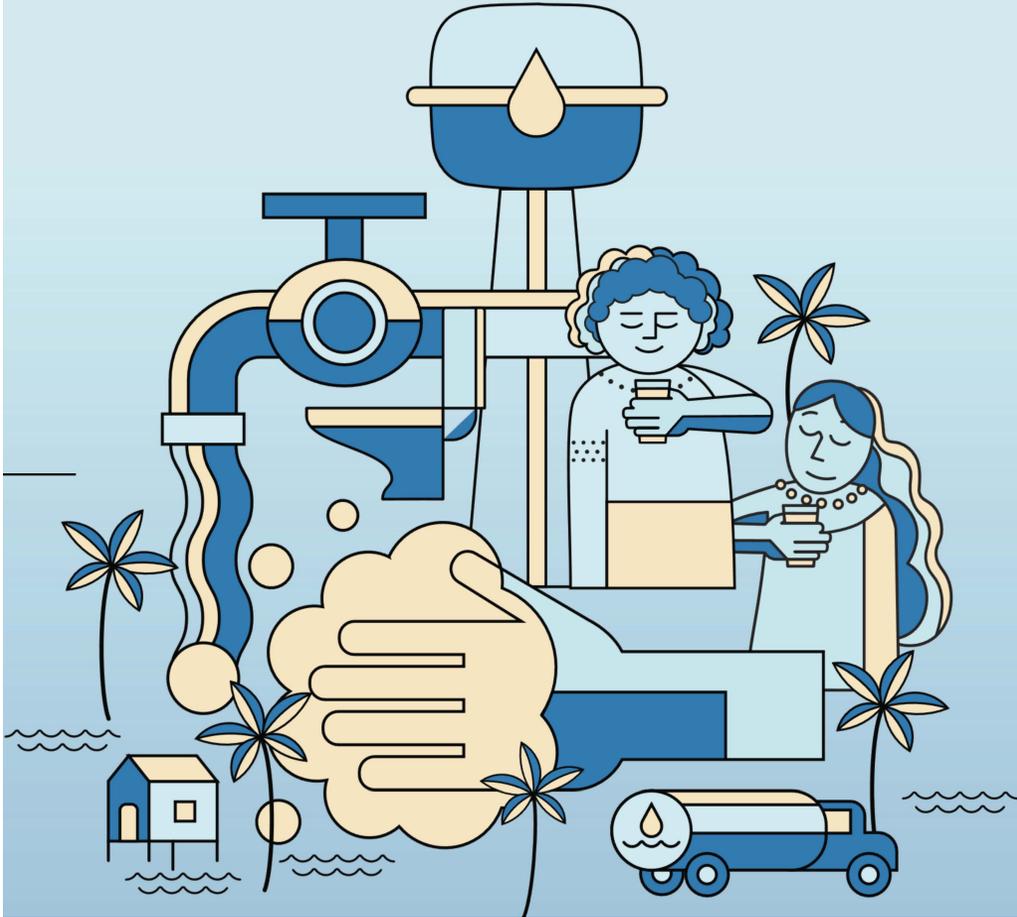


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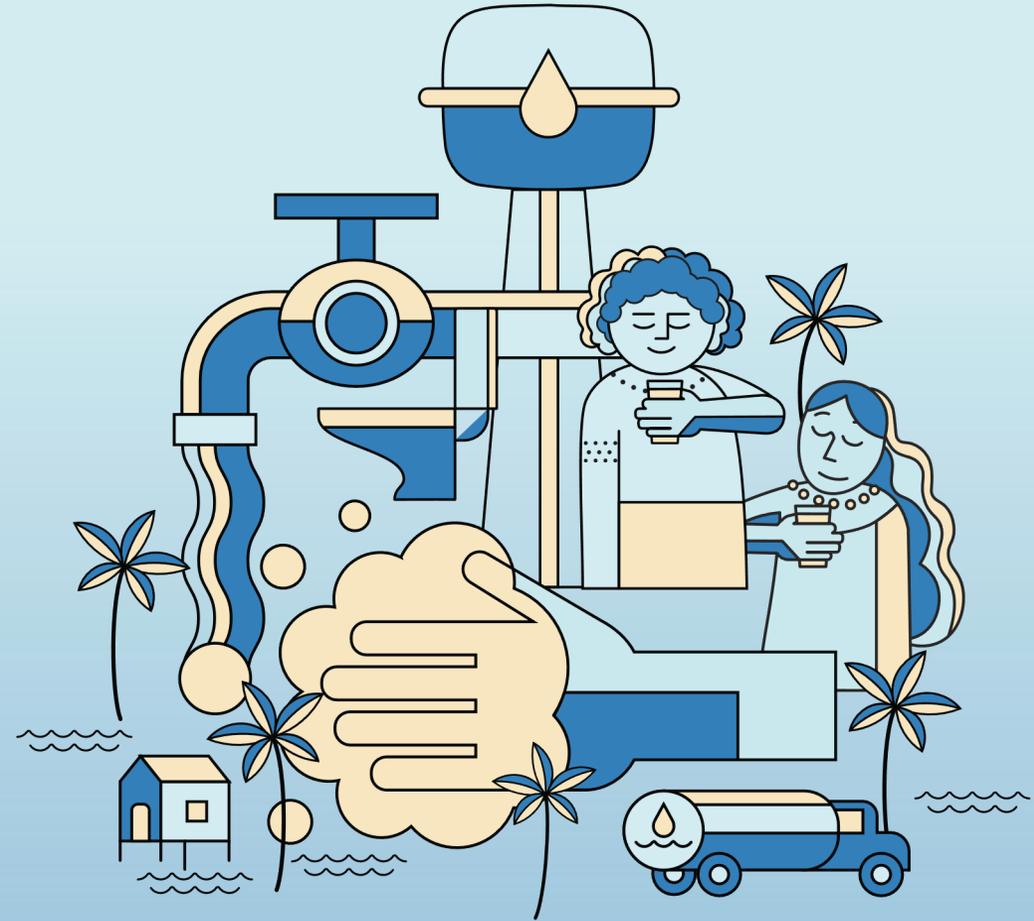
# Pacific WASH

## WEBINARS



## On-site Sanitary Behaviors

30 November 2022



We will begin shortly.  
Participants, kindly note the following for this seminar

Please rename your Zoom name to:

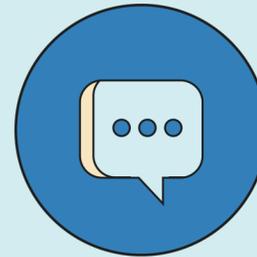
**Name, Org or Project**  
(e.g. Las Fernando, ADB)



**Please turn your mic off  
during the presentation**



**Raise hand  
when you want to talk**



**Use the chat box  
for questions/concerns**



**We have a Q&A portion  
after the presentation**

# Webinar schedule

Time (ADST)	Speaker
11.00am	<b>Welcome – Bronwyn Powell</b> , Pacific WASH TA Team Leader
11.10am	<b>Opening Remarks – Lusia Sefo-Leau</b> , CEO, PWWA
	<b>Presentations:</b>
11.25am	<b>1. Mark Ellery</b> – Water, Sanitation and Local Governance Consultant
11.40am	
11.55am	<b>2. Sharon Lesa</b> – Wastewater Division Engineer, Samoa Water Authority
	<b>3. Raghava Neti</b> – Senior Water Supply and Sanitation Specialist, Water Global Practice, The World Bank
12.10pm	<b>Q&amp;A session</b>
12.25pm	<b>Closing and group photo</b>

# Introducing the Speakers



**Mark Ellery**

*Water, Sanitation & Local Governance  
Consultant*

Asian Development Bank



**Raghava Neti**

*Senior Water Supply and Sanitation  
Specialist*

The World Bank



**Sharon Lesa**

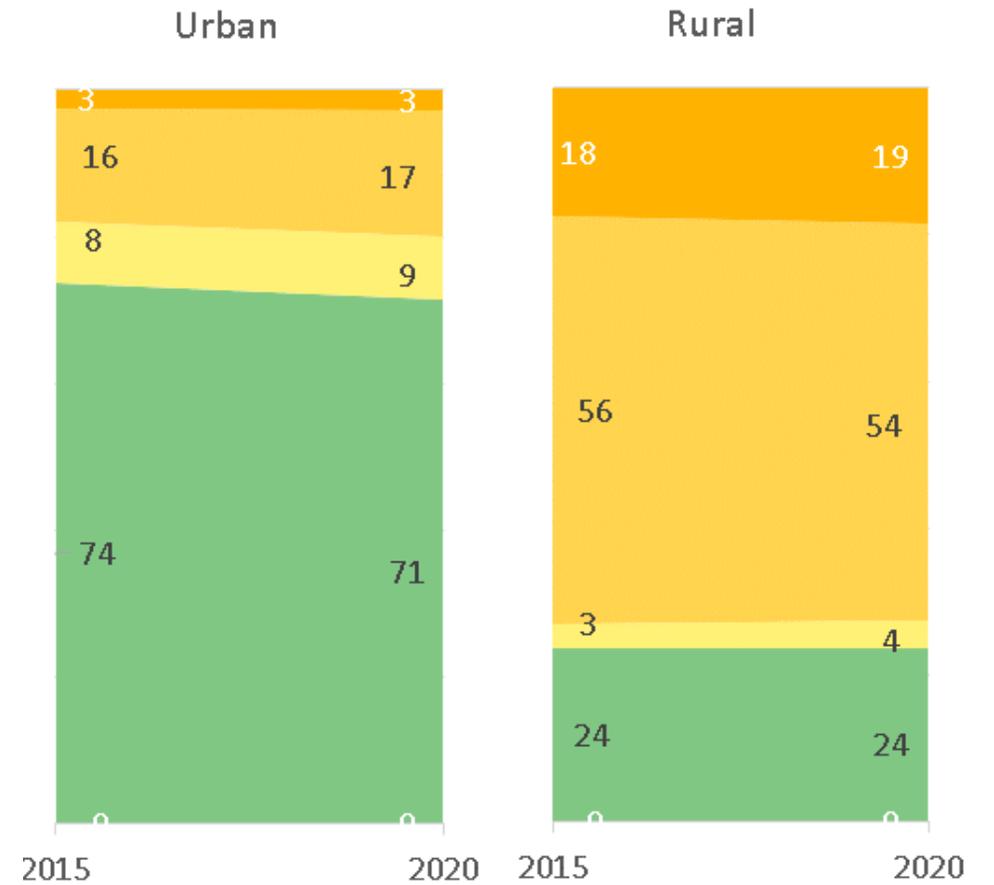
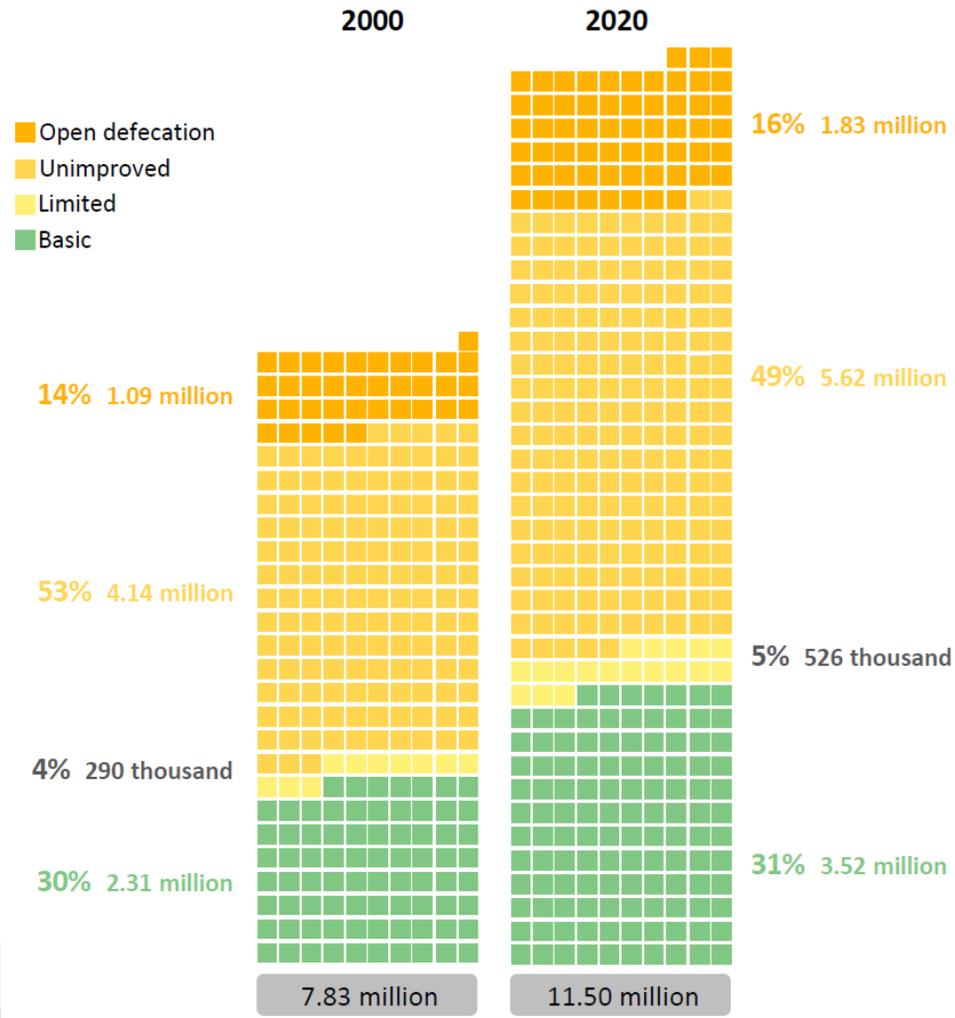
*Wastewater Division Engineer*  
Samoa Water Authority



