 l/c/d is added for commercial and institutional consumption. Finally, an additional 2 l/c/d is needed to account for the impacts of increasing air temperature on domestic water consumption. Importantly, given a changing climate and population (in number and behavior), and the level of uncertainty that comes with these, the desalination plant has a modular design so as to allow production to be easily and quickly adjusted to meet South Tarawa's demand. The plant has also been designed with selected provisions to enable expansion of the plant up to 6,000 m3/day total capacity in the future, without the need to upgrade supporting infrastructure. These are considered robust engineering design features to better enable PUB to undertake necessary expansion works in the future, as the population and demand increase.

A climate event (as foreseen in Box 1) would lead to a sudden reduction in available water for some time. Whereas this would not pose an existential threat to South Tarawa because the new desalination supply is in place, it would have an impact on water availability and would require a management response. Depending on conditions, during a climate change event that seriously reduces or eliminates the lens supply, Government will employ rationing as a response. This will be supported through community awareness programs and outreach so that communities are prepared and amenable to any rationing. However, the level of rationing imposed in the event of a reduction in lens supply is expected to be manageable, given that the desalination plant will represent around two-thirds of the available potable water supply (versus the current situation where the lens supply is the main source). The latter suggests that in an extreme event where the lens supply dropped to zero, customers would only need to adjust their consumption down by around one-third.

Box 1 – Translating Climate Change Risks in Water Supply into Design Parameters

As determined in the previous sections, the threat of sea overtopping and drought to the freshwater lenses at Bonriki and Buota is one of the main pathways by which the water supply on South Tarawa is vulnerable to climate change. After projected climate change, a sea overtopping and/or drought event could catastrophically reduce the lenses' yield. The duration of such an event would vary and cannot be accurately forecasted, but it is reasonable to estimate it would be between 3 and 5 years duration. The return period for such an event is unknown, but it is reasonable to estimate that the return period lies between 10 and 50 years.

There would be no water available from the lenses for PUB during these events. In other years, that is, in **non**-event years, there would be 2,000 m^3 per day available from the lens for PUB.

To translate this climate vulnerability and risk into network design parameters, the network planners and the project design team made the following assumptions:

1. On average, one year in five will be an 'event' year, or 20% of years will be 'event' years;
2. To meet basic demand in event years, an alternative water supply is needed. This alternative water supply has to be capable of fully replacing the lenses during event years. It should also be capable of meeting additional demand due to population growth in non-event years; and
3. The lenses will provide water during the 80% of years that are non-event. During these years, a slightly higher volume of potable water capacity will be available to the population.

The major process operations associated with the plant are set out in a diagram in Figure 4 (and described in Annex B), and a summary of the equipment is set out in Table 5. Design of the desalination plant has been undertaken first to Australian (where available) and then International Standards. As it is crucial to maintain a consistent supply, all individual processes will incorporate a partial or full standby item, and critical spares will be held on site. Thus, failure of one item of plant will not compromise production capacity. This is considered a feature in any robust water supply engineering design and is particularly relevant to remote island contexts where there is a longer lead-time for spares, chemicals and specialist support (if required). The desalination plant is expected to be procured through a design-build-operate (DBO) contract (described further under Output 2 below). The DBO contracting approach, considered a form of performance-based contracting, is expected to ensure that the design and construction is undertaken with knowledge of accountability for the operation and maintenance over the following 5 years, resulting in an improved and robust design which gives careful consideration of the challenging environment presented by the remoteness of South Tarawa.

Other considerations applied to the plant design include: (i) plant design capable of operating under worst possible conditions (for example, poor quality of feedwater); (ii) incorporating flexibility, through the use of PLC and program logic, to automatically adjust the plant process to changes in feed water quality; (iii) employing an adequate degree of redundancy to maximize system availability, allowing necessary downtime of selected process units for membrane cleaning and preventive maintenance; (iv) giving a high focus to whole of life cost and minimization of energy consumption; and (v) use of skid mounted equipment that can undergo factory acceptance testing (FAT) before shipment to South Tarawa, which a representative from PUB can witness. Government uses WHO guidelines for drinking water quality standards in South Tarawa, and so the plant is designed to meet these. Further, there will be no ammonia, nitrate, heavy metals or other ionic species in the abstracted bore water that would be cause for a public health concern. Management and operation and maintenance (O&M) of the plant is described under Output 2 below.

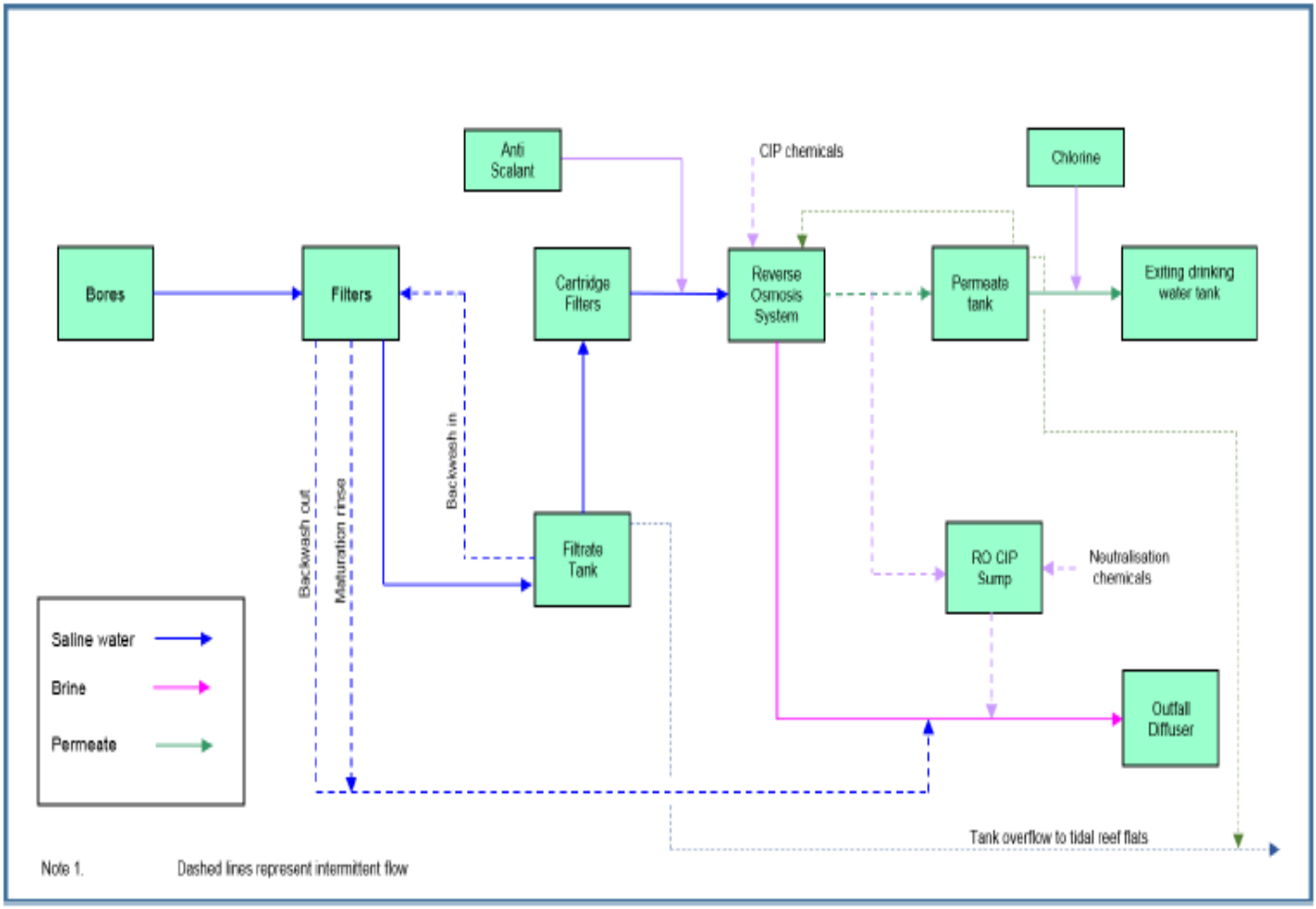


Figure 4 – Schematic diagram of desalination process

Table 5 – Equipment summary

Item	Description
Bores	
Number drilled	12
Number equipped	10
Capacity	17 L/s each bore
Filters	
Type	Media filters
Number	10
Filtrate tank	120 m^3 nominal capacity
Reverse osmosis system	
Number of units	4
Unit capacity	1,000 m3/day
Recovery	43%
Maximum motor size	110 kW
Type of energy recovery device	Isobaric
Design average flux	14 L/m2/hour
Number of pressure vessels on each unit	12
Number of membranes on each unit	84

Permeate tank	120 m^3 nominal capacity
Chlorination system	
Type	Gaseous chlorine
Capacity of chlorinator	18 kg/day

Activity 1.2 – Upgrade and expand the water supply network. This activity involves significant climate-resilient upgrades to, and expansions of, the water supply network so that 100% connection rates to piped water supplies in South Tarawa are achieved. All residents will have access to the upgraded water supply network and the new source of desalinated water, including those most vulnerable households. The upgraded network will address the current problems of severe leakage, system tampering, unauthorised connections and un-metered connections with all connections now being metered. The network will have adequate capacity to meet water demands over the design horizon (to the year 2041) and will be climate-proof. The upgrades comprise:

- Two headwork facility upgrades at the existing headworks that are located at the Buota and Bonriki groundwater lenses, and at the desalination plant to be sited in West Betio;
- Upgrades to major pipelines to meet design flows over the design horizon (augmentation to the existing storages, plus some upgrades to distribution pipelines);
- Additional storage at a number of distribution areas (on-ground polyethylene tanks, reinforced concrete tanks or coated steel tanks);
- Booster pumping stations at selected distribution areas;
- Upgrades to reticulation networks in communities across South Tarawa;
- Servicing the currently unserviced areas of Bonriki North and Buoto.

A delivery mechanisms strategy and sequencing plan for the works has been prepared so as to maximize the number of people who experience project benefits, as quickly as possible. Given that the desalination plant will be located in Betio – at the western end of South Tarawa, the mostly densely populated area and that with the highest rates of waterborne disease - this supply zone will be prioritized in the sequencing of rehabilitation efforts. The new supply from the desalination plant is thus likely to supply Betio first, and progressively to other zones that have undergone rehabilitation.

This new and rehabilitated network will ensure safe water reaches households. This is a necessary condition for people to be able to stop boiling water. However, it is not considered sufficient to stop households from boiling water, as household distrust for the water is very high and water boiling is a daily habit for residents. Additional institutional strengthening and outreach activities under Outputs 2 and 3 will be necessary to ensure households stop boiling water.

The project will minimize Non Revenue Water (NRW) through several project elements, including: 1. Capital works (infrastructure); 2. O&M of the network; 3. Capacity building in NRW management; and 4. Community engagement to encourage better NRW management in NRW management.

- Activity 1.2 - CAPEX of water supply network: The majority of leaks in the existing South Tarawa network are in the reticulation, which is largely being replaced through STWSP. DMAs already exist informally in South Tarawa given that most communities are supplied by an isolated header tank which is fed from the transmission main. DMAs will also be formalized under the project through the full metering of each zone (at bulk supply and connections levels). One of the key reasons for vandalism/tampering of the network in the past has been poor service pressure / service provision, which is being addressed through the project.
- Activity 2.1.1 - O&M contract for water supply network (described in below): This component involves an outsourced O&M contract for the water supply network, storage and pumping infrastructure through a 5-year performance-based contract (PBC). One of 4 performance targets proposed is in NRW reduction. By setting a performance target for NRW, the contractor has financial incentive to ensure sound management, monitoring and O&M of the system and its components (including metering), prompt response time to leaks/repairs, adequate provision and availability of spares (allowing in particular for long lead times for parts to reach Tarawa), etc. all of which are expected to enhance NRW reduction. Importantly, PUB will be working alongside the contractor and this will enhance capacity transfer during the 5 year O&M.
- Activity 2.2.3 - Provide specialist support to PUB in key result areas (described below). This will cover the following functions (i) customer service and billing; (ii) human resources; (iii) financial sustainability; and (iv) asset management. Items (i), (iii) and (iv) will contribute to NRW reduction, both in terms of physical and apparent losses. These are similarly key result areas used in regional and international benchmarking schemes.

- Activity 3.1 - Implement water conservation and WASH awareness program (described below). Within this program, Part A 'Water for Life' objectives include 'enhance water conservation understanding and practice', and 'enhance customer best use and maintenance practices for the service' which will improve water demand management, ensure responsible use and reduce wastage of a critical resource, and encourage the community's ownership of the project. These elements can thus contribute to reduced NRW (understanding the need to pay for water, reduced tampering, improved water resource management, etc.).
- *Cross-cutting*: Other notable elements which have been informed by community consultation and incorporated into the project design, and which are relevant to minimizing NRW during implementation include: (i) Provision of individual household taps with meters, with a tariff applied; as well as (ii) communal taps with water provided at low or no-cost to reduce the risk of creating inequities in water supply access for the poor and discourage tampering of the system by those who cannot afford to pay; (iii) community-led tap design; and (iv) Designing a tariff based on what is affordable (rather than cost recovery) and a tariff structure established that acknowledges social structures and economic conditions and constraints in low income households.
- *Parallel efforts: KAPIII program:* The KAP-III project (completing in 2018) dedicated important efforts to the reduction of leakages through: (i) the rehabilitation of all header tanks and ground storage infrastructure, (ii) the repair of leaks identified along the system's water transmission main, and (iii) the development of PUB's capacity for leak detection and repair, with the set-up and training of a Leak Detection Unit in PUB in charge of the planning and management of leak investigation and reduction. The new pilot water supply systems in three villages, implemented under KAP-III, were also designed with due consideration to future NRW reduction efforts, with the set-up of fully metered district metered areas (DMAs).

Activity 1.3 – Construct solar PV plant and system. The new desalination plant will require a significant quantity of electricity for its operation. The current electric power network in South Tarawa is generated mostly from diesel. There is currently some excess installed generating capacity, but this is not expected to meet the growing demand for more than a few years. Several options were considered to meet the energy needs of the desalination plant, including diesel, on-grid solar and off-grid solar (See Annex B). The optimum solution identified comprises a 2500 kW ground mounted, fixed centralized PV array with a 2000 kW Solar Smoothing Energy Storage (SSES) system to be connected to the grid. This will offset around 98% of the demand of the entire system in 2020 and around 73% of the energy demand in the year 2041, including the desalination plant and water supply network (pumping). The proposed works also include an upgrade to the existing 11 kV power network of approximately 1 km to cater for the additional energy demand associated with the desalination plant. This activity will, in effect, avoid GHG emissions, and so support Kiribati in complying with its nationally determined contributions (NDC) to the UNFCCC.

Climate Proofing

Output 1 consists of the installation and renovation of infrastructure. As noted in Annex F, subsequent to climate change, all land on Tarawa below 3.474m above sea level will be vulnerable to overtopping and seawater flooding due to sea level rise and increase storm surges. Hence all the project infrastructure is exposed to such flooding and overtopping. As described in Annex F, all the infrastructure is designed to be resilient to the anticipated flooding/overtopping and so is not considered vulnerable to climate change. It is noted that the additional costs (of ensuring resilience to climate change as opposed to ensuring resilience to the current climate) are very small and considered negligible in the calculation of adaptation costs.

Component 2. Institutional strengthening for water supply management

Output 2: Water supply management is strengthened

The overall purpose of this output is to ensure the overall water supply system is adaptive and best able to respond to anticipated and unforeseen challenges in the coming decades, including those associated with climate change. This will be achieved through private sector engagement in water supply services and capacity building of PUB, MISE and other key government agencies with a view towards improved governance, management, sector coordination, regulation and O&M. No significant restructuring of PUB management or personnel arrangements is proposed. Specific activities will be enhanced to ensure households change boiling water practices.

Key activities include:

Activity 2.1 Undertake O&M of desalination plant (5 years). The desalination plant will be procured through a DBO contract including a 5-year O&M component, including performance criteria for operation and maintenance (for example, plant available capacity in m3/day, response time, etc.). ADB's experience in the Pacific region and informal discussions with firms active in the sector suggest that there are firms interested in this activity. A similar contract is being successfully implemented through an ADB project in Ebeye, Marshall Islands (Ebeye Water Supply and Sanitation Project). The O&M contract proposed for STWSP, in addition to ensuring reliability of the plant and water supply, has an equally important role of building the capacity of PUB to undertake the plant's O&M independently, including aspects such as maintenance procedures, asset management, troubleshooting and inventory control. This mentoring and capacity transfer role will be outlined as a key task in the scope of the DBO firm's services. In terms of technical sustainability, it is envisaged that as the O&M contract and project financing draws to a close, PUB will review their capacity to independently undertake the plant's O&M, and assess whether to continue with outsourced support (if so, likely at a smaller scale, given capacity development throughout the 5-year contract).

It is noted that the plant will be operating at a higher capacity due to climate change and therefore proportional operating costs are required to adapt to climate change.

Activity 2.2 – Implement institutional strengthening. There are four sub-activities:

Sub-Activity 2.2.1: Operate and maintain the water supply network, storage and pumping infrastructure through a 5-year performance-based contract (PBC). This is proposed to include the following performance targets:

1. Reduced NRW. By setting a performance target for NRW, the contractor has financial incentive to ensure universal metering and reduced tampering, thus directly reducing the likelihood of pipeline contamination. The result is improved water quality at connection (and reduced need for water boiling).
2. Continuity of supply. By setting a performance target for continuity of supply (hours of service per day), the contractor has a financial incentive to improve response time to leaks and to ensure effective demand management (through use of a PLC program integrating variable speed pumps to tank levels, service pressure, etc.). These efforts will minimize pipe depressurization and associated contamination. The result is improved water quality at connection (and reduced need for water boiling).
3. Improved operations including energy management. This target will improve energy conservation/efficiency and therefore directly support the project's climate mitigation objectives.
4. Improved health, environment & water quality/compliance. By setting a performance target for water quality compliance, the contractor has a financial incentive to ensure quality at critical points (pumping stations, end-of-pipeline, etc.). Compliance data and reporting will support communications campaigns to customers, informing of the safety of tap water.

