Increasing the Water Security of the Island Republic of Kiribati Through a Multi-Prong Approach

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NEWEA 2019

Presentation overview

1. Introduction to the Republic of Kiribati
2. Desalination
3. Water Supply Infrastructure Upgrades
4. WASH Awareness Program
5. Financial and Economic Analysis
6. Institutional Due Diligence

The Republic of Kiribati

Republic of Kiribati

Island nation in the central tropical Pacific Ocean

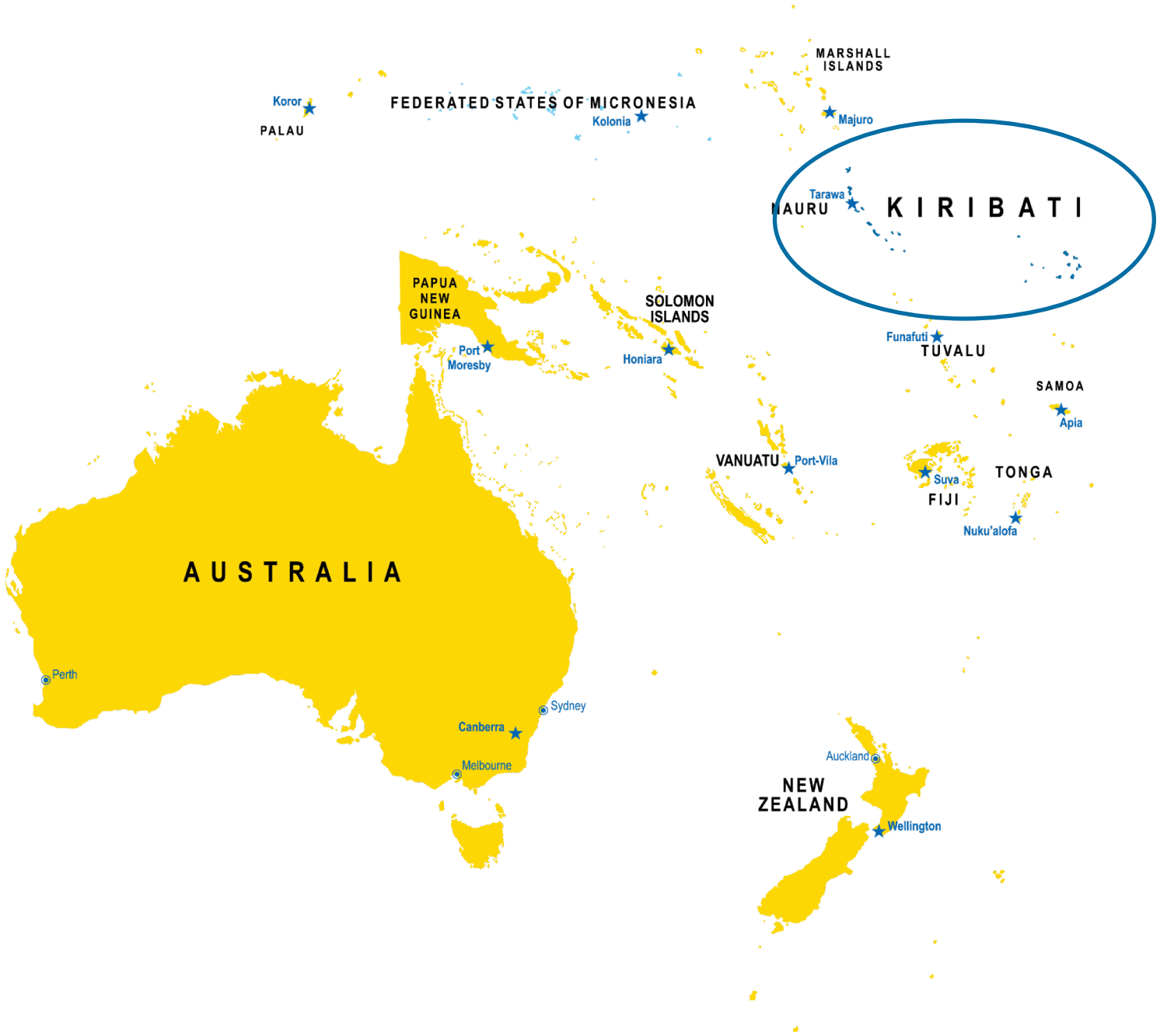
- Only country situated in all four hemispheres

32 low-lying atolls and one raised coral island

- Surrounded by extensive reefs
- 21 islands inhabited
- Capital (Tarawa) located halfway between Hawaii and Australia

Estimated population = 112,850 (2009)

- Approximately half of the population lives in Tarawa


MARSHALL ISLANDS
Koror
PALAU
FEDERATED STATES OF MICRONESIA
Kolonia
Majuro
Tarawa
NAURU
KIRIBATI
PAPUA NEW GUINEA
SOLOMON ISLANDS
Port Moresby
Honiara
Funafuti
TUVALU
SAMOA
Apia
VANUATU
Port-Vila
Suva
FIJI
TONGA
Nuku'alofa
AUSTRALIA
Perth
Sydney
Canberra
Melbourne
Auckland
NEW ZEALAND
Wellington

