WASH IN HOST COMMUNITIES IN JORDAN

An interagency assessment

September-October 2013

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EXECUTIVE SUMMARY

This report describes the findings of an interagency WASH assessment conducted in Jordan (governorates of Mafraq, Irbid, Ajloun, Jerash, Balqa and Zarqa) in September – October 2013, covering 29 BSUs.[1] With a focus on water supply, sanitation / wastewater, and solid waste management, the assessment aimed to identify needs in WASH at the communal level, and to suggest possible responses to those needs.

Jordan is a water-scarce country, and the difference between water demand and water resources is increasing. At the same time, nearly all households have access to piped water at home. Various rural and urban centres tend to be interconnected in comprehensive water supply networks. Partly due to ageing infrastructure, operation & maintenance (O&M) of water supply infrastructures was highlighted as a challenge. Water supply is intermittent. It is common for households to run out of water, despite having water storage facilities at their disposal. The capacity of water utilities to provide supplementary water trucking services is limited, so the use of private water trucking is prevalent. The proportion of households having satisfactory free residual chlorine at tap level does not exceed two-thirds, and the population largely relies on bottled water for drinking. Non-revenue water still amounts to nearly 50%, due both to physical losses and to commercial losses. Short-term responses would include targeted interventions on public buildings (e.g. schools), support to water utilities to rent private boreholes, and provision of tools and equipment to fix major issues. Longer-term responses would entail support in water quality monitoring and overall non-revenue water (NRW) reduction measures. Special attention should be given to the prevention of aquifer depletion.

Nearly 100% of the population have access to toilets at home, but sewer networks cover only half of the population. Lack of O&M equipment and ageing infrastructure are common. The half of the population un-served by sewerage collects wastewater in pits, allowing wastewater to seep into the ground. Pit emptying is mostly done by private operators. The standard way of wastewater treatment and disposal is represented by wastewater treatment plants. However, 'free' wastewater dumping by wastewater trucks in uncontrolled sites might represent an issue. Likewise, the actual condition of wastewater treatment plants (WWTP) would need further research. Potential responses to the immediate needs would be supporting water utilities to unblock sewers, and sanitising the most apparent cases of uncontrolled wastewater disposal. Longer term responses would involve bulk sewer network extension as well as new WWTPs. Alternative and more sustainable wastewater treatment

[1] BSU stands for *Basic Service Unit*. A BSU is a community that shares the same access to services. It does not necessarily overlap with administrative divisions.

options would need to be explored too. Case-by-case risk analysis of private wastewater pits should be conducted.

Municipalities and Common Services Councils are in charge of the solid waste management chain from collection to disposal. Municipal solid waste departments are overstretched in terms of staffing, vehicles and waste bins. As a result, informal dumping is frequent in residential areas, as well as the practice of burning waste. The situation is exacerbated by the low number of waste transfer stations and of disposal sites. Informal door-to-door collectors of scrap materials are common in residential areas, but the value chain of recyclables is not easy to establish. Only two sanitary landfills are in place in the country, and the boundary between standard and substandard waste disposal sites seems somewhat unclear. The condition of both standard and substandard waste disposal sites requires further investigation. Immediate responses would be the provision of targeted municipalities with hardware and staff, as well as the sanitisation of targeted substandard waste disposal sites. In the medium-longer term, management support should be given to municipalities, in conjunction with raising awareness amongst the population, with a focus on the "4 R's" (Reduce, Repair, Reuse & Recycle). Waste disposal should be addressed with new / improved landfills and transfer stations, including safe disposal of hazardous waste.

Informal settlements are small clusters of substandard shelters — mostly tents — inhabited primarily by Syrian refugees and to a lower extent by Jordanians. Informal settlements represent an exception in the overall picture because they are not covered by public services. Only one fourth of informal settlement dwellers have access to indoor or outdoor taps, and nearly none of them have access to piped water. Informal settlement dwellers have developed coping strategies, mainly by getting water from private trucks. As a result, half of the taps were found without any free residual chlorine. Two thirds of the population practice open defecation. Communal toilets are rather unused, as they are considered unsafe for women and children. Solid waste is never collected in more than half of the cases, and 20% of it is burned. Compared with overall national data, informal settlements are characterised by much higher levels of need at a much smaller scale. As a response strategy, interventions should focus on responses to the immediate needs rather than on longer-term solutions.

1. BACKGROUND

Several need assessments were conducted by various agencies in the last year in response to the influx of Syrian refugees in Jordanian host communities. In the WASH sector, the most comprehensive assessment conducted to date was an interagency KAP study (Knowledge, Attitude and Practice) with a final report issued in September 2013.[2] The KAP study covered five governorates (Mafraq, Irbid, Ajloun, Jerash and Balqa), based on data collected between December 2012 and April 2013. The KAP study focused exclusively on the household level, and highlighted needs on the demand side. The communal level — or supply side — was not addressed. An EMMA study (Emergency Market Mapping and Analysis) was conducted in August - September 2013, assessing the water market in urban areas and in informal settlements in Balqa and Zarqa governorates.[3]

The overall objective of this WASH assessment is to fill existing information gaps by analysing the WASH situation at the communal level — or on the supply side. The rationale for this is that households may have certain needs (e.g. poor access to drinking water) whilst the reasons for those needs are likely to be at the communal level (e.g. a faulty water network system). If this is true, responses addressing those needs will need to target the communal level more than the household level. Therefore, the goal of this assessment is not only to identify WASH needs, but also to provide an overview of the WASH situation at the communal level and to suggest adequate responses to those needs. This was done through the methodology described in section 2.

The assessment covers three key aspects of WASH: water supply, sanitation / wastewater, and solid waste management. It was decided not to focus on hygiene since the KAP study mentioned above provided already comprehensive data on hygiene practices and needs. In addition, it is worth noting that solid waste management in Jordan was not specifically covered in past assessments in the framework of the Syrian crisis.