These targets are aligned with the Key Result Areas of Benchmarking by the Pacific Water and Wastewater Association (of which PUB is a member), and the International Benchmarking Network for Water and Sanitation Utilities (IBNET). All of the performance targets will help to ensure that households quickly stop boiling water and therefore reduce emissions of GHG.

The network PBC will be a separate contract to that which involves the desalination plant, given the different skill sets required. Similar to the objectives of the O&M contract for the desalination plant, for the network the O&M task has an equally important role of building upon existing capacities in PUB to undertake preventive, predictive and breakdown maintenance of the network, to ensure sound asset management and availability of spares and equipment in-country, which is highly relevant for remote islands with long lead-times for spares. The mentoring and capacity transfer role of the private contractor will be outlined as a key task in the scope of the firm's services. A review of the O&M contract can be undertaken as the project financing draws to a close, to assess whether PUB would continue with outsourced support (if so, likely at a smaller scale, given capacity development throughout the 5-year contract).

Sub-Activity 2.2.2: Provide specialist construction oversight and lead quality control efforts during construction (assumed by same contractor as 2.2.1).

Sub-Activity 2.2.3: Provide specialist support to PUB in key result areas. This will cover the following functions (i) customer service and billing; (ii) human resources; (iii) financial sustainability; and (iv) asset management. These are similarly key result areas used in regional and international benchmarking schemes. In particular, the technical assistance on customer service will contribute to meeting climate change mitigation objectives. Additional outreach and communications will be delivered in order to improve trust in PUB and enhance engagement between PUB and customers, and therefore lead customers to accept the water quality and reduce the need to boil water.

Sub-Activity 2.2.4: Provide vocational training for technical and administration staff and mentoring and training for managers in PUB. While the scope and extent are still being refined, the following provides a broad outline of the proposed program:

- Technical staff undertake training in water industry operations and associated English language, computing and foundation skills training to attain the qualifications in Water Industry Operations;
- Electrical technicians undertake training to meet the requirements for the on the job component of a Certificate in Electrotechnology;
- For managers, training and mentoring is targeted at PUB and MISE managers with a view towards developing whole of project management skills, including contract management and procurement skills;
- For administration staff, training in customer service.

Activity 2.3 – Implement project and safeguards

Sub-Activity 2.3.1: Provide technical implementation assistance through consultants. A project implementation assistance (PIA) consultant firm will provide project management and supervision for the investment project, including management and coordination of safeguards. In the selection of PIA consultants and their TOR, a strong emphasis will be placed on capacity transfer. Please refer to Annex J on project organization chart and roles and responsibilities for further details.

Sub-Activity 2.3.2: Ensure safeguards compliance. This encompasses the implementation of environment and social safeguards within the project, including the Gender Action Plan, in-line with ADB and the World Bank's safeguards policies and the AMA.

Activity 2.4 - Undertake detailed project design (through Project Design Advance, PDA**).** In November 2017, ADB approved a PDA grant of US $2 million, advanced from the Asian Development Fund (ADF) allocation of US$15 million for the project. The PDA facilitates a smooth transition from the project preparatory technical assistance (PPTA) to the investment project and will minimize contracting delays, speeding up the initial disbursement under the ensuing financing. The PDA will finance a consultant firm to undertake (i) surveys to facilitate detailed design of key assets; (ii) detailed design of water supply network infrastructure; (iii) procurement support to MFED, MISE and PUB, including preparation of bidding documents, bid evaluation and contract award; and (iv) safeguards support and community engagement in preparation for the project. The PDA will also support selected consultant positions in the PMU.

Activity 2.5 - Treat water (additional treatment needs due to climate change for 5 years). Due to climate change, it is assumed the lens will provide 2,000 m^3 of water per day for 80% of years (see Box 1). In the remaining 20% of years it will provide no water. Hence, the desalination plant should provide, on average, 20% of 2,000 m3/day, or 400 m3/day, to compensate for the impacts of climate change. The project will cover these needs for five years. Activity 2.5 encompasses operating costs including chemicals (antiscalant, chlorine and other chemicals for membrane cleaning), consumables (cartridge filters), and asset maintenance (e.g. implementing and running a preventive maintenance program). These costs are not covered by Activity 1.1 (desalination plant CAPEX, i.e. works only) and Activity 2.1 (desalination plant O&M 5-year contract, which covers the costs of personnel providing outsourced operational support).

Component 3. Outreach and awareness raising

Output 3: Awareness on climate change, water and health issues is raised

This Output includes the following two activities:

Activity 3.1 - Implement water conservation and WASH awareness program (WAP).

This activity involves the implementation of a comprehensive and intensive 5-year 'Water Conservation and WASH Awareness Program (WAP)' in South Tarawa by an international NGO (INGO) supported by local Civil Society Organizations (CSOs) at the community level. Broadly, the WASH situation in South Tarawa is grim. There is insufficient potable water available to facilitate hygiene practices, only 35% of the population has access to improved sanitation facilities, and incidence of water borne disease is high. The project is going to significantly improve the water service, in quality and volume, and the community welcomes this. However, the WAP is seen as critical to ensure the successful outcomes of the project, especially community adaptation and improved resilience to climate change impacts, including the new water supply. Key lessons from a previous ADB experience in Tarawa, through the Sanitation, Public Health, and Environment Improvement Project (completed in 2005) included that (i) local customs and traditional practices in South

Tarawa affect outcomes; and (ii) service improvement requires ongoing motivation. These considerations have been considered through the WAP design. Several changes and impacts of the project on the population will be addressed through the WAP. Key transformations include: a) supply of 24/7 pressurized water to individual households; b) supply of safe, treated water; c) requirement for households to pay for water according to metered consumption; d) supply of a new type of water unfamiliar to most customers; and e) supply of free water availability at community taps (as a safety net for the poor). Three programs are proposed to form the WAP:

- Part A 'Water for Life' - A water focused communication and engagement program that expands on the PUB's existing information, education and communications program and extends across all of South Tarawa. 'Water for Life' will focus on the implementation of the new water supply system, user pays, and 24-hour metered supply to facilitate a smooth transition by households to the new conditions. It will be led by PUB with support from MISE. The impacts the program aims to achieve are critical for climate change adaptation and resilience. Among these, the objectives of Part A 'enhance water conservation understanding and practice', and 'enhance customer best use and maintenance practices for the service' will improve water demand management, ensure responsible use and reduce wastage of a critical resource, and encourage the community's ownership of the project. Further, the objectives surrounding 'strengthen trust in the service and provider' and 'create acceptance and demand for the PUB safe and reliable water service' are highly relevant to climate mitigation, given current practices surrounding burning kerosene to boil water. In the event that the lens supply is not available, and rationing is implemented, awareness raising and community outreach through this activity will be essential to ensure public acceptance and participation in rationing strategies;
- Part B 'WASH Community Partnership' – A broader WASH behaviour change campaign with a focus on tackling behaviours linked to climate change adaptation, climate mitigation benefits, water security and safety, sanitation, hygiene, menstrual hygiene management, and solid waste management. This program will expand on and align with the STSISP community engagement program. The part is proposed to be led by an INGO and the Ministry of Health and Medical Services (MHMS);
- Part C 'Walk the Talk' – A program focused on strengthening the enabling environment (including policy, regulations, institutional capacity and leadership) required for comprehensive and sustainable adaptation to climate change, behaviour change, and effective sector coordination. This part will be led by MISE. Further lessons through ADB's Sanitation, Public Health, and Environment Improvement Project included that multidimensional projects require effective coordination, and organizational change requires time. This conclusion has been drawn from subsequent analyses of the sector and will be a necessary element in the success of future sector initiatives.

Activity 3.2 – Construct climate change and water visitor education center. An activity linked to the WAP is the construction of a small (5.2 m by 8 m) public education center co-located with the desalination plant. The objectives of the center are to educate plant visitors about climate change, desalination and water resources management, and how these are connected to topics such as water conservation, disaster risk management and renewable energy. The center will help visitors to understand: What is climate change and what are the impacts to Pacific Islands and to Kiribati? How does climate change affect natural disasters in the Pacific and how is this linked to water resources management? What can we do to manage natural disasters if they are going to be more frequent? What is the STWSP and why do we need it? What is desalination and how does it work? Why is renewable energy important and why are we using solar at the desalination plant? Visitors to the plant are expected to include students from local schools, government officials, CSOs, and interested community members. PUB will be responsible for the ongoing management of the center and for providing a guide for tours when needed.

Component 4. Project management

Output 4: Project is managed efficiently and effectively

Activity 4.1 - Provide support to project management unit (PMU). Staff from MISE/PUB as well as individual consultants will staff the project management unit housed within MISE.In the selection of PMU consultants and their TOR, a strong emphasis will be placed on capacity transfer and mentoring. The PMU will be the core unit responsible for the overall implementation of the STWSP including the day-to-day project activities, compliance with the provisions of the grant and project agreements and government policies and guidelines, project administration, preparation of grant withdrawal applications, and maintenance of records. Please refer to Annex J on project organization chart and roles and responsibilities for further details.

Box 2 – Ongoing and New Complementary Water Sector Interventions in South Tarawa

Ongoing

In the past decade there have been several studies on the South Tarawa water supply situation, climate change, the feasibility of desalination and renewable energy options. These have led to the *Tarawa Water Master Plan* and the *Water and Sanitation Roadmap 2011 to 2030*.

A recent review of related activities identified 25 ongoing initiatives in the water, health and sanitation sector. The largest ones are the Kiribati Adaptation Program (KAP) and the South Tarawa Sanitation Infrastructure Sector Project (STSISP).

1. KAP – with support from the World Bank and LDCF - has been the major sector initiative over the past two decades. KAP has supported the reduction of Kiribati's vulnerability to climate change, climate variability and sea level rise by raising awareness of climate change, by assessing and protecting available water resources and by managing inundation risks. KAP has been implemented in three phases, running from 2003 to 2016. KAP III is now implementing its final activities. These include:
    - Construction of three NRW management pilot areas on South Tarawa for total mains replacement and the provision of new metered customer connections. The intention is to provide 24/7 water supply to these pilot areas. These works are scheduled for completion in February 2018;
    - Water tank restoration and repair works; and,
    - Preparing detailed designs for selected zones in South Tarawa's water supply network, which will be reviewed and incorporated into STWSP.
2. STSISP – with support from ADB - aims to improve health and reduce chronic water-borne illness and disease among South Tarawa communities. Actions include: the rehabilitation of the existing sewer system and saltwater system in Betio, Bairiki and Bikenibeu; community engagement program working with 80 mother health committees and 250 communities on South Tarawa; establishing the sanitation maintenance fund - with an initial $1.4 million in grant funds and a phased tariff structure; and, an onsite sanitation pilot project.

Other important partners are the Kiribati Education Improvement Program (KEIP), supported by DFAT, and UNICEF. These partners support various environmental health projects related to water supply and sanitation in schools and hospitals.

New Complementary

Two new initiatives are proposed to be implemented alongside this project (and outside the scope of this proposal). These are:

1. Rainwater Harvesting (Government of Kiribati). Government has made commitments to increase access to water through the provision of 500liter water tanks to all households in Kiribati. A budget of A$3.5million ($2.8m) was approved in the 2018 budget for Kiribati and MISE is currently developing a workplan and schedule to commence the roll out of this initiative from 2018 over a 5-year period. This commitment by Government has direct linkages with the STWSP as it will provide an additional means of strengthening resilience and water security. It is anticipated that water tanks would be provided to approximately 6,705 households in South Tarawa.
2. Pilot sanitation systems (supported by World Bank through parallel financing of $2 million). This is expected to include the piloting of low-cost sanitation, with a priority focus on three pilot villages which will soon receive 24/7 water supply (through a different project).

C.4. Background Information on Project / Programme Sponsor (Executing Entity)

MFED is the Executing Entity for the STWSP. With a total of 145 staff, the mission of MFED is to enhance sustainable economic growth and financial stability for the welfare of the people of Kiribati through the management of both government and development finances. This is achieved through implementation of economic policies designed to enhance sustainable growth; sound management of government finances; a growth orientated taxation system; an efficient financial services sector which enhances growth of the domestic economy; collection of revenue from customs duty, and from businesses in line with the laws of Kiribati; and timely provision of key statistical data.

In addition, the Ministry contributes to all of Government's desired outcomes by providing sound financial and economic policy advice to other ministries. This includes: assessing and advising on the appropriateness of government spending programs, including the effectiveness of government expenditure; ensuring there are effective financial accountability and associated reporting arrangements in place; effective management of the RERF to help finance Government expenditures and maintain the value of the fund; and effective monitoring of ministry operating plans and budgets.

MFED comprises the following key divisions: Administrative Services Division, National Economic Planning Office, Accounting Division, Internal Auditing Division, Taxation Division, Kiribati National Statistics Office, Climate Finance Division, Information Technology Unit, National Authorizing Office and the Kiribati Fiduciary Services Unit. The Ministry is also responsible for the State Owned Enterprises including the Kiribati Provident Fund, Development Bank of Kiribati and the Kiribati Insurance Corporation.

MFED is also the responsible authority for the following Legislative Acts: Public Finance (Control and Audit) Act, Procurement Act, Stores Regulations, Internal Revenue Board Act, Statistics Act, Census Act, Kiribati Provident Fund Act, Kiribati Insurance Act, Development Bank of Kiribati Act, Loans and Borrowing Act, the State Owned Enterprises Act, the Excise Tax Act, Value-Added Tax Act, the Revenue Administration Act and the Anti-Corruption Act.

Please refer to Section E.5.2 for further information on MFED as the executive entity, their role, and their capacity to deliver. MFED's website http://www.mfed.gov.ki/ provides more background information on the Ministry and their work.

C.5. Market Overview (if applicable)

PUB manages the water supply, power generation and sewage services in urban South Tarawa, and is responsible for the provision and regulation of water supply (i.e. rationing), as well as maintenance of the water supply assets (existing and new). They experience significant financial difficulties due to high operational costs and low levels of cost recovery. Pipe-delivered water is rationed to all consumers by intermittent supply (two hour every two days), and the network experiences significant losses from leakages and illegal connections. Commercial and industrial customers connected to the PUB system are metered, whereas most domestic connections to the PUB water supply are not. All meters in use in the PUB water supply system are the conventional post-payment type.

Prior to 2013, unmetered domestic consumers (comprising about 90% of PUB's water supply customers) were charged a flat monthly rate of $10.00 for all consumption. However, this practice has been discontinued.[13] Most domestic consumers now do not pay for pipe-delivered water. However, water may be delivered by PUB tanker truck to domestic consumers' household tanks on request. This service is presently charged at A$5.00/m3, plus the cost of delivery which ranges from A$12 to A$57 depending on distance. Commercial customers consist of for-profit businesses. 'Industrial' consumers largely consist of government departments and non-profit institutions. Water deliveries by PUB tanker truck to commercial and industrial customers are charged at their respective rates per m^3 plus the cost of delivery. Based on these charges, total water supply revenues in 2016 were about $0.83 million (almost entirely from commercial/industrial customers), against water supply expenditures in that year of about $1.06 million.

As part of this project, a socially-inclusive and regulated tariff will be designed and regulated. Government has made commitments to tariff reform and to furthering its policy on community service obligations. This is described further in Section D.2.

Power in South Tarawa is distributed at 11 kV by underground cables and serviced at 415 V 3-phase/ 240V 1-phase 50 Hz via kiosk mounted distribution transformers connected to ring main units. The existing supply network has a total generating capacity of 6.9 MW made up of 5.45 MW from diesel driven synchronous machines (2 power stations) and 1.45 MW from solar PV facilities. There are 6 solar PV sites presently, made up of 400kW at the Bikenibeu Power Station (Japan funded; commissioned in April 2015), 500kW at the Bonriki Pump Station (UAE funded; commissioned in September 2015) and 550 kW from four other roof top installations on institutional buildings - schools, hospital, stadium (World Bank funded; commissioned in September 2016). PV solar constitutes around 20% of the total grid supply capacity. The STWSP has proposed a 2500 kW ground mounted, fixed centralized PV array with a 2000 kW Solar Smoothing Energy Storage (SSES) system to be connected to the grid, as described in Activity 1.3.

C.6. Regulation, Taxation and Insurance (if applicable)

[13] In 2013, Cabinet required PUB to cease charging for domestic water (as consumers considered the service inadequate).

The project will comply with all Kiribati laws and regulations, including the Occupational Health and Safety Act 2015, Public Utilities Ordinance of 1977, Public Health Ordinance of 1926, Public Health Regulations of 1926, Foreshore and Land Reclamation Ordinance of 1969, Land Planning Ordinance 1972, and Local Government Act 1984 Environment (Amendment) Act 2007. An Environmental License will be obtained for the project prior to any construction works beginning. The concerned Government agencies (MFED and MISE) have the authority to obtain all necessary approvals and licenses, and to manage and operate the public water supply system. ADB projects in Kiribati are tax-exempt, including import tax. There are no regulations affecting the import of foreign currency under this project.