Tarawa

- Majority of Tarawa's population lives in South Tarawa
- Land area of ~ 5.4 square miles
- Highly urbanized
  - Population of 56,300
  - ~ 10,360 people/square mile
- Population Growth
  - 2.3% per year
  - High fertility rates
  - Inward migration from outer islands

Economy

- One of the worlds poorest countries
- Few natural resources
  - Exports fish and copra (dried coconut meat)
  - Fishing licenses

Need for water infrastructure

- Rapidly growing population
- Existing Water Supply
  - Current Water Rationing - access to public water supply potable water 2 hours every second (2^{nd}) day
  - High physical losses in system (estimated at 67%)
  - Average per capita water supply = 3 gal/day
  - Estimated demand 15 – 30 gal/day
- Population required to use unsafe alternative water sources
  - ~82% of population uses contaminated well water for bathing
- Water-borne, food-born, and skin disease
  - 4^{th} highest infant mortality rate in the East-Asia Pacific Region
- Climate Change and Climate Variability

Anticipated effects of climate change

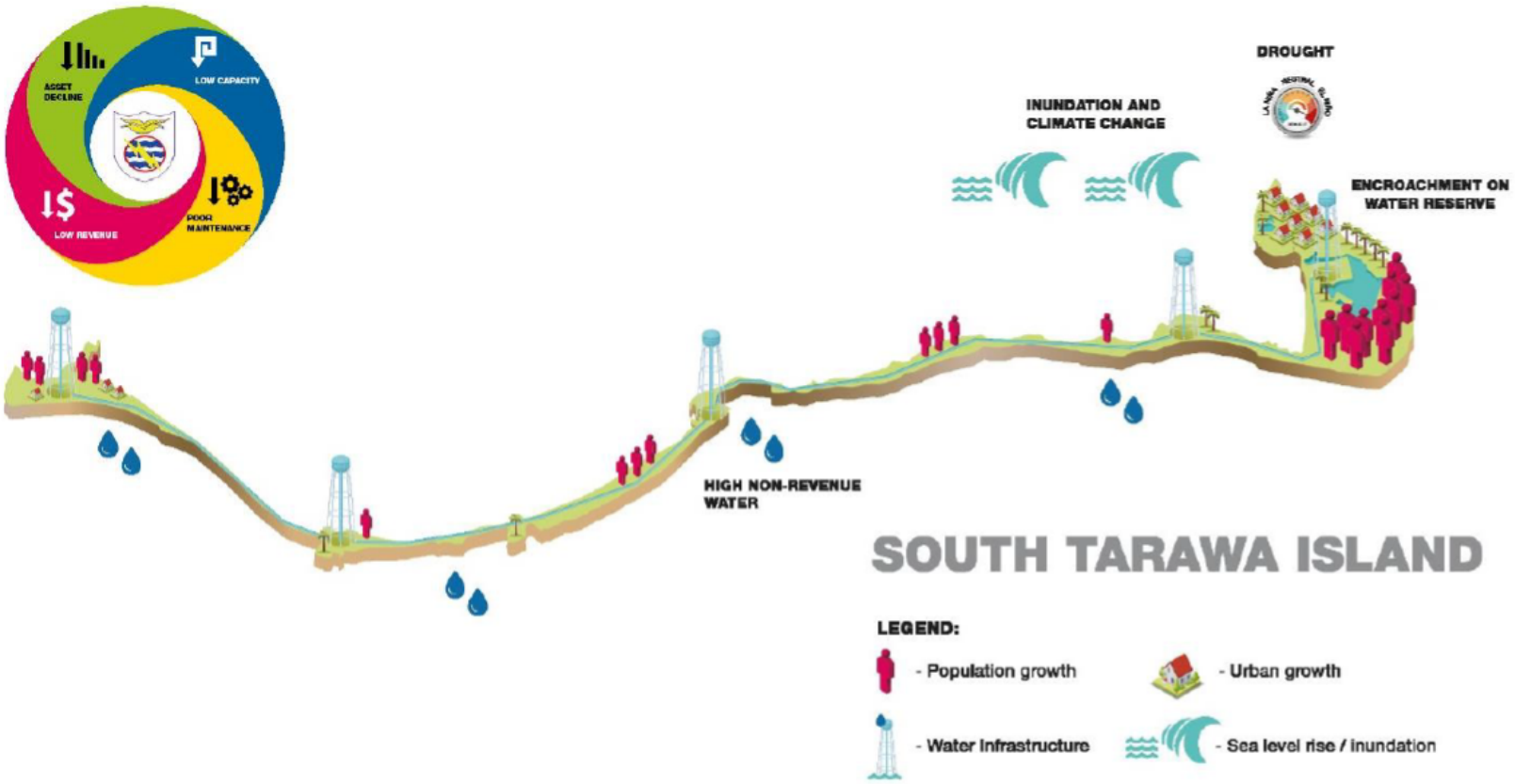
Groundwater supply directly dependent on the size of the land area

- Coral limestone is porous, allows seawater to flow through it
- Shrinking land area reduces the size of the water lens
- As sea level rises, wells become contaminated with salt water