**Bronwyn Powell - Facilitator**

*Team Leader and WASH Advisor*  
Asian Development Bank

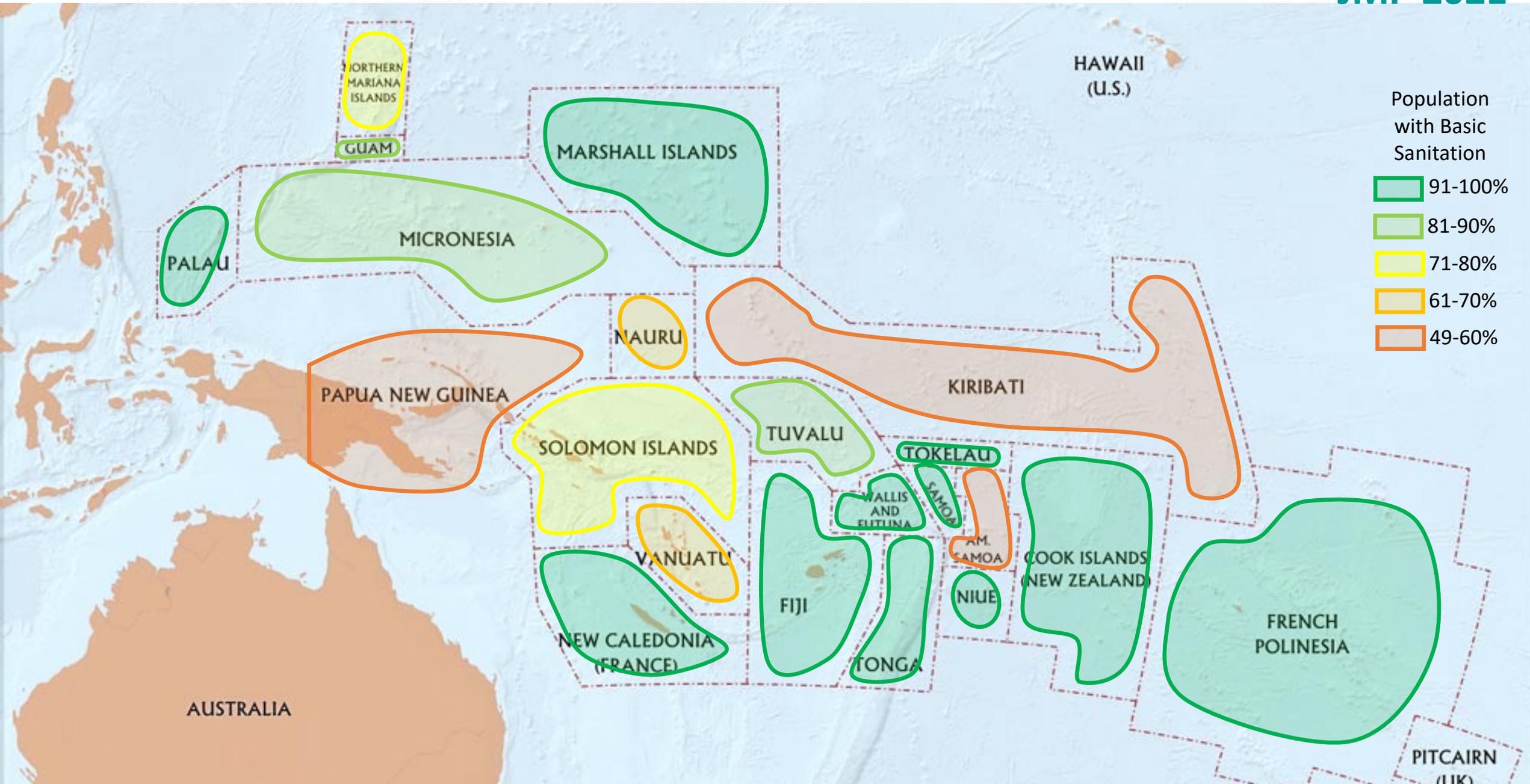
# Pacific Sanitation Context



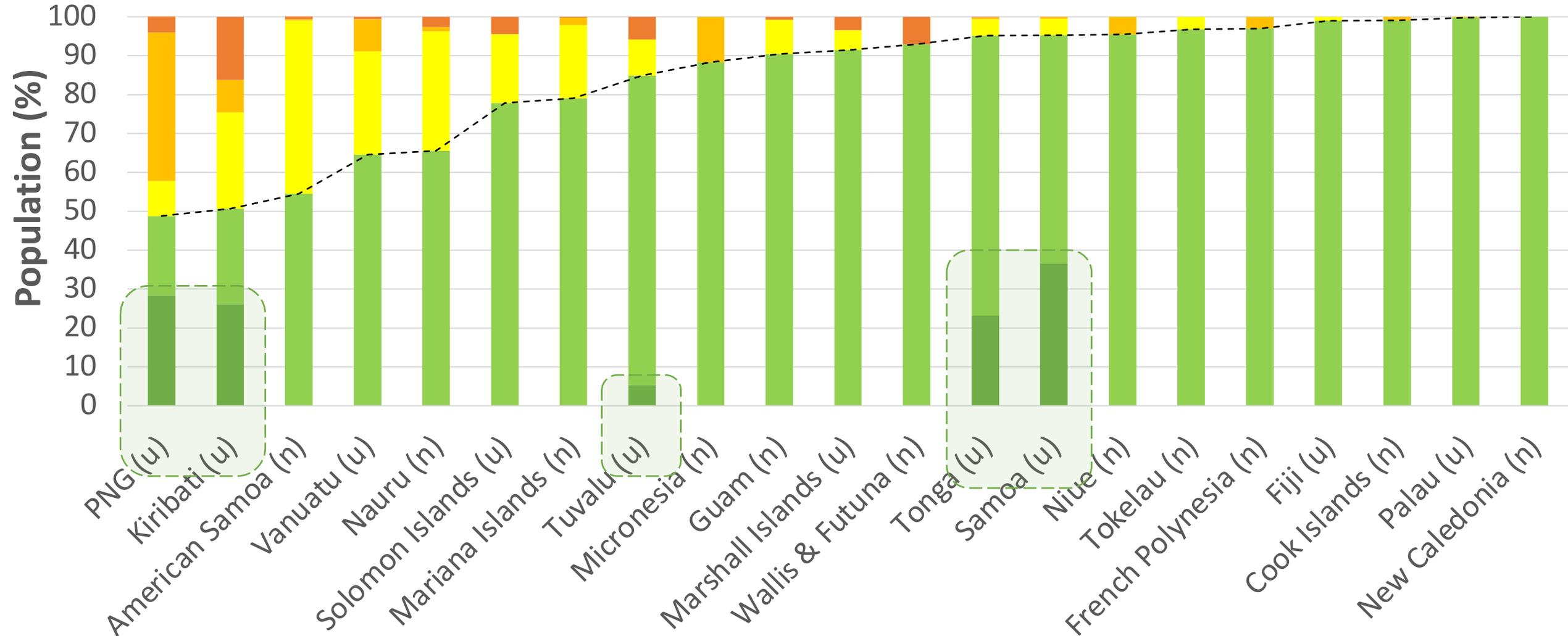
Inequities in access between urban and rural populations

1.2m people gained access in last 20 years, but this did not keep up with population growth

# Access to at least Basic Urban Sanitation Facilities JMP 2021



# Pacific Access to Basic Urban Sanitation Facilities JMP 2021



■ Safely managed sanitation\*

■ Basic (Improved and not shared)

■ Limited (Improved and shared)

■ Unimproved sanitation

■ Open defecation

- - - At least Basic

\* Data not available

(u) Urban data available

(n) Only national data available

# SDG Sanitation Ladder

## SDG Definitions

### No service (open defecation)

Disposal of human faeces in fields, forest, bushes, open bodies of water, beaches or other open spaces or with solid waste

### Unimproved Service

Use of pit latrines without a slab or platform, hanging latrines and bucket latrines

