Joining Forces *to* Combat Protracted Crises

Humanitarian and Development Support for Water and Sanitation Providers in the Middle East and North Africa

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Executive Summary

Protracted crises in urban contexts of the Middle East and North Africa region present a growing challenge for water supply and sanitation (WSS) service providers and, in turn, the governments and international organizations that support them.

In the worst crises, considerable responsibility for financing WSS service provision passes from local state actors to international actors. WSS service providers struggle to stem the rate of service decline without substantial external support—from both humanitarian and development actors. New types of partnerships between humanitarian and development actors are needed to identify approaches to help WSS service providers build greater resilience into services both prior to and during protracted crisis. The two groups of actors have no option but to cooperate in urban areas as their support involves the same state actors and overlaps in space and in time, with activities directly influencing one another.

The protracted nature of crisis in countries characterized by fragility, conflict, and violence (FCV) transcends conventional notions of (pre-, during, and post-) crisis management. There is often no obvious path of return from protracted crisis for WSS service providers. Rather it requires more fundamental resilience-building measures that anticipate the full breadth and depth of the pernicious problems that emerge during protracted crisis.

This report examines five pernicious problems identified by WSS service providers operating in protracted crisis in the Middle East and North Africa region. The five problems are: (1) inadequately governed water resources management; (2) aggressive competition from alternative providers (e.g., tanker trucks), undermining network services; (3) paralysis of high-tech wastewater treatment plants; (4) escalating energy costs of off-grid generation; and (5) the cashflow crunch as service provider costs jump and revenues fall. For each problem, a dedicated chapter in the report puts forward likely root causes, researches how humanitarian and development actors with direct experience of operating in protracted crisis have helped WSS service providers tackle the problem, and recommends ways that both groups of actors can more effectively support WSS service providers to stem the rate of service decline. Each chapter begins with a summary of findings on each problem.

The pernicious problems are shown to stem from precrisis vulnerabilities that have their origins in the rapid period of urbanization and infrastructure expansion across the Middle East and North Africa region. Access to WSS services, especially in urban areas, improved significantly over the Millennium Development Goal period: Over 90 million people gained access to piped water and nearly 60 million gained access to sewer systems from 2000 to 2010 alone. But such rapid urbanization and WSS service

expansion—reaching near-universal access in urban areas by 2010—failed to develop services resilient to potential hazards in the Middle East and North Africa region.

A more concerted effort to promote WSS service provider resilience prior to crisis is therefore needed. Once a country is in protracted crisis, opportunities for building resilience in WSS service provision become highly constrained by factors well beyond the control of service providers owing to increased insecurity, political tensions, and macro-fiscal constraints. Even with external assistance, the scope for building resilience during protracted crisis is highly constrained—yet efforts to do so should and must be redoubled.

Humanitarian and development actors should strengthen their partnerships in both anticipating and responding to protracted crises. Based on a shared understanding of how the pernicious problems have their roots in precrisis vulnerabilities, and how they emerge to accelerate the rate of decline in WSS service provision during crisis, there are four proactive ways to strengthen humanitarian-development partnerships to anticipate and respond to protracted crises:

1. **Humanitarian and development actors should work together with WSS service providers to make emergency preparedness plans for acute crises—as a "no-regrets" investment.** Even though emergency preparedness plans can never sufficiently prepare WSS service providers for protracted crisis, they are an obvious step in building resilience to acute, short-run crises (e.g., armed conflict, flood, drought, earthquake, energy shortage, epidemic, civil unrest) and are a no-regrets investment. Humanitarian actors have deep experience of how and why WSS service provision deteriorates, or even collapses, in short-run and protracted crises, but they seldom have the opportunity to work with WSS service providers precrisis. Development partners, in turn, would be able to fund these plans and support tried-and-tested preparedness measures for operating in acute crises, including both hardware and software solutions.
2. **Precrisis partnerships would enable humanitarian actors to establish links with WSS service providers and their supporting ministries.** Development actors need to place greater emphasis on building the resilience of service providers precrisis, and during protracted crisis wherever possible. But they should also work with humanitarian actors precrisis, to ensure that WSS service providers have established functional links with humanitarian actors and with other state actors key to service delivery during crisis (e.g., central ministries, municipalities). This will facilitate a more effective reaction, response, and recovery in protracted crisis. These precrisis partnerships would also ensure that there is improved sharing of water resources data, network data, and financial data for WSS service providers.
3. **In protracted crisis, it should be a standard requirement for humanitarian and development actors to coordinate and align their interventions to support resilience building of WSS service providers.** Humanitarian actors, in addition to their core emergency response roles and while adhering to humanitarian principles,[1] should be encouraged to further build their capabilities to support the business continuity of WSS service providers. Even with limited appetite for risk among development

actors, opportunities exist for humanitarian and development actors to strengthen their joint support to WSS service providers in protracted crises. Humanitarian actors tend to have better access to FCV settings, with secure bases and offices, and may have better knowledge of local context. This is particularly the case in armed conflict and in situations of mass displacement, where humanitarian actors can bring a deep understanding of—and, in some cases, the ability to communicate with—the parties to the conflict. Humanitarian actors often have well-established links with WSS service providers, understand the service delivery constraints, and know where the poorest and most vulnerable communities live, whether internally displaced people, refugees, or host communities. This is valuable knowledge that development actors can build on while contributing specialized expertise, new perspectives on reform opportunities, and flexible, multiyear funding.

4. **Both precrisis and during protracted crisis, humanitarian and development actors should work in a complementary and coordinated manner with WSS service providers to unmask underlying vulnerabilities.** A necessary prerequisite for building resilience is publicly available data on the dependence of WSS service providers on: public subsidy and subsidized grid electricity; on levels of outstanding service provider debt; on the efficiency of service provider billing and collection processes; on the degree to which revenues cover operation and maintenance needs; and on whether revenues are being used to cover non-water sector expenditure such as road repairs or refuse collection. The evidence set out in this report illustrates how financial transparency has been successfully used to strengthen service provider and external responses during crisis to sustain service delivery.

Strengthening humanitarian-development partnerships to support WSS service providers in these ways would address key aspects of precrisis resilience building and also of resilience (re)building in protracted crisis. These actions could become a set of global safeguards to better protect water supply and sanitation services from crises. The modest costs associated with these actions would be an insurance policy against the far greater costs of inaction—particularly as when water supply and sanitation service providers fail, loss of life inevitably follows. None of the above actions are meant to absolve service providers or the governments that oversee them from taking full responsibility for addressing the pernicious problems prior to or during crises. Rather the proposed collaborative action is aimed at reducing the risk of service deterioration or collapse during protracted crisis.

Note

1. https://www.unocha.org/sites/dms/Documents/OOM-humanitarianprinciples_eng_June12.pdf.

Abbreviations

CMWU	Coastal Municipalities Water Utility
FCV	fragility, conflict, and violence
GDP	gross domestic product
ICRC	International Committee of the Red Cross
LC	local corporation
NGO	non governmental organization
NRW	nonrevenue water
O&M	operation and maintenance
SARC	Syrian Arab Red Crescent
UNICEF	United Nations Children's Fund
WASH	water supply, sanitation, and hygiene
WHO	World Health Organization
WSS	water supply and sanitation
WWTP	wastewater treatment plant

Maintenance of water pipeline (700 mm) in Deir Ezzor city in 2014. This water pipeline from Al Basel pumping station feeds many neighborhoods in the city (approximately 30,000 beneficiaries). The pipeline was severely damaged due to the hostilities in the area. These emergency repair works were carried out on the frontline after a ceasefire was agreed. © M. Al Ali/SARC.

Chapter 1
Introduction

Protracted crises in urban contexts present a growing challenge for governments and international organizations—both humanitarian and development actors. This is particularly the case in the Middle East and North Africa region owing to the upsurge of conflict over the past decade.[1] In many countries, political unrest has dissolved into protracted crisis, causing the countries to become characterized by fragility, conflict, and violence (FCV).[2] In others, the spillover impacts of a neighboring crisis have led to a rapid influx of refugees—particularly into urban areas. These crises become protracted when "a significant portion of a population is facing a heightened risk of death, disease, and breakdown of their livelihoods" over an extended period—often more than five years (FAO 2016).

Across urban areas of the Middle East and North Africa region, unreliable water supply and sanitation (WSS) services are often a source of frustration among citizens and part of a complex backdrop of conditions that can fuel unrest. There are complex, two-way linkages between water and violence. Water scarcity, drought in particular, can exacerbate tensions that may ultimately lead to conflict (Pacific Institute 2018). More often, however, WSS services, or the lack thereof, are a risk multiplier—part of a complex backdrop of conditions that can fuel unrest (Sadoff, Borgomeo, and de Waal 2017).

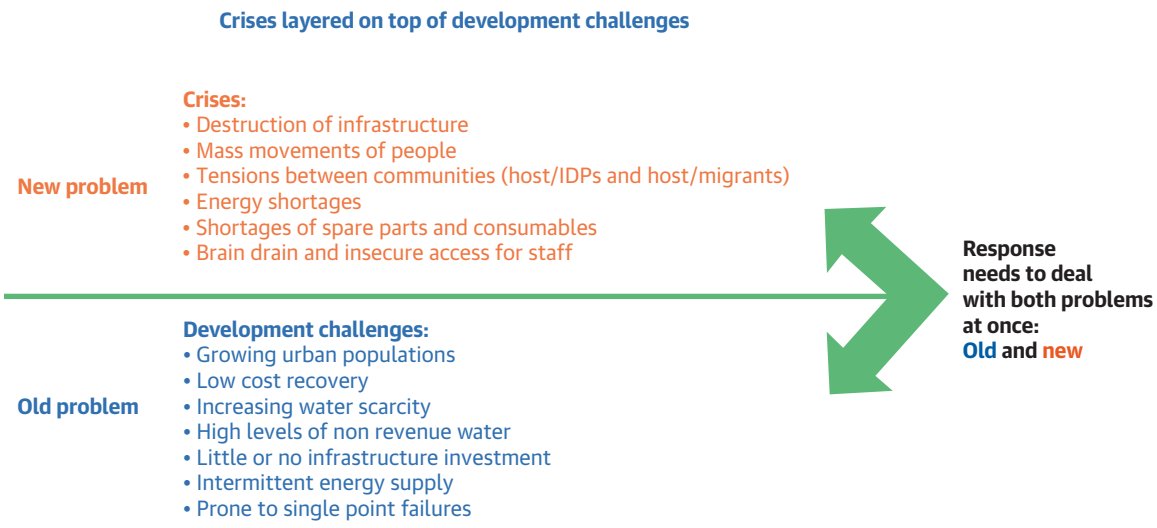
More evident, however, is that the provision of WSS services deteriorates as a result of the uptick in fragility, conflict, and violence. The deterioration of WSS services can occur through direct impacts (e.g., destruction of infrastructure) or indirect impacts (e.g., steady erosion of the ability to operate and maintain services) on the WSS service provider and on the infrastructure that it operates (ICRC 2015). Particularly in cities, where communities depend on a complex, interconnected set of services, attacks on water, sanitation, and power systems can be instantly debilitating. As a crisis wears on, problems are compounded, and service providers face difficulties in gaining safe access to infrastructure systems as well as shortages of personnel and materials needed for the operation and maintenance (O&M) of the systems. To make matters worse, sanctions, embargoes, and other forms of restrictions can be a significant impediment to the importation of materials that could be considered "dual-use items," yet are essential for the safe delivery of WSS services.[3]

In countries experiencing protracted conflicts, children under 5 years of age are more than 20 times more likely to die from diarrheal disease linked to unsafe water and sanitation than violence in conflict.[4] In times of crisis, children face many dangers: displacement, separation from family, hunger, and exposure to exploitation and violence. Yet the cumulative impact of both direct and indirect impacts on WSS services ends up being a greater threat to the lives of children and young people—and the civilian population as a whole—than violence in conflict.

This impact on children is just one of many humanitarian consequences of insufficient access to WSS services and it highlights the need to identify approaches to stem the rate of decline in service provision. Humanitarian consequences resulting from the rapid decline or collapse of service delivery include disease outbreaks, forced displacement, and loss of livelihoods. Building greater resilience into WSS services to prevent their collapse is a priority, both to mitigate humanitarian consequences and to limit the substantial costs associated with having to subsequently respond to the associated health crises, forced displacement, and loss of livelihoods.[5] New types of partnerships between humanitarian and development actors are needed to identify approaches and initiatives that build greater resilience into WSS services both prior to and during protracted crisis.

The increasingly complex nature and scale of protracted crises in the Middle East and North Africa region is driving the formation of new types of partnerships between and among the World Bank, United Nations agencies, bilateral donors, nongovernmental organizations (NGOs), and WSS service providers. A shared aim of these new partnerships is to bridge the humanitarian-development divide, since a significant number of crises have become protracted. In protracted crisis, responding to ensure WSS service continuity in urban areas involves facing the problems of the "new" humanitarian crisis layered on top of "old" development challenges (figure 1.1). This layering of humanitarian crisis on top of development challenges transcends traditional notions of a phased "handover" from humanitarian to development actors. Saving lives has to be done while stabilizing WSS service delivery—albeit under some of the most challenging circumstances anywhere in the world. Only by addressing both the current humanitarian crisis and pre-existing development challenges can resilience to future hazards be built. This needs to be done even during protracted crises to prepare for the next acute crisis—as shown by the Republic of Yemen's cholera outbreak (2016 to date) and as became evident when countries in protracted crisis were faced, in early 2020, with the acute COVID-19 pandemic.

FIGURE 1.1. Humanitarian-Development Partnerships Need to Address Problems Old and New



In the last decade, new humanitarian-development partnerships have varied widely, from informal short-term cooperation on damage assessments to large-scale operational engagements. Cooperation between humanitarian and development actors on damage assessments has become routine across FCV-affected parts of the Middle East and North Africa region. Growing in importance too are large-scale operational engagements such as the $683 million Yemen Emergency Health and Nutrition Project—of which $137 million is earmarked for water supply, sanitation, and hygiene (WASH) purposes—financed by the International Development Association and implemented by the United Nations Children's Fund (UNICEF) and World Health Organization (WHO).[6]

A consensus on a new humanitarian-development approach to service delivery—including for WSS services—is needed to underpin these new partnerships. This is particularly relevant to the approach to urban crises in the Middle East and North Africa region. Actors cannot operate within separate silos: Humanitarian and development activities often overlap in space and in time, such that they directly and immediately influence each other. Indeed, short-term humanitarian measures can directly undermine longer-term development measures, and development measures (or the lack thereof) can deepen humanitarian needs in times of crisis. For example, the focus on expanding WSS infrastructure in Middle East and North African countries without ensuring sufficient recurrent cost financing has left systems vulnerable to rapid decline during a downturn.[7] Equally, while trucking water to people in need during a crisis is a way of saving lives, it can also undermine the efforts of a struggling water supply service provider to restore basic services. What is needed are development-leaning approaches that build the resilience of services to shocks, coupled with emergency-oriented humanitarian approaches that, in conjunction with efforts by service providers, support people's immediate needs.

The protracted nature of crises in FCV-affected contexts transcends the more conventional precrisis, during crisis, and postcrisis cycle of, for example, natural disasters, epidemics, or time-bound military operations. Conventional risk management support to WSS service providers in these acute types of crisis would typically involve emergency preparedness planning: pre-positioning of equipment and provision of spare parts and consumables; establishment of coordination mechanism(s) and procedures; identification of alternative water sources and initiation or setting up of contracts for tanker truck programs; and measures to enable the public notification of emergencies, when warranted by a particular incident. But responding to protracted crisis requires more than emergency preparedness planning alone—it is simply impossible to stockpile supplies for a generation-long protracted crisis.[8] Rather it requires more fundamental resilience-building measures that anticipate the full breadth and depth of the pernicious problems that emerge during protracted crisis—and which are the focus of this report.

The indirect impacts of a protracted crisis are less visible but often more damaging than the direct impacts of an earthquake or operations involving the use of explosive weapons. This is powerfully captured in the following quote from a humanitarian actor:

> Often direct impact is the most visible and well-understood, especially … in the digital age of media, where pictures of extensive direct destruction of infrastructure can so easily be transmitted to the world at large. However, people are also affected by armed conflict in urban areas

with effects on service provision that go far beyond the visible signs of destruction (i.e., indirect impact). Indirect and cumulative impact if left unaddressed can leave whole systems in disarray. Field experience suggests that the cumulative impact is the most destructive and the most difficult to recover from.[9]

There is relatively little research or guidance in the literature on fragile contexts that specifically addresses the delivery of WSS services in protracted urban crises. In recognition of the scale, duration, and complexity of the challenges facing WSS service providers in FCV-affected contexts, the World Bank convened a workshop at the Center for Mediterranean Integration, Marseille, France, in May 2017. The workshop involved WSS service providers and humanitarian and development actors from, or working in, Djibouti, Iraq, Jordan, Lebanon, Morocco, Palestine, and the Syrian Arab Republic, including Agence Française de Développement, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the International Committee of the Red Cross (ICRC), UNICEF, and Gruppo di Volontariato Civile. The objective of the workshop was to identify the main challenges faced by WSS service providers that lead to service decline, or even collapse, in protracted crisis, and ways to mitigate these challenges. The knowledge generated in the workshop was supplemented with additional research, interviews, analysis, and case studies, including on Libya, Syria, and Yemen.