C.7. Institutional / Implementation Arrangements

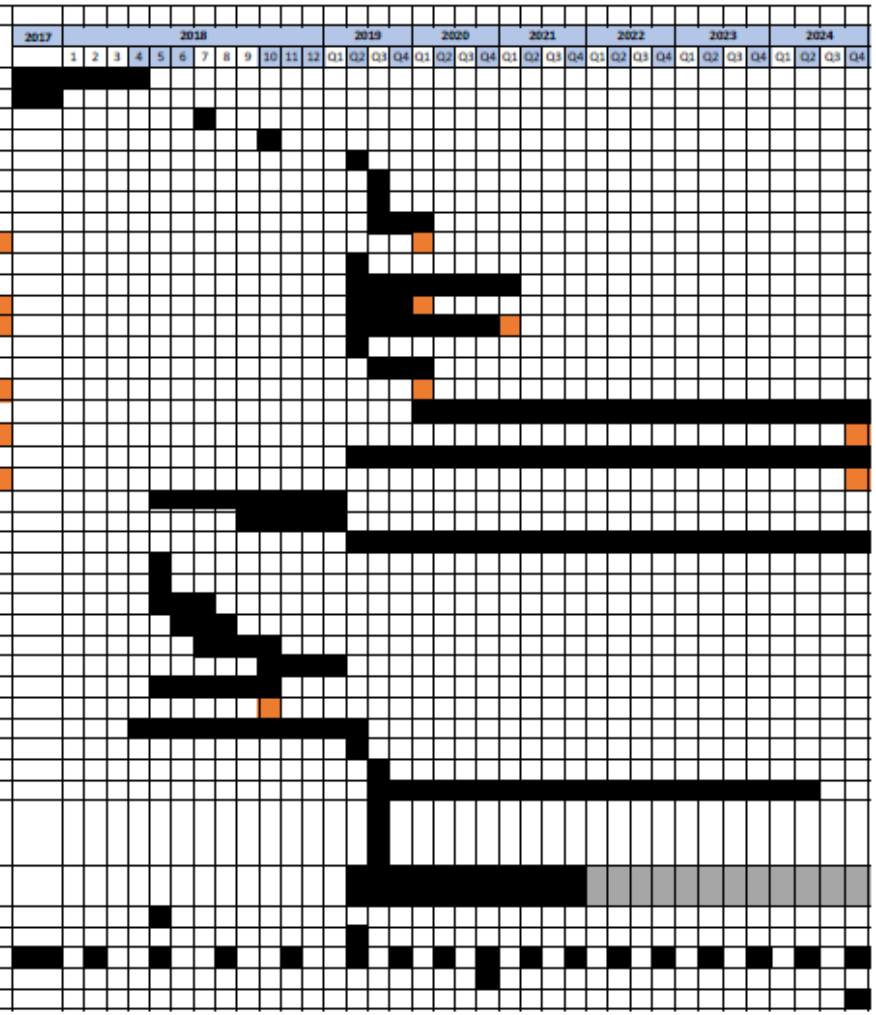
The project is fully aligned with national policy and strategy (refer Section E.5.1) and is being steered and implemented by Government. The existing National Infrastructure Development Steering Committee (NIDSC) will act as the project steering committee. MISE, through the PMU, will program, administer, and coordinate daily project activities, manage contracts including those for consultants and contractors, convene the steering committee, and liaise with other government, NGOs and development partners. The PMU will report to the Secretary of MISE and to the NIDSC. The project will fund individual consultant support to the PMU for project management, procurement and safeguards functions. During project preparation, the PMU will be supported by the Project Design Advance (PDA) consultant firm. The PDA firm's main tasks will include surveys to facilitate detailed design of key assets, detailed design of the water supply network, preparation of bidding documents and procurement support up to contract award, updating of safeguards documentation and community engagement in preparation for the project. During project implementation, the PMU will be supported by the PIA consultants, whose core tasks will include project management, supervision and safeguards management and coordination. Please refer to Annex K on Project Organization Chart & Roles and responsibilities for further details.

The NDA, through the Climate Finance Division, will provide oversight and monitoring of the project, while Kiribati's National Water and Sanitation Coordination Committee (NWSCC) will support communication and coordination among sector stakeholders. Cabinet has determined priorities for climate finance and approved the STWSP and associated GCF proposal being developed by ADB. The NDA has consulted with stakeholders on this funding proposal and provided their endorsement (refer Annex A for their no-objection letter). For information on funds flow structure, please refer to Section F.4. Financial Management and Procurement.

C.8. Timetable of Project Implementation

South Tarawa Water Supply Project - Indicative Project Implementation Schedule

Components	Activities	Indicative Subactivities
Project Processing Milestones		PPTA (ongoing)
		ADB PDA approval
		GCF consideration
		Target ADB Project Board approval
1. Strengthening climate resilient, low carbon water infrastructure	1.1 Construct desalination plant	Contract award - Desalination Plant
		Construction: Bores
		Construction: Outfall PS retrofitting
		Construction: Desalination Plant
		Milestone - Desalination Plant Commissioned
	1.2 Upgrade and expand water supply network	Contract Award - Water Supply Network
		Construction: Water Supply Network
		Milestone - Water supply network - 1st zones commissioned
		Milestone - Water supply network - 2nd zones commissioned
	1.3 Construct solar PV plant and system	Contract Award - Solar PV / Energy
		Construction: Solar PV / Energy
		Milestone - Solar works commissioned
2. Institutional strengthening for water supply management	2.1 Undertake O&M of desalination plant (5-years)	O&M contract: Desalination Plant
		Milestone - Desalination O&M Contract complete
	2.2 Implement institutional strengthening	Institutional Stengthening incl. Network Maintenance contract
		Milestone - Network O&M contract completion
	2.3 Project Implementation and Safeguards	Indiv. Consultant support to PMU funded by PDA
		Recruitment of PIA Firm
		PIA Firm / Construction Supervision
	2.4 Undertake detailed project design	PDA Firm Contract Award
		Inception Phase
		Surveys
		Network detailed design
		Bidding Documents Preparation
		Procurement support to project
		Updating of Safeguards Documents
		Safeguards docs complete based on surveys & network DD
		Community Engagement
3. Outreach and awareness raising	3.1 Implement water conservation and WASH awareness program	Contract Award
		INGO subcontracting of local CSOs / NGOs
		WASH Awareness program implementation
	3.2 Construct climate change and water resources visitor education center	(In parallel with Desalination plant construction)
4. Project Management	4.1 Project Management Unit	Indiv. Consultant support to PMU funded by Project
	Missions	PDA Inception Mission
		Project Inception Mission
		Review Missions
		Mid-Term Review Mission
		Project Completion Review Mission



Notes

1. Inception report – Within 6 months after FAA Effective Date (FAA effective date is "start of project implementation")
2. Independent interim evaluation report – Within 9 months after end of Year 3
3. Project completion report - Within 15 months after completion date
4. Independent Final Evaluation Report - Within 33 months after the completion date

D.1. Value Added for GCF Involvement

GCF contribution to the project is critical to ensuring the resilience of South Tarawa's water supply to climate change. Without GCF support, this project as designed cannot proceed. The cost of ensuring the climate resilience of the water supply system for the people of South Tarawa is significant and combined with the costs associated with reducing greenhouse gas emissions, it has been calculated to be 49% of the total project cost. GCF support is essential due to Kiribati's climate vulnerability and the severe economic and fiscal constraints it faces in addressing these climate change challenges.

Kiribati is a SIDS and one of the least developed countries of the world. In 2016, GDP per capita was estimated to be $1,823 (measured in purchasing power parity terms), ranked 169th in the world, slightly ahead of Haiti, but below Afghanistan (IMF 2017)[14]. It has the lowest GDP per capita of all Pacific countries. Kiribati is also classified as a Fragile State (World Bank 2017), and in 2014 Kiribati ranked a low 133 of countries by the Human Development Index; it fell to 137 in 2015 and 2016 (UNDP 2014, 2015, 2016). Kiribati is an ADB 'grant-only' country, meaning that ADB cannot provide loans nor process third party loans for Kiribati.

The economy of Kiribati is highly vulnerable to external shocks and income volatility due to its exposure to climate change, geographical disadvantage, dependence on imports, and reliance on revenue from overseas sources. Private sector growth is constrained by the small-scale of the economy; the high costs of doing business; and the country's widely dispersed population. With a large public sector (accounting for half of the country's 18% in permanent employment), maintaining fiscal sustainability is the Government's key priority.

In its 2017 Article IV consultation, the IMF noted that despite economic growth over the past six years (that was substantially driven by large, donor-financed investments and strong revenues from fishing licenses) risks to long-run economic development prospects remain high. A significant contributor to these risks is climate change. As a result, IMF advised, "*Continued efforts are needed to enhance resilience to climate change and mitigate its negative impact on long run growth. Budget provision should explicitly recognize climate change adaption costs and infrastructure maintenance needs*."

The STWSP is part of Government's continued efforts to enhance resilience to climate change, and Government's financial and in-kind contribution to the project over its lifetime is substantial (given the balance of financial resources needed for ongoing operation of the water supply system will be met by Government). However, considering Kiribati's severe constraints and climate vulnerability, grant support from GCF is critical to the project.

D.2. Exit Strategy

Sustainability of project design

The project's sustainability in the long run has been considered in all aspects of its design. In particular:

1. The infrastructure outputs and activities have been designed with a planning horizon of 2041 sized taking into account the impacts of climate change on water supply and demand, climate-proofed and designed with durability of materials as a high priority. Network infrastructure has been designed to function under various 50-year growth scenarios. The desalination plant has been designed for an increase in production to 6,000 m^3 per day in the future;
2. Institutional strengthening of the water sector (including governance, management, O&M) is one of the three project outputs. Capacity transfer to PUB and MISE is expected via (i) exposure to specialists in the PMU (contracted through the project); (ii) working alongside specialist contractors during construction, commissioning, and during the defects liability period of key infrastructure; (iii) mentoring from, and working alongside professionals undertaking the O&M contract of the desalination plant and of the network; and (iv) from specialist support to PUB on central functions (e.g. billing, asset management). A specific program focused on various on-the-job and external training, through which staff will earn certificates in water industry operations, computing stills, leak detection, electrotechnology and other new skills specifically needed for the new system, is described further under Activity 2.2;
3. The use of long-term performance-based O&M contracts for the desalination plant and water supply network will ensure the strong performance of these key assets for at least 5 years following completion of works. These contracts will be designed to include enhanced on-the-job training for PUB staff. Based on skills transfer during

the 5 years following commissioning, the Government can review whether outsourced maintenance should continue and/or to shape the design of future private sector support;
4. The WAP has been designed to achieve long-term and sustainable behavior change to continually meet its objectives;
5. Costs, resource requirements and sustainability have been evaluated as part of the decision-making process for the various interventions;
6. Through the implementation of a socially-inclusive and regulated tariff, and Government commitment to meet the balance of financial resources needed for ongoing operation of the water supply system through subsidies.

E.1. Impact Potential

Potential of the project/programme to contribute to the achievement of the Fund's objectives and result areas

E.1.1. Mitigation / adaptation impact potential

Adaptation impact potential

Bonriki and Buota lenses are currently the only large freshwater sources in South Tarawa suitable for drinking water production and most of the population depend on these for freshwater. As described in section B.2, the lenses are threatened by climate change, potentially rendering them useless for extended periods. Other existing sources of water across the island are too small and unreliable to make a significant contribution, and many are also threatened by climate change. Further, on the demand side, higher temperatures due to climate change will increase the need for freshwater per person (i.e. for drinking and hygiene).

The proposed project, with GCF support, is to install a seawater desalination plant that is resilient to climate change and meets the increased demand for water due to climate change. Hence, this project will adapt and climate proof South Tarawa's entire water supply to climate change. Adapting the water sector is essential to the continued habitation of Kiribati. The entire population of South Tarawa (which currently accounts for approximately 53% of Kiribati's population – a percentage which is expected to reach approximately 59% by 2041) will directly benefit. Overall, this project is of enormous strategic value to South Tarawa, the country's largest population centre and one that is growing.

Adaption amongst the most vulnerable people and communities. The most vulnerable people and communities to adverse climate impacts on water supply in South Tarawa include those that (1) are not directly connected to the PUB supply; (2) have little political power in order to negotiate an improved connection; or (3) cannot afford alternatives (technically and/or financially) to PUB water, such as boiled water, bottled water or harvested rainwater. Without this project, water shortages will increase due to population growth, and the most vulnerable people and communities will face a decreased water supply and increasingly poor water quality.

Adaptation of human health and wellbeing, and food and water security. By providing access to a resilient water supply of good quality, this project will directly improve water security and positively impact human health and wellbeing.

Adaptation of infrastructure and built environment. The project provides infrastructure – a desalination plant, water supply network and solar PV plant – and these have all been designed to be fully climate change proof (see Annex F).

Mitigation impact potential

The project also achieves mitigation benefits by providing safe water to all households on South Tarawa coupled with programs that raise community awareness, build trust in the PUB and new water supply, and encourage behaviour change that reduces or even removes the need (and perceived need) to boil water. In this way, the project will alleviate or eliminate the GHG emissions that result from households burning fuels for water boiling. Currently, almost all households on South Tarawa boil water for drinking using locally sourced wood, coconut residues, kerosene, and propane gas. Without this project, the water boiling would continue.

E.1.2. Key impact potential indicator

[14] In 2015, the Committee for Development Policy of the United Nations reviewed the status of Kiribati as a Least Developed Country. The Committee then decided not to recommend graduation but to review the situation in 2018, for possible graduation in 2021. The main reason for the decision was the economic vulnerability of Kiribati.

GCF core indicators	*Expected tonnes of carbon dioxide equivalent (t CO_2 eq) to be reduced or avoided (Mitigation only)*	*Annual*	4,471
		Lifetime	89,434
	• *Expected total number of direct and indirect beneficiaries, disaggregated by gender (reduced vulnerability or increased resilience);* • *Number of beneficiaries relative to total population, disaggregated by gender (adaptation only)*	*Total*	62,298 direct beneficiaries in 2018 (estimated 32,034 female and 30,264 male), increasing to an estimated 94,501 in 2041 (estimated 48,668 female and 45,833 male if gender ratio is same). This is the entire population of South Tarawa.
		Percentage (%)	53.7% of Kiribati population in 2018 increasing to 59.8% in 2041
Other relevant indicators	Please refer to project logic framework (H.1)		

Adaptation

The entire population on South Tarawa will benefit from a climate resilient water supply. In 2041, this is projected to be 94,501 people. In 2018, this is estimated to be 62,298 people.

Mitigation

Reduced emissions

1. Currently, most households on South Tarawa boil water before consumption, including water provided by the PUB network. A survey of boiling practices of 200 households revealed that 164 respondents boil water. Of those that boil water, 50% use wood as the principal source of fuel, 35% use kerosene, 9% use gas, 3% use copra, and 2% use other fuels (see Annex L).

In total, 58 of the 164 households reporting boiling water reported using kerosene as the main fuel to boil water. On average, they use 0.93 liters per boil and they boil water 1.7 times per day (many households boil water 2 or 3 times per day). Hence, these 58 households would use 58 x 0.93 x 1.7 times per day, or 91.7 liters of kerosene per day, representing 33,470 liters of kerosene per year. Further, assuming that all other households use zero kerosene, the 200 households surveyed use 33,470 liters of kerosene per year. For purpose of extrapolating these survey results to the entire population of South Tarawa, the following assumptions are made:

- The average household consists of 7 persons thus representing 8,899 households in 2018;[15] and
- No other households than those reporting using kerosene are actually also using kerosene.

Given these assumptions, the population of South Tarawa is using an estimated 1,489,248 liters of kerosene to boil water in 2018.

[15] See, for example, 2015 Population and Housing Census of the National Statistics Office

To estimate future use, we assume the following:

- Household size (7 people per household), the percentage of households using kerosene (35%) and the amount of kerosene used to boil one liter of water do not change over the period of analysis; and
- In 2041, the population of South Tarawa reaches 94,501.

Hence, in 2041, the population of South Tarawa will be using an estimated 2,259,249 liters of kerosene per year.

Given that the net calorific value of kerosene = 43.8 TJ/Gg = 43.8 TJ/1000 ton[16] and the CO2 emission factor for kerosene = 71,900 kgCO2/TJ = 71.9 tons CO2/TJ[17] , the **total CO2 emissions avoided due to boiling water is 107,409 tons,** over the period of analysis. This figure can be considered conservative because (i) it neglects emissions due to the use of gas to boil water; (ii) it assumes no households are forced to switch from wood to kerosene due to wood shortages; and (iii) it does not account for the increased water demand due to warmer temperatures caused by climate change.

2. In the baseline, water is pumped from Bonriki and Buota lens into the reticulated network. Using the following parameters and estimations (Annex B):

- Rough estimate of energy index at the Bonriki lens pumping station ~ 0.37kWh/m3
- Water pumped per day ~ 2000m3/d
- Energy consumed per day for pumping water from the lens into the network = 2000*0.37 = 732kWh
- Energy consumed per year for pumping water from the lens into the network = 365x 732kWh = 276.2 MWh
- Energy consumed per over the project's 20-year period for pumping water from the lens into the network = 20 x 276.2 MWh = 5.34GWh or 5.34 million kWh.

In the baseline, this electricity is provided from the existing diesel generators.[18] Using the following parameters and estimations (Annex B):

- In the baseline, the diesel plants run at 50% load;
- The energy conversion factor, for the diesel plants, at 50% load, is 10.59 MJ used per kWh of electricity produced;
- The energy content of diesel oil is 38.6GJ per kL of diesel;
- As a result of the above, generating 1kWh of electricity from the diesel plants leads to the emission of 0.733kg of CO2.

Hence, in the baseline, over 20 years, the production of 5.34 million kWh leads to the emission of 5.34 x 10^6 x 0.733 kg of CO2, or 3,914 tons of CO2. With the project, this baseline scenario does not occur, and so these emissions are avoided.

Combining (1) and (2) above, the reduced emissions resulting from the project total **111,323 tons CO2** (107,409 tons + 3,914 tons).

