An urban refugee dividend?

Rethinking humanitarian aid as WASH investment in Jordan

Lucy Earle, Loan Diep, Deena Dajani, Ghada Balaw, Ala'a Omoush, Kate Crawford, Majd Al Naber, Samer Fakhoury, Margarita Garfias Royo and Samer Talozi

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About the authors

Lucy Earle, director of Human Settlements Group, IIED; Loan Diep, independent research consultant; Deena Dajani, senior researcher, IIED; Ghada Balaw, independent engineer consultant; Ala'a Omoush, independent engineer consultant; Kate Crawford, technical director, KLH Sustainability; Majd Al Naber, director general, WANA; Samer Fakhoury, researcher, WANA; Margarita Garfias Royo, lecturer, UCL; and Samer Talozi, associate professor, JUST.

Corresponding author email: lucy.earle@iied.org

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International Institute for Environment and Development
44 Southampton Buildings, London WC2A 1AP, UK
Tel: +44 (0)20 3463 7399
www.iied.org

www.linkedin.com/company/iied
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This working paper presents the findings of a study that explored water, sanitation and hygiene (WASH) services for Syrian refugees in Jordan, focusing on a detailed case study of service access in an urban neighbourhood and a review of service investment in Zaatari refugee camp. It identified how urban refugees are particularly impacted by existing water scarcity, and showed that for a fraction of the cost of installing a network in a camp, many more refugees and their hosts could have benefited from investments in an urban setting — where most refugees are living. This should inform future decision making about how and where to host refugees in future crises in ways that are environmentally as well as economically sustainable.

Contents

Abbreviations

CSV	Comma-separated variable
DFID	(former UK government) Department for International Development
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (the main development agency of Germany)
GMM	Greater Mafraq Municipality
GoJ	Government of Jordan
HPN	Humanitarian Practice Network
IATI	International Aid Transparency Initiative
IIED	International Institute for Environment and Development
ILO	International Labour Organization
INGO	International nongovernmental organisation
ISG	International Solutions Group
JOD	Jordanian Dinar
JRP	Jordan Response Plan
JURD	Jordan Urban Refugee Dividend
JUST	Jordan University for Science and Technology
l/c/d	Litres per capita per day
MOPIC	Ministry of Planning and International Cooperation
MSF	Médecins sans Frontières
MWI	Ministry of Water and Irrigation
NRW	Non-revenue water
OECD	Organisation for Economic Cooperation and Development
PCA	Programme Cooperative Agreement
PDF	Portable document format
QGIS	Quantum geographic information system
SDG	Sustainable Development Goal
SIWI	Stockholm International Water Index
UCL	University College London
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USCRI	US Committee on Refugees and Immigrants
WAJ	Water Agency of Jordan
WANA	West Asia-North Africa (Institute)
WASH	Water, sanitation and hygiene
WS (1,2,3)	Water solution (1,2,3)
WWTP	Waste water treatment plant
YWC	Yarmouk Water Company

Summary

Background

Since the start of Syria's prolonged civil war in 2011 refugees have been moving to neighbouring countries, including to Jordan. The Jordanian government estimates that as many as 1.3 million Syrians (including unregistered refugees) were living in the country up until the end of 2024, out of a total population of 11.4 million. While some Syrian refugees have returned since the fall of the Assad regime in November 2024, estimates suggest numbers are still relatively small (under 50,000).

To respond to the massive flows of people from Syria in the early years of the crisis the government, in collaboration with the UN, built the Zaatari camp in 2012, followed by a second camp, Azraq, in 2014. These provided much-needed basic services at a time of great emergency and need, but the fact that they still exist has created a largely dependent population — at considerable expense in terms of humanitarian aid.

According to UNHCR estimates, most of the Syrian refugees in Jordan live outside the camps, with over a million living in the urban, peri-urban and rural areas of Amman, Irbid, Mafraq and Zarqa governorates. But these refugees receive only limited support from international organisations, despite a situation where public services struggled to meet demand — even before their arrival.

Incorporating responses to urban refugees into long-term development planning would be of clear benefit to the government, the international community and the refugees themselves — but also for low-income Jordanian hosting communities whose needs remain unmet. This study explores WASH needs and opportunities for urban refugees — but also opportunities to meet host communities' needs, focusing on a comparison between one camp (Zaatari) and an urban neighbourhood (Al-Dahiyyah in Mafraq city).

Study outline

This project focused on water, sanitation and hygiene (WASH) provision. While significant resources have been spent in the delivery of WASH services to camps, less has been invested in long-term solutions for both refugee and host populations in urban areas.

It combined three parallel and complementary work packages:

- A desk-based study of the history of the humanitarian WASH response in Zaatari refugee camp and an attempt to find related data on expenditure.
- A multi-method study in a refugee-hosting area of Mafraq city to build a profile of the neighbourhood (Al-Dahiyyah) and gain a deeper understanding of refugee and low-income hosts' experiences of living with water insecurity.
- A series of scenarios for WASH services, including cost estimates, for urban refugees and hosts in Al-Dahiyyah, with a focus on equity — taking the social, environmental, economic and political context into account.

These three areas of inquiry were then brought together to respond to the overarching research question: Given past investments in refugee camps, what could have been — and what could still be — achieved for sustainable WASH provision in urban refugee-hosting neighbourhoods in Jordan if comparable resources were invested there to strengthen local services and infrastructure for both refugees and host communities?

Key findings

UNICEF has systematically provided regular and high-quality WASH services to refugees in Zaatari camp in the face of numerous logistical, technical and political challenges. However, many WASH interventions in the early years of the camp were enormously expensive. While reflection on the choices made should provide an opportunity to learn lessons for future responses and reveal the cost-effectiveness, or otherwise, of camp-based operations, very little data on expenditure in the camp is in the public domain.

Humanitarian spending is rarely disaggregated by location, meaning it is currently not possible to know what has been spent where in Jordan even at the most basic level — for example in camps as compared with urban areas. However, it is clear that responses to the majority of refugees, who are living in urban areas, have not been nearly so comprehensive as in the camps. Urban refugees share many of their struggles to access WASH with host communities, but they face additional challenges. Data collected in Al-Dahiyyah would suggest that refugees are over-represented in the population who do not have mains connections to the water network. Even among connected households, the limited amount of water received through the rationing system, low pressure, and the unpredictability of provision, leave them water insecure. Many urban refugees are paying more, either because they live in disconnected areas and are dependent on private water vendors, or because they are on a shared meter. There is a significant gap in the refugee response in urban areas, representing a missed opportunity for an integrated humanitarian–development approach to water vulnerability.

The study produced a series of costed designs for sustainable WASH infrastructure in Al-Dahiyyah. These calculations took population growth into account and would reduce water losses, as well as ensuring universal connections to mains water and sanitation. These were compared with a WASH network installed in Zaatari camp between 2015 and 2019 at a cost of approximately US$55 million that serves 80,000 people and has an assumed lifetime of 10 years. The comparison shows that for half the cost of the Zaatari camp network, Al-Dahiyyah could be provided with a network that would eventually reach more than three times as many people with a life cycle up to three times as long.

This study has important lessons for the international community in future responses to refugee crises. A serious effort must be made to facilitate cost-effectiveness analyses of different forms of refugee hosting. It is only by establishing and sharing information on the true cost of camps, that the potential dividend of urban refugee hosting can be understood. This could make a very real contribution to negotiations over how and where to host refugees in future crises, and has the potential to inform a transition from unsustainable encampment policies towards a more enlightened approach that supports towns and cities to absorb refugees, while providing improved service provision for all. The potential cost-savings of such an approach render it particularly pertinent in the current context, in which the US administration has tightened aid budgets and shifted its geopolitical priorities. Increased investment in defence and domestic spending in donor countries, including in Europe, are putting additional pressure on development and humanitarian financing.

1 Introduction

Between 2021 and 2024, IIED led a research project with WANA Institute, UCL, and Jordan University for Science and Technology (JUST) entitled, **The urban refugee dividend — rethinking humanitarian aid as urban WASH investment.** Known as the Jordan Urban Refugee Dividend project, or JURD for short, at its heart the project is an examination of the disconnect between humanitarian and development programming in refugee contexts. More specifically, it highlights the critical lack of attention by international agencies, donors and hosting governments to urban refugee populations, particularly in countries with an encampment policy. It demonstrates the impact of this gap on vulnerable displaced populations, and the potential of economically sustainable service provision for urban refugees and low-income host populations. It also explores the wasted resources and missed opportunities that ensue from a narrow focus on camp-based populations, and the lack of transparency within the UN system on how and where it spends humanitarian resources.

The JURD project focused on one sector — water, sanitation and hygiene (WASH) — in one country, Jordan. Jordan is one of the most water-scarce countries in the world, and also has one of the highest proportion of refugees per capita globally. The project was a shared endeavour between engineers and social scientists and was run in a partnership between UK (IIED and UCL) and Jordanian research institutes and universities (WANA and JUST). The overarching research question guiding the project was: **Given past investments in refugee camps, what could have been — and what could still be — achieved for sustainable WASH provision in urban refugee-hosting neighbourhoods in Jordan if comparable resources were invested there to strengthen local services and infrastructure for both refugees and host communities?**

The civil war that followed the 2011 uprising in Syria prompted large-scale refugee movements, including to Jordan, one of Syria's neighbouring countries. As of May 2025, nearly 535,000 Syrian refugees were registered with the United Nations High Commissioner for Refugees (UNHCR) in Jordan (UNHCR, 2025). However, this number is known to under-represent the actual number of refugees, since many thousands chose not to register with the UN, for a variety of reasons. The government of Jordan (GoJ) estimates that as many as 1.3 million Syrians could be living in Jordan, out of a total population of 11.4 million (ACAPS, 2024).

In response to massive flows of refugees in the early years of the crisis, the Jordanian government, in collaboration with the UN, built Zaatari camp, located near the border between the two countries in 2012. A second camp, Azraq, was built in 2014, in a more remote location.[1] Approximately 80,000 refugees live in Zaatari, and around 45,000 in Azraq. The camps ensured the humanitarian community could swiftly provide basic services to refugees, including water and sanitation, as well as shelter, food, and healthcare. However, the camps have endured long past the emergency phase of the response, leaving their residents largely dependent on aid, or to make a

[1] There are two other smaller camps in the country, hosting fewer than 5,000 refugees between them.

living within a heavily subsidised camp economy (Alhaj Hassan et al., 2024). The majority of the Syrian refugee population lives outside of camps (UNHCR, 2024). An estimated 80–82% of Jordan's refugees (over one million people) are living in urban, peri-urban and rural areas of Amman, Irbid, Mafraq and Zarqa governorates (Kattaa and Both, 2023; ACAPS, 2024).

Refugees in urban areas receive limited assistance from international organisations compared to camp-based refugees, and assistance provided by the GoJ is also limited. In most urban areas, public infrastructure was not designed to support significant and sudden increases in demand and is therefore under pressure. Indeed, many public services were already struggling to meet demand before refugees from Syrian arrived. The subsequent strain on services represents a significant challenge for the government.

This project focuses on one of the most critically affected sectors: WASH. While significant resources have been spent in the delivery of WASH services to camps, fewer have been invested in long-term solutions for both refugee and host populations in urban areas. There are several reasons for this, including uncertainties related to the duration of the war, and political sensitivities, which made the government of Jordan reluctant to move away from temporary service provision for the camp-based refugee population.[2] In addition, the international community has been unwilling or unable to transition from humanitarian assistance to long-term investment in infrastructure and service provision due to both the political context and their institutional mandates. In parallel, water utilities in Jordan lack the adaptive capacity to cope with, and respond to, such sudden increases in demand.

Given that refugees from Syria have now been living in Jordan for over a decade, with over 80% of them settling outside of camps, incorporating humanitarian responses to refugees into long-term development planning would be of clear benefit to the Jordanian government, the international community, and the refugees themselves — but also for low-income, Jordanian hosting communities whose needs remain unmet. This study explores WASH needs and opportunities for refugees — but also opportunities to meet these host communities' needs, focusing on a comparison between a camp and an urban area.

1.1 Aims and objectives

This paper presents the findings of the JURD project which focused on the provision of WASH for Syrian refugees in Jordan. The study's original aim was to explore opportunities for investment in water and sanitation infrastructure and services in urban areas in ways that are more sustainable and equitable and, in doing so, compare the costs of these more sustainable activities with humanitarian expenditure in camps. In response to a lack of data in the public domain on the cost of camps, the study evolved to also incorporate an investigation into financial reporting and transparency within the UN system.

This work has relevance for actors at the city, national and international scales. The project has produced alternative WASH scenarios for a refugee-hosting neighbourhood, that could be adopted by the local water utility company. In presenting such scenarios, the research team has also sought to stimulate debate at the national level (among the GoJ, the UN, donors and NGOs) on the need to move away from temporary, humanitarian interventions, to development-oriented, longer-term infrastructure and service provision that is of benefit to both refugees and hosts. At an international level, the presentation of the cost comparison, and the investigation into the lack of transparent financial reporting, serves to challenge the international community to reconsider the establishment of refugee camps in future displacement crises, in favour of more cost-effective and sustainable support for refugee-hosting areas. It is also a call for the international community to hold honest and open discussion on the financial implications of the decisions made in the early stages of refugee response, and to ensure lessons learned from these experiences are applied to future displacement scenarios in the region and elsewhere.

JURD was funded by The British Academy through its 'Knowledge Frontiers' programme that supports multidisciplinary collaborations between social scientists and engineers. IIED led the project, in collaboration with University College London, the Jordanian University for Science and Technology, and the West Africa North Asia Institute, Amman. It focuses on two of the biggest global challenges today: displacement and water insecurity. JURD explored how new partnerships between humanitarian actors, utility and service providers, and city governments could support transitions from immediate, emergency, relief towards a more sustainable and equitable response to protracted displacement.

[2] GoJ has described Syrian refugees as 'guests' and granted them permits under a 'temporary residence' (for a discussion of the political sensitivities of the 'guest' discourse see El-Abed 2014). It remains uncertain what percentage of Syrian refugees will choose to return to Syria following the overthrow of Al-Assad in December 2024 and how this will impact on GoJ's response to hosting refugees that choose to remain. Latest figures suggest 22,000 Syrian refugees, of whom 3,100 were registered with UNHCR, have returned from Jordan to Syria (UN, 2 January 2025).

To achieve its aims, the multidisciplinary project combined three parallel and complementary work packages:

1. Social scientists and engineers undertook a desk-based study of the history of the humanitarian WASH response in Zaatari refugee camp and attempted to find related data on expenditure.
2. The research team conducted a multi-method study in a refugee-hosting urban neighbourhood of Mafraq city to build a profile of the neighbourhood and gain a deeper understanding of refugee and low-income hosts' experiences of living with water insecurity.
3. Engineers on the team designed a series of scenarios for WASH services for urban refugees and hosts in Mafraq city, with a focus on equity, taking the social, environmental, economic and political context into account.