While the core material for this report comes from Middle East and North African contexts, the lessons are applicable across a much broader range of urban contexts. This report, and its underpinning research, was a joint effort by the World Bank, UNICEF, and the ICRC, with support from the Arab Countries Water Utilities Association. The research consisted of data collection and interviews with WSS service providers in seven FCV-affected contexts across the Middle East and North Africa region: Iraq, Jordan, Lebanon, Libya, Palestine, Syria, and Yemen. The WSS service providers took various forms: from utilities to municipal departments and even deconcentrated branches of a central ministry. The intended audience of this report encompasses WSS service providers and their parent ministries as well as humanitarian and development actors.

This report examines the origins and trajectories of five pernicious problems that are typically experienced by WSS service providers operating in protracted crisis. The five problems are: (1) inadequately governed water resources management; (2) aggressive competition from alternative providers (e.g., tanker trucks), undermining network services run by WSS service providers; (3) paralysis of high-tech wastewater treatment plants; (4) escalating energy costs of off-grid generation; and (5) the cashflow crunch as service provider costs jump and revenues fall. The following five chapters discuss each problem in turn, exploring its origins as a precrisis vulnerability that is then transformed into a pernicious problem in a protracted crisis setting. Together, these pernicious problems have incremental and compounding effects that, in their entirety, lead to major cumulative impacts on WSS service delivery, with negative consequences for the health and well-being of the civilian population.

These precrisis vulnerabilities have their origins in the fast growth of urban WSS service providers across the Middle East and North Africa region. Access to WSS services, especially in urban areas, improved significantly over the Millennium Development Goal period: Over 90 million people gained access to piped

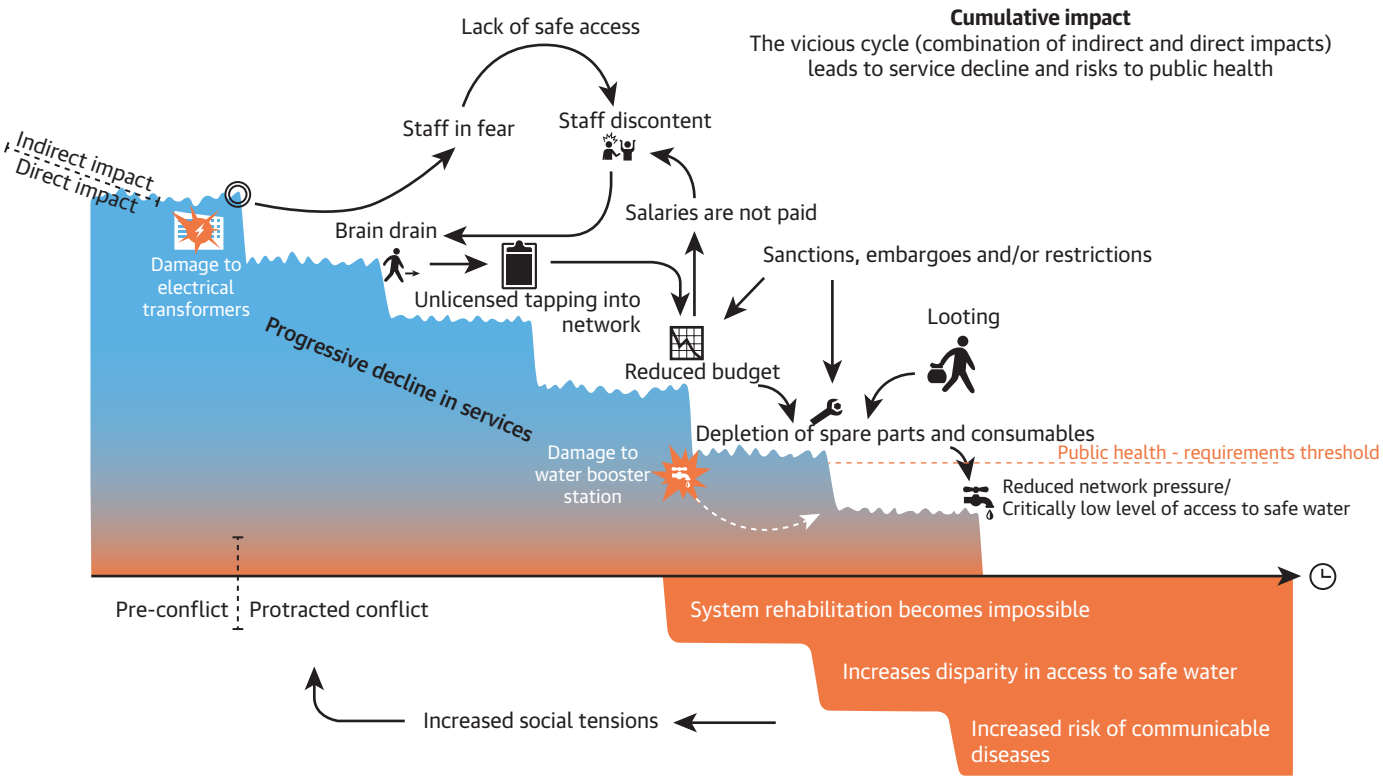
water and nearly 60 million gained access to sewer systems from 2000 to 2010 alone. But such rapid urbanization and WSS service expansion[10]—reaching near-universal access in urban areas by 2010—failed to develop services resilient to potential hazards in the Middle East and North Africa region. In many cases, service expansion was achieved in an economic context distorted by subsidies and lacking service provider accountability, leading to grossly inefficient WSS service providers that were, in effect, set up for failure.

When countries subsequently experienced FCV-related crisis, precrisis vulnerabilities were greatly exposed, propelling service provision into rapid decline. The speed of deterioration depended on both the extent of these vulnerabilities and the magnitude of direct and indirect impacts. With a few important exceptions, the low- and middle-income Middle East and North African contexts studied in this report entered into crisis from an already vulnerable position of aging infrastructure, reduced operating capacity, and inadequate cost recovery. Once in crisis, the roles of sector actors changed: As the capacity of public WSS service providers to maintain minimum service levels decreased, United Nations agencies, international organizations, local NGOs, and alternative providers stepped in to fill gaps and support WSS service providers to sustain services to avoid total system collapse. In many contexts still facing protracted crisis, the policies underpinning the precrisis vulnerabilities persist, undermining recovery and attempts to build resilience.

While each of the five pernicious problems may well also be experienced by WSS service providers in more stable settings, it is the magnitude of each and their compound effect that so dramatically hits unprepared service providers caught up in FCV-affected situations. During protracted crisis, the cumulative effects of all five pernicious problems emerge together, rendering unprepared service providers incapable of stemming the rate of decline—posing an existential threat to the public provision of networked WSS services. This drives a negative feedback loop in which rapid service decline poses a significant risk to public health and in which disparities in access to water increase social tensions that may even protract conflict itself (figure 1.2). There is a need to reduce the rate of the progressive decline in services to limit the vicious cycle illustrated below.

WSS service provider managers and practitioners from the seven study contexts identified important lessons across the five problem areas. chapters 2 to 6 each begin with a summary of findings in relation to the problem in focus. An analysis then follows of the origins of the precrisis vulnerability and how it caused, or contributed to, rapid decline in service delivery during crisis—and how humanitarian and development actors have helped WSS service providers tackle the problem. Each of the five chapters ends with recommendations to enable service providers and their humanitarian and development partners to stem the rate of decline and restore services—even if still in a situation of protracted crisis.[11] chapters 7 then provides cross-cutting considerations, drawn from the interactions among service providers and humanitarian and development actors around the five problem areas. chapters 8 concludes the report by proposing proactive ways for humanitarian and development actors to help WSS service providers build the resilience of services—both precrisis and during protracted crisis.

FIGURE 1.2. The Cumulative Impact of Protracted Conflict on Provision of WSS Services



Source: ICRC 2015.

Notes

1. The Middle East and North Africa region, as classified in the World Bank structure, includes Algeria, Bahrain, Djibouti, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, United Arab Emirates, and Yemen (Republic of). This study examined the crisis-affected contexts of Iraq, Jordan, Lebanon, Libya, Palestine, Syria, and Yemen.

2. **Fragility:** The revised classification of fragility and conflict situations for World Bank Group engagement "is based on methodologies that distinguish countries in the following categories: Countries with high levels of institutional and social fragility, identified based on public indicators that measure the quality of policy and institutions as well as specific manifestations of fragility; Countries affected by violent conflict, identified based on a threshold number of conflict-related deaths relative to the population. This category distinguishes two further subcategories based on the intensity of violence: (i) countries in high-intensity conflict and (ii) countries in medium-intensity conflict" (World Bank 2020). See also OECD (2015).

   Armed conflict: "1. **International armed conflicts** exist whenever there is *resort to armed force between two or more States*. 2. Non-*international armed conflicts* are *protracted armed confrontations* occurring between governmental armed forces and the forces of one or more armed groups, or between such groups arising on the territory of a State [party to the Geneva Conventions]. The armed confrontation must reach a *minimum level of intensity* and the parties involved in the conflict must show *a minimum of organisation*" (ICRC 2008).

   Violence: "The international use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation" (Krug et al. 2002).

3. *Dual-use items* are goods, software, and technology that can be used for both civilian and military applications.

4. "To illustrate the dangers that stem from a lack of safe water and sanitation, mortality estimates in 16 countries experiencing protracted conflict were compared: Afghanistan, Burkina Faso, Cameroon, the Central African Republic, Chad, the Democratic Republic of the Congo, Ethiopia, Iraq, Libya, Mali, Myanmar, Somalia, South Sudan, Sudan, the Syrian Arab Republic and Yemen. World Health Organization mortality estimates were used for 'collective violence' and 'diarrhoeal disease'" (UNICEF 2019).

5. The cost of inaction can be substantial. For example, according to the Global Task Force on Cholera Control (GTFCC), the "economic burden of cholera … costs an estimated $2 billion per year globally in health care costs and lost productivity." Yet a GTFCC case study shows that tackling cholera proactively in the Democratic Republic of the Congo over the next 10 years could result in "up to 50 percent cost savings compared with the ongoing average yearly cost of continuously responding to emerging cholera outbreaks." (Note that this estimate is for cholera only and excludes other diseases related to a lack of access to safe water and adequate sanitary conditions.) See: GTFCC (2017).

6. A further $400 million was agreed by the World Bank Board of Executive Directors on May 14, 2019.

7. The North Gaza Emergency Sewage Treatment plant is a high-tech facility that was financed by development partners without a clear plan for the financing of its O&M.

8. While reference is made throughout the report to more conventional risk management approaches—recognizing that service providers in protracted crisis settings also face acute crises—delving into the interplay between these different forms of crisis is beyond the scope of this report.

9. Personal communication/internal ICRC report.

10. Often in the absence of comprehensive master plans.

11. Ideally this would have examined how vulnerabilities influenced the trajectory of decline during crisis.

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Assessment visit to the damaged Figeh Spring catchment; the main drinking water supply source for the city of Damascus and some surroundings, from which approximately 5,000,000 Syrian residents and internally displaced people benefited. © L. Khalil/ICRC.

Chapter 2
Water Resources: Building a Shared Body of Knowledge in Good Times and Bad

Summary of Findings

Inadequately governed water resources management is the precrisis vulnerability most predictably exacerbated during protracted crisis—in some cases with irreversible consequences.

A vacuum of water and environmental governance during protracted crisis affects both water quantity and quality for WSS service providers—but is more often and immediately experienced as a rapid deterioration of water quality. With the onset of crisis, groundwater is particularly under threat: Overexploitation caused by a lack of regulatory enforcement and/or a rapid increase in the drilling of wells as part of the emergency response can lead to a rapid drop in water levels, a rise in salt concentrations, and in coastal areas, saline intrusion. Water can be rendered unsuitable for human consumption by such deterioration, as has been experienced in Gaza over the past decade.

In the absence of proper regulation, monitoring, or data, service providers are faced with uncertainties about total groundwater storage, making it hard to predict when aquifers may become compromised (Richey, et al. 2015). Once in protracted crisis, water governance becomes more politically charged and negotiating increases in water resource allocations far more difficult. For example, increasing the summer flows through al-Badaa canal, needed to supply Basra, Iraq, requires water management discussions about Mosul dam in Iraq, Ilisu dam in Turkey, and flows on the Karun river from the Islamic Republic of Iran.

Opportunities to stem the rate of decline in water resource availability and quality in protracted crisis have included working with service providers to rehabilitate existing wells rather than drilling new emergency wells in the absence of adequate data; drilling into deeper aquifers (Aleppo, Syria); improving management of bulk water (Palestine); blending more saline water with water from softer sources (Palestine); reducing pollution from wastewater treatment (chapter 4); increasing reuse of treated wastewater (Jordan); and desalination as a last resort. Precrisis measures to stem the rate of decline in the event of a crisis include all actors sharing and publishing data on water resources.

2.1. Precrisis Vulnerability: Ignored Signs of Water Scarcity and Quality Deterioration

Decades of overexploitation and suboptimal water resources management in the Middle East and North Africa region have left it suffering from water insecurity both in terms of quantity and quality. The problems are evident from service provider to transboundary level, but the impacts are disproportionately felt among lower-income countries, which cannot afford energy-intensive, high-cost technologies such as desalination.

Water scarcity is a significant and growing threat to WSS service provider resilience. The Middle East and North Africa region is the most water-scarce in the world, presenting a constant operational challenge to its service providers, which is exacerbated during protracted crisis. While water availability is highly variable within the region, the average per capita availability is a little over 1,000 cubic meters per year compared with a global average of more than 7,000 cubic meters per year (Zyadin 2013). Rapid population and economic growth, rapid urbanization, and changing lifestyles are additional stressors, as is climate change, evidenced in reductions in rainfall, increasing temperatures (IPCC 2014), higher evapotranspiration rates, and increasing agricultural irrigation requirements (Verner 2012). Service providers have limited access to the data and know-how that would enable them to plan and invest for growing water scarcity.

Reliance on shared transboundary waters adds a political dimension—and a layer of uncertainty and risk—to water resources management and planning. Every Middle East and North African country shares at least one aquifer with a neighbor, and over 60 percent of the region's transboundary surface waters originate from outside the region. For instance, the headwaters of the Tigris and Euphrates rivers begin in Turkey and flow into Iraq, and control of those rivers is dependent on the release of waters from upstream dams in both Turkey and Syria, and also the Islamic Republic of Iran in relation to the Tigris. Increased water diversion from transboundary rivers is a highly sensitive and political issue in the region (World Bank 2018a).

Water governance is underdeveloped, particularly in terms of allocation mechanisms for competing demands, and regulation of abstraction. WSS service providers compete for water with the inefficient use of water in the agricultural sector, which accounts for nearly 80 percent of water use on average in the Middle East and North Africa region—or 90 percent in the case of Yemen. Middle East and North African countries have some of the lowest irrigation water fees in the world, which encourages farmers to grow water-intensive crops and discourages adoption of water-saving irrigation technologies (Berglöf and Devarajan 2015).

Groundwater is under particular threat owing to overexploitation and saltwater intrusion. A significant proportion of the Middle East and North Africa region's population is located in areas with high, or very high, levels of groundwater stress. Without a system—or the enforcement of a system—of groundwater abstraction rights consistent with local hydrogeological conditions, countries such as Jordan, Libya, and Yemen are seeing groundwater withdrawals for irrigated agriculture exceed total renewable levels. As a result, water levels are dropping and salinity is increasing. For instance, in the Sana'a basin, Yemen,

overexploitation of groundwater has caused water levels to fall by about 6 meters per year, while excessive abstraction in Jordan's Amman-Azraq basin increased groundwater salinity from about 400 to 1,800 milligrams per liter from 1994 to 2004. Such deterioration can render water unsuitable for human consumption, as service providers have found in Gaza with saline intrusion.

Water quality in the region is also degraded by pollution, especially from untreated wastewater and agricultural run-off. More than half of the wastewater collected in the Middle East and North Africa region is returned to the environment untreated, resulting in health hazards and environmental pollution. Weak environmental legislation also leads to pollution from excessive use of fertilizers and pesticides, further reducing groundwater and surface water quality. Impacts range from risks to public health from waterborne diseases such as cholera to loss of ecosystem services and fisheries because of pollution. Treated wastewater can be reused in agriculture and industry, so this mismanagement also represents a missed opportunity.

Without proper regulation, monitoring, or data, service providers find it hard to predict when aquifers may become compromised. Water supply service providers often lack the ability or incentive to monitor water quality; to manage abstractions; to obtain better quality without further deterioration; to reduce energy demands; or to install treatment methods that address degraded water quality (Richey et al. 2015).

Countries that can afford to rely on expensive technologies do so, without addressing root causes of water scarcity. Water desalination has been practiced for more than 50 years in the Middle East and North Africa region. It is the primary response to water scarcity and quality deterioration in oil-producing countries. Neither desalination nor wastewater reuse can be a large-scale default option for lower-income Middle East and North African countries. Stress on water resources has, however, become so severe in some FCV-affected contexts that small-scale investment in desalination is beginning to be deployed even for humanitarian response (e.g., Gaza and Yemen) with larger investments by development actors planned (e.g., Gaza Central Desalination Plant). Cost recovery in these contexts is already proving challenging, with external actors having to fund O&M.

