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IMPLEMENTATION COMPLETION AND RESULTS REPORT

<TF10875 / TF11351 / TF11448 / TF11818 / TFA5560>

ON

GRANTS

IN A TOTAL AMOUNT OF US$11.57 MILLION

TO THE

REPUBLIC OF KIRIBATI

FOR THE

Kiribati Adaptation Program - Phase III Project
June 17, 2019

Social, Urban, Rural And Resilience Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective December 28, 2018)

Currency Unit	AU$
AU $0.7051	= US$1

FISCAL YEAR
January 1 - December 31

Regional Vice President:	Victoria Kwakwa
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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AF	Additional Financing
CBA	Cost-benefit analysis
CAPEX	Capital Expenditure
CAS	Country Assistance Strategy
CC	Climate Change
CCA	Climate Change Adaptation
CET	Community Engagement Team within the PMU
DRR	Disaster Risk Reduction
EIRR	Economic Internal Rate of Return
ENPV	Economic Net Present Value
GoA	Government of Australia
GoK	Government of Kiribati
IA	Implementing Agency
IDA	International Development Association
IRI	Intermediate Results Indicator
ISP	Island Strategic Plan
IVA	Island Vulnerability Assessment
KAP	Kiribati Adaptation Program
KAP III	Kiribati Adaptation Program - Phase III
KRRP	Kiribati Road Rehabilitation Project
LTCSS	Long-Term Coastal Security Strategy
M&E	Monitoring and Evaluation
MELAD	Ministry of Environment, Lands, and Agricultural Development
MFED	Ministry of Finance and Economic Development
MISE	Ministry of Infrastructure and Sustainable Energy, formerly Ministry of Public Works and Utilities
MoHMS	Ministry of Health and Medical Services
OB	Office of the President (*Te Beretitenti*)
O&M	Operation and Maintenance
PDO	Project Development Objective
PMU	Program Management Unit
PUB	Public Utilities Board
RPF	Regional Partnership Framework
SNPD	Strategic National Policy Division of the Office of the President
TA	Technical Assistance
WoIA	Whole of Island Approach

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P112615	Kiribati Adaptation Program - Phase III Project (KAP III)
Country	**Financing Instrument**
Kiribati	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
Republic of Kiribati	Office of the President (Office of te Beretitenti)

Project Development Objective (PDO)

Original PDO

To improve the resilience of Kiribati to the impacts of climate change on freshwater supply and coastal infrastructure.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
TF-10875	3,000,000	2,995,683	2,995,683
TF-11351	5,378,254	5,377,885	5,377,885
TF-11448	1,803,600	1,803,574	1,803,574
TF-11818	900,000	899,996	899,996
TF-A5560	485,308	484,461	484,461
Total	**11,567,162**	**11,561,599**	**11,561,599**
Non-World Bank Financing			
Borrower/Recipient	250,000	250,000	53,000
Total	**250,000**	**250,000**	**53,000**
Total Project Cost	**11,817,162**	**11,811,598**	**11,614,598**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
15-Sep-2011	12-Mar-2012	30-Oct-2014	31-Dec-2018	31-Dec-2018

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
11-Jan-2016	3.56	Change in Results Framework Change in Components and Cost Change in Loan Closing Date(s) Change in Implementation Schedule
03-Aug-2017	6.19	Additional Financing Change in Results Framework Change in Components and Cost Change in Loan Closing Date(s) Change in Implementation Schedule

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Satisfactory	Moderately Satisfactory	Substantial

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	13-Feb-2012	Satisfactory	Satisfactory	0
02	08-Apr-2013	Satisfactory	Satisfactory	1.42
03	11-Nov-2013	Moderately Satisfactory	Moderately Satisfactory	1.82
04	22-Jun-2014	Moderately Satisfactory	Moderately Satisfactory	2.31
05	29-Dec-2014	Moderately Unsatisfactory	Moderately Unsatisfactory	3.37
06	27-Jun-2015	Moderately Unsatisfactory	Moderately Unsatisfactory	3.61
07	14-Dec-2015	Moderately Unsatisfactory	Moderately Unsatisfactory	4.15
08	22-Mar-2016	Moderately Satisfactory	Moderately Satisfactory	4.99
09	22-Sep-2016	Moderately Satisfactory	Moderately Satisfactory	6.22
10	22-Mar-2017	Moderately Satisfactory	Moderately Satisfactory	6.63
11	10-Oct-2017	Moderately Satisfactory	Satisfactory	8.97
12	27-Apr-2018	Satisfactory	Satisfactory	10.67
13	01-Nov-2018	Satisfactory	Satisfactory	11.27
14	23-Dec-2018	Satisfactory	Satisfactory	11.40

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Public Administration	**26**
Other Public Administration	26
Transportation	**6**
Other Transportation	6
Water, Sanitation and Waste Management	**68**
Water Supply	40
Other Water Supply, Sanitation and Waste Management	28

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)
Finance	**13**
Finance for Development	13
Disaster Risk Finance	13
Social Development and Protection	**10**
Social Protection	10
Social Safety Nets	10
Urban and Rural Development	**39**
Disaster Risk Management	39
Disaster Response and Recovery	13
Disaster Risk Reduction	13
Disaster Preparedness	13
Environment and Natural Resource Management	**40**
Water Resource Management	40
Water Institutions, Policies and Reform	40

ADM STAFF		
Role	**At Approval**	**At ICR**
Vice President:	James W. Adams	Victoria Kwakwa
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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

1. ***Country context***. The Republic of Kiribati (population approximately 116,000) is one of the smallest, most remote, geographically dispersed, and climate change-vulnerable countries in the world. Kiribati comprises 32 low-lying atoll islands and one raised limestone island with a total land area of 726 km^2, located in three main island groups (Gilbert, Line, and Phoenix) scattered over 3.5 million square kilometers of the central and western Pacific Ocean. Most of the islands are no more than two meters above sea level and are only a few hundred meters wide. The supply of groundwater (in the form of freshwater 'lenses') is constrained due to the atolls' very narrow land masses, necessitating (sometimes severe) rationing. Increasing salinization of the groundwater lenses due to coastal inundation, compounded by periodic droughts, exacerbates these extreme water shortages. Rainwater, the only source of fresh water, is particularly impacted by droughts that typically accompany the *La Nina* phenomenon and occur approximately every six to seven years. Sea level rise and changes in rainfall and evapotranspiration due to increased temperatures could also impact groundwater supply, resulting in a 19 – 38 percent decline in the thickness of the groundwater lens in Tarawa by 2030. Exceptionally limited freshwater water supplies directly impact human wellbeing.

2. Although Kiribati lies in relatively calm latitudes, the very low width and elevation of the atolls means that almost all land is 'coastal', directly exposing human settlements and infrastructure to coastal erosion and climatic threats. Specific features (spits, channels and ends) of the dynamic and changing shorelines are particularly subject to flooding and inundation during spring tides, storm surges (with an estimated 14-year return period at appraisal), and episodic swell events generated by remote tropical cyclones. These phenomena damage assets and endanger communities, and sea-level rise (currently modelled at 8 - 12 cm by 2036) is expected to increase the frequency and magnitude of these events.[1] Modeling for the capital Tarawa, for example, calculates that for every 10 cm rise in mean sea level, the number of high tides above the destructive 'king tide' level will increase by roughly 10 percent.

3. Kiribati's remoteness and small islands separated by vast oceans causes significant economic challenges. Its geography raises the cost of public service delivery -- leading to an infrastructure gap -- and limits opportunities for private sector development and diversification (with principal exports limited to coconut products and marine products). The country had the lowest per capita income in the region (gross national income per capita of US$2,090 at appraisal) and one of the highest rates of poverty with 22 percent of the population estimated to be in extreme poverty[2] and a further 66 percent of the population estimated at risk of falling into extreme poverty[3].

4. Overall, the impacts of climate change and sea level rise are expected to be especially severe on coastal land and infrastructure, water resources, human health, agriculture, loss of biodiversity, ecosystem degradation and loss of fisheries. The impact of the latter on the national economy would be severe, with exports of marine products accounting for around 10-20 percent of Gross National Product and income from fishing licenses a further 20-25 percent. The *Kiribati Sustainable Development Plan (2008-2011)* identified the fishing and tourism industries as the "backbone and mainstay of the country's future economy". It was estimated that, without continued adaptation, Kiribati could face an estimated US$8 to US$16 million a year (around six percent of annual Gross Domestic Product at appraisal) in climate change-

[1] Modelling available at the time of appraisal estimated that, by 2050, up to 80% of the land in Buariki, North Tarawa, and up to 50% of the land in Bikenibeu, South Tarawa could become inundated by sea-level rise and increasing storm surge, resulting in greater salinity of the water lenses, incremental loss of freshwater supply, damage to buildings and infrastructure, and increasing incidences of diseases and epidemics.
[2] Inequality in Kiribati is relatively low (Gini coefficient of 0.39).
[3] Pacific Regional Partnership Framework Pacific Islands - Regional partnership framework: FY17-FY21. Washington, D.C.: World Bank Group. 2017.

related damages by 2050. Mitigating these impacts would protect incomes and livelihoods of the country's population, including the poor and the bottom 40th income percentile.

5. ***Sector context at appraisal***. The National Adaptation Program of Action, adopted by the Government of Kiribati (GoK) in 2007, identified **saltwater intrusion and coastal zone inundation** as the most relevant climate-related hazards for Kiribati. Water resources and coastal zone management, and community resilience were identified as priorities. To address and minimize these risks, the GoK implemented a multi-year World Bank-supported program known as the Kiribati Adaptation Program (KAP), of which this project (KAP III) is the third phase. The preparation phase (KAP I, 2002-2005) had two major objectives: (i) to mainstream adaptation into national economic planning; and (ii) to prepare a pilot Adaptation Project to reduce Kiribati's overall vulnerability to climate change, climate variability, and sea level rise.[4] KAP Phase II (2006—2011, P089326) implemented a limited number of pilot rainwater harvesting investments in South Tarawa and Banaba, commenced one groundwater abstraction system in North Tarawa, four simplified seawall works in South Tarawa, and Outer Island mangrove planting.

6. ***Higher-level objectives to which the Project contributed***. The KAP was guided by the GoK's priorities articulated in the Kiribati Development Plan 2008–11, and the Bank's broader Pacific Regional Strategy and the Kiribati Country Assistance Strategy (CAS) FY2011-2014 (the first climate change-focused CAS in the Pacific, Report #59355). These documents identified the needs and priorities for Kiribati to respond to its extreme vulnerability to the effects of climate change and natural disasters.

[4] See, for example, Falkland, T. (2005) *Water Resources Investments*. Report for the Government of Kiribati in preparation for KAP II; Kench, P. (2005) *Coastal Protection Measures*. Report for the Government of Kiribati in preparation for KAP II.

Theory of Change (Results Chain)

Problem: Sea-level rise, saltwater intrusion, and drought related to climate change (CC) are exacerbating an already constrained supply of fresh water; coastal erosion, storm surge, and flooding are damaging assets and endangering communities.

<table>
<tr><th>Activities</th><th>Outputs</th><th>Lower Outcomes</th><th>Medium Outcomes</th><th>Long term outcomes</th></tr>
<tr><td>Design and construction of groundwater abstraction systems</td><td>Groundwater abstraction systems installed and operating</td><td rowspan="3">Increase in people with access to improved water sources at community level</td><td rowspan="8">Improve resilience to impacts of CC on fresh water supply</td><td rowspan="12">Program level: Kiribati is resilient to climate change and storm disasters by increasing its fresh water supply and protecting vulnerable coastlines

WBG's Pacific Islands Regional Partnership Framework: Focus Area 3 - Protecting incomes and livelihood by strengthening resilience to natural disasters and climate change</td></tr>
<tr><td>Design and construction of rainwater harvesting systems</td><td>Rainwater harvesting systems installed and operating for drought conditions</td></tr>
<tr><td>O&M training of communities</td><td>Community O&M committees established to manage freshwater resources (1)</td></tr>
<tr><td rowspan="5">Rehabilitation of water transmission main to reduce leakage

Design and construction of replacement secondary distribution network</td><td>Potable water saved through reduced leakage</td><td rowspan="3">Increase in people with access to 24/7 pressurized water</td></tr>
<tr><td>Secondary distribution network completed in pilot zones</td></tr>
<tr><td>Communities reached through water conservation campaign</td></tr>
<tr><td>Leak Detection Unit established and institutionalized in PUB</td><td rowspan="2">Increased readiness to expand 24/7 pilot water network improvement to all of South Tarawa (2) (3)</td></tr>
<tr><td>Infrastructure designs and market analysis for expansion of pressurized water distribution network completed</td></tr>
<tr><td>TA for assessment of coastline risk and island vulnerability</td><td>National coastal management policy framework, Long-Term Coastal Security Strategy, and Island Strategic Plans developed</td><td rowspan="4">Increased people and assets protected from coastal erosion, flooding, and storm damage (5)</td><td rowspan="4">Improve resilience to impacts of CC on coastal infrastructure</td></tr>
<tr><td>Design & construction of seawalls on South Tarawa</td><td>Length of seawalls completed on South Tarawa (4)</td></tr>
<tr><td>Mangrove Planting on Outer Islands</td><td rowspan="2">Length of coastline protected by mangroves</td></tr>
<tr><td>Development of Community-based Mangrove Management Plans</td></tr>
</table>

Assumptions: (1) Communities remain committed to operation and maintenance (O&M)

(2) South Tarawa population is willing to pay for and conserve water

(3) Funding is secured for water network expansion

(4) Contractors available to undertake design and construction

(5) Long-term coastal security strategy is adopted and consistently applied

Project Development Objectives (PDOs)

The PDO was to *improve the resilience of Kiribati to the impacts of climate change on freshwater supply and coastal infrastructure*. It was consistent in the PAD and grant agreements.

Key Expected Outcomes and Outcome Indicators

7. The project's key outcomes were increased supply of fresh water and protected coast lines where high energy waves threatened critical infrastructure assets (on South Tarawa). These were measured with three PDO-level indicators: (a) volume of potable water per day provided; water saved through reduced leakage and wastage, with a target of 190 kiloliters/day[5]; (b) volume of potable water provided from new groundwater sources and new rainwater harvesting systems, with a target of 82 kiloliters per day; (c) length (with a target of 1.6 km) of coastline with vulnerable public and private assets made resilient to the effects of sea-level rise and wave action and extreme and variable weather events to a 25-year design life (Annex 1. Results Framework).

Components

8. The project had four components as summarized below. The actual costs include US$0.87 million of Additional Financing (AF) for scale-up of activities under Components 1 and 3.

Component 1: Improving Water Resource Use and Management (est: US$4.42 million; actual: US$5.39 million) supported the provision of design, civil works, equipment, technical assistance (TA) and community engagement for: (a) installation of groundwater abstraction systems in North Tarawa; (b) leak detection, loss repair, rehabilitation, and expansion of the reticulated water network in South Tarawa, including capacity development of the Public Utilities Board (PUB) and community awareness campaigns; (c) installation of community rainwater harvesting systems on public buildings; and (d) updating the governance and financing model for water resource management.

Component 2: Increasing Coastal Resilience (est: US$2.76 million; actual: US$2.62 million) supported the provision of design, civil works, equipment, TA and community engagement for: (a) investments in long-term shoreline protection in priority, high wave-energy sites on South Tarawa; (b) TA for coastal assessment, improved design, construction, and asset management; and (c) public-community partnerships for planning and implementing mangrove planting on the outer islands.

Component 3: Strengthening Capacity to Manage the Effects of Climate Change and Natural Hazards (est: US$2.15 million; actual: US$2.21 million) supported the project Implementing Agencies (IAs) through the provision of design, civil works, equipment, small grants, and TA for: (a) climate change adaptation (CCA) and disaster risk reduction (DRR) functions of the Strategic National Policy Division (formerly the Strategic Risk Management Unit) in the Office of the President (Office of *Te Beretitenti*, OB*)*; (b) development of a long term coastal security strategy for Kiribati, a national coastal management policy framework, island-level vulnerability assessments and CCA/DRR plans through a 'whole of island approach' (WoIA); (c) international and domestic communication and media activities related to CCA and DRR; (d) climate change website maintenance; and (e) community-led climate adaptation and disaster risk reduction activities financed through the Resilience Fund. The Resilience Fund, called the "disaster fund small grants scheme" for community-level climate change adaptation and disaster risk reduction in the PAD, was rebranded to emphasize the objective and distinguish it

[5] The unit of measure 'kiloliter' (kL) was used in the PAD and the Results Framework. In this document, the equivalent (but more commonly used) measure 'cubic meter' (m^3) will be used in succeeding sections.

from the GoK's existing "Disaster Fund" intended for post-disaster relief and financed by a different development partner, with different governance arrangements.

