COVID-19 and the Water Sector

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Outline

An Assessment Report

- Context Setting: COVID-19 and the Water Sector
- COVID -19 & Water Security Risks
- COVID-19 & Water, Sanitation and Hygiene (WASH)
- COVID -19 & Water Demand and Supply
- COVID-19 & Wastewater
- COVID -19 & Ambient Water Pollution
- Conclusions & Recommendations

Disclaimer : Information / data used in this presentation is compiled from secondary sources. Please refer to the assessment report for those sources. Thank you!

1. Context Setting: COVID-19 and the Water Sector

- ✓ COVID-19, not a waterborne disease and is transmitted mainly through an airborne medium, still put the entire water sector (drinking water supply, hygiene and sanitation, and wastewater management) to stress

- ✓ Pandemic had surprising implications on water infrastructure, health and safety of water and wastewater utility workforce, and other issues concerning water quality

- *Water sector in the frontline*: highlighted the **health impact** linkages between the COVID-19 pandemic and the water sector

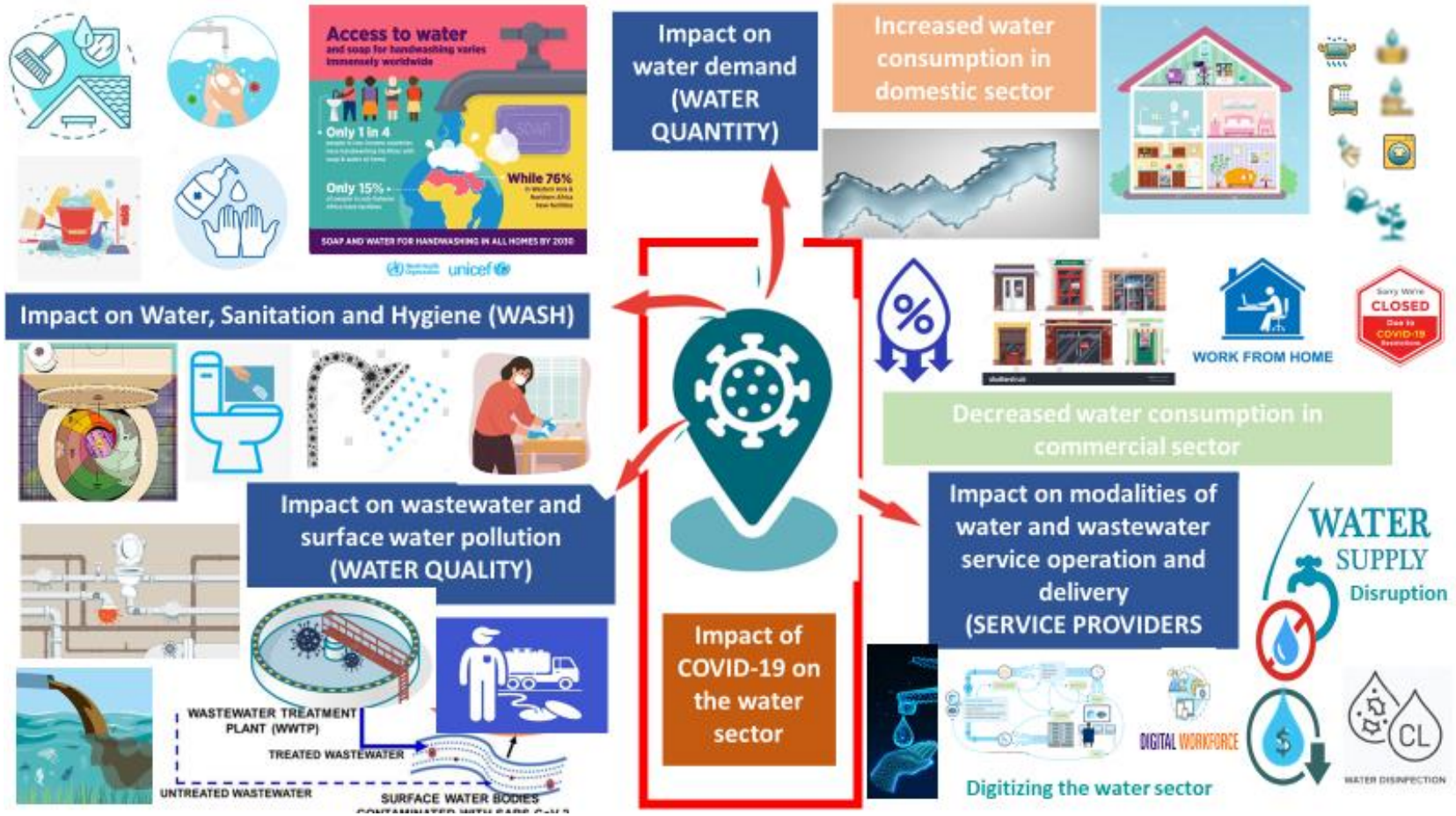
- *Innovations and Digitalization* of the water sector

- *Inequity and access gaps in the adequate quantity and quality of water and sanitation services*: resurfacing the discussion on the **social impact** of the water sector during the pandemic

- *Economic impact:* water sector service providers faced short-term revenue losses