2.2. Managing Services During Crisis: Regaining Control of Ungoverned Water Resource Depletion

During crisis, the rate of water resources deterioration in the study contexts increased because of: (1) the loss of the limited water resources management capacity; (2) the diversion of funding from resource monitoring to other immediate O&M needs; and (3) the need to supply water for humanitarian needs, especially where cities had to cope with either being disconnected from remote sources, or with a rapid and large influx of internally displaced people (sometimes abbreviated as IDPs) or refugees into host communities.

Governance and monitoring of water resources became more challenging during crisis. With the onset of crisis, tools available precrisis for managing water resources were rapidly lost owing to conflict,

BOX 2.1. Case Study: The Predictable Deterioration of Gaza's Aquifer

Lack of an ongoing political dialogue or agreed and effective mechanisms for cooperation, together with ongoing restrictions on movement and access, have limited Palestinian ability to develop new water resources, even as the population grows and the quality of existing water resources declines.[a]

It has been known since the 1980s that saltwater intrusion affects the groundwater beneath Gaza.[b] Levels of chloride and nitrate in the aquifer have also risen because wastewater treatment is of low quality, due to high costs and the restrictions on the entry of materials (i.e., lack of energy, fuel, chemicals). Yet both the number of wells drilled into the aquifer and abstraction levels have increased over the same period, with over-abstraction estimated in 2017 at 180 million cubic meters per year.

Water supplied through municipal networks in Gaza is undrinkable and almost everyone relies on small- to medium-scale alternative providers for potable water. While 95 percent of people in Gaza are connected to the piped network, just 1 percent have access to improved drinking water—compared with universal access 20 years ago. Though many options have been explored (e.g., aquifer recharge, blending groundwater with freshwater from Israel), deterioration of groundwater quality has predictably continued unchecked.[c]

a. Israel, Ministry of Foreign Affairs, Prime Minister's Office. 2005. "Agreed Documents on Movement and Access from and to Gaza: Agreement on Movement and Access; Agreed Principles for Rafah Crossing." http://peacemaker.un.org/sites/peacemaker.un.org/files/IsraelOPt_AgreedDocumentsOnMovementAccessGaza2005.pdf.
b. Swain, Ashok. 2003. *Managing Water Conflict: Asia, Africa and the Middle East*. London: Routledge; Sowers, Jeannie, Avner Vengosh, and Erika Weinthal. 2011. "Climate Change, Water Resources, and the Politics of Adaptation in the Middle East and North Africa." *Climatic Change* 104 (3-4): 599-627.
c. World Bank. 2018b. *Toward Water Security for Palestinians: West Bank and Gaza Water Supply, Sanitation and Hygiene Poverty Diagnostic*. WASH Poverty Diagnostic. Washington DC: World Bank. http://documents.worldbank.org/curated/en/684341535731512591/West-Bank-and-Gaza-WASH-poverty-diagnostic-toward-water-security-for-Palestinians.

weakened institutions, limited mobility, lack of funds, looting of and damage to water resource monitoring networks, and loss of staff. Once in protracted crisis, addressing deterioration of water resources appeared to be overwhelmingly difficult and beyond the scope of any actor—even when deterioration had been predicted or acknowledged for decades (box 2.1).

Emergency responses to meet the essential water needs of affected populations overlooked standard development requirements for environmental and hydrogeological studies. In the absence of easily available data on water resource characteristics, emergency responses compounded precrisis water resources deterioration and aggravated the recovery challenges. This was particularly the case where hydrogeological conditions were conducive to the drilling of boreholes and where multiple actors—households, WSS service providers, humanitarian actors, and alternative providers—intervened without coordination or control mechanisms in place. Even where these emergency responses were made in coordination

with, or requested by, WSS service providers and relevant line ministries, they were made without adhering to policies and regulations.

When WSS service providers could not reach well fields or water sources during conflict, new wells were sometimes drilled in protected or controlled watershed areas. This was done both with and without the help of humanitarian actors, with unknown consequences to aquifers in the longer term. Movement of internally displaced people and refugees usually exacerbated pressures on water resources, leading to social tensions and increased fragility within communities of displaced people, between displaced people and host communities, and collectively toward local and central authorities responsible for services. Concerns raised by nearby groups had the potential to weaken social cohesion or even deepen conflict.

Keeping water sources linked to water supply networks was especially difficult under conditions of armed conflict and so put pressure on both the quality and quantity of water in more local aquifers. Cutting water pipelines was a repeated tactic of war in some contexts (Pacific Institute 2018). Particularly vulnerable cities were those reliant on a single upstream source for their water supply, where the capture or

BOX 2.2. Case Study: Overcoming the Shutdown of Aleppo's Main Water Supply

Aleppo in Syria had close to universal water supply coverage prior to the conflict, with nearly all residents able to access water of an adequate quantity and quality. Then, as now, Aleppo's main water supply was the al-Khafsa water treatment facility, nearly 90 kilometers away. Even before the hostilities in the city, the breakdown of the al-Khafsa facility was a potential single point of failure.

In August 2015, water cut-offs became frequent due to armed conflict in eastern Aleppo escalated substantially, with water to western Aleppo cut off by a shutdown of the pumping station. Though western Aleppo had over 100 groundwater wells as part of the city's water supply contingency plan, many had dried up owing to over-pumping, depleting the first groundwater aquifer and then the second, deeper one.

In response, a joint decision was made by government, service provider, and humanitarian organizations to tap into a third even deeper aquifer. This entailed drilling 94 further groundwater wells at a depth in excess of 300 meters, deeper than the old wells at around 200 meters.

During this time, the ICRC provided support to the Aleppo Water and Sanitation Authority, including by developing an online platform to allow Aleppo's residents to locate their closest well,[a] and by providing goods in kind (spare parts, equipment, and consumables) to help restore service delivery from the al-Khafsa facility. As piped water was restored, it reduced the dependence on water trucking and the use of local groundwater wells.

a. ICRC (International Committee of the Red Cross). 2015. "Syria: ICRC Works to Avoid Massive Water Crisis in Aleppo." ICRC web article, November 10. https://www.icrc.org/en/document/syria-icrc-water-crisis-aleppo.

destruction of a single pipeline from the distant water source could disrupt supply to the entire coverage area. This put extreme pressure on whatever meager local alternative water resources were available. For example, during the hostilities in Aleppo, Syria, the cutting of the surface water pipeline to the city forced over-abstraction on two layers of aquifer and the drilling down into a third, very deep layer to cope (box 2.2).

2.3. Recommendations to Stem the Rate of Decline

All actors should publish the water resources data they generate to enable better decision-making in water resources management in protracted crisis. Data on water resources across all of the contexts in protracted crisis (other than Jordan) were inadequate. All actors—governments, WSS service providers, humanitarian actors, development actors, and the private sector—should take responsibility for building a body of scientific knowledge on water resources use by WSS service providers. While WSS service providers and their governments should take the lead, humanitarian and development actors have a duty to ensure this happens where they are financing interventions. Many of the data collected in the pre-digital age by both public sector actors (e.g., relating to well locations and pump tests) and private sector actors (e.g., data from test drilling for oil) have simply been lost. Yet, even in the digital era, many data end up being inaccessible, due to technological obsolescence (e.g., the use of old media formats or old computers that are incompatible with newer, more widely used versions). Common data platforms for water resources management could support the sharing and publication of water resources data generated by both domestic and international actors. [1]

Development actors have an important role to play in helping WSS service providers prepare for crisis during periods of relative stability. Too often, water resource mapping initiatives funded by development actors are project based, with equipment falling into disuse or lost when the project ends. Ministries and service providers with the capacity (human resources and data) to actively manage water resources precrisis will be better placed to manage water resources during crisis. For example, the 60-year-long cooperation between Jordan and Germany's Federal Institute for Geosciences and Natural Resources is one initiative that has generated a wealth of scientific publications and compiled extremely detailed data, as published in the *Groundwater Resource Assessment of Jordan (2017)* (Jordan, Ministry of Water and Irrigation, and BGR 2019).

Humanitarian actors should both draw on and add to the best available water resources data to inform decision-making on water resources exploitation. Decisions on whether to rehabilitate existing sources or develop new sources have long-term consequences even when made as part of an emergency response. For example, temporary emergency wells often end up becoming permanent sources—possibly not controlled by the WSS service providers and potentially causing harm to the aquifer. Information gathered during emergency operations, about the locations of wells drilled, water quality, and pump tests, for instance, should be added to both the local public record and the scientific record.

Note

1. For example, the World Bank Water Data website (www.wbwaterdata.org) has been developed as a public good to empower governments, development organizations, private sector, non-governmental organizations, academia, civil society, and individuals with knowledge about existing water data that can be harnessed to generate policy-relevant insights.

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Yemeni people fill their plastic bottles with water in Sanaa, Yemen on August 21, 2015. People meet the daily water requirements from water tanks after a water cut off occurred in Sanaa due to clashes. © Mohammed Hamoud/Anadolu Agency/Getty Images.

Chapter 3
Water Supply: Supporting Business Continuity to Stem the Tide of Unregulated Alternative Provision

Summary of Findings

Non-network alternative provision of water—signs of which are easily identifiable precrisis—rapidly and aggressively expands during crisis.

Alternative providers (e.g., private tanker trucks, water kiosks, pushcart vendors) moved from filling gaps in urban water supply service provision precrisis to aggressive competition with WSS service providers during crisis, including through unregulated water withdrawals, vandalism, or takeover of public sources, and illegal tapping of service provider networks. This undermined the financial viability of WSS service providers and greatly increased water costs for consumers and humanitarian actors.

Precrisis, private water markets ranged from the less visible in Syria to the glaringly obvious in Yemen. In both cases, expansion of alternative provision during the crisis period—and its corrosive effect on public service providers—was rapid and difficult to reverse. Additional precrisis problems that accelerated loss of market share to alternative providers during crisis were networks that were not zoned (Basra, Iraq; and Beirut, Lebanon); high levels of nonrevenue water (NRW); a lack of bulk water metering; and low or no customer metering.

Means used to manage private water market growth and help public service providers win back market share have included service providers retaining control of water sources and providing bulk tanker filling stations (Jordan); regulation of tanker water quality (Jordan); active involvement by humanitarian actors to return to public provision in phases (Aleppo, Syria); deployment of local engineering staff (Syria); and support for service providers to pay salaries to retain staff (Gaza and Yemen).

3.1. Precrisis Vulnerability: Infrastructure Expansion Without the Required Resilience

By 2010, basic water supply coverage in the Middle East and North Africa region extended to more than 90 percent of the population, with near-universal coverage and relatively advanced service levels in urban areas. This included many of the countries that went on to experience the onset of fragility, conflict, and violence with the start of the Arab Spring. But these high water supply coverage levels masked underlying sectoral weaknesses, which contributed to the rapid decline of services

during crisis. Far more attention had been paid to expanding WSS infrastructure than to ensuring that the performance and accountability of the heavily subsidized service providers was sustainable.

Cost recovery has been neither a policy of governments nor a realized priority for WSS service providers or their development partners. The Middle East and North Africa region's water tariffs are low relative to production costs and its effective water subsidies are the highest in the world (Kochhar et al., 2015). These subsidies (in the form of direct cash transfers and cheap electricity) enable water supply service providers to continue to deliver services with low levels of cost recovery and little opportunity to improve efficiency through inward investment. As a result, NRW levels remain high, intermittent supply is commonplace, and energy efficiency is low. The quality of both the service and the water delivered to consumers thus progressively falls: Intermittent supply damages networks, which in turn can lead to higher levels of fecal contamination, requiring households to both store and treat water; where treatment is not possible, households are at risk of contracting waterborne diseases and other infections.

Performance monitoring has been undervalued and regulatory frameworks marginalized. Neither governments nor service providers have fully embraced performance monitoring and regulation. Outside of the Gulf Cooperation Council countries, only two WSS service regulators have been set up in the Middle East and North Africa region (in Egypt and Palestine). Even where they do exist, regulatory frameworks have been marginalized and monitoring reports have either not been produced continuously (Egypt) or not been linked to an incentive framework to improve performance (Palestine).

Despite providing decades of support, development actors have paid insufficient attention to building the resilience of service providers. Development investments in large capital projects have focused on extending water supply coverage in urban areas but have done little by way of resilience building. Development actors have not involved in the design of investment programs those humanitarian actors that provide support to WSS service providers, missing the opportunity to benefit from their understanding of both planning for emergency response and delivering services in protracted crisis.[1] Capital projects have been implemented without addressing underlying NRW problems and have funded neither asset inventories, nor the building of geospatial and systems mapping capabilities, nor emergency preparedness planning at the service provider level.

Largely as a result of the above weaknesses, intermittent supply of water, and water rationing are major drivers of alternative provision across low- and middle-income cities in the Middle East and North Africa region. Alternative provision includes bottled water, tanker water, household wells, informal water kiosks and networks, and buying from neighbors. Alternative provision is always multiples more expensive than publicly provided network water supply, yet it coexists with service provider supply to fill a service gap.[2] This is particularly regressive as it is poorer households that tend to be least well connected to the lower-cost service provider networks. In Libya, even before 2011, only 65 percent of households were connected to a piped water supply managed by a local branch of the General Water and Sewerage Company; the rest relied on tanker water, private wells, and harvested rainwater. In Sana'a, Yemen, before the current conflict, over 60 percent of water supply was delivered by private tanker trucks

(World Bank 2017). Even in Syria, where coverage of piped water to households was over 90 percent before 1990, tanker water was becoming a growing form of alternative provision in some areas before the conflict.

3.2. Managing Services During Crisis: The Struggle to Prevent System Failure and Overcome Aggressive Competition

Among the contexts studied, direct impacts of crisis on public water supply services included damage to or destruction of capital assets, and death of or injury to staff. Indirect impacts included deferment of maintenance and rehabilitation activities, diminished revenue and cashflow, staffing losses, limited mobility, and the challenge of serving both displaced people and host communities. The cumulative impact that resulted from direct and indirect impacts led to system-level deterioration and a reduction in the ability to deliver WSS services. As service providers struggled to maintain supply, people resorted to alternative providers, including tanker trucks, water kiosks, and pushcart vendors. As households made this switch, they stopped paying service provider bills, accelerating the rate of decline in service provider supply and the rapid increase in alternative provision.

Only a few humanitarian actors were capable of working with WSS service providers to prevent the collapse of entire WSS systems. The aim of the few humanitarian actors that did have the capability to work with WSS service providers was to maintain services at a minimum operating capacity to safeguard public health—that is, to progressively work towards realizing the WHO requirement for water service level to promote health, which is 50 liters per capita per day. Humanitarian actors' support included contracting out emergency rehabilitation of WSS systems to construction firms (where and when possible) and providing spare parts (e.g., pumps, motors, fittings, transformers) and consumables (e.g., chemicals for water treatment, fuel).

Sanctions, embargoes, and other forms of restrictions were found to be a potential impediment to ensuring continuity in service delivery. At the onset of a crisis, local markets typically remained relatively robust with existing stocks still available to purchase, albeit at a higher price. In protracted crises, however, stocks became depleted and WSS service providers had to rely on humanitarian organizations to procure and deliver goods or purchase goods from the black market, often at exorbitant prices. Where sanctions were imposed, those items stipulated as dual-use were restricted and national banking institutions were prevented from transferring money to make payments for goods.

Ensuring access to consumables for water treatment plants was an absolute necessity that required a shift in thinking by WSS service providers and technical changes to treatment processes. During protracted crises, WSS service providers requiring continuous supplies of water treatment consumables (e.g., aluminum sulfate, sodium hypochlorite, silica sand) found them difficult to import, with regular routes blocked by the conflict dynamics. Humanitarian actors had to work with WSS service providers to identify the right products and methods to ensure service continuity. This involved adapting methods and equipment, providing training, and introducing new standard operating procedures. For example, where physical access or sanctions made procuring and delivering chlorine gas difficult if not impossible (e.g., Syria),

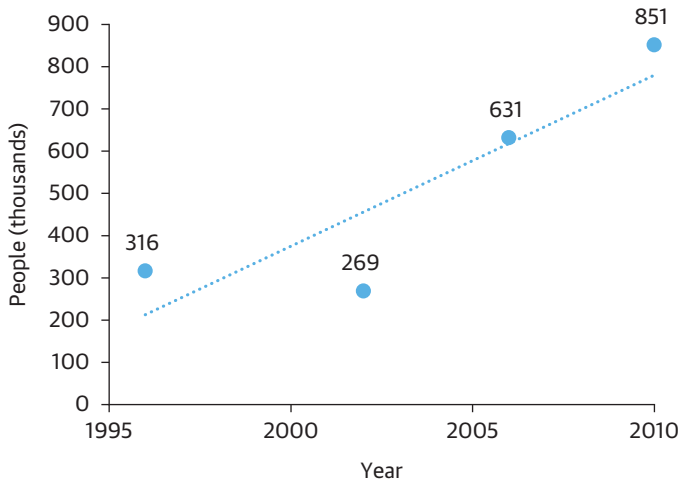
the alternative was to use either calcium hypochlorite or high test hypochlorite. Use of the latter was generally more acceptable and was a cheaper method for water treatment with a longer shelf life. Persuading WSS service providers to switch from using chlorine gas to high test hypochlorite was not always easy, however, as more equipment, additional time, and technical expertise are required to retrofit the system for its use.