The New York Times

Tabwena Kaokatekai, 42, of Buariki, a village in North Tarawa, with her newly planted mangrove trees. Erosion along the beach here has already toppled dozens of coconut trees into the ocean. Josh Haner/The New York Times

Water supply challenges



Funding

Funded by the Asian Development Bank

- Technical Assistance Special Fund (TASF)
- Project completed by GHD International Development Assistance (IDA) group

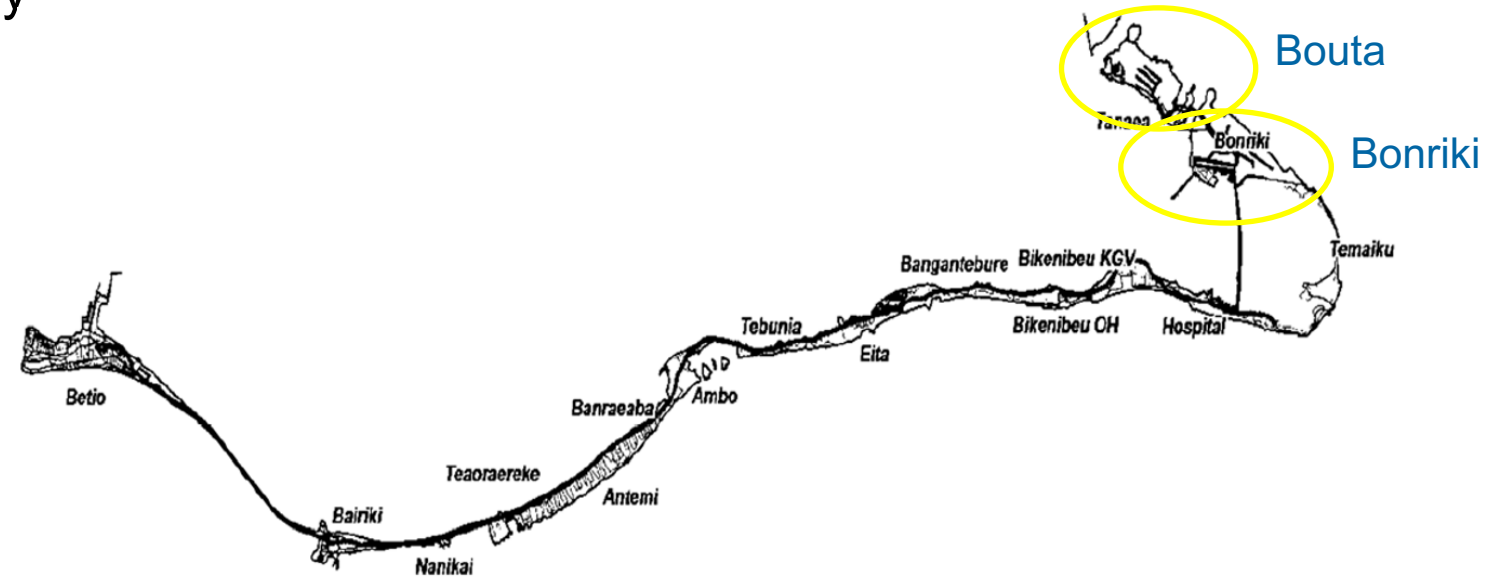
Technical Assistance Project goals:

- Assist the Public Utilities Board and Ministry of Public Works and utilities plan, design and prioritize investments to improve water supply services in South Tarawa

Desalination

Need for desalination

- Kiribati has two groundwater lenses:
  - Bouta
  - Bonriki
- Rainwater harvest potential not adequate to augment supplies
- Proposed desalination facility to supplement groundwater water supply



Water demand assessment

- Water Supplies
  - Groundwater lenses
  - Proposed Desalination Plan
- Design horizon to year 2040
- Two population projection scenarios:
  - Low growth rate – based on predicted growth rate for Kiribati
  - High growth rate – based on predicted growth rate for South Tarawa
  - Both scenarios incorporate a climate change allowance rate
  - Leakage allowance (15 – 25%)

