

Optional Sectoral Module WATER AND SANITATION



In a resilient city, potable water and sanitation services are accessible to all segments of the population (*inclusive*). Water and sanitation infrastructure is planned with a holistic approach taking into account social, economic, and environmental risks and vulnerabilities (*robust* and *reflective*). Planning for and investment in the sanitation and water systems is driven by demand and supply data, environmental goals, participatory engagement, and is based on cross-departmental collaborations that support coordination with existing urban development plans and priorities (*coordinated* and *inclusive*). In a resilient city, there is sufficient human and technical capacity to ensure sustainable operation, maintenance and financial management of water and sanitation infrastructure and services (*redundant*). Water and sanitation services are part of an integrated urban water management system (*coordinated*).

TOPIC	GUIDING QUESTION	APPLICABLE RESILIENCE QUALITY	RELATIONSHIP TO RESILIENCE QUALITY
Institutional Capacity	Who manages the water, sanitation and drainage systems in the city? Are all providers of the same service well-coordinated in terms of management, development planning, and emergency response?	Coordinated	Close coordination among water, sanitation and drainage utilities can facilitate planning for future demand and accelerate response in case of disruption.

Finance	What are the funding sources for water, sanitation and drainage infrastructure? To what extent is the funding discretionary at the local level? To what degree are funding sources and uses coordinated across agencies that provide water, sanitation and drainage infrastructure and services?	Robust	Water, sanitation and drainage systems that strive for complete coverage and continuous operation rely on sustained and predictable funding. When a city has discretionary control over funding for such utilities, it can be held accountable for achieving a pre-determined service standard and coverage in line with available funding. Coordination across agencies helps identify coverage gaps, improve alignment of trunk and local infrastructure and facilitate spending efficiency.
Finance	Is contingency financing available for water, sanitation and drainage infrastructure and services?	Redundant	A contingency fund covers unexpected disruptions in the water, sanitation and drainage systems, accommodates sudden demand increases and changes in regular financing flow.
Planning	Does the city have an overview of all water, sanitation and drainage infrastructure in the city, including capacity levels, design specifics, number and location of key facilities? Is planning for disasters, shocks, or stresses incorporated into the regular water, sanitation, and drainage infrastructure planning process?	Reflective; Coordinated	Overview of key facilities and their capacity levels allows the city to evaluate service accessibility and determine investment needs based on future demand estimates. Monitoring performance of key facilities and infrastructure allows the city to identify vulnerabilities and make maintenance/upgrading investments to improve the overall robustness of the city's water, sanitation and drainage systems.
Planning	Do sewage and water pipeline networks cover all areas of the city, including informal and low income neighborhoods? If no, are there plans for expanding sewage and water pipeline networks into these areas of the city?	Inclusive	Inclusive water, sanitation and drainage systems are characterized by equal coverage to all built-up areas of the city, service quality and affordability.

Planning	Does the current capacity of water supply and sanitation services meet existing and projected demand? Are informal settlements incorporated into water and sanitation service demand estimates?	Robust; Inclusive	Robust capacity management ensures that increases in demand are absorbed without causing service disruptions for existing consumers. Recognition of informal settlements in water and sanitation service demand estimates allows for more inclusive and accurate planning of services.
Supply & Quality	Is the water supply source for the city protected from contamination? What are the main sources of contamination?	Robust	The water supply basin should be protected from contamination through economic and command control enforcement.
Supply & Quality	Are water and sanitation services in the city mostly supplied from modern treatment works through pipeline water and sewage networks, or through other systems? (e.g., on-site sanitation facilities, private boreholes, open wells or similar sources)? Do other systems serve as primary or back-up modes? What percentage of water samples in a year comply with national potable water quality standards? What percentage of the sewage reaches a treatment plant?	Robust; Redundant	Modern treatment works and distribution of drinking and wastewater through pipeline networks helps ensure water purification before and after it reaches the consumer. Proportion of pipe network versus other supply systems is indicative of the city's ability manage and ensure water and sanitation service quality. Where majority of water and sewage networks are owned and regulated by the local government, it is easier to monitor and ensure appropriate water treatment.
Supply & Quality	Is water quality monitored in urban rivers to assess the efficiency of sewage treatment? What are the main water quality goals for urban rivers?	Reflective; Robust	A sound sewage collection and treatment service should provide good standards of water quality in urban rivers.
Capacity	Is the current water availability greater than the demand at design level? Is there alternative supply for drought years (risk greater than design)?	Robust	A sustainable water supply should have water availability at the design level and emergency alternatives for drought beyond the design water availability.

