

SINGAPORE'S RESPONSE TO QUESTIONNAIRE BY SPECIAL RAPPORTEUR ON HUMAN RIGHTS AND THE ENVIRONMENT

Introduction

1 Singapore faces unique circumstances that has made water-related issues a perennial challenge. As a low-lying, densely-populated island city-state with limited natural resources, we are vulnerable to rising sea-levels and weather variabilities. We take a holistic approach to ensure that our environment and water resources are well-managed so that everyone has access to affordable high-quality water, modern sanitation, and a clean, safe, liveable, and sustainable environment, in line with Sustainable Development Goals (SDG) 6, 11 and 13.¹ We employ a practical, inclusive, and outcomes-based approach to policies on the environment, including water, which is non-discriminatory and respectful of human rights.

Keeping Our Water Clean

2 Singapore's founding fathers understood early that the country's sustainability and vibrancy depended on a clean environment and well managed water resources. In 1969, then Prime Minister Lee Kuan Yew made it a national priority to clean Singapore's waterways and curb pollution. This began an almost two-decade long planning and clean-up operation to remove sources of pollution, provide proper sewage infrastructure and new facilities for resettled residents and businesses, and implement strict measures to minimise future pollution. The operation covered about 30% of Singapore's land area and cost then nearly S\$300 million.² This began a journey that transformed Singapore's cityscape and laid the foundation for urban redevelopment that treasures clean air, land, and water.

Institutions and Regulations

3 Two agencies under the Ministry of Sustainability and the Environment, namely the National Environment Agency (NEA) and the Public Utilities Board (PUB) - Singapore's National Water Agency, oversee most of the laws that safeguard our water and waterways. NEA regulates the discharge of trade effluent into drains and waterways, while PUB regulates the sewerage system and the

¹ SDG 6: Ensure availability and sustainable management of water and sanitation for all; SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable; and SDG 13: Take urgent action to combat climate change and its impacts.

² More information on the Singapore River clean-up can be found at: https://eresources.nlb.gov.sg/infopedia/articles/SIP_2019-05-21_104327.html

treatment and discharge of industrial used water. NEA's regulatory powers are stipulated in the Environmental Protection and Management Act (EPMA) and the Environmental Protection and Management (Trade Effluent) Regulations. Under the EPMA, no trade effluent can be discharged without written permission by NEA. PUB administers the Sewerage and Drainage Act (SDA) which provides for and regulates the construction, maintenance, operation, and protection of the sewerage and drainage systems, and empowers PUB to regulate the discharge of used water and trade effluent into the sewerage system.

Water quality monitoring

4 The water quality of inland water bodies and coastal areas is regularly monitored.³ For inland water bodies, parameters monitored include pH, dissolved oxygen, biochemical oxygen demand, total suspended solids, ammonia and sulphide. Coastal water samples are analysed for metals, total organic carbon, and other physical, chemical and bacteriological parameters. These monitoring regimes allow us to assess if water quality has been affected by pollution, eutrophication of seawater, and algae blooms that may affect our natural ecosystems and fish farms.

Eliminating water pollution

5 Singapore's regulations, policies, monitoring regimes, and infrastructure have allowed us to keep our waters clean. Singapore ensures that 100% of the population is served by modern sanitation. The system allows all used water to be collected and treated, and prevents pollution of waterways and reservoirs. PUB has constructed a Deep Tunnel Sewerage System (DTSS), which conveys used water by gravity to centralised water reclamation plants for treatment and recycling into high-grade reclaimed water called NEWater.⁴

6 To prevent marine litter, all waste in Singapore is collected and processed or recycled. Apart from providing regular cleaning services at coastlines and beaches, NEA also works with partners to organise regular clean-up exercises in these areas and in-land water bodies. We also contribute through regional and international platforms as well as bilateral and multilateral development cooperation programmes to tackle marine litter.

³ Detailed water quality information is published annually in the Environmental Protection Division Report (<https://www.nea.gov.sg/corporate-functions/resources/publications/annual-reports>)

⁴ The NEWater process recycles treated used water into ultra-clean, high grade reclaimed water through treatment technologies (microfiltration, reverse osmosis and ultraviolet disinfection).

Climate Change - Managing the Threats of Sea-Level Rise and Floods

7 Under the Second National Climate Change Study published in 2015 by the Centre for Climate Research Singapore (CCRS), it was projected that by 2100, Singapore could experience more intense and frequent heavy rainfall and mean sea level rise of up to 1 metre.

Coastal Protection and Adaption

8 We are planning for the potential impacts of sea level rise. We conducted a pioneering Coastal Adaptation Study in 2013 to identify the vulnerabilities of our coastlines and potential impacts of coastal inundation. This study was completed in 2019 and has helped prioritise coastal protection plans at vulnerable areas. PUB has been appointed as Singapore's Coastal Protection Agency and will study selected coastal areas in greater detail to ascertain the feasibility, type and extent of specific protection measures required, as well as estimated implementation costs. PUB leads and coordinates efforts to develop long-term strategies to manage coastal flood risks; protect Singapore from inland and coastal flooding, intense rainfall, and encroaching waters; and strengthen Singapore's overall resilience against climate change.

9 Since 2011, the minimum level for newly reclaimed land has been increased from 3 to 4 metres, above the Singapore Height Datum (SHD)⁵ to cater for long-term sea level rise. Future facilities such as the Changi Airport Terminal 5 and Tuas Terminal mega port will be built at least 5 metres above SHD. At present, about 70% of Singapore's coastline is protected from erosion by waves and storms, using structures such as stone embankments and seawalls. The rest consists of natural areas such as beaches and mangroves. Other conventional coastal protection measures include the installation of pumps and tidal gates at mouths of waterways, as well as storm surge barriers and dykes. Our coastal reservoirs are accompanied by a system of tidal gates, spillways and pumps. The enhancement of the coastal reservoirs to adapt to projected rising sea levels is currently underway.