[16] (see table 1.2 page 1.18 - 2006 IPCC Guidelines for National GHG Inventories - http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf)
[17] (see table 1.4 page 1.23- 2006 IPCC Guidelines for National GHG Inventories - http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf)
[18] The existing power supply network on South Tarawa has a total generating capacity of 6.9 (megawatt) MW made up of 5.45 MW from diesel driven synchronous machines (2 power stations) and 1.45 MW from solar PV. Best estimates suggest that the present system maximum demand is around 5 MW leaving available capacity of just under 2 MW. The PUB's estimated annual increase in demand is 3%, mainly from increased residential connections and some new commercial developments.

Project emissions

The project will result in the emission of **21,889 tons** of CO2 over its life, between 2020 and 2041. These emissions result from using South Tarawa's electricity grid to meet the excess energy needs of the desalination plant and network not offset by the solar PV plant.

The project includes installing 2,500 kW of PV plant capacity (Activity 1.3) to largely cover the energy needs of the desalination plant and network. It will offset between 98 % of energy needs in 2020 and 73 % in 2041. The excess demand for energy (around 2 % of the energy needed in 2020, rising to 27 % of the energy needed in 2041) will be met by South Tarawa's grid. To be conservative, the entire excess demand has been considered as additional load on the grid's diesel generators, taking into account that the existing solar PV feeding into the grid is already at capacity,

The calculations are as follows:

- Energy index for the desalination plant and network ~ 3.86kWh/m^3
- Desalination plant capacity ~ 4000m^3/d
- Energy consumed per day by the project = 4000*3.86 = 15,440kWh
- Energy consumed per year by the project = 365 x 15,440kWh = 5,635,600 kWh
- Annual energy provided by the Solar PV plant = 4,142,474 kWh
- Energy consumed per over the project's 20-year period = 20 x 5,635,600 kWh = 112.71 GWh or 112.71 million kWh
- Energy provided by the Solar PV plant over the project's 20-year period = 20 x 4,142,474 MWh = 82.85 GWh or 82.85 million kWh
- Excess energy demand to be met diesel generators = (112.71 – 82.85) GWh = 29.86 GWh

Hence, in the project, over 20 years, the incremental energy demand of 29.86 million kWh leads to the emission of 29.86 x 10^6 x 0.733 kg of CO2, or **21,889 tons of CO2**.

Total avoided emissions

The total avoided emissions are the reduced emissions minus project emissions, that is: (107,409 tons + 3,914 tons) – 21,889 tons = **89,434 tons CO2.**

E.2. Paradigm Shift Potential

Degree to which the proposed activity can catalyze impact beyond a one-off project/programme investment

E.2.1. Potential for scaling up and replication (Provide a numerical multiple and supporting rationale)

Atolls are found mainly in the Pacific and Indian Oceans with just a small number in the Atlantic Ocean. Atolls are small and low-lying and they do not have river systems, natural freshwater lakes or deep groundwater with fossil water in aquifers. They do, however, typically, have freshwater lenses and these are often the only large-scale, permanent, local source of freshwater.

Many atolls are remote. Remote atolls often have limited locally available governance and management capacity, due to the small population pool. Also, remote atolls often rely on imported fossil fuel for energy - meaning they are energy dependent and they have relatively high GHG emissions per capita. For such remote atolls, in the future sustainable water supply systems should: (i) be relatively easy to construct, to manage and to govern; (ii) facilitate energy independence; and (iii) help reduce energy related pollution. Finally, many, but not all, remote atolls face similar demographic challenges, i.e. a rapidly growing population and relatively high population density. This means that traditional water use systems may no longer be adequate.

Hence, the solutions being developed under this project for Kiribati should be applicable and replicable to almost all *remote* atolls throughout the world that have a sizeable or growing population density.

Desalination technology has a very high potential for replication and scale-up in the Pacific in particular. According to CAIA, about half of the countries in the Pacific islands region are reliant on the ground water found in thin freshwater lenses for a large percentage of their freshwater needs. Further, some studies indicate that the first impact of sea-level rise that will make Pacific islands uninhabitable is the destruction of the groundwater lenses. Hence, determining alternative water supplies that are sustainable and climate resilient in the small island context (such as through desalination) is key to increasing the adaptive capacity of many Pacific islands. Government has already expressed an interest in exploring development partner support for climate-resilient water supply infrastructure –potentially involving desalination technology - for the remote outer islands, and it is anticipated that other Pacific Islands will become increasingly interested in pursuing the technology given anticipated climate change impacts on water resources.

There are almost no known water sector interventions to-date in the Pacific (or more broadly in ADB's developing member countries) which have involved renewable energy offset at a significant scale (with the exception of wastewater treatment projects involving the production of biogas and its conversion to electricity). The inclusion of renewable energy targets in policy formulation suggests there will continue to be a growing demand for renewable energy across the region, and it is highly relevant in islands which rely largely on imported fossil fuel for energy generation.

ADB is well placed to facilitate this replication of technology and infrastructure, through its investment program and network of partners across the Pacific. ADB has in recent years implemented water supply infrastructure projects in 12 countries in the Pacific and is currently developing water supply and/or sanitation investment projects in Fiji, Tonga, Palau, Marshall Islands, Federated States of Micronesia, Papua New Guinea, Solomon Islands, Timor Leste and Vanuatu. These may provide direct opportunities for sharing some or all of the technology to be demonstrated in this project.

E.2.2. Potential for knowledge and learning

ADB will ensure that the knowledge and lessons generated through this project will be captured and disseminated through direct and indirect measures throughout the Pacific and to some extent more broadly in Asia and even the Indian Ocean.

This project presents several opportunities for knowledge sharing, including: (i) through the Pacific Water and Wastewater Association (PWWA)'s annual conference, to which ADB has provided long-term support; (ii) The project team has had preliminary discussions with PWWA on a regional knowledge sharing event focused on desalination, which could be extended to include utilities with operational desalination plants hosting visits from operators who are in the earlier stages of desalination project development; (iii) International water resource and desalination community (ADB has recently published a paper in collaboration with Kiribati's PUB and Marshall Islands' Utility on Desalination in Pacific Island Atolls, and a presentation at Singapore International Water Week's Desalination Business Forum is proposed);); (iv) through Pacific-based events such as the 2019 ADB Annual General Meeting in Fiji where there may be a session held on building resilience in the Pacific, or Asia-Pacific events such as the 2018 Asia Pacific Adaptation Network Forum to be held at ADB HQ; (v) through hosting visits to the desalination plant's visitor center from local and international guests; (vi) through sharing information with Pacific policy makers through ADB's knowledge MOU with the University of the South Pacific; and (viii) other ad-hoc sharing events and knowledge products via ADB's Urban, Water and Climate Change Sector and Thematic Groups. In addition, ADB shares knowledge with development partners, governments, academics, utilities and CSOs through formal and informal consultations and discussions.

Expected topics for sharing include e.g. (i) building climate change resilience for water resources in atolls; (ii) role of renewable desalination in climate change adaptation and mitigation; (iii) the role of civil society organizations (CSOs and NGOs) in strengthening climate change resilience; (iv) role of public education facilities in creating awareness of climate change and water resource management; (v) technology providers & their role in building water security in small island states; and (vi) women as drivers of change in managing climate-resilient water resources.

The types of knowledge sharing platforms which will be employed include case studies, blogs, impact stories, videos, blogs, vlogs, toolkits, journal articles and others.

E.2.3. Contribution to the creation of an enabling environment

On South Tarawa, previous attitudes and approaches to water use have typically been short-term and unsustainable (based on necessity), with little understanding or awareness of public water supply management and use. Likewise, with water considered a free good and a basic right, the role of PUB is not fully appreciated by the public and some government departments. Further, PUB's traditional focus has been on the management of infrastructure, rather than the ultimate objective of ensuring a quality, safe and reliable product to customers. This project is expected to contribute significantly to a paradigm shift in these attitudes and behaviour, and also in attitudes to climate change and water use.

This is a large-scale project covering infrastructure, management, governance and awareness raising. It should result in the public being more knowledgeable about safe water and prepared to take necessary steps to access it, including ultimately paying appropriate tariffs. After the project, the public should better understand the challenges of climate change, and they should also understand and appreciate the role of PUB. Further, PUB's role will transcend that of a utility with the responsibility of maintaining assets in basic working order, to a results-oriented and customer-oriented public utility, whose aim is to ensure the public have reliable, adequate, affordable access to a safe and reliable water supply.

The project incorporates some major activities to create an enabling and successful environment: (i) the comprehensive and intensive 5-year WAP that includes developing and supporting local CSOs on Kiribati; (ii) the 5-year O&M contracts for the desalination plant and water supply network, and overall institutional strengthening activities, that will help to build the capacity of PUB staff and change attitudes towards O&M; and (iii) the climate change and water public education centre at the desalination plant. On item (i), a thorough assessment of CSO capacity in Kiribati was undertaken to identify the actors, and their strengths and weaknesses. Based on this assessment, the project has developed a central role for CSOs in project implementation. Given the relative scale of this project compared to the population of South Tarawa, this should directly result in a significant enhancement of Kiribati's civil society.

E.2.4. Contribution to regulatory framework and policies

The project is consistent with:

- *Kiribati Development Plan 2016-2019*, which commits to improving access to quality water and sanitation infrastructure, and to develop and promote the use of renewable energy in all sectors of the economy;
- *National Water Resources Policy 2008;*
- *Tarawa Water Master Plan*;
- *Tarawa Water and Sanitation Roadmap 2011 – 2030*;
- *Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management (KJIP) 2014-2023*;
- *Kiribati National Adaptation Program of Action* (NAPA);
- Sustainable Development Goal 6: Ensure access to water and sanitation for all.
- *National Energy Policy 2009;*
- *Kiribati Integrated Energy Roadmap 2016 – 2025*
- *Nationally Determined Contributions to the Paris Agreement 2015*

The above are further expanded on in Section E.5.

The project is also aligned with initiatives outlined in the *Kiribati Economic Reform Plan*, including the Community Service Obligation Policy and tariff reform. The project itself is expected to drive reform with regards to water tariffs, cost recovery, and helping MISE and PUB to design, regulate and ultimately rollout a socially inclusive system. Once implemented, the tariff reform will facilitate other project objectives, notably: (i) it will facilitate budget provision for O&M, as it will generate revenue; (ii) it will facilitate further investments in upgrading and expansion and (iii) it will provide incentives for water conservation and for demand side management.

'Walk the Talk', one of the three WAP programs, will contribute to the policy and regulatory framework for water and climate change. This program is focused on strengthening the enabling environment (including policy, regulations, institutional capacity and leadership) required for comprehensive and sustainable behaviour change. It includes the following goals/impacts: 1. Increased enforcement of WASH related regulations and 2. Strengthened Government of Kiribati leadership in WASH.

E.3. Sustainable Development Potential

Wider benefits and priorities

E.3.1. Environmental, social and economic co-benefits, including gender-sensitive development impact

The social, economic and environmental co-benefits of the project are significant, and overall, the provision of a safe and sufficient water supply has the potential to be a truly transformative event in the lives of all people in South Tarawa. The project will have a significant gender-sensitive development impact as it is designed so that women equally and meaningfully share in the project's benefits and decision-making (see section F.3 below for a summary of the strategies to ensure this impact). The most significant co-benefits of this proposal relate to health.

Health benefits

The key beneficial impact of the STWSP in South Tarawa is on people's health. This is because the project will eliminate the currently high dependence of residents on contaminated water supplies for drinking and basic hygiene, and therefore the significant negative impact this has on people's health and wellbeing. Water quality tests have shown that essentially all sources of water in South Tarawa are contaminated. As a result, most households boil water before using it, regardless of its source. In a recent survey of 200 households, it was found that 85% of interviewed households boil water at least once per day. Despite these efforts to treat water at the household level, the incidence of water-borne disease throughout South Tarawa, with associated treatment costs, loss of productivity, and fatalities, is high as shown in Ministry of Health and Medical Services data.

Water-borne diseases most commonly afflicting the residents of South Tarawa are diarrhea, dysentery, conjunctivitis, tinea corpis, and ringworm, including tinea vesicolor. Of these, diarrhea and dysentery are the most serious and life threatening, but the others also incur substantial treatment costs and personal downtime (causing loss of productivity for both patients and caregivers). Cases have grown at approximately three times the rate of population growth in South Tarawa. About 48% of the cases were children 4 years old or younger, ages at which diarrhea/dysentery disease is

especially life threatening (girls have a higher likelihood of suffering these diseases than boys)[19]. In fact, Kiribati's infant mortality rate is among the highest in the Pacific at 44 per 1,000 live births and is partly attributable to infantile diarrhea.[20] In 1977, South Tarawa had an outbreak of cholera. Under current conditions an import of cholera today would have an expectedly rapid and devastating effect on the population, especially children. Without the project, water-borne disease cases in South Tarawa are expected to continue to grow at a pace consistent with past trends. The risk of a more serious outbreak of water-borne disease, such as cholera, is considerable.

The beneficial health impact of the project is significant and is measured in terms of (i) aggregate avoided costs of medical treatment, (ii) aggregate avoided costs of lost productivity on the part of patients and caregivers, and (iii) value of avoided loss of statistical lives due to water-borne diseases.

Socio-economic benefits

Women, children, the elderly, and the most disadvantaged households bear a disproportionate share of the burden of inadequate water services in South Tarawa and will benefit the most from improvements to the current situation. Water supply projects have impacts on people's lives that extend far beyond the expected improvements to health and reduction in time spent collecting water. Social benefits of the project are expected to include: significant improvements in household income levels and security of livelihoods; increased school attendance along with better child care; and wider social and cultural benefits such as reductions in stress levels, increased status and self-esteem, better family and community relations and increased ability to observe religious rites and customs:

- *Women's time.* The social impacts of poor water supply is further confirmed by Balancing the Burden (ADB 2015) which finds that it is not just the collection of water that has an impact on women's time use. Women are also affected to a great extent by the health issues resulting from inadequate water supply. As water collectors and carriers, they tend to be exposed to harmful pathogens in water and risk being ill themselves. In addition, they bear the brunt of caring for the other members of the household who are sick due to unclean water. It is possible that, based on evaluations of similar projects in other regions, women may be able to increase their monthly incomes because they are able to use time saved in collecting water to pursue income-generating activities (ADB, 2015).
- *Stress.* Responsibility for ensuring enough water for family use can also increase stresses on relationships within the household, creating potentially violent situations. And the necessity for both men and women to obtain water when it becomes available due to intermittent supply leads to household disruptions and can in some cases contribute to absentee-ism at work (pers. comm, 2017). The project will help to reduce one cause of stress and household disruption.
- *Wider economy.* It is also anticipated that the project will have wider impacts on the economy, especially for the tourism and coastal fisheries industries.

Environmental benefits

Current water losses from the South Tarawa water supply system are high. Losses comprise a) leakage in the in-line reservoirs and distribution system to households; b) spillage because of customers modifying the reticulation system (due to its low pressure) and leaving pipes open for filling containers; c) wastage from the misuse of water and some lack of understanding of the importance of water conservation e.g. discharging stored potable water to collect 'fresh' water when supply is next turned on. The project will reduce leakage and wastage and improve water use and management through a range of measures, including the provision of reliable water supply 24/7, upgrading infrastructure, and raising awareness of water conservation, climate change and health and hygiene (which will have both environmental and social benefits).

E.4. Needs of the Recipient

[19] ADB, 2014. Economic Costs of Poor Water and Sanitation South Tawara Study.

[20] UNICEF and The Partnership for Maternal, Newborn and Child Health. 2013. *Kiribati: Tracking Progress in Maternal and Child Survival.* A Case Study Report, 2013. http://www.unicef.org/pacificislands/14-02-2014_Kiribati_Case_Study_For_Delivery_to_UNICEF_8-29-2013_conversion.pdf (accessed 10 March 2016).

Vulnerability and financing needs of the beneficiary country and population

E.4.1. Vulnerability of country and beneficiary groups (Adaptation only)

South Tarawa's population, the beneficiaries of this project, are already highly vulnerable. The Human Development Index in 2014 ranked Kiribati at a low figure of 133 in countries ranking; it fell to 137 in 2015 and 2016 (UNDP 2014, 2015, 2016). The latest Household and Income Expenditure Survey (2006) estimated basic needs poverty across Kiribati at 21.8%, with poverty highest in South Tarawa (22.4%). It also indicated that 66% of the I-Kiribati population was either poor[21] or borderline (highly vulnerable to falling into poverty). Unemployment in South Tarawa is very high at 63%, with women making up 60 % of this group (2015 Census).

And now, Kiribati is also among the most vulnerable nations in the world to climate change and sea-level rise, with most land less than 3 m above sea level, and the quality and quantity of freshwater declining and increasingly threatened. The population is projected to experience increasing difficulties to satisfy its clean water consumption needs due to their vulnerability to climate change. It is this critical need for a source of safe and clean water that is resilient to climate change that this project will address.

E.4.2. Financial, economic, social and institutional needs

Please refer to Section D.1 for a summary of Kiribati's financial needs. Public health is the major social (and economic) need in South Tarawa that this project will directly positively contribute to, as discussed in Section E.3.1.

E.5. Country Ownership

Beneficiary country (ies) ownership of, and capacity to implement, a funded project or programme

E.5.1. Existence of a national climate strategy and coherence with existing plans and policies, including NAMAs, NAPAs and NAPs

Kiribati National Adaptation Program of Action (NAPA)

In its first NAPA adopted in 2007, Government recognized the importance of the potential impacts of climate change on Kiribati water resources. Justifying the adoption of a water resource adaptation project, the NAPA states that:

> *Climate change, in the form of more frequent and higher-level storm surges also threatens the water resources by over-topping the lenses with seawater. This causes the lens to be contaminated by saline intrusion from the surface. The time needed for a given lens to return to normal is dependent on rainfall, but recovery may require months or even years, completely disrupting social and economic patterns in villages or islands (p. 40).*

The objectives of the proposed water resource adaptation project are stated as:

- To maintain and conserve available good ground water lenses;
- To gain users confidence in the reliability of the distribution system and promote their willingness to pay, based on consumed quantity;
- To increase water storage and water resources to meet current demands and at times of serious droughts;
- To manage risks to water resources throughout the atolls. This will be achieved through risk assessments and in designing and implementing responses, including sustainable community-based monitoring system; and
- To assess impacts of urban water supplies on other natural resources, systems and subsistence activities.