It is not the intention of the authors to suggest that Zaatari camp be closed, or for UNICEF and partners to cease delivering WASH services to the camp, to invest these resources in urban areas instead. Our aim has been to explore the impacts on Syrian urban refugees and low-income Jordanians of the decision made in the early years of the crisis to build the camps and deprioritise urban populations.

By making the case for sustainable investment in services that serve both host and refugee populations in urban areas, the project contributes to the existing, and expanding, literature on the humanitarian–development nexus. It does so by juxtaposing two areas of enquiry that are rarely considered together: an analysis of humanitarian spending on WASH in camps, and an investigation of the impacts of the lack of investment in WASH for low-income refugee hosting urban neighbourhoods. It then seeks to present a practical way forward, by proposing a series of economically sustainable urban WASH interventions that potentially also reduce water losses, while drawing out wider lessons for future responses to displacement crises. The study has been conducted with careful consideration of the different mandates of UN agencies, their partner organisations, and the government of Jordan, as well as the range of political and economic limits that they face. The findings aim to generate debate and discussion to support the development of new partnerships and new ways of working, with the ultimate goal of supporting better planning for the arrival of urban, and increasingly long-term, refugees.

This working paper begins with a brief overview of the methodological approach — a combination of a desk-based study of a camp with fieldwork in a refugee-hosting area. It then sets the scene in Jordan, describing the WASH context nationally, and in the governorate of Al-Mafraq, where the study sites are located, and briefly considers the impact of refugee arrivals in the region.

The following empirical sections focus on the two sites of comparison chosen by the project: Zaatari refugee camp and the Dahiyyat Al-Malik Abdullah neighbourhood (known as Al-Dahiyyah) in Mafraq city. The section on Zaatari traces the evolution of the WASH response in the camp — drawing on secondary sources to demonstrate how this has shifted from temporary to more permanent infrastructure. It then moves to a discussion of the attempts to find cost data for these investments. It details the unanticipated difficulties of undertaking a comparison of WASH provision between camp and urban areas, because of the lack of transparency around the expenditure on WASH in the camps. The subsequent section on Al-Dahiyyah, a neighbourhood with poor water and sanitation services, draws on primary survey and interview data to describe how residents access and manage scarce water resources.

The paper then presents scenarios for the Al-Dahiyyah neighbourhood, that could provide sustainable, improved and regular water and sanitation for both Jordanians and Syrian refugees over a 30-year period, concluding with a comparison of costs and benefits of the proposed networks for Al-Dahiyyah, with the actual costs of a network in Zaatari camp.

1.2 Methodology

While this project is comparative, examining the WASH response in both a camp and an urban area, primary data collection took place only in the urban refugee hosting context of Al-Dahiyyah. This was for a number of reasons. Firstly, Zaatari camp is a zone of extensive humanitarian engagement and academic research interest. As a result, there is considerable grey and published literature available on the WASH response in the camp. By contrast, Al-Dahiyyah and Mafraq city more broadly, have received relatively little attention from the humanitarian sector, and the experiences of refugees and the urban poor are scantily documented. In addition, primary data collection was required in Al-Dahiyyah so as to equip the team to design new WASH scenarios for the neighbourhood. As it was never the intention of the project to design any scenarios for Zaatari camp, this type of primary data collection was not required. All primary data collection was undertaken in Arabic by native speakers.

Work Package 1 involved a multidisciplinary team of social scientists and engineers who analysed humanitarian WASH provision in Zaatari camp through:

- **Historical mapping** of the implementation of the WASH response in the camp
- An exhaustive online search for data on **costs of the WASH response,** including through analysis of data uploaded to the International Aid Transparency Initiative Portal
- **Key informant interviews** with government stakeholders, NGOs and other agencies involved in the WASH response to confirm the infrastructure timeline and seek access to data on costs of the response in the camp.

Work Package 2 sought to understand WASH needs and insecurity among urban refugees and low-income hosts in Al-Dahiyyah, the impacts of limited access to networked water and sanitation, and to provide a baseline for scenario modelling using:

- **Semi-structured qualitative interviews** (23 in total, 19 with Syrian refugee households and 8 with Jordanian host households). To capture different experiences around water insecurity during winter and summer seasons, almost half the interviews were conducted in February and March 2022, with the rest conducted in late June to July 2022.[3]
- A **survey** with 165 respondents on water and sanitation connections, water use and management, private water providers and costs of supply (two-thirds of interviewed households were Syrian refugees, the rest were Jordanian households). The survey was conducted in August 2022.
- Three **focus groups** with 36 participants (from host and refugee communities in Al-Dahiyyah) that aimed to gain further insight on some of the findings from the survey. They were conducted in March 2023.

Based on this data, for **Work Package 3**, the team of engineers designed a range of WASH scenarios for Al-Dahiyyah and estimated the associated costs of the proposed interventions. Their methods included:

- **Key informant interviews** with representatives of the municipal government and water utility to understand the city's current challenges with equitable water and sanitation access, and in service provision more widely
- **Scenario-building** for solutions to achieve WASH security for urban refugees and hosts
- **Estimations of infrastructure costs** for a networked solution for water and sanitation.

[3] Interviews were conducted with women in the household by women researchers. In three of the interviews, male members of the household joined part or all of the interviews as they had limited mobility and were not able to leave the room where the interview was held.

2

Water challenges in Jordan: an overview

Before detailing the WASH response in Zaatari camp, and drawing on primary data to describe the challenges of Syrian refugees living in underserved urban areas, it is important to provide an introduction to Jordan's overarching challenges with the provision of water and sanitation services. The JURD study engages with one of the most critical issues facing Jordan today: water scarcity. According to the Falkenmark water stress index, 'extreme water scarcity' relates to any level of freshwater resources below 500m^3 per capita per year (SIWI and UNICEF, 2023). In 2021, the government of Jordan declared the freshwater resources per capita to be 61m^3 per year in the country, far below the Falkenmark threshold of extreme water scarcity. They are expected to fall further to 35m^3 by 2040 (MWI, 2023). As a result, Jordan is commonly referred to as one of the world's most water-scarce countries (GIZ, 2023). The country has had a water rationing system in place since 1987 which is applied everywhere, almost without exception. As a result, even in urban areas, neighbourhoods do not have 24-hour supply. Most receive water once or twice a week for up to 8 hours, while some urban and rural areas receive water even less frequently and for shorter periods. Clearly, any analysis of WASH interventions for refugees must begin with a recognition of the underlying factors causing water management challenges in the country. While the arrival of Syrian nationals in the 2010s has had significant impacts on water management in Jordan, it is important to note that the country has had resource management challenges for many decades. These water resource management challenges centre around five factors.

2.1 Climatic

Jordan is located in a region characterised by an arid climate with hot, dry summers and mild winters. Rainfall is rare and irregular. Climate change adds another layer of challenge and uncertainty with regard to water and heat stress, and has been linked to more prolonged and more extreme periods of drought (Al-Qinna et al., 2011). Climate projections for Jordan indicate that there could be up to a 37% decrease in annual precipitation by the end of the century (Abdulla, 2020).

2.2 Transboundary water sources

Groundwater and surface water are the main 'conventional' sources of water (60% and 31% respectively, for all water uses across sectors) (Al-Addous et al., 2023). The Jordan River provides the largest surface water supply. Jordan shares around 25% of its surface and underground water resources with neighbouring countries, with implications for the political dynamics in the region. Throughout its history, Jordan and its neighbouring countries (including Syria, Saudi Arabia and Israel) have disputed access to shared water resources. Jordan faces challenges from upstream diversions and pollution which further strain limited water supplies. Plans and treaties for peaceful and equitable allocations of resources have been marked by complexities, and sometimes conflicts (ibid.).

2.3 Distribution across sectors

Around 42% of the country's freshwater supply (groundwater and surface water) is allocated to agriculture. A further 53% is mainly used by municipalities (for domestic consumption) and by the tourism industry (MWI, 2023). Industry also claims 3% of the country's water to support manufacturing and other economic activities. The agricultural sector extracts groundwater from aquifers at unsustainable rates. In 2023, irrigation accounted for 38.5% of all groundwater use, a further 45.8% of surface water use, and 99% of treated wastewater use (ibid.).

2.4 Infrastructural gaps

Jordan's water infrastructure gap is characterised by insufficient and inadequate distribution systems to meet the population's demands. Approximately 94% of the population is connected to the water public network (MWI, 2023). However, supply is largely considered unreliable. Many urban and rural communities frequently experience water shortages, with supplies sometimes lasting only a few hours once every two weeks. Non-revenue water (NRW)[4] is a major issue and has been estimated at approximately 52% of extracted water. For example, an estimated average of 46.4 litres per capita per day were consumed by Yarmouk Water Company residential subscribers in 2021 — an estimated 50% of supply (MWI, 2021). The company consistently performs worse on both quantity of water supplied and NRW than utilities in other parts of the country (ibid.). The pressure at which water is delivered in the network across the country is also low, but increasing it could weaken and burst pipes. Despite efforts to improve infrastructure through investment in pipeline networks, the gap between supply and demand has continued to widen. Residents often rely on private vendors for water, generally at elevated costs.

2.5 Demand management

There are important disparities across Jordan in water consumption, which varies by geography (such as northern vs southern governorates), and demographic factors (urban vs rural), and income levels. Across the country's 12 governorates, water consumption rates could be as low as 51 litres per capita per day (l/c/d). In refugee camps consumption can be as low as 35 l/c/d, while other segments of the population consume up to 255 l/c/d (Ogata et al., 2022; UNHCR, 2024). Current measures to incentivise water savings, such as tariffs based on actual usage, have not proved effective in decreasing consumption by the wealthier segments of the population and reducing inequalities. A stronger shift towards demand management in the more affluent areas is urgently needed to promote water-saving systems with increased water reuse. This would balance out with ongoing supply-side reforms (Al-Addous et al., 2023). Regulations (such as building codes) are particularly lacking in incentives for the private sector to promote water saving.

These factors have collectively contributed to a situation of extreme water scarcity in Jordan. The arrival of refugees in the 2010s has only intensified demand for water resources which were already under pressure — estimated at a doubling or tripling of demand in some parts of the country. The GoJ expects water demand to continue to grow in all sectors, and predicts an increase of 35% per cent between 2021 and 2040 (MWI, 2023).

[4] NRW is all water that is produced by a utility that fails to generate revenue. This occurs through leaks and damage to/ageing of infrastructure, but also from theft, illegal connections and inaccurate meters.

3

Background to the study sites: Al-Mafraq governorate

The JURD project focuses on Al-Mafraq governorate, which hosts large numbers of Syrian refugees. Its capital and largest urban area is Mafraq city, where the Al-Dahiyyah neighbourhood, profiled in this study, is located. The governorate is also home to the country's largest refugee camp for Syrians, Zaatari.

Al-Mafraq governorate is located in the north-eastern part of the country and is bordered by Syria in the north, Iraq in the east and Saudi Arabia in the south-east (see Figure 1). The region is semi-arid: rain mostly falls during the winter months, with an annual average of 108–147mm (Al-Qawasmi 2021). For comparison, annual precipitation averages 300–600mm in the Western Highlands, and 50–100mm in the south (Climate Centre, 2022). Encompassing 29.6% of the total area of Jordan, Al-Mafraq is the second largest governorate after Ma'an.

The population of the Al-Mafraq governorate increased by 133% over the period between the two government censuses of 2004 and 2015. This large increase (from 14,924 to 235,784 people) was largely driven by the arrival of non-Jordanian residents, of whom over 70% were refugees from Syria (DoS 2004, 2014, 2015).

Figure 1. Location of Zaatari camp and Mafraq city, in Al-Mafraq governorate

Al-Mafraq witnessed the largest percentage increase in its population size compared to the 11 other governorates of Jordan, after the arrival of Syrian refugees in the country. Today, the three governorates of Amman, Irbid and Al-Mafraq alone host 64.5% of all the Syrian refugees in the country (UNHCR Operational Data Portal, 2025). Al-Mafraq governorate is home to Zaatari camp which hosts 67,532 Syrian refugees, with a further 71,176 Syrian refugees living in urban and rural areas in Al-Mafraq alongside host communities (ibid.).

The capital of the governorate of Al-Mafraq, also known as Al-Mafraq, but referred to here as 'Mafraq city' to avoid confusion, is an important economic and administrative centre for the region, with a diverse population and a range of commercial, educational, and governmental facilities. It is the largest per capita refugee host city in Jordan. While the cities of Amman and Irbid host larger numbers of refugees, the percentage increase in Mafraq city's population has been the greatest, with estimates suggesting the population served by the Greater Mafraq Municipality (GMM) doubled to 73,500 in the five years, 2011 to 2016 (World Bank, 2016).

The arrival of Syrian refugees has had a significant impact on Mafraq city's services — not least water and sanitation, which were already experiencing considerable challenges. While there has been recent investment in the city's water and wastewater infrastructure, the local water utility Yarmouk Water Company (YWC) (serving Mafraq and other northern governorates), is dealing with ageing infrastructure in a context of arid geophysical conditions. These issues have been exacerbated by the increased demand associated with the arrival of refugees.

The percentage of households connected to the water network in Al-Mafraq governorate is 97% (MWI, 2021). However, averages at governorate level hide considerable disparities. For example, Qasabat Al-Mafraq, the most populated district of Al-Mafraq governorate and the fourth-largest refugee hosting district in the country with 38,021 Syrian refugees in 2020 (UNHCR, 2020), has connection rates of only 28% of households for both Jordanians and Syrians (UNICEF, 2020). In addition, connection rates do not reflect a range of problems with water services, including unreliable delivery and variable water quality.

Public sewerage coverage in Al-Mafraq governorate is just 17%, the lowest across all governorates in Jordan (MWI 2023). Studies have estimated that expanding the urban sewerage systems to fully cover the cities of Irbid, Ramtha, and Mafraq would require an investment of US$300 million (Breulmann et al., 2021).

International development assistance has been mobilised or scaled up in response to the arrival of Syrian refugees. For example, the World Bank has provided financial assistance to expand WASH services for Jordanians as well as Syrian refugees, including through the Jordan Water Sector Efficiency project, a US$300 million ongoing initiative (World Bank, 2023). USAID, with its longstanding operations in Jordan, has supported with, for example the restoration of the Sumayah pump station and the construction of the Mafraq Wastewater Treatment Plant (The Jordan Times, 2016). Similarly, GIZ has offered sustained assistance to the Jordanian government, including assistance to the Water Authority of Jordan (WAJ) in improving efficiency for water pumping operations (GIZ, 2023).