The timing of the assessment was essentially dictated by the RRP6 (Regional Response Plan) timeframe. The idea was to release a comprehensive WASH assessment in the initial phase of the RRP6 process in order to inform decision making and strategic planning in the next phases of RRP6. However, the data collected in the assessment and presented in this report have wider scope and can be used for longer-term decision making in the

[2] *Interagency Knowledge, Attitudes and Practices Study of Syrian Refugees in Host Communities in North Jordan*. Conducted by ACTED, Relief International, OXFAM and UNICEF.
[3] *Water Market System in Balqa, Zarqa, & Informal Settlements of Amman & the Jordan Valley – Jordan, August - September 2013*. The EMMA study was conducted by OXFAM. The final report released in late September 2013, when this WASH assessment was already ongoing.

humanitarian and development sectors. This assessment was commissioned by UNICEF and was led by ACTED in partnership with Mercy Corps, OXFAM and Relief International.

2. METHODOLOGY

A range of methods were used in the assessment to cover the three key aspects of WASH (water supply, sanitation/wastewater, solid waste management) at different levels (households, communal services and infrastructure). Moreover, data gathered through different methods allowed triangulation of various datasets and contributed to the reliability of data analysis. Secondary data were also used, whenever available, to contextualise the key outputs of the assessment.

Table 1 below summarises the main phases of the assessment:

WASH assessment process	
Dates	**Activities**
03/09 to 12/09	Preparation
15/09 to 03/10	Data collection / data entry • Week 1: Mafraq, Irbid • Week 2: Jerash, Ajloun • Week 3: Balqa, Zarqa
25/09 to 07/10	Data analysis
08/10	WASH Technical Workshop
19/10	Draft report
25/10	Final report

Table 1: WASH assessment process

Human resources in the field:

- Enumerators: 15 (week 1), 20 (week 2), 22 (week 3)
- Technical staff: 8 (week 1), 8 (week 2), 12 (week 3)

Enumerators were in charge of conducting household questionnaires and focus group discussions, whilst technical staff were in charge of holding key informant interviews and conducting observations. In addition, desk staff were in charge of data entry and liaising with institutions, whilst a management team coordinated the assessment operation.

2.1. SAMPLING

The assessment was conducted in six governorates located in the North of Jordan: Jerash, Ajloun, Irbid, Mafraq, Balqa, and Zarqa.

An initial list of 30 BSUs[4] was established based on already existing information derived from several household needs assessments conducted by ACTED. However, this list was later revised in light of consultations with other participating agencies and local authorities. The initial selection of BSUs was based on the following criteria:

- Rural / urban representativeness (cross-cutting)
- High concentration of Syrian refugees (cross-cutting)
- Poor access to drinking water
- Poor access to sanitation
- Low access to municipal solid waste collection.

For each predefined BSU, the household sample size was calculated using the sample size calculator with error margin of 10% and confidence level of 95%.[5] The estimated number of households surveyed was around 95 per BSU, 60% of which were Syrian households and 40% Jordanian. In actuality, a total of 2,263 households were surveyed in 29 BSUs, on average 78 households per BSU, with slight variations across all communities. Of these households, water from 1,730 households was tested for free residual chlorine.

2.2. Observation and key informant interview

To understand the WASH situation in host communities at the communal level, observation and key informant interviews were selected as the primary methods of data collection.

Observation was conducted to obtain first-hand data on the communal infrastructure present in the surveyed BSUs. Whilst data from observation cannot be quantifiable and statistically analysed, this method represented an effective way to rapidly assess communal infrastructure and services and to collect data beyond the reach of household surveys (see section 2.4). Observation was structured through specific observation protocols, covering water supply, sanitation / wastewater and solid waste. The observation protocols provided guidance to the assessment staff, in terms of what to look for and what to notice as relevant (see Annexes 6, 7, 8). As part of the observation, special attention was given to water sources and, in particular, to boreholes. A borehole survey form (Annex 9) was designed for this purpose, adapted from WHO guideline.[6]

Key informant interviews were conducted to obtain information on aspects not directly observable and beyond the reach of the household survey. In addition, key informants provided relevant points of view on the aspects researched. Key informants were

[5] Systematic random sampling methodology uses sample size calculator tool to determine how many people need to be interviewed in order to get results that reflect the target population as precisely as needed. Confidence level represents how often the true percentage of the population who would pick an answer lies within the confidence interval.
[6] WHO, *Water Safety Plans. Managing drinking-water quality from catchment to consumer*, 2005, p. 225.

interviewed via semi-structured protocols defining the questions to be asked per subject area (Annexes 10 and 11). Typical key informants were mayors and area managers with regard to solid waste, and representatives of the local water utilities with regard to water supply and sanitation / wastewater.

Twenty-one key informant interviews and 107 observations of communal infrastructure were conducted in 29 BSUs.

2.3. Household survey and focus group discussions

At the household level, the assessment team conducted a survey using a structured questionnaire with smartphones. The main objective of the survey was to identify the following at the household level:

- Demographic data
- Water: water storage; access to public/private suppliers; water quality checks (free residual chlorine) at tap level; water quantity supply at household level; water shortage.
- Sanitation/wastewater: access to private sanitation facilities; wastewater evacuation systems; gender-specific issues
- Solid waste: waste generation, waste composition, recycling, access to public/private waste collection services

Focus group discussions (FGD) were conducted at the communal level with 58 women in rural areas, 60 in urban settings and 28 in informal settlements to discuss WASH specific needs in relation to women and children and cultural factors (such as menstrual hygiene, safe access to sanitation, household level water usage). In addition, one FGD was conducted with community representatives to identify community perceptions about immediate WASH needs and to triangulate the information collected at the municipality and water authority levels.

2.4. Limitations

Whilst conducting household surveys, the assessment teams faced several implementation challenges, including high refusal rates from Jordanian households, based on the fact that they “are not in need of charity”; long travel distances to some of the communities; and the limited timeframe for data collection. Another challenge was that in some of the predefined communities the assessment teams could not always find the correct number of Syrian households, due to the high mobility of Syrians.

For observation of communal infrastructure and key informant interviews, formal authorisation by the Ministry of Water and Irrigation (MoWI) to survey public water and

wastewater infrastructure was received at the end of the first week of data collection. This delay slowed down data collection, obliged the assessment teams to 'catch up' past BSUs in the coming weeks, and limited the piloting of water and sanitation assessment tools. In addition, observation could be done only after conducting key informant interviews with the relevant authorities, which obliged to continuously adjust the schedule based on key informants' availability.

