Amman Water Profile

Background

Amman is the cultural, political and economic centre of Jordan, providing a home to approximately 4.4 million people – 42% of the population of Jordan. In a region of turmoil and conflict, Jordan has remained relatively stable over recent decades. Since the late 1940's, Jordan has accepted several major influxes of refugees as a result of regional conflict – many of which have settled in Amman. Largely due to forced migration, Amman has experienced rapid growth in recent years, with the population doubling from 2 million to 4 million between 2004 and 2015 (Greater Amman Municipality, 2015).

Jordan sits on the East Bank of the Jordan River and is almost entirely landlocked, but for a small stretch of coastline onto the Red Sea. In terms of per availability of renewable water resources, Jordan is one of the most water scarce countries in the world (Ray, 2010). Water scarcity defines a way of life for citizens of Amman. Water supply is intermittent, reaching most households only once a week. At approximately 94 litres per day, per capita consumption is low when compared to neighbouring states and those with relative economic standing.

Although characterised by water scarcity and drought, Amman also suffers from flash floods due to the high intensity, short duration rainfall events that are typical of the region.

Jordan is a constitutional monarchy in which the King holds major executive and legislative power. Water is a national issue with much of the policy and regulatory functions under central government control.

Key Shocks and Stresses

Shocks and stresses cited by stakeholders in Amman can be characterised into three primary themes: water scarcity; cost recovery of water and wastewater services; and flooding. Additional, but less frequently cited shocks and stresses include:

- Environmental degradation
- Ageing infrastructure
- Terrorism
- Poor planning
- Poor governance

Water Scarcity: Water resources in Jordan are extremely scarce. Reduction in resource availability has reduced radically over time – falling from 3,600m3 per person in 1946 to 125m3 per person in 2013 (IMWI, 2016). Projections estimate that demand will outstrip supply by 26% by 2025 (MWI, 2016).

Stakeholders cited several key contributing factors: Population growth through forced migration, Transboundary water, Water quality

Cost Recovery of Water and Wastewater Services: The Jordanian water sector is only able to recover 60-70% of total costs. The sector has seen a continual decline in cost recovery rates since 2005 due to major capital investment and little change in tariffs. Water and wastewater bills account for less than 1% of total household expenditure. (MWI, 2016).

Service provision is heavily dependent on subsidies from the national budget and is therefore very vulnerable to fiscal crises. In addition, with limited fiscal resources, government relies heavily on involvement from donor organisations and the private sector.

The following stresses were cited as the primary drivers of poor cost recovery in Amman: Cost of energy, Non-revenue water.

Flooding: In 2015 several people in low lying areas of Amman died during a particularly bad flooding event.

Outside of Amman, flash flooding has a major impact on the operation of critical water resources infrastructure. The King Abdallah Canal is vulnerable to debris carried by flood waters that block the canal. This issue was cited during several interviews but less so during the workshop exercise.

Road accidents/ congestion due to flooding arose several times during the shocks and stresses exercise of the main workshop as a low frequency, high impact shock.

Cape Town Water Profile

Background

Cape Town is the second most populous city in South Africa with a population of around 4 million people, and is one of its fastest growing cities in South Africa with an increase in population of 1.6% from 2015 to 2016 (CCT, 2018). It is the capital of Western Cape Province and is also the seat of South Africa's parliament and its legislative capital.

Cape Town is one of South Africa's main economic centres and contributes about 9.4% to the GDP (CCT, 2018). At the same time, there are high levels of poverty and economic inequality in Cape Town, with a wide gap between rich and poor and about 20% of the population is living in informal settlements. (CCT, 2018). The drought has put significant pressure on the city's budget due to reducing revenue and additional costs for augmentation schemes as well as impacting on businesses within the city and external investment. (CCT, 2018).

Cape Town is world renowned for its stunning natural beauty and biodiversity, making it one of the most popular tourist destinations in the world.

Climate change is a major stress and Cape Town is particularly vulnerable to its impacts, which are expected to become more frequent and intense. The city, as well as the surrounding Province, are currently confronted with a severe three-year drought, with recent annual rainfall levels being among the lowest in recorded history. The people of Cape Town have responded to the possibility of what has come to be known as "Day Zero" by curtailing consumption by more than 50% compared to pre-drought consumptions levels.

Key Shocks and Stresses

The key shocks and stresses identified in Cape Town are:

Drought: Cape Town has experienced a three-year drought due to lack of rainfall and the resulting availability of surface water sources. This has had significant impacts on businesses, residents and the environment in the city of Cape Town.