Component 4: Project Management (est: US$1.47 million; actual: US$1.40 million) supported the establishment and operation of a Project Management Unit (PMU) responsible for project coordination, procurement, financial management, environmental and social safeguards, monitoring and evaluation (M&E).

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

PDO Indicators

9. The PDO and basic components were not changed but some activities were added to components 1 and 3 (consistent with the project's Theory of Change) with the AF scale-up as described under 'Other Changes' below. The three PDO-level indicators and some intermediate results indicators (IRI) were rationalized through a Level 2 restructuring (approved on January 11, 2016) and the AF.

Original Indicator	Revised Indicator and Justification
Volume of potable water per day provided, water saved through reduced leakage and wastage *Target: 190 m^3/day*	Volume of potable water saved through reduced leakage (m^3/day). The change focused on leakages that could be found and repaired along the length of the 30km transmission main. No change to target.
Volume of potable water per day provided from new groundwater sources, and new rainwater harvesting systems *Target: 82 m^3/day*	Disaggregated to new indicators for each type of water source: - Volume of potable water provided from new rainwater harvesting systems. *Target: 6.1 m^3/day* - Volume of potable water provided from new groundwater sources *Target: 21.0 m^3/day* These targets updated appraisal estimates of sustainable water yield based on suitable roof surfaces (for rainwater harvesting) and available land donations (for groundwater abstraction) as verified during implementation. The sites remained unchanged.
Length of coastline with vulnerable public and private assets made resilient to the effects of sea-level rise, wave action, and extreme and variable weather events to a minimum 25-year design life *Target: 1.6 km*	Revised to Length of coastline protected, *Target: 1.2 km* Simplified to measure both engineered and non-engineered solutions (mangrove planting). Target was revised from 1.6 km to 1.2 km to account for two 50-year design life (higher unit costs) seawalls to protect high-value road assets.

10. Under the AF (P163153) and restructuring (Level 2) approved August 3, 2017 changes to the Results Framework included the addition of one PDO indicator: "People provided with access to improved water sources, of which female, urban/rural" (corporate results indicator). One IRI was added to measure the completion of community-led sub-projects under the Resilience Fund (competitive small grants) for adaptation, and an indicator to capture the extension of OB's building to house the Strategic National Policy Division.

Other Changes

11. The AF of US$0.865 million from the Government of Australia (GoA) was provided partly under the Australia - Pacific Islands Partnership Trust Fund (TF A5560, a new trust fund) for an AU$ amount equivalent to US$485,308, and the Pacific Regional Infrastructure Facility in an AU$ amount equivalent to US$380,000 (to the existing TF 11351). It scaled up the project as discussed below.

12. ***Expansion of Design of the Improved Water Supply Pilot Zones*** (Component 1). Technical engineering design and market studies were completed for expanded coverage of the 24/7 pressurized water network to the urban villages of

Betio, Bairiki, and Bikenibeu. When constructed (beyond the scope of KAP III), this would enable more than half of South Tarawa's population[6] to receive more reliable access to potable water. The scale-up in terms of the geographic scope of the design and market studies financed under the project was intended to enable the PUB to bundle the design services, thereby minimizing the costs of mobilizing international and domestic consultants, and ensuring consistency with the network design approaches under the original project.

13. ***Development of a Long-Term Coastal Security Strategy (LTCSS)*** (Component 3). Under the original project, a baseline study and a medium-term coastal management framework and policy were completed. The LTCSS was designed to address the GoK's emerging prioritization of evidence-informed, practical options to ensure long term viability and climate-adaptive strategic investments (by public sector and development partners) to 2050. The Strategy differentiated between the densely populated urban centers (South Tarawa/Betio, Kiritimati Island), and other inhabited outer islands.

14. ***Resilience Fund scale-up*** (Component 3). The scale-up would enable an additional 15 - 60 eligible communities of 10 or more households each, in additional outer islands (initially, the second but highly remote population center of Kiritimati Island) to receive grants of between US$3,750 – US$15,000 (US$8,450 on average) to implement small-scale climate adaptation and disaster resilience sub-projects. The original project's calls for proposals received over 300 applications (mostly for sub-projects to improve access to potable water), of which only the 35 top-ranked across 13 islands could be supported under the original funds.

15. ***Extension of the OB's Building.*** Component 3 funded the architectural design of an extension to the OB's office building to house staff of the OB's Strategic National Policy Division that leads coordination for climate adaptation and disaster risk management. Through the January 2016 restructuring, the closing date was extended by 18 months (from August 31, 2016 to February 28, 2018) to construct the extension of the OB's office and to utilize savings (estimated at US$0.95 million) from favorable exchange rate movements.

16. The August 2017 restructuring provided additional funding for these activities and further extended the closing date to December 31, 2018, for a total of 28 months, to add time to complete the scaled-up activities.

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

17. **Relevance of the PDO is rated High**. The PDO was highly relevant to the country's development priorities and Bank strategies at appraisal (see Section I.A), throughout implementation to closing.

18. The *Kiribati Development Plan (2016-2019)* explicitly identifies climate change as the long-term issue that threatens the sustainability of the country's economic development. KAP III is identified as contributing to the Plan's Key Performance Areas on Environment (coastal resilience) and Infrastructure (protection of water resources and improvement of fresh water supply). Similarly, the *Kiribati 20-Year Vision 2016-2030* (KV20), which is the GoK's overarching framework for all national policies and plans, recognizes the small atoll country's vulnerability to climate change as a key constraint to achieving the desired national outcomes. It emphasizes the national importance of further mainstreaming climate change adaptation and mitigation measures into all sectors and various development programs. The *Kiribati Climate Change Policy* (2018) sets out the importance of security of place, the objective of which is to ensure that "The Republic of Kiribati, her people, culture and economy will remain resilient and viable in facing the challenges of climate change". Priorities in the Policy include: (i) coastal protection and infrastructure; (ii) water security; (iii)

[6] Current figures are from the 2015 population census. Betio: 17,356; Bairiki: 3,177; and Bikenibeu: 7,558 = 28,100 people, projected to increase to 35,300 people by 2025).

environmental sustainability and resilience; and (iv) disaster risk management. Finally, the PDO is consistent with the *Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management (2014-2023)*, the goal of which is to increase resilience through sustainable climate change adaptation and disaster risk reduction using a whole of country approach.

19. The PDO also remains consistent with the World Bank Group's *Pacific Islands - Regional Partnership Framework (FY17-FY21)* [Report #120479] covering nine Pacific island countries including Kiribati (the RPF). It is in line with the RPF's Focus Area 3: Protecting incomes and livelihoods, through its contribution to the achievement of Objective 3.1: Strengthened resilience to natural disasters and climate change. Implementation experience from KAP III is now informing the design of the proposed IDA/ADB co-financed South Tarawa Water Supply and Kiribati Outer Islands Transport Infrastructure Investment Projects.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

The PDO was to improve the resilience of Kiribati to the impacts of climate change on: (a) freshwater supply; and (b) coastal infrastructure. The project substantially achieved all revised key indicator targets (and original targets, where relevant), surpassing several of them. Discussion will be unpacked into two sections.

Outcome 1: *Improving resilience to the impacts of climate change on freshwater supply*

Rating: High

20. Throughout Kiribati, clean, safe drinking water is primarily sourced from thin (usually less than 30m thick), fresh groundwater lenses floating on denser seawater in the aquifer. The lenses are extremely fragile and exist in a delicate balance between the volume of rainfall recharge, and extraction (due to evapotranspiration, discharge to the sea and tidal mixing with the underlying seawater in the aquifer and pumping from individual wells and public water supply systems).[7] Thus, groundwater supply in Kiribati is an inherently limited resource. When the balance of a lens is disturbed by drought or over-extraction, the groundwater becomes brackish and unfit for consumption and agriculture. Coastal inundation and sea-level rise exacerbate the water scarcity. Predicted sea-level rise suggests that Tarawa (home to around 50 percent of Kiribati's population) may have up to 20 percent less groundwater available by 2030.[8]

21. The Kiribati Development Plan recognizes that poor hygiene from inadequate water and sanitation is a key contributing factor to communicable diseases – for example leprosy is still present in Kiribati. Diarrheal disease in vulnerable groups such as pregnant women and children under age five is a chronic problem, with girls more likely to be affected than boys.[9] Kiribati has one of the highest rates of infant mortality in the region with particularly high cases of water-related preventable diseases in Betio and South Tarawa.[10] While about two-thirds of the South Tarawa population is connected to a reticulated water system, water is only supplied up to two hours every other day at very low pressure. In 2012, responding to the poor service levels, Members of Parliament called on the public to stop paying their water bills, particularly for domestic supplies. Although limited service continued to be supplied after 2012, it deteriorated further

[7] About 95 percent of households on outer islands and 65 percent of households in South Tarawa rely on household wells for some of their drinking water requirements. In South Tarawa, the PUB piped water supply is sourced and piped in from two large water lenses in Buota and Bonriki, north of the city.

[8] White, I. (2010) *Tarawa Water Master Plan: Te Ran, Groundwater*. Report prepared for the National Adaptation Steering Committee under Office Te Beretitenti and the National Water and Sanitation Coordination Committee through the Ministry of Public Works and Utilities. Tarawa: Kiribati Adaptation Program Phase II.

[9] Based on the findings of ADB (2014), Economic Costs of Inadequate Water and Sanitation, South Tarawa, Kiribati.

[10] For example, 53 percent of diarrheal disease and worm infestation in 90 percent of school children; skin lesions and rashes in 90 percent of school children; and birth defects from heavy metal contaminated well water.

as PUB was unable to recover even user-charges towards its operating costs. Baseline household surveys conducted by PUB and the PMU Community Engagement Team (CET) in the pilot zones in 2016 found that of the 72 percent with a PUB connection, nine out of ten did not pay for their supply (see Annex 6 for the KAP III Community Engagement Strategy).

22. Through the project, the number of people with access to improved water sources has risen from the baseline of 5,000 people (when this indicator was added in 2017) to **12,780, exceeding the final target of 11,000 by 116 percent**. All IRIs have either been met or exceeded. KAP III improved the resilience of national agencies, communities and households to the impacts of climate change on freshwater supply through four complementary interventions, namely:

a. ***Increasing the sustainable supply and abstraction of groundwater***

- Groundwater extraction using a conventional vertical well can penetrate the thin lens and draw salinity upwards from the underlying seawater. A groundwater abstraction system (or gallery)[11] makes use of a series of perforated horizontal infiltration pipes placed at a shallow depth to skim freshwater from the lens (Figure 1). Under KAP II, the available lenses in most of the islets in North Tarawa had been hydrologically surveyed and a groundwater abstraction gallery located on government-leased land at the Immaculate Heart College was partially installed. Under KAP III, this gallery was completed and improved, and two additional abstraction galleries with associated village-wide reticulation systems were completed. The water is solar-pumped from the abstraction gallery to an overhead tank and gravity-fed to about 16 tap-stands (one per three to four households[12]) throughout each village. The galleries are primarily intended to augment the existing water supplies and provide water security in dry periods. The secondary purpose is to provide access to a source of water with reduced potential pollution levels. (See Annex 7 for photographs and Annex 8 for a map of project investments).

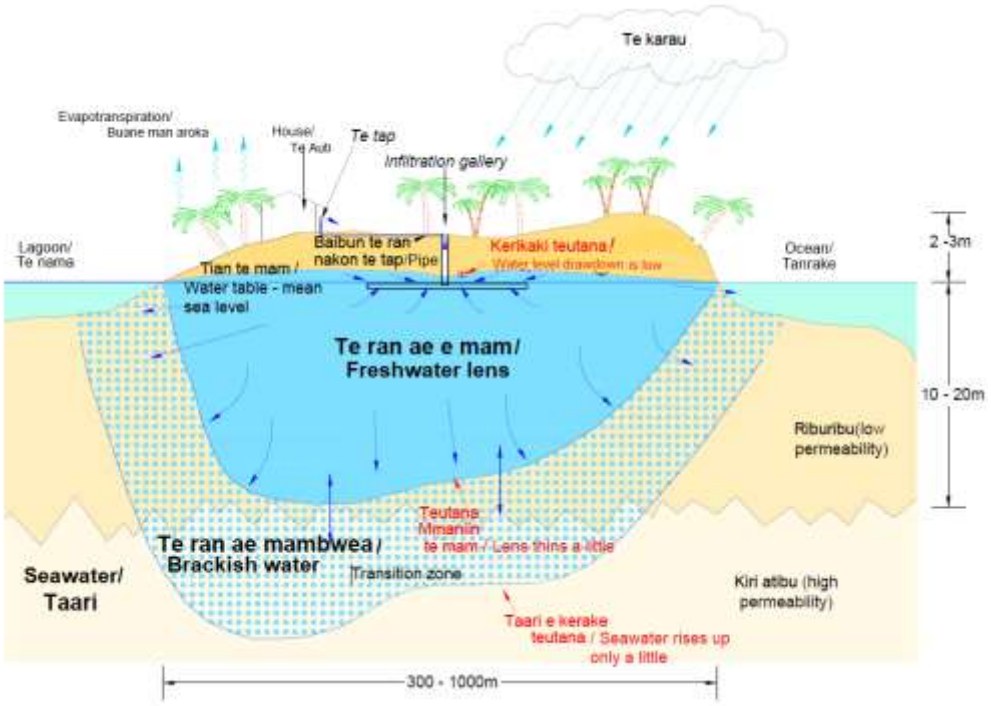


Figure 1. Diagram of a groundwater abstraction gallery[13]

[11] Also known as an infiltration gallery.
[12] Each household has an average of seven people.
[13] Adapted from White et al. 2004.

- By the end of the project, all three planned groundwater abstraction galleries were completed: at the Immaculate Heart College (6 m^3/day yield for around 250 boarding students and teachers and, during droughts, around 900 villagers), in Notoue village (9 m^3/day yield for 890 beneficiaries), and at Tabonibara village (7 m^3/day yield for 310 beneficiaries), for a total supply of 22 m^3/day, exceeding the PDO indicator target of 21 m^3/day. Programs of health and hygiene training for beneficiaries led by the Ministry of Health and Medical Services (MoHMS) as well as O&M training of village-based committees led by the Ministry of Infrastructure and Sustainable Energy[14] (MISE) were initiated by the project and are ongoing[15], ensuring the improved health impacts and sustainability of this freshwater supply. With proper maintenance, the groundwater galleries are expected to be resilient to 60 continuous months of drought, and have a design life of 200 years.
- Importantly, the construction of the abstraction galleries was preceded by around 30 months of a carefully planned and executed community engagement strategy (similarly conducted across all project activities, Annex 6). Participatory planning in each village confirmed all residents' commitment to a village-based system and developed and officially recorded voluntary land use agreements between MISE and affected single and multiple landowners of 19 land parcels amounting to 6,690 square meters. By painstaking, culturally-based negotiated agreement with every landowner (including those based overseas), the project funded the removal of polluting animal pens and ceremonial *babai* (taro) pits to outside the galleries' footprint and paid cash compensation for replacement coconut and pandanus trees. The landowners further agreed that lands within the water protection zone footprint need not be acquired or leased by GoK, so the galleries do not place any additional annual lease payment burden on the national budget.[16]

b. *Increasing freshwater supply from rainwater harvesting*

- Building on the experience gained by the IAs under KAP II,[17] six rainwater harvesting systems were constructed at faith-based public buildings and community halls (*maneaba*) in North Tarawa,[18] taking into account existing available rainwater and well water systems operating in each village. Under KAP III, a further large-scale rainwater harvesting system (the largest in Kiribati with storage capacity of 300,000 liters) was constructed in Buota, North Tarawa. As there were no suitable public buildings in Buota, the project also funded the construction of collection roofs over the tanks, in-line ultraviolet treatment and an on-demand, solar-powered pumping system and associated reticulation and tap-stands to serve the adjacent five villages. The systems were designed to supplement existing water supplies during arid conditions and can supply water for up to 20-year return period droughts.