Overall, practical challenges were represented by the short timeframe to cover 30 BSUs and by the long distances to reach the destinations daily, especially in Zarqa and Balqa governorates, given that ACTED office in Mafraq was the assessment 'base camp'. As a result, 29 BSUs were assessed out of 30.

2.5. WASH TECHNICAL WORKSHOP

An integral part of the assessment was a full-day WASH Technical Workshop held on 8th October 2013 from 9am to 4pm. The aim of the workshop was to present the preliminary findings of the assessment, and to open the debate on 'the way forward', i.e. on the responses to the needs and gaps identified in the assessment. The choice of holding a workshop derived from the need to gather the points of view of the various WASH stakeholders in Jordan, as well as to identify key strategies of interventions in the short term and medium-long term.

The workshop was structured into two sessions. The first session presented preliminary findings from the assessment, with frequent Q&A periods. Data were divided into four chapters: water supply, sanitation / wastewater, solid waste and informal settlements. At the end of the first session, key points were summarized, with the active participation of the attendees. In the second session of the workshop, debate was opened on the possible responses to the needs and gaps identified in the first session. As an output, the workshop produced short term and medium-long term responses for each chapter covered. Due to time constraints, it was not possible to discuss responses to the needs in informal settlements. It was proposed by the participants to meet again in two weeks to discuss the cost aspects of the proposed responses.

Invitations to the workshop were sent to relevant WASH actors in the country. The workshop was facilitated by ACTED. Participants included representatives of the following:

- ACTED
- BPRM / US Embassy
- Mercy Corps
- Ministry of Water and Irrigation
- OXFAM

- Relief International
- THW
- UNICEF
- UNOPS
- Water Authority of Jordan
- World Vision
- Yarmouk Water Company

3. FINDINGS

3.1. Demographic Profile

The following provides a snapshot of the key demographic characteristics of 2150 households analysed for the water, wastewater and solid waste sections.[7]

- 44% of male respondents were interviewed, in comparison to 56% female.
- 42% are Jordanian households, and 58% are Syrian households.
- Of the Syrian households, the vast majority, 95%, are registered with UNHCR.
- The average household size is 6.2, although the average of Syrian households (6.5) is higher than of Jordanian households (5.9).
- The majority of households reside in houses (52%), followed by apartments (41%). 5% reside in basements.
- In terms of occupancy status, the majority of households (72%) rent their accommodation, with Syrians renting at nearly three times the rate (98%) of Jordanians (35%). In comparison, 26% own their accommodation, all of them Jordanians. Just 2% of households were hosted for free.

3.2. Water

3.2.1. Overview of water supply system in Jordan

Water scarcity is considered one of the most important constraints to Jordan's economic growth and development.[8] As such, Jordan is considered a country affected by physical water scarcity, i.e. "water resources development is approaching or has exceeded sustainable limits".[9] In 2007, water demand exceeded Jordan's available water resources by 638 millions of cubic metres (MCM).[10] According to government officials, the refugee influx due to the Syrian crisis is putting further stress on available water resources.[11] The Disi project, inaugurated in July 2013, is a large-scale water conveyance system which abstracts water from the Disi aquifer in South Jordan. For the time being, it supplies mainly the Amman area.[12]

[7] This figure does not include the 113 households living in informal settlements or tents / temporary structures who were analysed separately as a group in section 3.5.
[8] Ministry of Water and Irrigation, Eng. Ziad Darwish, Water Resources Management presentation, March 2011, available at: http://capacity4dev.ec.europa.eu/public-water_and_sanitation/terms-4009/categories/geographical/jordan?page=2
[9] ODI, ECDPM and GDI/DIE, 2012. *The 2011/2012 European Report on Development. Confronting Scarcity: Managing Water, Energy and Land for Inclusive and Sustainable Growth*. The European Union. http://www.erd-report.eu/erd/report_2011/report.html
[10] See: *Water for Life. Jordan's Water Strategy 2008-2022*, p.1-5. http://www.joriew.eu/uploads/private/joriew_org_jordan_national_water_strategy.pdf
[11] http://jordantimes.com/water-demand-to-increase-by-16-in-2013---ministry
[12] http://jordantimes.com/king-inaugurates-disi-water-project

The water sector governance in Jordan has central powers held by the Ministry of Water and Irrigation (MoWI) and by the Water Authority of Jordan (WAJ), whilst local powers are delegated to branches of the WAJ as well as to state-owned companies such as Yarmouk Water Company (YWC) and Miyahuna.[13] YWC manages water supply and sewerage systems in the governorates of North Jordan: Mafraq, Irbid, Jerash and Ajloun. The other governorates covered by the assessment (Balqa and Zarqa) are managed by WAJ local branches. The same applies to the remaining governorates in Jordan with the exception of Amman district, where water and sewerage systems are managed by Miyahuna.

3.2.2. PUBLIC WATER SUPPLY INFRASTRUCTURE

The assessment revealed that water supply in Jordan happens generally through ageing networks. On average, key informants reported that networks in their areas of competence are 35 years old, ranging from 20 to 50 years old. Several key informants reported the presence of main leaks in specific spots in the water mains, and recognised difficulties in dealing with increasing water demand, particularly during the hot summer months from June - August.

Water supply networks tend to be quite complex and centralised. A range of water sources is used, predominantly deep boreholes and secondarily springs in the hilly areas in the North. In all cases, several water sources feed the same networks, via centralised pumping stations where water storage and treatment usually take place. After treatment, water is pumped or flows by gravity to the various distribution networks covered. In some cases, water supply networks cross governorate boundaries. In addition, the functioning of water networks can vary seasonally, where water from additional sources is used in summer to meet increased water demand from end users. Due to the water scarcity issues mentioned in section 3.2.1, water supply is intermittent: networks are divided into rationing zones receiving water at established intervals. As an example, Annex 2 represents the schematic diagram of the water network in Ajloun governorate. The BSUs covered by the assessment are circled in red.[14]

In summary, a centralised water supply model is in place rather than a village-based or town-based model. As a result, observation of water supply infrastructure in relation to the individual BSUs was particularly difficult. Typically, certain boreholes were observed in certain BSUs, but this did not imply that such boreholes supply that BSU directly. On the contrary, in most cases, these boreholes feed a centralised water network in conjunction with other water sources, and specific BSUs might not necessarily be part of that network.