Desalination facility

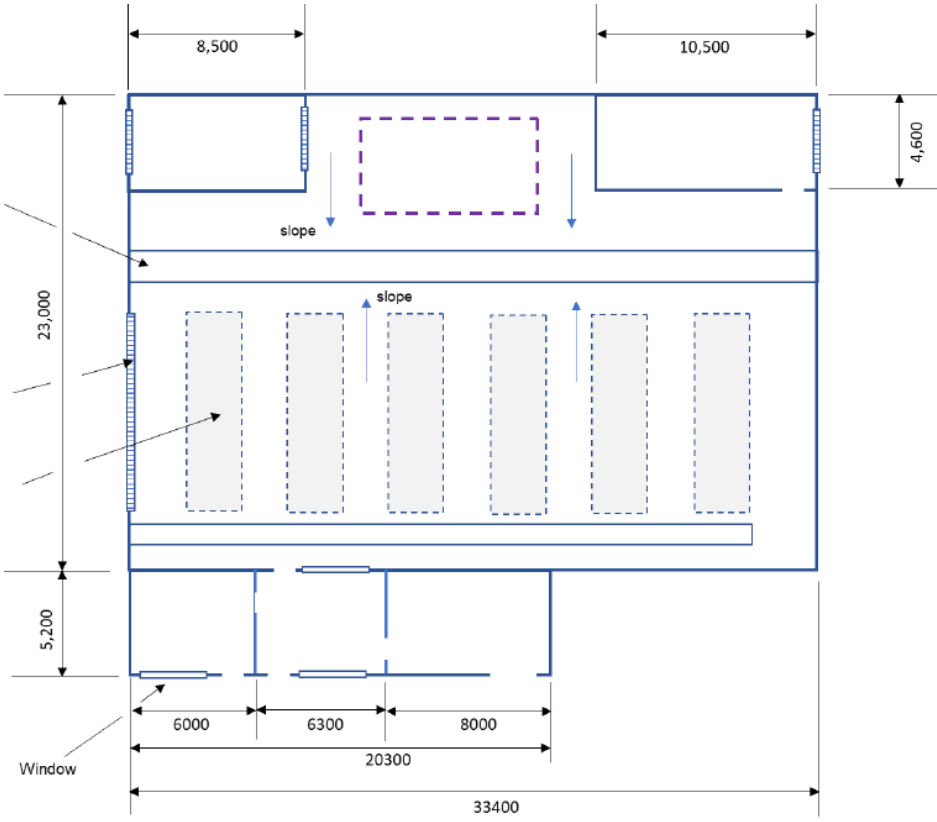
- Initial desalination plant capacity = 1 MGD (lower growth rate range)
- Modelling effort included future new plant to meet high growth rate range flow
- Ability to upgrade to overall capacity of 1.6 MGD
- Construction of facility anticipated to commence in 2020

Proposed site opposite existing sewage outfall system

- Brine disposal for reverse osmosis process

Desalination plant

- Reverse Osmosis System
  - Initially 4 installed (includes redundant unit)
  - Space allocated for 2 additional RO units
  - Skid mounted systems – transported in a 40 ft shipping container
- Saline water from deep bores
- Designed to meet WHO guidelines for drinking water quality



PLAN VIEW OF R.O. BUILDING

Water supply infrastructure

Water supply infrastructure

- Hydraulic modelling undertaken to assess major infrastructure upgrade options (EPANET 2.0)
- 4 year implementation program
  - Rehabilitation of leaking storage tanks (elevated and ground)
  - Replacement of ground tanks
  - Piping replacements
  - Construction of two new SWRO plans

Electricity infrastructure

Electricity infrastructure

Electrical power options considered for proposed desalination plant:

- **Option 1:** Standard non-renewable grid network connection
- **Option 2:** Grid connected PV installation at desalination plant site
- **Option 3:** Multiple distributed roof top grid connected PV installations with solar smoothing energy storage component
- **Option 4:** Single ground mounted grid connected PV installation at Bonriki pump station and solar smoothing energy storage component (included sub options)

WASH Awareness Program (WAP)

WASH Situational Analysis

Water, sanitation, and hygiene (WASH)

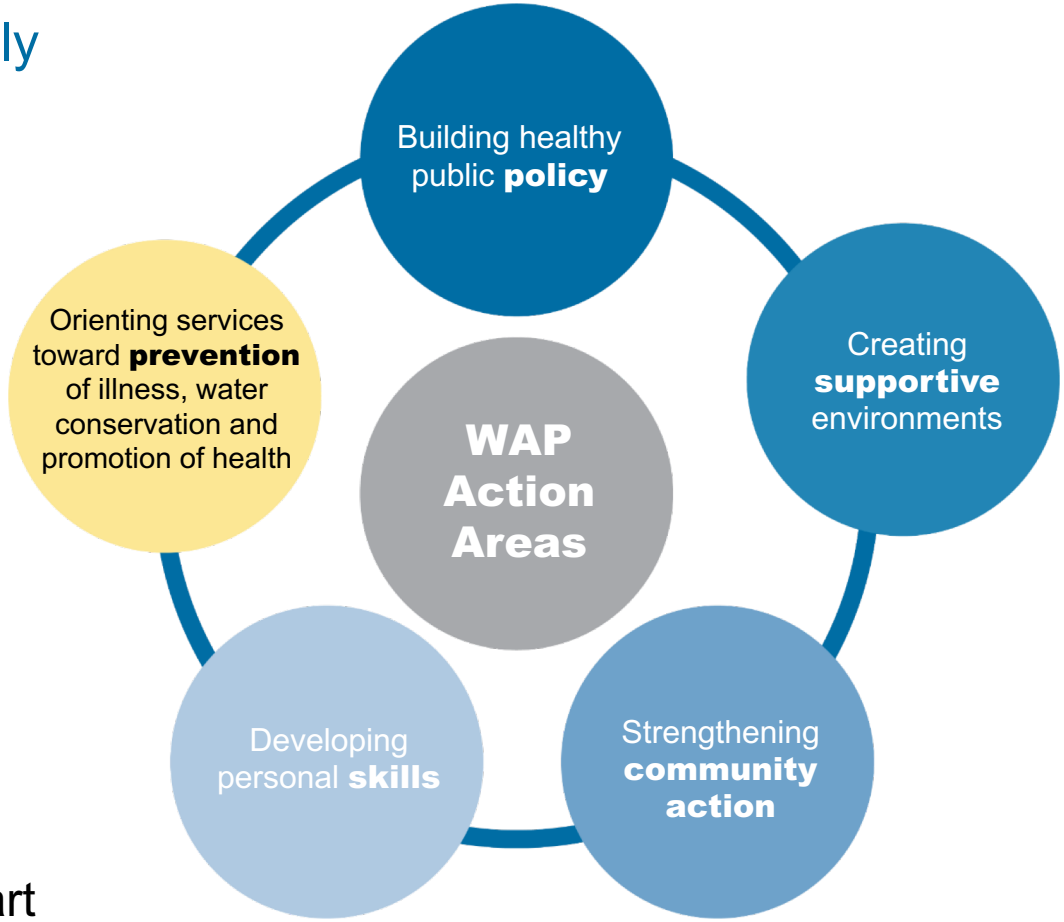
- Insufficient potable water for hygienic practices
- 3 gpd potable water available every other day
- 2/3 of population in poverty or on the edge of poverty
- Improvement projects are occurring in schools to provide adequate facilities