- By closing, all seven completed rainwater harvesting systems were in use in North Tarawa (see video here: *http://www.worldbank.org/en/news/feature/2017/03/21/adapting-to-life-in-climate-change-hit-kiribati*). The systems have been operating satisfactorily since completion in December 2015[19] (with part of the last year being a period of drought) and are being maintained and utilized by community/village water committees that have been legally registered under the Incorporated Societies Act. Under the original project design, the total increased freshwater supply from both rainwater harvesting and groundwater abstraction was targeted at 82 m^3 (or kiloliters). The target for rainwater harvesting was reduced to 6.1 m^3 in January 2016 to update the appraisal estimate of sustainable water yield, although

[14] Formerly the Ministry of Public Works and Utilities
[15] Including providing for the cost of replacement parts.
[16] Annual compensation payments for leases over land (for public purposes) are high, at three percent of GoK annual expenditures (2016 Budget).
[17] Four rainwater tanks were installed on church and maneaba buildings in South Tarawa.
[18] Locations were: Tabonibara Catholic Church; Tabonibara Maneaba; Taratai Congregational Methodist Church; Nuatabu Congregational Methodist Church; Nuatabu Kiribati Presbyterian Church; and Tearinibai Kiribati Presbyterian Church. Steel-roofed public buildings (churches and *maneabas*) are still relatively uncommon (compared to thatch-roofs) in rural Kiribati.
[19] ISRs mis-state completion in December 2016.

the actual number of sites and size of tanks remained the same.[20] **Together the baseline and project-funded systems yield 6.5 m^3/day, slightly exceeding the PDO indicator target.**

- In addition, through the Resilience Fund for community-led small adaptation grants, a total of 328 rainwater harvesting tanks (ranging from 5,000 to 10,500-liter volume), and 36 solar and Tamana[21] pump systems were installed, providing 14.2 m^3/day to approximately 13,400 people[22] in 70 community groups (minimum of 10 households each) on the 15 most populated of Kiribati's 22 inhabited islands. Each grant ranged from US$3,750 to US$15,000. The initial three public calls for submissions elicited over 300 applications, preliminarily screened for completeness and endorsed by the respective Island Councils. The original project allocated funding for materials to 35 community groups on 13 islands in the Gilberts group of islands (including Tarawa) on a transparent, criteria-linked, highly competitive basis. The Fund was fully committed, and all sub-projects were under implementation by December 2016. Based on unmet demand, and strong implementation progress, the AF provided an additional US$200,000 for the Fund, which doubled the community groups reached. A feature video can be viewed here: *https://www.worldbank.org/en/news/feature/2019/01/31/kiribati-spirit-of-dedication-increases-communitys-resilience-towards-climate-change*.

- The Resilience Fund was administered through a carefully managed, competitive process that rewarded communities that demonstrated: (i) understanding of their exposure and vulnerability; (ii) assessment of alternative options for adaptation; and (iii) willingness to contribute community resources for investment and future maintenance. Community applications for sub-projects required Island Council endorsement and operational support. Construction of the sub-projects was done by communities, but all procurement (and shipping) was centrally managed by the PMU for greater time and cost efficiency, and to overcome the logistical challenges of delivering goods to islands spanning an area of 3.5 million square kilometers. The project also provided basic carpentry and plumbing training, technical supervision, and quality control to communities. **Altogether, additional improved water supply of 42.7 m^3/day is available from groundwater abstraction and rainwater harvesting systems.**

c. *Water network rehabilitation, conservation, and increasing efficiency of supply in South Tarawa*

- Prior to KAP III, PUB did not have the tools, expertise, capacity, or financial resources to quantify losses or undertake repair or leak reduction programs. Large (unaccounted-for) losses and leakages in the South Tarawa water reticulation system were estimated at appraisal, consistent with estimates in the *National Water Resources Implementation Plan – A 10 Year Plan* (November 2008), with at least 50 percent of the major losses likely to be in the secondary network. The original project target was based on reducing losses from 40 percent to 20 percent in pilot secondary network replacement zones.[23] The project supported PUB to undertake systematic field detection of actual losses along the 30-kilometer long transmission main and in-line storage systems (groundwater and overhead tanks). This on-the-job training enabled PUB to establish its Leak Detection Unit with the capacity to make repairs. The Unit (with three full time staff) is now institutionalized, fully funded and monitors the system to ensure the sustainability of South

[20] At the time of appraisal, the available steel roof surfaces (for rainwater harvesting) and land area that would be donated (for groundwater abstraction) was not yet known. Hence, it was not possible to accurately estimate what daily average yield and consumption rate should be targeted to ensure the galleries could be operated sustainably i.e., to provide drinking water under arid conditions with a yield rate of 98% reliability in any given 20-year period. The target was adjusted once these parameters were known.

[21] The Tamana Pump, invented in Kiribati and first used in Tamana Island, but now used internationally, is a simple hand-powered system made using plastic tubes that can greatly reduce water contamination by allowing pumping from closed wells.

[22] Around 12 percent of the national population.

[23] Almost all water reticulation systems experience unaccounted water losses with a 20 percent target being standard.

Tarawa's water supply. By February 2018, losses of **645 m^3/day had been detected and eliminated (out of total network losses[24] of 648 /day), far exceeding the PDO-level target of 190 m^3/day**.[25]

- Replacement of the secondary distribution networks (laying of 4,602 meters of new pipes, installing 438 tap-stands and water meters, and replacing a 20 m^3 storage tank, fittings, and valves) was carried out in nine pilot water supply zones in three villages with introduction of a corresponding "user pays" system to incentivize conservation and trial a basic cost-recovery mechanism for PUB.[26] The new pilot zone systems resulted in the delivery, for the first time ever in South Tarawa, of 24/7 pressurized water (along the entire transmission main), directly benefitting 2,800 people with chlorinated, pressurized, potable drinking water in the pilot zones through 438 individually metered household connections, far surpassing the end target of 180 households. Providing pressurized water 24/7 greatly exceeds the original target to improve water supply from two hours every other day (unpressurized) to three to four hours per day. Pressurizing the entire transmission main was essential to prevent contaminated groundwater from re-entering the network (a recognised source of faecal and virus contamination).

- PUB, as IA for this activity, was highly engaged in all aspects of the rehabilitation of the transmission main and construction of the new secondary distribution network in the pilot zones. PUB took every opportunity offered by the project to build internal capacity including basic asset condition assessment, maintenance and works planning, operational trouble-shooting, hydraulic modelling for possible network expansion, market studies (including household willingness-to-pay, expenditure and post-construction beneficiary impact surveys), geo-referencing all new water meters with an easy-to-use, smart-phone based addressing system in the previously un-addressed villages in order to support the billing and customer-service systems, and implementing a professionally-designed public communications/behavior change campaign for water conservation and the user-pays system. A sample campaign can be viewed here: *(https://www.youtube.com/watch?v=_FvvGtJnzVY)*.

- Under the AF, market studies were conducted, and detailed designs and bidding documents prepared for the three largest urban neighborhoods (Betio, Bikenibeu, Bairiki) for future construction. In the absence of topographical data, unmanned aerial vehicles (drones) were used to gather information to enable expansion of the network design. PUB is actively monitoring water usage and payments with a target of recovering 80 percent of user charges (equivalent to that of the PUB electricity service) and encouraging water conservation. On this basis, PUB is continuing to explore potential measures to improve its outdated and transaction-heavy billing system to make it easier for customers to receive their bills and make payments.

In summary, 645 m^3 of water have been saved from rehabilitation of the transmission main and storage reservoirs. New, 24/7 pressurized water supply in the pilot zones is providing an additional 140 m^3 of water (50 liters/person/day x 2800 people). Combined with the rainwater harvesting and ground water abstraction, additional potable water provided by the project totals 182.7 m^3 or 223 percent of the appraisal estimate of 82 m^3.

d. Supporting stakeholders at national, local, and community levels to manage water resources

- In January 2018, Cabinet made the historic decision to approve a volumetric water tariff for the project-funded pilot water improvement zones in South Tarawa. This decision reversed a long-standing policy that no domestic consumers need pay for water and is a bold recognition that expanded water supply services are only viable if consumers bear at least some cost for their water. The tariff approved for the pilot areas means that consumers have a strong

[24] Losses remaining in some overhead tanks and at the Betio Reservoir will need to be addressed in a future project using more specialized repair methods.
[25] The secondary distribution network was in such a state of disrepair that it is only possible to measure losses in the transmission main.
[26] In part due to the poor pre-project service levels and in part due to political pressure, PUB had been directed by GoK to cease billing for (but still provide) domestic water supplies in 2012.

incentive to conserve water and also shifts PUB's primary accountability to customers for the quality of its water service provision (particularly in terms of pressure and potability to an approved MoHMS standard).

- PUB is now testing its capabilities to manage these new, upgraded water supply services; properly maintain its infrastructure; roll out billing and customer management systems; and encourage water conservation through a tariff structure and awareness activities. Household meters in the pilot zones were provided addresses under the project to ensure unique billing identifiers and enable servicing and maintenance by PUB.

- PUB marketing staff (originally supported by the CET, a communications advisor, and specialist media firm under the project) are providing ongoing monitoring and support to households to help them manage their water use and budget for their water bills. A beneficiary impact survey conducted in the pilot areas six months after construction suggests that access to 24/7 water has transformed the lives of all residents, with particular benefits cited by women and girls, the elderly and people living with a disability. Easier access to water for personal hygiene, and the ability to provide more (clean) water for their families were highlighted as benefits. Improvements in diarrhea and skin conditions (for children under 5 years old) have also been reported in MoHMS surveillance data from clinics in South Tarawa as a whole, which may be partly attributable to commissioning of the clean water supplies in the pilot villages of Tanaea and portion of Eita (February 2018) and Nanikaai (June 2018).

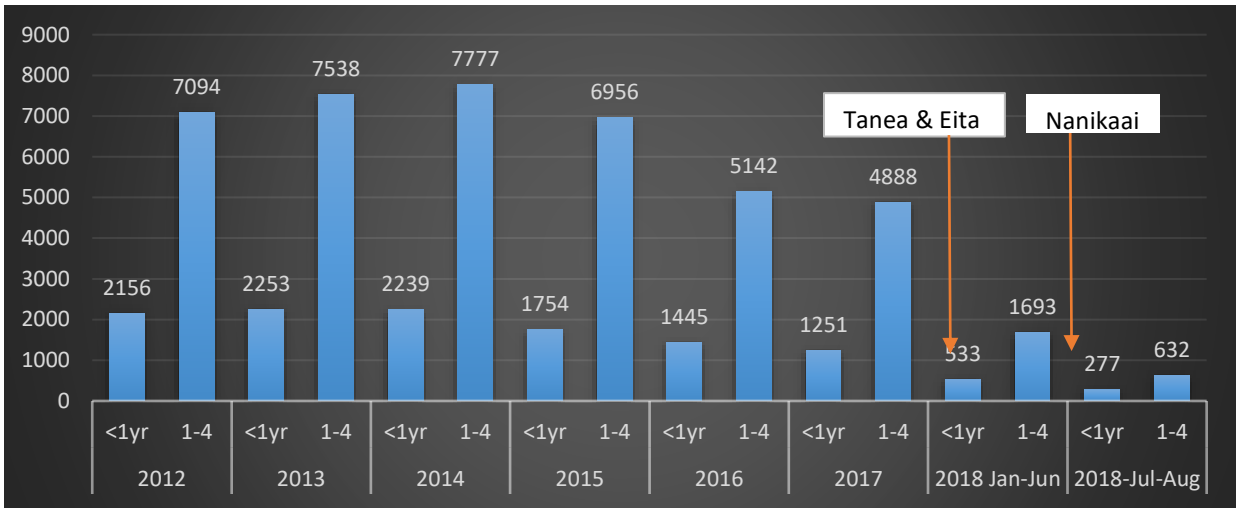


Figure 2. South Tarawa: Incidence of diarrhea cases in infants and children under 5 years old

- In order to ensure sustainable O&M of the groundwater abstraction galleries, the village committees were registered by the Ministry of Women, Youth, and Social Affairs under the Incorporated Societies Act, with constitutions and authority to levy and collect small fees from residents. Sustainability and honoring of the voluntary land agreements by future generations were additionally embedded by using *Te Berita*, a traditional community agreement binding all members to abide by the pledge, entailing a cultural sanction for enforcement. The pledge is literally written in/on stone or concrete and celebrated annually. MISE, which is responsible for water supplies on all islands, has recorded its satisfaction with this new governance model developed under KAP III, and is undertaking steps to draft legislation for similar voluntary water protection zones for future use.

Overall, achievement of the PDO (a) to improve resilience to the impacts of climate change on freshwater supply is rated "high" since all indicator targets have been exceeded (including the one target that was reduced when the project was at 35 percent disbursement).

Outcome 2: *Improving resilience to the impacts of climate change on coastal infrastructure*
Rating: High

23. Due to Kiribati's geography, all infrastructure and human settlements are 'coastal' and directly exposed to coastal erosion and climatic threats. Episodic swells, twice-monthly spring tides, and periodic storm surges cause widespread coastal inundation and destruction. Coastal erosion (particularly on South Tarawa) is associated with settlement pressures and inappropriate land use planning. Approaches tend to be reactive, ad hoc and primarily respond to high existing exposure in a cycle of ongoing deterioration caused by a lack of rigorous understanding of the complex coastal processes at play in different locations. Furthermore, the frequency and magnitude of destructive events that affect human settlements in the atolls are expected to increase due to climate change. The Intergovernmental Panel on Climate Change Assessment Report (2014) estimates a rise in sea levels of 8 - 12 cm by 2036 and calculates 10 percent increase in the number of high tides above the destructive spring tide levels. These processes are further exacerbated by increasing sea surface temperature that is threatening the living reef ecological systems which produce the material that builds up shorelines, and also act naturally to mediate the wave energy reaching the shore.

24. The way in which human settlement interacts with the highly dynamic coastal environments requires management at national, local, and community levels. This was a guiding principle of the two main types of interventions supported by the project, namely seawall construction and mangrove planting.

a. *Investments in engineered and nature-based shoreline protection*

- The project supported detailed coastal risk assessments and engineering studies for nine vulnerable coastal erosion sites on South Tarawa, building on earlier KAP II assessments. Design options were prepared for all nine sites, including protection measures and maintenance needs required for the main road and Bonriki International Airport.[27] These designs met the standards set out in the MISE Shoreline Protection Manual, including climate change effects, prepared and adopted under KAP II. Three seawalls measuring 370 linear meters were completed by the project on South Tarawa. The coastal risk assessment carried out for the whole of South Tarawa as part of the LTCSS concluded that the rock revetment seawalls constructed under KAP III are the only two sections of defense on the island that are likely to have a serviceable life of approximately 50 years, with minimal maintenance requirements. These seawalls protect critical segments of the main road and adjacent water and electricity mains from direct inundation from serious inundation events. The two seawalls are at the south-eastern gateway to a large, 330 ha parcel of state land (Temaiku) identified as suitable for future expansion of South Tarawa and protect the only main road servicing South Tarawa and linking Temaiku to the other main business and administration centers. Importantly, the evolution of seawall design under KAP III was the catalyst for a Pacific Regional Infrastructure Facility research project into cost-effective design options for coastal protection, which has provided guidance for projects across the Pacific.

- Shoreline mangrove plantings - over 35,000 seedlings along 46 segments of coastline measuring 1.005 linear km - were completed by communities in nine Outer Islands, under the training and continuous monitoring of MELAD. At the 46 sites selected by MELAD based on experience implementing nature-based solutions throughout Kiribati, land development pressures have not yet disrupted natural sediment supply processes, so mangroves help to accelerate this process by stabilizing deposited sediments with their tangled root systems. They maintain water quality and clarity, filtering pollutants and trapping sediments originating from land, as well as mitigate the impacts of coastal flooding. The communities protected by the mangrove plantings have an estimated population of 7,330 people.

- Ongoing mangrove awareness-raising, initiated by MELAD under the project, is conducted during Island Council meetings, at village meetings in *maneabas*, and during school visits. Students and teachers tend to the plantings and

[27] Reconstructed under the IDA-funded Kiribati Road Rehabilitation Project and Kiribati Aviation Investment Project.

revegetation as part of their environmental studies. MELAD officers continuously monitor the seedlings, as two years (on average) are needed to reach full viability.

Combined, the engineered and nature-based measures have protected 1.37 kilometers of coastline (above the baseline) for a total of 1.87 kilometers[28], exceeding both the revised PDO-level target of 1.2 kilometers and the original target of 1.6 kilometers. Community-based mangrove management plans have been prepared and adopted under the village development committees and are being implemented to ensure the sustainability of the coastal protection measures on the outer islands.

b.*Supporting national, local, and community-level coastal adaptation and management*

- The project supported the development of Kiribati's first LTCSS, which establishes a coherent framework for managing use of the coast by responsible agencies and communities. Preparation of the LTCSS included an updated coastal risk assessment for highly vulnerable areas in South Tarawa and outer islands, prioritizing GoK assets and documenting locations where coastal hazards (shoreline change and coastal flooding) affect development or culturally important locations. It includes a consistent set of practical tools aimed at breaking the reactionary cycle of GoK or communities funding low-cost, poorly constructed, under-designed seawalls that require frequent maintenance and have led to a huge recurring annual financial commitment for maintenance.

- The LTCSS enables a more coherent cross-sectoral approach, particularly by GoK agencies, to deliver improved coastal resilience and security outcomes by: (a) proposing realistic and practical options for implementation in the medium term (3—15 years), but which are appropriate for a 100-year planning timeframe; (b) enhancing government support structures and governance arrangements to be financially and institutionally sustainable; (c) considering land use needs and demand for both residential settlements/population centers and livelihoods (agriculture, fisheries, commercial and industrial purposes); and (d) addressing and customizing approaches for the different needs of urban South Tarawa and rural Outer Islands. The Strategy presents a comprehensive menu of adaptation and risk-reduction approaches in line with the KV20 and the Kiribati Climate Change Policy and is planned to be presented for Cabinet approval in 2019.

