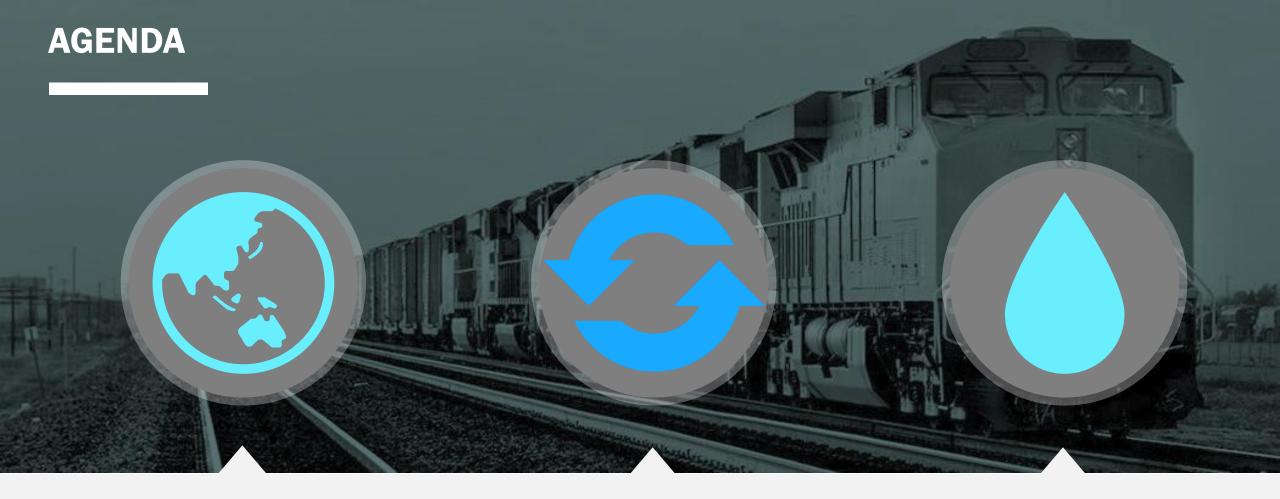
December 7, 2018 WateReuse NorCal Chapter Meeting

Integrated Water Management in Singapore

Closing the Water Loop



OVERVIEW OF SINGAPORE

Where in the world is this tiny island?

CLOSING THE WATER LOOP

Integrated Water Management

NEWater

Reclaiming every drop of used water

Source: NEWater image (PUB, Singapore)

Where is Singapore?













