

Water Resource Challenges facing the Pacific Island Nation of Kiribati

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Tonkin Consulting

Introducing the Crawley Family

- Phil - Dad
- Allison - Mum
- Rebecca – 11 yo
- Jonathan – 9 yo
- With our fellow AVI volunteers



Our First Impressions

- Climate – Hot and Humid
- Developing Country
- Rubbish
- Poor Infrastructure
- “Pacific Time”

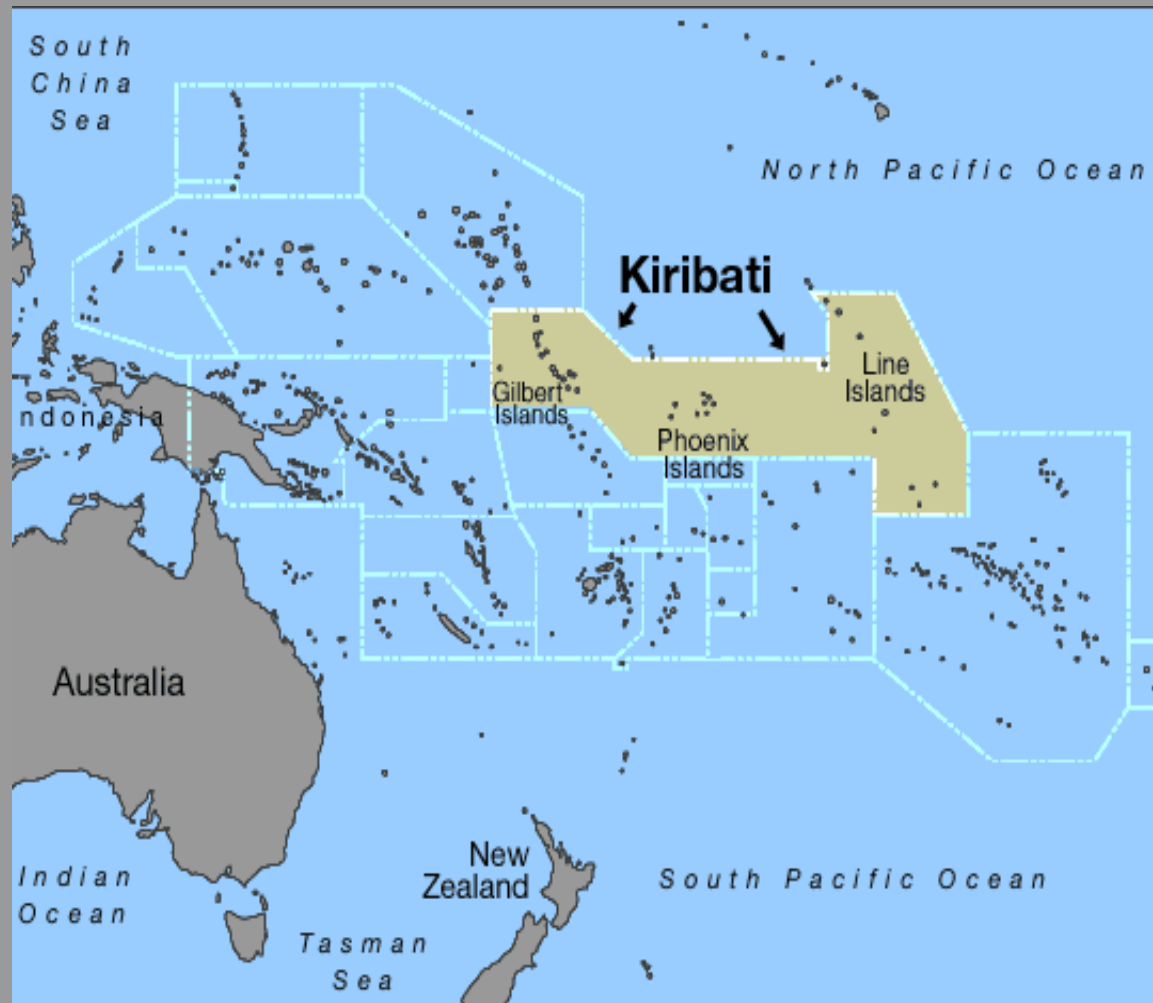


The Nation of Kiribati

- Independence in 1979
- Former British Colony – Gilbert (now Kiribati) and Ellis (now Tuvalu) Islands
- Land area of ~ 800 km²
- Sea area > 3 million km²
- GDP – US\$1,420 per capita (2010)
- Ranked 122nd out of 187 Countries on the 2011 UNDP HDI (Human Development Index)

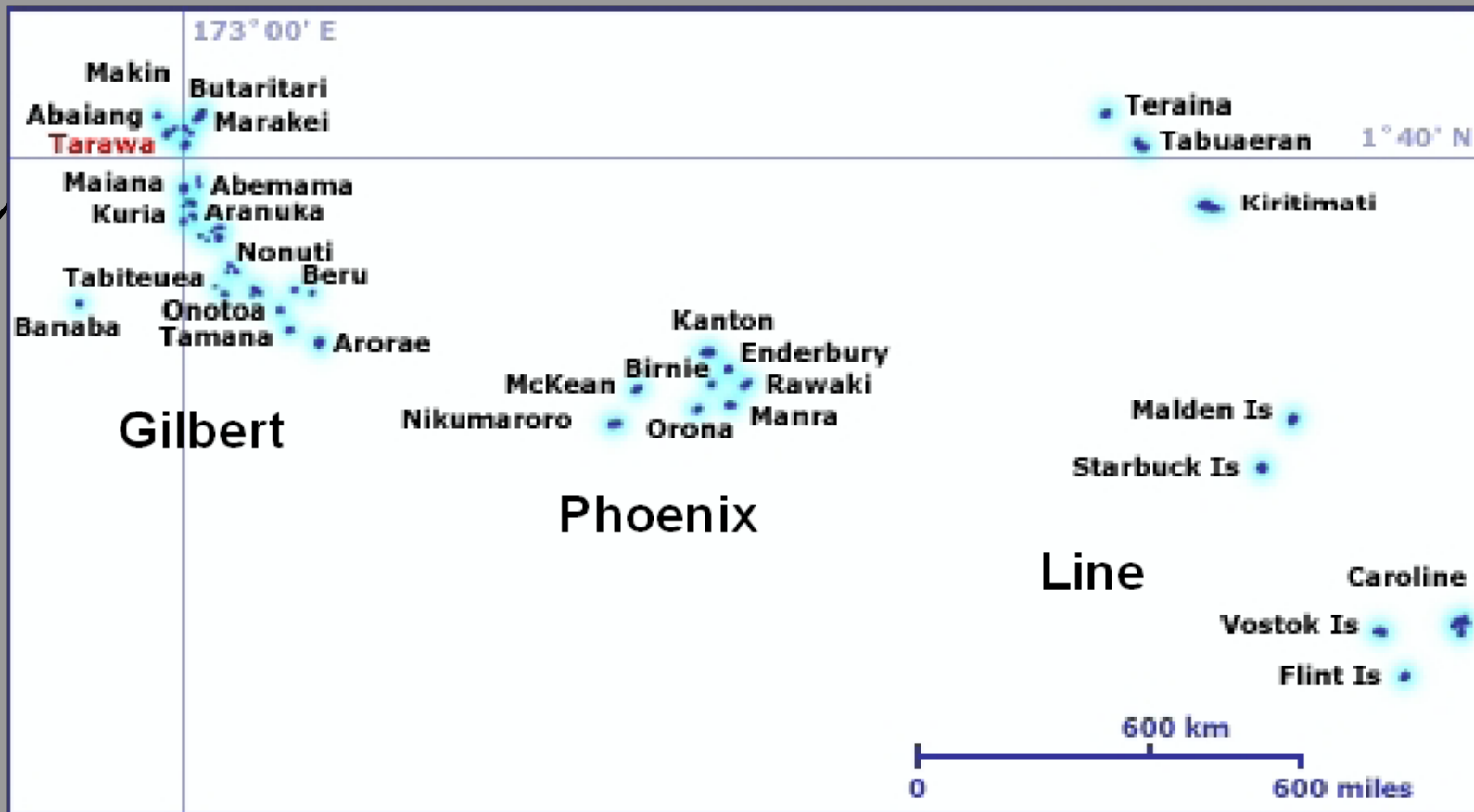
Kiribati – Where is it ?