WASH Awareness Program (WAP)

Three part program

There are three key elements to the South Tarawa Water Supply Project WAP that warrant separate approaches:

- Part A “Water is Life” – focus on the water supply infrastructure that will be delivered under the project
- Part B “WASH Community Partnership” – focus on the broader WASH related behaviors impacting public health
- Part C “Walk the Talk” – to promote a stronger enabling environment that supports Part A and Part B



Financial and economic analyses

Financial and economic analyses

Outline of the project

Costs	Estimated Cost ($USD)	Contingency
Desal Unit (first 4 units)	$15 M	included
Water supply infrastructure upgrade	$22 M	included
Supplier operation contract, 3-5 years (2022 up to 2026)	$0.3 M/year	Allowed for 5 years
PV System	$7.6 M	included
Social Safeguard Costs (GAP, Participation Plan, Resettlement Plan)	$0.62 M	
Total	**$46.72 M**	

Implementation Schedule		
Technical investigations, bidding, detailed design, M&E delivery	July 2018- December 2020	2.5 years
Site Installation, commissioning	January – December 2021	1 year
Full operation	from January 2022	

Initial project cost will be 100% externally funded, by grants from **Asian Development Bank** (ADB), **World Bank**, and the **Green Climate Fund** (GCF).

Financial and economic analyses
User Fees/Rates

- Desal water to be metered and charged for through a volume-based rate
- Willingness to pay (WtP) Objectives
  - Avoid reasons to continue using contaminated water
  - Recover costs of supply from other consumers

A stepped fee structure is a common approach to attaining these objectives and is recommended

Financial and economic analyses

Fee Rates: Example | At this rate, typical monthly bills

Example Rate Schedule:

	Rate $/ 100 gal (USD)	Monthly Consumption Band (up to __gal/month)
Domestic Consumers		
Pipe Water Delivered on Premises		
Lifeline Block (≤ 2,000 gal/month)	$ -	2,000
> 2,000 but ≤ 4,000 gal/month	$0.68	4,000
> 4,000 but ≤ 5,300 gal/month	$0.95	5,300
> 5,300 gal/month	$1.36	Unlimited
Pipe Water Delivered to Communal Taps	$ -	Unlimited
Non-Domestic Consumers	$1.36	All consumption/month

Financial and economic analyses
Tentative financial analysis

- Given high rates of poverty in South Tarawa, it is unlikely that Public Utilities Board can recover water supply costs through the fee rate schedule alone
- Long term Government water supply subsidies under the Community Service Obligation (CSO) policy will be required

Next Steps:

- Design a fee system and estimate revenue projections and subsidy requirements based on WtP survey results and community understanding
- Finish preparations and implement project by 2022.

Institutional due diligence

Institutional due diligence
Vocational training and capacity development

New Desalination Plant, Water and Solar Power Infrastructure:

- high levels of maintenance
- safe work practices
- sound management

Technical staff need to be multi-skilled with competencies at internationally recognized levels:

- Formal qualifications and accreditation
- Two to three years of training delivered largely on the job by trainers in-country. (electricians, also 6 months overseas)
- English, computing and foundation skills training
- Training delivered by experts in leak detection and other new skills for the new system
- Surveying, GIS, AutoCAD