Kiribati's (Intended) Nationally Determined Contribution (Government of Kiribati, 2015) notes that in 2014 GHG emissions from Kiribati were extremely small at approximately 63,000tCO2e/year or approximately 0.6tCO2 per capita.

[21] It is noted that I-Kiribati may prefer other terms be used rather than "poor" (e.g., living in hardship. Personal communication with the Secretary of the Ministry of Health and Medical Services, February 2018)

This represents just 0.0002% of global emissions. Notwithstanding, through the INDC Kiribati committed to reducing GHG emission as follows:

- Without international assistance, Kiribati committed to reducing emissions by 13.7% by 2025 and 12.8% by 2030, compared to a *business as usual* projection;
- *With appropriate international assistance*, Kiribati stated it could reduce its emissions by more than 60% (61.8%) by 2030. This translates to reducing annual emissions by 35,880tCO2e by 2025 and by 38,420tCO2e by 2030.

The measures to achieve these reductions include the transition to solar PV as a leading source of energy. The INDC also assess Kiribati's vulnerability to climate change, its low adaptive capacity and the need to adapt key sectors of the economy. Amongst the vulnerabilities identified, the vulnerability of the water supply and of the groundwater lenses to climate events such as inundation and droughts was highlighted, and set out as a priority.

Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management 2014-2023 (KJIP)

The project is fully aligned with the *Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management (KJIP) 2014-2023*, especially these major strategies: 'Increasing water and food security with integrated and sector-specific approaches and promoting healthy and resilient ecosystems'; 'Promoting sound and reliable infrastructure development and land management'; 'Promoting the use of sustainable, renewable sources of energy and energy efficiency' (through the provision of solar PV for powering the desalination plant); and, 'Delivering appropriate education, training and awareness programs' (through WASH and water conservation/climate change awareness programs). Further, the KJIP seeks results that this project will help to achieve, especially:

1. The public is aware of water safety and proactively reduces the spread of vector-, water- and food-borne diseases.
2. The livelihood of I-Kiribati is improved through public buildings, infrastructure and utilities that are well maintained and resilient to climate change and disasters (climate proofing).
3. Water reserves are protected and communities have access to sufficient and adequate fresh water at all times (including during extreme events such as drought, heavy rain and storm surges) and to improved sanitation facilities.

Kiribati Development Plan 2016-2019

The project fully supports the *latest Kiribati Development Plan 2016-2019*, which commits to improving access to quality water and sanitation infrastructure, and to develop and promote the use of renewable energy in all sectors of the economy.

National Water Resources Policy 2008

The project fully supports the *National Water Resources Policy* 2008 three policy goals: 1 - Provide safe, socially equitable, financially, technically and environmentally sustainable water supplies to enhance the welfare and livelihood of the people of Kiribati; 2 - Protect and conserve freshwater sources for public water supplies; and 3 - Deliver freshwater efficiently and effectively.

National Energy Policy 2009

The project fully supports the *National Energy Policy 2009* and the associated recently approved *Kiribati Integrated Energy Roadmap 2016 – 2025* which seeks to finding improved energy solutions, increasing access to renewable energy, implementing climate change mitigation and adaptation measures that are sustainable, reliable and affordable. As part of the Kiribati Energy Roadmap, the project will contribute to the goal for Tarawa for a 45% reduction in fossil fuel use by 2025 of which 23% of this goal will be achieved through deployment of renewable energy and 22% through improvements in energy efficiency.

E.5.2. Capacity of accredited entities and executing entities to deliver

ADB and MFED are confident in their ability to deliver this project and meet its objective. The ADB is a multilateral development finance institution that provides loans, grants and technical assistance. ADB is composed of 67 members,

48 of which are from the Asia and Pacific region. ADB's clients are its member governments, who are also its shareholders. In addition, ADB provides direct assistance to private enterprises of developing member countries through equity investments and loans. In 2016, loan, grant and technical assistance approvals to ADB's developing member countries amounted to $17.8 billion, and total co-financing mobilized, with donor support, amounted to $13.9 billion, bringing total sovereign operations to $31.7 billion in 2016. Non-sovereign operations for the same year amounted to $2.5 billion.

ADB has been working with the Government of Kiribati since 1974 when it joined the Bank. Since then, ADB has approved 14 loans and grants totaling $66.5 million through the Asian Development Fund, as well as 41 technical assistance projects worth $19.6 million. ADB is currently working with the Government of Kiribati, with MFED as the Executing Entity, on the STSISP and Kiribati Road Rehabilitation Project. No major financial management issues have been reported, and fund flow and disbursement procedures/arrangements have been assessed as adequate. In 2016, ADB completed a technical assistance project on public financial management in Kiribati that helped to build the capacity of MFED (along with improving accounting practices and strengthening revenue management and policy). Finally, an assessment of the financial management and procurement capacity of MFED has been undertaken through the PPTA and have been assessed as adequate, with selected risk mitigation measures in place (see Section F.4).

For most ADB projects, MFED acts as the Executing Entity and as it has on other projects, MFED will effectively support the project through the following key roles and responsibilities:

- The representative of the Government as a grant recipient.
- Facilitate negotiation, signing, and execution of the financing agreement with ADB.
- Through the Kiribati Fiduciary Support Unit, lead the project's procurement actions in coordination with the MISE.
- Responsible for financial management through KFSU.
- Submit withdrawal applications to ADB.
- Expedite implementation and minimize cost by: ensuring the timely availability of necessary counterpart funds; reviewing invoices and payments to contractors, consultants, and service providers; and monitoring project progress and instructing MISE to take corrective action to prevent significant variations and deviations from schedules and budgets.

Further, the NDA (through the Climate Finance Division), will play a key role in overseeing and monitoring of the project.

E.5.3. Engagement with NDAs, civil society organizations and other relevant stakeholders

The preparation phase of the project includes a substantial multi-stakeholder and community engagement program.

Stakeholder consultations. Numerous consultations and interviews have been held with relevant stakeholders, including MISE, PUB, Office of the President, Ministry of Environment, Lands and Agricultural Development (MELAD), Ministry of Women, Youth and Social Affairs (MWYSA), Ministry of Health and Medical Services (MHMS), Ministry of Education, Ministry of Internal Affairs (MIA), airport improvement consultants, international and national NGOs, KAPIII staff and specialists, Australian Department of Foreign Affairs and Trade, New Zealand Ministry of Foreign Affairs and Trade and UNICEF. A workshop was held on 18 July 2017 to kick-off the project and to obtain feedback from stakeholders at an early stage, and recommendations from stakeholders were incorporated into the project's inception report. A presentation was also given to stakeholders on the outcomes of the PPTA on 13 February 2018. Landowners have been consulted on the location of water storage tanks and booster pumping stations.

CSO training program. The WAP will be implemented by an international NGO in partnership with local CSOs. As such, one objective of the community workshops held was to evaluate the capacity of WASH CSOs for their potential involvement in the future WAP. Eight representatives from the only two identified national, community based, WASH sector CSOs active in South Tarawa – Te Maeu and Kiribati Community Health Organization (KCHO) – were both invited to participate in the training (25-26 July 2017) and form part of the community consultation team. The training covered key technical terms and the desalination process, community consultation theory and design, recording, ethics, workshop planning and group facilitation. The two CSOs also attended a regional knowledge event organized by ADB's

Pacific Department and NGO and civil society center (NGOC), focused on improved engagement of CSOs in Samoa in September 2017.

Community engagement. A total of 20 community workshops across 13 villages were held 31 July – 5 August 2017. The workshops had a total of 426 adult participants, with an average age of 42 years (range 17-78 years), 58 % women, and most representing low or no income households. The workshops were held to a) provide objective information to assist the community to understand the STWSP, the alternatives being considered, opportunities and issues and key stakeholders roles and responsibilities; and b) encourage in-depth consideration of the project and give an opportunity to voice concerns, raise questions and generally draw out a range of voices and ideas. Each small group made a presentation to the workshop.

Key findings were:

- There is a general willingness to pay for water if it is set at an affordable rate. There is a risk that if a tariff is not affordable people will bypass the system.
- Confidence in PUB's ability to sustainably manage the upgraded and new infrastructure is low.
- The willingness to pay of those consulted during the workshops in 2017 is likely to be less than AU$10/month/HH although this needs to be confirmed through a more detailed study, such as a Willingness to Pay survey. Other WTP have been undertaken and are further described in Section F.1.
- Communal taps which charge for water are not popular and will not be supported if these are the only service option.
- The taps are likely to be the weakest point in the system and a risk to achieving lower non-revenue water (NRW) targets.
- There are concerns related to the safety of desalination water and its taste, and environmental impacts.
- Communities are willing to play a role in managing the water supply system.

Accordingly, the following recommendations are reflected in the project design:

- The price of water must be set based on what is affordable (rather than cost recovery) and a tariff structure established that acknowledges social structures and economic conditions and constraints in low-income households. A willingness to pay survey is required and further information will be gained from the KAPIII pilots. Individual household taps with meters should be provided with a tariff applied.
- Communal taps (with design led by the community) are required with water provided at low or no cost to reduce the risk of creating inequities and tampering with the system.
- A dedicated communication campaign is essential which focuses on the new water supply system, generating motivation and behaviors around paying for water, water system management, building trust in the PUB and encouraging behavior change related to water conservation and NRW (see Section C.3 for description of WAP and the Institutional Strengthening component of the project).

Communities in South Tarawa were also engaged in a household survey on water boiling and fuel use, undertaken January 2018, in preparation of the project. Engagement of CSOs and communities will continue to be a significant feature of the project through implementation, especially the WAP. The Poverty and Social Assessment presents a stakeholder analysis and stakeholder participation plan, followed by the stakeholder communication strategy that will guide information disclosure, consultation and stakeholder participation throughout the project. PUB and MWYSA provided input to these plans.

NDA involvement and support. Finally, the NDA has been involved in the project throughout its preparation and will continue to play an active role. The NDA consulted other government departments and stakeholders for their feedback on this funding proposal (as they also did for the concept note) prior to seeking Cabinet endorsement and providing a no-objection letter expressing their support for the project (see Annex A).

E.6. Efficiency and Effectiveness

Economic and, if appropriate, financial soundness of the project/programme

E.6.1. Cost-effectiveness and efficiency

The proposed financial structure (i.e. 97% funded by external grants) is deemed reasonable to provide South Tarawa's population with reliable and climate-resilient access to a safe water supply.

Based on a unit production cost (UPC) analysis using the capital recovery factor (CRF) approach, a seawater reverse osmosis (SWRO) desalination plant with an economic operating life of at least 10 years is found to be the most cost-effective option to provide adequate and sustainable safe water supply in South Tarawa. This was against conventional alternatives such as rainwater harvesting, household water wells, reticulated groundwater from water reserves in Bonriki and Buota, potential new groundwater sources in North Tarawa, as well as other technological and non-conventional sources of water such as bottled water, recycled water, bulk importation of water by ship, constructed rainwater catchments, a constructed island for groundwater harvesting, and solar stills. The proposed SWRO desalination plant is also appropriately scaled to meet present and projected future demand for safe water.

The Government will provide in-kind contributions to the project including (i) PUB's involvement in pipe-laying works in selected zones; (ii) office space for the project design advance (PDA) and project implementation assistance (PIA) consultants; and (iii) staff from MISE/PUB assigned to the project management unit. It is not feasible for GCF to extend loans to Kiribati due to the country's continued high risk of debt distress, as determined through the debt sustainability analysis conducted during the IMF's 2017 Article IV mission. ADB and the World Bank each extend 100% grant assistance to Kiribati and the respective country allocations of these institutions, including proposed co-financing for this project, are about fully programmed. Given Kiribati's high risk of debt distress, which rules out any substantial borrowing, GCF is best positioned to close the financing gap through the requested grant assistance and help deliver safe, climate-resilient and sustainable access to water to the people of South Tarawa.

This is not expected to crowd out private investment. There is limited scope in the economy for private sector activity in general, given Kiribati's small size, high costs of doing business, and widely dispersed population. There will also be no crowding out of other public investment as internal revenue collections are already stretched due to the high wage bill, as well as subsidies and government grants; and external grants are earmarked for specific projects. The IMF's 2017 Article IV report states that further development spending, and securing the external grants for these, remains crucial for long-term economic growth.

In addition, efforts are being made to ensure there are no overlaps with other development interventions in Kiribati. Substantial engagement with stakeholders, including government, and communities has been a major part of this project from the early stages of preparation. The National Drought Committee and National Water and Sanitation Coordination Committee, which is being reconvened, will be instrumental in ensuring strong communication and coordination among stakeholders and across sectors. Lastly, Part C 'Walk the Talk' in the project's WAP will support a strengthened enabling environment, enhanced sector coordination and improved efficiencies across the many ongoing and planned activities in the sector and linked to the project.

E.6.2. Co-financing, leveraging and mobilized long-term investments (mitigation only)

N/A

E.6.3. Financial viability

The FIRR is estimated to be -17.1 %. The FIRR is expected to remain the same without GCF support, since this would have to be replaced with alternative sources of grant financing (loan financing not being a feasible option for Government).

The project is financially unviable due to the need to balance revenue generation with making water supply services attractive to a significant number of poor households and encouraging them to shift from using free and widely available—but contaminated—water sources. This will ultimately constrain the setting of water supply tariffs, and the sensitivity analysis indicates that large increases in revenues would be required to make the project financially viable. Additional support will be needed to meet operating expenditures over the useful life of the project. This is discussed further in Section F.1.

E.6.4. Application of best practices

Recent studies (described further in F.2) concluded that seawater reverse osmosis desalination represents a practical and affordable longer-term option for supplementing water supplies in South Tarawa. Desalination is also considered an innovative and climate-adaptive technology, given its capacity to improve resilience to water quality degradation and diversify existing water supplies independent of rainfall. ADB's experience in implementing a recent desalination project in another densely-populated atoll – Ebeye, in the Marshall Islands – has been applied in the development of STWSP. Like Ebeye, South Tarawa uses saltwater for sewer conveyance, precluding municipal-scale wastewater recycling as a viable potable water supply option on the island.

Energy consumption is one of the critical factors in determining the cost-effectiveness of incorporating desalinated water into the water supply mix for any utility. One of the key lessons learned from Ebeye relates to the saltwater feed to the plant. The use of saltwater wells on Ebeye, as opposed to an open intake or beach well which are typically used in desalination plants, has likely resulted in improved plant performance. This is because the saltwater obtained from wells has been naturally filtered to remove suspended solids, and also diluted with rainwater, resulting in a total dissolved solids (TDS) 10-20% lower than saltwater from the nearby lagoon. This has 2 main implications: (i) Given that energy consumption of reverse osmosis is directly proportional to feedwater TDS, the resultant energy consumption of the RO system is lower that it would be if using seawater from the lagoon; and (ii) Given that the saltwater from the wells has been naturally filtered, no pretreatment of water prior to the RO process is necessary (typically desalination plants will include a process such as Dissolved Air Floatation (DAF) or microfiltration as a pretreatment to the RO).

STWSP has also been designed to draw feedwater from wells below the atoll. Like Ebeye, the desalination plant will likely not require a pretreatment system (resulting in CAPEX and OPEX savings). This will be confirmed following the results of hydrogeological surveys planned for mid-2018 and funded through the project design advance (PDA). In addition, the energy consumption of the desalination plant in South Tarawa is estimated to be 3.07kWh/m3, lower than most desalination plants internationally (typically around 4kWh/m3). The plant has been designed with modularity (individual RO trains and multiple borehole pumps), which means that production can be easily increased / decreased based on demand. This will also avoid energy inefficiencies related to low plant utilization. In line with best practices, the plant has also been designed to facilitate future expansion (for example by allowing additional space and sizing pipework and tanks to allow for larger production volumes). In this way the plant is future-proofed and will allow PUB to pursue further expansion in the coming decades with minimal service interruption.

The plant will have its energy consumption offset by solar PV. A recent IRENA study concluded that solar photovoltaic-powered RO desalination is the best renewable energy technology option for South Tarawa[22]. The project will be the first desalination project at-scale in the Pacific with renewable energy offset.

The current high rate of water losses in South Tarawa is another consideration in introducing a relatively expensive water supply into the mix. The infrastructure components in the project will be phased such that desalinated water is only introduced into the network zones that have been rehabilitated. The desalination plant will be located in Betio, the most densely populated islet in Tarawa (population around 17,000), and that with the highest rate of waterborne disease. Priority will be placed on rehabilitating this zone so as to facilitate augmentation of potable water supplies to this area.

The project includes performance-based contracting for both the desalination plant and the network. Particularly in a development context, PBCs are a tool of emerging importance for supporting sustainable operational improvements through private sector engagement. For the desalination plant, the 5-year outsourced O&M contract could include performance criteria (for example) for (i) quantity produced per day; (ii) plant available capacity; (iii) quality of water produced; (iv) energy consumption; and (v) timing of membrane replacement; etc. For the water supply network, the PBC for O&M is proposed to involve performance-based targets for (i) non-revenue water (NRW); (ii) continuity of supply; (iii) quality of supplied water; and (iv) energy efficiency, and these combined will help to achieve the project's mitigation benefits.