[13] Official website of the MoWI: http://www.mwi.gov.jo/Dashboard.aspx
[14] The diagram was provided courtesy of Mercy Corps. The document was compared to data from key informant interviews, which allowed pinpointing the BSUs covered by the assessment.

Twenty-one boreholes were surveyed during the assessment. Due to time constraints, the boreholes surveyed represent a convenience sample: boreholes were surveyed when time allowed and when the teams had access to them. Table 2 below summarises the boreholes surveyed and the sanitary risk scores reported. The BSUs are not indicated since, as mentioned above, boreholes do not supply BSUs but entire water supply networks.

Governorate	Boreholes surveyed	Low risk	Medium risk
Mafraq	9	3	6
Irbid	6	4	2
Ajloun	2	0	2
Jerash	3	1	2
Balqa	0	n/a	n/a
Zarqa	1	1	0
TOTAL	21	9	12

Table 2: Summary of borehole survey

It is important to focus on a few significant risk indicators out of the 16 risk indicators utilised. In 71% of the boreholes, the drainage is faulty, meaning that the area directly surrounding the borehole does not allow surface water (rainwater or water from leaking pipes) to flow away. This represents a risk in terms of borehole contamination from surface water. In 43% of the cases, there were animals or faeces in the area directly surrounding the borehole, and in 33% of the cases, fencing was missing or damaged. This indicates a risk of faecal contamination, especially if it is associated with faulty drainage, and is particularly relevant given that 38% of the boreholes surveyed had the borehole head unsealed.[15] In 10% of the boreholes, pollutants such as fuel or pesticides were found in the broader area surrounding the boreholes. Twelve of the boreholes assessed were not equipped with flow meters or had out-of-order flow metres.

Overall, the above data do not suggest widespread heavy structural damages to the boreholes. It is significant that not one of the boreholes assessed was ranked as 'high risk'. However, there remain some challenges associated with borehole O&M. Identified deficiencies seem to point to general low care in daily operation and to poor basic preventative maintenance. The teams conducting the borehole assessment reported verbally on different occasions that boreholes were either unguarded or guarded by unskilled personnel mostly unaware of the sanitary risk associated with the borehole condition.

[15] Presence of faeces in the borehole represents a relevant risk factor in itself. Anyhow, no boreholes were rated as "high risk" based on the total risk scores obtained in the borehole survey form.

In addition to the boreholes, 18 water pumping stations and storage facilities were visited. Whilst in some cases, pumping stations and water storage were part of the same facility, in other cases, they were separated. Due to the varying setup of these facilities, no standards survey form was designed. Data concerning the pumping stations were mainly included in the water observation protocols.

Figure 1: Leakages from a storage facility

The condition of pumping stations and storage facilities visited varied. Nearly all of them were fenced, and most of them were guarded and secured. In only one case, the fence was heavily damaged, and in one case, the facility was unguarded. In one pumping station and in one storage facility, animals were found in the fenced area. Leakages and stagnant water were observed in two pumping stations as well as in about three water storage facilities. Eight pumping stations were clearly operational, whilst two were not operational, and two were in very bad condition.

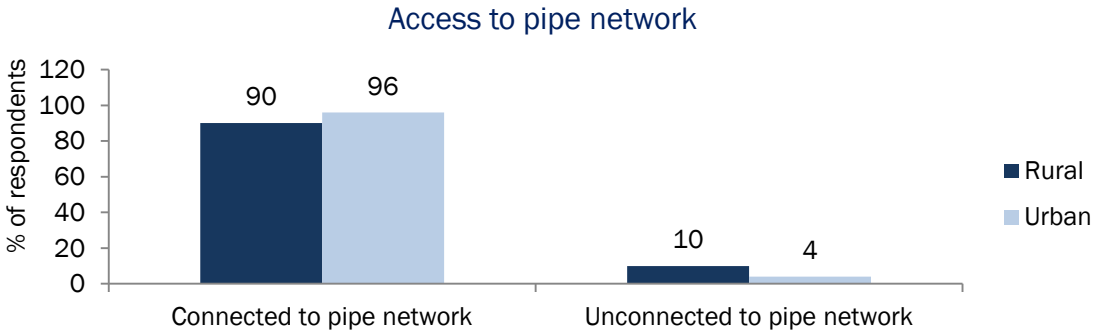
As found with the boreholes, the data from the pumping station and storage facilities seem to point to similar issues with the quality and frequency of O&M.

3.2.3. Public water supply coverage

Despite ageing water networks, public water network coverage is extensive. All the BSUs surveyed in the assessment are connected to a water supply network, and most rural and urban households have access to the water network. In fact, more than nine in ten households (93%, n=1997) are connected to the piped system, with slightly less network coverage

Figure 2: A recently built pumping station

in rural (86% connected) than in urban areas (95% unconnected). Similar information was provided by key informants and community representatives in FDGs, who corroborated that their communities are primary reliant on the public network for water. When they were able to provide data or estimates, informants reported that 89% of population is covered by the water network in rural settings, whilst the proportion rises to 94% in urban settings (92% on average). It is worth noticing that in 16 cases, no information / estimate about network coverage was available from the key informants.



These findings are slightly lower than the findings by the Joint Monitoring Programme's (JMP) *Progress on Sanitation and Drinking Water 2013*, which reported that 97% of Jordanian urban dwellers and 90% of rural dwellers have access to improved drinking water sources.[16] However, the definition of "improved water source" used by the JMP is broad, which includes yard taps, public taps and rainwater harvesting. On the contrary, this assessment focused on piped water supply at the household level.

Households unconnected to the public water network predominantly receive water from private and purchased sources. Although the assessment found that a vast majority of households (98%, n=2108) have access to at least one tap either inside or outside their accommodation, tap connection does not necessarily correlate to piped system access. In fact, 6% of households with taps are not connected to the piped system.