Vocational training and capacity development
Management staff

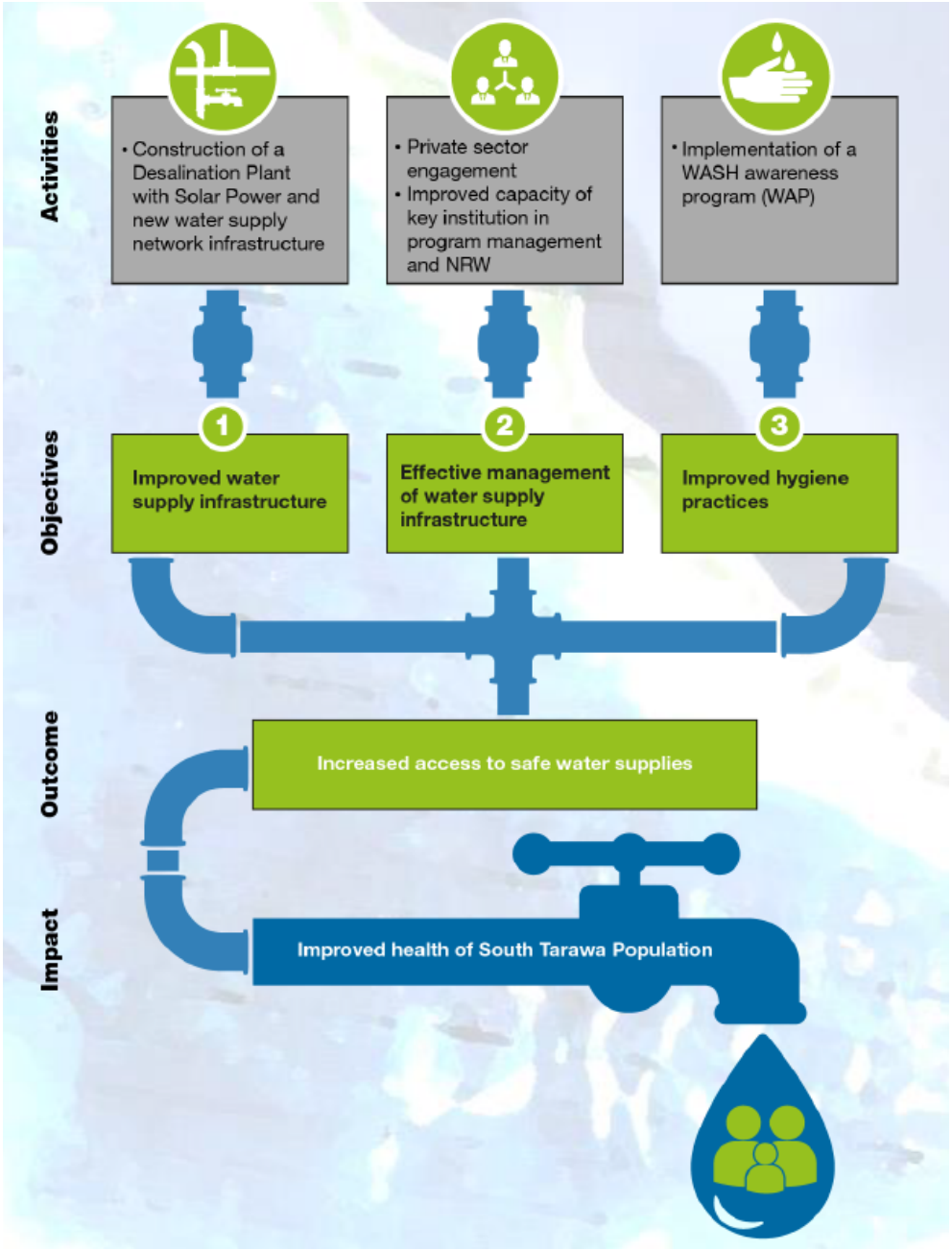
Managers will need skills, knowledge and understanding to manage the new system:

- whole of project management skills, including contract management and procurement skills
- capabilities already developed to be built further so management of the new system can be sustained
- targeted skills development through mentoring by pairing with an Australian utility organization
- new system management capacity development through training and mentoring in leak detection and new system management

Administration staff will need skills in customer service for new system:

- customer service training delivered from the start of the project and continuing education

Summary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• Construction of a Desalination Plant with Solar Power and new water supply network infrastructure
• Private sector engagement
• Improved capacity of key institution in program management and NRW
• Implementation of a WASH awareness program (WAP)
Objectives
1
Improved water supply infrastructure
2
Effective management of water supply infrastructure
3
Improved hygiene practices
Outcome
Increased access to safe water supplies
Impact
Improved health of South Tarawa Population