- GoK, under Cabinet direction, adopted a structured approach of identifying hazards, development risks, and potential interventions called the Whole of Island Approach (WoIA). The purpose of the WoIA (referred to as 'locally managed adaptation planning' in the PAD) is to prepare Kiribati for the risks posed by climate change and natural disasters. It focusses the assessment of exposure, sensitivities and adaptive capacity within a sustainable livelihood framework. This includes people's access to natural, infrastructural, human, and financial resources to support their livelihood needs and the institutional structures and processes that influence resource access and use. In line with the WoIA, the project supported preparation of nine Island Vulnerability Assessments (IVAs) and four Island Strategic Plans (ISPs), covering a population of 33,761 and 13,745 people respectively (31 and 12 percent of national population).[29] The ISPs define risks, issues, and development priorities for each island for expenditure planning and directing donor investment. The OB, relevant line ministries, and the Island Councils are continuing the WoIA with the aim of completing ISPs for all 22 inhabited islands.

Justification of Overall Efficacy Rating

25. For PDO (a) on improving resilience to the impacts of climate change on freshwater supply, the project provided a total of 12,800 people (116 percent of the target of 11,000) with access to improved water sources and added an

[28] ISRs under-reported 1.37 kilometers in total, rather than 1.37 kilometers above the baseline.

[29] IVAs were completed for: Abemama, Nonouti, Kiritimati, Tabuaeran, Teraina, Butaritari, Marakei, Tabiteuea North, Maiana (household survey only), and Abaiang. ISPs were completed for: Kiritimati, Tabuaeran, Teraina, and Abemama.

improved water volume totaling 182.7 m^3 or 223 percent of the appraisal estimate. For PDO (b) on improving resilience to the impacts of climate change on coastal infrastructure, the engineered and nature-based protection measures now protect 1.37 km of coastline above the baseline for a total of 1.87 kilometers[30], exceeding both related PDO indicator targets**.** Therefore, achievement of both PDOs is high and the overall efficacy rating is **High**.

C. EFFICIENCY

Assessment of Efficiency and Rating

Rating: Substantial

26. **Economic analysis at appraisal**. Conventional ex ante economic analysis was not applied at appraisal. The PAD recognized the difficulties associated with assessing the impacts of future climate events and project benefits associated with climate adaptation. In addition, the specific scope of some of the activities/investments to be supported by KAP III were not yet fully defined, so associated costs and benefits could not be quantified at appraisal. However, qualitative incremental cost analysis highlighted that without adaptation measures, the combined sea level rise, changes in rainfall and higher temperatures could result in 19-38 percent decline in the thickness of the main groundwater lens in Tarawa and inundation of up to 54 percent of land in some villages in South Tarawa and up to 80 percent in some villages in North Tarawa by 2050.

27. **Economic analysis at ICR**. At completion, additional tests of project efficiency were carried out, as benefits from the investments financed by KAP III in terms of reducing immediate vulnerabilities to climate change and disaster risks have already started to accrue. Cost-benefit analysis (CBA) was undertaken for key investments under Components 1 and 2, which represent 66 percent of the original project costs of US$10.8 million and 60 percent of the revised project cost of US$11.57 million. Investments under Components 1 and 2 that were subjected to CBA comprise 84 percent of the consolidated cost of the two components and 51 percent of the entire project cost. Investments in capacity building and policy advisory support associated with the implementation of Components 1, 2, and 3 were not included, as the benefits of these activities are difficult to quantify and fully attribute to the project. In addition to CBA, cost-effectiveness analysis was applied and assessment of efficiency in the use of resources was likewise carried out. Details are provided in Annex 4.

28. The economic analysis yielded positive results. The Economic Net Present Value (ENPV) for all investments analyzed are positive and the economic internal rates of return (EIRR) are higher than the social discount rate of 6 percent. Sensitivity analysis shows that even if the net benefits had been 20 percent lower compared to the base case, the resulting ENPVs remain positive and the EIRRs of all investments other than Buota rainwater harvesting facility higher than the social discount rate of 6 percent. In the case of Buota rain harvesting facility (with cost of AU $0.5 million), the EIRR is 2.8 percent, as this activity suffered from substantial delays and cost increases due to failure of the original contractor to deliver the output, resulting in PUB completing the works through Force Account.

	Base Case		20% Reduction in Benefits	
Water resilience	NPV (million)	EIRR	NPV (million)	EIRR
Leak detection and rehabilitation program	1. 32	10%	0.51	7%
Water abstraction galleries	3.53	14%	1.73	7%
Rainwater harvesting facilities				
Banaba+ other small RWH facilities	1.38	38%	1.1	20%
Buota	1.63	12%	0.29	2.8%
Coastal Resilience – Seawalls	1.06	10%	0.42	8%

[30] ISRs under-reported 1.37 kilometers in total, rather than 1.37 kilometers above the baseline.

29. These results are conservative, as the analysis was only able to quantify a partial set of benefits due to data limitations. For water resilience projects, other benefits resulting from the reduction in the incidence of water-borne diseases have not been fully quantified in the economic analysis. These include the opportunity cost of school absenteeism among school age population, and estimated value of loss-of-life avoided in the project sites. Likewise, resource cost savings resulting from switching from alternative water supply (e.g., wells, standpipes, vendors, bottled water) to piped water supply have not been quantified due to limited data. For seawalls, other economic benefits that were not quantified include: (a) avoided damage costs on power and water mains; (b) avoided business disruptions due to power and water outages and traffic delays; and (c) avoided disruptions in lifeline and other public services (hospitals and schools). Considering the criticality of the only major road on South Tarawa to the Kiribati economy, these unquantified benefits are expected to be significant.

30. **Administrative efficiency**. Actual administrative cost was US$1.4 million (12 percent of revised budget). This is slightly lower than the 13.6 percent estimate at appraisal. There were no increases in administrative costs although the project was extended by 28 months, indicating efficient use of the administrative budget. Moreover, the share of project management costs in total budget significantly declined from 21 percent under KAP II to 12 percent under KAP III. This reflects to some extent the efficiency gains associated with having procedures and processes established and during the first and second phases of the program. Efficiency gains may have also resulted from the continued capacity building of implementing agencies that had started during the first two phases of the program, as well as a transition to a predominantly nationally-staffed PMU.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

31. The project's overall outcome rating is **Satisfactory**. In view of the formal revision of the operation's key outcome targets through restructuring, the "split rating" method was used, which takes into consideration the (disbursement-weighted) original and revised PDO-level indicators to derive the project's overall Outcome rating. Relevance was rated 'high' and Efficiency rated 'substantial' at project closing.

		Without Restructuring	**With Restructuring (January 2016)**
Relevance of PDO		**HIGH**	
Efficacy (PDO)		**SUBSTANTIAL**	**HIGH**
	Volume of water saved through reduced leakage	High. Original Target=190 m^3; final achieved 645 m^3 (339% of target)	High. Revised Target=190 m^3; final achieved 645 m^3 (339% of target)
	Volume of potable water per day provided from new groundwater (GW) sources, and new rainwater (RW) harvesting systems	Modest. Original Target = GW+RW=82 m^3 Achieved = 42.7 m^3 (52% of target)	High. Targets revised to GW+RW=21 m^3 + 6.1 m^3 = 27.1 m^3. Achieved = 42.7 m^3 + 140 m^3 from new PUB network supply = 182.7 m^3 (223% of *original* target)
	People provided with access to improved water supply	NA. Indicator was added at Restructuring.	High. Target=11,000; Achieved=12,780 or 116% of target
	Length of coastline with vulnerable assets made resilient	High. Target=1.6km; Achieved = 1.87 km. (117% of target)	High. Revised Target = 1.2 km. Achieved=1.87 km (156% of target)
Efficiency		**SUBSTANTIAL**	
1	Outcome ratings	Moderately Satisfactory	Highly Satisfactory
2	Numerical value of outcome ratings*	4	6
3	Disbursement	$3.56 million	US$8.01 million
4	Share of disbursement	0.31 (31%)	0.69 (69%)
5	Weighted value of outcome rating	1.24	4.14
6	**FINAL OUTCOME RATING**	**SATISFACTORY** = 1.24 + 4.14 = 5.38 rounded down to **5**	

*Note: Highly Unsatisfactory (1); Unsatisfactory (2); Moderately Unsatisfactory (3); Moderately Satisfactory (4); Satisfactory (5); Highly Satisfactory (6)

E. OTHER OUTCOMES AND IMPACTS

Gender

32. Stakeholder consultations suggested that problems with the provision of basic services, including water, have a large impact on the lives of the poor and especially on women. Pre-construction baseline household surveys on service usage, needs and priorities were conducted by PUB and the CET in the three pilot water improvement zones in 2016. The surveys found that only 17 percent of households always had sufficient water supply when needed in the past 12 months, 79 percent identified that water pressure had never or not always been sufficient during the same period. Two thirds of households spent more than half an hour a day on water collection tasks (averaging 55 minutes per day) prior to the project's introduction of 24/7 pressurized water. In addition to the time and physical effort spent collecting water, at least one person in the household needed to wait at home during the day to ensure that the family did not miss the short window when PUB water was supplied (two hours every other day prior to the project interventions), significantly limiting opportunities for employment outside the home. The surveys and consultations found that the burden of bulk water collection from community or shared standpipes and shallow wells was generally shared between males and females, but that women tended to be responsible for a larger share of water-related household tasks such as cleaning, washing and caring for infants and elderly family members and spent significant amounts of time fetching well water for these uses.

33. Project reporting on beneficiary numbers was disaggregated by gender, and all consultations were done with men, women, and youth in separate groups to minimize bias in opinions and feedback, and to ensure everyone had a voice outside the traditional authority of the male village elders *(unimane*). Targeted messaging and communication tools for eliciting the voice of children under 18 (a music video can be viewed here: (*https://www.youtube.com/watch?v=alsVsJ5r9h4*) and women were explicitly prepared for the pilot water improvement zones. This was particularly important in the village of Nanikaai where the surveys identified that 30 percent of households were female-headed and in Tanaea where 40 percent of the population was under 18 years old.

Institutional Strengthening

34. Overall, works and goods packages were specifically scaled to the capabilities of the domestic contracting market to increase capacity and market opportunities within the private sector. The IAs had limited staff with experience in contract procurement and management. Throughout the project, pre-bid meetings were run by MISE staff with potential domestic bidders, facilitated by the PMU Program Manager, Procurement Officer and project engineers to familiarize both the IAs and local contactors with reading and pricing bills of quantities, meeting bidding requirements, environmental management requirements, etc. Despite these measures, domestic contractors did not have the capacity to undertake the two large rock revetment seawalls or the water network replacement works. Some of the repair methods required specialized technology, and there was no history of these types of works being carried out in the country prior to KAP III. Several attempts to procure regional contractors failed because of the extremely high logistical costs, low risk appetite of the bidders, and lack of wider market opportunities for contractors in South Tarawa.

35. Eventually, in the case of two of the seawalls, MISE contracted an international contractor (that also undertook the civil works under the Kiribati Road Rehabilitation Project, KRRP) and PUB undertook the pilot water improvement zones works under Force Account with specialized training, hands-on construction supervision and quality assurance provided by the design consultants. In December 2017, three-day training (classroom and fieldwork) was provided by the project team to the PMU, PUB, Kiribati Postal Services and the Kiribati National Statistics Office (ten women and eight men) in establishing a smartphone-based georeferenced addressing system for all PUB customers in the pilot zones and all outer island Resilience Fund investments.

36. Actively implementing their respective sub-components resulted in considerable institutional strengthening of the IAs. In the case of PUB, it enabled twenty staff-members to gain experience and training in planning and undertaking

marketing studies and information, education and communication campaigns, and gain technical skills including network pipe laying, plumbing, and concrete repair. These facilitated learning-by-doing activities were directly relevant to the IAs' ongoing functions as regulators (MISE and MELAD) and operators (PUB) and crucial to the sustainability of the higher service levels achieved in the pilot zones. PUB expressed a high degree of satisfaction with this outcome.

Poverty Reduction and Shared Prosperity

37. Introducing a user pays system will have positive impacts on poor people and vulnerable groups by enabling the sustainable provision of 24/7 pressurized water in South Tarawa. As the only household income data available was the 2005 Household Income and Expenditure Survey, the project supported the PUB and CET to carry out baseline and impact household surveys as well as expenditure diary tracking in the pilot zones in 2016 and 2018. It was found that adults of working age were as likely to be unemployed (22.6 percent) as engaged in productive activity (29.2 percent) in the two months preceding the survey. Furthermore, several households lacked formally registered tenure[31] (particularly high at 66 percent 'caretakers' in Nanikaai). This raised a policy issue as to whether households lacking registered land tenure should be 'recognized' by being provided with an individual water supply. PUB elected to do so on the grounds that water is a basic human right of all Kiribati citizens, that clean water serves to protect the wider community's public health (irrespective of tenure arrangement), and that not doing so would increase the risk of unconnected households illegally tapping into the improved system or burdening newly metered neighbors. The supply of safe water should improve the quality of life of all people in the communities covered by the pilots, while the individual meters and intensive public awareness campaigns about the price of water (measured by bucket) allows lower-income families to manage consumption according to need and ability to pay. The feedback from communities has been overwhelmingly positive although more needs to be done by PUB to make the payment of bills more frequent, predictable and easier. Ongoing community engagement is supporting households to understand their water usage and facilitate budgeting and water conservation.

38. The need to utilize Force Account mechanisms had a positive impact in terms of job creation for communities in the relevant sub-project areas. Local labor was engaged for the secondary water network replacement and the Buota rainwater harvesting works, supporting a total of 5,040 person-days of work (AU$134,396 in wages) and 977 person-days of work (AU$19,358 in wages), respectively.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

39. KAP III was the culmination of a decade-long engagement with GoK to address climate change impacts by strengthening the capacities and abilities of national agencies, local island governments, communities and households to manage risks at their respective levels. Based on joint water sector coordination by GoK across development partners, KAP III was positioned to take on fresh water supply (groundwater abstraction systems, rainwater harvesting), and rehabilitation and replacement of the water reticulation network in South Tarawa. This was appropriate since KAP II had supported hydrological mapping of 18 freshwater reserves in North Tarawa, built rainwater harvesting systems, and had supported the preparation of the water sector national strategy and water master plan for South Tarawa. A set of design

[31] In the case of unregistered caretakers, some households have lodged their sub-lease agreements, but these have not yet been fully processed after some years. Also in the case of unregistered caretakers, some households have not yet submitted their applications for sub-leases to the Land Management Division of MELAD and, in a limited number of cases, have been dealing directly with the original landowners for permission to occupy the plot.

principles and menu of works had been developed under KAP II for coastal protection measures at priority sites. The designs assumed a form of construction that suited MISE's capacity, very limited private sector construction capacity for heavy civil engineering works (at the time of preparation) and were based on a comprehensive review undertaken in preparation for KAP III. Importantly, KAP III was designed to support infrastructure investments in vulnerable sectors, as a means of incrementally building resilience to the impacts of climate change more broadly.

40. Based on lessons learned from KAP II and limited impacts of past water and sanitation sector-wide approaches in Kiribati, the project design recognized the need for day-to-day community engagement across all components. It also recognized that complex and sensitive policy issues, land and asset ownership would need to be addressed to underpin the sustainability of the proposed infrastructure investments. Increased, long-term resources were budgeted at the outset. Building on the KAP II experience, risk mitigation measures were adequately identified.

41. However, a number of issues were less well-identified at the time of appraisal. First, although the PDO was straightforward and focused on two main outcomes, the project design was ambitious in scope and geographic coverage and had a large number of IAs. This resulted in an initial lack of clarity over responsibilities between IAs and, at times, competing demands on the technical advisors supporting the IAs. Second, appraisal did not take adequate account of the significant number of large-scale infrastructure projects that were being prepared simultaneously, and that would lead to a significant burden on the IAs (particularly MISE), during implementation. By October 2014 MISE and PUB were among the three responsible IAs for 24 separate infrastructure projects with total funding in the amount of US$213 million with 10 development partners (including the IDA-funded KRRP and Kiribati Aviation Investment Project). As a consequence, at times KAP III activities were accorded a lower priority due to their relatively small size.

42. Finally, the project required restructuring to rationalize the measurement of the original PDO indicators and IRIs on resilience of freshwater supply. At appraisal, as the available steel roof surfaces (for rainwater harvesting) and land area that would be donated (for groundwater abstraction) were not yet known it was difficult to establish a target. In the case of the leak reduction indicator, the target ultimately proved low owing to the state of disrepair of the transmission main and the secondary network after decades of under-investment.