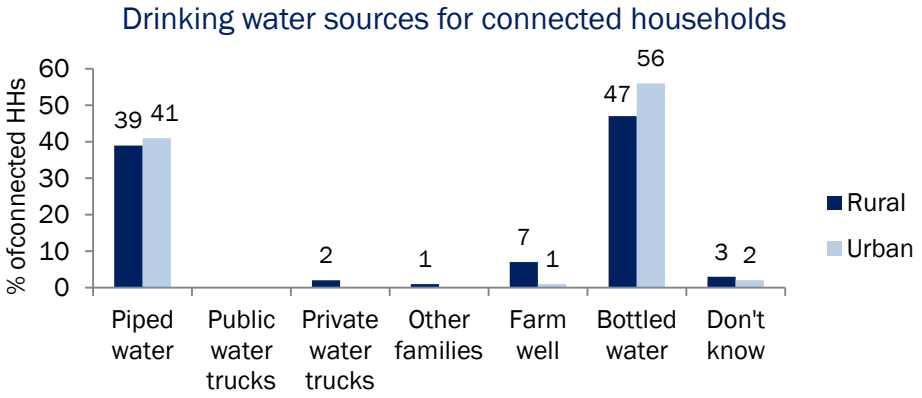
3.2.4. Drinking water

In spite of extensive network coverage, the public continues to rely overwhelmingly on non-public water to meet their drinking needs. Although 40% of households with access to the piped system (hereafter called 'connected') use public water as their primary drinking water source, with no significant difference seen between rural (39%) and urban (41%) connected

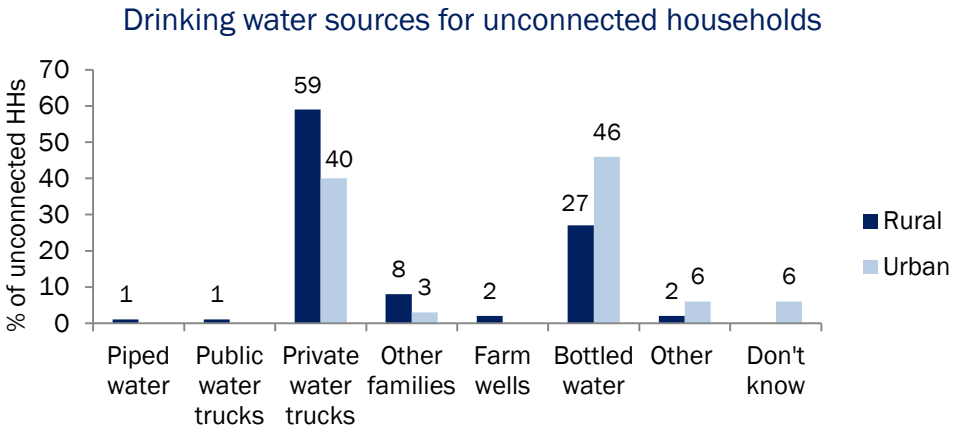
[16] JMP, 2013, available at: http://www.wssinfo.org/fileadmin/user_upload/resources/JMPreport2013.pdf. The indicators of 'improved' sources of drinking water were developed by the JMP in relation to the Millennium Development Goals (MDGs): http://www.wssinfo.org/definitions-methods/watsan-categories/.

households, the assessment found a much higher reliance on bottled water purchase for 51% of connected households (47% rural, 56% urban). The lower rates of public water drinking consumption in both rural and urban connected households suggest a continuing disconnect between water quality perception and reality as reflected by free chlorine residual level testing results (discussed in section 3.2.5).

Despite access to the piped system, 4% of connected households are using farm wells, and 2% are using private water trucks as their primary sources of drinking water. There is also a clear rural / urban divide amongst farm well and private water truck users, with 7% of rural, connected households dependent on farm wells for drinking water, compared to only 1% of urban, connected ones. A heavier reliance on farm wells for rural, connected households largely accounts for their lower rate of bottled water consumption in comparison to urban, connected households. Private water trucks are similarly used at higher rates for drinking water by rural, connected households (2%) than by urban, connected ones (<1%).



A robust market in private water supply has emerged to meet the gaps in end-user demand and need, particularly in response to water intermittency as well as for households lacking access to the piped system. Indeed, whilst private supply fills gaps for households temporarily not receiving piped water, it also serves as a significant adaptive strategy for the 7% of households (n=153) surveyed who lack access to the public network. The assessment found that the majority of these households predominantly rely on private water trucking (55%), followed by bottled water to a lesser extent (31%), to fulfil their drinking water needs. The rural / urban division is more apparent here, as rural households without piped connection are more likely to use private water trucks (59%) than urban households (40%), whilst the reverse trend is true for bottled water (27% rural, 46% urban).



The widespread presence of private water trucking operators has the clear merit of filling service gaps in public water supply. In that sense, they play a valuable role in the water supply system nationwide. However, it needs to be said that — based on the analysis above — private water trucking might be one of the causes of inadequate water quality at tap level. In the same way, special attention should be given to bottled water. As described in a very recent study,[17] bottled water vendors are widespread, especially in some governorates. They buy water from private trucks, treat it (mainly through reverse osmosis) and bottle it usually in 5-gallon containers sold at low prices, ranging from 0.5 JD to 1 JD per container. These shops are required to comply with existing drinking water regulations and undergo checks by the authorities in charge. That said, further research is probably needed to investigate to what extent those shops actually comply with regulations and whether they actually undergo regular checks by the authorities in charge.