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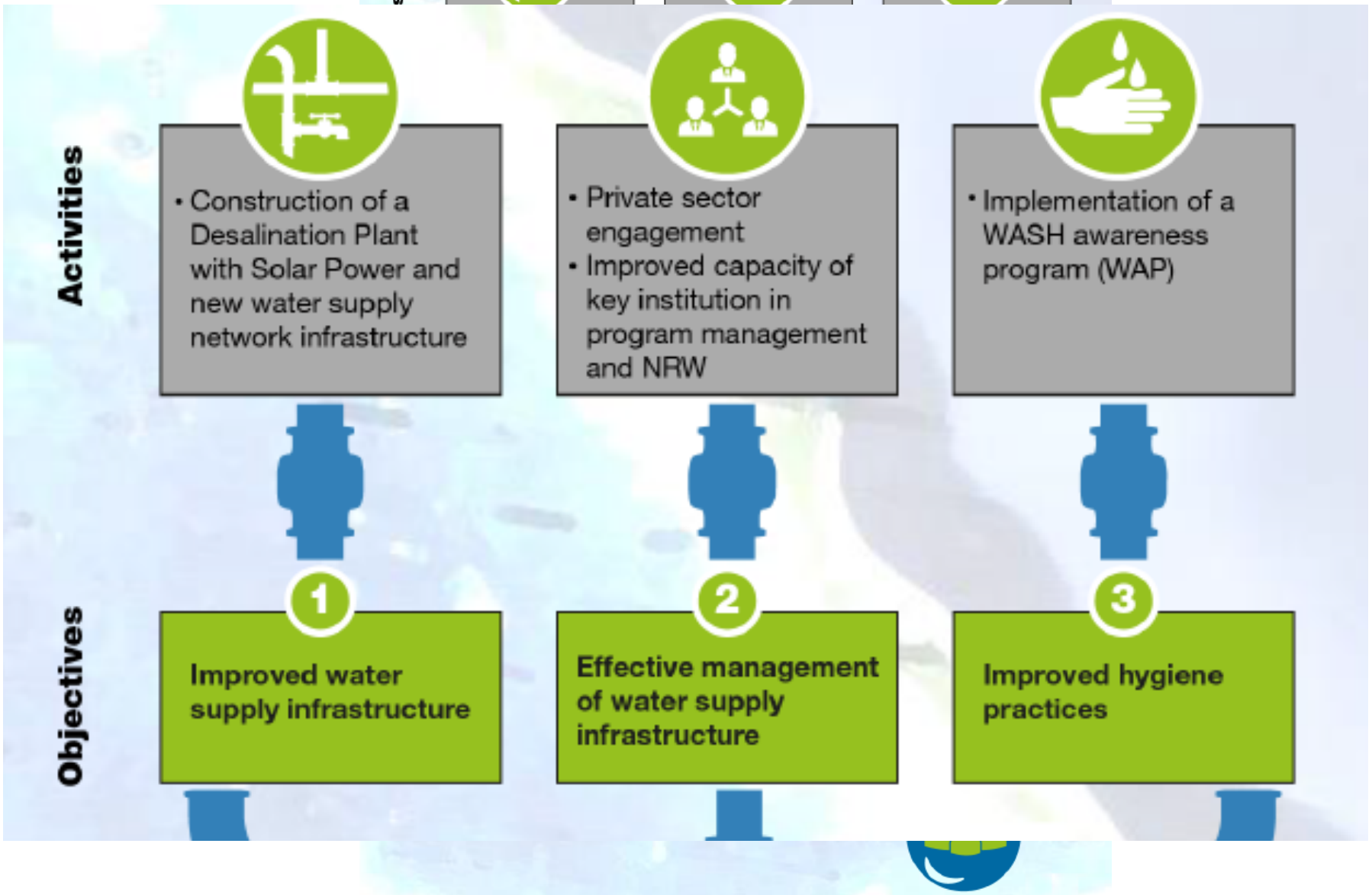
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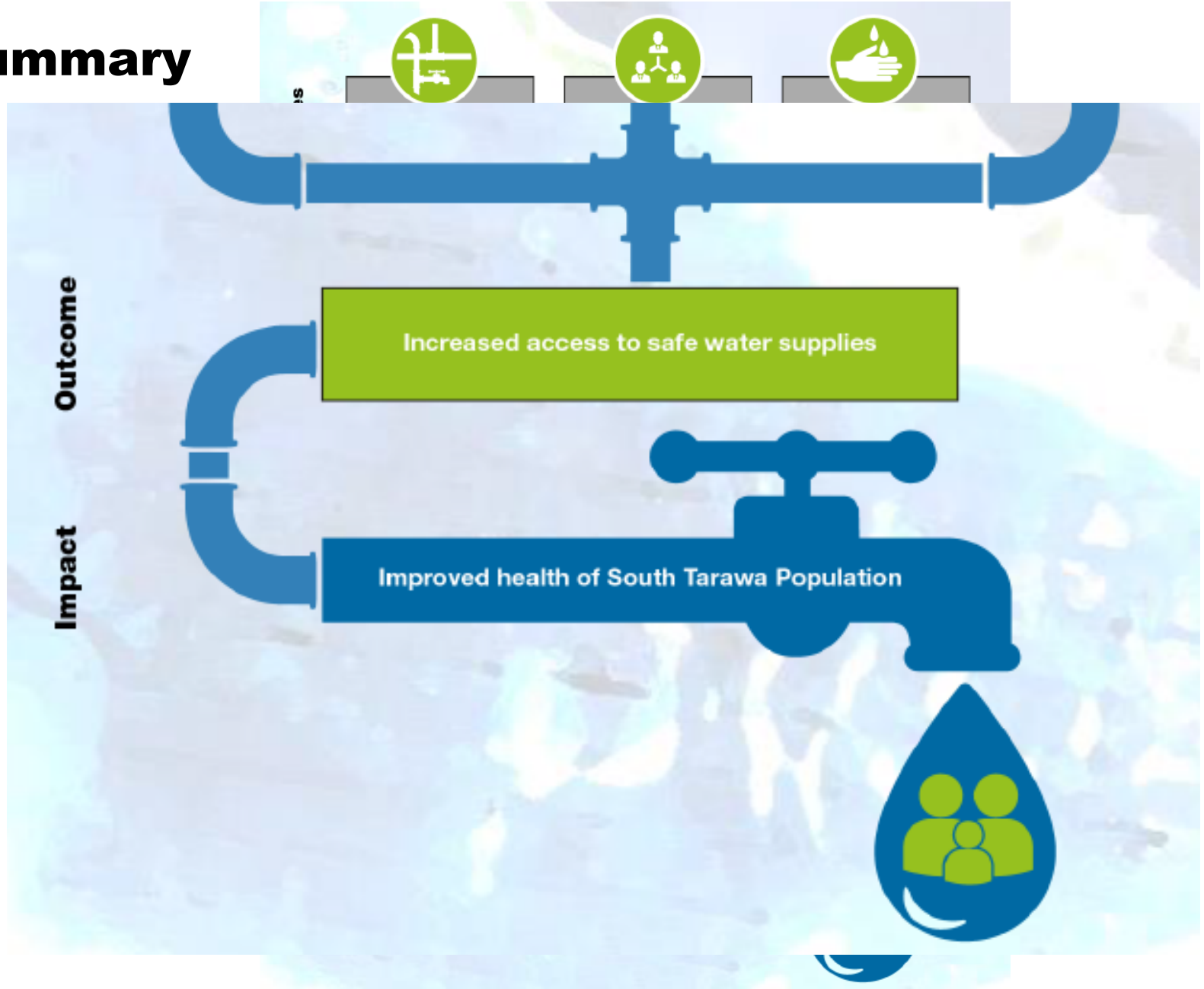