10 To deepen our understanding of sea level science and how rising sea levels could impact Singapore, CCRS initiated the National Sea Level Research Programme (NSLP) in 2019 to develop scientific capabilities in sea level research and provide advanced scientific evidence about present and future sea level rise locally, to ensure that Singapore's coastal adaptation policies are based upon the latest science. CCRS has also embarked on the Third National Climate Change Study to update projections for future climate change in Singapore and the region,

⁵ Singapore Height Datum (SHD) is the reference established based on the mean sea level determined at the tide gauge located at Victoria Dock in Tanjong Pagar between 1935-1937.

making use of the latest findings from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6), and the NSLP. The study is expected to be completed in 2022.

Managing stormwater and floods

11 Over the last 30 years, Singapore has experienced increasing rainfall intensities and increasingly frequent intense storms. To manage storm water, PUB has taken a system-wide “source-pathway-receptor” approach. Beyond the conventional method of widening and deepening drains and canals, this approach incorporates solutions to slow the flow of storm-water into the public drainage system. First, new and re-developments are required to implement “source” measures such as detention tanks to limit the peak runoff that is discharged into the public drains. Second, PUB continually implements a comprehensive drainage improvement programme to increase the capacity of drains and canals. Third, new and re-developments are required to adopt “receptor” flood protection measures, such as higher platform and crest levels, to protect them from residual flood risk. As a result, Singapore has reduced its flood-prone area from 3,400ha in the 1970s to less than 30ha today. In addition, Singapore actively studies the potential impacts of climate change, such as more intensive rainfall and rising sea level, and plans adaptation measures accordingly.

Diversifying Water Supply and Managing Water Demand

12 Singapore is considered one of the most water-stressed countries in the world due to limited land available for water storage. Singapore continues to experience dry spells, i.e. at least 15 consecutive days with daily total rainfall of less than 1mm. Singapore has developed a robust and diversified water supply strategy known as the “Four National Taps” (comprising local catchment water, imported water, NEWater and desalinated water). In particular, NEWater and desalinated water help provide a buffer against dry spells. While progressively expanding the capacities of these two taps to strengthen our water security and drought resilience, we are investing in R&D to reduce the energy consumption of NEWater and desalination and harnessing renewable energy through innovative methods like deploying floating solar farms.⁶

⁶ PUB has lined up several projects to deploy more floating solar systems on reservoirs, for instance, two 1.5 megawatt-peak (MWp) systems on Bedok and Lower Seletar Reservoirs as well as a 60 MWp project at Tengeh Reservoir. Expected to be operational by 2021, the floating PV solar system on Tengeh Reservoir will be one of the world’s largest when completed.

Reducing water consumption

13 Singapore has a three-pronged strategy to manage water demand and achieve a sustainable level of water consumption:

- Pricing water to reflect its scarcity. The water price in Singapore is pegged to the long run marginal cost (i.e. the cost of supplying the next drop of water), and is charged based on quantity used. The Government also provides rebates to help ensure that water remains affordable, especially for lower-income households.
- Mandatory water efficiency measures such as water efficiency labelling for water fittings and appliances, minimum water efficiency standards and requiring businesses/industries which are large water users to appoint water efficiency managers and submit water efficiency management plans annually.
- Extensive public education and outreach programs to encourage the population to use water wisely. These include water conservation campaigns, water efficiency courses and guidelines for businesses to improve water efficiency.

14 Through these measures, Singapore's per capita household water consumption has been reduced from 148 litres per day in 2016 to 141 litres per day in 2019. We are working towards lowering this to 130 litres per day by 2030.

Public Participation - Transforming Singapore's Waterways

15 The Active, Beautiful, Clean Waters (ABC Waters) Programme is a long-term initiative by PUB, to transform Singapore's waterways and reservoirs into beautiful streams, rivers and lakes well-integrated with the surrounding parks and spaces. Launched in 2006, this initiative cultivates public ownership over our waterways and water bodies, and fosters an appreciation of our precious water resources. By harnessing the full potential of Singapore's waterbodies, the ABC Waters Programme enhances Singaporeans' quality of living, and plays a part in transforming Singapore into a City of Gardens and Water.

16 Public feedback is sought during the various stages of each ABC Waters project so that the features provided at the site are relevant to the public's use of the communal space. There are also educational signages to raise awareness that the site is located within a water catchment and of the need for responsible use of the communal space.

Sharing Singapore's Experience

17 PUB exchanges experiences in ensuring water security among the international community through two platforms - the Singapore International Water Week (SIWW) and the Singapore Water Academy (SgWA). The SIWW is a leading global platform to share the latest in business and technological innovations, as well as policy developments in sustainable urban water management. In 2018, SIWW welcomed over 24,000 participants from 110 countries and regions. The next SIWW is scheduled for 20 to 24 June 2021.

18 The SgWA is a practitioner-focused institute in urban water management. The Academy leverages PUB's experience to provide programmes that enhance water management competencies. The flagship Singapore Water Management (SgWM) Series is an international training programme that comprises four courses: water quality management, sustainable urban stormwater management, water reuse and water supply network management. PUB also collaborates with external partners such as UNICEF to anchor international water programmes in Singapore. Since 2017, SgWA and UNICEF have jointly conducted a course titled "Leaving No One Behind: Sustainable WASH Services in a Rapidly Changing Context" which features Singapore's experience in water management.

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