- Middle of the Pacific Ocean
- Nation straddles the Equator
- 32 sand and coral atolls and one limestone island
- Comprises three main island groups: Gilbert, Phoenix and Line
- Most atolls no more than 4m above sea level
- Highest elevation is 80 m ASL on Banaba
- South Tarawa is centre of Government and Commerce



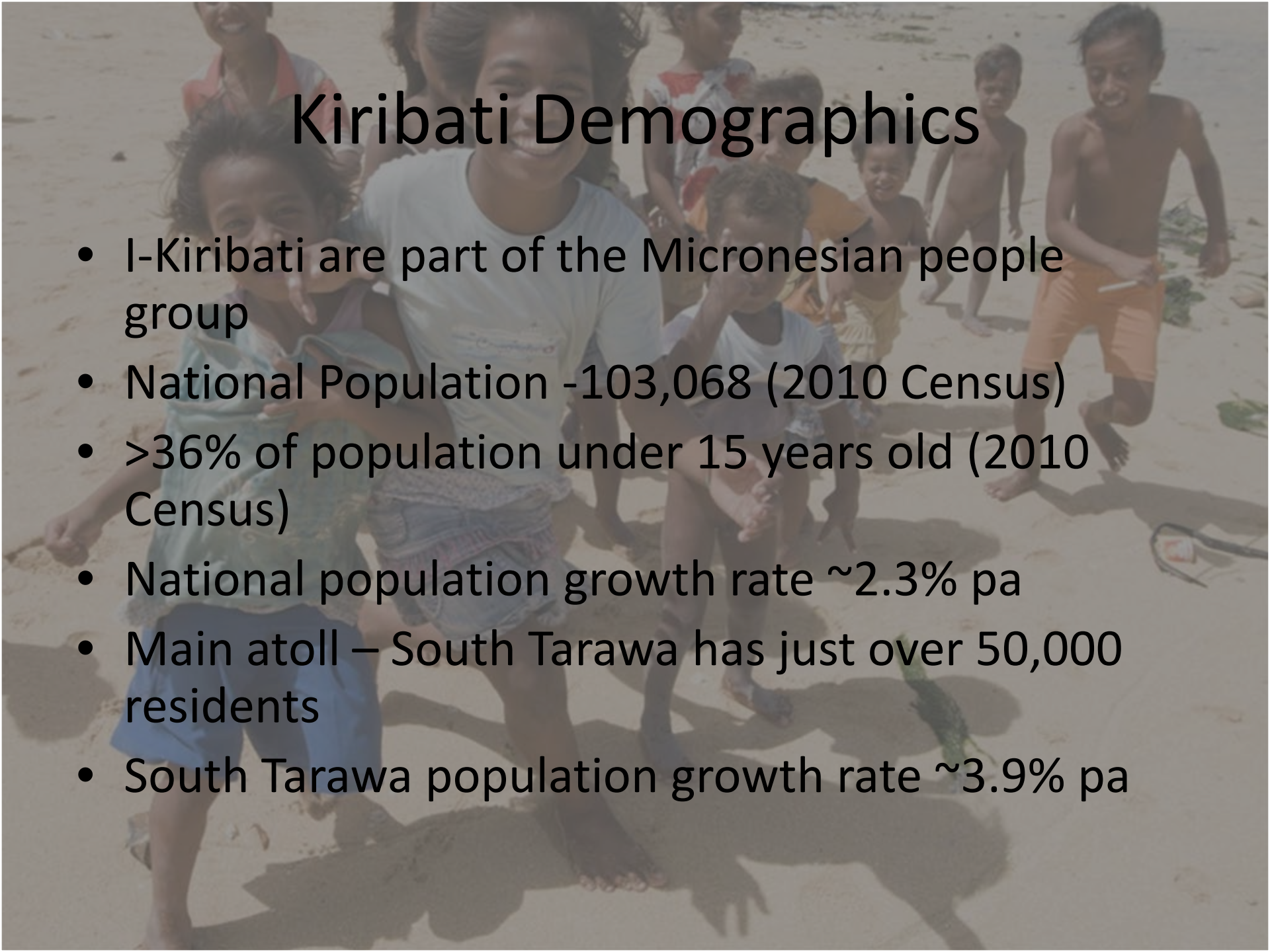
Locality Plan for Kiribati

Islands Groups of Kiribati



Kiribati Climate

- Maximum 32°C, Minimum 26°C (year round)
- Tarawa Average Rainfall – 1900mm/annum
- Wetter season – December to May
- Drier season – June to November
- No cyclones or typhoons since near the equator
- Impacted by El Nino (Wet) and La Nina (Dry)
- **Not** affected by Tsunamis

A group of children, likely from Kiribati, are standing on a sandy beach. They are smiling and looking towards the camera. The children are dressed in casual clothing, including t-shirts and shorts. The background is a bright, sunny beach with sand and some sparse vegetation.