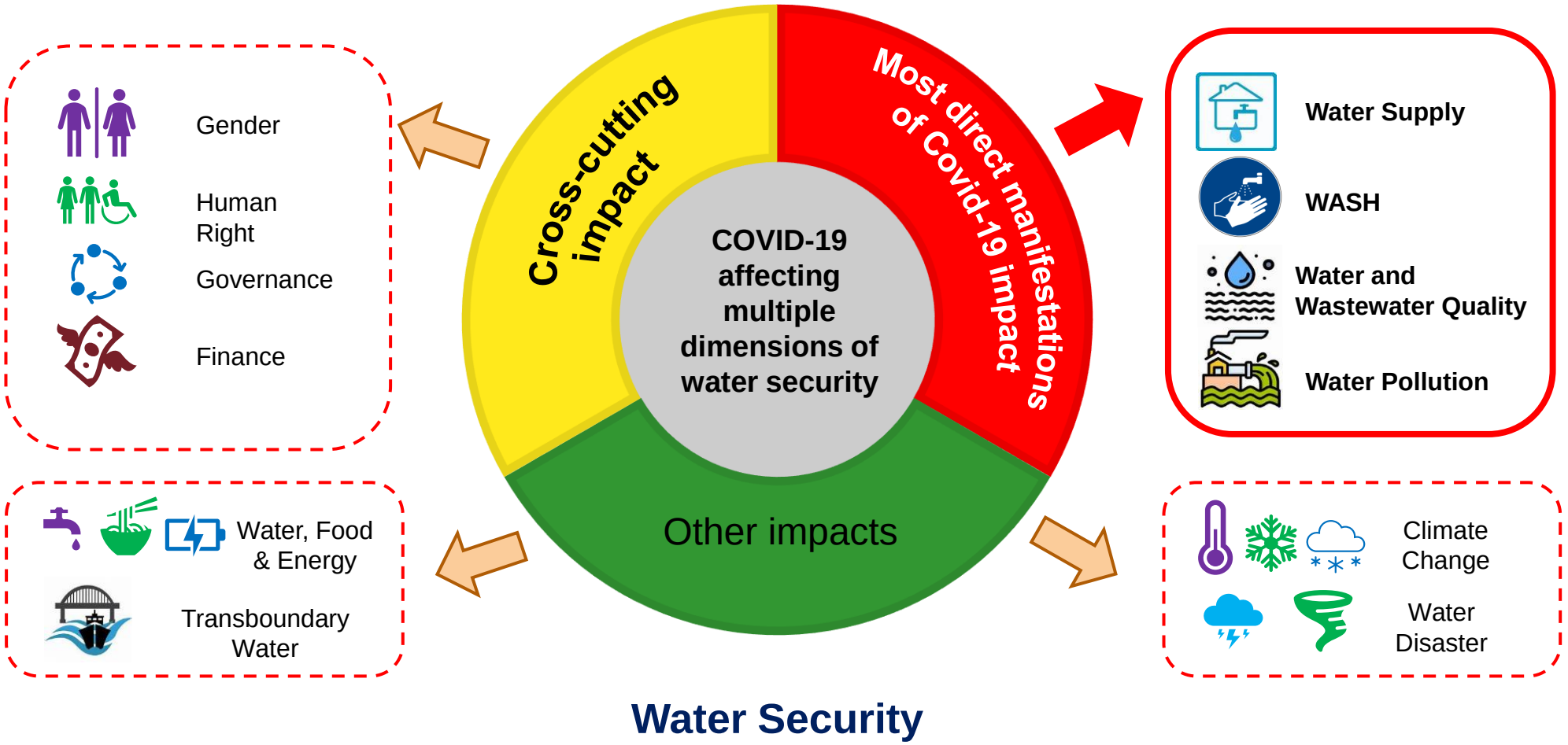
1. Context Setting: COVID-19 and the Water Sector

- ✓ (Impact on water supply) Shifting consumption pattern leading to increased demand for clean water
- ✓ (Impact on water and sanitation service providers) Affecting the modalities of water and wastewater service operation and delivery
- ✓ (Impact on water, sanitation, and hygiene (WASH)) Securing and extending water, sanitation, and hygiene (WASH) service provision
- ✓ (Impact on wastewater) Monitoring and surveillance of wastewater for coronavirus and other contaminants
- ✓ (Impact on surface water pollution) Imperiling quality of water bodies through virus transport:



2. COVID-19 and the Water Security Risks

- COVID-19 affected water security across all its dimensions, mainly across the four elements of urban water security



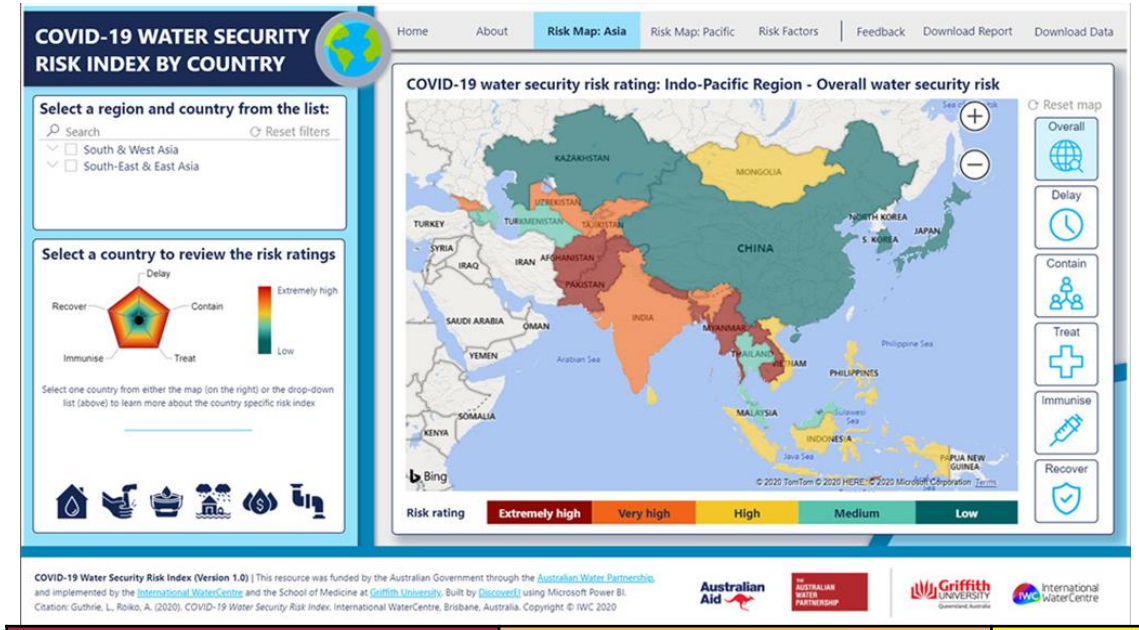
2. COVID-19 and the Water Security Risks

- **Water security index (WSI)** is an indication of water security gaps resulting from a situation wherein the affordable access to an adequate and acceptable quality of water is challenged
- **COVID-19 Water Security Risk Index** was developed as a project and implemented by the International Water Centre and Griffith University's School of Medicine with the supported of the Australian Water Partnership
- The **COVID-19 Water Security Risk Index** was measured using following water security related factors

- Sewage surveillance capacity
- Ability to isolate – Access to water and sanitation at home
- Access to hand sanitizer
- Access to hand washing and cleaning
- Access to hand washing at home
- Medical – WASH in health care facilities
- Water collection burden
- Water utilities' ability to generate income
- Natural disaster resilience (drought, flood, storm)

2. COVID-19 and the Water Security Risks

➢ The COVID-19 Water Security Risk Index was measured in all 47 countries in the Asia-Pacific region