### Limited Service

Use of improved facilities shared between two or more households

### Basic Service

Use of improved facilities which are not shared with other households

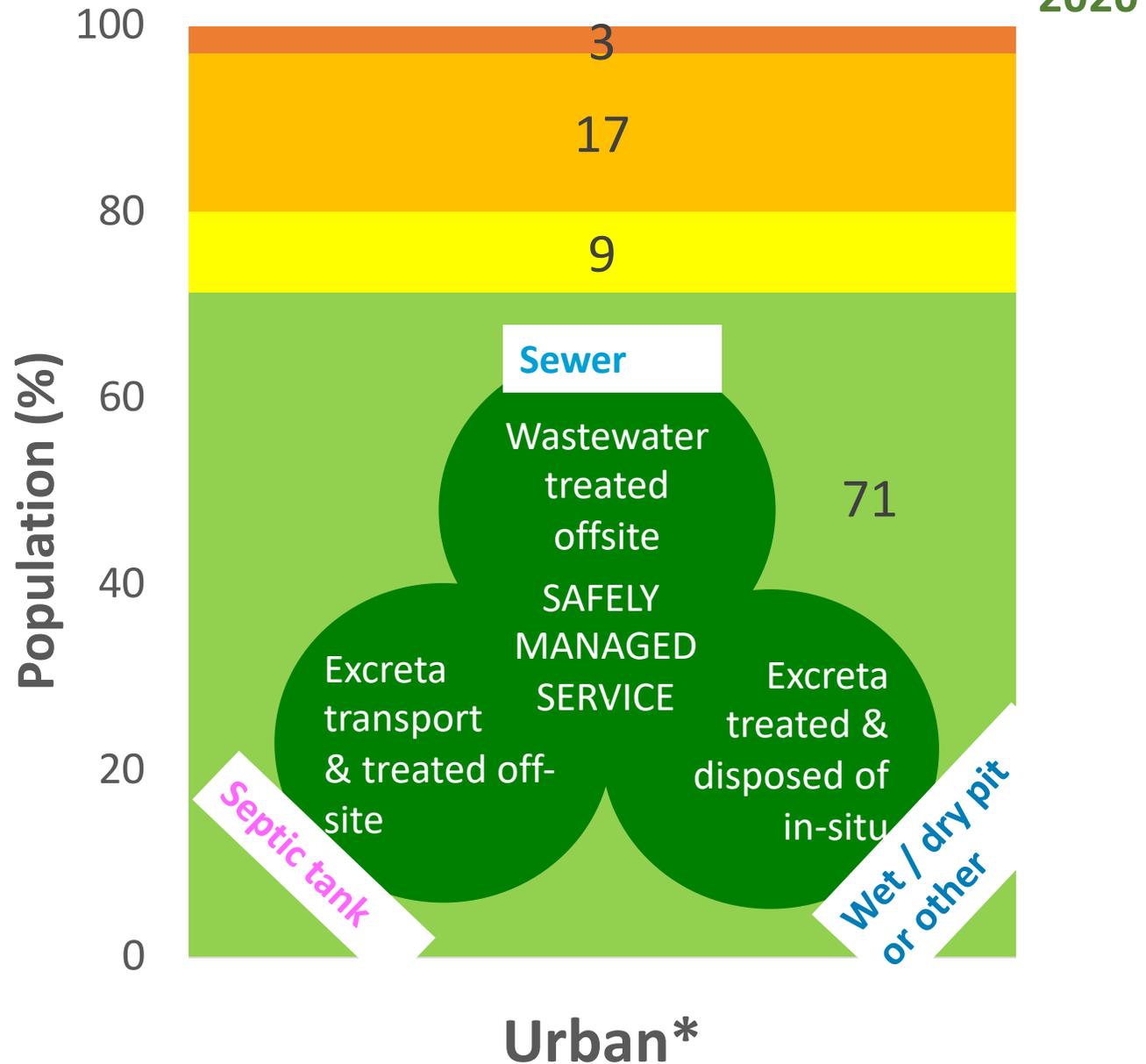
### Safely managed

Use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site

\*No safely managed estimate available

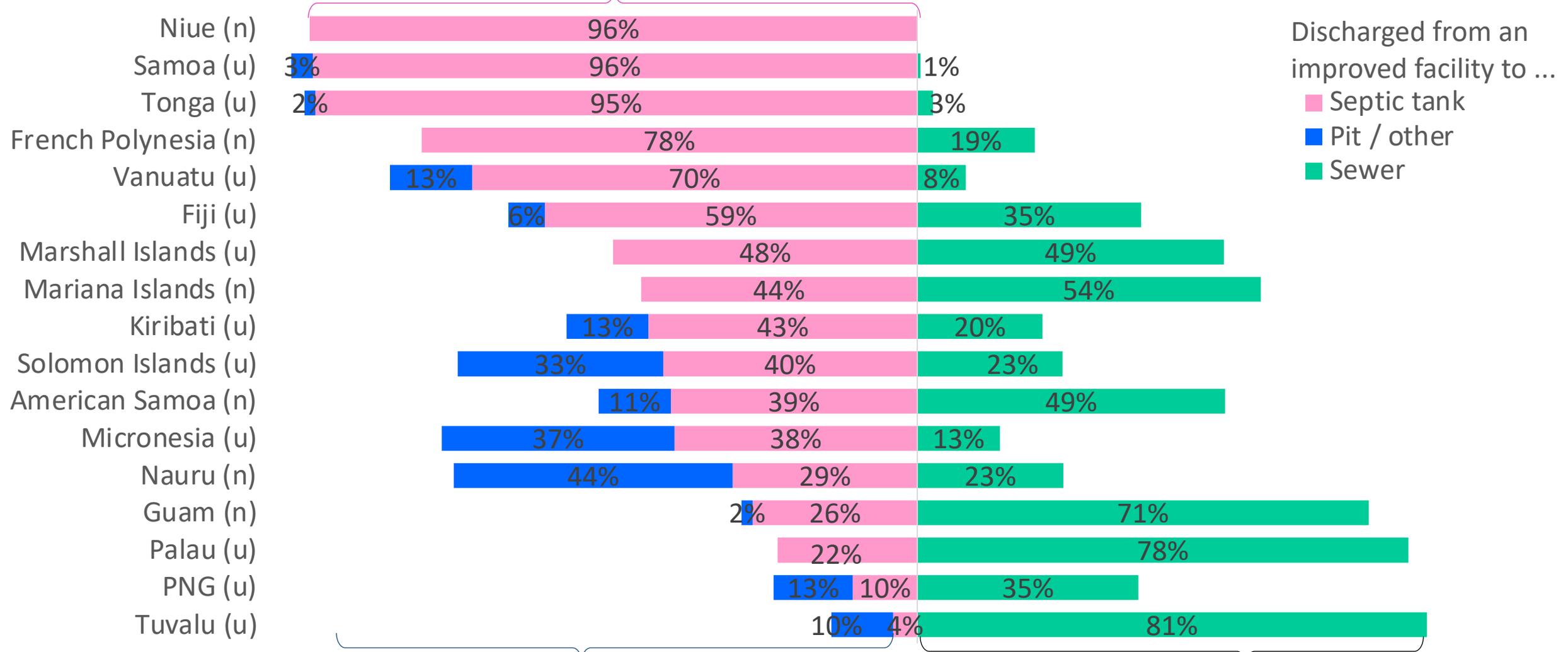
Source: WHO/UNICEF JMP (2021)

## Pacific Urban Sanitation Status 2020



# Faecal Sludge Management vs Sewerage Treatment in the Pacific 2020

Mostly faecal effluent disposed on-site & faecal sludge disposed off-site



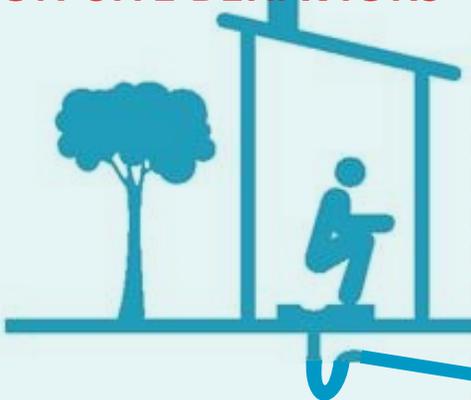
Discharged from an improved facility to ...

- Septic tank
- Pit / other
- Sewer

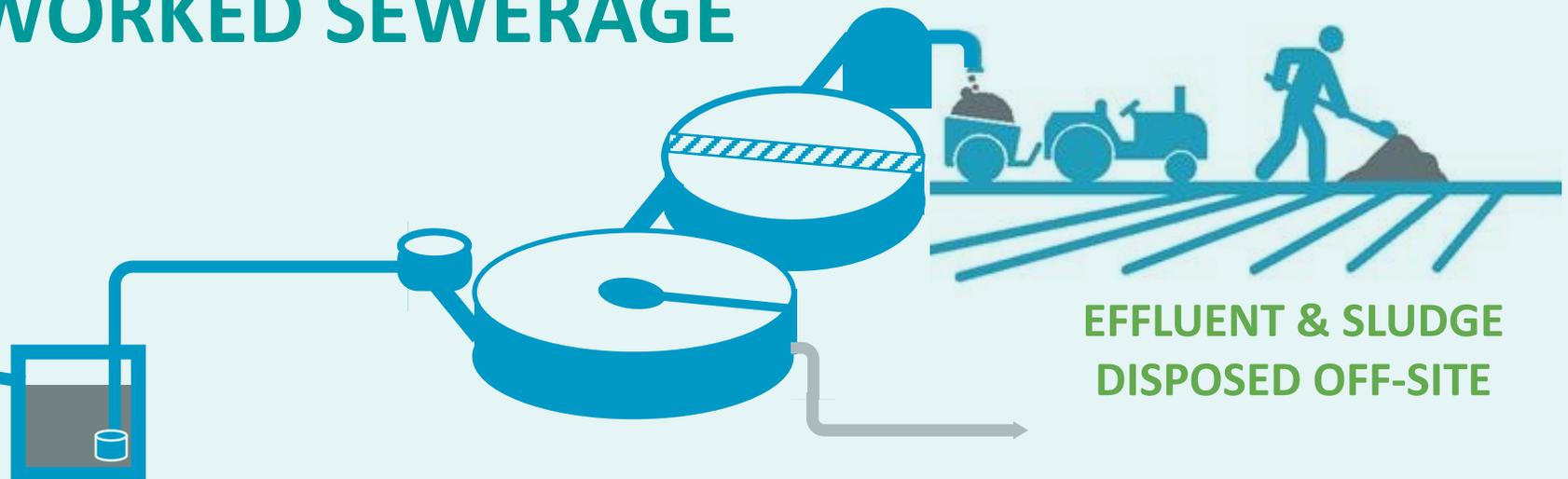
Data not available for: Tokelau, Cook Islands, New Caledonia, Wallis & Futuna

(u) Urban data available (n) Only national data available

ON-SITE BEHAVIORS



# NETWORKED SEWERAGE



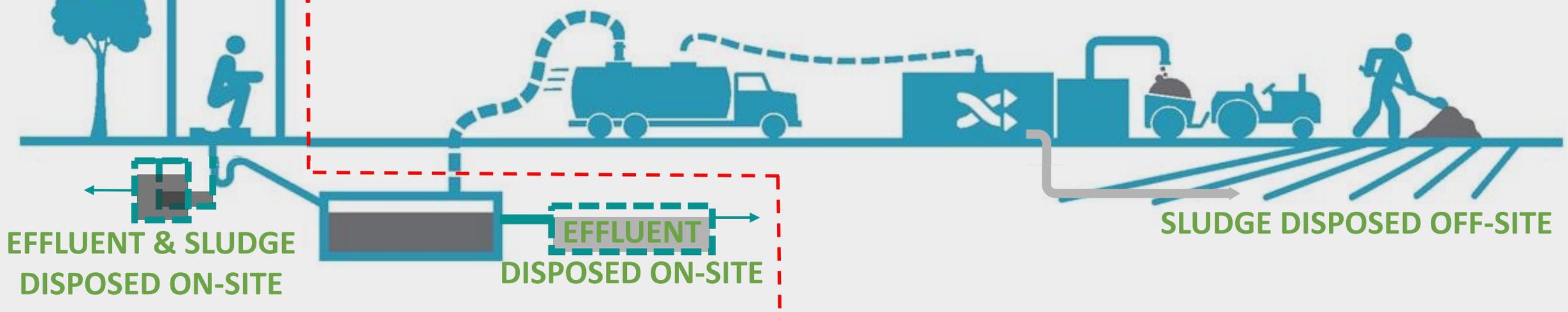
EFFLUENT & SLUDGE  
DISPOSED OFF-SITE

# Safely Managed Sanitation Elements

ON-SITE BEHAVIORS



# ON-SITE SANITATION



EFFLUENT & SLUDGE  
DISPOSED ON-SITE

EFFLUENT  
DISPOSED ON-SITE

SLUDGE DISPOSED OFF-SITE

COLLECTION ➤ CONTAINMENT ➤ EMPTYING ➤ TRANSPORT ➤ TREATMENT ➤ REUSE/DISPOSAL

# Onsite sanitary behaviour considerations

## Sanitation choice

- Technology choice and local conditions
- Emptying / transport service availability
- Supply chains
- Affordability

## Health

- Cleanliness
- Safety and accessibility for all ages and genders
- Cultural considerations

## Service sustainability

- Preventing blockages
- Ensuring functionality
- Minimise risk of overflow to surface
- Costs
- Safe disposal

## Webinar will explore:

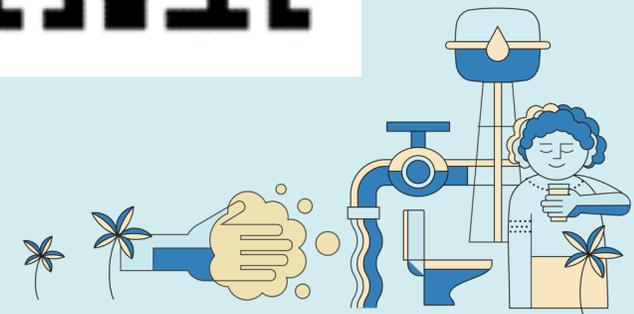
- 1) Principles of wastewater treatment for 'good enough' sanitation option
- 2) Explore where household and utility responsibilities start and end
- 3) Approaches to influencing household behaviours