Kiribati Demographics

- I-Kiribati are part of the Micronesian people group
- National Population -103,068 (2010 Census)
- >36% of population under 15 years old (2010 Census)
- National population growth rate ~2.3% pa
- Main atoll – South Tarawa has just over 50,000 residents
- South Tarawa population growth rate ~3.9% pa

Available Water Resources

- No rivers, streams or lakes
- Primary potable water supply sources are underground freshwater lenses
- Freshwater lenses “float” above the sea water
- Thickness of lens is a function of land width, rainfall, extraction rates
- Lenses can be “destroyed” if over extracted
- Groundwater supplemented by rainwater harvesting (where possible/practical)

Water Governance

- Multiple Government agencies with overlapping roles and responsibilities
- Opportunity for greater coordination and effective cooperation
- National legislation needed to protect precious groundwater resources
- Strong leadership required (including at a political level)

Overview of Tarawa Atoll

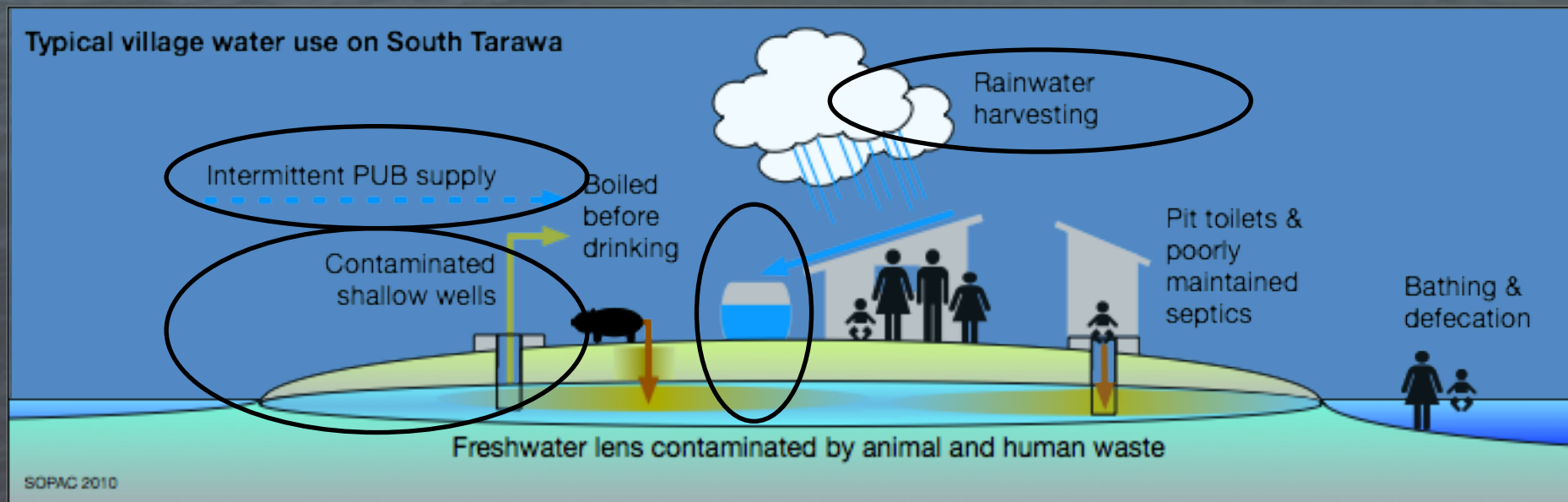
- South Tarawa is main centre of Government and commerce
- Series of islets linked by causeways
- South Tarawa Land area of 15 km²
- ~30km from West to East but only a maximum of 1km wide
- South Tarawa population – 18,000 (1979) increased to 52,402 (2010 Census)
- One of the most densely populated areas on the planet (Betio – ~9,000 persons per km²)

Tarawa Atoll



South Tarawa Primary Drinking Water Sources

- Household Wells (23%)
- Reticulated Supply (PUB) (67%)
- Rainwater (9%)
- Other (1%)



Local Well Water Supply

- Groundwater lenses along South Tarawa
- Water extracted via household wells
- All South Tarawa lenses are contaminated (ecoli, colliforms, nitrates, some locations with heavy metals and hydrocarbons)
- Water needs to be boiled before use.