Humanitarian funding has also been deployed in urban areas to support WASH services. Some of these are quite small-scale interventions. For example, the NGO World Vision has been piloting grey water reuse in Irbid at household level. Approaches also include developing partnerships with local municipalities, community-based organisations, and other stakeholders to leverage existing infrastructure and resources. One key initiative has been the provision of cash assistance or vouchers to refugees, enabling them to purchase water and sanitation-related items such as hygiene kits, water purification tablets and sanitation products. Humanitarian assistance in urban areas has also involved hygiene campaigns to promote behaviour change. Through community-based outreach programs, refugees are sensitised to the importance of safe water practices, proper sanitation and personal hygiene. There have also been measures taken to introduce Syrian refugees, who are not used to water scarcity, to water-saving strategies.

However, humanitarian organisations with a mandate to support refugees have faced challenges in the provision of water and sanitation services and/or have chosen not to respond to the WASH needs of Syrians living in urban centres. Firstly, this is more difficult than in a camp situation: refugees are often dispersed across urban areas and have diverse living arrangements and service access (see section 6. There is also the potential that assistance targeted at refugees could inflame tensions with host populations who are also suffering from water scarcity (ISG, 2019; Toppo, 2015; MercyCorps, 2013). More sustainable interventions that also assist local hosts, such as the rehabilitation or construction of water supply systems, installation of sanitation facilities, and upgrades to wastewater treatment plants run counter to some humanitarian organisations' mandates. They may be required to focus predominantly on refugees, or on temporary, emergency support (Culbertson et al., 2016). This highlights a

well-acknowledged tension within the sector as to the ultimate purpose of humanitarian WASH — to respond quickly to acute needs and then leave, or to build resilience and strengthen existing systems by working in partnership with local authorities and with longer time horizons (Luff, 2014; Diep et al., 2017; Sanderson, 2019). Political sensitivities, on the part of the GoJ, towards long-term investments for Syrian refugees may also have deterred humanitarian organisations from investing in urban areas.[5]

As a result, many urban refugee populations and their local hosts remain underserved. The absence of humanitarian actors operating in Jordan's urban areas in response to the Syrian refugee crisis was highlighted in a Médecins Sans Frontières (MSF) report entitled 'Where is everyone?' (Healy and Tiller, 2014). The authors draw attention to the fact that assistance received by Syrian refugees in the country did not appear to be based on need or vulnerability, which is meant to be at the core of humanitarian response:

Status was the principal determinant of assistance. […] In Jordan, there was a significant gap in assistance between refugees in the camp settings and those in the urban centres, and an even more significant gap between those registered with UNHCR and those (15%) who were not. (Healy and Tiller, Médecins Sans Frontières, p.16).

The MSF report notes that 'everyone was aware of the imbalances', but 'most agencies gave higher priority to their larger, more visible and more straightforward camp operations than to their smaller, more complicated and more likely to fail urban ones' (ibid. p.18). This led to a situation in which camp populations were 'over covered' for some services. By contrast, 'the assistance that urban refugees receive is not sufficient, either in breadth (numbers who receive it) or in depth (amount that they each receive)' and many are finding themselves in destitution (ibid. p.38). Others concur (Day et al., 2020 p.26), noting specifically with regards to WASH that: "the performance of the network and levels of satisfaction [in Zaatari] appear to contrast significantly with water scarcity problems faced by other communities in Jordan".

An evaluation of the first five years of the UN's WASH response in Jordan, led by UNICEF, echoes these concerns. While the evaluation authors report, on the one hand, 'crucial improvements to water and wastewater infrastructure in host communities and informal tented settlements' (ISG, 2019 p.4), they conclude that it is difficult to judge the extent to which UNICEF programming addressed needs generated by the refugee crisis (ibid.). They also note that it is difficult to identify how UNICEF 'has promoted equitable results in host communities' (ibid. p.99). Projects were reportedly both small-scale and 'general' (ibid. p.60), covering wide areas. They also note a failure to acknowledge the potentially limited improvements at household level that might be achieved from improvements to urban water distribution systems. In a similar vein, in the MSF report Healy and Tiller (2014 p.39) conclude that while a 'very large humanitarian machine' has been assembled quite quickly, it has been targeted at the most manageable interventions. It is: "significantly harder to do more complex tasks, such as the urban response […]". Shifting this focus, to incorporate other vulnerable populations outside the camps has been problematic: "once in motion, the humanitarian response has been very difficult to direct" (ibid.).

[5] The resistance towards extending citizenship rights to long-term Syrian refugee residents has been attributed to the ongoing struggle over Jordan's [state constructed] national identity. The development of a Jordanian national identity has been contentious, premised on the exclusion of an estimated half of its population who are Jordanian nationals of Palestinian origin, forced migrants to whom the state had previously extended citizenship (Massad, 2001; Gandolfo, 2012).

4

Evolution of the WASH response in Zaatari camp

In contrast to the scattered and insufficient approach to WASH provision in refugee-hosting urban areas, the humanitarian response to WASH needs in camps has been comprehensive and ambitious. Zaatari's residents currently receive well above the Sphere standards minimum of 15 litres per capita per day.[6] Consumption fluctuates, but in 2020, for example, was increased from 35 litres at the start of the year to 60 litres by December (UNHCR, 2020), and in 2024 averaged between 35 and 55 litres per person per day (UNICEF 2024). Consumption is thus comparable with average Jordanian households in urban areas of Al-Mafraq governorate (MWI, 2021), despite the semi-desert location of the camp. The following section provides an abridged history of water and sanitation provision in the camp, showing how infrastructure progressed from temporary to semi-permanent, over the course of approximately seven years, from 2012 when the camp was established, to 2019 when a networked system for water provision and wastewater treatment came onstream. This transition must be understood in a context where both the presence of refugees and the issue of water scarcity have been highly politicised.

Zaatari camp is located in Al-Mafraq governorate, in the northwest of the country, 12km from the Syrian border. The camp was opened in July 2012, and was built in weeks, as the numbers of Syrian refugees crossing the border rose exponentially, and transit centres on the Jordanian side were overwhelmed. 2012 and 2013 were the peak years, seeing 176,020 and 301,620 refugee arrivals respectively (ACAPS, 2016). By August 2012, around 10,000 refugees were arriving in the country per week. The numbers entering Zaatari slowly declined from a peak of 100 per day to around 50 per day in September 2012. By December 2012, the population of Zaatari was over 66,000 and reached a maximum of about 200,000 people in April 2013 (Ledwith, 2014). Most refugees then either found Jordanian 'sponsors' allowing them to settle in host communities, or relocated from border areas and camps to towns and cities without formal permission. The camp population stabilised in 2014 and has remained at around 80,000.

Within the international system, UNICEF is the lead agency for WASH. It initiated its refugee response in Jordan in March 2012, by setting up WASH facilities at transit centres for the relatively small number of refugees who were crossing the border at that time. A few months later, when the numbers arriving in Jordan began to rise exponentially, UNICEF was deemed to be: "the only organization in Jordan that had the resources, capacity

[6] See Sphere Association. The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response, fourth edition, Geneva, Switzerland, 2018. www.spherestandards.org/handbook

and institutional commitment to take leadership of the WASH response related to the Syrian refugee crisis" (ISG, 2019 p.80). UNHCR requested that UNICEF take responsibility for leading the WASH sector. At that time, the main priority was establishing WASH services for the Zaatari camp.

The early days of Zaatari involved WASH preparations for a temporary camp — the government and NGOs procured tents, portable sanitary facilities and trucked-in water supplies (ISG, 2019 p.27). During the period July–December 2012, UNICEF worked with Mercy Corps to establish and manage WASH services, and with ACTED for hygiene promotion (ibid. p.69). The first concern was to ensure a steady flow of water and adequate sanitation facilities (ibid. p.20).

As noted above, the camp population rose sharply in its early years but there was no master plan for the corresponding growth of camp facilities (Dalal et al., 2018). Private companies were hired to provide shared portable chemical toilets, with cleaning and emptying services while water was provided by communal water trucking from surrounding boreholes (owned and operated by private individuals) to public tanks (UNICEF and UNHCR, 2015).

According to an independent evaluation commissioned by UNICEF of the first five years of its WASH response in Jordan and undertaken by ISG: "In the emergency response phase, the WASH programme had some remarkable achievements. Principal among them, the programme supplied water and sanitation for all inhabitants of the camp including those that arrived newly each day" (ISG, 2019 p.21). However, refugees and emergency responders faced numerous well-documented problems in its early days, with overcrowding and discontent leading to violence and riots, and the camp was considered insecure (Ledwith, 2014). During the first year of the camp hygiene was poor and waterborne diseases were common (ISG, 2019 p.21). At this point, UNICEF was operating in the face of stiff resistance from the Jordanian government who were keen to avoid the construction of permanent infrastructure. This was because it feared the message this would convey — that Syrians would be present in the country for the medium to long term. One of the GoJ's main aims of its response to the Syrian refugee displacement has been to resist the permanent settlement of Syrians. They did not wish to undermine the demographic balance in the country that favoured citizens and their descendants from Transjordan — people who were living in British administered territory east of the Jordan river prior to 1946 (Ali, 2021). This resistance did eventually diminish and the hygiene situation improved as UNICEF was able to install WASH blocks and transition sanitary facilities away from mobile toilets to sealed pits and steel tanks made for sewage collection (ISG, 2019 p.7).[7]

Many of the WASH interventions in the early phase were enormously expensive. First, because rapid decision making on the location for the camp meant that it is sited over one of Jordan's largest aquifers, and there was a danger of leaching of wastewater (ibid. p.76).[8] This is particularly critical in a country dependent on groundwater extraction. Second, UNICEF was dependent on contractors to put temporary facilities in place rapidly, and at premium cost (ibid. p.7). Third, drinking water was provided by trucks, and waste was trucked away (van der Helm et al., 2017; ACTED, 2014). This resulted in numerous problems in a sector that is known to be rife with corruption and fraudulent activities, and to experience considerable 'non-revenue water losses' (Farishta, 2014 p.18).

In addition, refugees were unhappy with the more permanent WASH facilities provided for them — notably the communal shower blocks installed shortly after the camp's establishment (van der Helm et al., 2017). However, these were slowly dismantled by refugees who used the materials to build their own private facilities (ibid.), before they were eventually removed (ISG, 2019 p.21). Refugees dug pit latrines which were unlined and led to pools of contaminated water throughout the camp. By the end of 2013, roughly 60–70% of residents had built in-home pit latrines that could be individually pumped or dug out (Ledwith, 2014). Given the location over an aquifer, measures had to be taken to prevent seepage into the groundwater, including replacement of septic tank materials (ISG, 2019).

The first six months also saw the construction and operation of the first borehole, and by the end of 2013, a second borehole was in operation. Water trucking services (and de-sludging of wastewater) continued to absorb huge amounts of funding, despite on-site boreholes reducing transport costs. This prompted the humanitarian community to advocate for more sustainable approaches. Planning for water and sewerage networks began in 2013, and 2014 saw the introduction of a master plan to guide further development within the camp (Dalal et al., 2018). In May 2014, the Zaatari Water Network Technical Working Group presented a planned water network design for the camp, that included a third borehole (ACTED, 2014). Construction of the water network began in 2015, the same year this borehole became operational (UNHCR, 2015c).

[7] A discussion of the fluctuating relationship between the government of Jordan and the humanitarian actors responding to Syrian refugees is beyond the scope of this paper. However, scholars have drawn attention to the ways in which refugee-hosting governments can use 'institutional ambiguity' to generate uncertainty among aid actors, and either maintain the status quo, or indeed profit from this uncertainty to increase their power over the distribution of aid (Schmidt, 2025).
[8] For example, refugees dug an estimated 11,000 impromptu latrines all of which had to be backfilled to address the risk of leaching, in addition to the installation of wastewater collection tanks and a wastewater treatment plant.

The network consisted of an integrated piped water supply system at household level constructed in two phases (UNHCR, 2015a, 2015b). The first phase connected the three internal boreholes to 10 water reservoirs. In parallel to the first phase, main communal tanks and main transmission lines connecting the tanks were built. The first phase was completed at the end of 2016. The second phase, starting in January 2017, connected the reservoirs directly to households (UNHCR, 2015b) and was complete by mid-2019. Water and wastewater trucking continued throughout the construction of the network.

The government of Jordan accepted a donation of an automatic, compact, energy-intensive wastewater treatment system (WWTP) in 2014, which was in operation by 2015 (UNHCR, 2015d). Wastewater continued to be collected and transported by sewerage trucks until a network connecting households to the WWTP was in place. This is the only WWTP of its kind in the country with high energy requirements that have significant operational costs and environmental impact (van der Helm et al., 2017). By 2017, almost all households reported having private toilets (REACH and UNICEF, 2017).

By mid-2019, both the water supply distribution system and the sewage network were running, and trucking inside the camp for water provision and waste disposal was phased out. Demand increased during the COVID-19 pandemic, when daily water delivery rose from 35 litres to 60 litres per person (UNHCR, 2020). In 2022, although all shelters in the camp were connected to the water network, a survey showed that 30% of households said the water supply was not enough to cover all their needs (Carlisle, 2022). Key informants report that external water trucking is still required in summer months.

Overall, the ISG evaluation is positive with regards to what UNICEF achieved in the first five years of its Syria response in Jordan in the camps, concluding that:

From July 2012 through July 2017, UNICEF provided life-saving water and sanitation resources under […] difficult conditions for the approximately 400,000 people that benefited from WASH services (International Solutions Group, 2019 p.80).

A report published by Oxfam notes that: "the performance of the water supply network in Zaatari camp appears exceptionally high" (Day et al., 2020: 26). A more recent evaluation of UNICEF's WASH programme also praises the agency (IQVIA, 2022) and it should be acknowledged that UNICEF has systematically provided regular and high-quality WASH services throughout the history of Zaatari camp — in the face of numerous logistical, technical and political challenges.

5

Digging for data: what has the Zaatari camp cost?

Having established how WASH infrastructure evolved from temporary to more permanent in Zaatari camp, the team moved on to the next question: what did all this cost? Establishing an answer was critical for the overall research project, as without this data it would not be possible to compare expenditure in the camp with the cost of improved WASH provision in a refugee-hosting urban area. More specifically, the team sought to understand the cost of the 'exceptionally' high-performing network, the spend on temporary infrastructure and services prior to and during its installation, and the resultant reduction (if any) in operation and maintenance costs. Multiple and intensive efforts were deployed by the research team to answer these questions. However, there are some fundamental problems with publicly available data that obstructed these lines of inquiry.