[22] International Renewable Energy Agency, 2015. *Kiribati Integrated Energy Roadmap (KIER) Renewable Energy*. Working Draft, September 2015.

The project's inclusion of a visitor center to be co-located with the desalination plant is a further example of best practices and has been shown in other countries (e.g. Singapore) to be pivotal in creating awareness and buy-in from the public when new technology is introduced. The visitor center is intended to be educational and to improve awareness of water resource management, climate change impacts, application of innovative technologies (such as desalination) in addressing water resource challenges, water conservation, disaster risk management and renewable energy.

E.6.5. Key efficiency and effectiveness indicators

GCF core indicators

Estimated cost per t CO_2 eq, defined as total investment cost / expected lifetime emission reductions (mitigation only)

(a) Total project financing	US$3.39m (for mitigation)
(b) Requested GCF amount	US$1.79m (for mitigation)
(c) Expected lifetime emission reductions overtime	89,434 tCO_2eq
(d) Estimated cost per tCO_2eq (d = a / c)	US$38 **/ tCO_2eq**
(e) Estimated GCF cost per tCO_2eq removed (e = b / c)	US$20 **/ tCO_2eq**

For the methodology to determine (c), see section E.1.2 above.

Emission reduction costs can only be meaningfully compared with other SIDS, in particular Pacific SIDS. This compares favourably to the Cook Islands BESS project approved under this Regional Program at GCF 15th board meeting with a rate of $167 per tCO_{2e}, and the recent solar power development project in the Solomon Islands that yielded a cost of $724 per tCO_{2e}.

Expected volume of finance to be leveraged by the proposed project/programme and as a result of the Fund's financing, disaggregated by public and private sources (mitigation only)

This project has leveraged $27.96 m in public sector investment. With support from ADB and the World Bank, and during the PDA phase (when procurement approaches will be finalized), Government will explore measures to attract future public and private sector co-financing, and as appropriate engage in dialogue with potential investors to facilitate further investment.

Other relevant indicators (e.g. estimated cost per co-benefit generated as a result of the project/programme)	-

F.1. Economic and Financial Analysis

Methodology

The economic analysis of the proposed project was carried out in accordance with ADB's guidelines for conducting the economic analysis of investment projects.[23] The economic efficiency of the investment was determined by computing the economic net present value (ENPV) using ADB's 9% social discount rate, and the economic internal rate of return (EIRR).

For the economic analysis, the domestic price numeraire has been adopted. Taxes and duties have been removed from the cost estimates, which include all physical works, supply, international and local labor. Cost estimates reflect end-2017 prices and are held constant throughout the period of analysis (to 2041, incorporating a 3.5-year implementation and 20-year operating period). As the local currency in Kiribati is the Australian dollar, which is also the currency of the foreign cost estimates, the shadow exchange rate factor is estimated to be 1.0. Due to high unemployment in Kiribati and in the capital atolls, a shadow wage rate factor of 0.8 is applied to the estimated unskilled local labor inputs.

As is common when undertaking the economic analysis of investment projects, numerous assumptions were used to delineate the "with project scenario" from the "without project scenario". Conservative assumptions were adopted, where assumptions were necessary, to avoid over-estimating the expected benefits of the project. Thus, it is possible that the analysis under-estimated the true economic benefits of the project.

Outcome of the economic analysis

The costs of the project are outlined in Section B and the benefits in Section E.3.1. The project EIRR is estimated to be 13.0%, comfortably above the 9.0% threshold. The ENPV of the project calculated at the 9.0% discount rate is $11.8 million.

Sensitivity analyses showed the economic efficiency of the project to be robust in the face of increased costs or decreased benefits. When all capital and O&M costs are increased by 20.0%, the ENPV remains positive at $0.9 million and the EIRR declines to 9.3%. However, combined with a 20.0% reduction in total benefits, the ENPV falls to –$16.7 million and the EIRR falls below the ADB social discount rate at 5.1%.

The project appears most sensitive to changes in savings on fuel costs related to water treatment, but estimates show that this must fall by 32.3% for the ENPV to fall to zero. Reducing the benefit of the health impact (i.e., avoided (i) treatment costs, (ii) productivity losses, and (iii) fatalities from water-borne disease) by 20.0% cuts the ENPV to $6.2 million and the EIRR to 11.1%. When health impacts and avoided household water treatment costs are decreased by 20.0% simultaneously, ENPV becomes negative at -$1.5 million while EIRR falls to 8.6%.

It is important to note that the preceding analysis excludes any economic valuation of consumers' willingness to pay for safe and reliable supply of clean water. Such benefits can be substantial, particularly given the current without-project scenario that is resulting in high incidences of water-borne diseases. To illustrate, valuing willingness to pay at a 'working hypothesis' tariff informally derived from community consultations (see Annex B) pushes the project's estimated EIRR to 15.9%, with an ENPV of $20.5 million. Pending the results of a formal willingness to pay survey, these benefits will be properly valued and included in the economic appraisal of the project.

Outcomes of the financial analysis

Since the existing PUB water supply tariff structure is dysfunctional, either as a price signal or as an equitable means to distribute costs among users, a water supply tariff structure is assumed for purposes of this analysis. It will be necessary to implement a new water tariff structure once a sustainably continuous water supply system is operating. The tariff proposed for implementation will determine the overall revenues that PUB can expect from the increased supply of water from the project, and hence the need for additional support under the terms of the CSO policy included in the SOE Act of 2013. Consistent with the objectives of the project and effective tariff design criteria, a (hypothetical) new tariff has been proposed for estimating a possible FIRR of the project. The 'working hypothesis' tariff proposed is summarized below and discussed in detail in Annex B.

Water supply tariff

The objectives of the proposed tariff are to: (i) protect the poor; (ii) recover costs from all other consumers (as the full cost of supply should be recovered from all consumers who can afford to pay for water); (iii) provide scope for cross-subsidisation between water supply customer; and (iv) provide clear quantification and sound basis for Government to provide well-targeted subsidies to PUB for water supply to the poor, via existing Community Service Obligation policy.

Reliable data on household water consumption, willingness to pay, and income is required to determine the most appropriate tariff for South Tarawa. While a formal willingness-to-pay survey is proposed with data expected to emerge in mid-2018, some information to inform willingness to pay in South Tarawa is already available:

- a willingness-to-pay study was carried out in 2014 through the South Tarawa Sanitation Improvement Sector Project (STSISP), and its results are reported in the Economic Costs of Inadequate Water and Sanitation report (https://www.adb.org/publications/economic-costs-inadequate-water-and-sanitation-south-tarawa-kiribati). This WTP study asked households "Are they willing to pay for improved services so that no one in the family would suffer from serious water and insect borne diseases". The result was that (i) the majority of the households are willing to pay for improved water and sanitation services; (ii) an average WTP amount is about A$13 /month; and (iii) there is a large variation across households and across villages. Since the survey question could be understood to encompass both water and sanitation services, it may not directly inform WTP for water in Tarawa. However it provides an indication and is not inconsistent with that proposed through the project's working tariff.
- Community engagement undertaken in 2017 revealed that some communities are paying between 20c and 50c for a bucket (assuming bucket ~ 10L, this equates to $20-$50/m3) for rainwater from community churches. Services by tanker delivery are charged A$5/m3 plus a delivery charge (A$12-57 per trip depending on distance). These figures suggest there are certainly segments of the population who are willing to pay far above the A$10/household/month represented in the working tariff.
- New Zealand supported the South Tarawa Desalination Economic and Social Feasibility Study (2017), which
- examined options for the provision of an interim water supply (underpinned by a desalination supply) that could potentially be put in place until more comprehensive water supply services could be restored. The study undertook a household survey of 30% of households in South Tarawa, and concluded that:
    - Most households were willing to pay either 10 or 20 cents for each 10 litre bucket of water (i.e. A$10-$20/m3)
    - Typical households would spend between $0.50 and $2.00 a day (A$15-A$60 per month) for their water needs
    - 84.51% are more than willing to pay for better water supply
    - Some households will find it difficult to pay for water and sanitation services, even if it is shared as they are already struggling to meet their basic need.

  While the survey is not specific to STWSP, the outcomes reinforce that WTP for PUB-supplied water will remain significant as the population is offered an improved service.
- Information is expected to emerge following commissioning in early 2018 of the pilot 24/7 water supply systems formulated under the KAP III program, which are being implemented in three communities in South Tarawa. The commissioning of these systems will provide valuable insight into actual user behaviour, e.g. (i) consumer acceptance of the tariff under continuous supply conditions and (ii) the distribution of consumption patterns across households of different income levels. It is envisaged that, following the commissioning of these KAPIII pilots, further context can be provided to shape proposed future tariffs.

In the meantime, a tariff has been designed to achieve the above objectives, based on the best available information and a set of reasonable assumptions. A stepped 'rising block' tariff with an adequate initial lifeline block to protect poor households is proposed.[24]

Table 6 – 'Working Hypothesis' Tariff

[23] Asian Development Bank. 2017. *Guidelines for the Economic Analysis of Projects.* ADB. Manila.

[24] One issue of using a stepped tariff is that a poor but large household's water consumption can easily exceed the lifeline block each month, kicking the household into a higher-priced consumption band that it cannot afford to pay. So, it is necessary to provide each household with (i) continuous information regarding its consumption each month so that it is aware of when it has exceeded the lifeline block and higher charges begin to apply, and (ii) access to a free or low-cost alternative source of safe water (such as community standpipe).

	Rate A$/m^3	Monthly Consumption Band (up to __m^3/month)
Domestic Consumers		
Pipe Water Delivered in Premises		
Lifeline Block (≤ 7.5 m^3/month)	$-	7.5
> 7.5 but ≤ 15.0 m^3/month	$2.50	15.0
> 15.0 but ≤ 20.0 m^3/month	$3.50	20.0
> 20.0 m^3/month	$5.00	unlimited
Pipe Water Delivered in Communal Taps	$-	unlimited
Non-Domestic Consumers	$5.00	All consumption/month

Table 7 – Average Monthly and per m^3 Charges

	Average monthly charges (typical bills)	Average tariff /m^3
Poor domestic	$0	$0.00
Middle income domestic	$19	$1.26
Upper income domestic	$65	$2.53
Weighted average domestic	$10	$1.30
Non-domestic	$64	$5.00

The 'working hypothesis' tariff does not recover the full cost of the water supplied, due to the high volume of free water supplied to poor households (as by principle, the tariff must be designed and constrained to encourage all users to obtain water from the safe public supply and not widely available (and free) but contaminated sources). As such, purely with respect to water supply operations, PUB is expected to incur an annual average operating loss (including depreciation) of about $1.5 m a year during the life of the project (2022–2040).

Support for operations

Considering the above, additional support will be required to offset operating losses over the long term. Funding all operating expenses not covered by the project will entail additional support to PUB averaging $1.1 million (A$1.5 million) a year. Government is dedicated to ensuring the long-term sustainability of this project and has formally committed through a Cabinet decision to meet the balance of finance needed for ongoing operation of the new water supply system, following the implementation of this project.

The Government's commitment to the sustainability of the sector and to tariff reform is further demonstrated through the Kiribati Economic Reform Plan (KERP). Through the KERP, the Government has committed to substantive reform actions that are expected in 2018, including:

- The MFED shall have published the Community Service Obligation Policy on their website and approved a specific appropriation for the policy in the 2018 budget; and
- Operation of the PUB will continue to improve through Cabinet approval of reforms to water tariffs that introduce usage fees to improve access and quality of water services in a sustainable manner.[25]

ADB, the World Bank, and the Governments of Australia and New Zealand are providing parallel support to Kiribati in Economic Management Reform. For example, through ADB's program grant "Proposed Programmatic Approach and Policy- Based Grant for Subprogram 1 Republic of Kiribati: Strengthening Economic Management Reform Program", Kiribati's economic management will be strengthened, creating a more stable macroeconomic framework. The

[25] Cabinet has already approved implementation of tariffs in the 3 KAPIII pilot zones.

programmatic approach, with one subprogram completed in 2017 and one planned for 2018, will build on current government-led reforms supported by a multi-partner policy action matrix. The improved (i) management of public finances, assets, and liabilities; and (ii) economic environment for the private sector align with the Kiribati Development Plan (KDP), 2016–2019 and the KERP.

GCF Concessionality
For justification for the proposed concessionality that GCF provides please refer Annex K.

F.2. Technical Evaluation

Desalination

The Tarawa Water Master Plan (2010) considered a range of potential sources and assessed their capacity to meet present and future demand, including rainwater harvesting, household water wells, reticulated groundwater from water reserves in Bonriki and Buota, potential new groundwater sources in North Tarawa, and solutions offered through technology as well as non-conventional sources of water. The latter included bottled water, recycled water, bulk importation of water by ship, constructed rainwater catchments, a constructed island for groundwater harvesting, solar stills and seawater reverse osmosis (SWRO) desalination. A unit production cost (UPC) analysis using the capital recovery factor (CRF) approach was carried out for groundwater and other options for meeting water needs. SWRO desalination was judged to be the most attractive provided its economic operating lifetime is at least 10 years.

Several subsequent reports have similarly recommended that seawater desalination is used as a means to augment potable water supply in South Tarawa, including:

- *Water and Sanitation Roadmap 2011 – 2030* Volume 1, Fraser Thomas and Partners, March 2012.
- *South Tarawa Water Supply Options Assessment Desalination Feasibility Study*. Fraser Thomas and Partners, April 2012.
- *South Tarawa Water Supply Options Assessment Desalination Feasibility Study*. Peer Review Report. Harrison Grierson Consultants Limited. January 2013.
- Mack, P. 2016. *Bonriki Inundation Vulnerability Assessment: Summary Report*. Secretariat of the Pacific Community.
- *South Tarawa Desalination Economic and Social Feasibility Study*. Jacobs, March 2017.

Another important factor which strengthens the case for desalination technology centers on its resilience to climate change impacts. Desalination is emerging as an important technology given its capacity to diversify water resources independent of rainfall and climate change impacts (Elliot et al., 2011). [26] Almost no other options of significant scale - particularly for island environments with a small land area – are known, with the exception of water recycling, which is precluded in South Tarawa since the sewer uses a saltwater flush system. Another climate change adaptation strategy which has been reported is water use efficiency, which is addressed through the water supply network rehabilitation, institutional strengthening and WASH/community awareness components of the project.

Solar PV

As reported by UNEP (Elliot et al. 2011), certain adaptation technologies such as desalination are energy-intensive, increasing greenhouse gas emissions relative to competing technologies. The relative energy efficiency of the plant proposed for STWSP (described in Section E6.4) as well as the full solar PV offset of the plant and new and rehabilitated network's energy consumption counter this possibility for STWSP. A recent study by the International Renewable Energy Agency (IRENA, 2015[27]) concluded that (i) solar photovoltaic-powered RO desalination is the best renewable energy technology option for South Tarawa; and (ii) renewable desalination is already cost-competitive with fossil-fuel driven desalination, and may be even more attractive in the future should diesel prices rise.

[26] M. Elliot et al. 2011. Technologies for climate change adaptation - The water sector. Roskilde: UNEP Risø Center on Energy, Climate and Sustainable Development.
[27] International Renewable Energy Agency. 2015. Kiribati Integrated Energy Roadmap (KIER) Renewable Energy. Working Draft, September 2015

The solar PV and associated infrastructure has been designed during the PPTA. In evaluating the options of installing varying levels of both central and distributed PV, it was recommended that 2,500 kW of ground mounted, fixed centralised PV array with a 2000 kW Solar Smoothing Energy Storage (SSES) system, to be located near the Bonriki pumping station, is the optimized configuration of the plant. The recommended option also includes an upgrade to the existing 11 kV power network of approximately 1 km.

Consideration of the technical impact, quality of supply and reliability was analyzed. The analysis indicated that provided the recommended control and protection measures are implemented, the proposed capacity is feasible from a technical perspective and could be installed without foreseeable technical limitations. Notwithstanding this, there is still an increasing residual risk with quality of supply and reliability as renewable penetration increases in South Tarawa. Whilst this requires specific, careful consideration of dispatch and spinning reserve regimes, the recommended SSES is believed to provide sufficient operation flexibility. Furthermore, the PDA phase will include an independent review of the proposed power supply plan, and a power system load flow and fault level study will be undertaken, prior to preparation of bidding documents for a design-build contracting approach.

An investment plan is currently under preparation by the Kiribati Scaling Up Renewable Energy National Task Force (SREP), which will give consideration to the proposed STWSP's solar PV installation and other ongoing and proposed initiatives.

F.3. Environmental, Social Assessment, including Gender Considerations

Environmental Assessment

ADB and World Bank have categorized the project as a 'B' for environment safeguards and an environmental and social impact assessment (ESIA) has been undertaken for the project that includes a grievance redress mechanism and environmental and social management plan with monitoring plan (ESMP) for the pre-construction, construction and operational phases of the project (refer Annex G). It concludes that as long as the proposed mitigation and monitoring measures are fully implemented, any environmental impacts will be site-specific, localized, and largely created during the construction period. Key conclusions from the ESIA are summarized here:

Construction

- No sensitive terrestrial or marine ecosystems will be impacted by the project as all project sites are already modified/disturbed environments. No cultural/heritage sites will be affected;
- The feed water to the facility will be sourced from a series of 35 m deep bores, a depth which will not impose adverse impact on the overlying fresh ground water lens used by the local community;
- There will be no displacement of people due to the location of the desalination plant and solar PV system;
- Construction activities do not include any large-scale earthworks. Construction will be undertaken during specified hours during daytime and noise is unlikely to be an issue. Dust emissions will be minimal, especially with standard site management;
- To manage the risk of accidents to workers and the public, occupational and community health and safety requirements will be included in all bid documents (including communicable diseases awareness and prevention);
- Construction waste will be used as backfill material or with the approval of MELAD distributed by the contractor for reuse;
- Unexploded ordinance (UXO) could be encountered during the excavation of a trench for the brine discharge pipe from the desalination plant to the outfall pump station. Following international practice and government procedure, a survey (and disposal as required) will be undertaken to ensure the route of the pipe is free of UXO.
- Following the Project ESMP, the contractor will prepare a construction ESMP which details their construction methodologies and site-specific plans. The construction ESMP will be reviewed and cleared before any physical works commence.