Sound Management of Urban Infrastructure

Reduce the risks

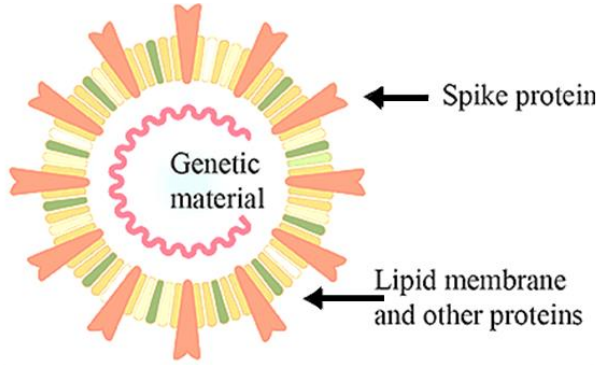
Extremely High		Very High		High		Medium		Low	
10		10		8		11		8	
• Afghanistan • Micronesia • Lao PDR • Nepal • Pakistan	• Cambodia • Myanmar • Timor-Leste • Papua New Guinea • Bangladesh	• Tajikistan • Solomon Islands • Vanuatu • Kyrgyz Republic • Uzbekistan	• Bhutan • Marshall Islands • India • Georgia • Kiribati	• Indonesia • Tonga • Tuvalu • Mongolia	• Philippines • VietNam • Sri Lanka • Fiji	• Samoa • Azerbaijan • Armenia • Turkmenistan • Maldives • Nauru	• Malaysia • Thailand • Niue • Cooks Islands • Palau	• Kazakhstan • Brunei Darussalam • China • Japan	• Korea • New Zealand • Singapore • Australia

http://www.watercentre.org/covid-19-water-security-risk-index/

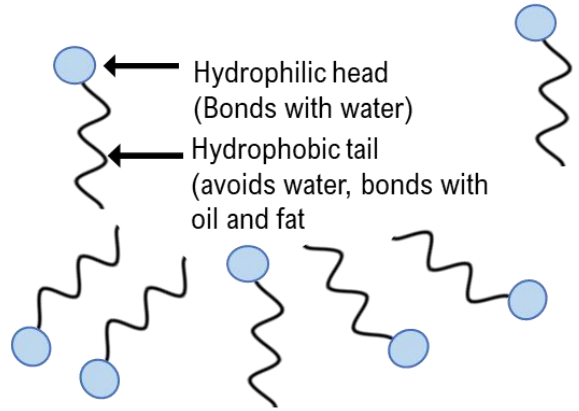
3. COVID-19 & Water, Sanitation and Hygiene (WASH)

- WASH is in the forefront of preventive measures of COVID-19
- Frequent and proper hand washing with soap and clean water for at least 20 second is the first line of defense to prevent human-to-human transmission of COVID-19
- Significant positive shift in personal hygiene behavior including hand washing patterns and trends after the onset of COVID-19 pandemic

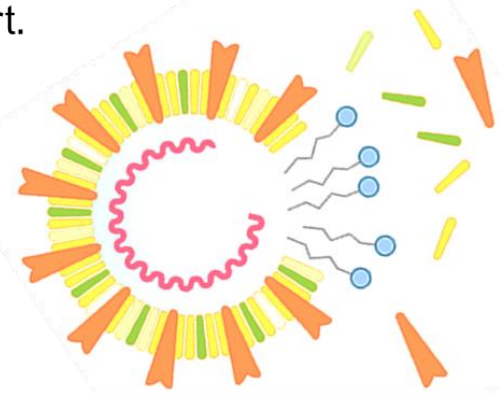
The Coronavirus has a membrane of oily lipid molecules, which is studded with proteins that help the virus infected cells.



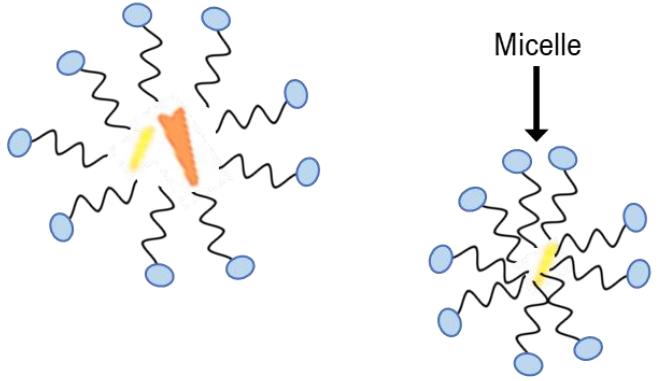
Soap Molecules have a hybrid structure, with a head that bonds to water and a tail that avoids it.



Soap Destroys the Virus when the water shunning tails of the soap molecules wedge themselves into the lipid membrane and pry it apart.



Soap Traps Dirt and fragments of the destroyed virus in tiny bubbles called micelles, which wash away in water.



3. COVID-19 & Exacerbated Vulnerabilities in the WASH Sector

Even before COVID-19, also

- **2.2 billion people** (1 in 4 people) **lacked** safely managed **drinking water** in their homes in 2020
- **3.6 billion people** still **lacked** safely managed **sanitation** in 2020, including **1.7 billion** who were **without** even **basic sanitation** such as private toilets or latrines;
- **2.3 billion people** worldwide (3 in 10 people) still **lacked a basic handwashing facility** with soap and water at home
- In 2020, **45% of the household wastewater generated** globally was discharged without safe treatment
- In 15 global South cities, **62% of fecal sludge** is unsafely managed, **62% of fecal sludge and sewerage** is not properly managed

COVID-19 pandemic **further widened the gaps in access** to water for washing hands or flushing toilets, lack of safely managed sanitation facilities connected to sewer network for wastewater treatment

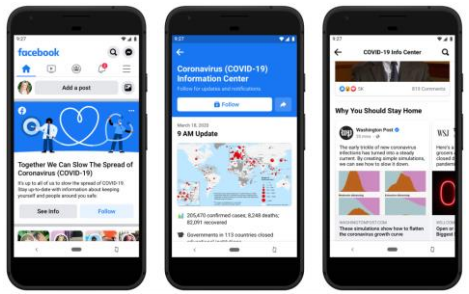
3. COVID-19 & Exacerbated Vulnerabilities in the WASH Sector

- Disproportionately affecting the disadvantaged group, the most - population in vulnerability included - urban poor, elderly people, people living with disabilities and ill-health, slums and informal settlements, refugees, and internally displaced, and social excluded groups such as Dalits (low caste/untouchables), and children and women - and safety of sanitation workers

- Lack of soap, hand sanitizers and surface disinfectants
- Lack of adequate and clean water
- Risk of COVID-19 community spread due to poorly managed public toilets / bathing space
- Safety of sanitation workers amidst risk of COVID-19 transmission

3. Improving WASH Service Delivery during COVID-19 Situation

- COVID-19 pandemic not only raised the **multitude of challenges** in WASH leading to WASH service gaps and vulnerabilities but also raised some experiences and innovative solutions to improve access to water, safe sanitation, and hygiene practices
- Extensive behavior change pandemic information prevention and control (IPC) measures on WASH - (especially on handwashing with soap) using digital tools - audio, video messages via radio and television, and using cell phone messaging and social media networks
- Digital solutions also applied for monitoring of hand hygiene practices in real-time were performed



3. Improving WASH Service Delivery during COVID-19 Situation

- Extending access to emergency WASH services for vulnerable groups - e.g. water supply through water from non-piped sources via water trucks, automated water ATMs; establishments of contactless, foot-peddled handwashing facilities and make-shift sanitation facilities in public areas, disinfection of public toilets and bath spaces, distribution of free soap or subsidized soaps or hygiene kits

- Strengthening WASH investments - COVID-19 has exposed financing gap and slow progress to universal access to WASH.