While reports published online provide details of budget lines and funding requirements, they do not provide information on actual costs and expenditure. The team found inconsistencies in the reporting on camp activities and projects in the publicly available information. This was not limited to variances between academic articles and grey literature. Minutes from meetings of UN teams working in the camp show inconsistencies on dates, follow-up of topics, units in some instances, and the renaming of the documents at different points in time.[9]

More official documents are similarly unreliable sources for the calculation of expenditure. From 2015 onwards, the government of Jordan, in collaboration with the UN, has regularly issued Jordan Response Plans (JRPs) that reflect 'resilience' needs (meaning the country as a whole) as well as 'refugee needs' (in both camps and host communities). The plans are financing appeals and are set out by sector. They include costs for water, wastewater and hygiene promotion. However, these appeals do not reflect expenditure, and in addition, do not always distinguish between the different camps.

For example, the JRP for 2015 states that: "The recurrent and running costs in Za'atari Camp are US$9 million per annum (including water trucking, wastewater de-sludging, solid waste management, WASH blocks maintenance, WASH monitoring, hygiene promotion etc)" (UN/Jordan Response Platform 2015, p.70). However, the updated JRP for 2017–2019 puts the WASH running costs of Zaatari and Azraq together at US$2.42 million per month (or US$29 million per annum) (UN/Jordan Response Platform, 2017 p.59). Knowing that Azraq is a smaller camp than Zaatari, and that the cost of the installation of an entire water and wastewater network was estimated at US$17 million (DFID, no date-b) it seems unlikely that its annual WASH running costs could be US$20 million. With these discrepancies, and without any further detail on

[9] For example, there was inconsistency in reporting units as cubic metres vs litres, cubic metres vs 'truck-loads', and metrics per person vs metrics per day. This made tracking of quantities and changes difficult.

how these running costs were generated, the JRPs cannot be deemed reliable sources of data.

Faced with these difficulties, the team requested interviews with a number of key informants who had worked or were working on the WASH response in Jordan. While representatives of international NGOs were, in the main, willing to speak with the team, they were not able to provide data on costs. Many asserted that the individuals who 'really knew' what had been spent in Zaatari, or could estimate the split between spend inside and outside the camps, were those working within the Ministry of Planning and International Cooperation (MOPIC). Representatives of MOPIC made it clear, by email and in person that providing such data, while theoretically possible, would require considerable analytical work, which was not being done, and there were no plans to do so. In addition, multiple and repeated requests were made for interviews with representatives of UNICEF at headquarters, regional and country office levels. Only one staff member agreed to speak with the team. While he was generous with his time, and committed to providing cost data, he later explained by email, that he was not permitted to share any information on the cost of the WASH response in Zaatari.

However, the online document review raises doubts as to whether UNICEF itself has access to reliable expenditure data. This is a concern, as without it, it will not be able to judge the effectiveness of its response. The ISG evaluation consultants were tasked with assessing UNICEF's WASH programme's use of resources over the period 2012–17 and the extent to which costs to deliver water and services were optimised. They noted that:

Assessing the programme's use of resources is difficult for several reasons. First, UNICEF Jordan's financial systems are organized to manage the organization's risk, manage compliance issues, ensure operational solvency, and protect the organization against fraud. Neither UNICEF Jordan nor the WASH programme track expenditures for management purposes. The evaluation team could not obtain documentation that demonstrated expenditure by year, activity, programme component, or beneficiary group. Also, the programme does not track its indirect costs or general and administrative expense rates related to the programme, making it difficult to know the resources required to manage and execute the programme or to compare that to other similar programmes.

They continued:

The WASH programme was able to provide some documentation regarding contract expenditure and Programme Cooperative Agreements (PCA). The evaluation team was provided information that accounted for US$268,614,178 of the approximately US$355 million that the programme managed between 2012 and 2017. However, the evaluation team notes that some significant agreements were missing from the documentation, such as PCAs with Mercy Corps, which financed Za'atari's boreholes among other activities (ibid. p.64).

The evaluation thus cannot provide disaggregated data on the cost of WASH provision in Zaatari over the period. Some estimates are provided on efficiencies gained over the course of the evaluation period — for example the unit cost of water in Zaatari declined significantly in the years between 2012 and 2017, as a result of the network development described above.[10] The evaluation also provides estimates of the ratio of expenditure on camps in relation to other geographic areas, suggesting that 63% of the total spend on operations has been on camps. However, this includes Azraq camp, as well as the two smaller camps in the country.

There is a second evaluation in the public domain, covering the period 2018–2022, also commissioned by UNICEF, but carried out by different consultants (IQVIA, 2022). But again it contains very little discussion of expenditure. The overall budget for the Jordan WASH programme for the period is stated to be US$139 million, but no further breakdown is given on geographical location of the spend, in either actual US$ amounts or as a ratio. The report provides a table showing yearly planned versus funded amounts for the four years of the programme (IQVIA, 2022 p.48), but, inexplicably, neither the total planned nor the total spent is equal to US$139 million. Interview questionnaires are included in annexes, suggesting that a series of questions relating to cost efficiency were posed to UN, GoJ and water utility representatives. Interview guidelines included the following:

Was the programme or project implemented in the most efficient way compared to alternatives? (Probes: quality, cost, time, stakeholder satisfaction, performance; Extent to which the costs to deliver water and wastewater services rationalized and optimized in the camps and settlements; cost saving/cost-minimization strategies; Comparison

[10] It is estimated that the cost of water per m^3 fell from US$6.44 to US$2.55 after the installation of the network, and that the cost or wastewater per m^3 fell from US$5.64 to US$1.94.

to similar situations at the local or regional level; Could more cost effective operations/interventions have been undertaken at an earlier stage; other alternative implementation modalities that can be explored? […] (IQVIA, 2022, p.xli).

However, responses to this question or follow-ups are not recorded. The evaluators note that the budget allocation was spent, and somewhat surprisingly, take this as an indicator of cost-efficiency: "It is noted from the analysis of budget utilization data that UNICEF utilized 100% of the allocated budget, across all the years from 2018 to 2021, to ensure cost-efficiencies." (IQVIA, 2022 p.41).

As a last resort, the team undertook an analysis of data uploaded to the International Aid Transparency Initiative portal (IATI). The IATI standard and portal developed out of a series of debates about aid effectiveness and accountability held in OECD-coordinated High Level Forums in the early 2000s, culminating in Busan in 2011 (Pamment, 2016: p.142). IATI was designed to provide a common standard for publishing information, and to establish an online registry to hold the data. While scrutiny of information on the portal did reveal a great deal about reporting standards and transparency on the part of UNICEF, it did not clarify any of the issues around cost.

The team filtered the IATI data to find all UNICEF WASH projects in Jordan between 2008 and 2019. Within each project, there is a contract award document in PDF format. These were converted into a '.csv dataset' for ease of analysis, and each budget line item, if it was sufficiently descriptive, was then manually tagged by:

- Type of costs: operational expenditure, capital expenditure, staff, communications, other or unknown
- Nature of costs: water or sanitation, both or unknown
- Nature of costs sub-categories: water trucking, water boreholes, wastewater treatment and so on
- Location of project or spending: Zaatari, Azraq (second-largest camp), other locations or unknown location.

This tagged dataset was then used to produce spending breakdowns for UNICEF Jordan and then for Zaatari only (where it had been identified). A final analysis gave the distribution of reported budget line items. It revealed the number of small-line items which were uploaded to the IATI, and how many large items with no disaggregation or 'taggable information' were included. The small items could be as little as US$30 for ring binders and spray paint, while the largest was for US$1.4 million with the same amount of information.

Of the US$268 million figure referred to in the ISG evaluation, line items could only be found for US$90 million worth of spending on the IATI portal.

This analysis revealed that there was no data in IATI for the years 2011–2014, although UNICEF took over provision of WASH in Jordan in 2012. Although some figures do exist for the years 2015–2020. The totals recorded under UNICEF's projects were far lower than the overall costs estimated for the response by ISG. Many line items (totalling US$5.7 million), could not be tagged by type, and those with a total value of US$60 million had no data on location. Almost no spending on sanitation was recorded or identifiable and, although some line items were provided for fuel or energy (such as for trucking or pumping), this was not consistently recorded. Finally, UNICEF data itemised trivial amounts spent on ring binders and posters for donor visits, but contained no breakdowns for large construction tenders or framework agreements. This suggests that it is possible for records to be kept, but that they are either not kept or were not provided to the IATI. It is simply not possible to determine what has been spent, in total, on the WASH response in Zaatari camp.

From the entire document review on WASH investments in Zaatari, the one significant data point that appears most reliable is the cost of the WASH network that was installed in Zaatari camp in two phases between 2014 and 2019. A press release from UNICEF, states the cost as 51 million Euros.[11] Reporting from the UK's then Department for International Development (DFID), one of the main donors, would suggest that Phase I cost US$26 million (DFID, no date-a) and Phase II US$30 million (DFID, no date-b). A DFID project completion report notes that the US$30 million figure for Phase II includes operation and maintenance costs for 12 months, but provides no further detail (ibid.).

Taking fluctuations in exchange rates into account, the total of US$56 million from DFID reports and the €51 million from the UNICEF press release are roughly comparable. For the purposes of the comparison with the networked solution for Al-Dahiyyah discussed in the next section, we will take the figure of US$55 million as the cost of the network in Zaatari. It should be stressed here that overall WASH expenditure in the camp was many multiples of US$55mn between 2012 and 2019. UNICEF WASH budgets over the period, for the whole Jordan response, amount to approximately US$494 million, according to the two evaluations cited above (ISG, 2019 and IQVIA, 2022). The percentage spent on camps is unknown (perhaps unknowable) but was estimated at 63% of the overall spend in the first evaluation (ISG, 2019).

[11] https://www.unicef.org/jordan/press-releases/environment-friendly-and-cost-efficient-water-and-sanitation-network-zaatari-camp

6

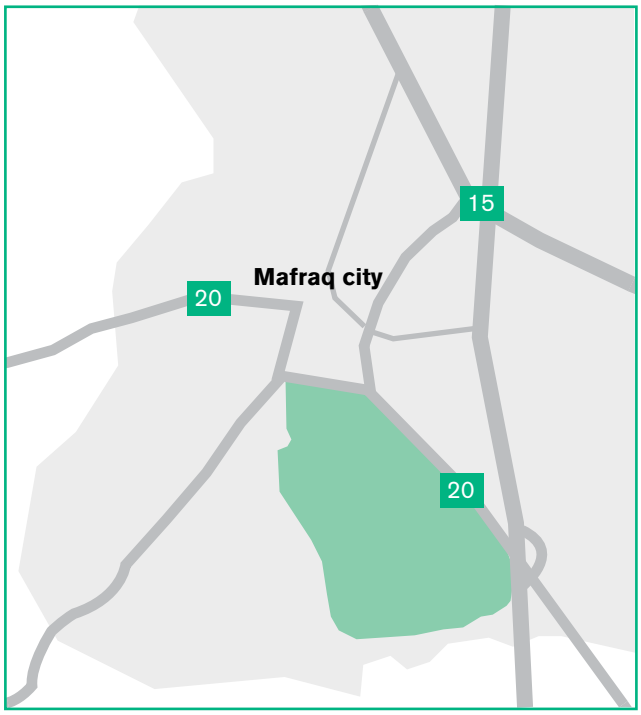
Understanding the WASH challenges in a refugee-hosting urban setting

While the costs of the camp are not clear, the story of Zaatari is well-documented, and there is considerable material online detailing the significant efforts made by the humanitarian community to maintain and then improve the provision of WASH to camp residents. In contrast, the experiences of urban refugees, who are living with water insecurity and associated vulnerabilities around WASH, are relatively under-researched. Filling this gap in data and understanding was one of the aims of the JURD project. The team deliberately selected an understudied neighbourhood on the outskirts of Mafraq city for an enquiry into WASH access for urban refugees, so as to also address the lack of research on low-income, refugee-hosting communities in secondary cities in Jordan.

In contrast to the camp-based response detailed above, where the primary target of interventions is a refugee population whose living situations differ quite considerably from the local population, refugees in urban areas share many of their struggles to access water and sanitation with host communities. In Jordan, the needs of low-income urban communities have been underserved for many years. This paper will now examine WASH services in the Al-Dahiyyah neighbourhood in Mafraq city, presenting results from a small-scale non-representative survey and data from qualitative interviews. The survey and interviews focused on water practices, access and costs and paint a detailed picture of WASH challenges for low-income Jordanian households, as well as their Syrian refugee neighbours.

Dahiyyat Al-Malik Abdullah, or Al-Dahiyyah for short, is a peri-urban neighbourhood of Mafraq city (see Figure 2) covering approximately 7km^2. Al-Dahiyyah was identified as one of five neighbourhoods in Mafraq city that had received significant numbers of Syrian refugees since 2012. Refugees and migrants make up 44.5% of the neighbourhood's total population (15,745 residents), with Syrian refugees accounting for 36.5% of Al-Dahiyyah's residents (DoS Census, 2015). While it is less dense than more central neighbourhoods in the city, unlike more centrally-located neighbourhoods, it is partially disconnected from services, including WASH provision.

Figure 2. Map showing Al-Dahiyyah neighbourhood (shaded green) in the southeast of Mafraq city



Source: Google Maps

6.1 Demographics

The survey showed that respondent households in Al-Dahiyyah comprised an average of five members (two adults and three children), and the ratio of men to women is 50/50 on average, although the percentage of women respondents to the survey was significantly higher (at 69%). The youngest respondent was 19 years old and the eldest 77 years, the average age of respondents being 42 years (see Figure 3). Most respondents were married (79%) followed by widowed (11.5%).

The survey revealed wide ranging vulnerabilities across the sample of displaced and host households. The majority of households (71%) earn less than 351 Jordanian Dinars (JODs) a month equivalent to US$494.86 (see Figure 4).[12] Almost half the survey respondents reported that their household's main breadwinner had only completed primary school (see Figure 5), and 23.3% reported that this main breadwinner was illiterate.

Most of the housing in Al-Dahiyyah comprises bungalows/single storey homes (58%) followed by apartment blocks (42%). Most residents are tenants (72%). Syrian refugees are much more likely to be tenants (95%). Almost all premises have a flat roof (92%) where water storage tanks are generally placed. A small number of households (5%) have an underground water tank which they use to store water and pump it to their household tanks when they run out. The majority of households do not have a solar water heating system (93%).

Municipal water is not the main source of drinking water. Most respondents (69%) say water quality is insufficient for drinking purposes. Just under 40% report using municipal water for drinking and 61.9% of households report purchasing 20L water in 20 litre bottles for drinking purposes. Around 44% report treating municipal water before drinking it, with commercial water filters being the most common home treatment process (86.3% among treatment options). Boiling water before drinking it is not common, only 19% of respondents use this method.