# Menti survey on onsite-sanitation

[www.menti.com](https://www.menti.com) code: **7618 5072**

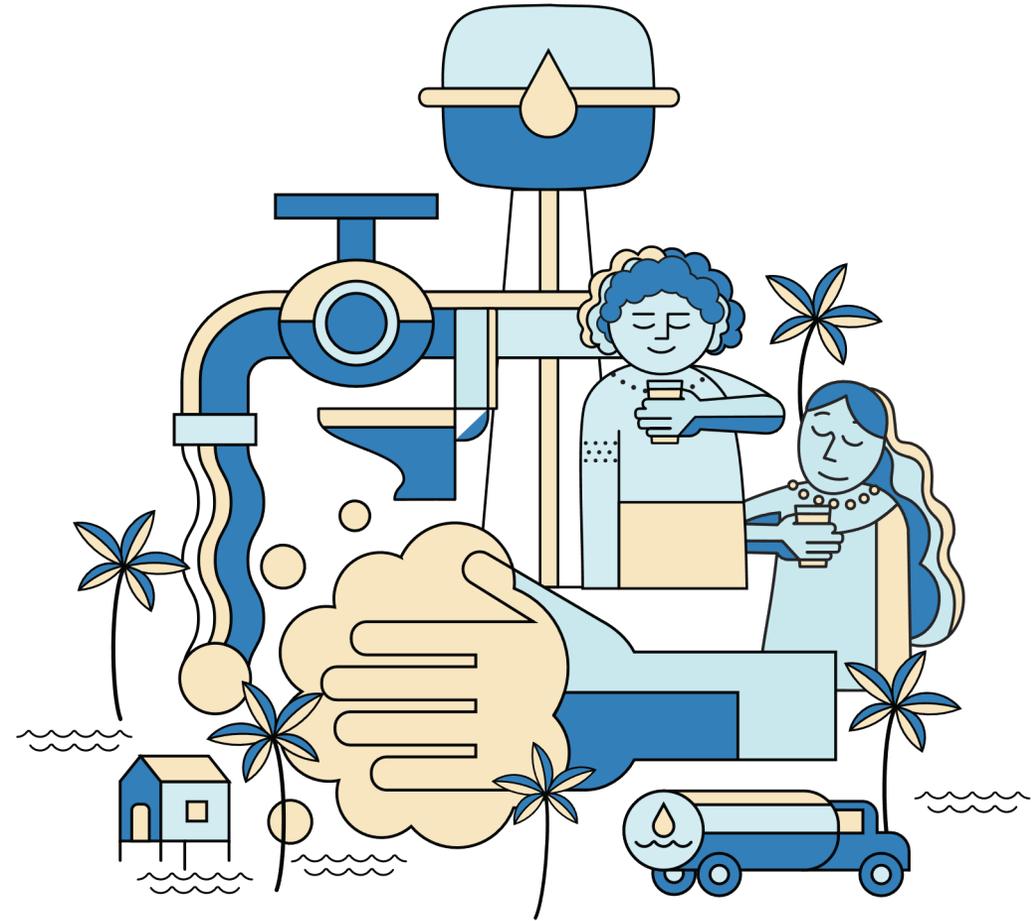
1. What is the term you use for a water-seal toilet that discharges to a pit?
2. For a given volume, which of these toilets will likely fill the fastest?
3. and slowest? [multiple choice]
4. Have you used a well-functioning dry pit toilet in the Pacific that doesn't smell?
5. In your experience what is the most common problem with septic tanks?



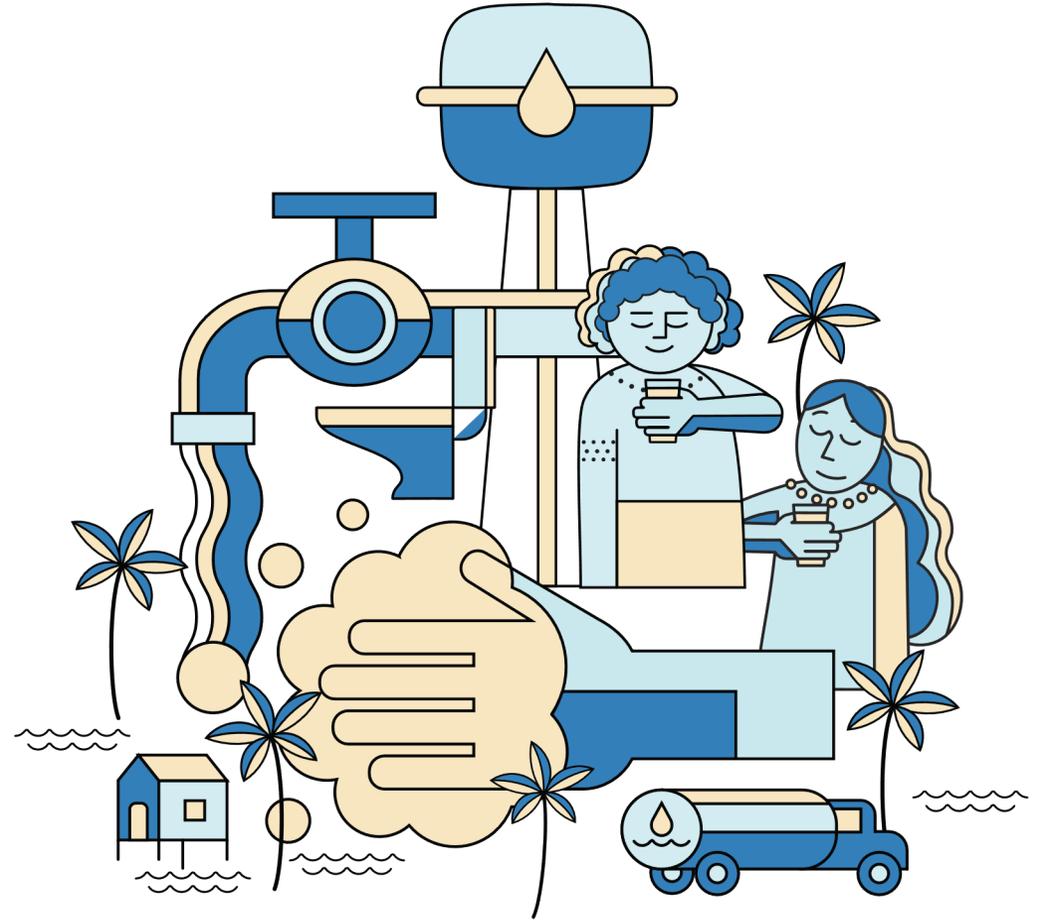


## Welcome from Pacific Water and Wastewater Association CEO

Lusía Sefo Leau



## ‘Good Enough’ Guide to On-site Sanitation in the Pacific *‘Dunnies for Dummies’*



# 'Good Enough' Guide to On-site Sanitation in the Pacific

0.1 Implications of faecal exposure

0.2 Principles of aerobic & anaerobic digestion processes

0.3 Hydro-geological implications of faecal waste disposal in the Pacific

## Public Health Acts

### 1. Pit Toilets

#### 1.1 Onsite principles of dry pit toilets

- Minimising moisture
- Maximising airflow
- Reducing odour
- Dig pit, move toilet & cover old pit

#### 1.2 Onsite principles of cesspit toilets

- Direct pit vs offset pit, single pit vs twin pit, pour flush vs push flush.

### 2. Septic Tanks & Soakaways

#### 2.1 Onsite principles of septic tanks & soakaways

- Understanding the role of soakaways
- Blackwater vs all wastewater plumbing, septic tanks & soakaways
- Optimising septic tank & soakaway design (sizing vs affordability vs risk)
- Using emptying frequency to estimate systemic system failures

### 3. Sewage/Septage Systems

#### 3.1 Onsite principles of networked systems

- Managing the interface between on-site behaviours and networked sewage / stormwater systems

#### 3.2 Onsite principles of treatment plants

- Design/maintenance of fit-for-purpose sewage vs septage treatment plants

## Local Government Acts

### Home Building Manuals

Rural

Informal

## Building Acts

### National Building Codes

Urban

Commercial

## Environment Acts

### Wastewater Regulations

Public

Provincial Council By-Laws

Municipal Council By-Laws

EIA & EMMP

# Why Safe Sanitation?

**Acute = Severe sudden symptoms**



Child wasting



Child mortality

**Chronic = Long developing syndromes**



Ineffective oral medication

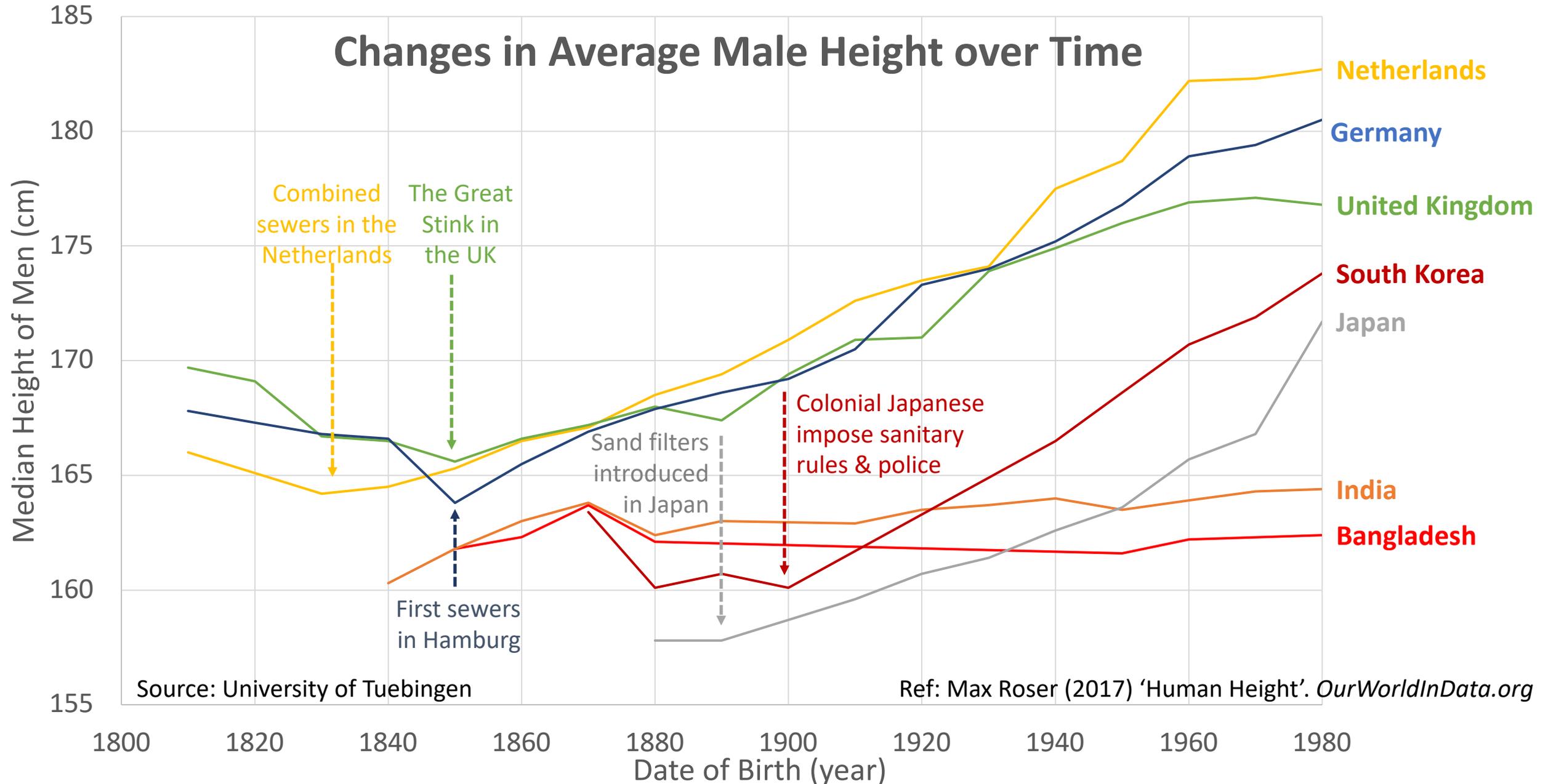


Antenatal nutrient deficiency



Low birth weight

# Men have Grown Taller with Sanitary Improvements





# Common Sanitation Options in the Pacific

Sanitation technologies can be divided into two types depending on whether they are primarily dry (aerobic) or wet (anaerobic). The safety of the sanitation options most utilised in the Pacific is dependent on particular household behaviours .