Most WSS service providers had not considered how to manage alternative providers in a crisis. Service providers did not have emergency response plans, let alone plans to sustain services over the period of a protracted crisis—that is, plans that would build redundancy into operations, for example, through backup water sources, or zoned networks to manage rationing. Crucially, most service providers were also not effectively managing alternative water sources or alternative providers such as tanker trucks. For example, in Aleppo, Syria, the water supply contingency plan included 100 groundwater wells that were found to be largely inadequate when the city's supply was cut off (box 2.2). It was also people's first exposure to tanker trucks and the need for home storage of water. Lack of experience—among service providers and households—in managing alternative providers meant there was no way to differentiate between good quality and inadequate drinking water.

Alternative providers played an important part in emergency operations in the FCV-affected contexts studied, but mechanisms for working with them were not put in place precrisis. In Syria, for example, UNICEF engaged private tanker truck operators that deployed about 120 trucks across western Aleppo to provide, at the peak, about 16 million liters daily to some 750,000 people. The tanker truck operations continued for over a year at an average cost of roughly $1 million per month. Responding at scale in the absence of alternative providers would have been impossible. The point is not that alternative providers are an inherently bad thing—they played a critical role in filling the supply gap during crisis in the FCV-affected contexts. The problem was that, precrisis, governments, service providers, and development actors had largely ignored their existence and therefore their management.

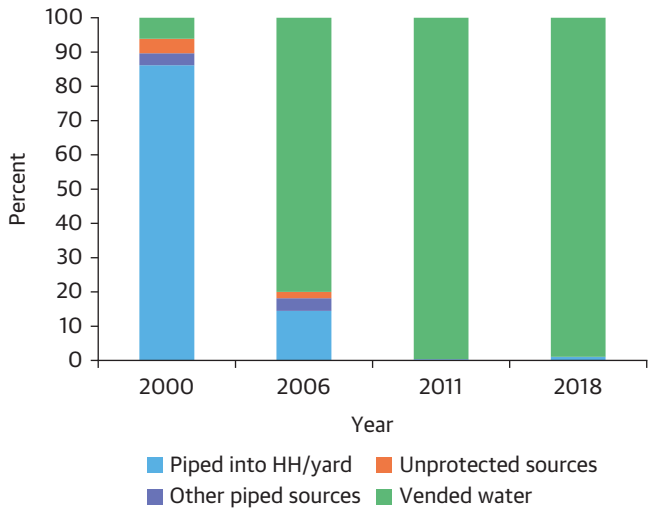
Left unmanaged in the precrisis period, alternative provision expanded rapidly during crisis as service providers further rationed water supply. Alternative providers were unmanaged and unregulated across all seven study contexts except Jordan. Precrisis—in Syria, for example—alternative provision gained momentum (figure 3.1). In protracted crisis, its expansion then becomes hard to stop as demand increases and alternative providers' profits grow. Iraq dramatically illustrates the speed and scale at which alternative provision can displace network provision in protracted crisis: In Basra, household use of piped water for drinking dropped from over 85 percent to less than 15 percent in just three years. By 2018—following a decade during which the service provider failed to regain market share—nearly 99 percent of drinking water was purchased from vendors (figure 3.2). This illustrates the difficulty of regaining market share from alternative providers. Even under more benign circumstances, the rise of alternative provision is very difficult to reverse. In Lebanon after the end of the civil war, 75 percent of household expenditure on water was spent on alternative provision (bottled and tanker water) and only 25 percent on service provider water (World Bank 2010).

FIGURE 3.1. The Rise of Tanker Trucks in the Syrian Arab Republic Precrisis



Source: WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.

FIGURE 3.2. The Collapse of Piped Services in Basra, Iraq, During Protracted Crisis



Source: Iraq Multiple Indicator Cluster Survey 2000, 2006, 2011, 2018.
Note: HH = household.

3.3. Recommendations to Stem the Rate of Decline

Governments and development actors need to put far greater emphasis on building the resilience of WSS service providers precrisis. A major driver of decline in water supply during protracted crisis has been the lack of attention paid by governments and development actors to building service provider resilience in the precrisis period. Anticipating and preparing for the onset of an armed conflict or a large influx of refugees would have been difficult. Yet large capital projects to expand service access have come at the expense of building in resilience and redundancy to address even the most likely hazards

(e.g., armed conflict, flood, drought, earthquake, energy shortage, epidemic, civil unrest). Many service providers across the Middle East and North Africa region, not just in the contexts studied, rely on a single source of water, on grid electricity, and on subsidies, and have no plan for what to do if any of these fails.

Development actors should put in place standby financing mechanisms to support WSS service providers to stem the rate of service decline in downturns during protracted crisis. Today, there are too few humanitarian actors that have developed a capacity to support WSS service providers in protracted crises. Yet, no matter how much humanitarian actors invest in developing these capabilities, there will still be a need to engage development actors to establish more durable solutions in protracted crisis settings. Standby financing mechanisms are needed to sustain the flow of spare parts and consumables to service providers, to keep personnel (e.g., operators and technicians) paid and equipped to carry out their duties, and to meet the capital costs of system repairs and rehabilitation. As security concerns often hinder the ability to fully rehabilitate WSS infrastructure, there is a pressing need to responsibly support preventive maintenance to address the indirect and cumulative impacts of a protracted crisis.

Humanitarian actors should be encouraged to further build their capacity to support the business continuity of WSS service providers. In protracted crisis settings, humanitarian actors should be encouraged to complement their emergency response mandates with preventive approaches that support the business continuity of WSS service providers. Such approaches may include initiating and overseeing infrastructure repairs and rehabilitation; provision of spare parts (e.g., pumps, pipes) and consumables (e.g., chemicals for water treatment, fuel); and provision of training and capacity building for service provider personnel (e.g., emergency preparedness and response, contingency planning). This can be done very effectively by building the capacity of local humanitarian actors (box 3.1).

Exit strategies should be planned for tanker truck programs wherever possible. When tanker trucks are identified as a necessary emergency water supply option, programs should be designed in cooperation with local institutions and, where relevant, any development actors still present. There should be agreement on the time frame, quantity, unit costs, available budget, and transport distance for trucking water, and a clear exit strategy wherever possible.

For example, during the battle of Qusayr in Syria in August 2013, over 1.5 million people lost access to their water supply from al-Qusayr water station due to damage to the transmission line. The ICRC, with the Syrian Arab Red Crescent, supported the local WSS service providers to put in place a two-stage emergency response plan over six weeks. The first stage ensured access to a minimum 5 to 25 liters per capita per day, which was progressively increased over time to provide 50 liters per capita per day until the transmission line was restored. An emergency response at this scale, and in an active armed conflict, requires multiple solutions: boreholes in Hama were equipped and connected to the main network; generators were installed to power submersible pumps; a tanker truck program for Hama city was set up; and water tanks were distributed to parts of rural Homs. To ensure an inclusive response, tanker trucks were also dispatched to Rastan district, where they filled a ground reservoir with water from local boreholes, and the water was then pumped direct to the network. In parallel,

BOX 3.1. Case Study: Filling Skills Shortages in Partnership with the Syrian Arab Red Crescent

Since the outbreak of conflict in Syria, the water supply infrastructure has suffered both direct damage and gradual deterioration due to inadequate O&M. Service providers aiming to restore or simply stabilize water supply have faced huge challenges in carrying out repairs owing to a lack of secure access to sites, a lack of financial resources, and the inability to procure and import materials—exacerbated by the loss of many skilled staff who left the country, taking their knowledge of the systems with them.

As Syria had a highly skilled workforce precrisis, the ICRC drew on local capacity by training 1,500 Syrian Arab Red Crescent (SARC) volunteers in WASH in emergencies and helping SARC to hire 100 Syrian engineers and 150 to 200 technical volunteers (mostly young engineering graduates) to work on programs designed to support WSS service providers. As a result, SARC has also developed its own response capacity for WASH in emergencies, and the ICRC continues to provide resources to sustain and develop the new team and its programs.

Through its work with SARC, the ICRC and other humanitarian actors now support each major WSS service provider in the country. Building the capacity of SARC has helped the ICRC and other humanitarian actors to overcome challenges of remote management where their own access has been restricted.

the ICRC negotiated safe access for the transmission line repairs. Just over six weeks later, the flow was restored to provide 3,500 cubic meters per hour to around 1 million people in Hama city, and the tanker truck program was phased out.

WSS service providers should manage alternative provision to avoid the erosion of revenue and quality. WSS service providers that had a policy of managing alternative provision avoided the erosion of water revenues and water quality. In Jordan, WSS service providers have retained control of water sources and, where there are shortages, provide water through bulk tanker filling stations. This is done using a combination of publicly and privately owned tanker trucks. There is a system of regular inspection and labeling of tanker water quality, and revenues for the water accrue to the relevant service provider at the filling station. This approach was adapted for use in Yemen through a partnership between the World Bank, UNICEF, and WHO (box 3.2).

In protracted crisis, humanitarian and development actors can help WSS service providers win back market share from alternative providers, but only with concerted, well-funded initiatives. The work of humanitarian actors to maintain services during crisis can help preserve consumer trust in, and revenues for, WSS service providers. Where alternative provision does take hold, development actors operating in protracted crisis settings should work with WSS service providers to help them win back market share.

In Lebanon, for example, the Greater Beirut Water Supply Project has supported the WSS service provider, that is, Beirut and Mount Lebanon Water Establishment, to reduce NRW. As of 2015, the utility

BOX 3.2. Case Study: Water Quality Monitoring of Public and Private Water Supplies in Yemen

With World Bank funding, UNICEF conducted bulk chlorination and water quality monitoring of public and private water sources and tanker trucks in Yemen to ensure safe drinking water supplies for affected populations in two major cities (Sana'a and Hodeidah).

UNICEF worked in partnership with the General Authority for Rural Water Supply Projects and local branches of the National Water Resources Authority to install 100 chlorine dosage pumps to the piped networks and conduct daily on-site chlorination of 330 private groundwater wells. Through this initiative, about 270,000 cubic meters of safe water per week were provided to people living in districts affected by cholera and acute watery diarrhea. Water quality monitoring in Sana'a and Hodeidah was conducted by 20 mobile teams deployed across 21 districts in the two cities. The water quality program focused on 4,270 registered private tanker trucks and 324 safe water source wells and water treatment stations.

UNICEF also worked with the General Authority for Rural Water Supply Projects, National Water Resources Authority branches, and the newly created Water Awareness Center to deliver awareness-raising campaigns. One message was to highlight the importance of chlorination for all water sold by tanker truck operators and/or well owners. Also with the support of Bank financing, WHO worked with National Water Resources Authority branches at governorate level to test water quality in 14 high-risk districts in 4 governorates, across which more than 100 contaminated water sources had been mapped in total.

has piloted a zone of continuous water supply in Beirut, and gained the ability to reduce leakages and provide services to international standards, and led the utility to issue output-based contracts to prepare for a leakage reduction program. Continuous water supply has been restored through reducing network leakages, the installation of flow meters, and the use of a supervisory control and data acquisition (SCADA) system—the first to be implemented in Lebanon. Achieving the reduction of leakages and shifting from intermittent to continuous water supply pushed alternative provision out of the pilot area over a period of three years.

Notes

1. According to the Organisation for Economic Co-operation and Development (OECD NEA 2018), "An all-hazards approach to emergency management is the most efficient use of available resources, including stakeholders."
2. Though there are no data specific to the Middle East and North Africa region, the median markup is 10 times higher based on the 40 studies examined (Garrick et al. 2019).

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Raw wastewater flows into the Mediterranean Sea near Deir Balah, Middle Area, Gaza Strip. © ICRC.

Chapter 4
Wastewater: Simpler Technologies Would be More Resilient

Summary of Findings

The limited ability of WSS service providers to keep high-tech wastewater treatment plants functioning during crisis means that the default option is to channel raw sewage into the local environment or directly to the sea when in close proximity.

Across the seven contexts studied, precrisis signals of vulnerability included wastewater treatment plants (WWTPs) that were only processing a small proportion of influent, and treatment systems with high O&M and energy costs such as activated sludge treatment plants.

Lower-tech systems with lower O&M and energy costs (e.g., stabilization ponds in Gaza) were easier to operate in crisis. During crisis, high-tech systems were quick to fail, causing increased downstream pollution; the backing up of sewage, from manholes, upstream (e.g., at the activated sludge WWTP in Sana'a, Yemen); and public health risks from spills. These systems were often built with customized parts, necessitating a service contract with the manufacturer for maintenance and repair, which could not be honored in times of crisis.

Stemming the rate of decline was made difficult by the loss of qualified staff, but a more major concern was the collapse or intermittency of grid electricity interrupting the biological treatment process, leading to the use of more costly off-grid energy options (made more expensive still where import restrictions on fuel were in place). The failure of sewage pumping stations led to mobile sewage pumps being put in place to help bypass these stations and ensure the evacuation of sewage from built-up areas (e.g., Aden, Yemen).

Jordan's as-Samra WWTP is unique among plants across the seven contexts: By producing biogas from waste, the plant is very nearly energy self-sufficient—though it is still dependent on regular government subsidies.

4.1. Precrisis Vulnerability: The Illusion of Wastewater Treatment

Even in precrisis environments, many treatment plants across the study contexts were unable to cope with high loads of raw wastewater influent, and sludge disposal. Precrisis, in Libya, less than 15 percent of wastewater collected was treated. In Syria, while 96 percent of households were connected to the sewer network, only 40 percent of the collected wastewater was treated, although many long-awaited

WWTP developments had finally begun to move forward as of 2011—only to be halted, and construction work destroyed, by the conflict. In Yemen, with 42 percent of households on the network, only 66 percent of all wastewater was collected—and just 8 percent of it treated. Wastewater services in Yemen (and elsewhere) were vulnerable: Sana'a had one main downstream treatment plant working below capacity and standards (Jeuland 2015).

The lack of precrisis prioritization of and capacity for maintenance has caused investment and operational issues across wastewater treatment facilities. These include: (1) undersized facilities (WWTPs, sewer network) and inadequately maintained or undersized mixed storm water and sewage collection systems; (2) pipe blockages due to lack of household education, badly designed screening, open manholes, and broken or damaged networks (damage caused by human or natural actions); (3) pumping failure due to electricity shortages and lack of proper maintenance; (4) investments in high-tech treatment plants requiring trained staff and high electricity inputs, resulting in high treatment costs; and (5) increased hydraulic and/or biological loads reducing effluent quality. When not properly disposed of or contained, wastewater can cause a physical danger to human life (box 4.1).

O&M of wastewater infrastructure has been subsidized in various ways across Middle East and North African countries. Precrisis, wastewater service fees were generally a surcharge collected with water supply service fees and were lower than the actual cost of treatment. Collection rates were low and, in some cases, fees were not collected at all. Governments instead supported wastewater services by subsidizing the balance through cross-subsidies on water supply, with funds from the national budget, by covering unpaid electricity bills, and/or by subsidizing grid electricity costs.

BOX 4.1. Case Study: Tragedy Caused by Wastewater Treatment Failings in Gaza

In Gaza, an area of 30 hectares north of Beit Lahia held 1.5 million cubic meters of untreated wastewater, which had formed in the absence of an adequate WWTP and because of prohibitions against discharging wastewater into the sea.

The untreated wastewater seeped into the groundwater. Tragically, insufficient structural maintenance of sand embankments containing the groundwater-fed lake led to the flooding of houses in the Beit Lahia area on three occasions during the period 1989–2007. There were multiple casualties, caused by drowning in the raw sewage.

The World Bank, with other development actors, supported the Palestinian Authority with an emergency project to build a new WWTP. The risk of further collapse was alleviated shortly after the 2007 incident, when the lagoons in Beit Lahia were drained, in 2008, into the new infiltration basins constructed as part of the emergency phase of the project.

It would, however, take another 14 years to complete the WWTP, as the FCV-affected area experienced three periods of conflict, as well as closures and restrictions on the entry of materials and equipment required for the wastewater subsector.

Investments in wastewater treatment have been much lower than investments in water supply and have not been matched with investments in capacity building. Across the contexts studied, many WWTPs lacked staff with the technical skills to operate the plants, and lacked the funding for plant O&M—even in the precrisis period (Choukr-Allah 2010). In many cases, treated wastewater quality exceeded the maximum allowable effluent standards. Development actors supported state-of-the-art treatment technologies even in FCV-affected contexts, assuming that conditions and priorities would allow for continued technical assistance, capacity building, and on-the-job training—but such assumptions have turned out to be flawed.

The North Gaza Emergency Sewage Treatment project funded by the World Bank and other donors, designed with a capacity of 35,600 cubic meters per day, is a case in point. Wastewater treatment consists of preliminary, biological chemical treatments, while anaerobic digestion is one of the several phases involved in sludge treatment. There is a high risk, however, that the biological processes will be interrupted because of lack of electricity or fuel. This high-tech approach has high running costs well in excess of what service providers, or customers, are willing or able to cover. External funding was provided in 2019 to support the plant's operation, and the World Bank will finance the plant's O&M for another four years (2020-2023) to protect the investment from collapsing.

International private sector contracts agreed precrisis for the operation of plants have been abandoned during protracted crisis. In Libya, WWTPs were typically operated for the post-commissioning year by expatriate technicians, who would then be replaced by local technicians (with some support by nonnationals). Lack of interest in WWTP O&M among Libyan technicians, the gradual withdrawal of expatriate technicians, and the abandonment of international O&M contracts have compounded the lack of spare parts and materials needed to operate plants. In Lebanon, a long-term hiring freeze across WSS service providers has forced large-scale use of temporary contracts for technical staff, including those managing WWTPs, hindering continuity and discouraging professional development. The international operator of the North Gaza WWTP abandoned its contract when government payments for its services failed to be made.