B. KEY FACTORS DURING IMPLEMENTATION

Factors subject to the Government's/Implementing Agencies' control

43. Key factors contributing to the success of implementation were: (a) purposefully planned and implemented, continuous community engagement to ensure support for the project approaches and interventions; (b) training to manage, operate, and maintain the village- and community-based water supply systems (including minimal user charges to ensure the availability of funds to replace parts); (c) publicly-signed agreements between communities, faith-based organizations, Island Councils and MISE committing to equitable access to water by all during times of drought; and (d) using community/village and Island Council governance structures for guidance and oversight of the O&M committees. The systems have been operating successfully since commissioning of the groundwater abstraction galleries (in October 2017, December 2017 and March 2018) and rainwater harvesting systems on North Tarawa (December 2015).[32] In contrast, many rainwater harvesting schemes supported through other projects are no longer operational because the same level of effort and support has not been given to O&M.

44. During implementation, GoK's appetite developed for more robust, higher-design standard coastal protection structures. This led to higher unit capital cost than was originally budgeted but resulted in three seawalls on South Tarawa that will have less frequent maintenance needs and are sufficient to protect the high value infrastructure assets that were

[32] In the case of the Buota system, due to its more sophisticated technical features, the Public Utilities Board has agreed to operate the system under a joint arrangement with the user communities.

being put in place in parallel under the Bank-supported KRRP. As MISE (through KAP III) had engaged a specialist coastal engineering firm to design coastal works under Component 2, the firm also carried out design at other priority sites.

45. The Resilience Fund was very slow to commence and took over 30 months of dialogue between GoK and the Bank to: (i) define the purpose of the Fund; (ii) agree on transparent eligibility and selection criteria; and (iii) develop robust operating and reporting procedures for decentralized implementation. Implementation progress ramped up with the appointment of a project-funded, competitively selected Resilience Fund Manager with a strong background in local government in Kiribati and a deep knowledge of all the islands. Together with the similarly experienced Program Manager, she was able to adapt Kiribati's established, sound principles of decentralized local government to the Fund's proposed procedures, encourage ownership by the Island Councils to publicize the purpose and criteria for the Fund, and to monitor and oversee the community implementing groups.

46. As the Fund applications were announced in four six-monthly 'rounds', community groups who were initially unsuccessful had the opportunity of applying to later rounds. The centralized procurement and shipping of materials (through the PMU on behalf of the successful communities) was packaged in lots within the capabilities of domestic suppliers that had experience managing unpredictable shipping delays. The Fund was heavily over-subscribed, and the success of its decentralized reach, coupled with strong fiduciary controls, provided the incentive for the GoA to provide AF to scale up the Fund. The publicly announced eligibility and selection criteria made clear that the small grants were not entitlements, but needed to be based on sound participatory planning and the community groups' own understanding of their vulnerabilities.

Factors outside of Government/Implementing Agencies' control

47. A key factor outside of Government control was the supply market for contractors (international and domestic). The remoteness and logistical challenges of operating in Kiribati made it very difficult to complete successful procurement of international or regional contractors, while domestic contractor capacity is very limited. This led to the need to implement two large civil works activities using the Force Account mechanism.

48. For activities where domestic contractors were engaged, significant management was required from MISE, well above the norm, to ensure contractors had fully planned their construction approach, including managing cashflow demands. Cashflow constraints led to termination of one contract (Buota rainwater harvesting), eventually requiring MISE to take over the works under Force Account. Similar constraints were faced with respect to attracting suitably qualified and experienced consultants. The use of firms (that could internally rotate key specialized personnel) and suitably experienced national consultants ultimately proved invaluable to the eventual success of many of the activities.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

49. A conventional M&E approach is not entirely appropriate for climate adaptation / resilience projects. Conventional methods assess what has taken place as a result of an intervention, not what has been prevented (in the case of coastal protection, potential prevention of flooding or asset damage, for example). For KAP III, the original Results Framework emphasized intermediate results and was output- rather than outcome-oriented, and baseline data was not available in some cases.

50. The objectives focused on two key sectors, with measurable indicators for both parts. The indicators selected to monitor progress toward achievement of the PDO correctly reflected defined areas of action and included a relevant mix of qualitative and quantitative targets (where appropriate). In some cases, beneficiary surveys and impact assessment for selected components contributed to the M&E design. Within the project design 'resilience' was taken to be:

a. Resilience of freshwater supply: increase in supply, decrease in losses due to leakage, rehabilitation of the distribution network to efficiently use scarce supply, and incentives (metering and corresponding user-pays system) for conservation.
b. Resilience of coastal infrastructure: understanding of the vulnerability of exposed assets, protection of high-value assets with engineered measures of commensurate design standard, and protection of communities with nature-based measures that can be managed and maintained locally.

51. To the extent that 'resilience' can be taken as encapsulated within the PAD, the IRIs adequately captured the contribution of the project's activities and outputs toward achieving PDO-level outcomes. Nonetheless, the original design of the Results Framework overly emphasized outputs and the inclusion of one or more indicators to capture the behavior change of water users, governance outcomes for sustainability, and adoption of related policies could have strengthened the Results Framework.

M&E Implementation

52. Baseline data for KAP III were collected and analyzed as part of the completion of KAP II. Data collection for the assessment of intermediate outcomes was carried out during implementation through random-sample household surveys and expenditure diaries[33], and an impact assessment for the Resilience Fund sub-projects. Physical outputs for major civil works were regularly monitored by the respective design and supervision engineers embedded in the IAs (particularly for the rehabilitation of the water supply network), and regularly reported to the Bank. The OB, with the support of the PMU, worked with Island Councils and the Ministry of Internal Affairs to monitor the completion of the Resilience Fund sub-projects, and MELAD actively monitored and regularly reported on implementation progress of the outer island mangrove planting activities. All indicators were consistently reported in ISRs, although in some cases under-reported.

53. Weaknesses in M&E design were addressed during the project restructuring as well as the AF. Where indicators were too complex and aggregated multiple outcomes, these were unpacked and simplified. Appraisal estimates were also updated as more information emerged during implementation, and corporate indicators were added where appropriate (Section I.B).

M&E Utilization

54. In general, the findings of M&E were used to inform decision-making, resource allocation and to modify project implementation. The project funded an independent mid-term review (MTR, November 2014) that provided an opportunity for updating the Project Operational Manual and for clarifying the IAs' roles and responsibilities for the different sub-components. The recommendations of the Bank's MTR included: (i) a substantial build-up of human resources in the PMU including hiring a Procurement Specialist for the large number of goods, works and services contracts (in contrast to large infrastructure projects with a limited number of sites and contracts); (ii) for the project-funded Senior Civil Engineer to assist the Program Manager in coordinating with other infrastructure projects; (iii) to engage additional specialist engineering inputs to PUB to achieve a more appropriately scaled and cost effective approach; and (iv) to provide additional expertise and guidance to the CET as the range of project-funded activities evolved from basic community engagement for design and construction, to engagement for establishing sustainable management and

[33] The latest available Household Income and Expenditure Survey for Kiribati was carried out in 2005.

ongoing O&M of investments. These measures enabled a turnaround from problem project status, and contributed to progressive improvements during the last three years of implementation, with a Satisfactory rating at closing for both progress toward achievement of the PDO and implementation.

55. Although aggregate progress reporting by the PMU was not always timely, the PMU submitted regular quarterly reports (written and presentations) to GoK's National Infrastructure Development Steering Committee. Donors (particularly the GoA – Department of Foreign Affairs and Trade represented by the Australian High Commission) were regularly briefed on the outcomes achieved by the project. This led to the GoA providing Additional Financing in the amount of US$865,308, equivalent to approximately 18 percent of their original financing (TF 11351).

Justification of Overall Rating of Quality of M&E

56. On the basis of relatively minor shortcomings in the M&E systems, implementation, and utilization, the overall rating of quality of M&E is **Substantial**.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

Safeguard Compliance

57. *Environmental Safeguards.* The project was correctly classified as Category B and triggered OP 4.01: Environmental Assessment and OP 4.12: Involuntary Resettlement. An Environmental Management Plan (EMP, E2766) was disclosed on February 1, 2011 in the InfoShop. The project was not expected to have long-term direct, induced or cumulative impacts on the environment, just minor disturbances from noise and dust, risks from the use and disposal of hazardous materials, and risks related to excavations and accidents. The project complied with environmental safeguard policies and promoted positive impacts. All civil works contractors and implementing agencies carrying out Force Account works followed the EMPs that formed part of all works contracts. The PMU regularly liaised with MELAD to monitor compliance and address emerging environmental issues. Design reports for the major works such as the groundwater abstraction systems in North Tarawa, the Buota rainwater harvesting system, the shoreline protection works in South Tarawa, and the OB building extension, included an environmental impact assessment to support the license applications. One good practice was that aggregates could be taken only from MELAD-approved sites.

58. *Social Safeguards.* Given that specific project impacts would not be known until implementation, the project used an existing Land Acquisition and Resettlement Policy Framework (RP1137, disclosed in the InfoShop on August 1, 2005), to comply with OP 4.12. Eventually, an Abbreviated Resettlement Action Plan (RP1137) for Component 1 was developed and disclosed on March 1, 2015. OP 4.12 was adequately complied with, and no physical displacement or relocation took place. Impacts involved permission to enter residential and community land, or to temporarily move minor structures to install underground water pipes. Rainwater harvesting systems in North Tarawa involved full consultation and community agreements, with no negative livelihood effects. For the groundwater abstraction systems in North Tarawa, landowners voluntarily provided land for use as water reserve areas. This involved extensive negotiation over approximately two years, and proposed groundwater systems were realigned on two occasions. Landowners were fully compensated for livelihood losses due to removal of trees and plants having economic value. Major structures (water towers and reservoirs, the OB building extension, and the Buota rainwater harvesting system) were built on government-leased land.

Fiduciary Compliance

59. *Procurement.* The PMU complied satisfactorily with the procurement procedures in the Grant Agreements and Procurement Plan. Procurement under the AF was carried out in accordance with the requirements detailed in the applicable Procurement and Consultant Guidelines (May 2004, and revised in October 2006 and May 2010), per the exemption granted by the Chief Procurement Officer from the application of the Procurement Regulations for IPF

Borrowers. Prior review of procurement activities was carried out in accordance with the thresholds established for use in the Pacific and based on the "Overall Procurement Control Risk" for the project, which was rated Substantial at closing.

60. Procurement processing and contractual delays hampered progress early in implementation but improved after the 2016 restructuring. The delays were also, in large part, caused by poor bidder and consultant response due to remoteness of the country, limited understanding of the supply market, and lack of capacity among local suppliers and contractors. These issues resulted in failed bidding processes and the need to utilize Force Account mechanisms for two major civil works activities: (i) the replacement of the secondary water distribution network; and (ii) the Buota rainwater harvesting system.

61. Mitigation measures included intensive implementation support and capacity building and training carried out by the task team, synchronization of procurement plans with design/consultant engineers' targets for civil works procurement, and establishment of a longer-term contractual arrangement for centralized procurement of Resilience Fund materials through an Indefinite Delivery Contract.

62. *Financial Management (FM)* complied with legal covenants at all times. Interim financial reports were submitted on time with the agreed format and content, transactions accounted for and documented adequately, audit reports were submitted on a timely basis with unqualified opinions. Generally, accounting information was up-to-date and reliable, but the Commitments Register was not regularly updated. FM for Force Account works was maintained and effective. However, budget management was weak, requiring considerable Bank oversight.

C. BANK PERFORMANCE

Quality at Entry

63. KAP III activities were largely designed using lessons from KAP I and II. Significant resources were included for community engagement based on the KAP II experience, and these proved essential to the project's success. Capacity building in PUB and MISE was supported by appointing individual engineering specialists long-term in these agencies (as was done previously with MISE under KAP II). Provision was made for specialist design firms in water and coastal engineering to augment the individual technical specialists. A major change in approach was to assume that construction of the water supply network and coastal infrastructure could be done by domestic contractors. There was, however, limited evidence that this was the case, the capacity did not eventuate, and this caused delays in implementation.

64. Whist the need to streamline the number of activities was recognized, DRR and CCA by their very nature involve several sectors and agencies. Agencies involved in KAP II wished to continue their involvement in the follow-on operation, and the project design catered for this. However, the interdependency between the activities implemented by various IAs was limited by design, to enable each to proceed independently.

65. The Bank's preparation team was led by an Environmental specialist and employed a skill mix of coastal and water resource engineering and urban and community infrastructure development specialists. The project concept review was held in June 2010 and the project approved by the Board in September 2011, just under 15 months later.

Quality of Supervision

66. Implementation support missions were regular, timely and solution oriented. The Bank conducted supervision missions semi-annually, supplemented by technical missions, procurement support missions, and FM implementation review missions, which were instrumental in resolving issues. Reporting was of high quality and appropriately candid. Together with the GoA, the Bank rightly identified that AF would enable scale-up of the project's impact, particularly on resilience at the community level, and build on well-functioning implementation mechanisms. This was based on close

coordination and regular dialogue with the Australian High Commission during each mission, including joint site visits to ongoing and completed project activities. The AF (P163153) was prepared in five months, from initiation to approval.

67. The Task Team, consisting of highly experienced disaster risk management specialists, coastal/water resource engineers, urban and community infrastructure specialists, provided global experience in areas pertinent to achieving the PDO. Supervision of fiduciary aspects such as procurement and financial management were also responsive and flexible, with regard to both tendering and disbursement processes. Tender documents were reviewed by the Task Team, whose recommendations were reflected in project implementation. Supervision of safeguards was satisfactory, and no negative social or environmental impacts were identified as a result of project activities.

68. The Task Team made a significant effort to complement constrained fiduciary and technical capacity by providing targeted and specific support to overcome bottlenecks as the project progressed. Missions took a very hands-on approach to training and 'learning-by-doing' for staff of the IAs and the PMU. Despite changes in Task Team Leaders over the first four years of implementation of the project (all based in Washington DC), two specialist team members based in Australia and New Zealand (both with significant prior experience in Kiribati) were closely involved from the initial design to closing. This provided continuity, institutional memory, the ability to undertake just-in-time technical missions and built long-term relationships with the IAs. Fiduciary staff based in Sydney also provided regular implementation support. The remoteness and limited connectivity of Kiribati resulted in high travel costs that required a significant supervision budget.

69. A key factor in improving project performance was the recognition that the nature and size of the project activities fell into a middle tier for which international contractors would not realize sufficient profits to enter the remote and logistically challenging Kiribati market, and for which domestic contractors had insufficient capacity. As a result, greater openness to implementing civil works through using Force Account, supplemented by specialist technical consulting services, led to unintended positive outcomes including considerable capacity building for the IAs, and job creation for local communities. Nevertheless, greater proactivity through an earlier restructuring would likely have improved project performance more rapidly and may not have required the extra 28 months of implementation.

Justification of Overall Rating of Bank Performance

70. The Bank's performance is rated **Moderately Satisfactory**, in recognition that greater proactivity through earlier restructuring could have fast-tracked improvements in implementation progress that took place in the final three years of implementation and may have avoided the need for project extension.

D. RISK TO DEVELOPMENT OUTCOME

71. **Use and maintenance of village water supply systems.** The sustainability risks were mitigated by the considerable effort put into community engagement and establishing arrangements for O&M of the groundwater galleries and rainwater harvesting systems. Also, the strong cultural mores in the North Tarawa villages means the systems will be respected, and the knowledge of their importance and use will be transferred through generations. Similarly, the risks for the Resilience Fund investments in the villages of the Gilberts Groups and Line Islands are low. In contrast, greater social fragmentation in Buota suggests a moderate risk, which is being mitigated through management by PUB who have the technical capacity for long-term O&M. However, as the income they can generate is limited, PUB will require ongoing funding through GoK's contribution to the Community Service Obligation.

72. **Use and maintenance of South Tarawa reticulated water network.** Gaining full political support for user-pays water service will be essential if PUB is to maintain and expand its provision of a high-quality pressurized water service. Should the South Tarawa 24/7 water supply system be expanded, PUB's operating costs will increase, and the need to generate commensurate income will become more critical. Establishing a more efficient and accessible customer billing

and collection system , as well as keeping the high levels of service demonstrated through KAP III, will be key to ensuring PUB's financial viability.

73. **Capacity for sustained operation by PUB.** PUB was directly involved in building the pilot zone networks under KAP III. This has given PUB's workforce, and the newly established Leak Detection Unit, hands-on experience that is relevant to maintaining and extending the system. PUB staff have been field trained consistently over approximately two years. This legacy of capacity building must be maintained, including under new projects, to ensure that the service levels and technical capacities developed under KAP III will enable expansion of the improved water supply beyond the pilot zones. Furthermore, any follow-on operations should be cognizant of and aligned with the water sector strategies and roadmaps developed under the KAP program, to ensure consistency.