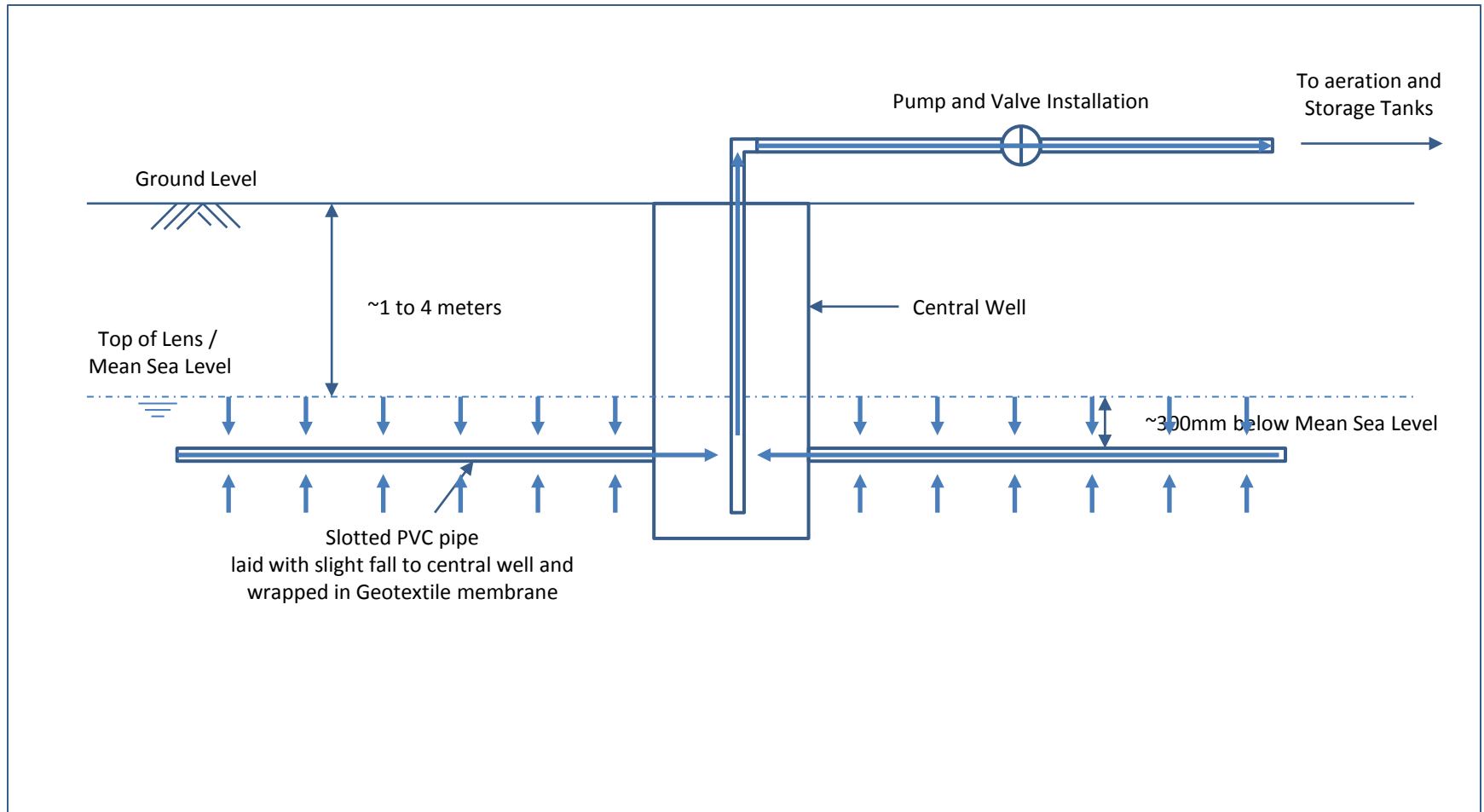


Household
Well

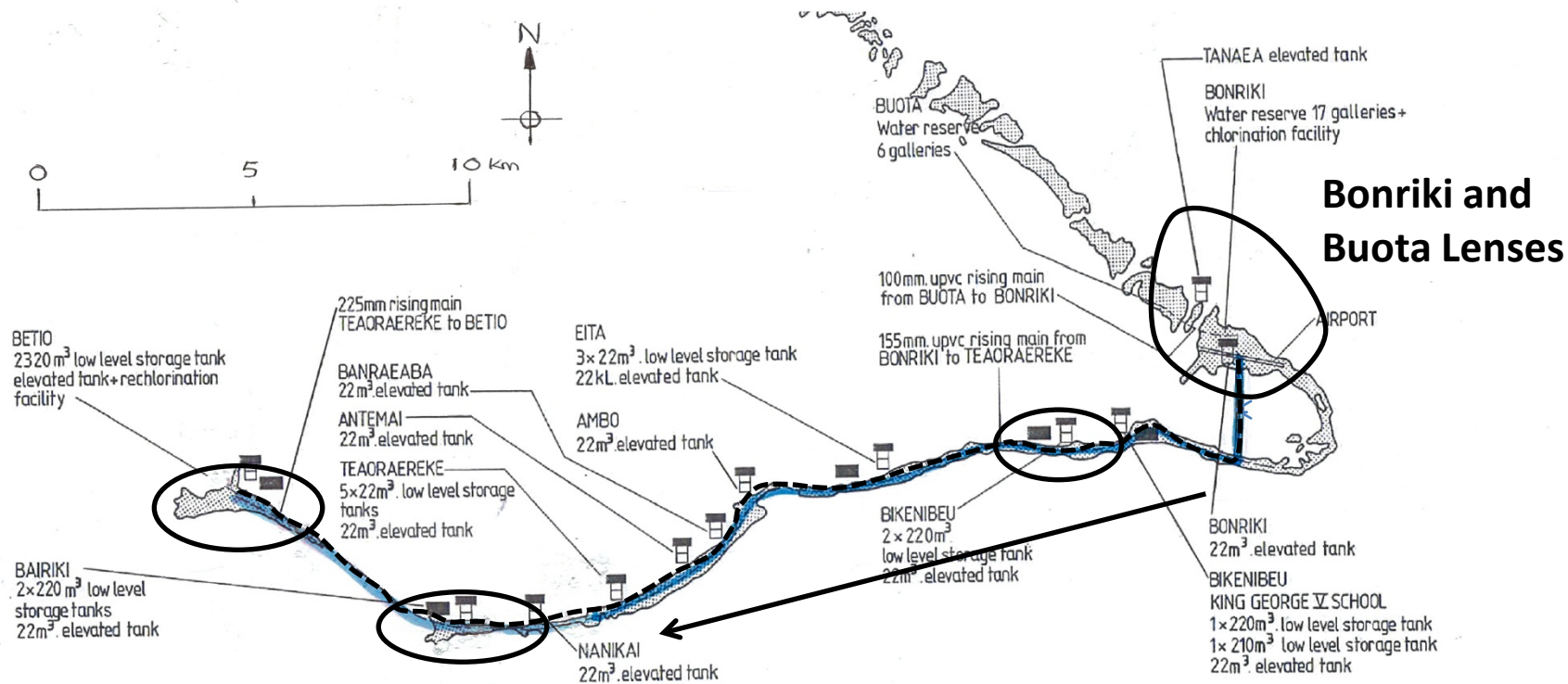
Reticulated Potable Water Supply

- Operated by Public Utilities Board (PUB)
- Water sourced from 2 groundwater lenses (Bonriki and Buota)
- Aeration of source water to remove hydrogen sulphide
- In-line chlorination at outlet from main storage
- Trunk main system along length of South Tarawa running east to west
- 18 tank sites provide supply to 52 supply zones
- Booster chlorination at western end (Betio)