Low levels of investment in wastewater reuse precrisis represents a missed opportunity to reduce water stress (World Bank 2018). In a region in which 80 percent of water use is directed to agriculture, wastewater reclamation should be a crucial source for irrigation, used in place of good quality groundwater or surface water to reduce water stress and help protect the environment (World Bank 2018). Many WWTPs had been designed to produce effluents suitable for irrigation. Effluent reuse practices varied widely, however, from being abandoned entirely in Libya to requiring subsidy in Jordan, and nowhere involved significant levels of payments from irrigators (Jordan Ministry of Water and Irrigation 2017).

4.2. Managing Services During Crisis: Paralysis of Wastewater Treatment Plants

During crisis, electricity outages limited the ability of WSS service providers to pump sewage to WWTPs or other safe areas for disposal. Even where generators were in place, accessing and paying for fuel to operate them for prolonged periods of time was challenging. So too was the procurement and import of

dual-use spare parts and chemical consumables for treatment, and ensuring availability of skilled staff to operate facilities. Wastewater spills in densely populated areas placed at risk the public health of those exposed. Plagued by technical, administrative, and socio-economic problems even prior to crisis, Libyan WWTPs simply discharged sewage into the sea with minimum or no treatment. In Yemen, wastewater flowed into the Sana'a Water and Wastewater Corporation facility even during power outages, leading to treatment failure, downstream pollution, and eventually, aquifer contamination—possibly contributing to the country's cholera epidemic. More cholera cases were reported in those places with non-functional WWTPs, such as Bani al-Harith district, to the north of Sana'a.

WSS service providers and humanitarian actors prioritized water supply over wastewater services at the onset of a crisis. In the early years of the Syrian conflict, the large WWTPs for Aleppo and Damascus were unsupported. By the time humanitarian actors had begun to consider support, these plants were inaccessible owing to the conflict dynamics. When the opportunity for safe access did present itself, it was too late—these facilities had already failed because of direct and indirect impacts (including looting).

International private sector suppliers of specialist equipment were unable to repair or replace equipment. Technology in WWTPs was sophisticated, especially in Libya, with large motors and pumps in the main sewage lifting stations requiring customized parts. In times of peace, service contracts were in place with specialist international manufacturers. During times of crisis, however, these same manufacturers were unwilling or unable to send out teams of technicians to make assessments and carry out repairs.

Humanitarian actors played a vital role in supporting WSS service provider efforts to manage wastewater in times of crisis. To ensure the safe evacuation of wastewater from built-up areas during crisis, humanitarian actors supported (and continue to support) the O&M costs of wastewater facilities, including spare parts (e.g., pumps) and consumables (e.g., chemicals for treatment, fuel), as well as standby generators and—where necessary and feasible—infrastructure repairs (box 4.2). Acquiring donor support to fund these ongoing requirements in protracted settings is often a struggle, however, as donors do not see preventive maintenance as part of humanitarian response.

4.3. Recommendations to Stem the Rate of Decline

More resilient WWTP design requires a greater understanding of how systems fail during protracted crisis, which should lead to the prioritization of investment in lower-tech facilities. There were very limited ways to address precrisis vulnerabilities in the wastewater subsector during protracted crisis. Many WWTPs in the Middle East and North African contexts studied used high-tech activated sludge management processes, which are costly to run and complicated to manage. These electromechanically intensive wastewater systems have been adopted without a strong rationale, given the abundance of space and sunlight ideal for low-cost, low-tech wastewater treatment solutions (e.g., lagoon systems for smaller towns). Simpler wastewater technologies requiring less capital investment and incurring lower O&M costs would be appropriate and need to be explored further by governments and their development partners. Investment in such technologies is critical to reducing WWTP failures during crisis.

BOX 4.2. Case Study: Partnering on the Safe Evacuation of Wastewater from Sabha, Libya

The ICRC is providing ongoing support in Libya to the General Company for Water and Wastewater to ensure the safe evacuation of wastewater from built-up areas. The wastewater collection and treatment system in Sabha is aging and, in the absence of proper O&M and security, has been gradually deteriorating and left vulnerable to looting. This has resulted in sewage flooding certain neighborhoods of the city.

With the WWTP no longer operational, wastewater has been pumped directly to a lagoon outside the city via one main lift station, which is fed by three lift substations. As the lift pumps require replacement, the General Company for Water and Wastewater has been improvising by running them at a low capacity in manual mode, with a mobile sewage pump as a backup. The situation has been further complicated by the low-voltage and intermittent power supply.

The ICRC is now carrying out the procurement and installation of replacement pumps, plus a voltage stabilizer for more consistent power, and providing protective equipment. The program in its entirety seeks to ensure a more durable solution. With civil and electromechanical engineers on the ground in Sabha, the ICRC was able to support the General Company for Water and Wastewater in diagnosing the problem and reach agreement on the corrective measures to be taken.

The design of WWTPs should provide for alternative emergency sewage discharge lines. In the worst-case scenario when a WWTP fails, sewage backs up, endangering public health. WWTP design should include emergency discharge lines—pressurized, if necessary—that direct wastewater to safe emergency lagoons or release it into the sea.

Governments and development actors need to invest more in local O&M capacity and ensure that wastewater services are financially sustainable. Even prior to protracted crisis, most WSS service providers do not have sustainable models for wastewater collection and treatment. This has led to low levels of professionalization in the subsector. Financially sustainable services would support greater investment in the building up of local O&M expertise capable of running systems during a protracted crisis.

WSS service providers should maintain documentation on international private sector contracts. Maintaining the details of relevant international private sector actors with prior knowledge of wastewater systems (sewage pumps and WWTPs) would expedite the ability of external actors to contact and mobilize specialist suppliers during emergencies (box 4.3).

During reconstruction, consideration should be given to more decentralized or hybrid systems, as well as to how they link to overall urban planning. These systems are often more resilient in the face of hazards. They provide treatment that is closer to the source, lower O&M requirements, and often reduce operating costs. When applied to large urban areas they can complement a conventional centralized system as part of a hybrid design and, in doing so, help build in further redundancies to avoid a single point of failure. The most opportune time to assess the feasibility of such options is during reconstruction or as part of the upgrading and/or retrofitting of existing systems.

BOX 4.3. Case Study: Strengthening Geospatial and Systems Mapping Capabilities of the Coastal Municipalities Water Utility to Better Support Emergency Infrastructure Repairs

In Gaza, the Coastal Municipalities Water Utility (CMWU) used reliable, geographic information system (GIS) supported wastewater data to inform the rapid repair efforts to address damage to wastewater installations during the 2014 hostilities.

The ICRC coordinated with the parties to the conflict to ensure safe access on site and, in support of the CMWU, procured a construction contractor to quickly carry out repairs to damaged wastewater infrastructure, including to: (1) a sewage pumping station; (2) a WWTP; (3) sections of the network, as well as both inlet and outlet pipes to lagoons; and (4) an effluent pressure pipeline. These repairs helped prevent untreated wastewater from flooding into the streets and nearby homes or seeping into the aquifer.

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Canada Well, Rafah, Gaza, 2019 – In support of the Coastal Municipalities Water Utility, the ICRC installed Solar PV, a net metering system, and a dedicated power line to improve the operational resilience in water supply and reduce operating costs for a critical public water supply facility. © H. Mhanna/ICRC.

Chapter 5
Energy: Developing Dedicated and Diversified Sources

Summary of Findings

The escalating costs of off-grid energy generation during protracted crisis can be an intractable challenge to ensuring the continuity of WSS services.

Precrisis signs of vulnerability are hidden but rooted in relatively energy-intensive WSS systems and subsidized electricity. The most vulnerable WSS service providers among those involved in this research were those with high energy needs per cubic meter of water delivered, and a high dependence on heavily subsidized grid electricity for water pumping and treatment. Providers with low-energy, partially gravity-fed systems and shorter transmission distances from water source to demand centers were less vulnerable (Lebanon; and Ibb, Yemen).

During crisis, failure or collapse of grid electricity supply was the chief concern among WSS service providers and drove increased reliance on diesel generators. This, in turn, meant greater reliance on fuel, which was often only available during crisis at premium prices, owing to import restrictions and embargoes or, in some areas, its availability being limited to the black market. WSS service providers identified that the rate of service decline could be stemmed by installing dedicated power lines to critical facilities (Gaza; and Sweida, Dera'a, and Tartus in Syria); diversifying energy sources by installing renewable energy technologies (Gaza; and Hodeidah, Yemen); and replacing high-lift water pumps with energy-efficient equipment (Jordan).

5.1. Precrisis Vulnerability: The Hidden Real Costs of Energy

WSS service providers require electricity to produce, treat, distribute, and recycle water. In the Middle East and North Africa region, development of scarce freshwater resources increasingly requires higher energy inputs for the production and supply of water. Water is either being pumped from ever greater depths or desalinated, and then pumped great distances to demand centers. With rapid population growth, urbanization, and the need for economic growth, there was mounting pressure on existing WSS infrastructure even prior to crisis, requiring new investments to meet the growing demand for energy.

Energy production in the Middle East and North Africa region continues to predominately rely on natural gas and oil (figure 5.1).[1] Future projections predict that the region's growing demand for

FIGURE 5.1. Existing Power Plant Generation Capacities

Power Plant Generation Capacities: Select MENA Countries

Countries in the Middle East and North Africa depend chiefly on oil and natural gas to fuel electricity production.

Electricity generation capacity, in thousands of megawatts

	Bahrain	Egypt	Iran	Iraq	Israel	Jordan	Kuwait	Lebanon	Oman	Qatar	Saudi Arabia	UAE	Yemen
Coal					4,840								
Natural gas	7,574	29,077	38,003	9,547	7,593	3,754	6,648	940	4,872	10,548	32,430	29,487	400
Hydro		2,800	10,858	2,574									
Nuclear			1,000										
Oil	7	1,000	11,311	6,040		382	11,172	1,130			51,774		654
Solar			17		104						14	120	
Wind		547	100										

Source: Stratfor 2018.

electricity will primarily be met by natural gas, with solar energy playing a lesser, but not insignificant, role (figure 5.2).

Energy supply systems are often monolithic in structure and lack diversified sources of energy production. The supply of electricity for cities in the Middle East and North Africa region has largely been developed to fulfil the entire multisectoral demand in urban areas—from households to critical infrastructure sectors—from one central source. Typically, these monolithic systems render the operational continuity of services vulnerable to single points of failure (box 5.1). During times of crisis, this vulnerability remains a large risk to carry, with few options available to restore services at scale and in a timely manner.

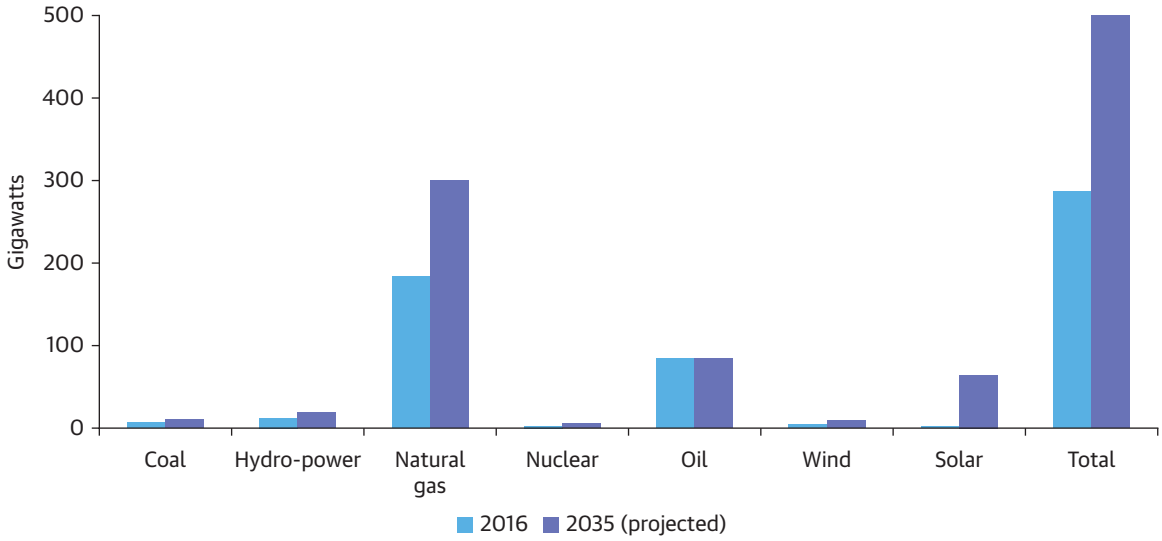
WSS sector performance is linked to energy management. Energy management remains one of the foremost opportunities for service providers to improve reliability in the delivery of WSS services. Although the two sectors—water supply and sanitation, and energy—are intimately linked, they remain largely siloed at the ministerial and municipal level. Weak cooperation between the sectors has prevented the exploitation of opportunities to optimize supply and demand alignment and drive down costs.

Electricity subsidies have reduced the incentives for WSS service providers to adopt energy efficiency measures. For those Middle East and North African countries that are net importers of fuel, high oil prices put a strain on government finances, initially at the national level. As subsidies are gradually stripped away, however, the burden is passed on to the WSS service providers and, ultimately, to consumers. Most service providers rely solely on grid electricity—a reliance that introduces vulnerability to cost volatility and limits electricity supply reliability for WSS services at the onset of a destabilizing event.

FIGURE 5.2. Future Projections for Middle East and North Africa Region

Middle East Power Generation Capacity: Now and Future Projections

New generation will be needed to satisfy the rising electricity demand in the Middle East. The chart below breaks down the likely sources of future generation capacity.



Source: Stratfor 2018.

BOX 5.1. Case Study: Cities are not Made to Withstand Urban Warfare

Cities in the Middle East and North Africa region, like many cities in the world, have energy supply infrastructure and services that have been built on a monolithic system design, which often operates in a serial manner. A failure in an upstream component leads to the failure of all downstream components and thus the interruption of the service—and all associated services reliant on it for their energy supply.

In times of crisis, this architecture creates a system-wide vulnerability owing to the presence of single points of failure. This vulnerability can be noticed in the infrastructure itself, as well as in the supply chains necessary to ensure its operation.

Prior to the crisis in Yemen, the gas-fired Marib power plant provided electricity for 40 percent of the country's energy needs, with little decentralized small-scale power generation. In Sana'a, for instance, WSS service providers relied solely on electricity generated at the Marib power plant. When the power plant failed during crisis, WSS services were left vulnerable to prolonged disruption. The only backup was to switch over to a generator, but few WSS installations had pre-positioned generators in the precrisis period; even if they had, generators quickly became prohibitively expensive to run as the primary energy source.

More resilient systems combine centralized supply with decentralized small-scale power generation, creating a more balanced grid that can improve the reliability of energy supply while retaining the operational flexibility to prioritize WSS installations, if required, during times of crisis.

During the onset of crises, it is typical for expensive, high-speed diesel-operated generators to be deployed both by WSS service providers and by external actors—with insufficient planning for their use in crisis or for the WSS service provider to reconnect to the grid during a period of relative stability.

Energy costs are often one of the largest cost drivers for WSS service providers, even where electricity costs are subsidized by the government. Energy is required for raw water extraction, wastewater collection, treatment of water and wastewater, clean water transmission and distribution, and sludge treatment and disposal. Small increases in grid electricity costs alone can have a large impact on WSS service provider finances—even before having to contend with managing the increased costs of off-grid electricity generation. As well as subsidizing electricity tariffs, governments in the Middle East and North Africa region regularly step in to pay WSS service provider electricity bills directly—simply to maintain services.

5.2. Managing Services During Crisis: Absorbing the Escalating Energy Costs of Off-Grid Electricity Generation

At the onset of crisis in the study contexts, the underlying energy vulnerabilities and system deficiencies of WSS service providers became more pronounced and, in time, worsened. The precrisis development focus often neglected to factor in resilience in energy supply systems to shocks and stresses, and the ability of these systems to recover as rapidly as possible their usual capacity and efficiency.

Direct damage to production and grid infrastructure resulted in sudden and dramatic reductions in electricity supply in many cities across Iraq, Libya, Palestine, Syria, and Yemen. An inability to ensure delivery of fuel to power plants resulted in significantly reduced electricity production. In parallel, indirect impacts such as inadequate O&M weakened the overall functionality of energy generation and distribution systems. The cumulative impact of direct and indirect impacts to the electricity sector over time resulted in knock-on effects for other, associated essential service sectors (e.g., water supply, sanitation, health, education) (ICRC 2015).

A reliable electricity supply was one of the main limiting factors in ensuring operational continuity in WSS service delivery—and yet few service providers were prepared for this during crisis. WSS service providers had very limited ability to respond to an unreliable supply without an emergency preparedness plan agreed in advance with the electricity service provider.[2] The default reaction to install generators (mainly high-speed diesel) at WSS installations was almost always made without considering fuel supplies or assigning dedicated operators for O&M (box 5.2).

Electricity prices increased dramatically during crisis. In Syria, the average price of electricity precrisis for the public sector (including municipal utilities), with the government subsidy, was 4 Syrian pounds per kilowatt hour. During crisis, the average price rose to 30 Syrian pounds per kilowatt hour. Although the Syrian government maintained electricity subsidies, the supply became increasingly intermittent owing to infrastructure damage and the vulnerability of the supply lines providing natural gas and oil.