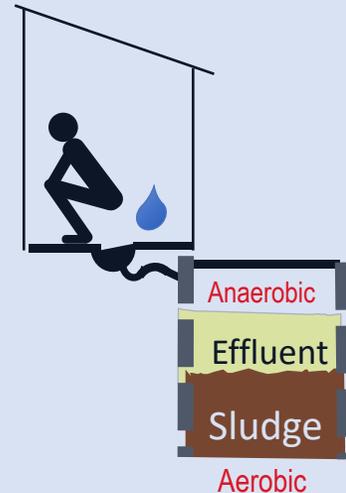
## Dry

### Dry pit toilet

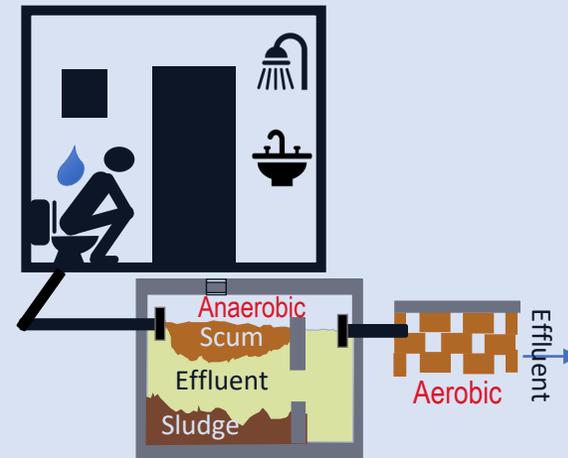


## Wet

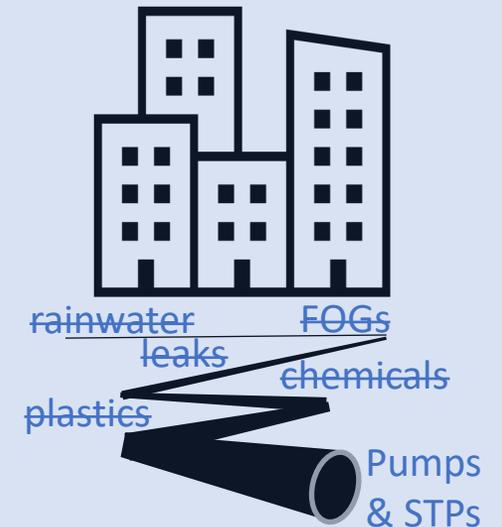
### Cesspit toilet



### Septic Tank & Soakaway



### Sewerage



#### CHALLENGE 1

Many premises don't know that minimising moisture & maximising airflow is the key to optimising dry pit toilets!

#### CHALLENGE 2

Many premises with access to water don't know that there are very low cost water seal toilet options!

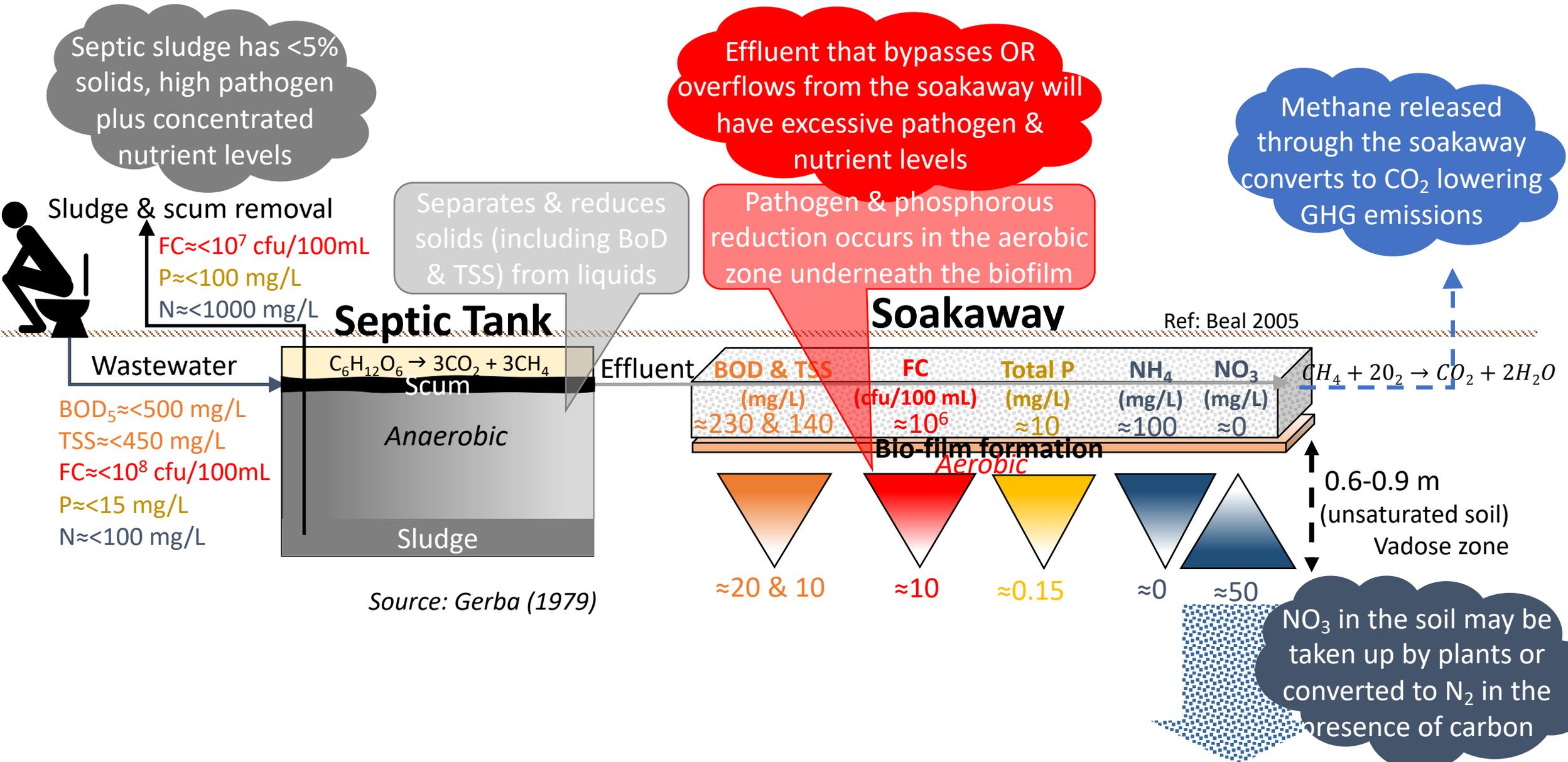
#### CHALLENGE 3

Many premises don't know that premature emptying of septic tanks is caused by inadequate soakaways!

#### CHALLENGE 4

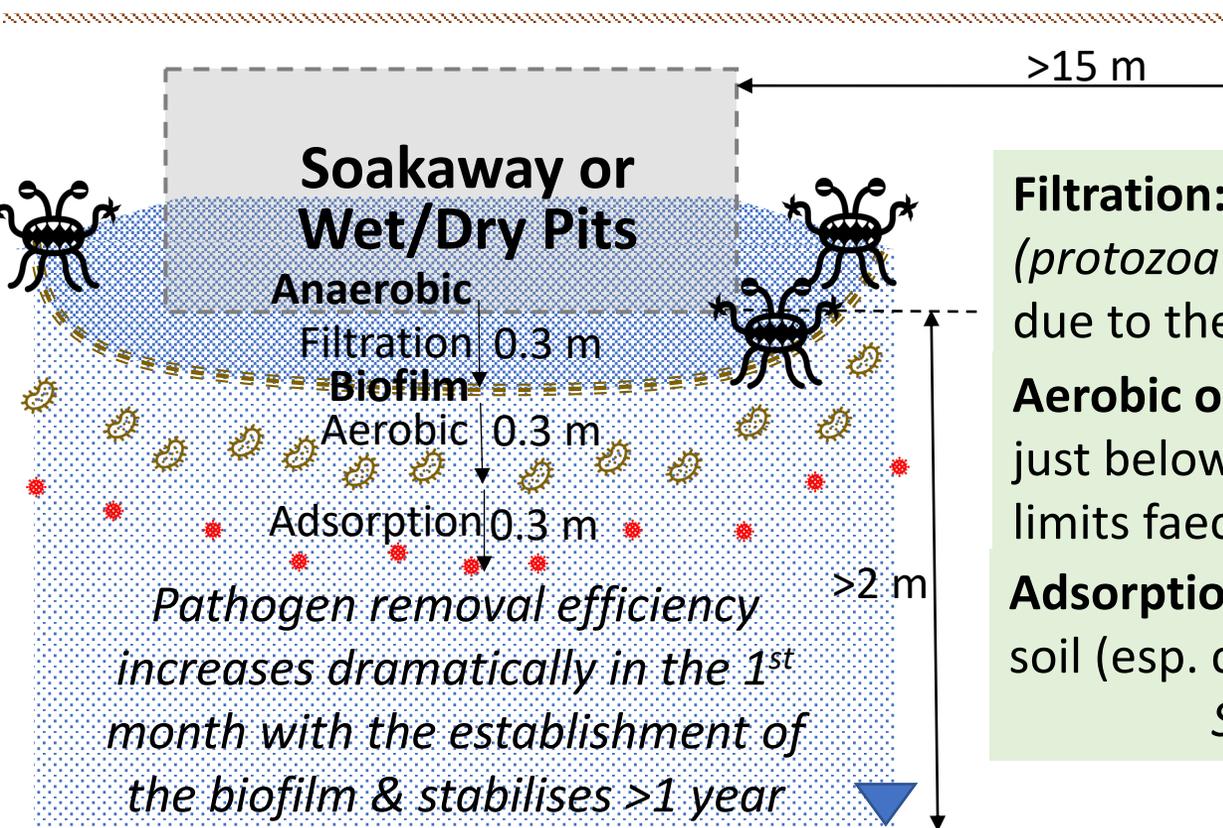
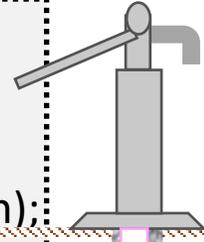
Many premises don't know to limit the ingress of water & non-biodegradable objects into networked systems.

# Overview of Septic Tank and Soakaway Performance



# Set-back Distances

- Pathogen survival **time** decreases:
- at higher ambient temperatures;
  - in drier soil with higher moisture holding capacity;
  - closer to the soil surface (more sunlight/evaporation);
  - in soil rich in microflora but low in soluble organics;



**Filtration:** by soil limits *parasite* (*protozoa* & *helminths*) transit due to their relatively large size

**Aerobic organisms:** in the soil just below the biofilm effectively limits faecal *bacteria* transit

**Adsorption:** to the surface of the soil (esp. clay) limits *virus* transit

Source: Lewis WJ (1980)

## Pathogens

	<b>Parasites (&gt;10 um)</b> <0.3 m, <1 year @ 20-30°C
	<b>Bacteria (≈1 um)</b> <0.6m, < 2months @ 20-30°C
	<b>Virus (&lt;0.1 um)</b> <0.9m, <20 days @ 20-30°C

Source: Pathogen survival times in wet faecal sludge, IWMI & SANDEC (2002)

$D = V * t = 15 \text{ metres}$   
Assuming,  $V=0.75\text{m/day}$   
 $t=20 \text{ days}$

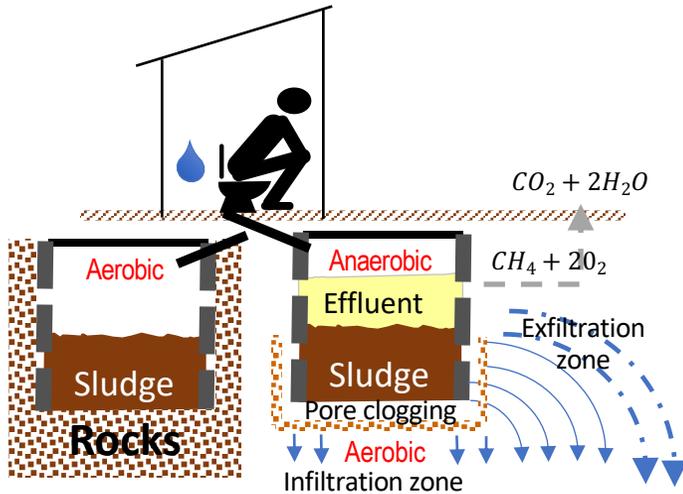
Environmental risk >> Health risk

- The **migration** of pathogens decreases:
- in a saline environment;
  - in drier unsaturated soil;
  - in finer & more clay soil;
  - at lower hydraulic loading rates