74. **The coastal protection works** on South Tarawa were built to a high design standard and should require limited maintenance; however, MISE's capacity to maintain coastal infrastructure is also limited, both in terms of skilled capacity and low level of public finance. Any future programs developed as per the LTCSS should be cognizant of these constraints. The Community-Based Mangrove Management Plans provide for mangrove zone demarcation to enable MELAD to set baseline data for ongoing monitoring and replanting, where necessary.

75. **CCA/DRR Governance and oversight.** Over the course of the project, OB developed and more firmly established its function as the oversight agency for CCA and DRR. While at the start of KAP III, the OB relied on project funding to support staff and carry out their CCA and DRR functions, by the end of the project, several permanent positions were established and filled, and the OB has a clear program of work and priorities on climate change policy and the WoIA. However, the OB is still heavily dependent on donor funds to cover its incremental costs to run and expand these priorities.

76. **Robustness of infrastructure design to uncertainty in long-term climate change scenarios.** Design standards used for the coastal protection and water supply systems utilize the relevant climate change and sea level rise scenarios adopted by the GoK. The designs accommodate some uncertainty in the scenarios, and the systems are sustainable with progressive maintenance and incremental upgrades. Significant divergence over the life of the assets from the scenarios assumed in the design would need to be addressed through additional investment.

V. LESSONS AND RECOMMENDATIONS

77. **Achievement of the project's objectives and sustainability of the outcomes were underpinned by a long-term engagement in the sector.** KAP III activities and, importantly, approaches were designed and implemented based on lessons learned from the first two phases of the program. In view of significant policy reforms supported through the dialogue under the KAP program, the Bank's long-standing relationship with the large number of agencies in the CCA and DRR space proved fundamental to the success of the project.

78. **Purposefully planned and implemented community engagement, tailored to each activity, is fundamental to achieving project objectives.** Strengthening the resilience of agencies, communities and households through the successful implementation and subsequent use and maintenance of public infrastructure such as coastal protection measures and water supplies is best achieved if accompanied by meaningful citizen and community engagement across the project cycle. This does not happen by chance, but requires a carefully planned and managed strategy, tailored to the needs and priorities of different communities (urban/rural, consumers/beneficiaries) and groups within communities (women and girls, men and boys, youth, elderly, low income groups, businesses). Making use of the well-documented 'ladder of citizen participation'[34] KAP III IAs found that meaningful community engagement needs to be able to evolve from information seeking, to semi-commercial behavior change campaigns, to empowering residents and allowing for

[34] Arnstein (1969).

public voice in decision-making and proactively recognizing the needs and priorities of different groups.

79. **In capacity-constrained contexts, project design should be ambitious, but also simple**. With its resources and knowledge, the Bank is well-placed among development partners and should not shy away from projects that attempt transformational change and new approaches involving multiple IAs and wide, dispersed geographic spread. To be successful: (a) project design and subsequent scale-up through AF needs to be carefully focused on a limited number of sectors relevant to national priorities (e.g. the Cabinet- and OB-requested LTCSS); (b) a project-specific, experienced, and well-resourced PMU that understands the local political economy and can forge close, day-to-day working relationships to support (not supplant) IAs is instrumental; and (c) frequent and close Bank implementation monitoring and support are crucial resolve implementation bottlenecks and supplement capacity.

80. **Make use of local institutions and domestic expertise.** Understanding local administration systems, deep and knowledge of local contracting and supplier markets, and attention to detail when preparing annual workplans and packaging contracts all serve to crowd in the expertise and opportunities for cost savings available in local institutions and markets. For example, the Resilience Fund was successfully implemented and scaled up despite remoteness and geographical dispersion, while meeting high fiduciary and reporting standards once the 'rules of the game' were carefully agreed (even though this took time). This was based on the clear communication of eligibility and selection criteria, accompanied by centralized procurement and shipping of materials not available on outer islands, and strong oversight and quality assurance of the community-led activities provided by the project in close alignment with local government/administration systems. Another example was the appropriate contract size and pre-bid training for local contractors that allowed for the eventual completion of 13 of the 16 works contracts by local contractors or (in two instances) by Force Account. Finally, the eventual success of the project was in no small part due to the caliber of national consultants who staffed the PMU and supported the IAs to manage the dispersed activities and rolling community engagement program.

81. **Much can be accomplished with a little.** KAP III was not a large project and IAs were stretched in implementing several other parallel and larger projects. Nevertheless, after early implementation delays the project achieved and, in many cases, exceeded its targets due to the right combination of a few critical factors. For example, PUB was able to provide a reliable, clean, individually-metered water supply after decades of under-investment, despite extremely limited agency resources. PUB showed commitment, ownership, and policy leadership throughout its activities and, after a number of delays, the right combination of high-quality engineering and marketing expertise (international firms embedded within PUB) built up good working relations with PUB staff and community leaders and provided high quality support and knowledge transfer. As well, through 'learning by doing' the PMU supported an incremental approach to unpacking complex problems and formulating bottom-up, field-based solutions across activities (relating to engineering designs, construction management, market research, clear communications with beneficiaries and consumers, and billing and revenue collection methods).

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: Improved resilience to the impacts of climate change on freshwater supply

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
People provided with access to improved water sources	Number	5000.00 31-Jul-2017	11000.00 03-Aug-2017		12780.00 29-Jun-2018
People provided with access to improved water sources - Female (RMS requirement)	Number	2500.00	6000.00		6495.00
People provided with access to improved water sources - rural	Number	3600.00	8400.00		8435.00
People provided with access to improved water sources - urban	Number	1400.00	2600.00		4345.00

Comments (achievements against targets):

Improved water sources that have been constructed through this project include: (i) piped household connections (yard connections), and (ii) community water points (public standpipes distributing water from groundwater abstraction galleries, as well as rainwater collection). This target was Exceeded (116%).

Indicator was added via the Additional Financing approved on August 3, 2017.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Volume of potable water saved through reduced leakage (kiloliters per day)	Text	<5 23-Aug-2011	190 31-Aug-2016		645 22-Oct-2016

Comments (achievements against targets):

Revised to 'Volume of potable water saved through reduced leakage (kiloliters per day)' during the January 2016 Restructuring. The change focused on leakages that could be found and repaired along the length of the 30km transmission main. No change to target of 190 kiloliters/day, which was Exceeded (339%).

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Volume of potable water provided from new rainwater harvesting systems (kiloliters per day)	Text	1 11-Jan-2016	6.1 28-Feb-2018		6.5 11-Dec-2018

Comments (achievements against targets):
This target was Exceeded.

At the time of appraisal, the available roof area that would be suitable for rainwater harvesting was not yet known. Hence, it was not possible to accurately estimate what daily average yield and consumption rate should be targeted to ensure the systems could be operated at a yield rate of 98% reliability over 20 years (including periods of drought). This adjustment was made during the January 2016 Restructuring, once the implementation details were known.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Volume of potable water provided from new groundwater sources (kiloliters per day)	Text	6 11-Jan-2016	21 28-Feb-2018		22 24-Feb-2018

Comments (achievements against targets):
This target was Exceeded.

At the time of appraisal, the available land that would be donated for groundwater systems was not yet known. Hence, it was not possible to accurately estimate what daily average yield and consumption rate should be targeted to ensure the systems could be operated at a yield rate of 98% reliability over 20 years (including periods of drought). This adjustment was made during the January 2016 Restructuring, once the implementation details were known.

Objective/Outcome: Improve resilience to the impacts of climate change on coastal infrastructure

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Length of coastline protected	Kilometers	0.50 23-Aug-2011	1.60 31-Aug-2016	1.20 28-Feb-2018	1.87 06-Nov-2017

Comments (achievements against targets):

During the January 2016 Restructuring, this indicator was simplified to measure both engineered and non-engineered solutions (mangrove planting). Target was revised from 1.6 km to 1.2 km to account for two 50-year design life (higher-standard, higher-unit cost) seawalls to protect high-value road assets.

By November 2017, however, both the original and revised targets were Exceeded (although the ISRs under-reported the length of coastline protected as 1.37 km *including* the baseline of 0.5 km; actual achievement was 1.37 km *over and above the baseline*, for a **total of 1.87 km of coastline protected**).

A.2 Intermediate Results Indicators

Component: Component C1 – Improve water resource use and management

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of groundwater abstraction systems installed and operating in North Tarawa.	Number	1.00 23-Aug-2011	3.00 31-Aug-2016		3.00 24-Feb-2018

Comments (achievements against targets):
Achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
The frequency of water supply of households has increased to more than four hours per day (number of households)	Number	0.00 23-Aug-2011	180.00 28-Feb-2018		438.00 29-Jun-2018

Comments (achievements against targets):
Secondary water distribution network replacement/improvement in South Tarawa provided 24/7 pressurized, metered water supply connections to 438 houses, exceeding not only the target by 243%, but also the service level (24 hours as opposed to 4 hours per day).

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Rehabilitation of distribution network to eliminate leakage (meters)	Meter(m)	0.00 23-Aug-2011	3000.00 28-Feb-2018		4602.00 29-Jun-2018

Comments (achievements against targets):
This target was Exceeded (153%). The distribution network in the Project areas was not only rehabilitated, but rather completely replaced.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Reduction in non-revenue water through provisionof consumer water meters	Number	0.00 23-Aug-2011	180.00 28-Feb-2018		438.00 29-Jun-2018

Comments (achievements against targets):
A water meter was provided at every house (tap-stand) connected to the new secondary distribution network. This target was Exceeded (243%).

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Community-led resilience sub-projects completed	Percentage	35.00 31-Jul-2017	80.00 31-Dec-2018		100.00 31-Aug-2018

Comments (achievements against targets):
This indicator was Exceeded.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

Baseline health statistics (eg. reported diarrhea cases) disseminated to communities through WASH training (number of communities in each six month interval)	Number	0.00 23-Aug-2011	6.00 28-Feb-2018		6.00 16-Mar-2018

Comments (achievements against targets):
This target was Achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of water utilities that the project is supporting	Number	0.00 23-Aug-2011	1.00 31-Aug-2016		1.00 22-Mar-2016

Comments (achievements against targets):
This target was Achieved.

Component: Component C2 – Increase coastal resilience

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Coastline asset condition	Text	Nil	100		100

assessment is completed and documented for all major non-government assets along the South Tarawa coastline (percentage of shoreline)		23-Aug-2011	31-Aug-2016		27-Sep-2017

Comments (achievements against targets):
This target was Achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Government coastal asset management condition assessment are maintained (percentage of shoreline)	Text	Nil 23-Aug-2011	100 31-Aug-2016		100 27-Sep-2017

Comments (achievements against targets):
This target was Achieved.

Component: Component C3 - Strengthen the Capacity to Manage the Effects of Climate Change and Natural Hazards

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

National Key Performance Indicators on Climate Change Adaptation and Disaster Risk Management are developed, applied and reported.	Text	Nil 23-Aug-2011	KPIs are fully reported publicly 28-Feb-2018		KPIs are fully reported publicly 26-Jun-2018

Comments (achievements against targets):
This indicator was Achieved.

Key Performance Indicators on Climate Change Adaptation and Disaster Risk Reduction were developed under the Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management (KJIP). The KJIP is being implemented through 12 strategies, with clearly defined results, performance indicators and prioritized actions outlined in the action matrix.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Functional plans (under the Disaster Management Plan) relevant to public health and potable water are established and operational (number)	Text	Nil 23-Aug-2011	3 Sector Plans Operating 28-Feb-2018		3 Sector Plans Operating 18-Dec-2018

Comments (achievements against targets):
This indicator was Achieved.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Population, for which Locally Managed Adaptation Plans are developed, finalized and being implemented.	Percentage	0.00 23-Aug-2011	33.00 31-Aug-2016		31.00 31-Dec-2018

Comments (achievements against targets):
In line with the 'Whole of Island Approach', the project supported preparation of nine Island Vulnerability Assessments and four Island Strategic Plans, covering a population of 33,761 and 13,745 people respectively (31 and 12 percent of national population).

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
The Office of the President's building extension to house government services for disaster risk management and climate change adaptation is built and used	Yes/No	N 31-Jul-2017	Y 31-Dec-2018		Y 17-Jan-2018

Comments (achievements against targets):
This indicator was Achieved.

B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1: Improve resilience to impacts of climate change on fresh water supply	
Outcome Indicators	1. People provided with access to improved water sources 2. Volume of potable water saved through reduced leakage 3. Volume of potable water provided from new rainwater harvesting systems 4. Volume of potable water provided from new groundwater sources
Intermediate Results Indicators	1. Number of groundwater abstraction systems installed and operating in North Tarawa 2. The frequency of water supply of households has increased to more than four hours per day (number of households) 3. Rehabilitation of distribution network to eliminate leakage 4. Reduction in non-revenue water through provision of consumer water meters 5. Community-led resilience sub-projects completed 6. Baseline health statistics (e.g. reported diarrhea cases) disseminated to communities through WASH training (number of communities in each six-month interval) 7. Number of water utilities that the project is supporting
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	1. Three groundwater abstraction systems installed and operating in Tabonibara, Notoue, and Immaculate Heart College, supplying 22 m^3/day of potable water. 2. Eight rainwater harvesting systems installed and operating in Tabonibara Catholic Church; Tabonibara Maneaba; Taratai Congregational Methodist Church; Nuatabu Congregational Methodist Church; Nuatabu Kiribati Presbyterian Church; Tearinibai Kiribati Presbyterian Church, Banaba, and North Buota, supplying 6.5 m^3/day of freshwater. 3. Rainwater harvesting tanks (#328), Tamana pumps (#35), and solar pumps (#1) installed under the Resilience Fund, contributing 14.2 m^3/day freshwater reaching 68 communities and approximately 13,400 people in Abaiang, Abemama, Aranuka, Betio, Butaritari, Kiritimati Island, Kuria, Maiana, Makin, Marakei, Nikunau, Nonouti, North Tarawa, South Tarawa and Tamana islands. 4. Community O&M (WASH) committees established to operate and maintain the freshwater supply systems (North Buota also assisted by PUB).

	5. 645 m^3/day of potable water saved through repair of leaks in the PUB South Tarawa transmission main and tank storage systems. 6. Secondary water distribution networks replaced (4,602 m) in three pilot villages in South Tarawa (Tanaea, Tebikenikora Eita, and Nanikai) supplying pressurized water 24/7 to 438 households (with water meters) water or 2,800 people (average supply 50 ℓ/person/day). 7. A Leak Detection Unit is permanently established and funded in PUB to manage future leaks and network maintenance. 8. Designs, camera ready construction documents, and implementation details, are prepared to expand the pressurized water distribution network into the major urban areas of Bikenibeu, Bairiki, and Betio.
Objective/Outcome 2: Improve resilience to impacts of climate change on coastal infrastructure	
Outcome Indicators	1. Length of coastline protected
Intermediate Results Indicators	1. Coastline asset condition is completed and documented for all major non-government assets along the South Tarawa coastline (percentage of shoreline). 2. Government coastal asset management assessments are maintained (percentage of shoreline).
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	1. 1.37 km of coastline protected (above the baseline), comprising 0.37 km rock revetment or concrete gravity structures in South Tarawa and 1.00 km of mangroves in Abaiang, Abemama, Nonouti, Marakei, Tabiteuea North, Kuria, Beru, and Onotoa islands. 2. Long-Term Coastal Security Strategy (LTCSS) based on completed coastline asset condition and risk assessments, developed for South Tarawa and Outer Islands. 3. Nine Island Vulnerability Assessments (IVAs) and four Island Strategic Plans (ISPs) completed, covering a population of 33,761 and 13,745 people (31 and 12 percent of national population) respectively.