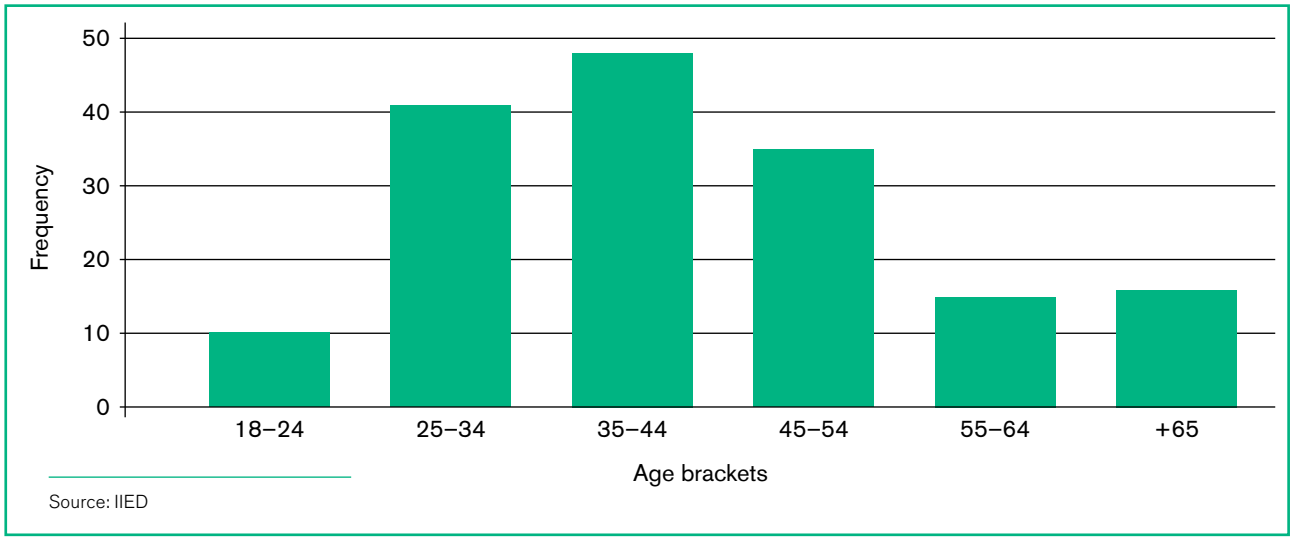
The majority of households heat water before bathing (92%). Many do not use electric-based boilers even if they have them because of the energy costs involved. Only 4.3% of households used solar systems to heat water for bathing, largely because they are not widely installed. Most households do not use a shower because of water scarcity, using a bucket and jug instead (60.6%).

The majority of households reported having sufficient water to wash hands (93%) and reported doing so with water and soap (99%). The main uses of municipal water as reported by respondents are: cleaning the home (98.7%), personal hygiene and bathing (97.3%), washing clothes (94.6%), washing dishes (manually) (86.6%), and horticulture (62.4%).

Less than half of all households (41.2%) reuse water within the household. Those that do re-use it for horticulture (57.4%), cleaning the home (47.1%) and toilet flushing (23.5%).

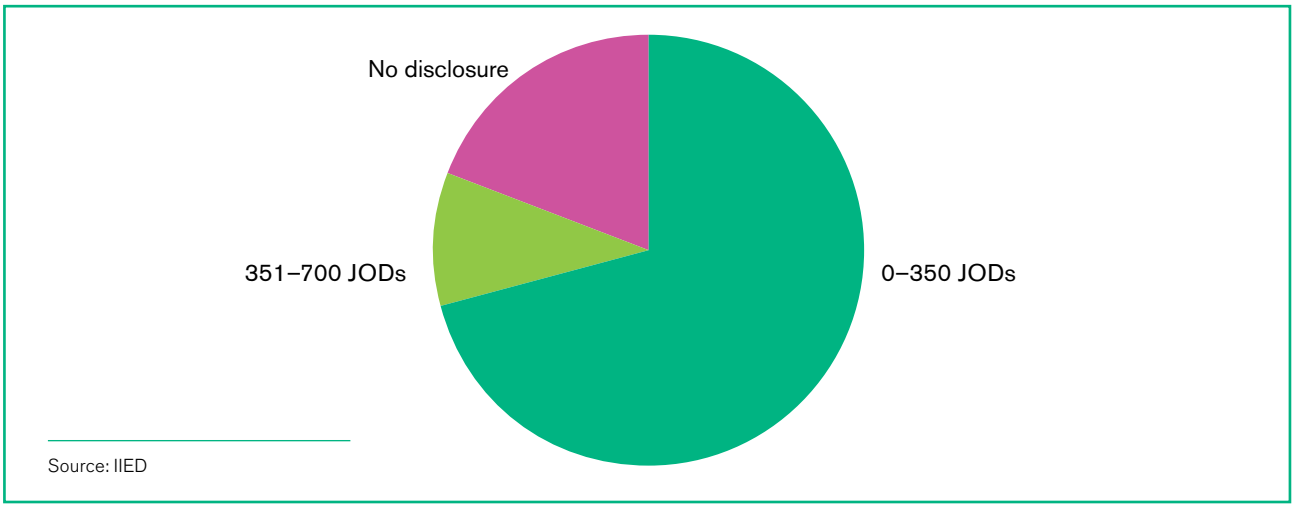
[12] The living wage for Jordan was calculated at 361 JOD per month in 2022 when the survey was conducted, indicating that the majority of the residents are earning below the living wage. The minimum wage in Jordan is 260 JODs for Jordanians and 230 JODs for non-Jordanians, but there are longstanding calls for an increase as it no longer reflects living costs.

Figure 3. Age range of survey respondents Al-Dahiyyah neighbourhood



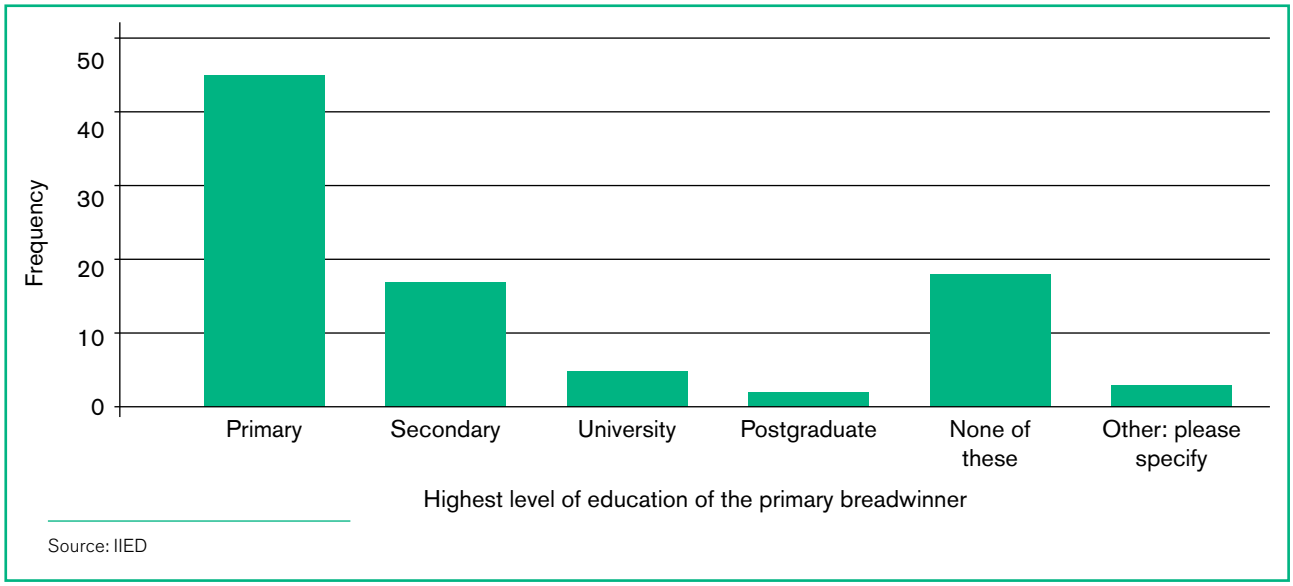
Source: IIED

Figure 4. Monthly income of survey respondents



Source: IIED

Figure 5. Level of educational achievement by main breadwinner



Source: IIED

6.2 WASH access

The qualitative interviews identified three types of water users in Al-Dahiyyah:[13]

Type 1: Users connected to both water and sanitation networks

Type 2: Users connected to the water network only

Type 3: Users disconnected from water and sanitation networks

Over 90% of survey respondents are connected to the water network (Types 1 and 2). Just over half of these households (54%) report water being supplied once a week through the rationing system, and 44% report receiving it twice a week. The number of hours of water supply vary, with most (58%) receiving it for less than 8 hours per week. Residents rely on storage tanks, filled during the water supply hours, to cover their water needs in between.

Water insecurity is a big issue for all Al-Dahiyyah residents. Over 80% state that water access, or lack thereof, causes stress within their households. Even among households connected to the water network, the limited amount of water received through the rationing system, the low pressure, as well as the unpredictability of water provision especially in summer, leave them 'water insecure'.

Over half of respondents (54%) said the amount of water they receive from the public utility, YWC, is insufficient to meet their needs, and 65% reported needing to purchase additional water from other suppliers. Additional water sources included private vendors/trucked water (79.4%) and 20 litre bottles of drinking water (62%) from shops.

Qualitative interviews revealed how water insecurity intersects with displacement status and socio-economic vulnerability. Households less able to buy additional water from private vendors were also the ones most likely to need it — either because they lived in areas disconnected from the water network (Type 3 households) or because, despite being connected, they could not afford a water pump. Interviewees said water pumps were essential for filling water tanks given the low water pressure in the network, especially in the summer months:

"People won't give you a chance to fill up your tank, the people [around us] have pumps and they are all extracting water, they don't leave us a turn. They say they also need water. Would they agree to switch off their pump for us to fill up before their tanks are full? They'd refuse. We only get water once everyone in the neighbourhood finishes filling up. Whatever is left, some weeks we get water, others we don't manage to fill the tank before the water supply is cut off." Displaced Syrian household member, Al-Dahiyyah (March 2022).

Type 1 households are the closest to Mafraq city centre, with Type 2 households further away and Type 3 households on the outskirts of Al-Dahiyyah. Water insecurity was highest amongst Type 3 households, who were fully dependent on water vendors. Most reported choosing to live in this disconnected zone because of the lower rents, as it was considerably cheaper than connected parts of the neighbourhood. Urban refugees in Type 3 households shared how their lack of connection to water and sanitation networks, and reliance on water vendors, resulted in them incurring debts to private tanker owners that they are unable to pay back. This made them even more water insecure, as water vendors were not returning their calls or meeting their requests to deliver water:

"If you want housing that is connected to water and electricity, the rent is high … the difference [in rent] is over 75 dinars (per month) … We are not connected to the water mains, and it takes so much out of you just to get a private water vendor to come. You are under their control, their mercy… You call, the phone keeps on ringing, but he doesn't pick up … I owe him 45 JODs for water, no, 47 JODs. What can I do?" Displaced Syrian household member, Al-Dahiyyah (June 2022).

All Type 3 households that participated in the qualitative interviews were Syrian refugees. Asked about who their neighbours are, all participants responded that everyone on the street and the next one was Syrian, suggesting that refugees are over-represented in 'water disconnected' areas of the neighbourhood. However, this finding could not be triangulated with the survey as the survey was not representative, so the over-representation of displaced residents among Type 3 households cannot be statistically established at this point.

[13] Type 1 households accounted for 52% of the survey sample, Type 2 households 39%, and Type 3 households for 7%. It is worth noting that the survey is not representative and these percentages do not reflect actual access to WASH services in the neighbourhood.

Turning to sanitation, limited connections to the wastewater network, and reliance on septic tanks/cesspits[14] were associated with a range of social and health risks. Tanks should be emptied regularly, but this was rarely the case. Interview participants shared stories of children sinking into the ground around the tanks while playing outdoors (the soil surrounding the tanks becomes saturated and weakened from irregular maintenance and emptying). They also reported an incident when two people died while digging a septic tank, because the neighbour's tank collapsed on them. Other reported challenges included odours that became unbearable in the summer. One participant described the impossible choice of either keeping windows closed to keep the odours out, but suffocating from the heat, or opening them to get a breeze in but feeling like 'you are living in your bathroom'. Participants also reported increased insects and bugs, especially in the summer, and shared concerns over the health risks this generates.

Finally, the qualitative research also exposed gendered experiences of living with water scarcity. Women are largely responsible for household chores around water, such as cleaning, washing, and bathing children, and poor water quality and water insecurity had a significant impact on their lives and the reinforcement of their gender roles. Participants also shared that adequate water is critical to managing menstruation with dignity. As one participant shared, it was particularly uncomfortable not having sufficient water to shower after the menstrual cycle:

"It is really difficult [during that time of the month], there is more need for water, you need to do more loads of laundry, to change your underwear more regularly, wash more regularly. It is difficult." Displaced Syrian household member, Al-Dahiyyah (June 2022).[15]

6.3 WASH costs

The survey revealed that Syrian refugee households pay an average of JOD10 per month for municipal water, while Jordanian households pay an average of JOD16 per month. The average spend per household member is also higher for Jordanians who spend JOD3.7 per capita on average compared to JOD2.1 per capita spent by Syrian households. Jordanian households also spend more on supplementary water from private vendors, paying an average of JOD20 per month compared to JOD15 paid by Syrian households.

However, qualitative interviews identified that Syrians may be paying more per cubic metre of water than Jordanian hosts. Most Syrian refugees living in Type 1 and 2 households reported being connected to a 'joint' water meter, meaning that they were living in a building with multiple separate units, but sharing one water meter. This was not the case for Jordanian families in the study. Syrians reported that applying for individual water meters was a complicated process, and that they were reliant on their landlords who were often unwilling to pay for individual meters to be installed (incurring a minimum cost of JOD 200). The situation has direct implications for how much tenants pay for their water, as well as contributing to low pressure in the network.

This is because YWC, along with other water utility companies in Jordan, apply different water tariffs depending on consumption. The more water consumed, the higher the unit cost. When multiple households share a meter, they are charged at a higher rate. As a result, even when households on a shared meter consume less water than their neighbours with individual meters, they pay more per cubic metre.

Furthermore, calculations made by YMC to determine supply are based on the number of meters registered to the network in a particular area, on the assumption that each registered water meter represents an average individual household. When multiple households are connected to a single meter, less water will be supplied by the utility than required, exacerbating problems with low pressure.

Similarly, Type 3 households who are totally reliant on water vendors also pay more per cubic metre of water, as the cost of water from private tankers is up to four times higher than municipal water, which is subsidised. This further increases water costs and unaffordability for the most vulnerable urban refugees.