N

# Relative Advantages of Cesspits vs Septic Tanks

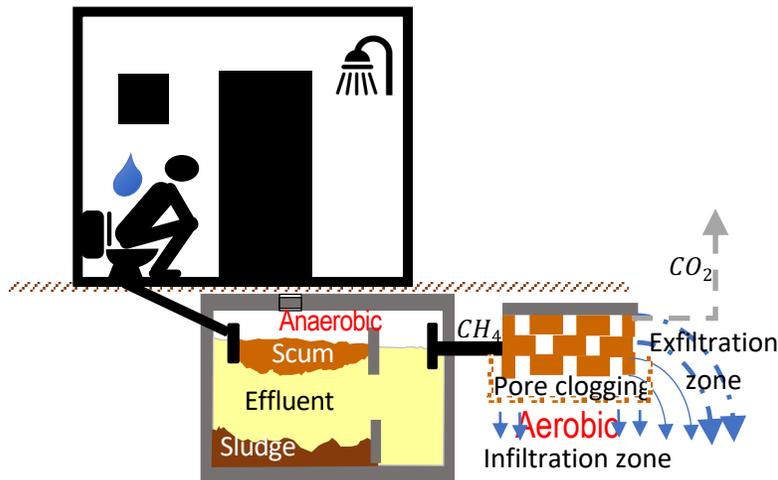
## Cesspits



### Advantages of Cesspits

- Cesspit faecal sludge fill rates (2.5 lpcy @ 60-80% moisture content) are  $\approx 10$ -20 times slower than septic tank fill rates (50-80 lpcy @ 96-98% MC)
  - The effluent absorption area for cesspits can be increased to suit dense soils by placing rocks around the perforated sludge storage chamber
  - Cesspits offer multiple options for resting, switching or emptying when they fill-up, as compared to septic tanks that must be pumped out
- Cesspits are  $\approx 10$ -20 times cheaper than septic tanks to install and maintain

## Septic Tanks



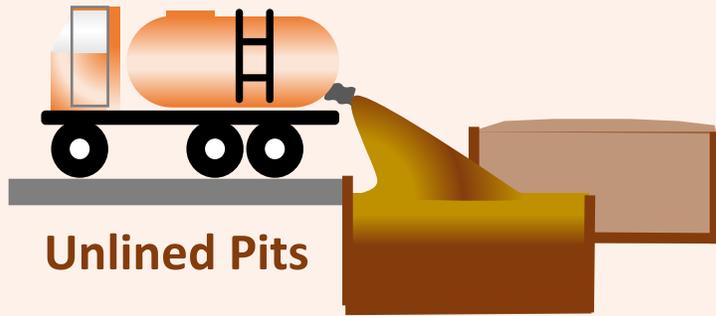
### Advantages of Septic Tanks

- Septic tanks can treat all wastewater, as compared to cesspits that cannot accommodate grey wastewater (fats, oil and grease)
  - Septic tanks contain nutrients in the sludge & effluent to potentially be removed, as compared to cesspits that will leach nutrients
  - Septic tanks enable the effluent treatment system to be tailored to suit the requirements for pathogen and/or nutrient removal
- Septic tanks can accommodate greywater and can potentially offer higher levels of nutrient/pathogen removal (with careful design)

# Passive Septage Treatment Plants

Septage plant treatment options are primarily driven by choices in the management of nutrient risks

## 1) Nitrogen leaches to the environment



**Unlined Pits**

*Pathogens attenuated below pits BUT nitrogen will leach through the soil*

### Sizing (=smallish)

- Pit volume to hold dry sludge (60% moisture)
- Pit area sized to facilitate effluent leaching
- Pits designed to limit moisture ingress

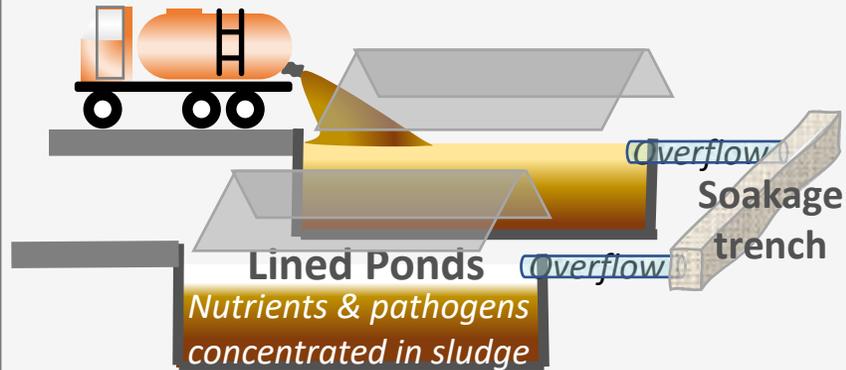
### Maintenance (= minimal)

- Mound ground over the pits when full

### Feasibility

- When septage tanker trucks are bringing sludge from toilets with well functioning soakaways (i.e. moisture content <96%)
- Where the nutrient risks are low (or carbon exists in an anoxic zone below the pit)

## 2) Nitrogen concentrated in the sludge



**Lined Ponds**

*Nutrients & pathogens concentrated in sludge*

### Sizing (=large)

- Pond volume sized to hold wet sludge (95% moisture) & soakaway to dissipate excess liquid
- Efficiently deployed in low rainfall areas or fitted with covers in high rainfall areas

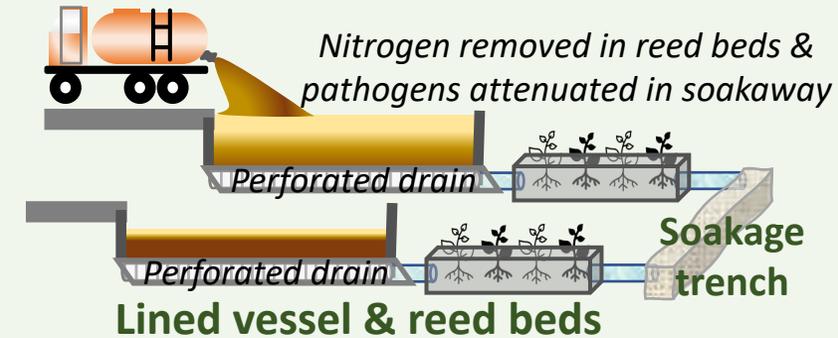
### Maintenance (=medium)

- Rest ponds when full ... dig-out sludge, turn into the soil and wait before re-using.

### Feasibility

- When there is demand for septage sludge as a 'nutrient rich' soil conditioner.
- Where the nutrient risks are moderate

## 3) Nitrogen concentrated in the effluent



**Lined vessel & reed beds**

### Sizing (=medium)

- Vessel sized to hold moist sludge (80% moisture) & soakaway to dissipate all liquid
- Vessel could also be an Imhoff tank or anaerobic baffled reactor or similar

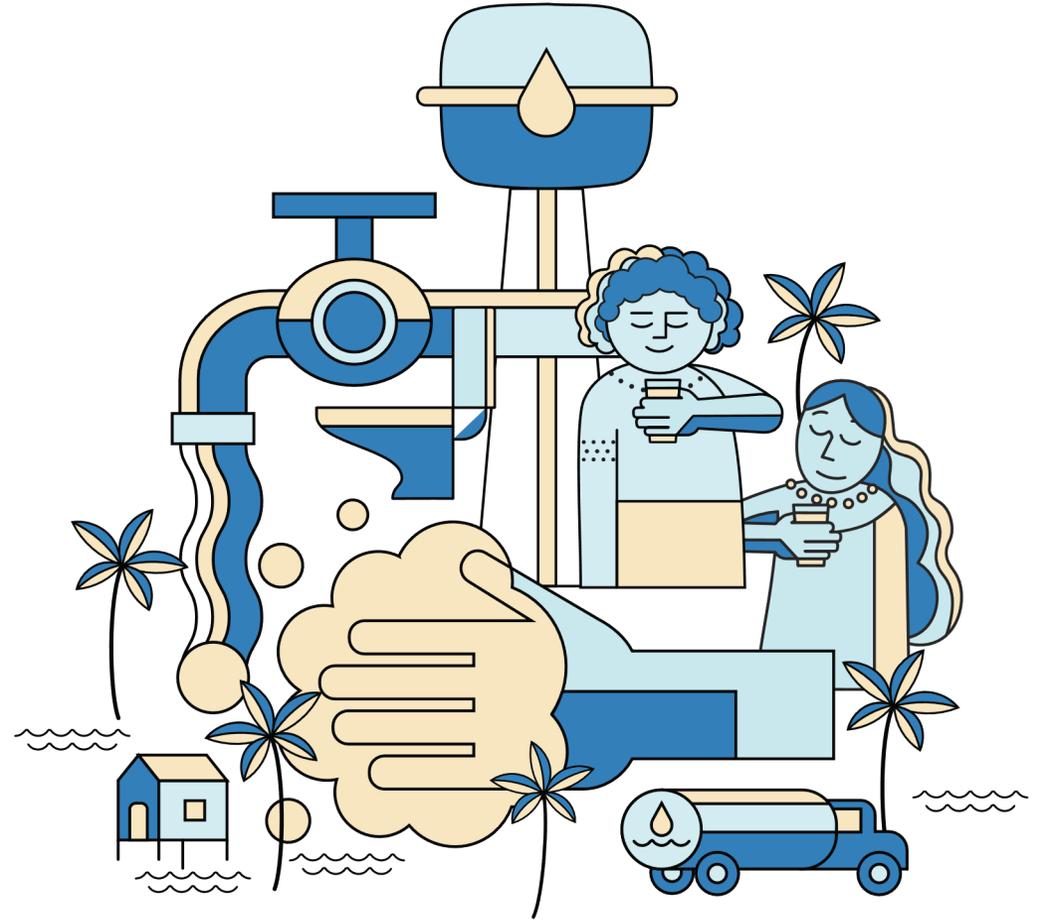
### Maintenance (=high)

- Dig out sludge when full & turn into soil
- Gravel in reed beds needs to be replaced

### Feasibility

- When moisture ingress is likely to be high
- When the nutrient contamination risks to the environment are considered to be high