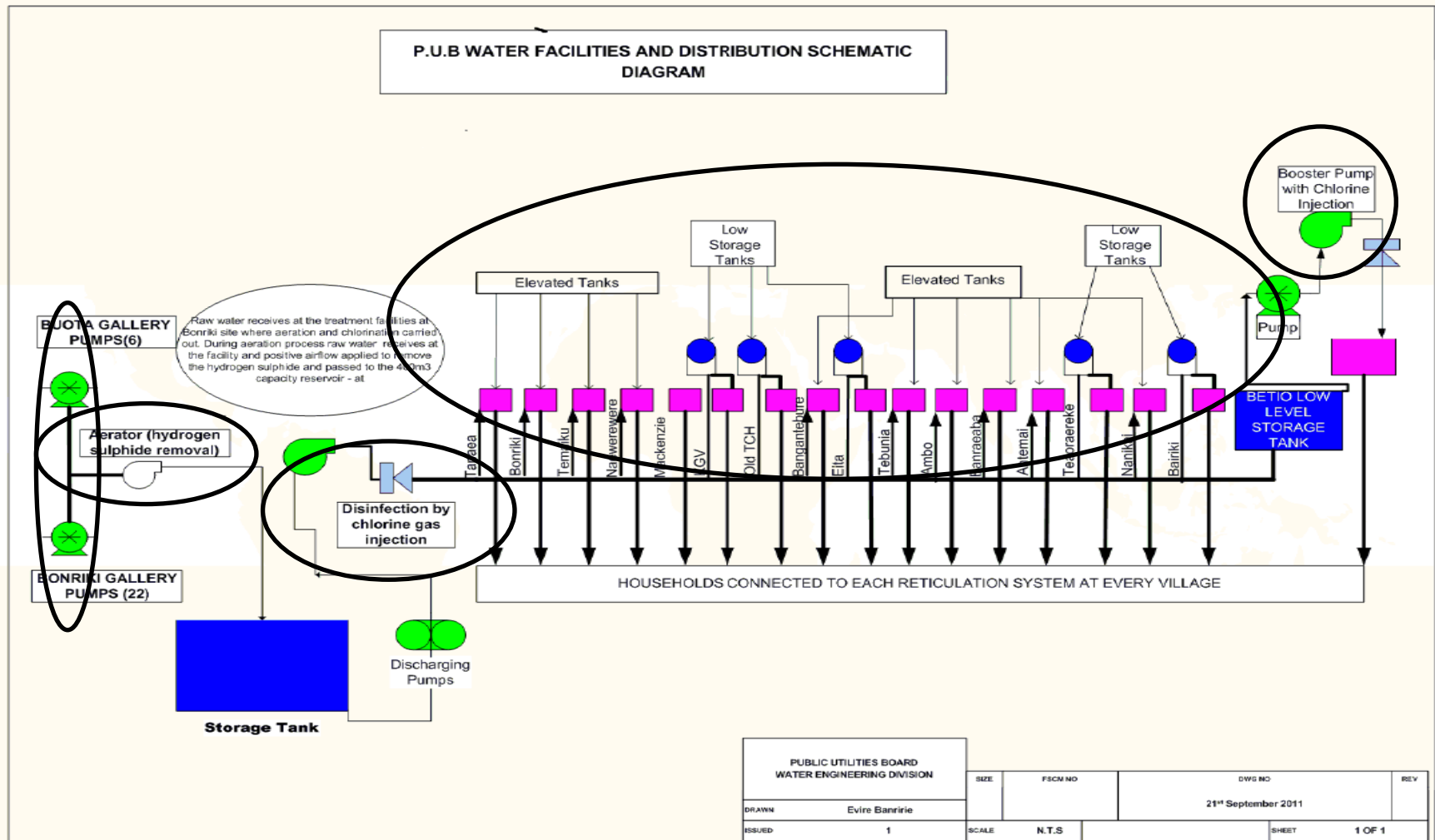
Freshwater Lens Infiltration Gallery



South Tarawa Water Supply System

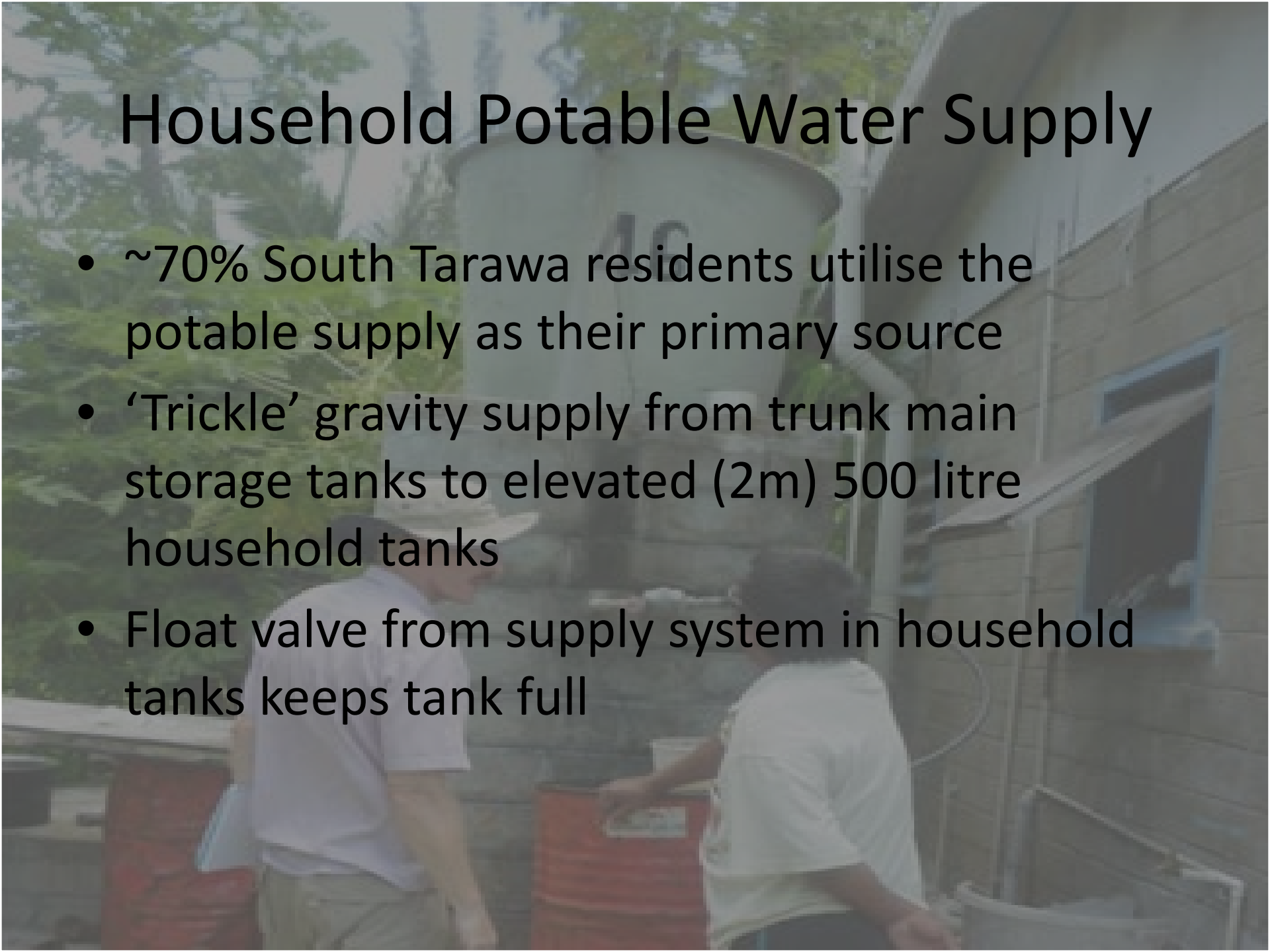


South Tarawa WS System Schematic



Household Potable Water Supply

- ~70% South Tarawa residents utilise the potable supply as their primary source
- 'Trickle' gravity supply from trunk main storage tanks to elevated (2m) 500 litre household tanks
- Float valve from supply system in household tanks keeps tank full