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Emilia Battaglini	Task Team Leader
Shyam KC	Disaster Risk Reduction Specialist
Nathan Hale	Team Assistant
Anil Somani	Environmental Safeguards Specialist
Nanda Gasparini	Social Safeguards Specialist
Olivia Warrick	Climate Change Adaptation Specialist
Richard Croad	Water Resources & Coastal Resilience Specialist
Colleen Gollach	Urban & Community Infrastructure Specialist
Tobias Haque	Economist
Miriam Witana	Procurement Specialist
John Nyaga	Sr. Financial Management Specialist
Thao Le Nguyen	Sr. Finance Officer
Supervision/ICR	
Artessa Saldivar-Sali	Task Team Leader
Shyam KC	Task Team Leader
Denis Jean-Jacques Jordy	Task Team Leader
Emilia Battaglini	Task Team Leader
Eric Leonard Blackburn	Procurement Specialist
Stephen Paul Hartung	Financial Management Specialist
Colleen Gollach	Urban & Community Infrastructure Specialist
Richard Croad	Water Resources & Coastal Resilience Specialist
Wolfhart Pohl	Environmental Specialist
Matthew Halsey	Social Development Specialist

Ann McLean	Social Development Specialist
Penelope Ruth Ferguson	Environmental Specialist
Miriam Witana	Procurement Specialist
Nicholas John Valentine	Environmental Specialist
Craig Andrew Clark	Social Development Specialist
Joyce Onguglo	Social Development Specialist
Marilyn Martinez	Economist

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY09	4.250	24,882.41
FY10	8.100	58,031.97
FY11	17.388	160,778.95
FY12	.225	23,056.09
Total	**29.96**	**266,749.42**
Supervision/ICR		
FY12	19.100	186,907.11
FY13	16.333	224,799.61
FY14	11.888	135,785.92
FY15	10.300	111,899.06
FY16	8.872	137,088.35
FY17	7.050	152,404.30
FY18	.725	43,490.82
FY19	.025	26,169.10
Total	**74.29**	**1,018,544.27**

ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US$M)	Actual at Project Closing (US$M)	Percentage of Approval
Component C1 – Improve water resource use and management	**4.42**	5.39	1.22
Component C2 – Increase coastal resilience	**2.76**	2.62	0.95
Component C3 - Strengthen the Capacity to Manage the Effects of Climate Change and Natural Hazards	**2.15**	2.21	1.03
Component C4 – Project Management, Monitoring & Evaluation	**1.47**	1.40	0.95
Total	**10.80**	**11.62**	**1.08**

ANNEX 4. EFFICIENCY / ECONOMIC ANALYSIS

1. **Economic analysis at appraisal.** Conventional ex ante economic analysis was not applied at appraisal. The PAD recognized the difficulties associated with assessing the impacts of future climate events and project benefits associated with climate adaptation. In addition, the specific scope of some of the activities/investments to be supported by KAP III were not yet fully defined, so associated costs and benefits could not be identified and quantified at appraisal. However, qualitative incremental cost analysis was applied, highlighting that without adaptation measures, the combined sea level rise, changes in rainfall and higher temperatures could result in 19-38 percent decline in the thickness of the main groundwater lens in Tarawa and inundation of up to 54 percent of land in some villages in South Tarawa and up to 80 percent in some villages in North Tarawa by 2050.

2. **Economic analysis at ICR.** At completion, additional tests of project efficiency were carried out, as benefits from the investments financed by KAP III in terms of reducing immediate vulnerabilities to climate change and disaster risks have already started to accrue. Cost-benefit analysis (CBA) was undertaken for key investments under Components 1 and 2, which represent 66 percent of the original project costs of US$10.8 million and 60 percent of the revised project cost of US$11.57 million. Investments under Components 1 and 2 that were subjected to CBA comprise 84 percent of the consolidated cost of the two components and 51 percent of the entire project cost. Investments in capacity building and policy advisory support associated with the implementation of Components 1, 2, and 3 were not included, as the benefits of these activities are difficult to quantify and fully attribute to the project.

Component 1:

A. ***Leak detection and rehabilitation / network expansion***

3. *Quantifiable economic costs.* Costs include capital expenditures (CAPEX) and operation and maintenance (O&M) costs. CAPEX in the total amount of A$3.5 million include costs of consultancy services, civil works and goods incurred in the conduct of systematic leak analysis and rehabilitation of the 30- kilometer transmission line and in-line storage systems. Based on project studies, the annual O&M cost is estimated to be in the amount of A$11,966 per year. Financial costs were adjusted removing actual taxes and duties, which account for one percent of CAPEX. The analysis applied a 6 percent social discount rate.

4. *Quantifiable economic benefits*. The extent and nature of physical losses throughout the water network of Public Utilities Board (PUB) were largely unknown but believed to be significant. These “unknown” losses contributed to water rationing among households currently connected to PUB. Households only receive water two hours every 48 hours. Due to insufficient supply, they also use alternative sources of water including contaminated rainwater and water from shallow wells, which are generally unfit for human consumption. Without the project, that is, absence of any interventions to reduce leaks, the existing network is expected to continue to deteriorate and will supply inadequate amount of water to households. With the project, PUB is able to “save” physical water losses in the amount of 645 m^3 per day. As a result, a total of 438 households in three pilot sites are now enjoying pressurized piped water 24- hours a day and is assumed to continue receiving such benefit over a 20- year period.

5. The streams of economic benefits of the leak reduction and rehabilitation program that were identified and quantified for this analysis include:

Table 1: Leak Reduction and Rehabilitation of PUB Network: Streams of Economic Benefits	
Economic Benefits	Measurement and Assumptions
Economic value of "saved" water	The value of water "saved" is computed as consumers' willingness-to-pay (WTP) for piped water (A$1.1 per m^3)[35] times the amount of "saved" water per year.
Avoided health treatment costs associated with water-borne diseases	The availability of improved supply of water is expected to result in the reduction in or elimination of the use of contaminated water. This is turn, is expected to reduce the incidence of water-borne diseases, which is very high in South Tarawa. A study[36] on the economic cost of inadequate water and sanitation in South Tarawa showed that 1 in every 2 persons (50% of population) suffer from water-borne diseases. For the economic analysis, it is conservatively assumed that 1 in every 4 persons (25%) suffer from water-borne diseases. With the project, it is expected that the incidence of water-borne diseases will be reduced and therefore households will be able to avoid incurring health treatment costs. For this analysis, the value of avoided health treatment cost is computed as the average treatment cost per person (A$18.2 per person[37]) x estimated share of the beneficiary- population who suffer from water-borne diseases (25% of total).
Avoided economic productivity losses	Avoided productivity losses of patients is computed as opportunity cost of time (A$4.07/hour[38]) multiplied by the number of lost time due to sickness (120 hours) multiplied by the beneficiary population who suffer from water-borne diseases (25%) and who are of working age (61%).

6. *Results*. The ENPV and EIRR were computed based on the estimates of the stream of economic benefits and costs over a 20-year period. Results show that the ENPV is positive at A$1.32 million. The EIRR is 10 percent, which is higher than the social discount rate of 6 percent. Sensitivity analysis shows that if the net benefits had been 20 percent lower compared to the base case, the resulting ENPV remain positive at A$0.51 million and the EIRR of 7 percent is slightly higher than the social discount rate.

7. Other benefits resulting from the reduction in the incidence of water-borne diseases have not been fully captured in the economic analysis. These include the opportunity cost of school absenteeism among school age population, and estimated value of loss-of-life avoided in the project sites. Likewise, resource cost savings resulting from switching from alternative water supply (e.g., wells, standpipes, vendors, others) to piped water supply have not been quantified due to limited data. The actual benefits of the PUB leak reduction program would therefore be larger had all these streams of economic benefits been quantified.

B. ***Groundwater Abstraction Galleries***

8. *Quantifiable economic costs.* Costs include CAPEX and O&M. The total actual CAPEX for the construction of water abstraction galleries amounted to A$1.076 million. O&M cost is estimated to be A$6,863 per year based on KAP-III technical studies. Financial costs were adjusted to remove actual taxes and duties, which account for 8 percent of total CAPEX. The physical life of the galleries is 200 years. The economic analysis was conducted over a 30-year period. This

[35] Computed, data from KAP III survey results
[36] ADB study
[37] recalculated, ADB study
[38] Calculated based on the reported average monthly income of household heads in KAPIII pilot sites.

means that the galleries have significant residual/salvage value on the 30th year. The social discount rate applied is 6 percent.

9. *Quantifiable economic benefits*. The economic benefits of building water abstraction galleries primarily come from the economic value of water yields.

Table 2: Groundwater Abstraction Galleries- Streams of Economic Benefits	
Economic Benefits	Measurement and Assumptions
Economic value of water yields from the galleries	The value of water yields from abstraction galleries is computed using a proxy value for the price of water, i.e., cost of buying water from rainwater harvesting facilities (A$0.04 cents/ liter[39]) multiplied by the amount of water abstracted from the galleries per year
Avoided health treatment costs associated with water-borne diseases	The value of avoided health treatment cost is computed as the average treatment cost per person (A$18.2 per person[40]) x estimated share of the beneficiary-population who suffer from water-borne diseases (25% of total).
Avoided economic productivity losses	Avoided productivity losses of patients is computed as opportunity cost of time (A$4.07/ hour[41]) multiplied by the number of lost time due to sickness (120 hours) multiplied by the beneficiary population who suffer from water-borne diseases (25%) and who are of working age (61%).

10. *Results*. Results yield a positive ENPV of A$3.53 million and an EIRR of 14 percent. When sensitivity analysis was applied by reducing 20 percent of benefits, the resulting ENPV remains positive (A$ 1.73 million). The EIRR of 7 percent is still higher than the social discount rate.

C. ***Rainwater harvesting facilities***

11. The project financed funded the construction of seven rainwater harvesting systems in North Tarawa, which have a combined yield of 6.5m^3 per day, which . The total CAPEX amounted to A$1.06 million while OPEX at A$552 per year. The economic benefits are as follows:

Economic Benefits	Measurement and Assumptions
Economic value of water yields from rainwater harvesting facilities	Value of water yields from rainwater harvesting = proxy value for price of water, i.e., cost of buying water from existing rainwater harvesting facilities (A$0.02 cents/ liter[42]) times the amount of water supplied from rainwater harvesting facilities.
Avoided health treatment costs	The value of avoided health treatment cost is computed as the average treatment cost per person (A$18.2 per person[43]) x estimated share of the beneficiary-

[39] The cost per bucket of 10 liters of water range from 20-50 cents. The analysis assumes the minimum cost of $A0.20 per bucket or A$0.04 per liter.
[40] recalculated, ADB study
[41] Calculated based on the reported average monthly income of household heads in KAPIII pilot sites.
[42] The cost per bucket of 10 liters of water range from 20-50 cents. The analysis assumes the minimum cost of $A0.20 per bucket or A$0.04 per liter.
[43] recalculated, ADB study

associated with water-borne diseases	population who suffer from water-borne diseases (25% of total).
Avoided economic productivity losses	Avoided productivity losses of patients is computed as opportunity cost of time (A$4.07/ hour) multiplied by the number of lost time due to sickness (120 hours) multiplied by the beneficiary population who suffer from water-borne diseases (25%) and who are of working age (61%).

12. *Results*. Results show that for Banaba and other small rainwater harvesting facilities, the ENPV is positive at A$1.38 million and the EIRR is 38 percent. When sensitivity analysis was applied by reducing 20 percent of benefits, the resulting ENPV remains positive at A$1.1 million). The EIRR of 20 percent is still higher than the social discount rate. In the case of Buota, which suffered from delays and time costs associated with failure of contractor that led PUB to assume work through Force Account, the ENPV is positive at A$1.63 million and EIRR of 12 percent is higher than the hurdle rate of 6 percent. However, when sensitivity analysis was conducted, a 20 percent reduction in benefits would bring the ENPV to A$0.29 million. The EIRR is 2.8 percent, which is lower than the social discount rate of 6 percent.

Component 2

13. Under Component 2, the project financed the design and construction of 3 seawalls with a total length of 0.3 kilometers. The seawall primarily protects a critical segment of South Tarawa's main road, water and electricity transmission mains from damages associated with coastal erosion, surges, and inundation due to high (king) tides. The South Tarawa main road is the only road that provides access and connects around half of the country's population to all essential economic and social services including education, health, and markets. Protection of this segment is therefore vital to the country's economic growth and poverty reduction efforts.

14. The economic analysis used very conservative assumptions given limited data availability. Quantifiable costs include CAPEX amounting to A$2.2 million (US$1.58 million) and annual O&M cost is assumed to be 0.5 percent of total investment cost. Actual value added taxes share only 0.3 percent of the total project cost. The cost-effective design of the seawalls allows for lower O&M costs. Physical life of the seawalls is 50 years with adequate maintenance. Economic life of the investment is 40 years. The social discount rate applied in the analysis is 6 percent.

15. *Scope of economic analysis*. The quantification of benefits focused on the impact of the construction of seawalls in protecting the critical segment of the road asset (Temaiku Road with length of 6.1 kilometers) and its proper and efficient functioning. This is conservative, as the adverse impact of travel delays and disruptions in this particular segment may also have negative effects on other segments of Kiribati's one and only road network. In terms of direct area of impact, i.e., requiring replacement in case of asset failure, the analysis assumes only the portion of the road (0.3 kilometers) that is directly protected by the seawall.

16. *Without and without project scenario*. If the seawalls were not constructed, it is expected that the road asset would face increased risk of asset failure. The section of the road would need replacement which could take place more frequently over the 20-year road life. Replacement at the level designed under the Kiribati Road Rehabilitation Project may take a year considering technical and financial capacity of Government, and relative remoteness of Kiribati to markets. Significant traffic delays and disruptions are expected. As a result, road users will incur higher vehicle operating costs (VOC) and productivity losses. These costs would be avoided and thus, become benefits under "with project" scenario.

17. *Quantified benefits*. The following benefits are quantified as follows:

Economic Benefits	Measurement and Assumptions
Avoided road replacement cost	Without the seawalls, a complete asset failure is highly likely. The analysis conservatively assumes that the road section (0.3 km) will be replaced every five years over the 20-year life of the road project. Avoided replacement cost is estimated as the length of road section that is damaged and needing replacement (0.3km) multiplied by the value of the road per kilometer, Based on KRRP, the value of the road per kilometer is A$2.24 million. The value of the road section to be replaced is therefore A$0.64 million).
Avoided increase in vehicle operating cost (VOC)	With the section of the road hardly impassable, the analysis assumes that road users would do a detour through the airport road which would increase travel distance by 5km, and therefore increase VOC. The KRRP ICR reported that for Temaiku road, the total traffic volume is 2,900 and is increasing at a rate of 3.1 percent per year. The average VOC is estimated at 0.58 per kilometer.
Avoided loss in productivity of road users	Road users would incur time costs as a result of traffic delays and disruption (including waiting time). KRRP estimated that the cost of passenger time is 0.46 per hour. The estimated increase in travel time as a result of increasing travel distance by 5 km is 15 minutes (assuming speed of 20 kph).
Residual/ salvage value	The time horizon used for the economic analysis is 20 years, which is the maximum design life of the road asset. The economic life of the seawalls is estimated to be 40 years (2 road asset life). This means that the seawall has a residual value at the end of the time horizon of 50 percent of total investment cost.

18. *Results.* Based on the above assumptions, the net present value (NPV) for the seawall investments is estimated at A$1.06 million while the economic internal rate of return (EIRR) is computed at 10 percent. The NPV is greater than zero and the EIRR is higher than the economic cost of capital of 6 percent. Sensitivity analysis shows that if the net benefits had been 20 percent lower compared to the base case, this would lead to an NPV of A$0.42 million and EIRR of 8 percent. These results are conservative, as the analysis was only able to quantify a partial set of benefits due to limitations in data availability. Other benefits that were not quantified include: (a) avoided damage costs on power and water mains, (b) avoided business disruptions due to power and water outages and traffic delays, and (c) avoided disruptions in lifeline and other public services (hospitals and schools). Considering the criticality of the road segment in the Kiribati economy, these unquantified benefits are expected to be significant.

Resilience Fund

19. The Resilience Fund (A$1.196 million) constructed 328 community rainwater harvesting tanks with volume ranging from 5,000 to 10,500-liters, and supplied and installed 36 solar and Tamana pump systems, which provided fresh water to around 13,400 people in 68 communities in 15 of Kiribati's 22 inhabited islands. Investment per beneficiary is computed at A$89.3. The average cost of water per month incurred by households per month is A$19.6. The investment per beneficiary of A$89.3 is only equivalent to 4.5 months of the reported average water consumption expenditures of households.

Administrative Efficiency

20. Actual administrative cost was A$1.4 million (12% of revised budget). This is slightly lower than the 13.6 percent estimate at appraisal. There were no increases in administrative costs even if the project was extended by 28 months indicating efficient use in administrative budget. Moreover, the share of project management costs in total budget significantly declined from 21 percent under KAP- II to 14 percent under KAP-III. This reflects to some extent the efficiency gains associated with having procedures and processes established and during the first and second phases of the program. Efficiency gains can also result from continued capacity- building of implementing units that started since first phase of the program.

21. The project experienced substantial delays due to primarily due to procurement delays and failed bidding processes. However, the project was able to steer through these hurdles. The project was extended for a total of 28 months. It was utilized to (a) complete ongoing activities under the original project scope, (b) implement additional activities resulting from savings from foreign exchange windfall, and (c) carry out activities under Additional Financing. The results of extending the project has been significant. It allowed the project to not only achieve but exceed project outcome targets.

22. The Additional Financing resulted in the delivery of additional outputs: (a) technical designs and associated community engagement activities for additional sites in the population centers of Betio and South Tarawa; (b) development of a “Roadmap for an Expanded Program of Leak Detection/ Water Network Improvements; (c) development of a Long-Term Coastal Security Strategy; (d) extension of the Office of the President's Building; and (e) scale up of Resilience Fund that resulted in increase in the number sub-projects, which are largely rainwater harvesting tanks. These outputs support the achievement and sustainability of project outcomes.