Over-abstraction and pollution of groundwater: There are concerns that Cape Town could face the stresses of over-abstraction and pollution of groundwater due to the large number of private boreholes that have been drilled during the drought. Currently, there are 22,000 private boreholes in Cape Town and limited groundwater data and modelling available to inform the management of groundwater supplies as well as limited city regulation and enforcement.

Flooding: Surface water and fluvial flooding have been identified as regular occurrences in the wet season in Cape Town. The combination of annual winter storms and heavy rains, the steep mountainous slopes generating high amounts of runoff, the large expanses of low-lying land (the Cape Flats) and a high water table means that much of Cape Town is at risk of flooding.

In parts of the city, where the land use is regulated and stormwater infrastructure is provided, flooding is less frequent. In informal settlements, flooding is an everyday stress particularly in the wet season. This is due to development in marginal lands including detention and retention ponds, wetlands and low-lying lands with water logged sandy soils, and a lack of formalized stormwater drainage. Poor solid waste management is also a contributing factor as it causes blockages of formal drainage.

Lack of adequate hygiene and sanitation: 20% of Cape Town's population lives in informal settlements. Cape Town has a target of one shared toilet to a maximum of five households and one tap to 25 households and within a maximum walking distance of 200 metres. However, it is not possible to provide water infrastructure or place flush toilets in areas that are vulnerable to flooding, on private land, on unstable ground or so densely settled that there is no room. As a result, some residents of informal settlements are provided with chemical or container toilets. Residents of the informal settlements reported that there were often maintenance issues with the sanitation facilities provided, including frequent blockages and sewage spills and irregular servicing by service providers. The lack of adequate hygiene and sanitation, as well as faecal pollution in the informal settlements, results in higher incidence of diarrheal disease amongst residents.

Ecosystem loss: Land pressures in Cape Town are resulting in increased development in valuable ecosystems, such as vleis, damaging wetlands and providing unsuitable locations for housing that suffer from regular flooding.

Limited investment in catchment management is resulting in the spread of invasive species throughout the catchments, outcompeting natural flora and fauna. Alien invasive species in the area exacerbate water scarcity, as they use much more water than indigenous species (CCT, 2018).

Hull City Water Profile

Background

Kingston Upon Hull - normally abbreviated to Hull - is a port city of 260,000 people located on the north bank of the Humber Estuary in the heart of the East Riding of Yorkshire, England.

Founded on reclaimed tidal marsh, the story of Hull has always been shaped by water, both as an opportunity and as a threat. Now the city faces significant resilience challenges, not least due to its low-lying coastal location, with more homes at risk than any other UK City apart from London. Despite signs of renewal, Hull remains one of the most deprived areas in the UK, with low health outcomes and high unemployment. Communities here are amongst the most vulnerable to climate risks in the UK.

The city's economy grew around farming, whaling, fishing and freight, then chemicals, pharmaceuticals and communications. It prospered to become a major port, which now supports 23,000 jobs. Despite its relatively small population the city plays a key role in the UK economy. The Humber is the largest trading estuary in the UK (by tonnage) and the fourth largest in northern Europe. It is emerging as a world-leading centre for renewables. Hull and the East Riding has recently attracted major investment in offshore wind energy. With a University of 16,000 students and as host for UK City of Culture 2017, the City is building reputation for innovation, creativity and openness to change. Now Hull is embracing climate adaptation and water-resilience as an opportunity to shape a successful and sustainable future.

Key Shocks and Stresses

Its coastal location continues to underpin the economy and major opportunities going forward, but Hull also faces particular challenges due to its low-lying coastal context. With parts of the city below sea-level and a catchment that drains towards the estuary, it will always be a highly- managed landscape.

Flood risk from multiple sources: Coastal protection must balance sea level rise, coastal erosion and habitat protection, flood storage, navigation and industry. The city is fully reliant on pumping to remove surface water; existing surface water systems are at or near capacity. Solutions to keep water out of the city are politically sensitive requiring loss of prime agricultural land and actions across administrative boundaries. Options for green-blue solutions are limited. Future solutions will need to build resilience to cope with more extreme events.

Wastewater treatment: A single wastewater treatment works takes all sewage flows from the city and is fully reliant on pumping. Much of the surface water landing on the city flows into the combined system, including most of the watercourses which have been culverted. Much of the infrastructure is ageing and at or near capacity.