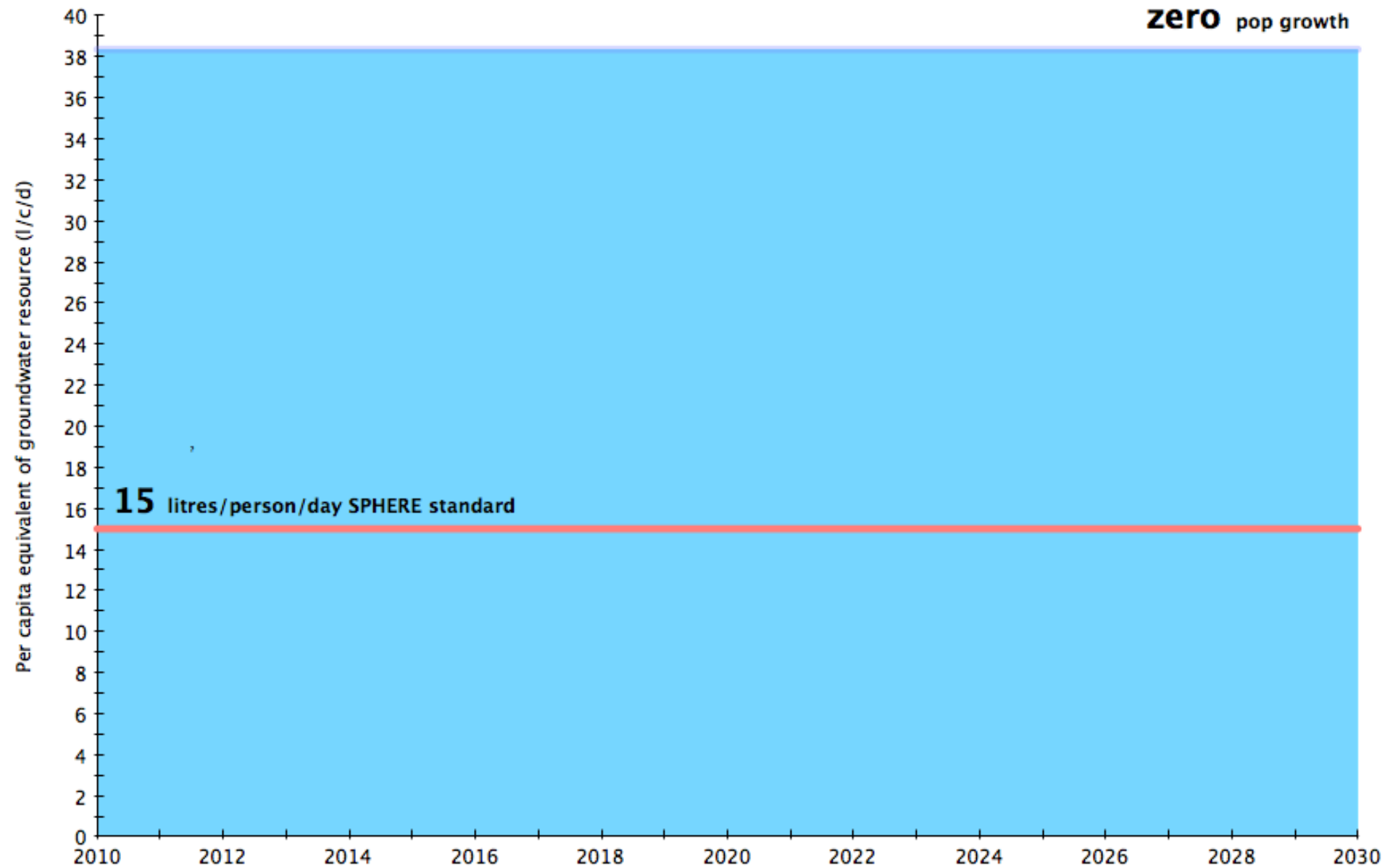


Declining System Performance

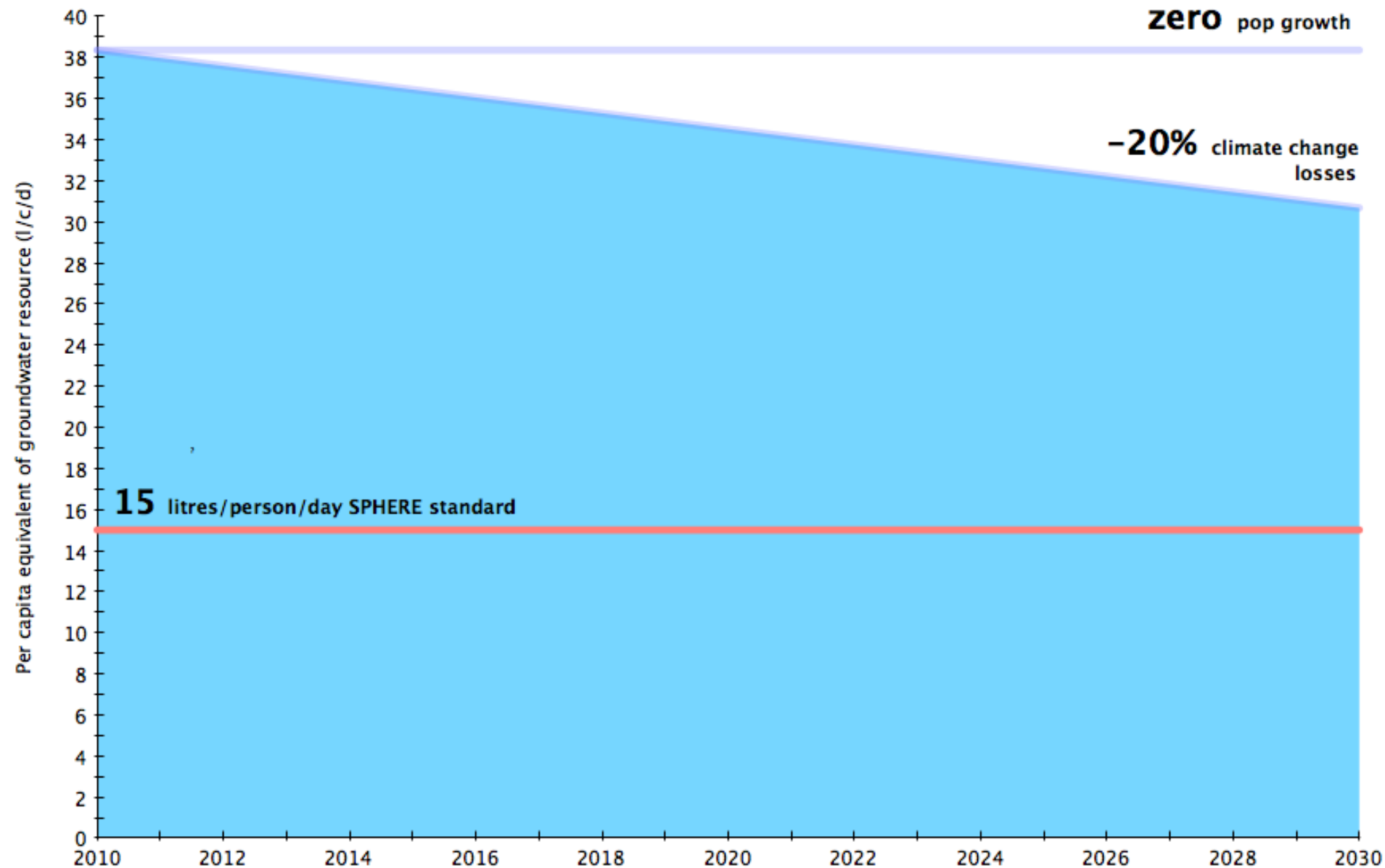
- System originally designed in 1987 and then upgraded in 2005
- System Performance has declined since 2005 upgrade due to:
 - Population growth/inward migration to South Tarawa
 - Widespread tampering at customer connections
 - Illegal connections within the distribution network
 - Increased losses from the transmission main
 - Limited infrastructure maintenance