IFC, 2020 estimate

water sector infrastructure gap

Additional 114 billion (annually)

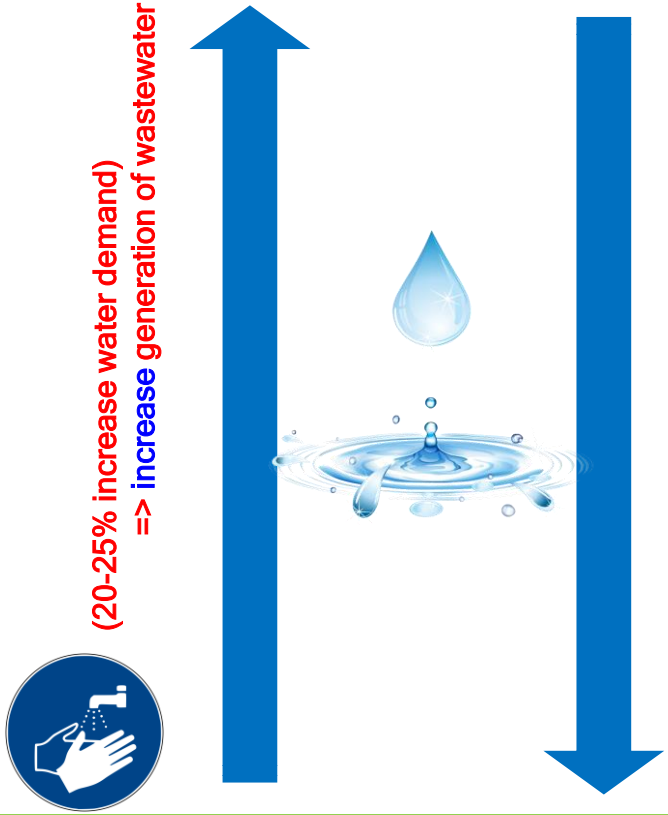
2030

4. COVID-19 & Water Demand and Supply

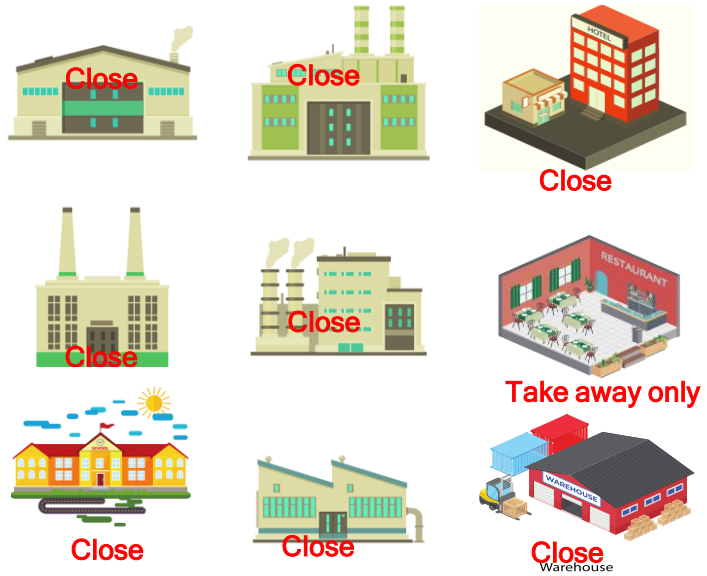
COVID-19 pandemic caused a **shift in water consumption pattern** owning to changes in lifestyles during COVID-19

Typical global average urban water use (Pre-COVID-19) in domestic: commercial sectors was 70% : 30%
During COVID-19, this split shifted changed as 82% residential and 18% commercial

Increased Domestic Water Use



Decreased Commercial, Industrial and Institutions Water Use



shutting down of schools, offices, shopping malls, public entertainment places, and reduced manufacturing activities

4. COVID-19 & Water Demand & Supply

The evidence of changes in water consumption pattern during the early months of the onset of COVID-19 pandemic in 2020, when almost all countries across the globe had order stay-at-home orders to contain the spread of the coronavirus

City/Country	Changes in household water consumption pattern, and domestic water use demand	Changes in commercial, industrial, and institutional water use demand	Source
Barcelona	+7%	- (35 ~ 50) %	(Xarxes, 2020) cited in Poch et al. 2020
United States of America	+4.80%	- 48% (government services - 34% (retail & wholesale trade, manufacturing, construction & other) - 18% (leisure & hospitality, transportation, employment services, & other)	(AWWA and AMWA, 2020)
Malaysia	+ (7~ 15)%,	- (10~ 30)%	(UNESCO IHP, 2020) webinar
Jakarta, Indonesia	+11%	- (23 ~ 34)%	(UNESCO IHP, 2020) webinar
Tabriz metropolitan area, Iran	+17.57%	-11%	(Feizizadeh, et al., 2021)
Portsmouth, UK	+15%	-17%	(Portsmouth Water, 2020)
Joinville, Southern Brazil	+11%	- 53% in industrial water consumption - 42% reduction in commercial sector	(Kalbusch et al., 2020)

4. COVID-19 and Water Demand & Supply: Effects of COVID-19 on Water Service Providers

Influence on water supply (Quantity):

- new consumption dynamics of shift in water demand
- network pressure management
- changing storage levels of tanks or reservoirs
- water supply reallocation
- water leaks

City

Influence on water supply (Quantity):

- Decrease water consumption volume
- network pressure management
- changing storage levels of tanks or reservoirs
- water supply reallocation
- water leaks

Industrial Estate

Influence on workforce

- Staff shortage (work from home)
- Risk of staffs falling sick, workforce hiring freeze,
- staff layoff

Water Services Provider

Influence on water supply (Quality):

- Increased testing of water quality for the potential presence of coronavirus
- intensified water disinfection

Influence on supply chain disruptions:

- Disruption in **supply chain of water disinfection chemicals**,
- PPE for employees
- infrastructure components, and other supplies
- logistics affecting the maintenance and repair,
- construction/extension of distribution networks etc.