Supplying generators 'locks in' service providers and/or humanitarian actors to expensive fuel supply arrangements. Humanitarian actors' engagement with WSS service providers on electricity supply

BOX 5.2. Case Study: Electricity as the Main Bottleneck to WSS Service Provision in Gaza

Gaza has consistently struggled to meet electricity demand, with grid provision available only 8 hours per day. During the July–August 2014 hostilities, the electricity supply quickly became a limiting factor in ensuring the provision of WSS services to the population.

Damage to electricity infrastructure was recurring and repairs were made by Gaza Electricity Distribution Company and the Gaza power plant provider continuously throughout the hostilities. When Gaza's power plant was rendered inoperable in late July 2014, the available supply was reduced by almost one third (from 208 to 60 megawatts). This remaining supply came from feeder lines that enabled electricity to be imported from Israel and, to a lesser extent, Egypt.

Direct damage to the feeder lines from Israel caused that supply to falter often, and although the lines were restored repeatedly, having generators as a backup to power vital WSS installations was a critical necessity. But generators were only an emergency response capability if fuel could also be delivered and staff were able to access the sites. During crisis, this scarce resource had to be imported and then allocated in advance for prioritized uses. Lack of safe access to WSS installations near the border area made the act of refuelling a challenge in itself.

during crisis was typically limited to procurement, delivery, and/or installation of generators to power WSS facilities. In Syria, the ICRC alone supplied more than 400 generators following the onset of conflict. Pre-positioning generators to ensure a backup for critical WSS installations is commonplace but has its limitations. This can be an effective temporary emergency measure, but it should be time-bound: Where generators become the sole source of electricity supply, the "lock-in" effect takes hold.

Prior to the onset of conflict in Syria, fuel was subsidized by the government, making the average price for the public sector (including for WSS service providers at municipal and governorate levels) 7 Syrian pounds per liter; during crisis, the average has increased to 185 Syrian pounds per liter. Precrisis, the average price on the black market (with no subsidy) was 15 Syrian pounds per liter, rising to 265 Syrian pounds per liter on average during crisis. In 2017, reliance on generators by WSS service providers diverted 10 to 40 percent of their monthly expenditures to power supply. In previous years, this proportion was sometimes even higher—for example, in 2016, in Sweida, Syria, up to 60 percent of expenditures were used up by the heavy reliance on generators.[3] Simply installing generators is thus not a durable solution for WSS service providers managing through protracted crisis.

Security concerns limited the options available to develop more durable energy supply solutions for critical WSS installations. In situations where safe access could not be ensured for a sustained period of time, the feasibility of rehabilitation and construction projects of any significant scale and duration was limited. In Yemen, for example, the ICRC had planned to initiate a mid-scale solar photovoltaic project to support reliable drinking water provision for 180,000 people in Hodeidah, but the prevailing security situation at the time meant the project could not proceed beyond the conceptual design stage. Furthermore,

among the contexts studied, introducing new technologies during crisis proved challenging owing to the need for training and new standard operating procedures.

Humanitarian actors remained relatively ill-equipped to engage in the energy sector. The technical complexity and scale of its systems and the financial capital it requires typically far outweigh those of the WSS sector. The few humanitarian actors committed to developing a capacity in energy supply primarily focused on ensuring adequate access to electricity for critical WSS installations. Hence the support typically targeted the transmission and distribution of electricity rather than its generation. The energy sector is faced with similar challenges to the WSS sector in terms of having to contend with sanctions, embargoes, and other forms of restrictions when seeking to import materials and items necessary to ensure continuity in service provision. In such situations, humanitarian actors can play a critical role in ensuring the import of materials and goods necessary for energy supply, in particular for WSS services.

5.3. Recommendations to Stem the Rate of Decline

Durable energy solutions are needed for critical WSS installations. When electricity service providers are faced with severely reduced energy production, their inability to prioritize supply for critical WSS installations—to ensure a minimum level of service delivery, at the very least—is a serious limitation.

BOX 5.3. Case Study: Direct Electrical Supply Lines for Critical WSS Installations in Gaza

Given the energy shortage in Gaza, an electricity supply schedule rations energy distribution to neighborhoods (4 hours on, 12 to 16 hours off). In 2013, the United Nations-assisted Emergency Fuel Programme was put in place in Gaza to provide fuel to maintain a minimum level of operation at health, water supply, wastewater, and solid waste facilities.

For WSS infrastructure, fuel is required for backup generators that compensate for electricity rationing or for limited supply during conflict. Additionally, displacement of people often shifts the demand profile for service provision, sometimes requiring certain installations to operate for longer periods of time.

The ICRC, in coordination with the Coastal Municipalities Water Utility and Gaza Electricity Distribution Company, installed a second power line (or a dedicated line) to 11 critical WSS facilities to limit the impact of power shortages and the lack of physical access during conflict. This modification enables the supply of twice as many hours of electricity from the public grid (or for continuity of supply if one line is damaged).

More recently, a remote control system has been put in place in some of the 11 facilities, allowing Gaza Electricity Distribution Company staff to manage their electricity supply from headquarters, limiting staff movement and exposure, and enabling a quick response in times of crisis. The program will be rolled out to a further four wastewater pumping stations and one water reservoir in the coming years, with 20 to 25 more facilities to be considered for inclusion in future.

Ensuring that electricity service providers have the operational flexibility to prioritize supply for such installations not only optimizes electricity supply for prioritized uses (box 5.3), but also provides cost savings for WSS service delivery.

For example, in Sweida, Syria, the population grew by 40 percent with the arrival of internally displaced people. With the water transmission line from Dera'a cut off, the governorate had to rely on groundwater to meet the increased needs, but this water supply was also reduced when electricity rationing began. Electricity was available at Sweida's water pumping stations for only a few hours daily, limiting the quantity of water pumped from boreholes and distributed via the network, which left 13 villages without enough water. The ICRC supported the Sweida water board to have a new 20 kilovolt overhead power line installed to provide a prioritized and continuous power supply direct to the water installation, bypassing the downstream grid supply to the villages. This enabled twice as much water to be supplied to the 13 villages, without affecting the ability to ration electricity to residents.

Cross-sectoral coordination is needed to address water, wastewater, and energy issues holistically. WSS service providers often find it difficult to assess electricity supply problems on their own. Lack of cross-sectoral coordination and cooperation—which is crucial to develop joint emergency preparedness plans—seriously weakens the ability to react and respond effectively to emergencies. Yet trying to establish cross-sectoral relations in the midst of crisis can be difficult. Those development actors that have relatively substantial precrisis experience of energy supply in country should consider providing technical advice to humanitarian actors during crisis, so that they may support WSS service providers to arrive at more durable energy solutions.

Supporting fuel provision is a costly, yet inevitable, activity for humanitarian actors in crisis situations. As critical as it may be, such support should be provided only as a means of last resort and for a limited time only. To give an idea of the level of funding required to support even part of the running costs of a WSS service provider, UNICEF reports that in Yemen in 2018 its fuel support program for WSS service providers covered 15 cities and provided 3.2 million liters of fuel per month for an annual cost of $34.5 million. This represented 23 percent of the UNICEF Yemen WASH budget for 2018.[4]

Diversifying the sources of energy production can ensure a more reliable supply for WSS installations. In instances where a heavy reliance on generators becomes prohibitively expensive, and when the situation on the ground allows for safe access, more durable solutions can be found to ensure continuity of WSS services.

For instance, the Canada Well in Gaza is a significant localized source of water for the community in its supply area, but it often fails to function during crisis as operators and technicians find it difficult to safely reach its location. The ICRC, in partnership with the Coastal Municipalities Water Utility (CMWU), installed a solar power generation system for the well and a second power supply line to the well. The latter enables double the number of hours of electricity supply from the grid and builds in a redundancy in case one of the connections is damaged. In addition, the well has been

equipped for remote operation. The result of these modifications is fourfold: (1) water pumping has increased by 25 percent; (2) there is no further need for a generator, resulting in cost savings; (3) net metering allows for excess solar energy to be injected into the grid, offsetting electricity costs; and (4) remote operation of the well is now possible in the event that it becomes hard to reach during times of crisis.

Notes

1. "Fossil fuels accounted for 97% of electricity production in the Middle East in 2017, with natural gas accounting for about 66% of electricity generation and oil for 31%. The remaining 3% of electricity generation in the Middle East countries comes from nuclear, hydroelectricity, and other renewables." (EIA 2018).
2. Of the service providers that took part in the energy management survey conducted by the Arab Countries Water Utilities Association (under this exercise), none had an emergency preparedness plan that incorporated sufficient energy management measures beyond the pre-positioning of generators.
3. Detail provided during a meeting between one of the report authors and the director-general of the Sweida Water and Wastewater Authority during an ICRC field mission, July 22-27, 2017.
4. UNICEF Yemen Country Office WASH budget/accounts.

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Beshriyyeh Pumping Station located east of Mafraq city in Jordan before being rehabilitated by the ICRC in support of the Yarmouk Water Company, August 2016. The station serves more than 11,500 Jordanian residents and Syrian refugees. © A. Otoom/ICRC.

Chapter 6
Cashflow: Financial Transparency is Fundamental to Identification of Service Vulnerabilities

Summary of Findings

The compound effects of protracted crisis attack cashflow, rendering most WSS service providers incapable of stemming the rate of service decline without substantial external support—whether in contexts affected by conflict or in contexts managing its spillover effects.

Service providers identified that when crisis hits, tax revenues to central government shrink and subsidies to both electricity and WSS service providers are largely, if not wholly, withdrawn. Precrisis signs of vulnerability were often opaque but included high levels of government subsidy (from general taxation); subsidized grid electricity; and the relative weakness of local currencies, especially if not freely exchangeable.

WSS service provider feedback and the limited data available show that service provider O&M costs rose, and revenues fell dramatically during crisis. Customer revenues were more reliable than government subsidies or the continued subsidization of electricity—customers continued to prefer lower-cost, publicly provided network water, if available, to higher-cost alternative provision. As cashflow was squeezed, service providers coped by entering into a rapid downward spiral of cutting production and reducing sales, further reducing revenues.

In the short term, the rate of service decline could be stemmed by humanitarian actors providing inputs in kind (fuel, consumables, spare parts) and covering the costs of repairs, though the high cost of emergency diesel generators exacerbated the decline in cashflow where there was no external support for fuel. In higher-capacity countries (Jordan), general budget support was used to offset the high operating costs of serving refugee populations.

Medium-term efforts to stem the rate of decline in cashflow included resuming billing and collection of tariffs (Iraq and Syria); increasing tariffs (Ibb, Yemen); legal enforcement of commercial customer payment obligations (Basra, Iraq); performance-based contracts to reduce NRW (Beirut, Lebanon); and improving customer databases (Jerusalem Water Undertaking in the West Bank). Making tariff adjustments was especially important where the local currency had depreciated, eroding the ability of service providers to purchase imported inputs priced in hard currency.

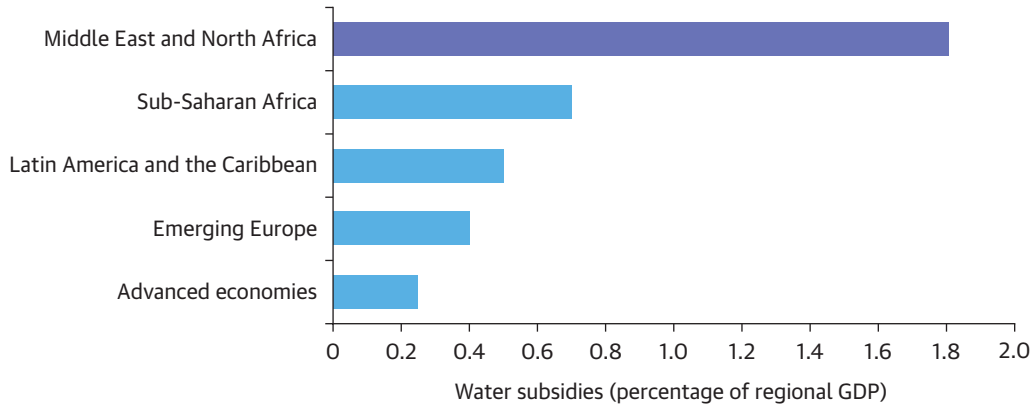
6.1. Precrisis Vulnerability: Kept Afloat by Subsidies

Middle East and North Africa region WSS service providers have been operating in a distorted economic environment supported by an array of overt and hidden subsidies. Service provider infrastructure and operations have been subsidized, customers have not paid the true cost of services, and sector pricing has reflected neither the true cost of production nor the true cost of sustaining water resources. The continued reliance of service providers on these distorted incentives, and the lack of focus on cost transparency and recovery, meant that service providers in the study contexts lacked the cashflow necessary to function when economic distortions were stripped away by protracted crisis to reveal a harsh new reality.

The Middle East and North Africa region has some of the lowest water tariffs globally and, as a region, spends the highest proportion of gross domestic product (GDP) on public water subsidies compared with other world regions (World Bank 2018). On average, the tariffs charged for WSS services across the region cover only 35 percent of the cost of production (World Bank 2018). The fiscal burden of the subsidies is estimated at almost 2 percent of regional GDP (figure 6.1) (Kochhar et al., 2015). These policies promote resource degradation, aggravate fiscal deficits, and compound service provider vulnerabilities in times of crisis, particularly cashflow—limiting the ability, for example, to pay staff salaries, procure spare parts and consumables, and repair infrastructure when necessary. NRW remains an impediment not only to ensuring an adequate and safe supply of water to consumers, but also to recovering the full production and supply cost of water (including energy costs).

WSS service providers dependent on subsidies actually start at a resilience disadvantage compared with service providers that are not subsidized. There are at least three reasons for this: (1) subsidies contribute to unsustainable and inefficient water use; (2) non-transparent subsidies obscure the customer's understanding of the cost of services; and (3) subsidies are disproportionately captured

FIGURE 6.1. Subsidies to Urban Water Supply Service Providers as a Percentage of Regional GDP



Source: Kochhar et al. 2015.

by wealthier households, which use more water, and may result—in the worst cases—in poor people lacking even household connections (Berglöf, et al., 2015). Collectively, these effects weaken a service provider's financial viability.

As WSS service providers have expanded in the Middle East and North Africa region, so too has their thirst for subsidy. Production costs have been driven up by: (1) increasing water scarcity; (2) growing energy needs; and (3) growing urban populations. While some Middle East and North African countries (e.g., Morocco, Tunisia) responded by reforming the sector and improving cost recovery, others (notably, most of the now FCV-affected contexts) did not embrace reforms. FCV-affected contexts concerned with other priorities—and thus reluctant to burden citizens with tariff increases or divert tariff revenue to other uses—were, in particular, less financially prepared for the crises they went on to face, whether internally or externally driven.

6.2. Managing Services During Crisis: The Cashflow Crunch as Costs Jump and Revenues Fall

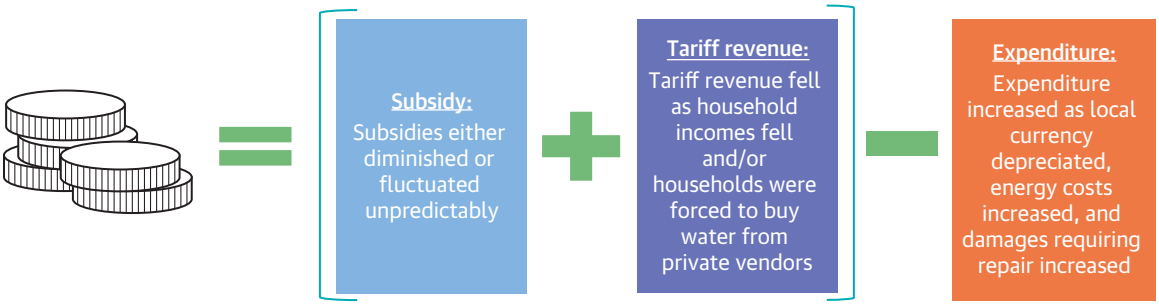
Data with which to analyze the finances of Middle East and North Africa region WSS service providers plunged into crisis are extremely limited. Formal budgeting, accounting, and auditing procedures were early casualties of crisis. Lebanon's successive national budgets have not been approved by parliament for over a decade, and its WSS service providers only resumed the filing of audited annual financial statements in 2015. Fundamental challenges to financial analysis arose at the service provider level in all of the contexts studied in this report—other than in Jordan, and for a few years in Yemen, where financial management and reporting was regular. In some of the contexts, financial reporting was obscured by the institutional set-up, with service providers embedded in other institutions rather than being stand-alone corporate entities. For example, in Palestine, many WSS service providers are departments of municipalities. Similarly, in Iraq, outside of Baghdad and the Kurdistan Regional Government, WSS service providers are deconcentrated departments (i.e., Directorate of Water) of the Ministry of Construction, Housing, Municipalities, and Public Works.

During crisis, service provision became a cash business. While service provider managers acknowledged that subsidy dependence was a vulnerability that left the service provider exposed in times of crisis, their chief concern during crisis was, simply, cashflow. This was because as crisis hit, all three constituent components of cashflow were affected (figure 6.2).

Cashflow came under attack during crisis in six fundamental ways:

1. **Loss of grid electricity**: Failure of grid electricity supply was an immediate and grave threat to cashflow. In the world's most water-scarce region, WSS service providers had come to rely on subsidized grid electricity to pump water from deep aquifers and over long distances to urban population centers. For public WSS service providers in Gaza, Iraq, and Yemen that suffered significant or total loss of subsidized electricity during crisis, energy costs increased by as much as six times with the switchover to high-speed diesel generators (box 6.1).