The survey found that Jordanian households not connected to a sewer network report higher costs for emptying septic tanks than urban refugees (JOD38 on average compared to JOD29 for Syrian households). They also report emptying them more regularly.

All households (displaced and host) pay an average of JOD27 per month for gas and electricity. Expenditure on fuel is relevant, as electricity is required for pumping water when pressure is low, and gas can be used to heat water for bathing. It is worth noting that although monthly costs were similar for refugees and hosts, host households could claim back a government subsidy to support them with energy costs, but urban refugee

[14] The most common sanitation option reported by households appeared to be combination of a septic tank and a cesspit, where a deep hole is lined with cement on the sides but not on the bottom, and which requires regular emptying.
[15] Having water to shower after a menstrual cycle is completed is significant for practicing Muslim women as it is a religious requirement to do so prior to praying. So the lack of water is interfering with their ability to practice their religion.

households are unable to do so. Several urban refugee households reported going without heating their water prior to showering, even in winter:

"In winter, we must do without warm water… We have a heater but we haven't switched it on once this winter. Not once. If we did, we wouldn't be able to afford the electricity bill that would arrive." Displaced Syrian household member, Al-Dahiyyah (March 2022).

Finally, in relation to hygiene, qualitative interviews found that some urban refugee women experience period poverty and are not able to afford sanitary towels.

6.4 Al-Dahiyyah and urban WASH gaps

The findings from this component of the study suggest an intersection of displacement status with socio-economic vulnerability and water insecurity. Vulnerable urban refugees have unequal access to water, and many are paying more for their water either because they are dependent on private water vendors (if living in more affordable but disconnected parts of the neighbourhood) or because they are on a shared meter. Even amongst connected households, water supply is intermittent and unreliable, and access to it is dependent on pumps, which require electricity.

This not only points to a significant gap in the refugee response in urban areas, but also to the missed opportunity for an integrated humanitarian–development approach to water vulnerability. In a context like Al-Dahiyyah, where over a third of residents are refugees, initiatives to bring refugee-focused organisations into dialogue with municipalities and utility providers could identify programming that meets the needs of vulnerable refugees, while supporting urban resilience. Al-Dahiyyah can serve as a test case for exploring possible interventions that bridge the humanitarian–development divide and support both urban refugees and the hosts they live alongside.

Very little publicly available data existed on Al-Dahiyyah prior to this study. Yet, Al-Dahiyyah, and other irregularly occupied neighbourhoods like it, have provided accommodation for tens of thousands of urban refugees across Jordan. Peri-urban areas of Jordan's towns have grown quickly over the past decade, as refugees settle in these poorly-serviced zones where rents are cheaper. These areas are classified as 'unorganised' by the municipality and fall outside the boundaries of urban development plans. Absent from plans and largely ignored by humanitarian actors, Al-Dahiyyah's urban refugees, and many like them elsewhere, are geographically and metaphorically on the margins.

7

Solutions for WASH equity in Al-Dahiyyah

JURD's third component, a scenario-building exercise, draws on findings from the first two work packages to explore economically sustainable interventions that could provide water security for urban refugees and hosts. The investment in WASH in Zaatari has delivered water security for its residents, but at significant financial and environmental cost. Meanwhile, the majority of Syrian refugees in Jordan live outside of camps, in neighbourhoods like Al-Dahiyyah, where they experience challenges linked to pre-existing weaknesses in water infrastructure (such as unreliability of water provision and low pressure) as well as additional, intersecting inequalities that emerge from displacement status and socioeconomic vulnerability. JURD's third component attempts to respond to the overarching research question: what could be achieved in terms of improved WASH provision in a refugee-hosting neighbourhood in Mafraq, with the same level of resources spent on Zaatari camp?

In exploring potential solutions to WASH challenges in Al-Dahiyyah, the team paid particular attention to the environmental sustainability of the interventions, and their potential to respond to projected population growth for the neighbourhood. The former, in particular, does not appear to have been an overt consideration in the camp-based response — not least given its siting over an aquifer. The choice of an energy inefficient wastewater treatment plant and the limited reuse of grey water further underscores the missed opportunity to ensure that humanitarian WASH action in the camp can complement sustainable development goals and targets on water — or at the very least, not undermine them.

Potential interventions for Al-Dahiyyah are presented in three sub-sections below. Firstly three scenarios for water are presented, one of which is based on the construction of a network. Secondly, three sanitation scenarios are presented, also including a networked solution. Thirdly, the two networked solutions for water and sanitation are developed and designed more fully, as well as costed. These two solutions are prioritised in the analysis because the installation of networks is the best guarantee of universal access. They also correspond most closely to the networked systems installed in Zaatari, allowing for a comparison of costs (detailed in the next section) and highlighting the missed opportunities for sustainable investments in WASH infrastructure and services in low-income, refugee-hosting urban areas.

7.1 Addressing water insecurity

This section sets outs three complementary solutions that would support water security in Al-Dahiyyah. It builds on an understanding of the current challenges to WASH provision in the neighbourhood, drawn from survey data as outlined above, and key informant interviews with the water utility. These solutions are:

1) Water solution 1 (WS1): Addressing non-revenue water loss in the current network
2) Water solution 2 (WS2): Supplementing current supply with rooftop rainwater harvesting and storage
3) Water solution 3 (WS3): Developing a new water distribution network with a sectoring strategy.

Water solution 1 (WS1), addressing non-revenue water loss in the current network

WS1 proposes investing in equipment for detection technology such as advanced sensors, detectors, or monitoring systems, alongside a proactive and regular maintenance schedule. This solution responds to existing issues in the network including water loss or non-revenue water, blockages in current network impacting reliability of water access for households in affected parts of the neighbourhood (caused by dust, soil, or other residues in the pipeline), and the high labour and associated costs of current methods of dealing with blockages (digging holes to identify cracks or leaks in old pipes or clogs/blockages in good ones)[16] The proposed alternative technologies can provide real-time data on the condition of the pipelines, helping to identify and address problems more efficiently. By coupling this with routine inspections and maintenance to prevent potential problems before they escalate, WS1 would replace the current practice of relying solely on user reports to identify clogging issues or leaks. It is worth noting that, given Jordan's water rationing strategy, water is not continuously pumped through the network. The resulting fluctuations in pressure lead to the acceleration of pipe degradation and increased maintenance and repair costs. These factors need to be considered in planning.

Alongside this, the landlord practice of joint water metering needs to be addressed to ensure sufficient water is entering the distribution network, to solve the issue of low pressure for connected households, as well as higher tariffs. The policy framework to address this already exists, and implementation can be encouraged via grace periods and other incentives for landlords (Fakhoury and AlHaddadin, 2023).

Water solution 2 (WS2), supplementing with rooftop rainwater harvesting and storage

WS2 can contribute to the challenge of water scarcity and groundwater depletion in Jordan in a limited way. Rooftop rainwater harvesting has the potential of creating new, decentralised sources of water that reduce dependencies on aquifers, which are currently over extracted. This solution entails setting up rooftop harvesting systems, as well as storage solutions for collecting rainwater for later use. This needs to be coupled with an education campaign on what harvested rainwater can or cannot be used for (cleaning, and small garden irrigation purposes). Based on average rainfall data for Mafraq city, an average home (with 100m^2 rooftop space) will harvest an average of 15m^3 during the rainy season. This represents 8% of the total demand of water per family based on the average household size (of five members) in Al-Dahiyyah. Yet, space needs for the storage tanks will reduce the available roof area, and with over 40% of residents of Al-Dahiyyah living in apartment blocks, that roof space will be shared by several families, significantly reducing the 8% per household contribution to less than 1%.

Other factors to consider when assessing the viability of rooftop rainwater harvesting are the patterns of rainfall, with declines in average rainfall amounts recorded since the 1970s attributed to climate change, with further reductions of up to 37% projected. Therefore, while an important supplementary and decentralised solution, that enables making the most of every drop of rainfall, a more detailed cost–benefit examination of this solution is needed in light of its sustainability and contribution.

Water solution 3 (WS3), a water distribution network based on a sectoring strategy

WS3 aims to ensure all households are connected to a water network, enabling universal access for all Al-Dahiyyah's residents. By making utility water available to all residents, it mitigates the vulnerability that results from being reliant on private water vendors. WS3 is designed on the basis of a circular loop supply system, instead of the tree branches or the 'dead end' system currently implemented. The proposed circular loop design is conceived with the aim of enabling a continuous flow of water to each household, even when clogging occurs in a single pipe or node (more in 7.3.1 below). This can be further enhanced by dividing Al-Dahiyyah into sectors that each receive water at different times (with the sectors drawn up based on factors including topography and population density). This is based on transferrable evidence and best practice from irrigation network design, where sectoring has been shown to provide water use efficiency as well as considerable energy savings (Fernández García et al., 2017). It is not widely used in water network design as most countries aim for water to be provided and available to their citizens at all times. However, in a country like Jordan where a rationing system is already in place, and where water is not continuously available, drawing on sectoring strategies from irrigation network design could further minimise potential water disruptions while supporting water pressure and reliability on days when the households are due to receive water.

[16] Water loss addressed by this scenario is physical (ie it responds to leaks and inefficiencies in existing infrastructure). The scenario cannot address water theft, which is also a form of non-revenue water. While some water theft is small-scale and localised, it is also a political issue when practiced by various powerful groups (such as large farm owners), bringing them into confrontation with the state.

WS1 and WS2 can play an important role in enhancing water access, but cannot achieve equitable access for Al-Dahiyyah's residents on their own. However, they have a vital role to play in ensuring the limited available fresh water (from aquifers and rainwater) is utilised as efficiently as possible. If fully implemented, they can achieve a small net gain of water, a very welcome contribution in a water-scarce setting like Jordan. Within a broader multifaceted water security plan, WS1 and WS2 would supplement WS3 to achieve best results, but they cannot replace WS3.

Coupling WS3 with a well-developed WS1 will ensure the network is well maintained and will support its longevity. Nevertheless, a wider drought adaptation strategy and water resource management strategy is still required to ensure that mechanisms for more universal access (such as WS3), when implemented, are able to deliver on their universal promise.

7.2 Addressing sanitation gaps

The project's engineering team developed three solutions to support access to sanitation in Al-Dahiyyah:

1) Sanitation Solution 1 (SS1): A network of community septic tanks/cesspits
2) Sanitation Solution 2 (SS2): Water recycling and reuse at household level
3) Sanitation Solution 3 (SS3): Improvement and expansion of current sanitation network (and eventually, establishing new treatment plants)

Sanitation Solution 1 (SS1) proposes a network of community septic tanks/cesspits

This solution responds to findings from fieldwork in Al-Dahiyyah — that many households with individual septic tanks/cesspits are not able to empty them regularly, or undertake routine maintenance, generating risks to public health and safety. It is designed to respond to differing population densities and topography across the neighbourhood. It is assumed that the utility company would be responsible for managing, maintaining and regularly emptying tanks/pits in return for a fee. This would have the additional advantage of being more cost-effective than emptying individual septic tanks/cesspits. However, financial and environmental costs remain embedded in the solution, as waste must be trucked away. Issues around odours and insects may also persist during summer months — even with regular emptying. In the longer term, a more sustainable solution would be to connect households to the sewer network rather than a community septic tank/cesspit.

Sanitation Solution 2 (SS2) proposes mechanisms for supporting water reuse within the household

This would reduce the amount of freshwater used for household tasks that do not require potable water (for example, toilet flushing, patio cleaning, or watering non-edible plants). The challenge of reducing freshwater use is pertinent, given that the majority of it comes from over-extracted aquifers, with almost 60% of respondents to JURD's survey stating they do not recycle water within the household. The proposed design is a decentralised, household level system that allows for the reuse of greywater for household tasks without it requiring additional treatment or entailing energy costs. SS2 proposes a differently coloured tank to collect and store water from washing machines and showers, to make it available for other uses.

While a promising and potentially low-cost solution for reducing freshwater consumption, this scenario does require further study to ensure feasibility, including running pilots to calculate the amount of water this solution generates for reuse and average saving per household, identifying the household tasks where this greywater can be safely reused, and confirming safe storage options along with any possible adverse effects.

Sanitation solution 3 (SS3) is a networked solution based on optimising the current network and then expanding it

This proposal responds directly to issues with the current network including: inactive sewer connections because of elevation differences, limited reach of network, and current under-utilisation of existing treatment plants. SS3 proposes a three-tiered approach (more under 7.3.2) whereby the existing sewer network is optimised, followed by an expansion of the network to link it to an existing treatment plant that is currently operating under capacity, and a maintenance programme. In the future, a new treatment plant will need to be factored in (or capacities of existing ones expanded) as Al-Dahiyyah's population grows. Currently, calculations suggest that existing treatment plants would be able to handle the additional amounts of sewage generated through the network if it is expanded to cover Al-Dahiyyah.

Optimising and extending the sewer network is the surest way of capturing and reusing the largest amount of water possible. In an arid country like Jordan, expanding the sewer network would contribute greatly to improved water security. Approximately 70% of domestic water is released as wastewater, most of which could be recovered, if it is properly treated.

The agricultural sector currently uses 99% of all treated wastewater, but still also draws on 51% of all surface water and 37% of all groundwater too. The limited treating of water is therefore currently a missed opportunity to reduce uptake of precious groundwater and surface water sources. If the amount of treated wastewater was increased and directed towards agriculture, then the sector's reliance on surface water and groundwater would decrease, supporting the environmental sustainability of aquifers allowing them to recharge, and ensuring freshwater is reserved for other purposes. Hence, wastewater should be seen as a resource and invested in as such. There is significant potential for reducing dependence on freshwater resources through the expansion of sewerage networks and treatment plants.