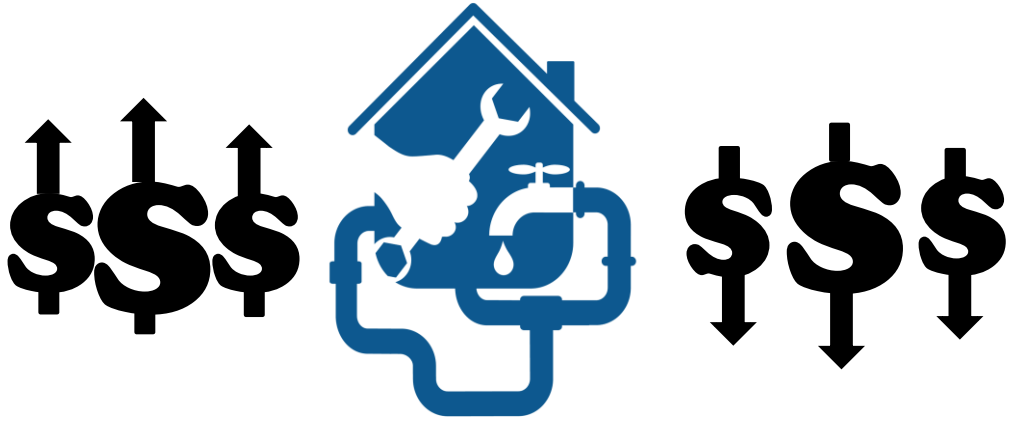
These shifts in water demand profile during COVID-19 caused service providers to adjust in their distribution operations and other management modifications, influencing the performance of service providers

4. COVID-19 and Water Demand & Supply: Effects of COVID-19 on Water Service Providers

Operational costs increased

- Expand water points, repairing, maintain, upgrade, and update its infrastructure and distribution networks
- Provide emergency supply of additional water through non-piped sources

Influence on water revenue



Water Service Providers

Declined Water Revenue

- Reduction in water demand by large water users like commercial, industrial, and institutional sectors,
- Delay or non-payment of water bills
- Deferment/ exemptions/ discounts on water bills as measure to COVID-19 crisis response

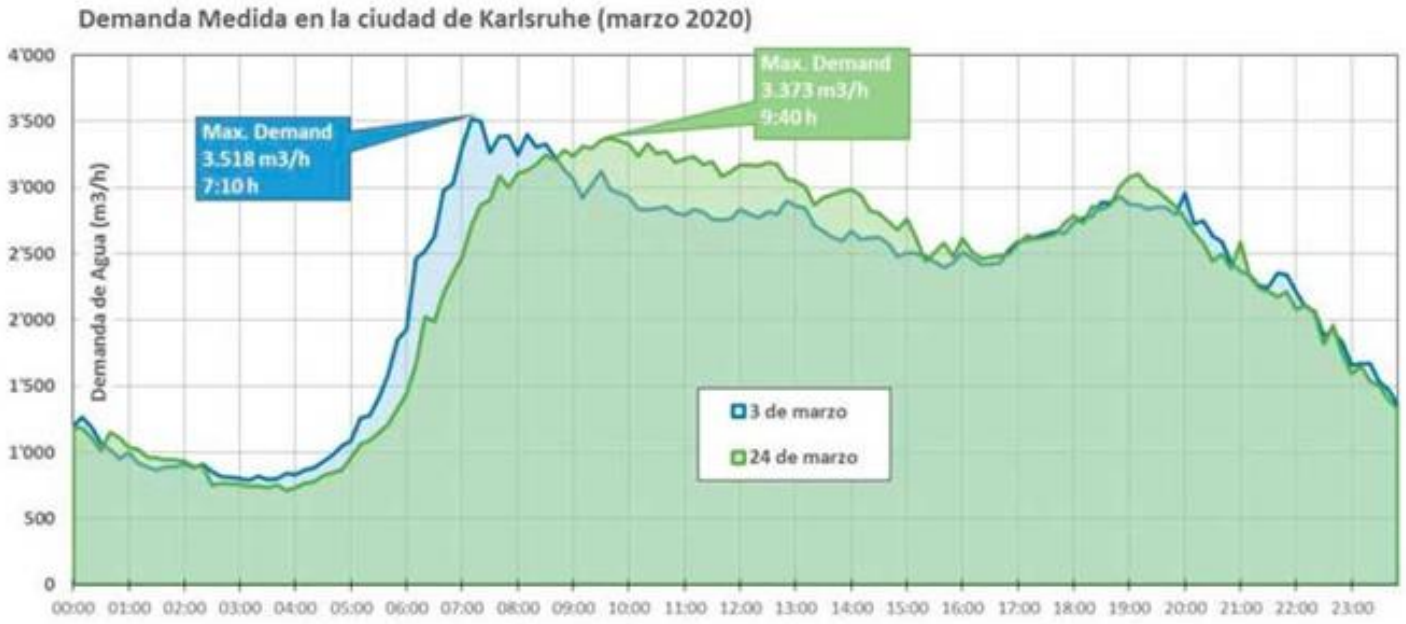
- The total estimated net decrease in drinking water utility revenues in the U.S. is anticipated to be US$ 4.7 billion on an annualized basis considering the anticipated US$ 7.4 billion decrease in non-residential revenues and a $2.7 billion increase in residential revenues (AWWA and AWMA, 2020)

- In the case of Asia and the Pacific, according to the ADB survey, 37% respondents reported an increased spending for chemicals because heightened disinfection is observed in potable water systems (ADB, 2021)

- Water Utilities often balanced the current account deficits and shortage by delaying their maintenance and capital investments often leading to a deterioration in assets and delays in planned coverage expansions, affecting the overall water supply performance

4. COVID-19 and Water Demand & Supply: Response and Recovery Measures for Water Supply Management

- **Digitalizing water sector:** Up taking digital solutions to manage water supply's day-to-day operation during COVID-19 (data management, decision support (and full automation)
  - computerized network to monitor, control utility infrastructure including digital surveillance of real-time water consumption quantity and pattern, leak detection technologies, network pressure management
  - digitalization of services: paperless office, e-billing/invoicing
  - customer care services and communications: (digital tools/Apps for raising hygiene awareness, risk communication, water saving guidelines influencing behavioral change, providing information on water supply disruptions, maintenance, and repair schedule as well as seeking community's support in informing water leaks).