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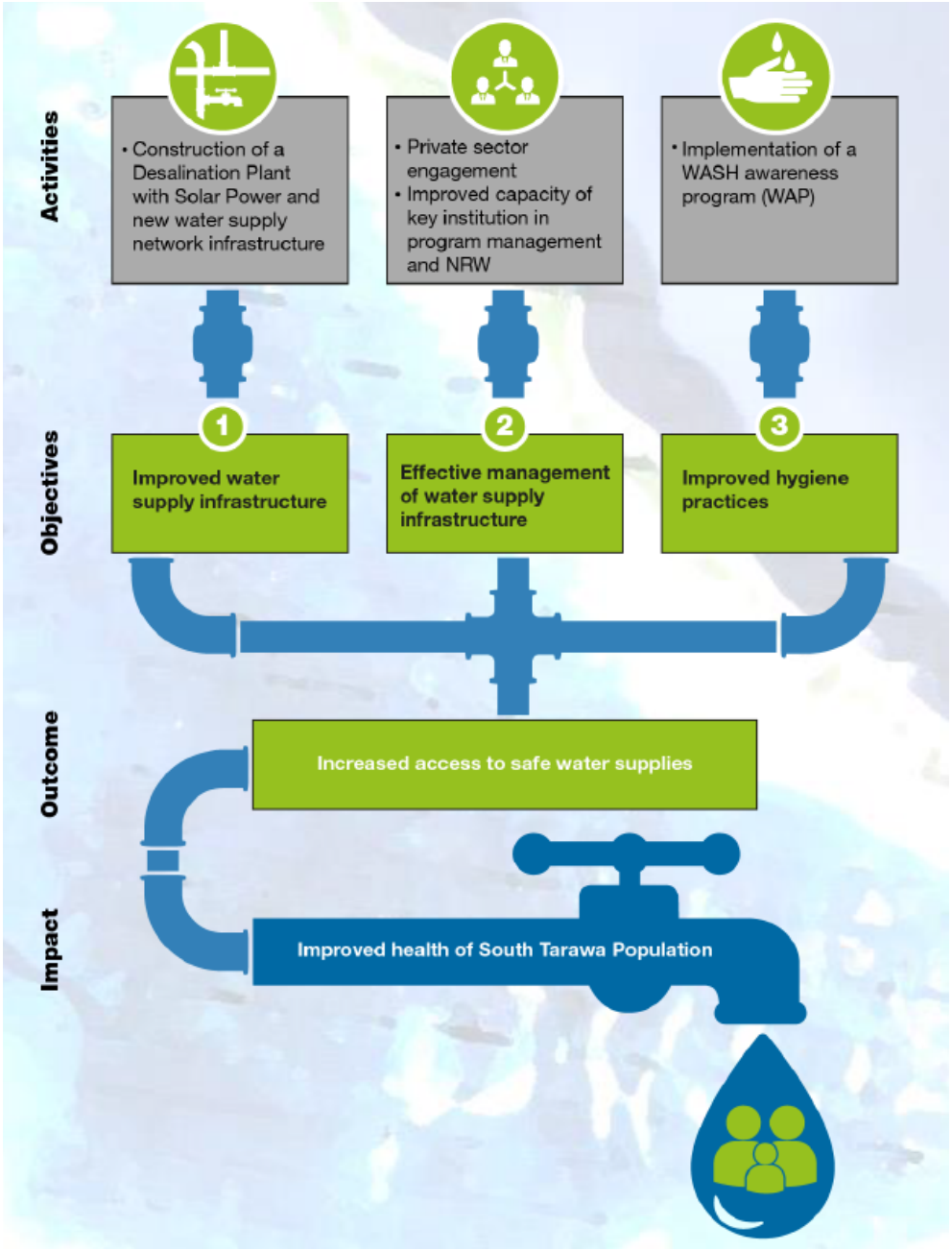
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Questions

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Thank you for your attendance