City of Gardens and Water

Source: commons.wikimedia.org, stproperty.sg, skyscrapercity.com



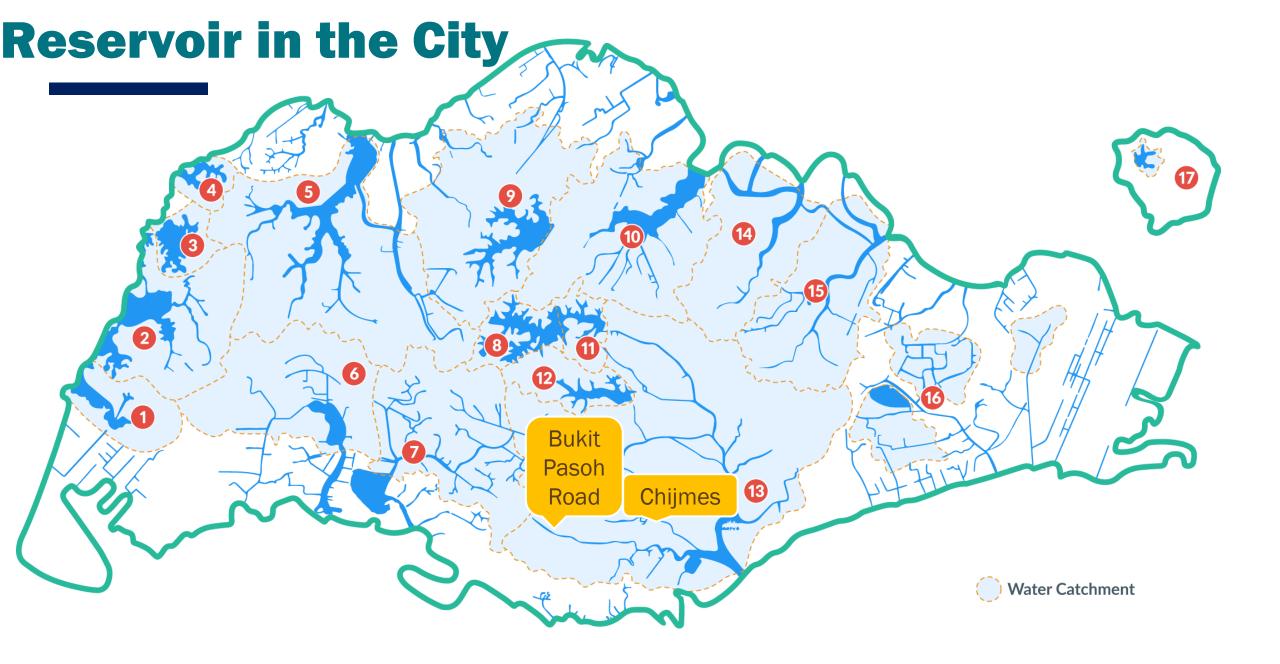




For Real!











To ensure a clean, sustainable environment and water supply for Singapore



To ensure a clean and sustainable environment for Singapore, together with our partners and the community



To ensure an efficient, adequate & sustainable supply of water

4 National Taps:

Local Catchment

Imported Water

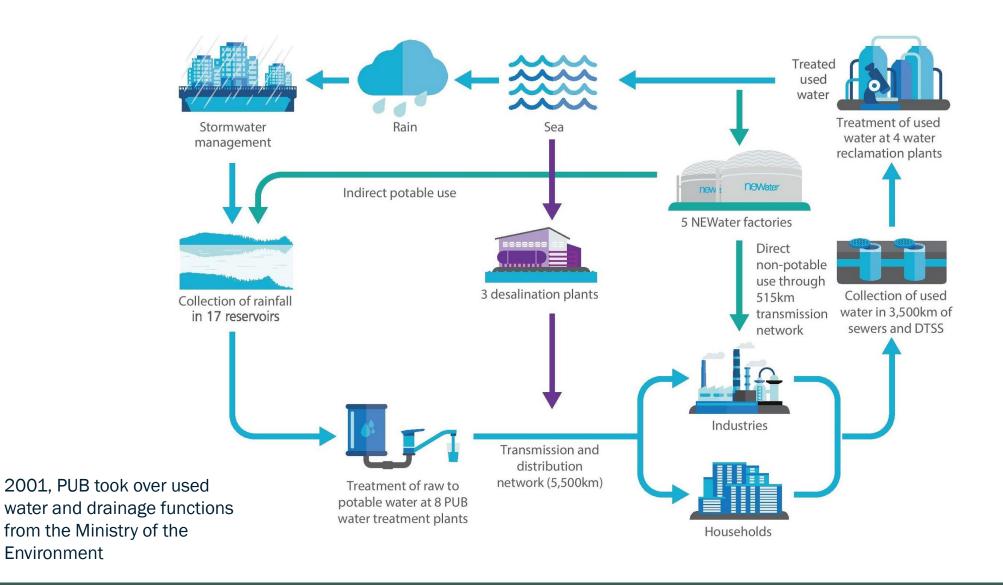
NEWater

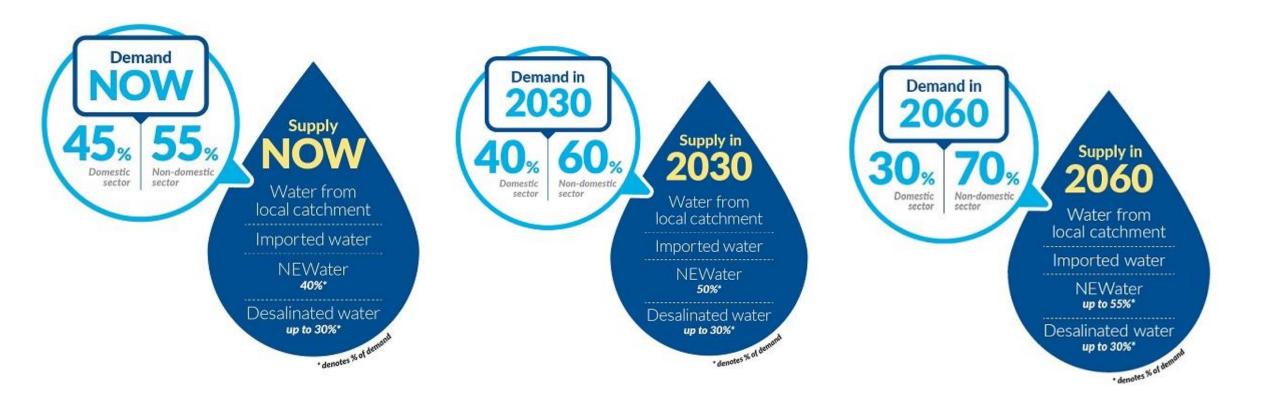
Desalinated Water



3P Approach:

Water for All: Conserve, Value, En Enjoy our Waters

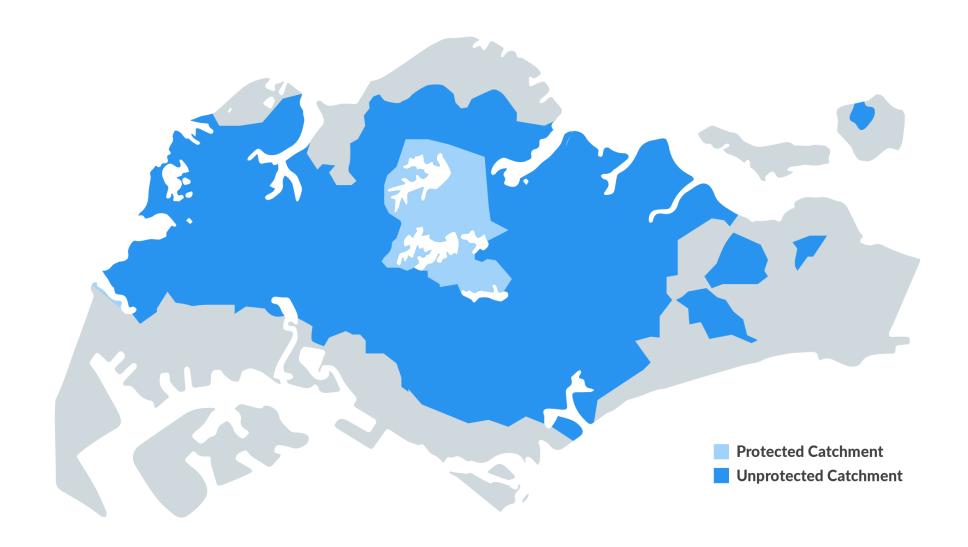




Water Demand vs Supply

Capture every drop of water Reuse water endlessly Desalinate more seawater

First National Tap: Local Catchments



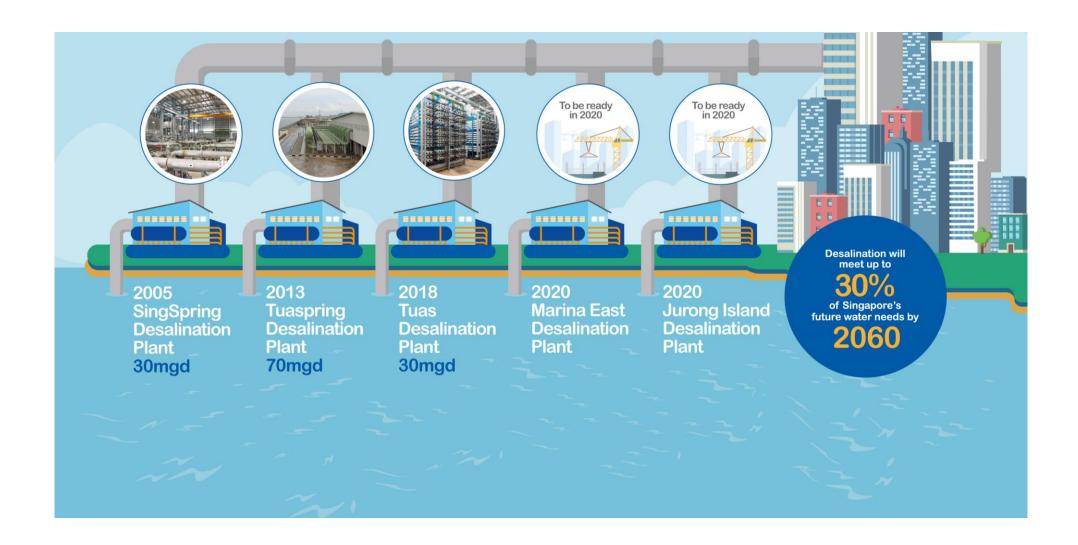
Second National Tap: Imported Water

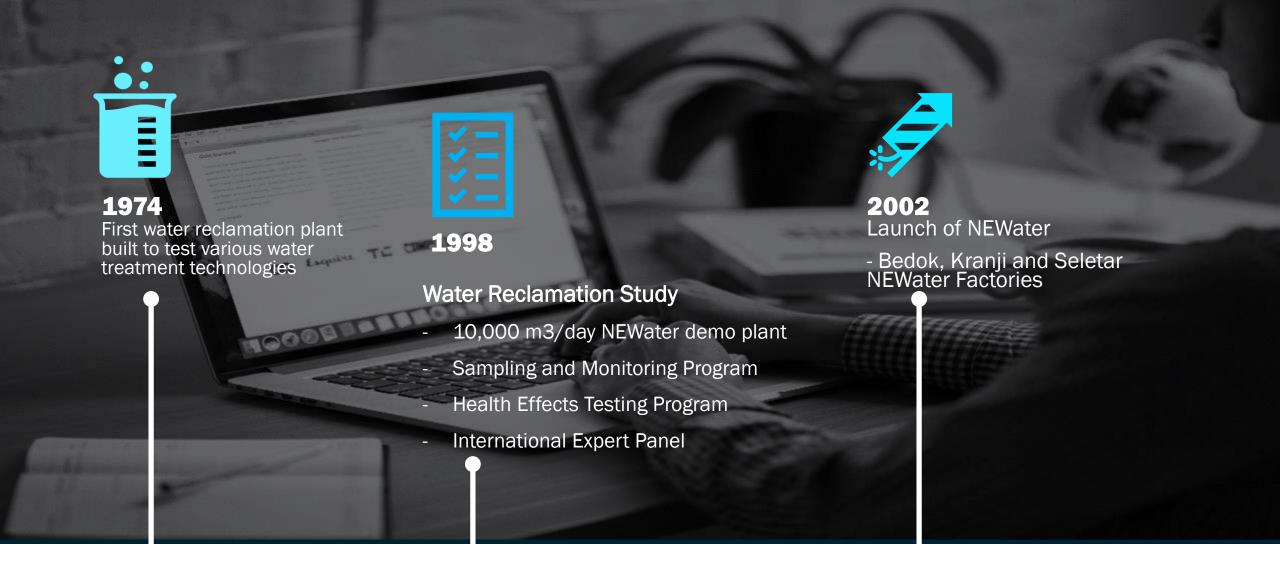


Third National Tap: NEWater



Fourth National Tap: Desalinated Water

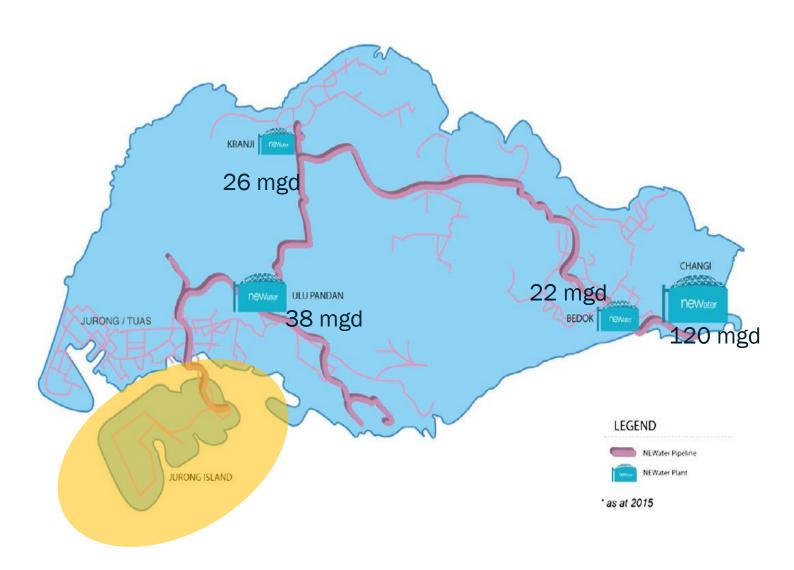




DEVELOPMENT OF NEWATER

Decades in the making

Non-Potable Reuse



Separate Purple Pipe System

Primarily used for cooling purposes

Reduces demand for potable water

Source: PUB, Singapore



Indirect Potable Reuse

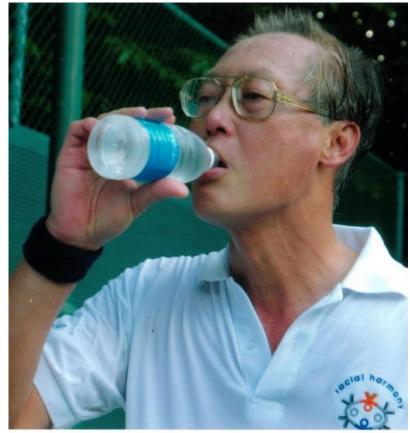
"During dry periods, NEWater is added to our reservoirs to blend with raw water. The raw water from the reservoir is treated at the waterworks before it is supplied to consumers as tap water."