Thank you





# BEHAVIOURAL CHANGES IN OFF-SITE SANITATION SYSTEMS – A COMMERCIAL PERSPECTIVE

Presented By  
Sharon Lesa – Wastewater Engineer  
Samoa Water Authority

Pacific WASH Webinar - On-site Sanitary Behavior Change

# OVERVIEW

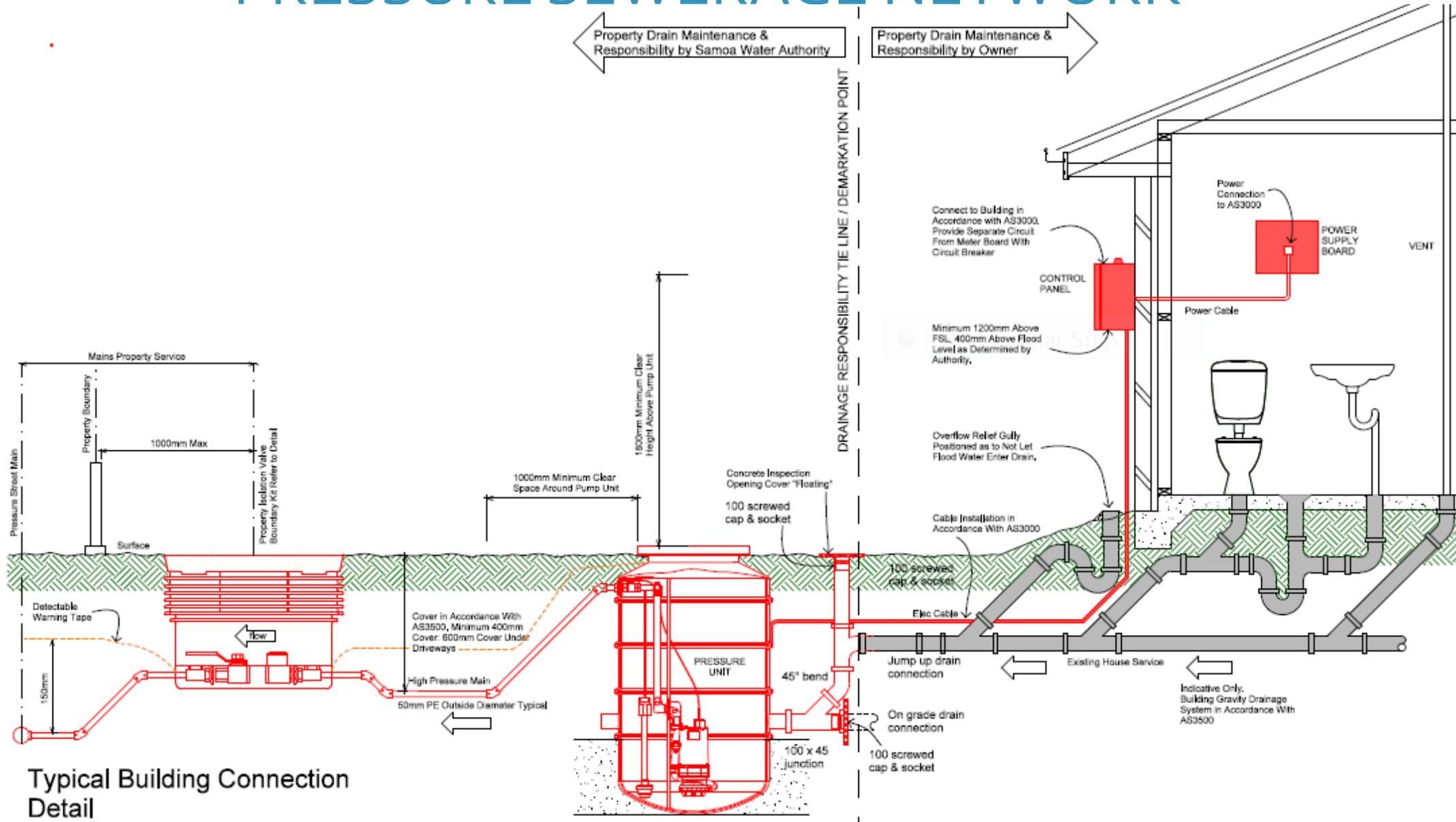
- Background
- Typical Sewerage Connections
- Regulating Discharge to Our Network
- Common Issues and Corrective Actions – Pressure Sewer Pump Stations
- Current Works to Optimize our System

# BACKGROUND



- Main water utility in Samoa. Servicing around 85% of the population.
- 30,000 water connections
- WWTP and Pressure Sewer Network commissioned in 2010, servicing only the commercial customers in the Apia CBD.
- 124 sewer connections.
- 112 sewer pump stations, 7.6km sewerage mains.
- 1 x Wastewater Treatment Plant located at Sogi, Apia .Operating at 60% of Average Dry Weather Flow (ADWF) capacity.

# TYPICAL SEWERAGE CONNECTION TO THE SWA PRESSURE SEWERAGE NETWORK



Typical Building Connection Detail

# REGULATING DISCHARGE TO OUR NETWORK



## Pressure Sewer System

Connection to the SWA network:

- Sewerage and Wastewater Regulation (2009).
- SWA Trade Waste Policy.

## Sogi Wastewater Treatment Plant

- Effluent discharged to comply with the SPREP (1996) regulatory standards.
- Draft National Effluent Discharge Standards.

## Customer Awareness and Responsibility

- **ALL** new and existing customers/connections must comply with SWA's Sewerage Regulation and Trade Waste Policy.
- Customers and landowners are made aware of the conditions of connections before signing the Pressure Sewer Installation Agreement and Customer Agreement.

# COMMON ISSUES AND CORRECTIVE ACTIONS

## PRESSURE SEWER PUMP STATIONS



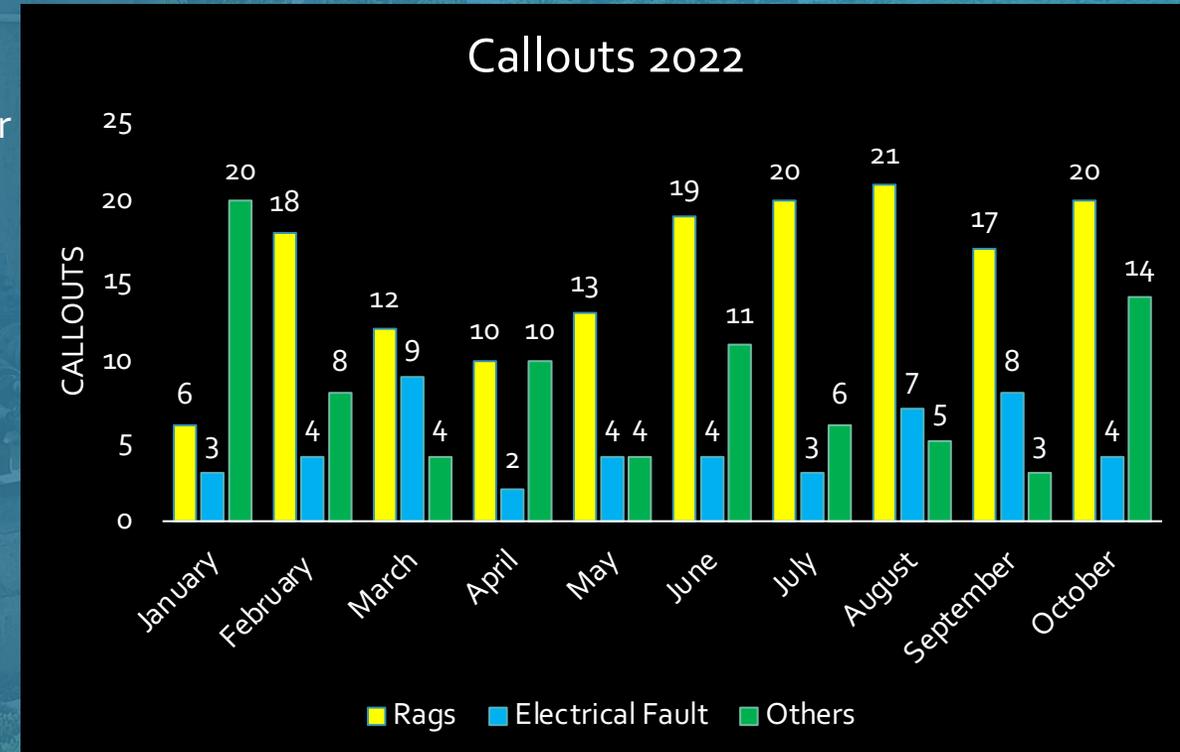
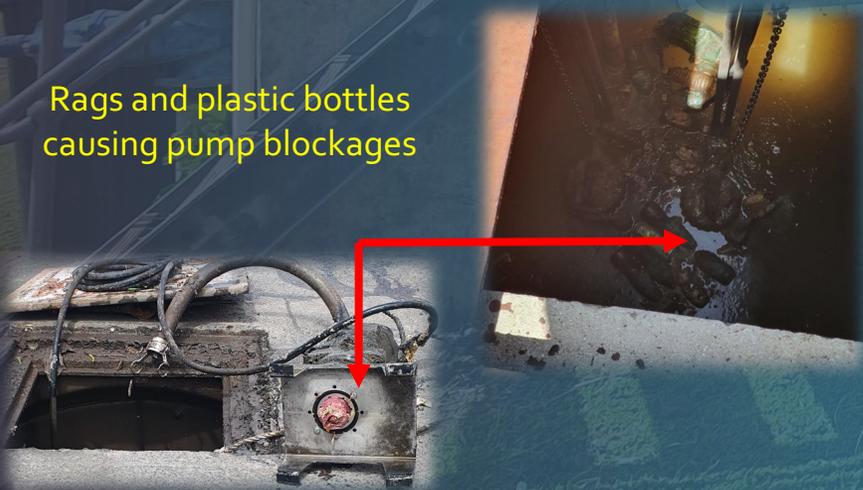
### Operational Issues – Pump Blockages

- Around 60% of reported pump faults are caused by disposal of foreign materials into the sewer tank (e.g. rags, tissues, plastic bottles).
- Reported via our customer callouts.

### Corrective Actions

- SWA's response time is within 2 hours.
- Work on improving public awareness and their understanding of our system (e.g. what/what not to flush).

Rags and plastic bottles causing pump blockages



# COMMON ISSUES AND CORRECTIVE ACTIONS PRESSURE SEWER PUMP STATIONS

## Operational Issues – Stormwater and Grease Discharge

- Indirect and direct stormwater discharge remains a big problem due to surge flows to our WWTP during heavy rain.
- Grease build-up due to poorly designed or less-frequent pump outs for grease-traps (used at restaurants and food-courts).

## Corrective Actions

- Scheduled inspection for grease traps.
- Issue warning letters to customers regarding violation of SWA's Trade Waste Policy.
- Continuous implementation of inflow and infiltration reduction program (i.e. via assets upgrades or removal of stormwater connections).



Grease build-up

Stormwater discharge found via dye-tracing



# CURRENT WORKS TO OPTIMIZE OUR SYSTEM



## ASSET MANAGEMENT, PREVENTATIVE MAINTENANCE AND PILOT TELEMETRY UNITS

- Very important to maintain an up-to-date Asset Register (for preventative maintenance schedules).
- Proactive response to customer callouts via utilising telemetry or SCADA units.
- Ongoing trainings and capacity building for our staff regarding WWTP operations and troubleshooting methods.

We always try to avoid this!



Annual Maintenance Activities

Install telemetry units for remote monitoring



# CURRENT WORKS TO OPTIMIZE OUR SYSTEM



## ENERGY EFFICIENCY AND OPTIMIZATION FOR PRESSURE SEWER

- Average electricity bill for O&M of 100+ pump stations is around **SAT\$15,000** per month (Very expensive!!!)
- Current works on energy optimization includes identifying the optimum runtimes for the pumps (from each pump station) so that they are not all running at the same time.
- Unnecessary concurrent pump operation can increase electricity needs and decreases overall pump efficiency.
- Smart control panels and data logging is critical to this optimization activity.



Training on installation of smart control panels



SWA team installing smart control panel for better flow controls and data logging



**THANK YOU!**

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**WORLD BANK GROUP**

**Onsite Sanitation Behaviors**

# **South Tarawa Sanitation Project Experiences**

ADB'S PACIFIC WASH WEBINAR

NOVEMBER 30, 2022

**Raghava Neti, World Bank, Fiji**

# Agenda



Why onsite behavior change?



Take aways

1. Promote ownership, use and stainability



Hurdles?

2. Vary based on the context, culture and capacity of institutions



How to tackle?

3. Strategic planning and interventions by the Governments and utilities



WB Global Knowledge and Project experience

4. WB project in Kiribati has strategies in place based on global and local experiences. Need to ensure governance, implementation, partnerships to succeed.



# Why?

ONSITE BEHAVIOR CHANGE IS  
IMPORTANT





# 1. Promote ownership, use and sustainability



## Why?



**CONNECT TO NETWORK**



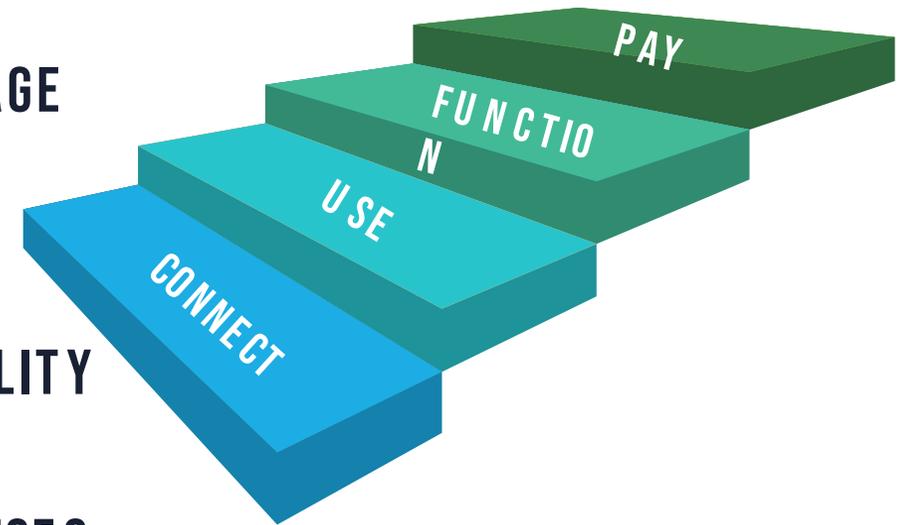
**PROMOTE USAGE**



**ENSURE FUNCTIONALITY**



**PAY FOR SERVICES**



**THE WORLD BANK**

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East Asia & Pacific

# Hurdles





# Hurdles?

## CONNECTIONS

Networks are built but toilets are not connected



## COST RECOVERY

Beneficiaries' payments for services



## USAGE

Toilets built, but people don't use, or use for different purposes

## FUNCTIONALITY

Beneficiaries construct / use the systems inappropriately leading to failures of systems / poor outcomes





How to tackle?