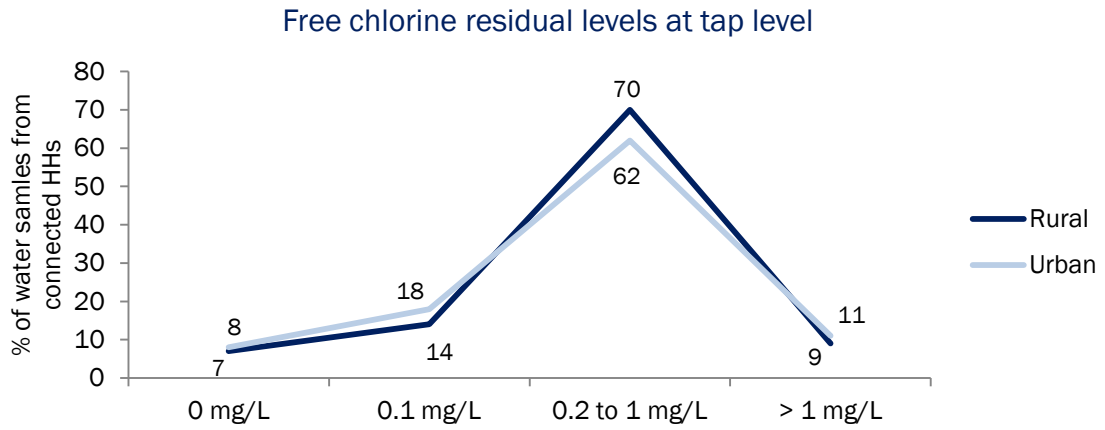
Widespread consumption of bottled water has been registered in several industrialised countries.[18] In general, this seems to suggest that habitual use of bottled water is not necessarily an indicator of piped water scarcity or low quality. It may represent consumers' preferences and water quality perceptions. In this sense, the increasing consumption of bottled water could be seen as part of the wider and much debated trend of "*commodification*" or "*commoditisation*" of water: water seen as an article of commerce more than as a natural resource, and as such following market rules. The role of private water trucking operators could be interpreted in the same way.[19]

[17] OXFAM, 2013, *Water Market System in Balqa, Zarqa, & Informal Settlements of Amman & the Jordan Valley - Jordan. August - September 2013*.
[18] See for instance: http://www.nationmaster.com/graph/foo_bot_wat_con-food-bottled-water-consumption. See also: http://www.euromonitor.com/bottled-water.
[19] See for instance: http://www.theguardian.com/global-development/2013/mar/15/talk-point-water-commodity-human-right.

3.2.5. PUBLIC WATER SUPPLY QUALITY

Public water in Jordan is routinely treated by the water utilities. The standard form of disinfection is chlorination, with free residual chlorine levels expected to fall within the Jordanian national standard of between 0.2 mg/L to 1.0 mg/L at point of use.[20]

Free residual chlorine testing performed at tap level in 1,546 connected households during the assessment revealed that only 66% of households (70% rural, 62% urban) had water which fell within the government standard. In fact, less than 10% of households in each setting (7% rural, 8% urban) had no free residual chlorine (levels of 0 mg/L), whilst the rest fell either between 0 mg/L and 0.2 mg/L, or above 1.0 mg/L.



Data on water quality can be read in different ways, according to expectations. On the one hand, the fact that nearly 10% of tests reported no presence of free residual chlorine at tap level, and that less than 70% of the tests complied with national standards, can be interpreted as an alarming indicator of gaps and issues in the water supply chain. On the other hand, half of the population relies on bottled water for drinking purposes, which minimises the health risks associated with the low presence of free residual chlorine in water. Indeed, the number of people actually drinking water non-compliant with national standards might be significantly lower than 36%.

Data from the assessment also seem to partially disconfirm past assessments. According to USAID, more than 99% of samples tested by the MoWI in 2010 fell within WHO guideline values.[21] However, the WHO guidelines, used as a reference in the USAID study, do not coincide with the Jordanian national standards. WHO guidelines for drinking water

[20] The reference document in Jordan for drinking water quality is the *Jordanian Standard No. 286/2011.*
[21] Don Humpal et al., USAID, *Review of Water Policies in Jordan and Recommendations for Strategic Priorities*, April 2012, p. 42.

recommend that free residual chlorine at point of use ranges between 0.2mg/L and 0.5mg/L.[22] The Jordanian standard is broader, prescribing a range between 0.2mg/L and 1mg/L, which was used as the water quality indicator in this assessment. This factor might account for the difference between the USAID data and the findings from this assessment.

It must be noted that the MoWI representative at the WASH Technical Workshop stated that compliance with Jordanian national standards for free residual chlorine in drinking water is actually higher than revealed in the assessment. In this regard, the Yarmouk Water Company representative pointed out that chlorine testing in the assessment could have been biased by the mixing of piped water with rain water harvested in household water tanks, particularly in rural areas. Indeed, community representatives in the FGDs corroborated that people are harvesting rainwater in addition to using the public network. Moreover, in some cases, water from households that are predominantly reliant on private trucks, and not on piped water, was tested from the tap.

At the same time, as noted by the MoWI representative at the WASH Technical Workshop, private water trucking for drinking purposes is regulated by existing legislation, as well as by the use of any borehole for drinking purposes. Water trucks need to be clearly identified (green colour), and boreholes need to undergo a series of controls and authorisations from the MoH and from the MoWI / WAJ. Any other form of drinking water supply would be considered unauthorised.

Additionally, water storage practices affect free residual chlorine, which tends to dissipate in time, especially if the storage facility is uncovered or not regularly cleaned. It might be the case that water tested during the assessment, in many cases, had been stored in household-level tanks for several days. This could have contributed to lower free residual chlorine levels than expected. Finally, leaking water mains represent a potential for recontamination of initially disinfected water, especially in intermittent water supply systems where pipes are not permanently pressurised.

Finally, household level chlorination practices could also account for free chlorine residual results which fell above the maximum acceptable level, as households treating their own water may be inadvertently over-chlorinating their water. More than a quarter (26%) of households using piped water as their primary source of drinking water treat this water, and 37% of these households use chlorine, with no significant rural (39%) / urban (35%) divide. The second and third most common treatment methods amongst households treating piped water are use of industrial / commercial filters (29%) and boiling the water (23%),

[22] WHO, 2011, *Guidelines for Drinking-water Quality. Fourth edition*.

respectively. Homemade filters are also in use, although much less commonly than other treatment methods (11% of households).[23]

Of the 112 samples tested from households not connected to the piped system, 61% fall within the government standard, whilst more than a quarter (26%) do not have any free residual chlorine. The rural / urban division with these results is striking, as the presence of no free residual chlorine in rural, unconnected households is more than three times (32%) the level seen in urban, unconnected ones (10%). In fact, the majority of the rural samples (40%) come from households using private water trucks as their primary drinking water source, suggesting that this source of water may be going untreated in some areas. In contrast, samples from urban, unconnected households largely had some free residual chlorine, either within the government standard (50%) or at the 0.1 mg/L level (40%).