23. Elements in project design that contributed to project efficiency: (a) engagement of communities in the design, implementation, and sustainability of capital investments ensures that the investments financed by the project respond to community adaptation needs; (b) bundling hard investments in coastal protection with roads (under KRRP) facilitated efficiency in procurement and implementation and promoted synergy in investments. It also facilitated immediate gains in terms of avoidance of road asset failure, which could likely happen if more resilient protection was not provided alongside road construction; (c) bulk procurement of goods resulted in efficiency gains in terms of time and cost. Item (b) and (c) particularly important in the context of Kiribati where remoteness to markets is a significant constraint.

ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

No comments received as of June 11, 2019.

ANNEX 6. COMMUNITY ENGAGEMENT STRATEGY

KAP III implementing agencies engaged with up to 100 different community groups in the Gilbert, Line, and Phoenix island groups of Kiribati to successfully implement the project activities. This required purposefully planned and implemented community engagement, tailored to each activity and adjusting to the needs and priorities of each community over time (Figure A6.1).

In the first year of implementation, the Bank team assisted each IA to prepare their respective workplans and, as part of the discussions, facilitated the IAs to reflect on the likely community engagement needs that would arise and the capabilities of their own staff to meet these needs. To the extent possible, existing IA staff and institutional arrangements were utilized for all community engagement activities. The project supported supplementary and specialist services where required, as well as the IAs' incremental operating costs. In the early years of implementation, a Social Development Specialist on the Bank team provided close and regular support and mentoring to the IAs and PMU Community Engagement Team (CET).

KAP III's community engagement strategy was based on the well-documented 'ladder of citizen participation'[44], i.e. meaningful community engagement needs to be able to evolve from information seeking, to semi-commercial behavior change campaigns, to empowering residents and allowing for public voice in decision-making and ownership of the infrastructure assets.

- Some activities required **seeking information** about the communities and understanding the range of their needs and priorities. For example, household surveys were conducted in the South Tarawa pilot water improvement zones by PUB and locally enumerators, and as part of Island Vulnerability Assessments by OB on outer islands. Advice on the survey methodology and training of enumerators were provided by the Kiribati National Statistics Office.
- Communities were **actively engaged in the design** of the planned infrastructure. For example, MISE and PUB engineers were accompanied by communications and marketing staff and the CET to seek community advice on soft solutions such as vegetation and beach cleaning at the seawall sites, and to identify where shared tap stands would be located in village reticulation systems. This engagement provided a natural segue into subsequent community-based O&M of village systems (e.g. abstraction galleries and rainwater harvesting systems). The new systems and land agreements were linked to local cultural mores and public traditional ceremonies.
- Other activities involved rolling **semi-commercial behavior change campaigns**, particularly around paying for water and conservation in the 24/7 pilot water supply zones in South Tarawa (Figure A6.2). In these cases, the Project funded short term specialists and firms to work with the IAs and the CET to provide additional expertise and guidance based on good international practice.

[44] Arnstein (1969).

Figure A6.1. KAP III Community Engagement and Project-Support Arrangements

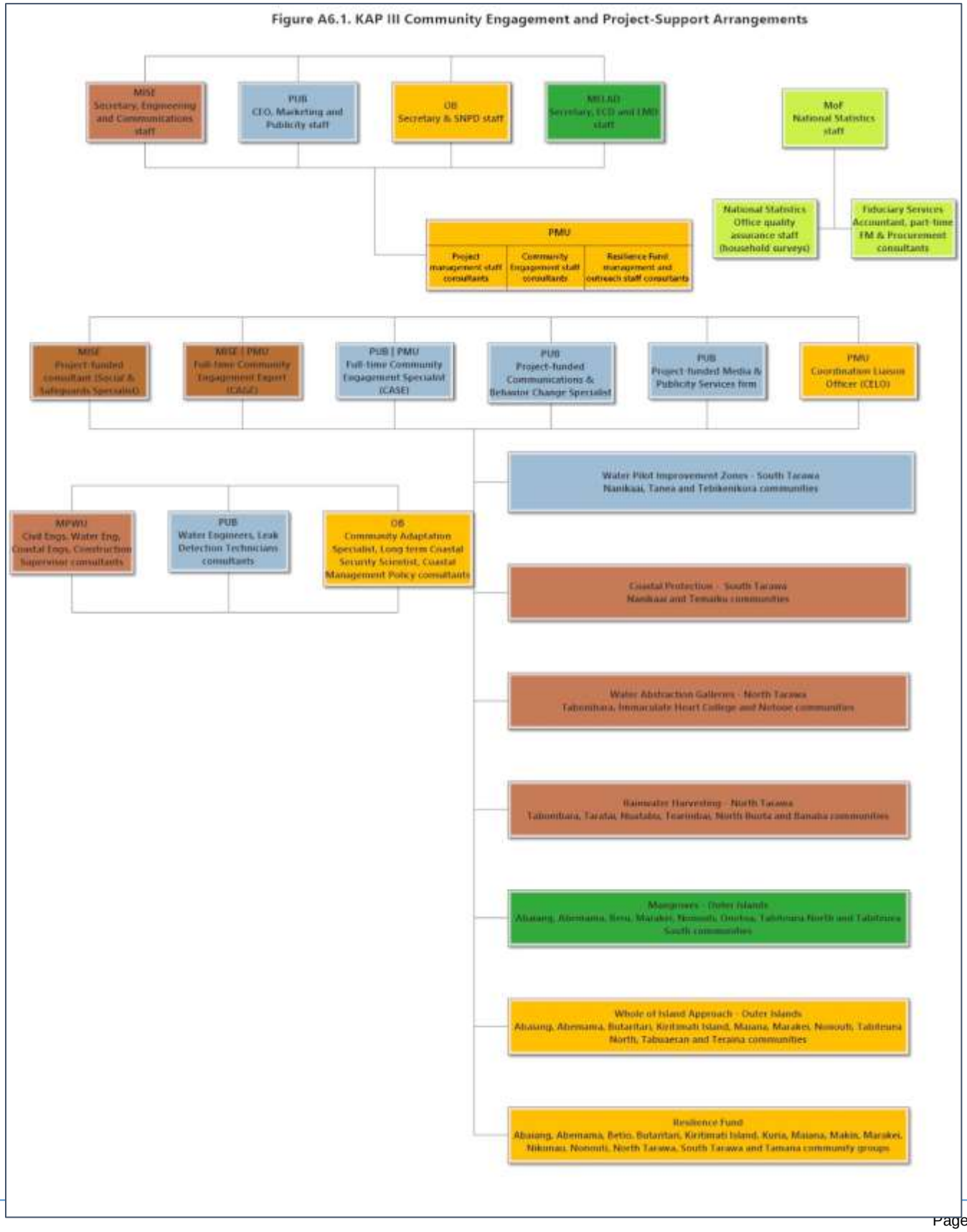
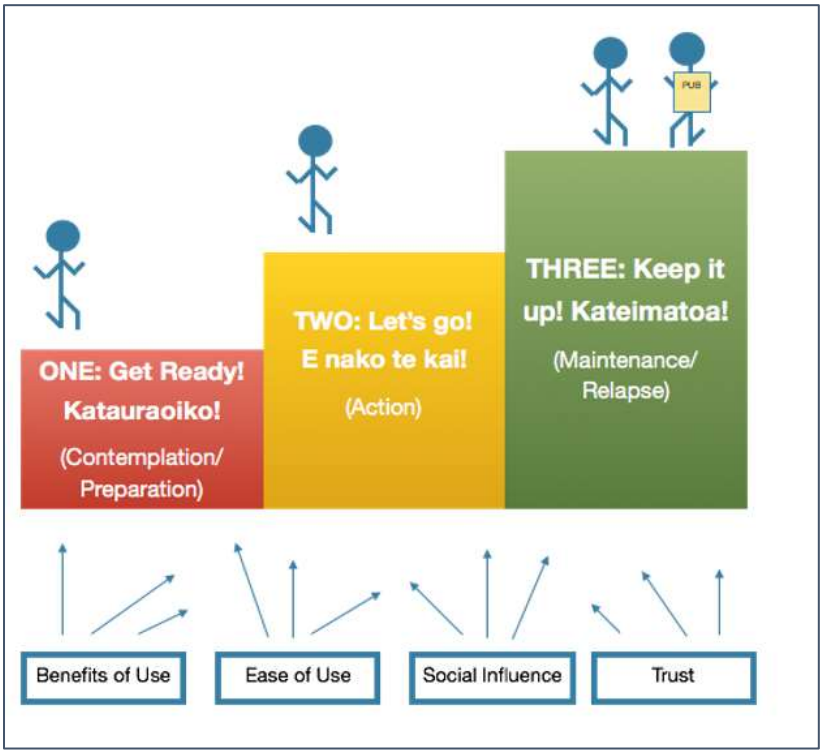


Figure A6.2. Mixed Acceptance and Behavior Change Model for Water Pilot Improvement Zones[45]



[45] Adapted from unified theory of acceptance and use of technology (UTAUT) model.
Venkatesh, V., Morris, M., Davis, G., and Davis, F. (2003). "User Acceptance of Information Technology: Toward a Unified View". *MIS Quarterly*. 27 (3): 425–478

ANNEX 7. PHOTOGRAPHS OF PROJECT INVESTMENTS

Pilot Water Network Improvement

Left: Field training in addressing for PUB Marketing and Leak Detection Unit staff (Nanikai). Right: PMU Community Engagement Expert explains to a new PUB customer the purpose of having an address to receive water bills and lodge complaints (Tebikenikora)

Project-funded Leak Detection Advisor to PUB inspects a valve box (Bikenibeu)

Images used in the community behavior change campaign for the PUB 24/7 water supply pilot zones.

Groundwater Abstraction Systems

(Left) Storage head tanks at Notoue village in North Tarawa—part of the Notoue groundwater abstraction system. (Right) Replacement babai (taro) pit adjacent to the Notoue groundwater gallery reserve area.

Excavation of groundwater abstraction gallery.

Rainwater Harvesting Systems

Water storage tanks as part of the Tabonibara rainwater harvesting system in North Tarawa. Water is collected from the roof of the adjacent maneabwa.

Treatment system for Buota rainwater harvesting facility.

Resilience Fund activities

Rainwater harvesting tank, guttering, and connection pipes installed at a site in Makin Island under the Resilience Fund activities. Left: village building; right: community church.

Mangrove planting, Makin Island

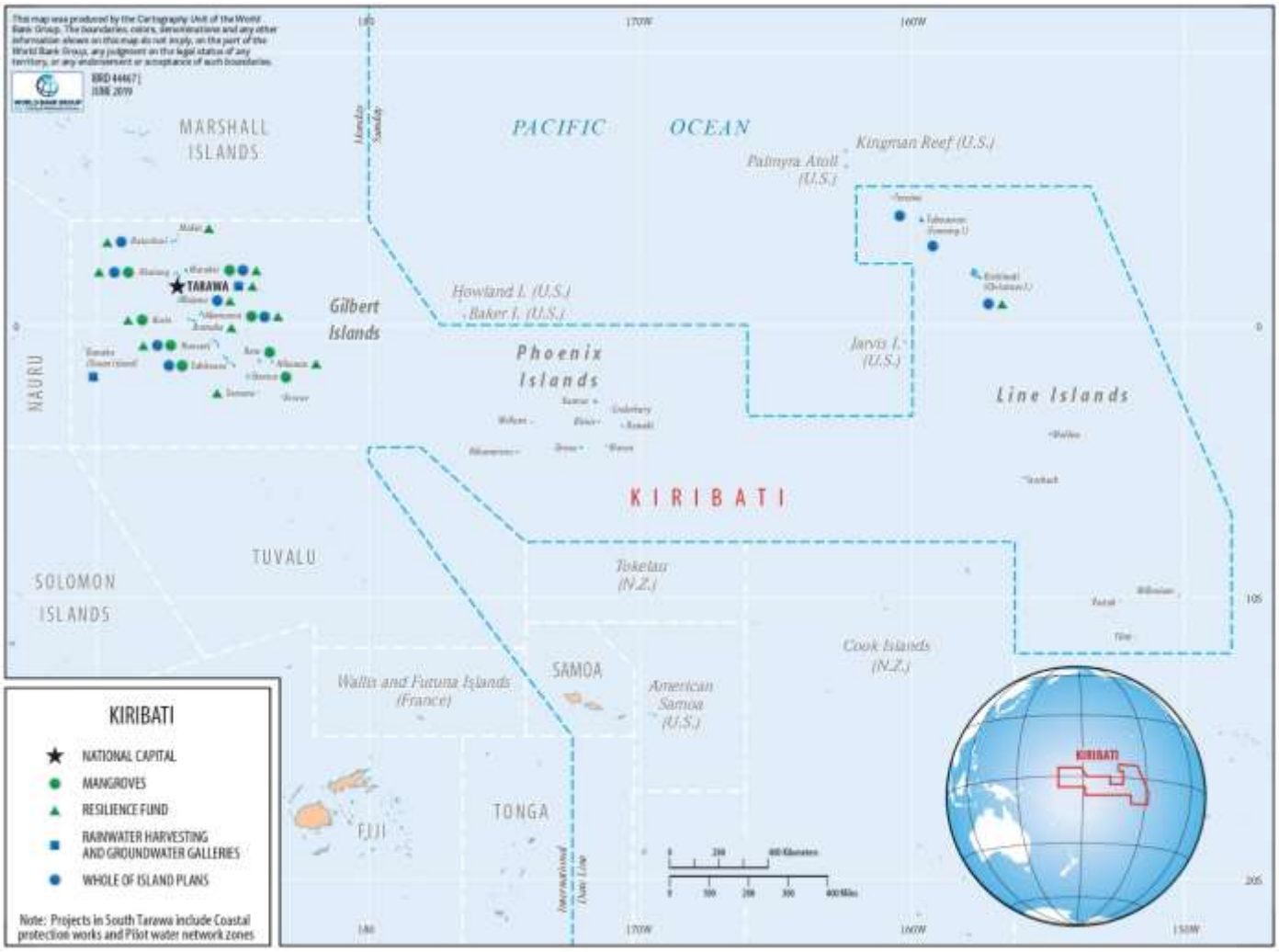
Tamana pump being operated. This is representative of several Tamana pumps installed in the Outer Islands.

Coastal Protection

Coastal protection works at Site 2 (Nanikai—Tearaereke causeway). Left: before showing breaches in existing wall; Right: nearly completed gravity concrete wall before reinstating the beach.

Coastal protection works at Site 10 in Temaiku designed and construction funded under KAP III (by the KRRP civil works contractor). Left: before showing erosion and diversion of road; Right: completed works designed for a 50 year return period event with sea level rise.

ANNEX 8. MAP OF PROJECT INVESTMENTS



ANNEX 9. SUPPORTING DOCUMENTS

Asian Development Bank (2014) *Economic Costs of Inadequate Water and Sanitation: South Tarawa, Kiribati*. © Asian Development Bank. http://hdl.handle.net/11540/778. License: CC BY 3.0 IGO.

Carter Center, Kilimanjaro Center for Community Ophthalmology and The Elfenworks Foundation (2009). *Women and Trachoma: Achieving gender equity in the implementation of SAFE.* Atlanta: The Cater Center. Available from: *https://www.cartercenter.org/resources/pdfs/health/trachoma/women_trachoma.pdf*

Government of the Republic of Kiribati (2008). *National Water Resources Implementation Plan. Sustainable Water Resource Management, Use, Protection and Conservation – A 10 Year Plan.* Coordinated by the National Water and Sanitation Committee under the Ministry of Public Works and Utilities, Tarawa.

International Monetary Fund (2019) *Kiribati: 2018 Article IV Consultation – Press Release; Staff Report; and Statement by the Executive Director for Kiribati*. IMF Country Report No. 19/26. Washington DC: IMF.

Ramsay, D. and Allis, M. (2018) *Rapid Coastal Risk Assessment: Long-term coastal security strategy for Kiribati*. Report prepared for Office of Te Beretitenti, Government of Kiribati.

White, I. Falkland, T. Perez, P. & A. Dray (2004) "Sustainable Development of Water Resources in Small Island Nations of the Pacific". Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Vertically-exaggerated-cross-section-through-a-low-coral-island-showing-the-fresh_fig1_237540301 [accessed May 7, 2019]

White, I. (2010) *Tarawa Water Master Plan: Te Ran, Groundwater*. Report prepared for the National Adaptation Steering Committee under Office Te Beretitenti and the National Water and Sanitation Coordination Committee through the Ministry of Public Works and Utilities. Tarawa: Kiribati Adaptation Program Phase II.