Digitalization of services

R-TAP, Hiraya Water's flagship product, automated control of pumps and provides 24/7 real-time monitoring of pressure experienced

(Source: https://az659834.vo.msecnd.net/eventsairseasiaprod/production-adb-public/6b8320e2c8ea40b29f83636fab043085

5. COVID-19 and Wastewater: Changes in Wastewater Landscape during COVID-19

- With domestic water consumption increased during COVID-19 for increased personal hygiene activities including increased handwashing frequencies and other household chores due to stay-at-home order, it is also expected that wastewater discharges followed the changes in water consumption

- COVID-19 not only increased the quantity of wastewater discharge but also changed the characteristics of municipal/domestic wastewater

- Prominent changes in municipal wastewater during COVID-19 is the increased the risk of antimicrobial resistance (AMR) in wastewater through extensive use of antibiotics and pharmaceuticals and chemical disinfectant agents and personal care products with antimicrobial properties

- The COVID-19 pandemic impacted wastewater utilities with similar challenges as water supply service providers –
  - Staff shortage, remote working, safety of workforce in maintaining wastewater service provision;
  - Financial challenges of decreased wastewater revenue, additional operational cost
  - Negative implications of COVID-19 on water circularity (wastewater and sludge reuse schemes)

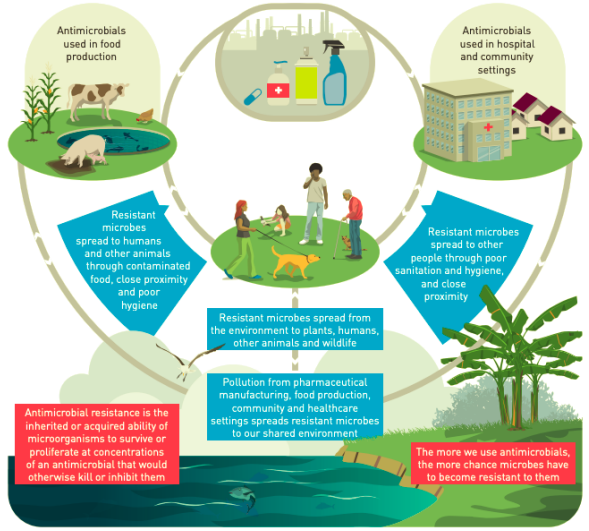


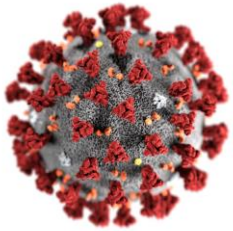
Figure 1

How antimicrobial resistance can spread (adapted from Government of Australia 2017)

Source: https://wedocs.unep.org/bitstream/handle/20.500.11822/38373/antimicrobial_R.pdf

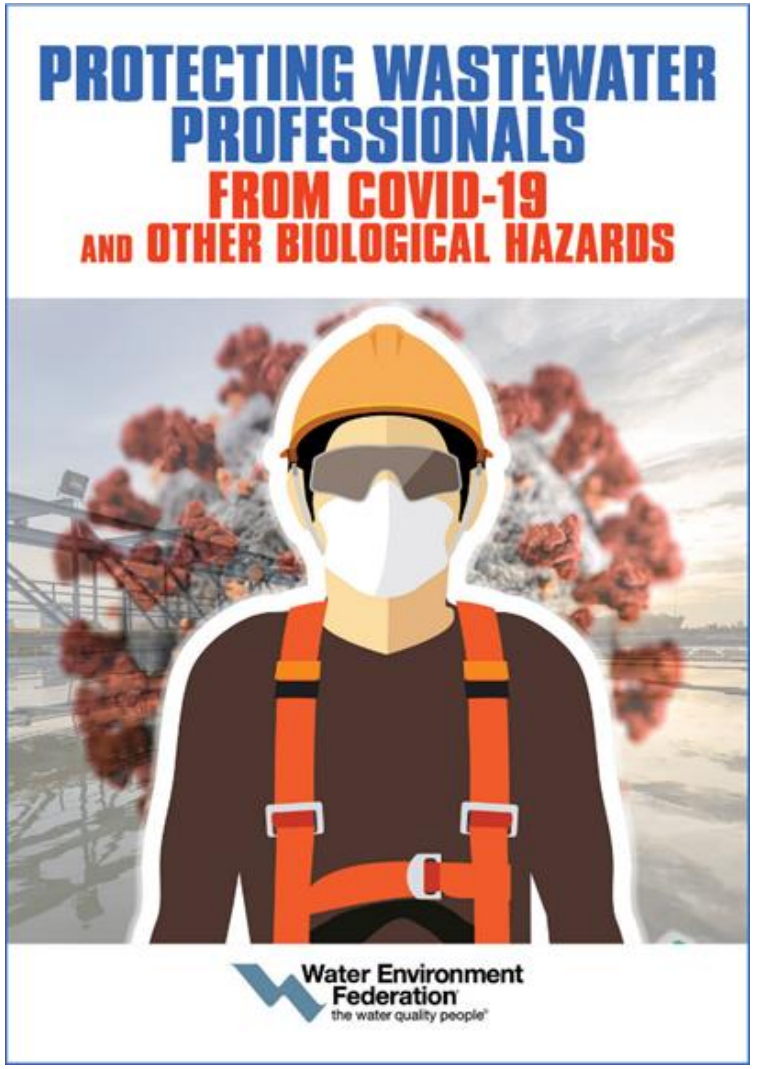
5. 5. COVID-19 and Wastewater: Changes in Wastewater Landscape during COVID-19

Operational challenges:



- damages to wastewater collection network/sewers
- sewer block with sanitizer wipes, excessive use of toilet paper,

- overall functioning and reliability of WWTPs treating chemicals and coronavirus
- potential presence of RNA of novel coronavirus (SARSCoV-2) & exposure of the virus to WWTP operators
- Increased need for enhanced wastewater treatment and disinfection activities