South Tarawa “Potable” Water Supply

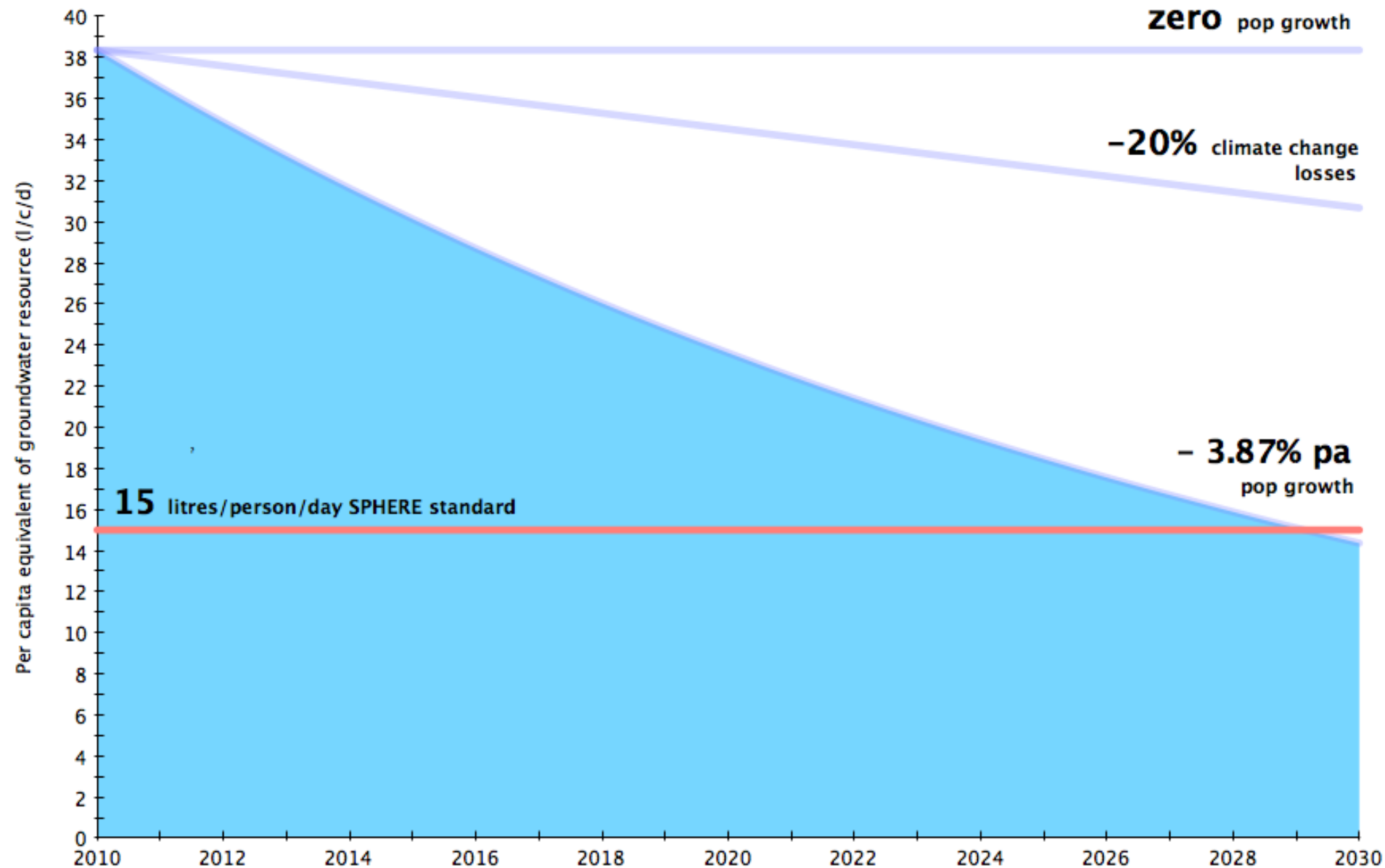
- No metering/volumetric charging
- A\$10/month connection charge
- 52 supply zones currently receive ~2 hours supply every 2-3 days
- Water wastage estimated at ~50 to 60%
- Extractions from Bonriki Lens ~20% above the estimated sustainable yield (2011)



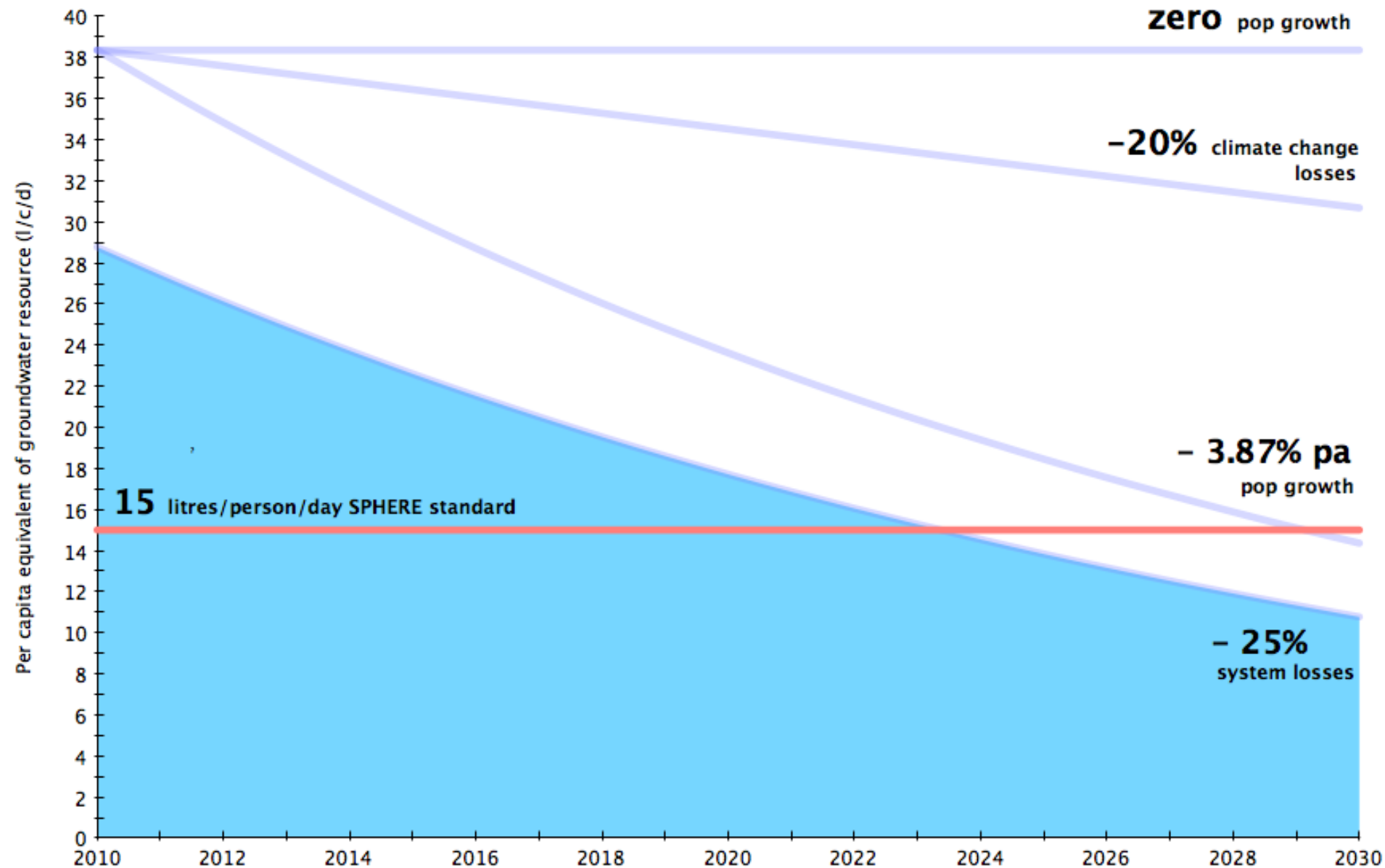
Assumptions: Total sustainable yield of 2010 kL/day (1,660 Bonriki + 350 Buota)
Initial (2010) population of 52,402 (2010 census)
Volumetric share spread evenly between population, regardless of access