3.2.6. PUBLIC WATER SUPPLY QUANTITY AND FREQUENCY

The intermittency of piped water has implications on water availability and use for end users. The frequency of water supply varies from location to location. As mentioned in section 3.2.2, most water supply networks are subdivided into water rationing zones, with each zone served on a rotational basis based on estimated demand. When asked about water supply frequency in their area of competence, the key informants provided different answers, ranging from every four days to once every 25 days, without any significant difference between rural and urban settings. In addition, it was somewhat difficult to get clear information on the individual BSUs since water networks cover several towns and villages.

Community representatives in urban areas also confirmed that water is supplied on an in intermittent basis, with complaints that water supply per capita is declining and the pumping rate has decreased to once every two weeks. In their minds, this is due in large part to increased water demand linked to the influx of Syrian refugees.

In light of this, the household survey found that 40% of households (46% rural, 33% urban) had run out of piped water in the past 30 days. Of these households, 80% experienced shortages once or twice, whilst 17% suffered shortages at least three or four times in the same period. It must be kept in mind that respondents become aware of water unavailability only when their household water storage tanks are depleted; indeed, nearly half of households connected to the piped system (47%) report that current water supply meets their needs 'most of the time' (44% rural, 49% urban), in comparison to only 10% reporting

[23] Respondents could select multiple treatment options.

'rarely'. Without these water tanks, households would likely experience water shortages (e.g. piped water shutoffs) on a more frequent basis.

Water utilities commonly provide trucking services to complement piped water supply, either via their own trucks or via rented ones. Doing so becomes particularly necessary when water demand spikes in the hottest months of the year, as mentioned in section 3.2.2. Based on the key informants who were able to provide information about this aspect, 11 BSUs covered by the assessment are provided with supplementary water trucking services, and only one is not. However, the actual efficacy of those services seems to be limited: of the 40% of connected households who reported running out of water in the last month, only 8% of these households had received any water trucking from the water utility in the same period.

Adaptive strategies pursued at the household level also ensure the availability of water when needed. Most households have resorted to storing water in household tanks to ensure water accessibility when water is not supplied by the piped network. The assessment confirmed that the vast majority of households, in both rural and urban areas, are equipped with access to at least one water tank — predominantly two cubic meters of storage, although some households have smaller (typically one cubic meter) or larger sizes. Humanitarian WASH standards in host communities in Jordan stipulate that at least 140 litres/person (L/p) of water storage capacity are required to meet water consumption needs.[24] The assessment reveals that only 5% of households with access to a storage tank (98%) have access to less than 140 L/p of storage — a surprisingly low and therefore questionable figure.

However, given that respondents were not asked about the number of households with access to the water tank used by their household, it is probable that in many cases, multiple households are using one tank, such as in apartment buildings or multi-household accommodation. Lack of clarity on this issue meant that the water storage capacity per capita was skewed towards a significantly higher than expected finding.

3.2.7. Non-revenue water

Non-revenue water (NRW) is the proportion of water abstracted, treated and pumped into the network that does not generate any revenues for the water utility. NRW includes physical losses such as leakages in water mains, in service connections and in the utility's storage tanks; commercial losses related to informal connections, metering inaccuracies, inadequate metre reading and billing inefficiency; and any unbilled authorised

[24] WASH standards in refugee camps and in host communities in Jordan were developed by the WASH sector working group in May 2013.

consumption.[25] Intermittent water supply systems are particularly prone to physical losses since pipes and fittings are put under stress by frequent variations in pressure. High commercial and physical losses translate to lower revenues, affecting the ability of water utilities to perform O&M, as well as upgrades, on water networks. This contributes to further network erosion and water losses.

Non-revenue water poses a major issue in water management in Jordan, in conjunction with water scarcity. NRW amounted to 45% nationwide of the per capita average of 145 L/day of supplied water in 2011.[26] In the north, it is estimated that Yarmouk Water Company incurs non-revenue water losses of up to 41%.[27] The goal of MoWI is to reduce NRW to 25% by 2022[28]. Most of the key informant interviewed at local level confirmed the NRW issue at national level, even though not all of them were able to provide data. Based on that, NRW amounts to 37% in rural settings and to 48% in urban settings (45% on average), with peaks above 55%, confirming the national data mentioned above.

In the household survey, an attempt was made to assess the degree of commercial water loss from households connected to the piped system through a series of questions about functional water metres and water billing frequency and payment. In light of this, a significant majority of connected households (92%, n=1845) are found to have water meters, with no significant rural / urban divide, in comparison to only 5% of households (n=102) who do not. Of the households with water metres, nearly all (99%, n=1827) report that their metres are functional, suggesting that the remaining households (<1%) are either illegally connected or are not using piped water. And of the households with functional metres, more than nine in ten households (92%, n=1685) report receiving water bills. However, as the assessment did not ask respondents to indicate the number of water bills received in a specific time frame (e.g. in the past 90 days), it is not clear if these households had received bills on a monthly basis within that period.

Whilst the high rate of households receiving water bills could suggest a low rate of commercial non-revenue water loss, the assessment found that the majority of these households (91%) had only paid their water bills once in the past three months, with a higher rate seen amongst rural (93%) than urban households (88%). In contrast, a much smaller proportion of households (5%) had paid their water bills once a month, with urban

[25] International Water Association (IWA), 2003, *Assessing non-revenue water and its components: a practical approach*. Available at: http://www.iwapublishing.com/pdf/WaterLoss-Aug.pdf .
[26] Average per capita of billed water ranges from 49 L/day in Jerash to 101 L/day in Amman. "Supporting Management of Water Services in Jordan," Ministry of Water and Irrigation, presentation, March 2011, slide 4.
[27] USAID, *Review of Water Policies in Jordan and Recommendations for Strategic Priorities*, p. 31.
[28] *Jordan Water Strategy 2008-2022*, p. 4-1 and 8-3.

households (7%) reporting this frequency at more than double the levels of rural dwellers (3%).