Water Sensitive Development: Hull has the most comprehensive Strategic Flood Risk Assessment in the UK, based on detailed understanding of integrated drainage systems to inform future development. There will be increasing pressure on land use as the city grows, especially as Hull has agreed to accommodate an element of housing growth for the East Riding area.

Community Engagement: Despite the extent of flood risk and impact on 9,000 properties during the 2007 floods, perception and awareness of risk is still relatively low, with only 4% of eligible households signed up to flood warnings. There is a need to reconnect the city with its water story, to build a shared understanding, particularly between urban and rural communities and also engaging immigrant and disadvantaged communities.

Watercourses: Over time many watercourses within the City have been in-filled and diverted to flow directly into the surface water drains or combined sewage system. Others have been contained in culverts.

The most critical shocks and stresses for the City of Hull are:

Shocks

- Climate change – sea level rise and more intense storms
- Coastal flooding/ tidal surge
- Fluvial Flooding
- Surface Water Flooding
- Ground water flooding
- Energy Crisis
- Emergency Services Failure

Stresses

- Ageing infrastructure
- Infrastructure capacity
- Development pressure on flood plain and water sources
- Saline intrusion
- Increasing water demand
- Lack of investment
- Poor planning

Miami-Dade County Water Profile

Background

Miami-Dade County (MDC) is the south-eastern-most county on the U.S. mainland and with a population of 2.7m people is the seventh-most populous county in the United States.

The county is home to 36 incorporated cities (including City of Miami and City of Miami Beach) and many unincorporated areas. The northern, central and eastern portions of the county are heavily urbanized with many high rises up the coastline, as well as the location of South Florida's central business district, Downtown Miami.

Southern Miami-Dade County includes the Redland and Homestead areas, which make up the agricultural economy of Miami. The western portion of the county extends into the Everglades National Park. East of the mainland in Biscayne Bay is also Biscayne National Park and the Biscayne Bay Aquatic Preserves.

The hydrological basin in which MDC is situated originates in Lake Okeechobee in the North and extends all the way to the southern coast where it discharges into the Everglades National Park and Biscayne Bay, incorporating the Biscayne National Park. The systems is extremely very flat with only about 3m of elevation drop over the approximate 100 miles between Lake Okeechobee and the coast.

The hydrogeology of the basin is defined by the extremely porous limestone that forms the Biscayne Aquifer and that lies only a few feet below ground level. Due to the sandy soils and extremely porous geology, the surface water, groundwater and coastal water systems are essentially unconfined and entirely interconnected; both in terms of quantity and quality of water.

Key Shocks and Stresses

Certain characteristics of the Miami basin (made up of the SFWMD and LEC Water Supply Zone) result in particular vulnerabilities that present challenges when considering resilience to shocks and stresses:

- The flatness of the system and elevated groundwater present challenges in terms of water storage that could play a role a flood protection and source water management. A flat system requires that drainage is more actively managed to control hydraulic gradients. Infiltration and inflow further blurs the traditional boundaries between water and wastewater supply and surface/groundwater management.
- The lack of boundaries between water systems present challenges in terms of pollution control

Hazard profiling is reported in a number of documents related to risk management in MDC, notably the Miami Dade County Local Mitigation Strategy.

Miami-Dade County developed a Threat and Hazard Identification and Risk Assessment (THIRA) that includes numerous natural, technological, crime/terrorism and public health hazards that Miami-Dade County could experience (Miami-Dade Office of Emergency Management, 2017). The principal identified natural hazards are:

Hurricane/ Tropical Storm	Winter Storm
Tornado	Erosion
Flooding	Saltwater Intrusion
Sea Level Rise	Erosion
Drought	Wildfires

The principal shocks and stresses include:

- Ecosystem degradation
- Hurricanes
- Ageing infrastructure (inflow and infiltration) – sea level rise, salt water intrusion
- Utilities infrastructure failure
- Sea level rise – salt water intrusion, increased pumping, septic tank contamination, environmental impact, ageing infrastructure
- Surface water flooding – changing precipitation & sea level rise, increased pumping, reduce water quality,
- Coastal flooding – storm surge and sea level rise
- Groundwater flooding – sea level rise (sunny day flooding)
- Water quality degradation – Salt water intrusion – sea level rise & over abstraction & over-drainage, environmental degradation (i.e. wetlands)
- Water quality degradation – nutrient loading & urban pollutants, emerging contaminants
- Poor governance and poor planning