Operations

Waste brine from the desalination plant will be routed directly from the facility to the outfall pipe at the outfall pump station located across the road, where it will be combined with sewage and subsequently be disposed to the ocean through the existing Betio outfall pipeline.[28] Prompt dilution of the waste is expected due to: (i) how the ports are oriented to the direction of the current; and (ii) the point of discharge is a well-mix area prone to wave surge and currents providing a good environment for diluting the high salinity effluent. The impact from brine disposal will be limited and localized, with the predicted result from the USEPA effluent plume model UM3 indicating suitable dilution is attainable at the lowest current velocity noted in the area. The diffuser, located at a depth of 30 meters between the coral knolls and reef slope, is about 47 meters away (south) from the shallower and nearest live coral (*Hypnea coerulea*).

Other operational impacts / mitigation measures are summarized below:

- To maintain a consistent water supply, all individual processes will incorporate a partial or full standby item or duplicate stand-alone plant, plus, critical spares will be held on site;
- There will be no cumulative effect on the local aquifer at the desalination project site due to the use of seawater extracted from well below the freshwater lens;
- Water will be regularly tested for salinity and harmful pathogens, in line with Kiribati regulations and WHO guidelines. If test results indicate contamination, PUB must promptly rectify the problem and keep the public informed to boil water;
- Fences with lockable gates, lockable manhole for underground water valves, and visible signs indicating danger and no-go areas will be displayed to minimize safety risks to the public;
- To minimize risk associated with chemical use, operators will be trained in Occupational Health & Safety and chemical handling, chemicals will be labeled, and safety instructions displayed;
- Acoustic packages will be installed at the desalination plant to reduce noise impacts from the high-pressure pump;
- The energy system design has involved in-depth review of the existing system. The augmentation of the supply system with solar PV will not negatively affect electricity supply to consumers.

Social and Poverty Assessment

A Poverty and Social Assessment (PSA) has been undertaken for the project. The social benefits of the project are outlined in Section E.3 above and they are significant. In addition to the positive impacts of the project, the PSA found that urgent actions are needed to address current and changing risks of water and vector-borne diseases: a) investments in adequate water supply infrastructure that can be sustainably operated and maintained; b) tariffs that better reflect 'user pay' principles to ensure improved cost recovery in the delivery of water supply services; c) sustained public awareness campaigns on the links between health, water supply, sanitation, and hygiene; and d) integrated approaches to simultaneously improve water supply, sanitation, and hygiene conditions in South Tarawa communities. Other key recommendations (already incorporated into the WAP and working hypothesis tariff) are:

- To encourage improved payment for water supply services, considerable public consultation will be required, supported by demonstrable community benefits to gain public support and significantly increased annual disclosures by PUB about its operations;
- There appears a general but limited household willingness to pay for improved water supply and sanitation services is low. This could be due in part to low levels of awareness of the benefits of adequate water supply and sanitation in terms of avoided productivity losses and household health expenditures associated with waterborne disease. An early and well-designed education and awareness program to promote better understanding of the links between water, sanitation, hygiene, and health is required, and this has been factored into the WAP design;
- NRW programs must include public information programming / behavior change-modeled IEC to educate the population about the damage caused by illegal connections and the dangers of additional household pumps to boost water pressure. This program will also encourage households to accept and maintain the user-pay system/adapt to best water conservation practice (Wakefield 2017b);

[28] Through the South Tarawa Sanitation Improvement Sector Project, the sewerage outfalls at Bikenibeu, Bairiki and Betio are being extended beyond the surf zone to a depth of 30 m, with a 10 m diffuser connected to each. The Betio outfall pipe consists of 1,200 metres of PN10 polyethylene pipe with an internal diameter of 312 mm.

- The project population includes people of all income levels, occupations and lifestyles. Each household, depending on its resources, will develop a "water use strategy". It is important to ensure that poorer households are not paying a greater percentage of their household income for their water because of reduced access to other safe water options. For example, income earners with built-in rainwater tanks have a free source of water, whereas those with traditional roofing buy rainwater from the maneaba or church at 50 cents a bucket. In rain rich years, the poor will still have to buy drinking water – rainwater or PUB water – or use water from their wells. The project must ensure through its pricing mechanisms that poorer households are not penalized because of their increased need for PUB water.

ADB has categorized the project as category C for Indigenous Peoples and B for Involuntary Resettlement. Kiribati is a single indigenous ethnic group and the project beneficiaries are not considered distinct and vulnerable to satisfy ADB's Indigenous Peoples Policy. The project will not have significant involuntary resettlement impacts, with impacts confined to minor land acquisition/lease and some affected assets such as crops and trees. The desalination plant is proposed to be constructed on Government long-term lease land. In all cases Government land has been sought for location of the storage tanks and booster pump station and only if government land is not available are private lands considered. There will not be any physical relocation or impact to income livelihood. The measures below were undertaken to ensure minimum lands required for water tanks and booster pumps. A Resettlement Framework has also been prepared which prescribes the policies and procedures to be followed in the preparation of resettlement plan as required for the reticulated water supply pipe network (refer to Annex M):

- Modify the tank and booster pump shape and configuration in order to reduce the footprint of the infrastructure i.e. tanks will have a similar volume but may be taller with a smaller diameter;
- Booster pumps will be accommodated in government owned fenced areas around the existing water tanks;
- Integrate new tanks and booster pumps into existing tank locations to reduce the need for additional land;
- Identify sites nearby existing water tanks suitable for the new tanks and booster pumps, avoiding resettlement issues. This is particularly the case for the airport tank site, where identifying an alternate close-by location obviated the need to remove existing small shops and restaurants located in the airport parking area close to the existing water tank.

Gender Impact and Gender Action Plan

The project is classified by ADB as effective gender mainstreaming (EGM) and a Gender Action Plan (GAP) has been prepared for the project (see Annex N).

Gender plays a significant role in the interaction with water and the impact of waterborne disease. Women's roles in water and sanitation include: water collection from wells and communal rainwater harvesting systems; responsibility for household hygiene and sanitation; decision making on use of household resources; care for HHs members whose illnesses are a result of waterborne diseases such as diarrhea; mobilizing communities and disseminating information on the impacts of poor water and sanitation attitudes and practices; and the management and monitoring of water collection, distribution and use. As such, the impact of ensuring that the household has safe water affects women's time and options for income generating and other activities. Caring for ill family members also is generally a female responsibility. Bouts of poor health through ongoing waterborne disease illnesses affect school attendance in both female and male children (GHD, 2015). Men's main role related to water is fetching water (in pales or other receptacles), linked to the purchase of rainwater for HH consumption.

A widespread and very low level of financial literacy in Pacific Island Countries is an impediment to achieving financial security at the household level. The issue of financial literacy is particularly relevant to water metering, which is to be pre-paid, and community consultations highlighted concerns about pre-paying by households who were dependent for their income on remittances from elsewhere. To address this, basic financial literacy education will be offered at the village level.

The GAP addresses potential gender inequality risks and promotes women as project beneficiaries through provision of targets for female participation in community discussions/consultations on the design and implementation of water supply improvements; female participation in MISE and other project related capacity building activities; employment of females for project related infrastructure; training on GAP implementation and gender awareness for the PMU, PIA

consultants, and MISE/PUB staff. Due to I-Kiribati roles both in carrying water as well as in undertaking general household work, the GAP also requires that males are adequately represented in the project. The following are only some of the strategies proposed to address gender disparities in this project:

- Establish new connections in project areas and informal settlements, which will benefit 100% of female-headed households as well. (Baseline: 4135 water connections as of 2015 of which approx. 20 - 25% are Female headed households)[29];
- Women, poor and vulnerable households participate in project orientation and consultations and focus group discussions. Due to men's role in carrying water and the need to engage men to not damage the water supply piping, male-only project orientation sessions will be conducted. Women-only consultations will also be conducted;
- Lifeline water tariff method developed by PUB with stakeholder communication program targeted at all households including poor households, low-income female-headed households, and vulnerable households (target: 100% of women headed households served by PUB);
- PUB water supply clients provided with quarterly financial literacy training to ensure ability to pay for water usage when required (target: 75% women, 25% men);
- At least 50% of community mobilizers will be women, as will 50% of participation (including girls in schools) in monthly WASH awareness-raising seminars and activities;
- At least 30% of new recruits to MISE's Water & Sanitation Engineering Unit (WSEU) are women, and at least 30% of PUB/MISE staff trained through the project are women; and
- At least 10% women involvement in community work during civil works and employment during operations and maintenance. Gender equality in wages, safety and hygiene for both men and women workers will be required.

The project will provide sufficient resources to implement the GAP, with the PMU being directly responsible for it being resourced, implemented and monitored as designed.

F.4. Financial Management and Procurement

Financial Management and Procurement

ADB's financial management and procurement policies and guidelines will be applied during implementation of the project. A Project Management Unit (PMU) will be established within MISE, staffed by appropriately qualified and experienced expertise through the entire procurement cycle of the project. The PDA consultant will also support the PMU with these functions, and a subsequent PIA consultancy is also expected to continue support to the PMU in the implementation phase with a focus on contract administration and construction supervision.

A country and sector/agency procurement risk assessment was undertaken in July 2017 (as described in Section E.5.2) resulting in the establishment of a risk rating of moderate to substantial for Kiribati. A subsequent project procurement capacity assessment for MISE conducted in Q1 2018 noted a high level of risk for procurement undertaken directly by MISE. However, the report also detailed that these risks were substantially mitigated due to the fact that KFSU, which has a much stronger procurement capacity than MISE, would be undertaking all of the procurement on behalf of MISE. The procurement risks would be further mitigated through the presence of a PMU and the direct support of a Procurement Specialist to the project to supplement the capacity of both the PMU and KFSU, as required.

An assessment of the financial management capacity of the executing and implementing agencies has been undertaken during preparation for STWSP. The overall assessment of the Project financial management pre-mitigation risk is moderate, but deemed adequate with the following mitigation measures in-place: (i) a qualified and experienced project accountant will be recruited as part of the PMU and based in the KFSU; the project accountant will handle all disbursements, accounting, financial reporting and auditing requirements; (ii) accounting and financial reporting

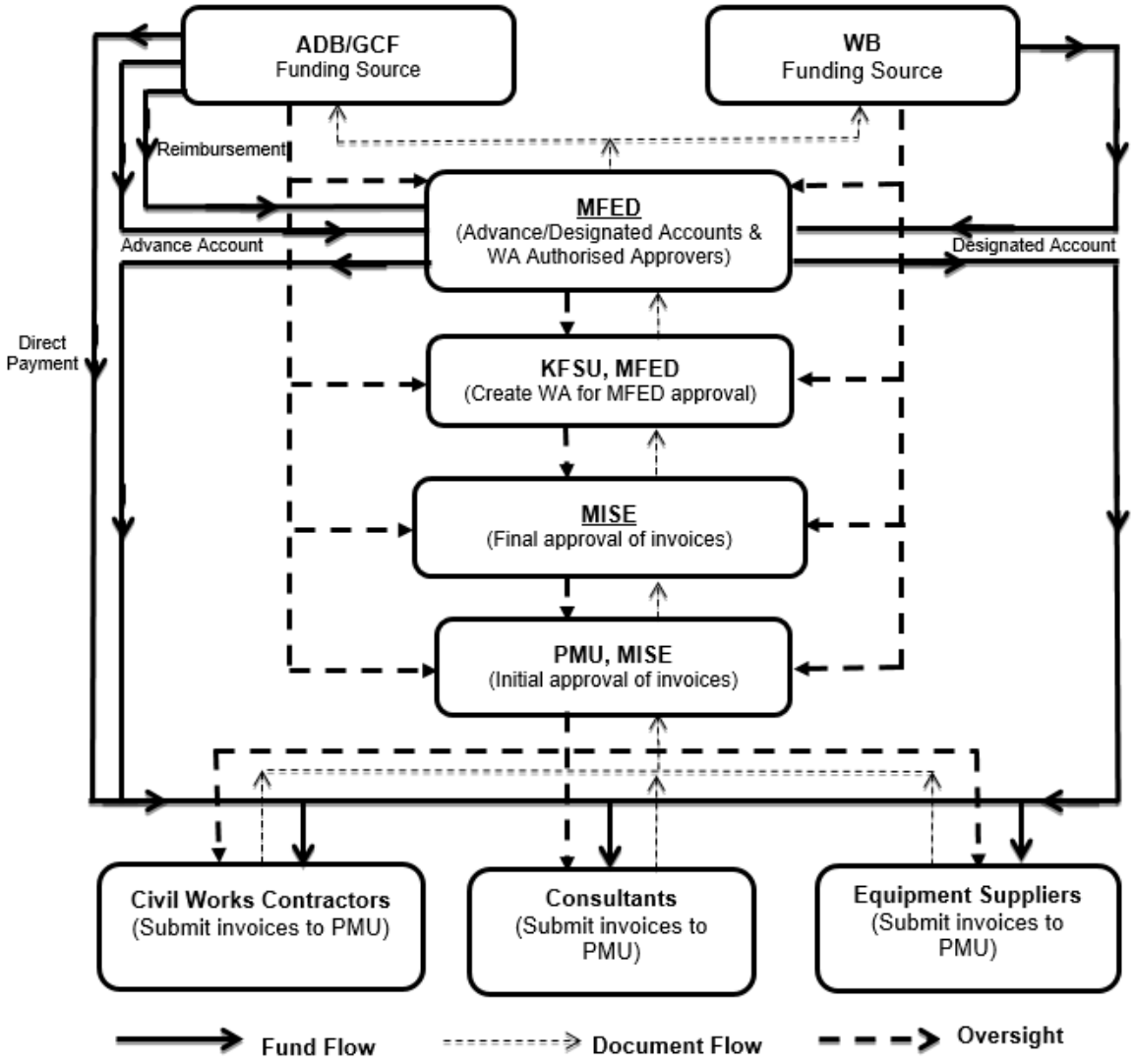
[29] Data provided by PPTA Economist. The 2006 HIES stated that between 20% and 25 % of HHs were female-headed.

software acceptable to ADB will be used for the project, supported by maintenance of hard-copy ledgers and records; (iii) an action plan for risk mitigation will be prepared and described in the project administration manual, and during implementation will be regularly reviewed and/or updated, to ensure the project responds dynamically to risks; (iv) these tasks are included in the terms of reference for the project accountant; (v) KFSU will provide financial oversight to the executing and implementing agencies, working also with the project accountant; and (vi) ADB will provide training to the executing and implementing agencies as needed. Together, these measures will effectively mitigate the identified financial management risks.

Disbursement

The STWSP grant proceeds will be disbursed in accordance with ADB's Loan Disbursement Handbook (2017, as amended from time to time). Detailed steps for disbursement are described below:

i. The consultant submits an invoice to PMU;
ii. PMU reviews the invoice and if it is in order, PMU sends it to KFSU with Project Director's endorsement;
iii. KFSU prepares the WA which is endorsed by Secretary MFED then submitted to ADB through Client Portal Disbursement system;
iv. ADB's Controller's Department (CTL) reviews the WA and when it finds the WA in order processes direct payment to the consultants and NGOs;
v. ADB will directly transfer the payment to the consultant's bank account.



ADB = Asian Development Bank; KFSU = Kiribati Fiduciary Services Unit; MFED = Ministry of Finance and Economic Development; MISE = Ministry of Infrastructure and Sustainable Energy; PMU = Project Management Unit; WA = Withdrawal Application; WB = World Bank.

Figure 5 - STWSP Fund Flow Diagram

Before submitting the first withdrawal application, MFED will submit to ADB a letter advising the authority of the person(s) who will approve the withdrawal applications on behalf of the government, together with the authenticated specimen signatures of each authorized person. Individual payments below this amount should be paid by the EA/IA and subsequently claimed from ADB through reimbursement, unless otherwise accepted by ADB.

Accounting

KFSU, through the Project Accountant seconded from MISE/PMU to KFSU, will maintain separate books and records by funding source for all expenditures incurred on the project following cash-based accounting system following the Government's financial regulations. KFSU will prepare consolidated project financial statements in accordance with the

government's accounting laws and regulations which are consistent with international accounting principles and practices.

Auditing and Public Disclosure

The Kiribati National Audit Office will audit the project account annually in accordance with International Standards on Auditing and with the Government's audit regulations.[30] The audited project financial statements together with the auditors' opinion will be submitted in the English language to ADB within six months of the completion of the PDA (for PDA funds), and annually for the project.

The annual audit report for the project accounts will include an audit management letter and audit opinions which cover (i) whether the project financial statements present a true and fair view or are presented fairly, in all material respects, in accordance with the applicable financial reporting framework; (ii) whether grant proceeds were used only for the purposes of the project or not; and (iii) the level of compliance for each financial covenant contained in the grant agreements for the project in accordance with ADB's Loan Disbursement Handbook and the project documents.

Compliance with financial reporting and auditing requirements will be monitored by review missions and during normal program supervision, and followed up regularly with all concerned, including the external auditor.

MFED have been made aware of ADB's approach to delayed submission, and the requirements for satisfactory and acceptable quality of the audited project financial statements. ADB reserves the right to require a change in the auditor (in a manner consistent with the constitution of the borrower), or for additional support to be provided to the auditor, if the audits required are not conducted in a manner satisfactory to ADB, or if the audits are substantially delayed. ADB reserves the right to verify the project's financial accounts to confirm that the share of ADB's financing is used in accordance with ADB's policies and procedures.