Source: PUB, Singapore











Direct Potable Reuse Public Education



Words Matter

Singapore Water Nomenclature

- ✓ Potable Reuse
- ✓ NEWater
- ✓ Used Water
- ✓ Water Reclamation Plant

Terminology consistently used

Operations

Training and Certification to ISO Standards:



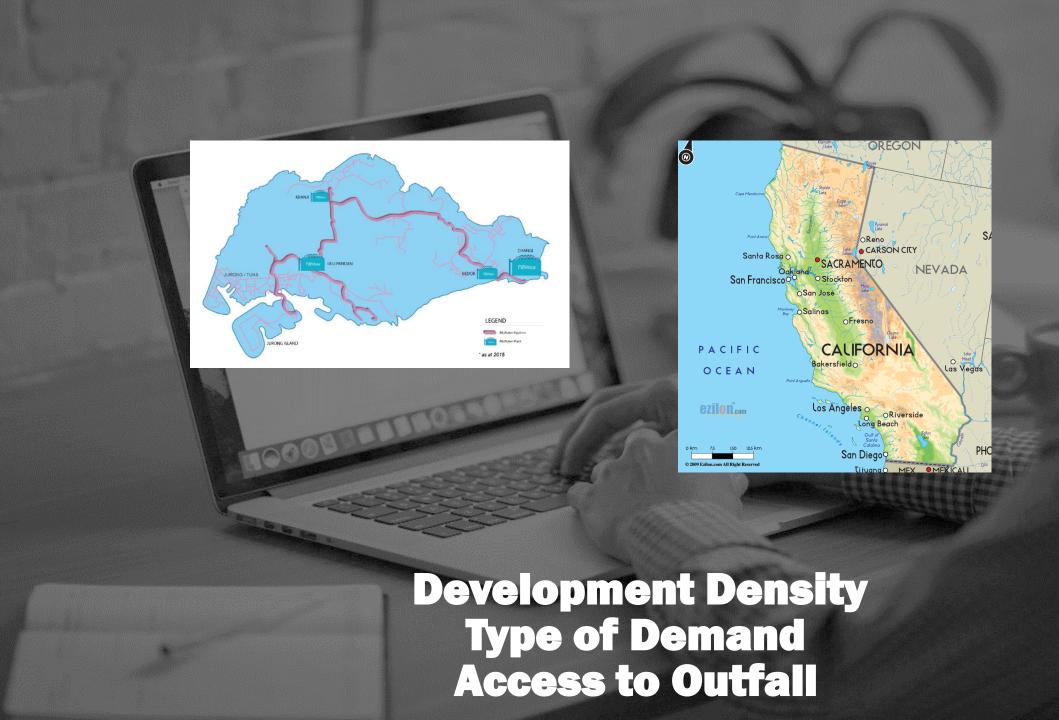
- ✓ ISO 9001 Quality Management System
- ✓ ISO 14001 Environmental Management System
- ✓ ISO 18001 Occupational Health and Safety Management
- ✓ ISO 22001, SS 444: Hazard Analysis Critical Control Points

Clear SOPs:

- ✓ Shutdown Clear direction and authority for operators
- ✓ Coordination WW and RW Communications
- ✓ Baseline Monitoring realtime and sampling results

Other Takeaways





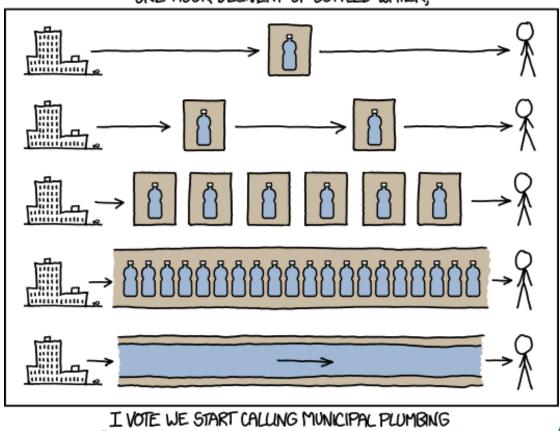
Still, there are similarities

- Reliance on imported water
- Impacted by drought
- Recycled water as a sustainable, localized, drought-proof water supply option



Parting Thoughts

NOW THAT AMAZON IS ADVERTISING ONE-HOUR DELIVERY OF BOTTLED WATER,



I VOTE WE START CALLING MUNICIPAL PLUMBING "ON-DEMAND HYPERLOOP-STYLE WATER DELIVERY" AND SEE IF WE CAN SELL ANYONE ON THE IDEA.

With recycled water, we're running the true Hyperloop

Questions?

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Northern California Reuse Practice Leader

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