7.3 The networked solutions

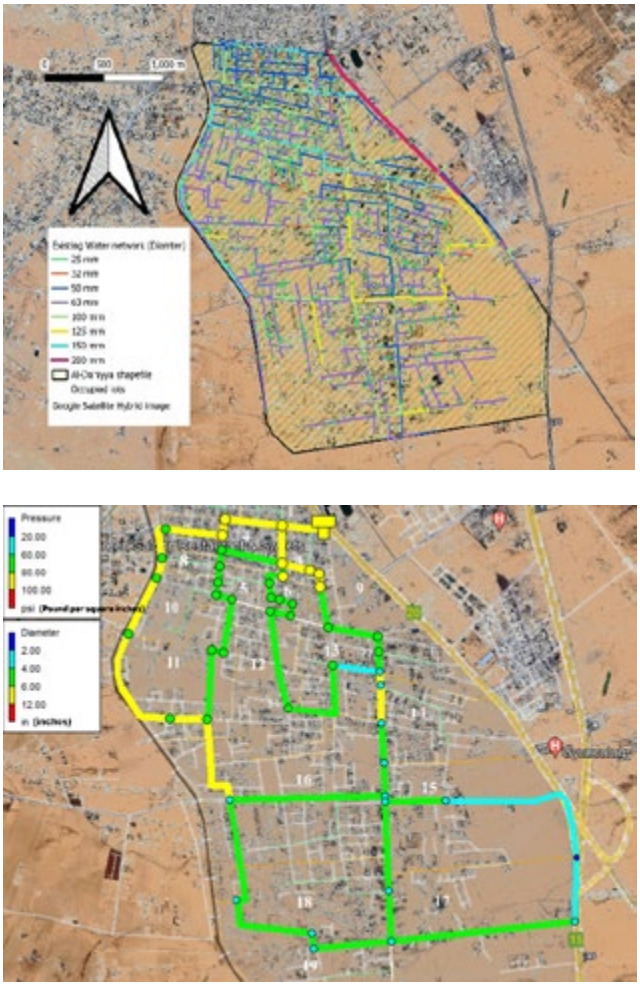
This section further develops the networked solutions, WS3 and SS3. They are the best way to guarantee universal access to WASH in Al-Dahiyyah, and also allow for a comparison with the networks installed in Zaatari camp by humanitarian WASH actors. The section also presents a preliminary costing exercise to examine the costs and benefits of an urban WASH response that aligns with sustainable urban development goals. To ensure proposed designs are forward looking, sustainable and resilient, the technical specifications and associated costs are calculated on the basis of accommodating population growth in Al-Dahiyyah for the next 30 years. The current number of residents in Al-Dahiyyah in 2024 is estimated at 30,187. The population is projected to reach 264,285 in 30 years.[17]

7.3.1 Networked water

Data provided by YWC reveals that there are currently 2,907 water subscribers in Al-Dahiyyah (out of an estimated 5,805 households), with a further 862 applications made by residents in the past year to be connected. The network is therefore estimated to cover 50% of households in Al-Dahiyyah. However, the proposed design is not based on a simple expansion, as several of the pipes in the existing network need to be replaced with larger ones. Key informant interviews identified that some of the issues within the existing network are due to new connections being linked to old pipes designed for single households, which now serve multiple households. This causes strain in the system, increasing water loss, and reducing water pressure. The costings provided for this solution therefore factor in a new network based on replacing existing pipes and installing new ones able to support a population of up to 264,285 residents.

The current water network in the neighbourhood is made up of a series of 'dead end' branches of diminishing diameter pipes, stemming from the mains supply pipe, marked red in the map on the top of Figure 6, below. WS3 proposes a circular loop system instead, as in the design on the bottom of Figure 6. This has numerous advantages, including the ability to bypass clogging in one individual connection, promising greater reliability in water provision. The proposed system also responds to population density, putting in place a series of secondary loops in densely populated areas, so as to provide stronger water pressure, and taking future population growth into account.

Figure 6. Existing 'tree branches' water network (top) and proposed circular loop design (bottom)



Source: Images created for JURD via QGIS software based on data shared with JURD by YWC.

[17] Population estimates are based on 2015 census population data and the growth rate for Al-Mafraq (of 5.5) and calculated on the basis of the formula $P = P_{initial}$ [2015] * (1+growth rate)^{year}

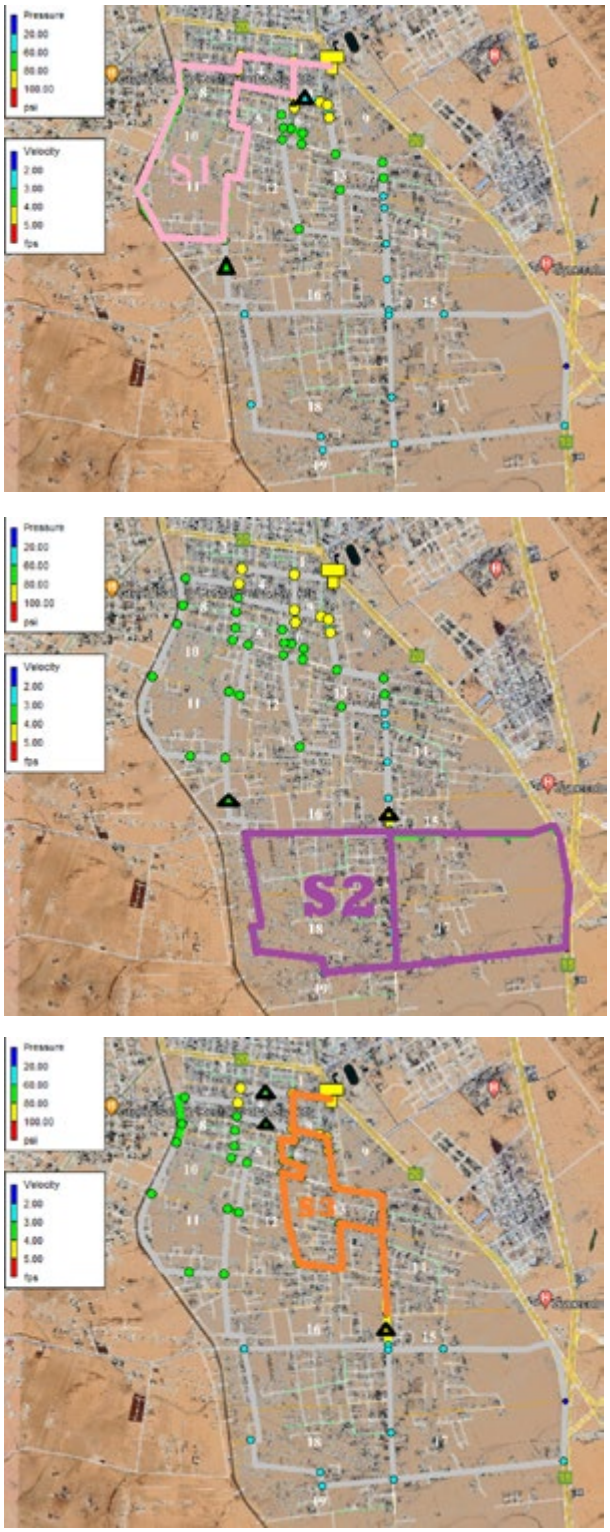
The proposed design is based on PVC pipes that vary in diameter to ensure efficient water distribution based on population densities and projected population growth. The design is based on the supply of 100 litres per capita per day of water. This is significantly less than the 220 litres per capita per day that is the international standard for water security, but responds to current YMC supply, which in turn is based on Jordan's available water resources.

Furthermore, to achieve the most efficient water distribution and to support water pressure, the proposed design can employ a sectoring strategy that divides Al-Dahiyyah into three main areas through the use of valves. The sectoring is based on factors such as topography, population density, and peak demand periods. Each of the sectors would have a defined supply duration to support efficient resource utilisation and equitable water distribution. Figure 7 shows the three proposed sectors for Al-Dahiyyah based on velocity and pressure calculations.

It should be noted that there are cost implications for residents wishing to connect to the water network, and low-income residents might struggle to afford these. Currently, if a household wishing to connect falls within YMC's 'management area', the connection fee is JOD200 for households up to 150m^2, with one extra JOD added for every additional square meter of space. However, if a household falls outside YMC's 'management area' the connection fee is JOD118 on top of covering all connection expenses to the nearest network point (including the cost of pipes), which can accumulate and become very costly. Therefore, connection costs (for existing and projected households) have been factored into the cost analysis for establishing a new water distribution network under 'incidental costs' (see Appendix 1).

If such a network is built for the current estimated population of Al-Dahiyyah of 30,184 residents (of whom over 35% are refugees) in such a way that it is future-proofed to accommodate up to a projected 264,285 residents in 30 years' time, the estimated cost is JOD1,845,922. Future-proofing would entail installing larger diameter pipes in loop systems to save cost and time in the future and allow loop expansions. If an entirely new network is built to accommodate up to 264,285 residents now, but designed to be sustainable and fulfil the neighbourhood's water needs up to 2054, this would cost an estimated JOD7,017,853.[18] This approach, that takes future needs into account integrating them into the design of the network, would help avoid the current scenario, where new connections are added in ways that weaken existing systems and cause premature ageing of networks.

Figure 7. Proposed sectoring strategy for Al-Dahiyyah



Source: image created by JURD using EPAnet 2.2 software based on Google satellite imagery. The circles represent junctions where pipes link together. The triangles represent valves that support water flow through the proposed sector. The rectangles represent the proposed sectors.

[18] See Appendix 1

7.3.2 Networked sanitation

For SS3, a three-tiered approach is proposed as follows:

1) Conduct a thorough review of the neighbourhood to ensure that available information on existing connections is correct, and elevation and other topography-related challenges are documented. Where illegal connections are found, these should be addressed in collaboration with local authorities, to enforce building regulations, and explore retrofitting or alternative solutions.
2) Extend the sewer network based on a design of concrete manholes and pipes that supports flexible connection solutions for households at varying elevations, such as pumping stations or alternative sewer line designs. Figure 8 below outlines a proposed design of the extended sewer network. Calculations of pipe diameters and lengths were based on expected velocity and 30-year population growth projections, and were produced on the basis of 100 litres of raw sewage per capita per day, for up to 264,285 residents.
3) Implement a proactive maintenance programme to ensure the continuous functionality of the sewer system and timely responses to any problems.

Figure 8. Proposed sewer network design for Al-Dahiyyah

Source: image created by JURD using Google Earth Pro.

It is worth noting that the costs of connecting to the sewer network (currently borne by users) mean that many households in Al-Dahiyyah will struggle to pay the upfront connection costs. Therefore, expanding the sewerage network needs to be accompanied by a public awareness campaign to inform residents of its benefits, and crucially, the establishment of a financial assistance programme. Subsidies or staggered payment schemes could support economically vulnerable households. At this stage, these charges have been factored into estimated costs for this solution as incidental costs.

Finally, as noted earlier, while existing wastewater treatment plants (which are operating under capacity) may be able to handle the increased wastewater quantity from connecting all of Al-Dahiyyah's current residents to an extended network, this will not be the case if future population projections for the neighbourhood play out. As such, a new or expanded wastewater treatment plant (by retrofitting the existing plant to increase capacity) would also need to be factored into this solution.

If such a network is built for the current estimated population of Al-Dahiyyah of 30,184 residents (over 35% of whom are refugees) in such a way that it is future-proofed to accommodate up to a projected 264,285 residents in 30 years' time, the estimated cost is JOD6,031,460. Future-proofing would entail installing larger diameter pipes to save cost and time in the future, and allow for expansion. If an entirely new network is built now, but designed to fulfil the neighbourhood's needs up to 2054, this would cost an estimated JOD15,755,537.[19]

[19] See Appendix 2

8

Costs comparison

To summarise the technical solution as set out above, and to understand its significance, the following section compares the two networked solutions, WS3 and SS3, with the WASH network in Zaatari. WS3 and SS3 together would guarantee universal access to water and sanitation for Al-Dahiyyah's residents, including its vulnerable urban refugees. The proposed designs for WS3 and SS3 are based on 30-year projections of population growth, and would thus support Al-Dahiyyah's population as it increases from its current estimated 30,000+ residents to a projected 260,000+ residents. The costs of infrastructure needed to provide this universal access for 30 years and encompassing this population growth in Al-Dahiyyah is estimated at JOD 7,017,853 for water and JOD 15,755,537 for sanitation,[20] equivalent to a total of US$32,106,851.87. These costings are based on the theoretical proposition of installing an entirely new network, as undertaken in Zaatari. However, establishing an entirely new network in an urban area would be inefficient and wasteful. Existing infrastructure can and should be rehabilitated, and reuse encouraged. Based on transforming the current network into the proposed solution, and re-using current infrastructure where it is in a suitable condition (particularly household connections that are least likely to suffer wear and tear) could potentially bring the total spend on getting universal WASH access to Al-Dahiyyah over 30 years to US$27 million.

By way of comparison, the Zaatari system, for 80,000 people cost US$55 million and was designed with an assumed life cycle of 10 years.[21]

Therefore, for an estimated US$27 million, less than half of the cost of the Zaatari network, an entirely new WASH system could be put in place in Al-Dahiyyah that could last for up to three times as long as the camp network, and eventually serve a population more than three times the size.

If these plans were to be modified in scope, and implemented today just to serve current residents of Al-Dahiyyah, of which over 35% are refugees, the costs would be significantly lower, at JOD1,845,922 for water and JOD JOD6,031,460 for sanitation.[22] This comes to a total of US$11,105,853.67 — a fifth of the cost of the network in Zaatari. These estimates are based on providing universal access to current residents on the basis of setting up the infrastructure to accommodate the increased population over the 30 years span. If universal access is provided to current residents based on the existing network, the costs could be as low as US$4.8 million.

It is worth reiterating at this point, that the US$55 million spent on the WASH network in the camp is a fraction of the overall expenditure on Zaatari. While actual cost data was not made available to the research team, and may not exist, the team was able to make an estimate

[20] Sanitation costs are higher, as the sewer network requires the installation of reinforced concrete pipes, which are more expensive than those used in the water network.
[21] While the 10-year life cycle is not explicitly stated in any document, the research team was able to access a financial analysis of cost savings (ACTED et al., 2014) which demonstrates that they are assuming a 10-year life span for the network.
[22] This scenario would still allow for larger diameter pipes to be introduced, even if not currently needed, to account for projected population growth.
[23] This figure is based on costs of the overall WASH programme for Jordan provided in ISG (2019) and IQVIA (2021). It uses the estimate, made by the evaluation experts who authored the 2019 report, that 63% of the UNICEF Jordan WASH budget was spent on camps. The final figures are based on population ratios between the two main camps, Azraq and Zaatari, and thus assume that costs per capita were equal. This is a huge and problematic assumption, but the research team could find no other way to arrive at an estimate of expenditure in Zaatari.

that the total expenditure on WASH in Zaatari from 2013–2021 was US$213,990,123.[23] The population of the camp has stood at approximately 80,000 since 2014 — representing only around 12% of registered Syrian refugees in Jordan.

The costing exercise for the Al-Dahiyyah network provided here is limited in scope, and the availability of data on Zaatari extremely limited, but the comparison helps to lift the veil on the cost of camps, and puts it into perspective. Our findings suggest a critical need to align humanitarian investments with wider development goals — particularly in light of the increasingly urbanised and protracted nature of forced displacement. The case for urban investments in protracted displacement situations is clear. Prioritising sustainable investments in urban infrastructure that are aligned with population growth projections and WASH needs not only meets the needs of refugees and other households experiencing water insecurity, but also supports broader goals. It could help Jordan meet its targets for SDGs 6 and 11 on water and resilient city infrastructures respectively. In addition, improved sanitation not only addresses risks to public health, but can also significantly decrease the use of freshwater, by increasing the amount of treated wastewater available for irrigation and agriculture. This is critical in a water-scarce country. Prioritising sanitation can address underserviced communities, while also supporting drought mitigation and water use planning.[24]

[24] Further analysis is needed to reveal how the net gain in water that results from expanded sanitation networks compares to other plans to increase water resources, such as desalination, which are costly as well as energy intensive.