# How to tackle?

MONITOR AND EVALUATE

2-WAY COMMUNICATION



ANALYZE AND UNDERSTAND THE CONTEXT AND ISSUES

LEARN FROM EXPERIENCES

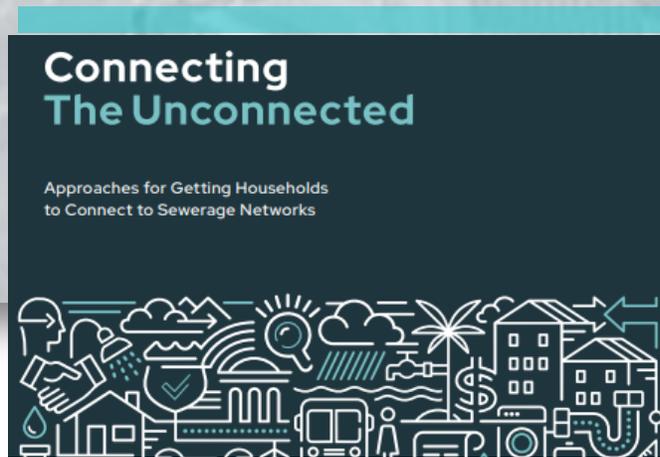
FACILITATE BEHAVIOR CHANGE

BUILD SKILLS TO ADDRESS ISSUES



# WB Knowledge products

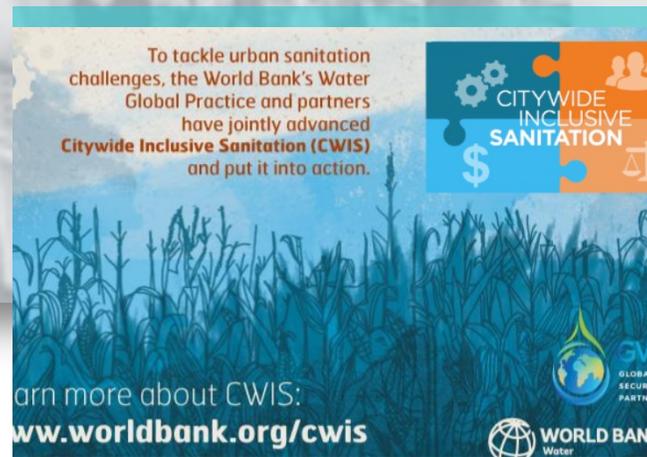
# WB Global Knowledge Products



## Connecting the unconnected

Approaches for Getting Households to Connect to Sewerage Networks

<https://www.worldbank.org/en/topic/sanitation/publication/connecting-the-unconnected>



## Citywide Inclusive Sanitation

Ensure everyone has access to safely managed sanitation by promoting a range of solutions

<https://www.worldbank.org/en/topic/sanitation/brief/citywide-inclusive-sanitation>



## Shared and Public Toilets

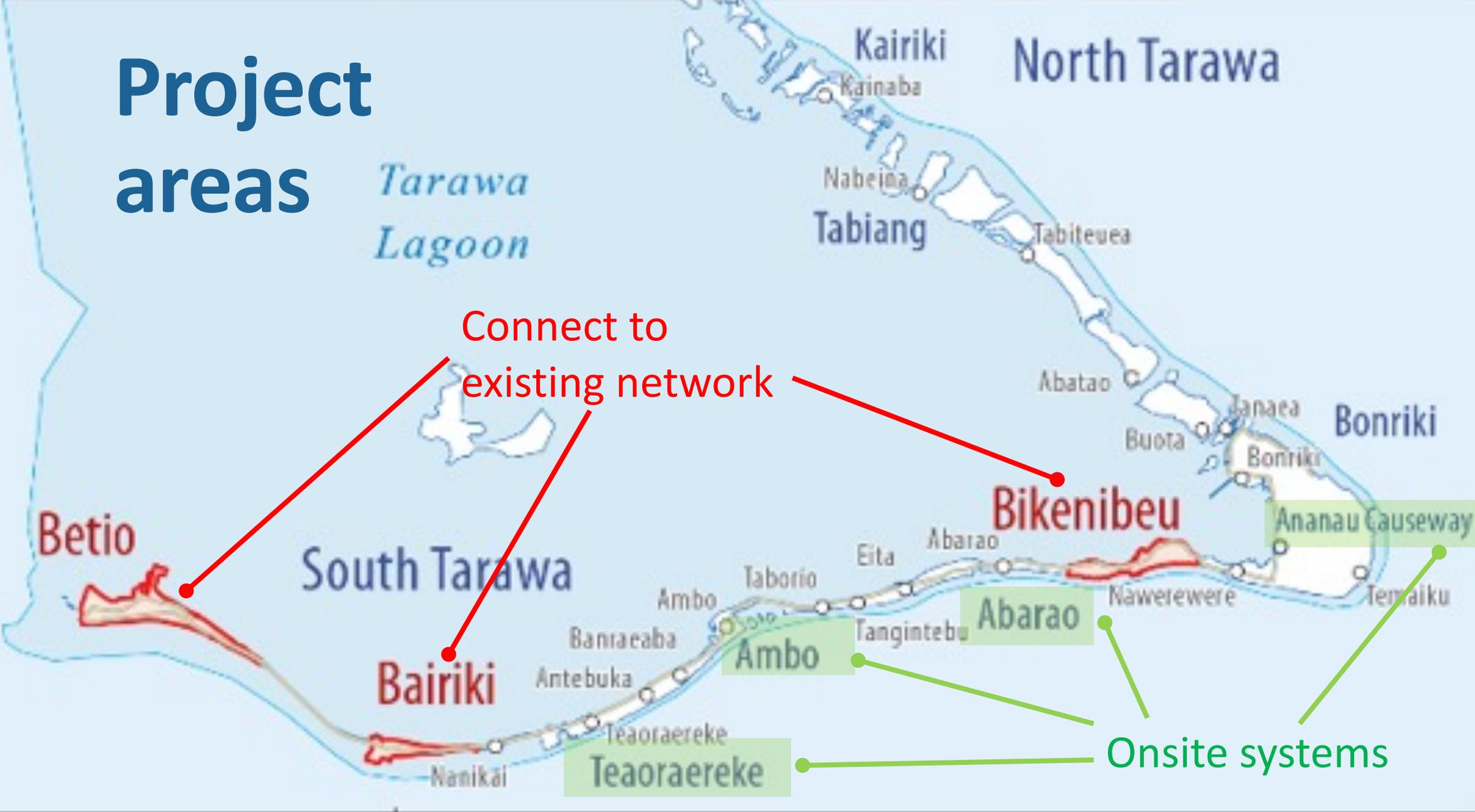
Successful delivery models

<https://openknowledge.worldbank.org/bitstream/handle/10986/30296/W18035.pdf?sequence=4&isAllowed=y>

# South Tarawa Sanitation Project Approaches



# Project areas





# Project components

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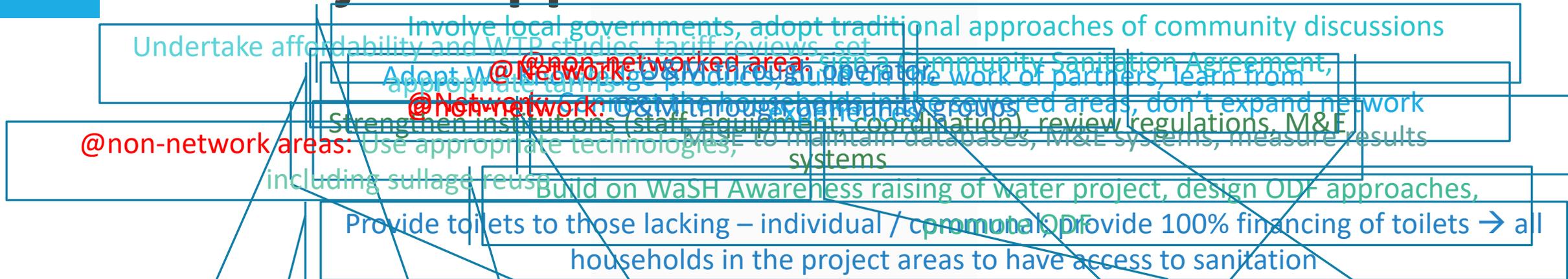
1. Sanitation Access and Liquid Waste managements
2. O&M, Institutional Strengthening, Sector Improvement
3. Community Engagement and Support
4. Project Management

**Funding – USD 19.49 m**



4. WB project in Kiribati has strategies in place based on global and local experiences. Need to ensure governance, implementation, partnerships to succeed.

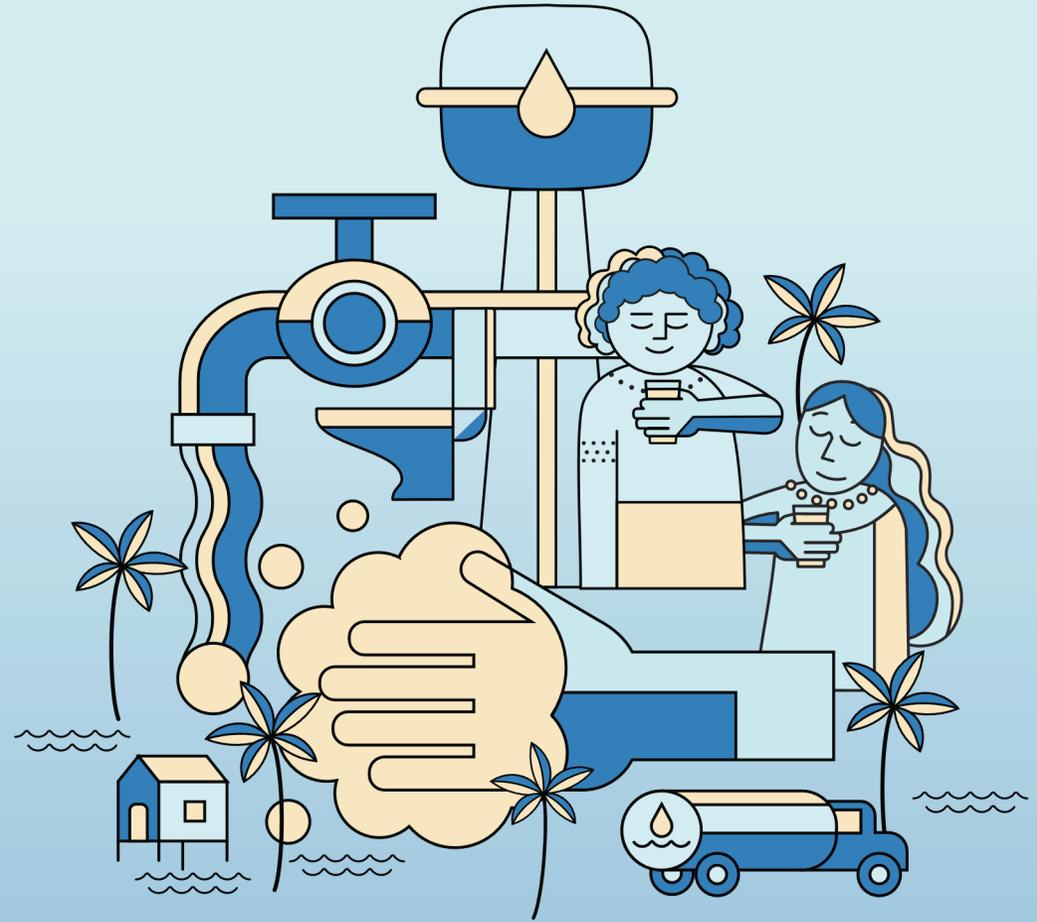
# WB Project Approaches



Thank you

QUESTIONS?

# Q&A



# Thanks for Watching

Available online:

<https://www.adb.org/publications/opportunities-pacific-wash-sector>