Public disclosure of the project financial statements, including the audit report on the project financial statements, will be guided by ADB's Public Communications Policy (2011). After review, ADB will disclose the project financial statements for the project and the opinion of the auditors on the financial statements within 30 days of the date of their receipt by posting them on ADB's website. The audit management letter will not be disclosed.

G.1. Risk Assessment Summary

Key risks have been identified throughout the project preparation phase and measures proposed to minimize or alleviate these risks so that the probability of them occurring is low. These risks relate to long-term financial sustainability, risk of plant failure, management and O&M capacity, water sector coordination, community behavior change, health and safety, wastewater disposal.

G.2. Risk Factors and Mitigation Measures

Selected Risk Factor 1

Description	Risk category	Level of impact	Probability of risk occurring
The project is financially unsustainable.	Financial	High	Medium

Mitigation Measure(s)

- Government commitment to CSO Policy and to tariff reform

[30] The Audit Act 2017 strengthens the powers of the KAO including undertaking of legal recovery actions.

- Government commitment to meet the balance of financial resources needed for ongoing operation of the water supply system
- Implementation of a socially-inclusive and regulated tariff, and community awareness raising activities surrounding tariff implementation
- Institutional strengthening of water sector supported by the project, including e.g. support to PUB in central functions (financial sustainability, billing, asset management etc.)
- Use of long-term performance-based O&M contracts (which will include the setting of targets for non-revenue water)

Selected Risk Factor 2

Description	Risk category	Level of impact	Probability of risk occurring
Plant failure affects the quality and/or quantity of water delivered to residents from the desalination plant.	Technical and operational	High	Low

Mitigation Measure(s)

- Long-term performance-based O&M contracts;
- Design to Australian and International Standards;
- All individual processes incorporate a partial or full standby item;
- Critical spares held onsite;
- Capacity-building of PUB staff.

Selected Risk Factor 3

Description	Risk category	Level of impact	Probability of risk occurring
Due to low capacity, the new water system is not managed, operated and maintained effectively.	Technical and operational	Medium	Medium

Mitigation Measure(s)

- Long-term performance-based O&M contracts
- Institutional strengthening of water sector, including capacity-building of MISE and PUB staff

Selected Risk Factor 4

Description	Risk category	Level of impact	Probability of risk occurring
Due to a lack of coordination, the multiple initiatives being undertaken in the water sector are inefficient or ineffective.	Technical and operational	Medium	Low

Mitigation Measure(s)

- National Infrastructure Development Steering Committee to support high-level coordination and strategy;
- National Drought Committee and National Water and Sanitation Coordination Committee to provide communication and coordination support;
- Expert support to PMU;
- Institutional and community advocacy through the WAP's "Walk the Talk" Program;
- Ongoing consultations between Government and ADB/WB project team;

- Project has been designed in close consultation and coordination with multiple stakeholders and has been designed to continue on from the STSISP (to close in 2019).

Selected Risk Factor 5

Description	Risk category	Level of impact	Probability of risk occurring
The community does not fully participate in the new water supply system.	Social and environmental	High	Low

Mitigation Measure(s)

- Comprehensive and intensive 5-year WAP with heavy involvement in implementation by local CSOs and Government
- Involvement of community to support labor for pipe laying in selected distribution zones
- Project stakeholder participation plan and communications strategy

Selected Risk Factor 6

Description	Risk category	Level of impact	Probability of risk occurring
Health and safety incidents during construction or operation of infrastructure.	Technical and operational	Medium	Low

Mitigation Measure(s)

- Training of PUB staff in occupational health and safety, specific to the new water supply processes and equipment
- Construction and operational health and safety plans and monitoring in place

Selected Risk Factor 7

Description	Risk category	Level of impact	Probability of risk occurring
Brine discharge at the ocean outfall significantly impacts seawater quality or marine species.	Social and environmental	Medium	Low

Mitigation Measure(s)

- All necessary environmental assessments to be undertaken and licenses obtained from MELAD prior to discharge.

Selected Risk Factor 8

Description	Risk category	Level of impact	Probability of risk occurring
Geophysical hazards - earthquakes and tsunamis – damage or destroy the infrastructure. Although potentially catastrophic, the probability of such an event occurring within the project lifetime are exceedingly low.	Social and environmental	Medium	Low

Mitigation Measure(s)

Existing design specifications are adequate for any anticipated impacts. All infrastructure is designed to withstand direct impact of Category D Typhoon.

Other Potential Risks in the Horizon

-

H.1. Logic Framework.

H.1.1. Paradigm Shift Objectives and Impacts at the Fund level[31]

Paradigm shift objectives	
Increased climate-resilient sustainable development	The Project will be a transformational event on Kiribati, providing more than half the country's population with a safe climate-resilient water supply. It will contribute to Kiribati's regulatory framework and policies on climate change and water conservation, enhancing both Government and civil society leadership, capacity and participation, and creating an enabling environment for sustainable climate-resilient development into the future. The solutions developed and implemented in South Tarawa through this project will be applicable to other remote, climate vulnerable atolls with growing populations. Significantly, the project will create a shift in knowledge and practice on how remote island communities in the Pacific and around the world can develop resilience to climate change existential threats to their water supply.

Expected Result	**Indicator**	**Means of Verification (MoV)**	**Baseline**	**Target**		**Assumptions**
				Mid-term (if applicable)	Final	
Fund-level impacts						
M3.0 Reduced emissions from buildings, cities, industries and appliances	M.1.1 Tonnes of carbon dioxide equivalent (t CO2eq) reduced or avoided as a result of projects.	Project reports	0	0	89,434	There is no collapse in price of diesel fuel. Solar production capacity is maintained to meet demand. Several minor assumptions regarding water boiling – see main text
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A.1.1 Number of females and males benefiting from the adoption of diversified, climate-resilient water supply.	Project reports	0	0	62,298 in 2018, 51% female, 49% male	Population growth means number benefitting will actually be higher.

[31] Information on the Fund's expected results and indicators can be found in its Performance Measurement Frameworks available at the following link (Please note that some indicators are under refinement): http://www.gcfund.org/fileadmin/00_customer/documents/Operations/5.3_Initial_PMF.pdf

A2.0 Increased resilience of health and well-being, and food and water security	A.2.3 Number of females and males with year-round access to reliable and safe water supply despite climate shocks and stresses	Project reports	0	0	62,289 in 2018, 51% female, 49% male	Population growth means number benefitting will actually be higher.
A3.0 Increased resilience of intrastructure and the built environment to climate change	A 3.1 Value of physical assets made more resilient to climate variability and change.	Project reports	0	0	$30.3 million	Co-financiers provide indicated support.

H.1.2. Outcomes, Outputs, Activities and Inputs at Project/Programme level

Expected Result	Indicator	Means of Verification (MoV)	Baseline	Target		Assumptions
				Mid-term (if applicable)	Final	
Project outcomes	**Outcomes that contribute to Fund-level impacts**					
M6.0 Increased number of small, medium and large low-emission power suppliers	6.1 Proportion of low-emission power supply in a jurisdiction or market.	PUB reports	27% (5.45 MW of diesel, 1.45 MW of solar: total 6.9MW)	TBD	42% (5.45 MW of diesel, 3.95 MW of solar: total (9.4MW)	There is no collapse in price of diesel fuel. Solar production capacity is maintained to meet demand.
A8.0 Strengthened awareness of climate threats and risk-reduction processes	8.1: Number of males and females made aware of climate threats and related appropriate responses	Project reports	0	0	62,289, of which: 51% female, 49% male	Entire South Tarawa population is reached by the awareness campaigns. Population growth means number benefitting will be higher.
Project/outputs	**Activities that contribute to outcomes**					
1. Strengthening climate resilient, low carbon water infrastructure	1.1 Desalination plant installed	Project repots	0	4000m3/d desalination plant installed	4000m3/d desalination plant installed	No unexpected factors (e.g. global fuel price rise) affect costs. No natural disasters or public health crises that could cause major delay
	1.2 Percentage of physical leakage from water supply network	Project reports	67%	-	25%	
	1.3 Installed capacity of Solar PV (kW)	Project reports	0	2,500	2,500	

2. Institutional strengthening for water supply management	2.1 Desalination plant available capacity (m3/d)	Project reports	0	4,000	4,000	occur during project implementation. Private sector responds positively to DBO contract opportunity. Government provides counterpart contribution on time. International NGOs respond positively to climate change and WASH awareness contract opportunity. Local CSOs fully participate in climate change and WASH awareness program.
	2.2a % compliance of residual chlorine samples at customer connection	Project reports	<80%	-	100%	
	2.2b Number of complaints per 1000 connections	Project reports	TBD	TBD	TBD	
	2.3 Percent of contract disbursements	PMU reporting	0	50%	100%	
3. Outreach and awareness raising	3.1a Communities reached through program outreach	Project reports	0	100	250	
	3.1b Attendance rate of members at regular working group meetings.	Project reports	0	50%	80%	
	3.2 Total (cumulative) number of visits to Visitor education center	Project reports	0	500	1000	

Activities	**Description**	**Inputs**	**Description**
1.1 Construct a desalination plant		Financing – refer Section B.1 Table 1 for summary financing plan Government of Kiribati counterpart contribution (e.g. MISE/PUB technical staff, PUB construction workers, office space, land space) Equipment, machinery and materials – refer Annex B	
1.2 Upgrade and expand water supply network			
1.3 Construct a solar PV plant and system			
2.1 Undertake O&M of desalination plant (5 years)			
2.2 Implement institutional strengthening 2.2.1 Operate and maintain the water supply network, storage and pumping infrastructure through a 5-year PBC 2.2.2 Provide specialist construction oversight and lead quality control efforts during construction 2.2.3 Provide specialist support to PUB in key result areas 2.2.4 Provide vocational training for technical and administration staff and mentoring and training for managers in PUB			
2.3 Implement project and safeguards 2.3.1 Provide technical implementation assistance through consultants 2.3.2 Ensure safeguards compliance			
2.4 Undertake detailed project design (through PDA)			
2.5 Treat water (additional treatment needs due to climate change for 5 years)			

3.1 Implement water conservation and WASH awareness program	
3.2 Construct climate change and water visitor education center	

H.2. Arrangements for Monitoring, Reporting and Evaluation

To be able to measure the mitigative performance (the CO_2 emissions reduced or avoided) of this project, a clear Monitoring and Reporting procedure guiding this project will be agreed between ADB) and the Secretariat, prior to the first disbursement. The monitoring and reporting report will be submitted on annually as part of the annual performance report by the ADB to the GCF.

Monitoring, evaluation, and reporting for the project more generally will follow ADB's Evaluation Policy. The Government is familiar with ADB's processes with respect to M&E and reporting given the ongoing STSISP. The PMU will be responsible for project monitoring and reporting. The PMU will prepare biannual reports on progress, on the current level for all indicators, on the implementation challenges and the financial status. The PMU will appoint one staff member as focal point for monitoring and evaluation (M&E).

Overall responsibility for day-to-day project monitoring and implementation rests with the project manager. The project manager will develop quarterly and annual work plans to ensure the efficient implementation of the project. The project manager will inform the implementing agency and the ADB of any delays or difficulties during implementation, including the implementation of the M&E plan, so that the appropriate support and corrective measures can be adopted. The project manager will also ensure that all project staff maintain a high level of transparency, responsibility and accountability in monitoring and reporting project results. The PMU will organize one independent evaluation at the financial close of the program.

Monitoring activities will take place as follows:

- A detailed project administration manual (PAM) is under preparation setting out the reporting, monitoring and evaluation activities, responsibilities, and budget.
- ADB will undertake two project review missions per year to assess progress of project implementation activities, compliance with covenants and project agreements, and to monitor progress in achieving project outputs and agree on any required modifications.
- ADB will undertake a review midway through project implementation or at any time that ADB and the Government consider it necessary. The midterm review mission will (i) review institutional, administrative, organizational, technical, environmental, social, economic, and financial aspects of the project based on the assumptions and risks included in the design and monitoring framework; (ii) review covenants to assess whether they are still relevant or need to be changed, or waived due to changing circumstances; (iii) assess the need to restructure or reformulate the project and the effects of this on the immediate objectives (purpose) and long-term goals of the project; and (iv) update the project's design and monitoring framework if restructuring or reformulation is necessary or its immediate objectives will change.
- Project implementation will be monitored on an ongoing basis by ADB staff in ADB HQ (Manila) and the South Pacific Subregional Office (SPSO, in Suva, Fiji).
- Within 6 months of physical completion of the project, MFED will submit a project completion report to ADB.

Throughout the life of the project, MFED, as executing entity, will provide ADB with (i) quarterly progress reports in a format consistent with ADB's project performance reporting system; and (ii) consolidated annual reports including (a) progress achieved by output as measured through the indicator's performance targets, (b) key implementation issues and solutions; (c) updated procurement plan; and (d) updated implementation plan for next 12 months.

Specific methodologies for M&E are as follows:

Monitoring and reporting for the project outcomes are outlined as the means of verification in Table H.1.2 above, where progress on each indicator from the baseline to the mid-point and end-point targets for those indicators will be tracked.

For Output 1 - Water supply infrastructure:

1.1 (desalination plant), field verification will be undertaken to monitor the installation and operation of the desalination plant, & the completion certificate submitted to the contractor will be used for verification.

1.2 (water supply network), field verification will be undertaken to monitor the installation and operation of infrastructure (e.g. pipes, pumps) & the completion certificate submitted to the contractor will be used for verification. Reports on non-revenue water submitted to PUB will be reviewed.

1.3. (solar), field verification will be undertaken to monitor the installation of infrastructure (e.g. solar panels) & the completion certificate submitted to the contractor will be used for verification. Power metering data from PUB will also be reviewed.

For Output 2 – Water Supply management:

2.1 (O&M contract desalination), Operations reports produced by the DBO contractor and submitted to PUB will be reviewed. These will contain data on production rates and output water quality.

2.2a (Compliance of water quality) – Samples taken at critical control points in the network will be tested by the network O&M contractor and submitted to PUB. Results will be reviewed.

2.2b (Number of complaints per 1000 connections) – verification will be based on PUB data obtained and supported through the water conservation and WASH awareness program.

2.3 (Contract disbursements) – verification will be based on PMU reported data on contract award and disbursements.

For Output 3 - Outreach and awareness raising:

3.1a (Communities reached through program outreach) – verification will be based on reports submitted by the NGO to the PMU.

3.1b Attendance rate of members at regular working group meetings (cumulative) – as above for 3.1a

3.2 Total (cumulative) number of visits to Visitor education centre – the number of visitors will be tracked by PUB and reported to the PMU.

HH survey on water boiling practices for monitoring mitigation outcomes can be undertaken through the water conservation and WASH awareness program.

I. Supporting Documents for Funding Proposal

A - NDA No-objection Letter

B – Project Preparation Draft Final Report

C - Integrated Financial Model

D - Letter of Commitment for Co-Financing

E - Project Confirmation/Term Sheet

F - Climate Risk and Vulnerability Assessment

G - Environmental and Social Impact Assessment

H - Map of Project Location

I - Timetable of Project Implementation

J - Project Organizational Chart and Roles

K - Justification for GCF Concessionality

L - Household Water Boiling Survey Report

M – Resettlement Framework

N – Gender Action Plan

GOVERNMENT OF KIRIBATI
MINISTRY OF FINANCE AND ECONOMIC DEVELOPMENT
P.O. Box 67, BAIRIKI, TARAWA
Telephone: 686 21806 Ext 212. Fax: 686 21307.

22 February 2018

To: The Green Climate Fund ("GCF")

Re: Funding proposal for the GCF by Asian Development Bank regarding the South Tarawa Water Supply Project

Dear Madam, Sir,

We refer to the South Tarawa Water Supply Project in Kiribati as included in the funding proposal submitted by Asian Development Bank to us on 9 February 2018.

The undersigned is the duly authorized representative of the Ministry of Finance and Economic Development, the National Designated Authority/focal point of Kiribati.

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

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

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

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

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

Yours Sincerely,

Honorable Dr Teuea Toatu
Minister of Finance and Economic Development
National Designated Authority – Green Climate Fund

Environmental and social report(s) disclosure

Basic project/programme information	
Project/programme title	South Tarawa Water Supply Project
Accredited entity	Asian Development Bank (ADB)
Environmental and social safeguards (ESS) category	Category B

Environmental and Social Impact Assessment (ESIA) (if applicable)	
Date of disclosure on accredited entity's website	2018-05-30
Language(s) of disclosure	English
Link to disclosure	https://www.adb.org/projects/documents/kir-49453-001-eia The Environmental Impact Assessment Report contains an ESIA consistent with the requirements for a category B project.
Other link(s)	https://www.adb.org/projects/49453-001/main
Environmental and Social Management Plan (ESMP) (if applicable)	
Date of disclosure on accredited entity's website	2018-05-30
Language(s) of disclosure	English
Link to disclosure	https://www.adb.org/projects/documents/kir-49453-001-eia The Environmental Impact Assessment Report contains an ESMP consistent with the requirements for a category B project.
Other link(s)	https://www.adb.org/projects/49453-001/main
Resettlement Action Plan (RAP) (if applicable)	
Date of disclosure on accredited entity's website	2018-05-30
Language(s) of disclosure	English
Link to disclosure	https://www.adb.org/projects/documents/kir-49453-001-rp
Other link(s)	http://
Any other relevant ESS reports and/or disclosures (if applicable)	
Description of report/disclosure	Resettlement Framework Initial Poverty and Social Analysis
Date of disclosure on accredited entity's website	2018-05-30
Language(s) of disclosure	English
Link to disclosure	https://www.adb.org/projects/documents/kir-49453-001-rf https://www.adb.org/projects/documents/kir-49453-001-ipsa