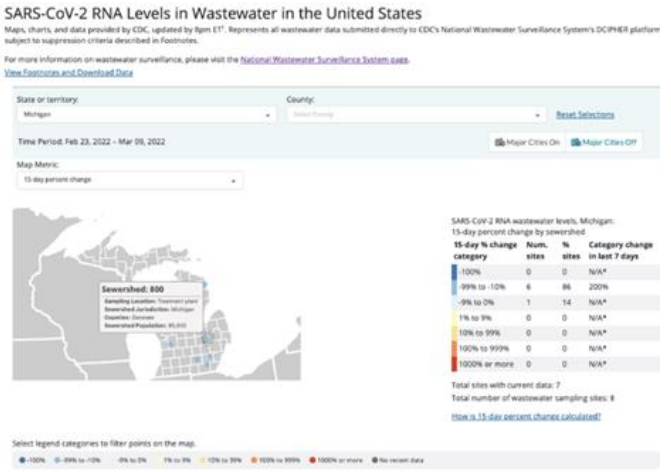


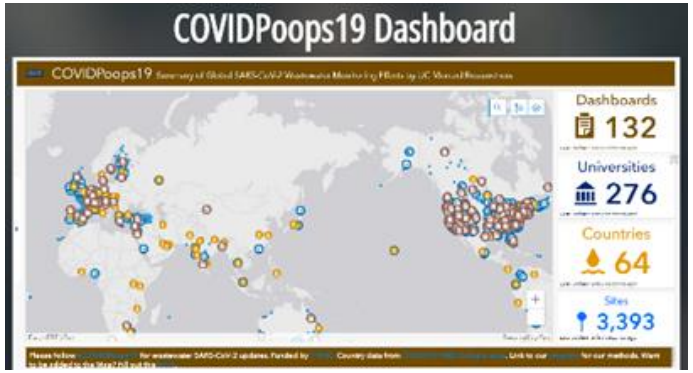
5. COVID-19 and Wastewater: Evidence of Detection of SARS-CoV-2 in Wastewater

- Various studies have reported the detection of SARS-COV-2 in feces, wastewater, and sludge. Surveillance of wastewater for the presence of SARS-COV-2 in untreated wastewater

- National Wastewater Surveillance System (NWSS) by the Centers for Disease Control and Prevention (CDC) uses digital technologies and platforms to share the wastewater monitoring results
  - Through the NWSS Data Collation and Integration for Public Health Event Response (DCIPHER) portal, health departments submit testing data to CDC.
  - The CDC will examine the data in real time and will communicate the results back to the health department to track SARS-CoV-2 levels and develop mitigation strategies by providing additional crucial information about the prevalence of COVID-19 in a community so that communities can act quickly to prevent the spread of COVID-19
  - Additionally, the CDC summarizes national data for the purpose of reporting and disseminating it to other partner agencies and the general public via the COVID Data Tracker system
  - Wastewater SPHERE through its global data center uses COVIDPoops19 Dashboard to provide databases for organizations and individuals testing for SARS-CoV-2 in wastewater and other waterways.

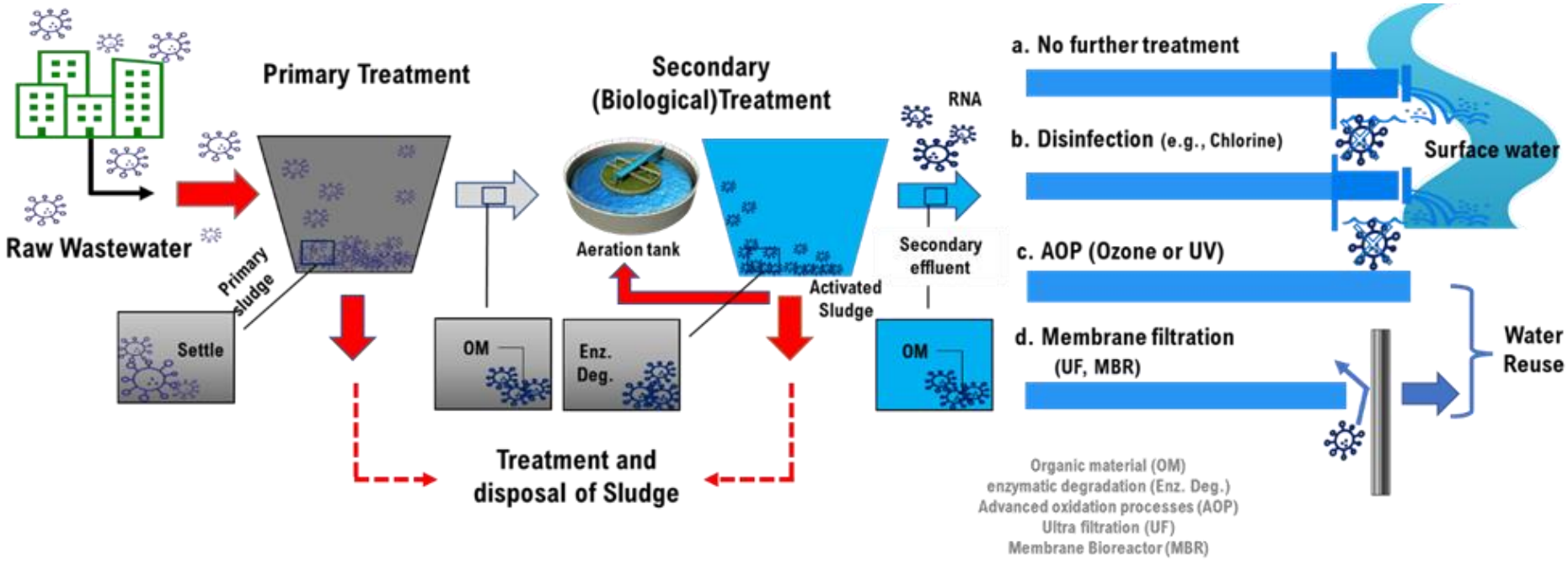
NATIONAL ™ WASTEWATER SURVEILLANCE SYSTEM





5. COVID-19 and Wastewater: SARS-CoV-2 Inactivation Techniques from Wastewater

- Various methods applicable in existing WWTPs) could possibly inactivate pathogens including SARS-CoV-2.
- The U.S. Occupational Safety and Health Administration (OSHA) , EPA states that the current disinfection techniques used in WWTPs, such as oxidation with hypochlorite or peracetic acid and inactivation by ultraviolet (UV) irradiation, are sufficient to protect the health of wastewater plant operators and the public
- Advanced oxidation process, UV irradiation, Membrane-coupled bioreactors are also considered an effective system to remove SARS-CoV-2



5. COVID-19 and Wastewater: Wastewater Systems' Response to COVID-19 Crisis

- Business continuity following the Safety and Emergency Response Guidelines
- Smart wastewater management – through intensified harnessing of digitalization in wastewater sector for data-based engineering, construction, and operation of facilities, and real-time data-driven decisions around process optimization, and increasing plant's performance, efficiency, and maintenance
  - Real-Time wastewater monitoring for detection of COVID-19 in wastewater (e.g., Sewer-sniffing IoT technology)
- Investing in wastewater management: COVID-19 has reiterated the need to step up investments in wastewater sector – for constructing more resilient wastewater and sanitation infrastructure, increased COVID-19 wastewater testing, and digital investments to embrace the digital transition in wastewater sector

GoAigua SARS-Analytics - shows the concentration of COVID-19 in wastewater in real time (implemented in Valencia, Spain)

Kando's Sewer-sniffing IoT technology, uses manhole sensors that can measure the flow of wastewater,and automatically collect, test and communicate WBE data in real-time to the cloud.