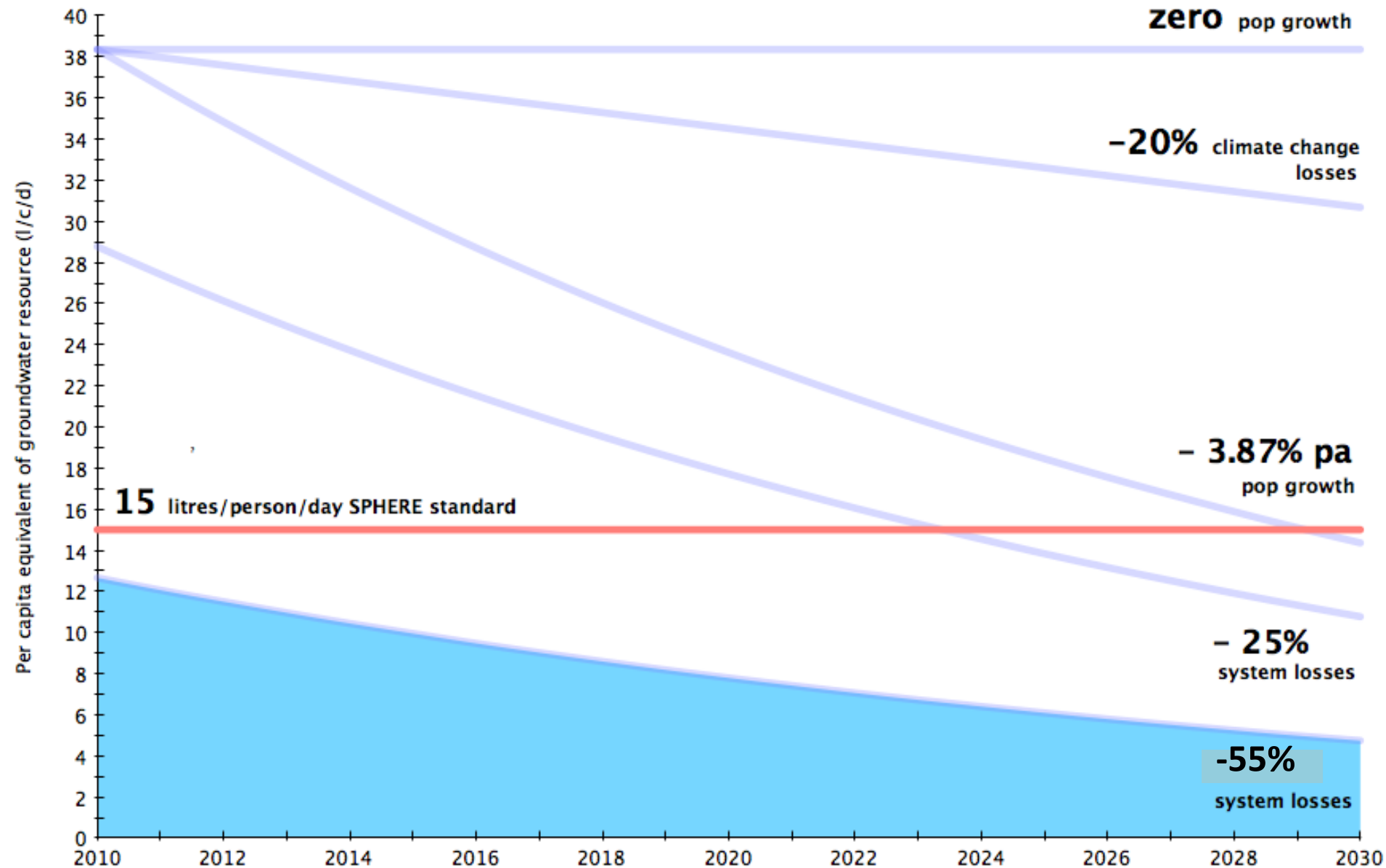
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Water Reserve Issues

- Bonriki and Buota water reserves are leased private land (but no formal lease documents !)
- Illegal squatters have moved onto these water reserves (68 households (555 persons) in Aug 2012).
- Impacts from illegal squatters includes:
 - Construction of dwellings and toilets
 - Keeping animals and livestock (pigs and chickens)
 - Construction of wells and Babai (vegetable growing) pits
 - Coral aggregate mining down to the water table
- Active cemetery in use on water reserve
- Protection of groundwater lenses is critical

Outer Island Water Supply Systems

- 21 inhabited Outer Islands
- Available water resources – fresh groundwater lenses and rainwater harvesting
- Limited understanding of existing lenses (extent and sustainable yields)
- Extraction via bucket or hand pumps (community schemes)

Ways Forward

Effective and sustainable long-term change requires:

1. Local understanding and ownership of issues.
2. Local development and ownership of potential solutions.
3. Local involvement and ownership of solution implementation.



Some First Steps

- GOK Cabinet Paper entitled “Urgent Water Issues for South Tarawa” (October 2012)
 - Protect Bonriki and Buota Lenses
 - Reduce water wastage from PUB network
 - Reform PUB water supply tariff
 - Increase RWH as supplementary supply source
- High level strategies endorsed by Cabinet
- Progress in implementing proposed high level strategies is being made (albeit slow)

Water Resource Challenges

1. Protection of potable water supply lens
2. Potable water resource availability
3. Potable water supply system losses and wastage
4. Governance and legislative improvements
5. Local groundwater resource contamination
6. Outer Island water resource identification and assessment

Summary

- Kiribati facing significant water resource issues
- South Tarawa water supply situation is dire
- Challenges involve political, social and cultural aspects
- Way forward requires strong leadership particularly at a political level
- Challenges need to be locally owned but with external support for solution implementation



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XX COMMONWEALTH GAMES



Kam rabwa
(Thank you)