FIGURE 6.2. How Everything Moves Against Cashflow During Crisis



Source: World Bank analysis.

BOX 6.1. Case Study: Humanitarian Aid Attempts to Stem Downward Spiral of Decline in Yemen

By the start of the civil unrest in 2011–2012, Yemen's urban water utilities had been working as autonomous, decentralized, corporate entities—known as local corporations (LCs)—for over 10 years. Each LC aimed to cover its O&M costs and had received considerable technical assistance from donors for core accounting and billing systems.

As well as generate monthly and annual accounts, operate cost centers, and calculate production and depreciation costs, some LCs had built up reserves in a 'depreciation account'. Their decentralized nature partly protected LCs from early economic shocks (2011–2014) as they were able to sustain operations using tariff revenues. As the crisis deepened, however, LCs were hit by a stream of economic shocks and stresses and internal displacement and refugee influxes, and caught in the midst of hostilities.

In 2014, the Public Electricity Corporation—which had supplied low-cost electricity precrisis—scaled back production as its public subsidies dried up, and subsequently collapsed, leaving LCs to generate their own energy. This initial shock was exacerbated by a sharp rise in diesel prices increasing precrisis energy costs by six times. By September 2016, most LC staff were not being paid as cashflow was diverted to keep generators running, and several million dollars of outstanding salary payments have amassed since.

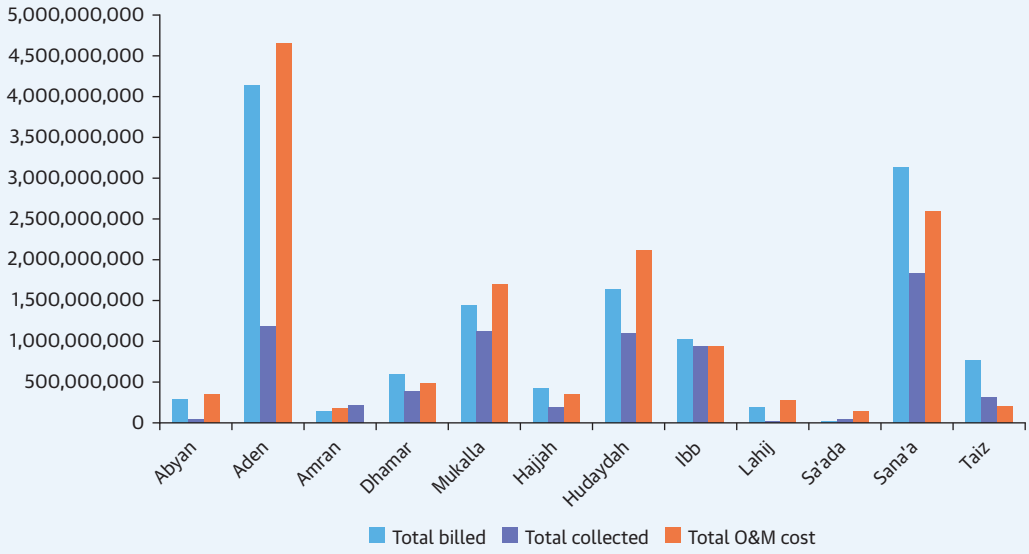
Humanitarian actors helped LCs such as those in Aden, Sana'a, Lahij, Abyan, and Mukalla with spare parts and repairs, as well as support to pay salaries and fuel costs, stemming the rate of further service decline (figure B6.1.1). In other LC areas such as Sana'a and Taiz, public water provision declined dramatically, and private tanker truck operators took over. To keep prices down for consumers, humanitarian actors also supported tanker trucks. In Sana'a, factional interests took over some LC well fields to sell water directly to private tanker truck operators.

Box continues next page

BOX 6.1. continued

The depth and protracted nature of the 2017 cholera crisis led the World Bank and other development actors to channel support through United Nations agencies to stem the rate of decline in water supply services. This included provision of spare parts, supplies, and fuel for utility operations, as well as the more typical Bank investments in infrastructure rehabilitation. Financing was also provided to enhance water security, through the demarcation of well fields and their catchment areas to prevent new drilling at or near existing protected well fields.

FIGURE B6.1.1. Revenues Versus Costs in Yemeni Rial for 2016, With Deficit Covered by Humanitarian Aid and Local Councils



Source: Dorsch International Consultants GmbH 2018.
Note: O&M = operation and maintenance.

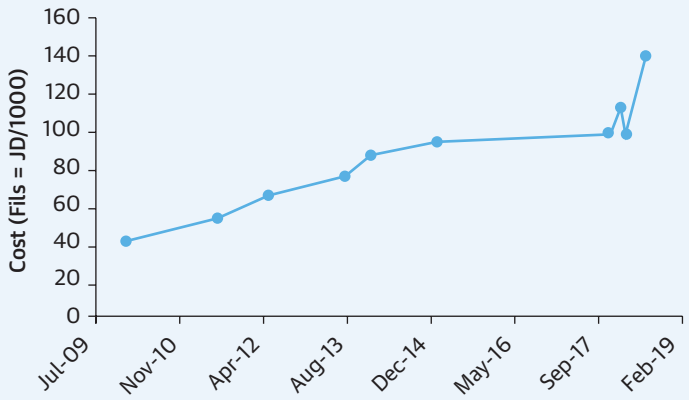
2. **Loss of subsidy:** All service providers interviewed had received subsidies precrisis, whether in the form of: (1) cash transfers from general taxation; (2) direct payment of staff salaries and pensions; (3) cheap or free electricity; or (4) other goods in kind (e.g., water treatment chemicals). Cash transfers were withdrawn first, with access to subsidized electricity diminishing next; salary payments were withdrawn last. Indeed, in Syria, direct payment of salaries continued for years into the crisis, even in areas held by opposition forces.
3. **Loss of market share:** Lacking grid electricity and subsidies, service providers found it increasingly difficult to provide services—water was rationed, system pressure dropped, and water quality deteriorated. WSS service provider revenue fell as consumers struggled to pay or switched to buying tanker water, but the longer-term effects on cashflow were seen as most damaging. High profit margins in tanker water sales meant powerful private interests took hold. In extreme settings in Yemen, private tanker water provision was 70 to 150 times the cost of precrisis utility water.

BOX 6.2. Case Study: Early Humanitarian-Development Support for Struggling Jordan Utilities

Jordan has had to cope with a series of external FCV-related shocks and stresses, in particular since 2011, including the large and rapid influx of refugees from Syria and a sharp rise in energy prices, which have exacerbated chronic water scarcity. During the period 2011–2015, an estimated 1.3 million refugees moved to Jordan—equivalent to 20 percent of Jordan's precrisis population—placing tremendous pressure on water supply services.

Interruptions to relatively cheap Egyptian natural gas supplies in 2011 led Jordan to switch to more costly electricity generation methods and diversify its energy mix, increasing its exposure to global energy prices. To stem an energy-related deficit (5 percent of GDP), the Jordanian government withdrew electricity subsidies, passing on the increased energy costs to consumers, including municipal utilities (figure B6.2.1.). To cope with water scarcity, Jordan also expanded its bulk water production facilities, including via the Disi Pipeline project, a public-private partnership. The Disi Pipeline pumps water to Amman, over a 1,000-meter elevation, from deep aquifers 300 kilometers south of the city, resulting in high electricity costs.

FIGURE B6.2.1. Unit Cost of Electricity for Pumping Water Per Kilowatt Hour (Fils=Jordanian Dinar/1,000)



Source: National Electric Power Company, Jordan.

With electricity responsible for half the cost of service delivery precrisis, cashflow came under severe pressure. The Water Authority of Jordan partially absorbed the shocks, but accumulated 2.4 billion Jordanian dinars of debt ($3.3 billion) by the end of 2017, financed through unpaid invoices to electricity distribution companies and the Disi Pipeline, and Ministry of Finance advances (figure B6.2.2.). Jordan's development partners, including the World Bank, provided about $1 billion to support the government to plug the deficit and avoid disorderly debt accumulation or water utilities defaulting on payments. By 2019, the government itself had cashflow problems, as a series of government bond payments became due. Along with budget support, the development actors provided project funding to help water utilities make efficiency gains.

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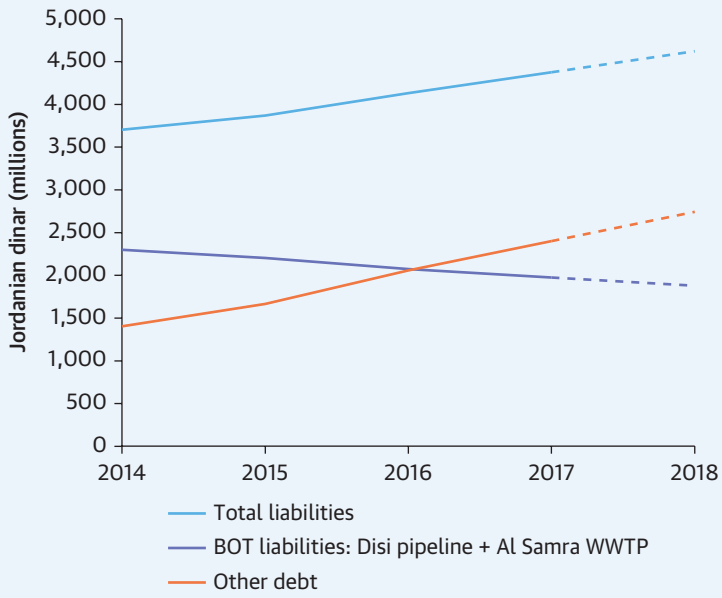
BOX 6.2. continued

FIGURE B6.2.2. Projections of Water Authority of Jordan Debt and Build-Operate-Transfer Liabilities



Source: Water Authority of Jordan audited financial statements.

A subgroup of humanitarian actors supported Yarmouk Water Company, the hardest hit utility, with measures to rehabilitate deteriorating water supply infrastructure in urban areas facing the stress of a rapid and large influx of refugees. These were more than emergency measures.[a] The ICRC alone rehabilitated some 37 installations (water treatment plants, pumping stations, reservoirs, transmission lines, networks) in Mafraq and Irbid governorates from 2014 to 2019, at a cost of more than 24 million Swiss francs, with the primary aims of reducing water losses and improving energy efficiency. Others like Mercy Corps spent $25 million on rehabilitation works over a three-year period.

In some areas, customer complaints received by the local Yarmouk Water Company branch fell sharply in number following the rehabilitation works.[b] There was less tension, in some cases, between host community and refugees compared with the social grievances expressed toward service providers and authorities. This humanitarian shift to providing support to utilities complemented the development actors' support.

a. Though there was a significant camp bias in the overall humanitarian response, considering that this type of setting remains the comfort zone of many actors, there were nevertheless a few humanitarian actors that provided support to the Yarmouk Water Company to rehabilitate water supply infrastructure serving host community and Syrian refugees alike. These actors included, but were not limited to, UNICEF, Mercy Corps, International Relief and Development in the early years, and the ICRC.

b. Personal communication with the ICRC team.

4. **Loss of control of water sources:** These powerful private interests also led to service providers losing control of publicly owned water sources. In Taiz city, Yemen, the main al-Haima well field became a front line and was taken over from the utility by factional interests. This led to a large drop in utility water production, affecting the utility's revenue and cashflow, as the factional interests abstracted water from the well field directly and sold it to city residents via a network of private tanker truck operators.
5. **Loss of staff:** Where salaries failed to be paid, staff morale dropped and "human capital flight" took hold, with well-qualified staff often leaving to work for service providers in other Arabic-speaking countries, particularly Gulf Cooperation Council countries. This led to loss of institutional memory, so vital in managing a system with many hidden, underground assets. Even where salaries continued to be paid, such as in Syria, highly qualified staff left for other reasons—such as being drafted into the army or migration due to insecurity—and production and service provision declined under less well-qualified replacement teams.
6. **Fall in exchange rates:** As the local currency depreciated against the U.S. dollar, this had an indirect impact on cashflow, by raising the price of inputs. In particular, the Syrian pound has fallen tenfold since 2011—to 515 Syrian pounds to $1—requiring the ICRC and UNICEF to cover spare parts and consumables costs. Where official rates were partially fixed, a black market for fuel and other inputs quickly emerged (e.g., Yemen), with costs further driven up by collusion between business interests and different militia. When Libya's central bank raised the official exchange rate almost fourfold in 2018, utilities found it extremely difficult to procure spare parts and consumables that could only be imported from abroad.

The speed, depth, and combination of attacks on cashflow varied greatly depending on the type of crisis, giving rise to different trajectories of decline across WSS service providers and contexts. For example, Syria experienced an initial slow decline at the start of the crisis as the government continued to supply subsidized electricity and pay salaries, and customers kept making payments. Cashflow then abruptly evaporated as bombing damaged links to the grid and system operation became entirely dependent on generators. At that point, WSS service providers became increasingly reliant on humanitarian actors to provide spare parts and consumables.

6.3. Recommendations to Stem the Rate of Decline

Accounting information can provide early warning signals that external intervention is needed. While the crises in Yemen and Jordan are not directly comparable in type or depth, the case studies illustrate commonalities in how cashflow was attacked and managed. First, rising energy costs emerged as a major threat to cashflow for service provision. Second, in the initial stages of crisis, positive cashflow was driven by tariff collection rather than subsidy or aid. Third, the level of autonomy of service providers and the relatively good quality of their accounting systems helped track the impacts of energy price shocks, the state of tariff collection, and the build-up of debt, clearly signaling the problems ahead.

Early intervention is necessary to avoid irreversible service decline. In Jordan, development actors and, to a lesser (but nonetheless crucial) extent, humanitarian actors, on seeing these signals, provided help. A combination of technical assistance and project and budget support was given to stem the attack on cashflow. In Yemen, however, external financial assistance did not come until after the attack on cashflow had triggered a rapid downward, and possibly irreversible, spiral in service provision. In Yemen, any significant external assistance only came in the form of humanitarian aid after utilities had lost access to the electricity grid, lost subsidy, lost staff, lost market share, and in some utilities, lost control of water sources.

Following the height of crisis, revenues from customers do begin to return, but the speed and level of their return depends greatly on proactive management of a service provider's customer base. For example, increases in water revenues are being observed in those parts of Syria that have begun to stabilize.[1] Billing and collection is thwarted, however, by three problems: (1) 6 million internally displaced people, living mainly in urban areas, are consuming water but are not registered for billing; (2) public offices are not paying for water; and (3) though a higher proportion of commercial than domestic users are paying their bills, many businesses continue to run up large debts with the utility.

Even 10 years after the height of hostilities in Basra, Iraq, just $3 million of the $11 million billed annually is collected, despite donor investment in water supply infrastructure. Basra Water Directorate has reestablished a tariff structure based on preconflict laws; a team of over 500 billing staff delivers bills and collects payments; and the city has more than 20 pay points. But the billing process is still manual; customer enumeration surveys are lacking; and there are no bulk or household meters, but many illegal connections. Consumers complain about water quality and that they regularly do not receive water. To benefit from past donor investments and those coming on stream, Basra Water Directorate could, for example, rebuild customer databases via customer mapping, regularization of illegal connections, and the introduction of household metering.

In protracted crises, service providers can embrace more proactive customer management to generate free cashflow for making improvements to water supply—but this requires government to enable, rather than hold back, efforts to improve cost recovery. More proactive approaches of this kind have been successful on a limited scale in Middle East and North Africa region service providers recovering from conflict such as the Jerusalem Water Undertaking in the West Bank, and there is also evidence from FCV-affected contexts in other regions.[2] Palestinian Authority policy supports the establishment of prepaid metering systems to help water utilities improve collection efficiency to better cope with O&M costs. Salfeet municipality began an NRW reduction program in 2017, reducing the proportion of NRW from 35 to 15 percent. By connecting water billing to the electricity prepaid metering system, so that customers pay water dues when they top up their electricity meters, the municipality has achieved a collection efficiency ranging from 95 to 100 percent.

WSS service providers need to win back market share from alternative providers, with the support of humanitarian and development actors. Lebanon's domestic water market is worth over $400 million

annually. Yet, even almost 30 years after the height of conflict, utilities still only directly supply 25 percent of households, with the private sector supplying bottled water and tanker water to the remaining 75 percent. This is despite alternative provision costing 5 to 10 times more than the public WSS service providers—an additional cost that represents a loss to both consumers and utilities. Unless they win back market share, Lebanon's WSS service providers will not have the revenue base required for positive cashflow, but they need to provide a more reliable service and better water quality to compete with alternative providers. WSS service providers in other protracted crisis settings should work to win back market share much sooner after the height of crisis.

Ring-fencing WSS service provider finances and moving toward corporatization is important. In the West Bank, while the Jerusalem Water Undertaking is a corporatized utility, most WSS service providers are departments of municipalities. Water tariffs collected are used by municipalities to fund unrelated services such as refuse collection, road improvements, and salaries in other departments. In the short term, to ensure that water revenues are available for O&M of water supply services, service provider finances need to be ring-fenced. In the medium term, corporatization of water supply services will provide greater financial autonomy and greater protection of water revenues from reassignment by other sectors.

Notes

1. ICRC personal communication.
2. Similar observations from across Africa can be found in de Waal et al. (2017).

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Water authority technician celebrating the end of maintenance works on one of the main water pipelines affected by the hostilities in Benghazi downtown, 2018. © A. Albarasy/General Company for Water and Wastewater (Libya).