5. COVID-19 and Ambient Water Pollution

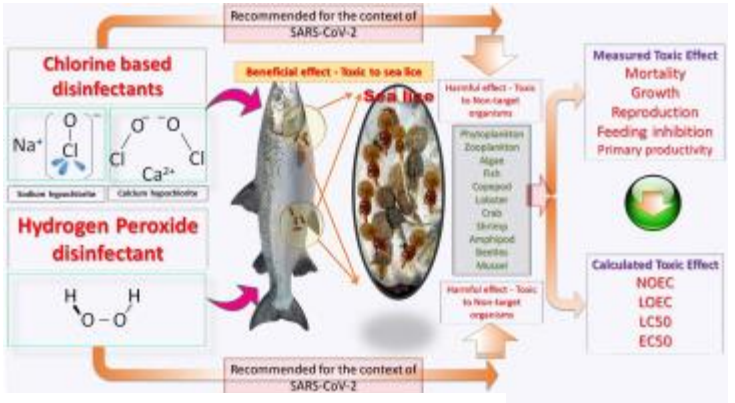
- In 2020, **up to 3.4 billion single use m**asks were discarded each day
- Coastal waters also reported PPE **during COVID-19**: costal sites from Peru reported **87.7% face masks** (De-La-Torre et al., 2021), Morocco **(96.8–100% face masks)** (Haddad et al., 2021; Mghili et al., 2021), Bangladesh **(97.8% face masks)** (Rakib et al., 2021); Iranian coast of the Caspian Sea **(1.02 × 10 −4 PPE/m2 density of PPE; 95.3% face masks)** (Hatami et al., 2022)
- A single surgical face mask that weighs roughly 3.5 gram, can release as many as 173,000 microfibers per day (Saliu et al. 2021).

- **Widespread disinfection spraying of streets, buildings, and public spaces with chlorine-based disinfectants** may release **high concentrations of residual chlorine** may remain into the environment, including surface water, shallow groundwater, and stormwater drains

5. COVID-19 and Ambient Water Pollution

- COVID-19 pandemic has added worry to the antimicrobial resistance in water pollution mainly due to the possibility of higher concentration of biocides reaching the receiving waters due to their high levels of usage of biocides in cleaning agents, overuse of antibiotics in COVID-19 patients, and PPE

- Few studies have detected sporadic presence of SARS-CoV-2 ribonucleic acid (RNA) in the receiving waters through untreated or poorly treated wastewater, however the risk of infection from contaminated surface waters depends on viral concentrations or viral load values and other climatic, geological, hydrological, and anthropogenic conditions



The pandemic again alarmed the need to accelerate measures to protect, restore and monitor ambient water quality to achieve water security

7. Conclusions

- The COVID-19 accentuated both the importance of and an impact on the water, sanitation, and hygiene sectors - challenged all dimensions of water security and slowed the progress of Sustainable Development Goal #6

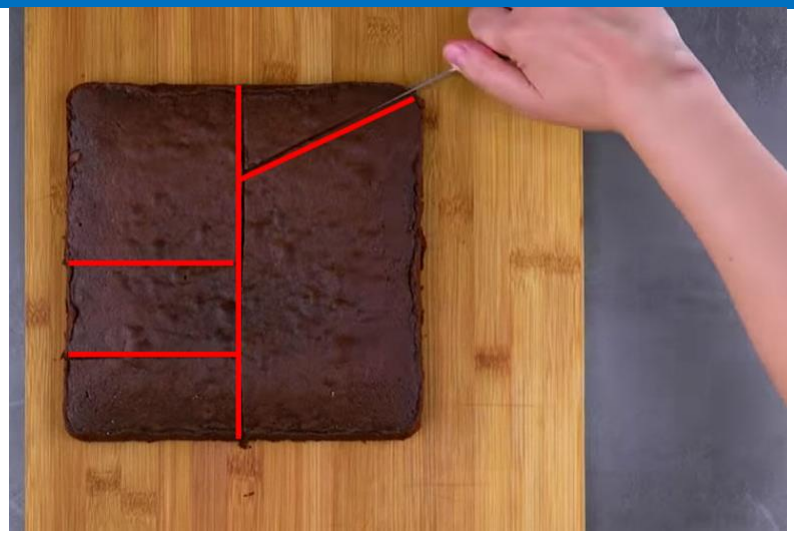
- The pandemic impacted the business continuity amidst the workforce challenge to operate with a limited onsite workforce while dealing with health and safety concerns in the water sector, in the changing demand landscape and declining water revenues

- The pandemic also surfaced the stark inequalities in access to water, hygiene, and sanitation facilities and a disproportionate burden to the vulnerable and marginalized communities, women and children, as well as securing and extending clean water, safe sanitation, and hygiene (WASH) services to meet the increased demand for water supply and amplified need for wastewater testing and disinfection

- Adaptability, preparedness for crises through emergency response plans, changes in modalities of operations, uptake of digital solutions, minimizing operational costs, and partly getting financial assistance from governments were some measures that made the water sector bear the brunt of the pandemic

- The COVID-19 pandemic both challenged water security but also uplifted water security discussion

8. How to Use the Information in this Assessment Report: Suggestions to UNEP



- Many ways to cut the cake (as per organization's need and priority)
- **Some immediate use of information by UNEP experts could be**

- Policy Brief: use of the assessment report into a brief for policy makers
- Country or regional Brief/Factsheet: picking information for country or region of interest - and work with them

- Project proposal/ concept note: building up on the ideas (on the priority area of UNEP) to develop proposal/concept notes to donors (example - use of digital technologies, spatial modelling, WBE training/methodologies, post-covid recovery project funding)

- Using network of Experts: the report provides many examples/efforts from various organizations, experts and their work around the topic of COVID-19 and the water sector (including speakers of the webinar)

- UN Interagency collaboration: Examples of UNICEF, UN Habitat, WHO and other agencies working in the subject matter- UNEP to finding ways to collaborate/connect to (Example: Thematic Working Groups)

Thank You!