Capacity	What is the annual average of daily number of hours of continuous water supply per household? Which areas of the city are most affected by the disruption to water and sanitation services?	Robust	Frequency of water supply discontinuity per household indicates the level of water scarcity in the city's overall water supply and reliability of this service. Assessment of disruption to water and sanitation services per area of the city helps identify vulnerable areas which are in need of back-up/temporary water and sewage systems.
Capacity	Is the city's drainage system currently able to cope with seasonal increase in rain/stormwater? How are the anticipated effects of climate change likely to impact the city's drainage systems and have these predictions been incorporated in planning and design efforts? For example, are design parameters for estimating reservoir size, dam configuration, spillway capacity, and highest flood levels reviewed in view of changing climate patterns, and rainfall intensities and durations?	Robust; Reflective	Experience of current seasonal rain/stormwater variations and forecasted impacts of climate change on rainfall levels should inform the design of the city's drainage system. Climate change projections allow the city to improve the design and capacity of existing drainage and water retention infrastructure, as well as make necessary flood protection investments to accommodate changes in rainfall patterns.
Facilities	Are principal components of the city's water and sanitation systems (e.g., water intake structures, water treatment plants, conveyance systems, storage systems, distribution network, sewage treatment works) located in disaster prone areas? If yes, are there plans to retrofit existing exposed facilities so that impacts of potential disasters may be reduced? Are new facilities built in safe areas or designed to be resilient to the hazards that are relevant for the areas in which they are built?	Robust; Reflective	Historic disaster monitoring and climate change projections allows the city to make improvements to existing water and sanitation facilities to mitigate impacts of potential hazards, and make informed decisions about new facility sites based on levels of exposure.

Facilities	Does the city regularly maintain and repair its water and sewage infrastructure? What volume of potable water is lost from distribution channels per year? What volume of wastewater is leaked into the environment per year?	Robust	Preventive maintenance of water and sewage infrastructure improves the duration and reliability of infrastructure. Regular maintenance of water distribution and wastewater collection prevents costly leakages of potable water and wastewater into the environment. Untreated wastewater discharge can have devastating impacts on the environment and health of affected populations.
System Continuity	Is the probability that water and sanitation will remain operational in post-disaster situations assessed? If yes, does the assessment include information about what proportion of water and sanitation user accounts is exposed to each hazard?	Reflective	Assessment of water and sewage networks' probability of continued operation informs the planning of back-up systems for water supply and wastewater collection. Assessment of the number of people affected by such disruptions allows the city estimate costs for keeping minimum levels of services available.
System Continuity	If a water and sanitation network has been impaired, do the systems have the flexibility for the demand to be absorbed by alternate water supply and wastewater collection modes?	Redundant	Flexibility in the water supply and wastewater collection systems entails existence of more than one service provider capable of absorbing excess demand created by the break down in the regular distribution/collection system. Alternative water supply systems include rainwater catchment, purchasing of bottled water, etc. There are also a number of alternative on-site wastewater collection and treatment systems for individual and shared usage.

System Continuity	Has the city identified strategic locations (such as health centers, shelters) or other areas requiring rapid assistance with supplies of bottled water, water tankering or water treatment kits? Is the access water supply available for all of those locations/functions?	Redundant	Identification of strategic facilities that cannot operate without water, such as hospitals and shelters, should be prioritized during planning of back up water supply. Minimum levels of water supply needs to be maintained to facilities whose operation is essential for the safety of city residents.
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Documents and Tools Informing the Guiding Questions:

- ARUP, RPA and Siemens, Toolkit for Resilient Cities (2013)
- Asian Development Bank, Flood Risk Management: A Strategic Approach (2013)
- Asian Development Bank, Guidebook: Increasing Climate Change Resilience of Urban Water Infrastructure (2013)
- GFDRR, Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century (2012)
- Inter-American Development Bank, Emerging and Sustainable Cities Methodology (2014)
- UN-Habitat, City Resilience Profiling Tool
- World Bank, Kenya Post-Disaster Needs Assessment 2008-2011 Drought (2012)
- World Bank, Government of Pakistan and ADB’s Post-Disaster Needs Assessment for flooding in Pakistan (2011)