Chapter 7
Lessons From WSS Service Provider and Humanitarian and Development Actor Interactions During Protracted Crisis

Despite much discussion of the importance of the humanitarian-development nexus, there is only limited evidence of positive practice in the WSS sector in this regard across the seven contexts studied. This is partly because urban conflicts in the Middle East and North Africa region are often characterized by a highly unstable security situation, which prevents more risk-averse development actors from operating on the ground. Yet the protracted nature of crises in the region, their impact on urban areas, and the fact that humanitarian and development actors are supporting the same WSS service providers increasingly requires exchange and coordination. This should aim to leverage their respective comparative advantages to arrive at more durable solutions in support of WSS service providers during protracted crisis.

Where actors overlap in presence, cultural barriers between humanitarian and development coordination mechanisms persist. Across the seven contexts, there was strong coordination among humanitarian actors—mainly, but not exclusively, through the WASH Cluster system.[1] There was also some coordination among development actors, most notably in Jordan, around the budget support mechanism, and in Gaza, in responding to emergency needs and reconstruction efforts after the 2014 hostilities. But barriers between humanitarian and development actors remain, rooted in separate mandates, different objectives, and even distinct institutional cultures—action-oriented humanitarian responders versus planning-oriented development technocrats. This was even the case where the two groups of actors had the same interlocutors in ministries and service providers.

Two places where there is evidence of active humanitarian and development actor cooperation are Yemen (a formal, contractual example) and Gaza (an example of informal cooperation).

Formal contracts between humanitarian and development actors in Yemen made available flexible, medium-term financing but exposed tensions between respective mandates. Yemen provides the formal, contractual example of cooperation, in which the World Bank has financed two projects with significant WSS components in response to the 2016-2017 cholera crisis. This unconventional arrangement includes: (1) a $200 million health emergency response project with UNICEF and WHO to stem the rate of decline in WSS service provision, with about half of the financing implemented through UNICEF; and (2) a $150 million integrated urban services project (including WSS) with the United Nations, using an existing government project management unit. The projects were agreed with United Nations agencies in clear recognition of their comparative advantage in operating in conflict situations.

Preliminary lessons from these projects under implementation include that: (1) a multiyear arrangement provides predictable funding to meet both humanitarian and development needs; (2) funding with combined humanitarian and development objectives encourages innovation (e.g., reducing costs and increasing reliability of water systems by installing dual-fuel systems); (3) additional flexibility is required to respond in a balanced way to humanitarian and development challenges (e.g., greater scope for funding O&M expenditure for urgent humanitarian needs, and training to rebuild staff capacity for development needs); and (4) development financing comes with greater compliance requirements (e.g., detailed environmental safeguards and procurement procedures).

One of the emerging tensions surrounds the political sensitivities of humanitarian aid provided to address the needs of affected populations under the control of non-state armed groups, or governments with disputed legitimacy. For humanitarian actors, there is a humanitarian imperative to engage with all parties to a conflict while adhering to humanitarian principles* to ensure safe access for humanitarian personnel so that they can work to protect and assist civilians no matter where they are located. Such engagement is more difficult for development actors to do or even support, however.

Humanitarian and development actor partnerships in Gaza have sustained support without the need for formal contracts. Humanitarian-development cooperation following the 2014 hostilities in Gaza provides an example of an informal and more organic partnership in action. The World Bank has supported the WSS sector in Gaza since 1995, including to establish the CMWU, which achieved cost recovery in 2000.[2] In 2006, after Hamas won the election in Gaza, many donors stepped back from directly supporting municipal WSS services including the CMWU (owned by municipalities). The Bank continued its financial and technical support for the CMWU under the Palestinian Water Authority's leadership. During the 2014 war, the Bank maintained its support for the CMWU, while humanitarian actors (ICRC and UNICEF) complemented this with support to meet emergency and humanitarian needs. The ICRC specifically coordinated the movements of utility staff and contractors with the parties to the conflict to ensure that utility staff and contractors had safe access to carry out operations, maintenance, assessments, and repairs during the hostilities.

After the 2014 hostilities, the damage was huge, with almost 485,000 internally displaced people (OCHA 2015). The ICRC, UNICEF, and other humanitarian actors were quick to support humanitarian needs as well as some repair and rehabilitation of WSS infrastructure, and funding for consumables, spare parts, and generators to keep facilities running. While the World Bank coordinated with the Israeli authorities for the entry of the required materials to Gaza, the WASH Cluster continued to update both the humanitarian and development actors and to exchange information during and after the conflict, which helped coordinate the response.

These limited but compelling examples offer pathways, or behaviors, that WSS sector actors can adopt to work together during protracted crisis across the problem areas. The unique advantages of humanitarian-development partnerships, when they work, are achieved through a combination of access to, and

*https://www.unocha.org/sites/dms/Documents/OOM-humanitarianprinciples_eng_June12.pdf

experience with, WSS service providers in FCV-affected settings and predictable, multiyear funding that can flexibly span: (1) immediate humanitarian needs; (2) WSS service providers' O&M needs; (3) infrastructure repair and rehabilitation needs; and (4) institutional development needs of WSS service providers that must be addressed to restore services (including addressing vulnerabilities to the next crisis).

Even with existing levels of risk appetite, opportunities exist for humanitarian and development actors to strengthen their joint support to WSS service providers. In Jordan, for example, where there are fewer security constraints, development actors providing budget support would benefit from working more closely with the humanitarian actors rehabilitating infrastructure in the north (e.g., water treatment plants, pumping stations, transmission lines, reservoirs). Indeed, both groups of actors are already working through the Ministry of Water and Irrigation, and Yarmouk Water Company, providing a clear focus for more collective efforts.

Elsewhere, consideration should be given to ensuring that: (1) during the onset of crisis, development actors are more assertive in informing the initiation of humanitarian programming in support of WSS service providers; and (2) during early recovery, humanitarian actors encourage development actors to engage earlier and recommence their programs to ensure sustainable restoration efforts as the humanitarian actors prepare to withdraw (once the entry strategies of the development actors have been clearly set out and followed up with concrete actions). The more difficult engagement is during protracted crisis, especially in armed conflict settings. Although engaging at this stage poses greater challenges, there is scope to consider knowledge and expertise exchange and possibly operational collaboration (where mutually agreeable) to arrive at more durable solutions in support of WSS service providers.

Notes

1. For more information about the WASH Cluster system, see the Global WASH Cluster website at https://washcluster.net. Note: In order to uphold its principles of neutrality and independence, the ICRC is an observer to the WASH Cluster.
2. Although the CMWU was not officially established until 2005, it began performing its services in the year 2000, immediately after the termination of the international management contract owing to the start of the second uprising.

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Damage to the anaerobic digesters that generate energy by methane gas at the Adra Wastewater Treatment Plant (WWTP). The WWTP serves the city of Damascus and some of the surrounding areas, from which approximately 3,000,000 Syrian residents and internally displaced people benefit. © L.Khalil/ICRC.

Chapter 8
Conclusion and Recommendations

This report has examined five pernicious problems identified by water supply and sanitation service providers operating in protracted crisis in the Middle East and North Africa region. The five problems are: (1) inadequately governed water resources management; (2) aggressive competition from alternative providers (e.g., tanker trucks), undermining network services; (3) paralysis of high-tech wastewater treatment plants; (4) escalating energy costs of off-grid generation; and (5) the cashflow crunch as service provider costs jump and revenues fall. For each problem, the report has put forward likely root causes, researched how humanitarian and development actors with direct experience of operating in protracted crisis have helped WSS service providers tackle the problem, and recommended ways that both groups of actors can support WSS service providers to stem the rate of service decline.

The very rapid period of urbanization and infrastructure expansion in the Middle East and North Africa over the past two decades failed to develop WSS service providers resilient to the potential protracted crises across the region. In many cases, the expansion of infrastructure was achieved in an economic context distorted by subsidies and lacking service provider accountability, which led to inefficient WSS service providers that were neither autonomous nor able to control their finances. When the seven study contexts experienced FCV-related crisis, major precrisis service vulnerabilities were exposed, propelling service provision into rapid decline. Indeed, in many contexts facing protracted crisis, the policies underpinning the precrisis vulnerabilities persist, undermining recovery and attempts to build resilience.

A much more concerted effort to promote WSS service provider resilience prior to crisis is needed. Drawing on broader literature on resilience from the disaster risk reduction, violence prevention, urban resilience, and banking communities, it is well documented that the hard work to build resilience has to be done in advance of crises, and that such investments have high returns (Basel Committee on Banking Supervision 2010; Mechler 2016; Mueller 2018). Though there are no specific studies on the costs and benefits of preventing WSS service provider collapse, the costs of *not* investing in water and sanitation are well documented (Hutton, Haller, and Bartram 2007). An aspiration of all sector practitioners is for WSS service providers *to be run on a sustainable basis and to be resilient to shocks*.

In the worst crises, considerable responsibility for financing WSS service provision passes from domestic to international actors. While this may be unavoidable in relation to a crisis of the magnitude experienced in Yemen, it is in the interests of the international community to prevent the collapse of WSS service providers. As well as the human cost, there is a financial cost to inaction. The sum required to respond

to a protracted health crisis caused in large part by inadequate access to water and sanitation facilities dwarfs the initial investments needed for resilient WSS services.

The compound effect of all five pernicious problems, which emerge together during protracted crisis, renders most WSS service providers incapable of stemming the rate of service decline without substantial external support. Once a country is in protracted crisis, opportunities for (re)building resilience in WSS service provision become highly constrained by factors well beyond the control of service providers (e.g., insecurity, political tensions, macro-fiscal constraints). Even with external assistance, the scope for building resilience during protracted crisis is highly constrained—yet efforts to do so should and must be redoubled.

New types of partnerships between humanitarian and development actors are needed to build greater resilience into WSS services both in anticipation of and during protracted crises. Despite vulnerabilities having clear precrisis roots, WSS service providers and their humanitarian and development partners still need to work together to stem the rate of decline and attempt to build resilience during protracted crisis, especially taking advantage of periods of relative stability. Today's protracted crisis may be a period of relative stability before the next, even deeper crisis—as the COVID-19 pandemic has demonstrated.

The central actors in restoring services are, and should be, the WSS service providers. The consensus across both the authors and contributors to this report was that WSS service providers (utilities, municipalities with responsibility for WSS services, etc.) should take a leadership role to coordinate externally supported assistance within their service areas. While overall financing arrangements may be negotiated with central government ministries responsible for water supply and sanitation, WSS service providers have the detailed knowledge of the specific needs, and so have a key role in coordinating interventions that will stem the rate of decline and build resilience at the local level.

Development actors need to place greater emphasis on building the resilience of WSS service providers precrisis and during protracted crisis wherever possible. A major driver of decline in services during protracted crisis has been the lack of attention paid by development partners to resilience building prior to crisis. By taking an all-hazards approach to the design of WSS systems, and avoiding designs that have a single point of failure, development actors could help build systems that are more resilient to probable hazards and, in doing so, mitigate some of the risks to service delivery caused by protracted crisis.

How to do this is context-specific, but typical measures may include ensuring that WSS service providers: (1) monitor and manage water resources to have more than just one source of water; (2) build redundancies into WSS service delivery systems, implement zoned networks with NRW programs, and actively manage and regulate alternative service providers; (3) invest in lower-tech WWTPs where possible; (4) have energy-efficient systems and are equipped with low-cost backup power solutions; and (5) build up cash reserves. Such measures would enhance the scope for humanitarian response during protracted crises.

Humanitarian actors, in addition to their core emergency response role, should be encouraged to further build their capabilities to support the business continuity of WSS service providers. While the core role of humanitarian actors is to save lives by responding to emergencies, the protracted and urban nature of many crises across the Middle East and North Africa region requires much more than the traditional emergency WASH response (i.e., water trucking, tanks, bladders, tap stands, jerry cans).

In protracted settings, humanitarian actors should be encouraged to initiate parallel preventive approaches to support the business continuity of WSS service providers, including infrastructure repair and rehabilitation; provision of spare parts (e.g., pumps, pipes) and consumables (e.g., chemicals for water treatment, fuel); and training and capacity building for service provider personnel (e.g., emergency preparedness and response, contingency planning). Taking into account the interconnectedness of essential services, humanitarian actors should also invest in developing in-house expertise on energy, or the ability to acquire such expertise (e.g., through secondment or consultancy contract), with a particular focus on ensuring a more reliable supply for WSS services. Supporting these preventive measures is key to stemming the rate of decline in WSS service delivery.

Humanitarian and development actors can strengthen their partnerships in both anticipating and responding to protracted crises. Based on a shared understanding of how the pernicious problems have their roots in precrisis vulnerabilities, and how they emerge to accelerate the rate of decline in WSS service provision during crisis, there are four proactive ways to strengthen humanitarian-development partnerships to anticipate and respond to protracted crises:

1. **Humanitarian and development actors should work together with WSS service providers to make emergency preparedness plans for acute crises—as a "no-regrets" investment.** Even though emergency preparedness plans can never sufficiently prepare WSS service providers for protracted crisis, they are an obvious step in building resilience to acute, short-run crises (e.g., armed conflict, flood, drought, earthquake, energy shortage, epidemic, civil unrest) and are a no-regrets investment. Humanitarian actors have deep experience of how and why WSS service provision deteriorates, or even collapses, in short-run and protracted crises, but they seldom have the opportunity to work with WSS service providers precrisis. Development partners, in turn, would be able to fund these plans and support tried-and-tested preparedness measures for operating in acute crises, including both hardware and software solutions.

   Hardware solutions should encompass emergency water supply such as stand posts; development and exploitation of redundancies in service delivery systems to ensure operational continuity in supply; low-cost energy sources for water pumping and wastewater treatment; and remote or decentralized operation of key facilities. Software solutions should include staff training on contingency plans and procedures; customer communication; and pre-positioning of spare parts and consumables that help ensure continuity of supply during crisis. These should be built into development projects along with infrastructure designs that incorporate the 'safe-to-fail' principle and sustainable means for operating without grid power.[1]

2. **Precrisis partnerships would enable humanitarian actors to: (a) establish links with WSS service providers and their supporting ministries; and (b) share knowledge of precrisis service delivery constraints.** Development actors should work with humanitarian actors precrisis, to ensure that WSS service providers have established and functional links with humanitarian actors and with other domestic actors key to service delivery during crisis (e.g., central ministries, municipalities). This will facilitate a more effective reaction, response, and recovery in protracted crisis. These precrisis partnerships would also ensure that there is improved sharing of water resources data, network data, and financial data for WSS service providers.
3. **In protracted crisis, it should be a standard, internationally agreed requirement for humanitarian and development actors to coordinate and align their interventions to support resilience building of WSS service providers.** Even with limited appetite for risk among development actors and the need for humanitarian actors to adhere to humanitarian principles,* opportunities exist for humanitarian and development actors to strengthen their joint support to WSS service providers in protracted crises. Humanitarian actors tend to have better access to FCV settings, with secure bases and offices, and may have better knowledge of local context. This is particularly the case in armed conflict and in situations of mass displacement, where humanitarian actors can bring a deep understanding of—and, in some cases, the ability to communicate with—the parties to the conflict. Humanitarian actors often have well-established links with WSS service providers, understand the service delivery constraints, and know where the poorest and most vulnerable communities live, whether internally displaced people, refugees, or host communities. This is valuable knowledge that development actors can build on while contributing specialized expertise (e.g., water resources management, medium to high voltage electricity supply), new perspectives and knowledge on reform opportunities, and multiyear funding that can flexibly span: (a) immediate humanitarian needs; (b) service providers' O&M needs; (c) infrastructure repair and rehabilitation needs; and (d) institutional development and reform needs of WSS service providers that must be addressed to restore services (including addressing vulnerabilities to the next crisis).
4. **Both precrisis and during protracted crisis, humanitarian and development actors should work in a complementary and coordinated manner with WSS service providers on improving financial transparency to unmask underlying vulnerabilities.** A necessary prerequisite for building resilience is publicly available data on the dependence of WSS service providers on public subsidy and subsidized grid electricity; on levels of outstanding service provider debt; on the efficiency of service provider billing and collection processes; on the degree to which revenues cover O&M needs; and on whether revenues are being used to cover non-water sector expenditure such as road repairs or refuse collection. The evidence set out in this report illustrates how financial transparency has been successfully used to strengthen service provider and external responses during crisis to sustain WSS service delivery.

Strengthening humanitarian-development partnerships to support WSS service providers in these ways would address key aspects of precrisis resilience building and also of resilience (re)building in protracted crisis.

*https://www.unocha.org/sites/dms/Documents/OOM-humanitarianprinciples_eng_June12.pdf

These actions could become a set of global safeguards to better protect water supply and sanitation services from crises. The modest costs associated with these actions would be an insurance policy against the far greater costs of inaction—particularly as when water supply and sanitation service providers fail, loss of life inevitably follows.

Note

1. In engineering terms, a system can be designed to be "safe-to-fail," which means that if any component within the system fails, the system as a whole fails, in a predictable manner, to a "safe state." In relation to the delivery of water supply by a service provider during a crisis, that safe state is ensuring the operational continuity of—at the very least—the minimum level of service provision necessary to safeguard public health (e.g., progressively work towards realizing, as quickly as possible, the WHO requirement of 50 liters per capita per day).

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