9 Conclusions

This paper has presented research findings from three interrelated work packages that make up the Jordan Urban Refugee Dividend study: a documentary review of WASH provision in Zaatari camp; a case study of WASH in a peripheral neighbourhood of Mafraq city; and the design of a range of sustainable water and sanitation scenarios for that neighbourhood. These three components could usefully standalone — they have generated evidence of relevance to a range of actors, including Mafraq municipal authority, the water utility company, the government of Jordan and international humanitarian actors. But brought together as they are here, the findings and analysis begin to paint a picture of the inappropriateness and inadequacy of urban refugee responses.

At the most basic level, this study has shed light on the WASH challenges of urban refugees and low-income Jordanians in a secondary city. The lives of Syrian refugees in Jordan's major urban centres are not well documented, particularly beyond Amman. The investigation into water use, access and costs in Al-Dahiyyah presented in this paper, while small-scale, makes an important contribution in that regard. It has revealed the range of different WASH scenarios for these populations, including highlighting that the most vulnerable may have no mains connection to either the water or sewer network. It suggests that the very poorest residents of peripheral areas may be paying more per cubic metre for water than those in wealthier neighbourhoods. It shows how, in the Jordanian context, landlords who provide housing on land that is outside the designated municipal area are able to circumvent regulations around WASH provision, to the detriment of their tenants, and that there are very real health and safety issues with improvised and poorly-maintained sanitation solutions. The study has also suggested some practical solutions for these problems — to eradicate joint metering, for example — that could be taken up fairly easily by the local authority and water utility.

The situation in Al-Dahiyyah, which has had very little attention from the humanitarian community, contrasts sharply with Zaatari camp, less than 20 km away. In Zaatari, hundreds of millions of dollars were spent on emergency-style WASH provision, including trucking of water and waste and other temporary measures, before an entirely new network was installed that provides water, for free, to 80,000 refugees. By some measures, this intervention has been very successful — the provision of water per capita in the camp appears not to have dropped below internationally-agreed standards. However, the lack of transparency on expenditure, combined with a generalised failure within the international community to provide specificity on the geographic location of its spending means that no cost-effectiveness analysis can be performed. As a result a fundamental question remains unanswered: How else could the billions of dollars spent on keeping a small fraction of the Syrian refugee population contained in a semi-desert location have been spent?

The final component of this study begins to answer this question. As well as providing the main utility company, the Yarmouk Water Company, with some alternative WASH designs for low-income neighbourhoods that would help address water loss and unreliable supply, the costings for these scenarios show the staggering discrepancy in potential benefits from investments in a camp as compared with investments in an urban area. For half the cost of the Zaatari network, Al-Dahiyyah could be provided with a network that would eventually reach more than three times the population with a life cycle up to three times as long.

More broadly, this study has important lessons for the international community in future responses to refugee crises. Displacement around the world is overwhelmingly urban, and increasingly protracted (Earle, 2023). Camps, intended as temporary solutions, often remain in place for decades, absorbing humanitarian attention and funding (ibid.). Meanwhile, urban refugees rarely receive assistance from humanitarian organisations, and neither do the cities that host them. Scholarship has long established that urbanisation of displacement, and its increasingly protracted nature, require better anticipation, understanding, and planning for the arrival and long-term settlement of urban refugees (Crisp et al., 2012). This shift in humanitarian action requires humanitarians to forge new partnerships, including with mayors and municipalities, utility and service providers, and representatives of refugee and host communities (ibid.). While long called for, this has rarely materialised (te Lintelo et al., 2018) and in the case of Syrian displacement, well-known patterns were repeated, with international actors initially sidestepping local authorities (ibid.) and local non-state actors (te Lintelo and Liptrot, 2023).

One of the aims of this study was to explore the impacts on Syrian urban refugees and their hosts — often low-income Jordanians — of the decision made in the early years of the crisis to build the camps and deprioritise urban populations. It is not unusual for observers of humanitarian assistance to Syrian refugees in Jordan to contrast the camp and the 'out of camp' response. Anecdotal references to the 80/20 split — 80% of refugees in urban areas, receiving just 20% of assistance — are common. The general absence of an adequate focus on urban refugees in general has been documented by external observers (Healy and Tiller, 2014). The specific imbalance in the case of WASH interventions has also been noted by others (Day et al., 2020) and in an evaluation of UNICEF's programming in Jordan (ISG, 2019). It is not the intention of the authors to suggest that Zaatari camp be closed, or for UNICEF and partners to cease delivering WASH services in camps to invest in urban areas instead. However, lessons should be learnt from these initial decisions. Camp-based humanitarian interventions in Jordan have created a dependent refugee population. This has meant that, from the start of the crisis, the UN and INGOs have had to put all their technical and diplomatic skills into servicing that population and raising funds from international donors to maintain these services. A quote from a senior staff member explains the approach: "The camps had to be a starting point for funding allocation because there was no other option for those people. 80,000 in Zaatari had no other way to survive. Others had government and other options. The starting point is how do we maintain services in the camps?" (ISG, 2019 p.78).

The initial decision to build camps in Jordan combined with political sensitivities within the GoJ have led to a situation in which there is limited space for discussion of the long-term needs of urban areas impacted by the arrival of large numbers of refugees. The encampment policies pursued by the government of Jordan, and implemented by the UN, have been the focus of humanitarian efforts and funding, while the needs of urban refugees remain unmet — with significant impacts on wellbeing (Alhaj Hassan et al., 2024). The majority of refugees in urban areas need assistance, and many host community households also require support (UN-Habitat, 2024; UN-Habitat, 3/6/2024). As a result, the current situation in Jordan is characterised by entrenched inequalities and unsustainable camp-based responses.

More than a decade after the start of the Syrian civil war, and despite political developments, the majority of the camp's residents are opting not to return to Syria, or continue to defer return until the situation stabilises. Meanwhile, even suggesting alternatives to the current humanitarian response is extremely politically sensitive, given current laws and policies in place in Jordan. For some humanitarian agencies, a more developmental approach contravenes regulations over the use of humanitarian funding and runs counter to their mandates. There is still no end in sight for the camp, and an increasingly fatigued, international donor community is wrestling with decaying temporary shelter units and an as yet unfulfilled desire to find an alternative to decades of further funding. Despite the many barriers, a transition towards long-term support and investment for Jordanian cities, their authorities, service providers and low-income neighbourhoods is clearly required. For WASH in particular, this type of longer-term planning is critical in an already water scarce country, where the climate crisis is likely to exacerbate water supply in the coming years.

The argument against camps has been made many times over, including in an 'anti-warehousing' campaign in the 2000s by the US Committee on Refugees and Immigrants (USCRI, 2019) which documented their negative social, environmental and geopolitical impacts, and highlighted how encampment denied refugee rights and put lives on hold for decades. Legal scholars have branded camps as: "a breach of the most fundamental human rights, a cruel and dehumanising absurdity excused by neither political nor economic convenience" (Verdirame and Harrell-Bond, 2005 p.226). But these arguments have done little to sway decision makers. Camps have lasting appeal — they make aid distribution easier, while the aid dependency of refugees in camps make them an enduring and 'visible tool' for fundraising (Hovil, 2014). Camps also sustain a significant in-country presence for the UN in many countries across the world. While encampment is not UNHCR's official policy there is: "some evidence that UNHCR advocated

the establishment of camps in certain situations, and hardly any to show that UNHCR ever publicly objected to it" (Verdirame and Pobjoy, 2013 p.474). Despite this, many observers and practitioners within the refugee and humanitarian system describe camps as a political decision — made by the host government over which other actors have little control.

Given that negotiations over a response to refugee movements happen in private, it is not possible to know whether and what type of arguments are employed against camps at the start of a refugee situation. One thing that is probably certain, is that there will be little informed discussion on the value for money or cost-effectiveness of camps in these negotiations. We are able to say this with some authority, having searched, exhaustively, for information on the costs of camps in just one sector. It would appear that it is currently not possible to give expenditure per capita for any given camp resident, or find averages across countries, regions or globally. With the recent reductions in overseas aid by the current US administration, UN agencies, including UNICEF and UNHCR, will have to drastically reduce their spending in humanitarian and displacement crises. This situation will be compounded by the decision by many European countries to increase their defence spending at the expense of aid, in the face of security threats from Russia. Finding cost efficiencies in refugee response is thus more urgent than ever.

It is time for a reckoning on the cost of camps. In order for the UN system to live up to statements of transparency and financial accountability, a serious effort must be made to facilitate cost-effectiveness analysis of different forms of refugee hosting. It is only by establishing and sharing information on the cost of camps, that the potential dividend of urban refugee hosting can be understood. This could make a very real contribution to negotiations over how and where to host refugees in future crises, and has the potential to inform a transition from unsustainable encampment policies towards a more enlightened approach that supports towns and cities to absorb refugees, while providing improved service provision for all. The current lack of transparency and failure to account for expenditure in ways that would allow for this type of analysis mean that lessons from Zaatari — either technical or strategic — are unlikely to be learned, and the humanitarian system may end up repeating this wasteful tragedy.

Appendices

Appendix 1: New water distribution network costs

NO.	ITEM	UNIT PRICE (JOD)	QUANTITY	TOTAL COST (JOD)
1	Installation of Poly Ethylene (PE) of 8" pipe diameter (250mm) with excavation, importing, backfilling and correcting construction conditions in all types of roads with 1m trench height and 60cm trench width from both sides of the pipe.	65	7,636.81	496,392.65
2	Installation of Poly Ethylene (PE) of 6" pipe diameter (180mm) with excavation, importing, backfilling and correcting construction conditions in all types of roads with 1m trench height and 60cm trench width from both sides of the pipe.	45	3,877.49	174,487.05
3	Installation of Poly Ethylene (PE) of 4" pipe diameter (125mm) with excavation, importing, backfilling and correcting construction conditions in all types of roads with 1m trench height and 60cm trench width from both sides of the pipe.	35	5,710.64	199,872.40
4	Installation of Poly Ethylene (PE) of 2" pipe diameter (63mm) with excavation, importing, backfilling and correcting construction conditions in all types of roads with 1m trench height and 60cm trench width from both sides of the pipe for areas that have 180mm pipes to join household connections in that implemented as two pipes in one trench (180 and 63), for buildings of more than 12 water meter subscription, like hospitals and schools.	25	2,021.43	50,535.83
5	Installation of Poly Ethylene (PE) of 1" pipe diameter (25mm) with excavation, importing, backfilling and correcting construction conditions in all types of roads for household connections, for buildings of less than 12 water meter subscription for household connections for 3m length connection for each household.	8	152,472.21	1,219,777.68
6	Installation of self-tapping connection from 25mm to 63mm for each household and correcting construction conditions in all types of roads.	50	50,824.07	2,541,203.50
7	Installation of self-tapping connection from 8" (2500mm) to 6" (180mm) for the network.	300	6.00	1800.00

NO.	ITEM	UNIT PRICE (JOD)	QUANTITY	TOTAL COST (JOD)
8	Installation of self-tapping connection from 6" (180mm) to 4" (125mm) for the network.	100	4.00	400.00
9	Damaged/Wrong water meters repair/correction for each household.	10	50,824.07	508,240.70
10	Installation of washout with excavation, importing, backfilling and correcting construction conditions in all types of roads.	700	1.00	700.00
11	Installation of valves needed for sectoring strategy.	1000	5.00	5000.00
	SUM			5,198,409.81
	Administrative and labour costs	25% of total		1,299,602.45
	Incidental/Unexpected costs	10% of total		519,840.98
	TOTAL			7,017,853.24

Appendix 2: New wastewater network costs

NO.	ITEM	UNIT PRICE (JOD)	QUANTITY	TOTAL COST (JOD)
1	Installation of reinforced concrete pipes with rubber rings of 16" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	180	1,449	260,820.00
2	Installation of reinforced concrete pipes with rubber rings of 20" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	220	136	29,920.00
3	Installation of reinforced concrete pipes with rubber rings of 24" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	260	129	33,540.00
4	Installation of reinforced concrete pipes with rubber rings of 28" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	300	504	151,200.00
5	Installation of reinforced concrete pipes with rubber rings of 36" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	360	1,974	710,640.00
6	Installation of reinforced concrete pipes with rubber rings of 40" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	400	2,586	1,034,400.00
7	Installation of reinforced concrete pipes with rubber rings of 48" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	500	970	485,000.00
8	Installation of reinforced concrete pipes with rubber rings of 60" diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads with less/more than 4m height of trenches.	600	1,384	830,400.00
9	Emergency unexpected encasement.	100	30	3,000.00

NO.	ITEM	UNIT PRICE (JOD)	QUANTITY	TOTAL COST (JOD)
10	Installation of 150mm pipe diameter with excavation, importing, backfilling and correcting construction conditions in all types of roads for household connections, for 4m length connection each household.	30	203,296.3	6,098,888.214
11	Household manhole to link with 150mm pipe with 60cm diameter of manhole for each household.	40	50,824	2,032,960.00
	SUM			11,670,768.21
	Administrative and labour costs	25% of sum		2,917,692.05
	Incidental/Unexpected costs	10% of sum		1,167,076.82
	TOTAL			15,755,537.09

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This working paper presents the findings of a study that explored water, sanitation and hygiene (WASH) services for Syrian refugees in Jordan, focusing on a detailed case study of service access in an urban neighbourhood and a review of service investment in Zaatari refugee camp. It identified how urban refugees are particularly impacted by existing water scarcity, and showed that for a fraction of the cost of installing a network in a camp, many more refugees and their hosts could have benefited from investments in an urban setting — where most refugees are living. This should inform future decision making about how and where to host refugees in future crises in ways that are environmentally as well as economically sustainable.

IIED is an international policy and research organisation working with partners globally to build a fairer, more sustainable world. Together, we challenge the destructive economic models, unjust power dynamics, entrenched mindsets and protectionist laws that perpetuate poverty, suppress rights and hinder progress towards a thriving world. We explore solutions to complex economic, social and environmental crises, using research, action and influencing to tackle the root causes of climate change, nature loss and inequality.

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International Institute for Environment and Development
44 Southampton Buildings, London WC2A 1AP, UK
Tel: +44 (0)20 3463 7399
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