It must be pointed out that representatives of the MoWI and YWC at the WASH Technical Workshop raised doubts about this aspect of NRW. In their view, physical losses represent the actual core component of NRW in the country, whilst water bills tend to be regularly issued and paid. They also tended to affirm that non-functioning water metres and informal connections do not represent a relevant share of overall NRW. Whilst the household data reveal low levels of non-functioning metres and informal connections, higher rates of infrequent household water payments suggests that this area might constitute a more significant component of NRW losses.

3.3. SANITATION

3.3.1. OVERVIEW OF SANITATION SYSTEM IN JORDAN

It seems that a much higher attention is devoted to water supply in Jordan than to sanitation / wastewater; consequently, not much data on sanitation / wastewater is available from secondary sources. This confirms well-known global trends and is justified to some extent based on the water scarcity issues affecting the country.

Figure 3: Water stream from a WWTP

The standard sanitation model in Jordan for wastewater management is represented by sewer networks discharging into wastewater treatment plants (WWTPs). Official sources report that only 63% of the Jordanian population was served by sewer systems in 2011,[29] against water supply network coverage above 90% (section 3.2.3). Besides, data from the assessment reveal even lower levels of coverage by sewerage (section 3.3.5). The goal of the MoWI is to serve all main cities and towns with adequate wastewater collection and treatment facilities by 2022. Treated wastewater tends to be reused for agricultural purposes, especially in the Jordan Valley, and is elsewhere often discharged into surface water bodies such as reservoirs and streams. In many cases, where riverbeds are dry, treated wastewater discharged into the riverbeds forms the main tributary, with consequent water quality concerns.[30]

In 2007, there were 21 WWTPs in the country.[31] Jordan has a range of wastewater quality standards based on where the effluent is discharged and on the usage (irrigation, surface water, groundwater recharge).[32]

[29] "Supporting Management of Water Services in Jordan," Ministry of Water and Irrigation, presentation, March 2011.
[30] *Jordan Water Strategy 2008-2022*.
[31] All data above are from: *Jordan Water Strategy 2008-2022*, section 6.
[32] WHO, 2006, *A compendium of standards for wastewater reuse in the Eastern Mediterranean Region*.

3.3.2. WASTEWATER INFRASTRUCTURE

Sewerage systems in Jordan are combined systems, collecting both blackwater and greywater. Likely due to the low precipitation levels in most of the country, stormwater drainage is not common. Based on key informant interviews, sewerage networks are 30 years old on average, with a range of 25 to 45 years of age. However, most of the key informants did not have any data at their disposal, and many of them relied on personal memory or on anecdotal evidence. Nearly all key informants lamented the poor condition of the sewerage systems as well as the chronic difficulties they face in maintaining the ageing networks, due to a lack of resources such as O&M tools and equipment.

3.3.3. WASTEWATER TREATMENT PLANTS

Eight WWTPs were mapped across the six governorates in relation to the BSUs covered, but it was not possible to collect detailed information about them due to time constraints and to the complexity and sensitivity of the subject.

One of the few WWTPs thoroughly visited was being restructured: a new plant was under construction, funded by a foreign agency, following the design by a European firm, and constructed by a Jordanian specialised company. The assessment team had access to it after winning the reluctance of the officer in charge of the construction site, and on condition that no photos were taken. The 'new' plant was being constructed according to advanced technology, including a variety of treatments at different stages: from screening, settlement and oil / grease removal, to activated sludge, aerated lagoons and facultative ponds, to sludge drying fields and effluent disinfection for irrigation reuse.

Nearby, the old plant was still operational. A screening system was the only discernible 'treatment' method used. Indeed, the screen was blocked and clearly unmaintained for a long time, so the influent discharged directly into a series of four or five ponds. Those ponds were unlined and did not seem to respond to any specific design, only to general principles of scum floating and of sludge settlement. The effluent was currently used to irrigate crops in the surroundings.

One of the engineers in charge of the old plant recognised that the effluent did not meet the national standards for wastewater reuse. In addition, one of the engineers in charge of the construction site raised doubts about O&M of the new plant once it is operational. According to his experience, the local water utility does not have suitable resources and expertise to adequately manage the new plant; therefore, the condition and efficiency of new system are likely to decline in a few years after start-up.

3.3.4. "SEPTIC TANKS"

Sewerage networks cover only about half of the whole Jordanian territory and population – see section 3.3.5 below for more details. Therefore, a parallel system is in place based on household-level "septic tanks" emptied by wastewater trucks which supposedly discharge to existing WWTPs.

Some clarification is needed on the definition of a septic tank. In general terms, a typical septic tank meets a specific design, including an internal partition for sludge settlement and a baffle or other device for scum retention. The outlet from a septic tank discharges to a soak-pit, to an infiltration trench, to a sewer or similar.

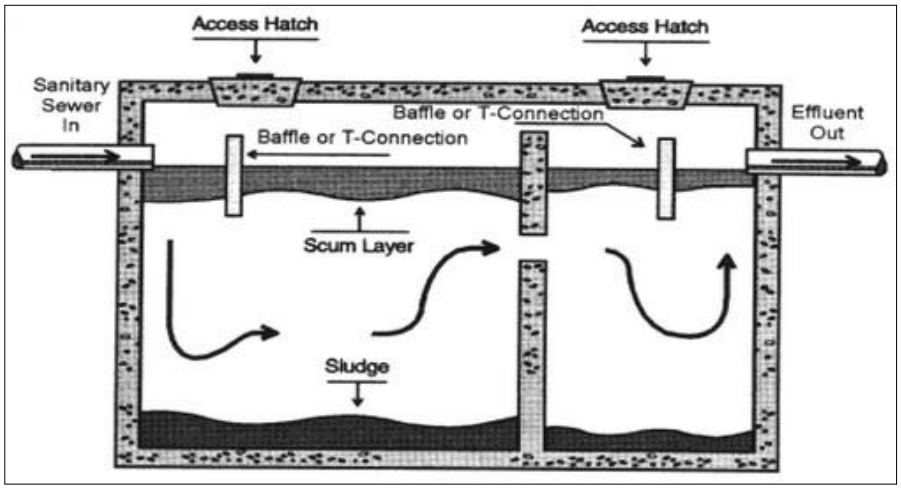


Figure 4: Proper septic tank design (www.adamsbros.ca / Septicsystems.php)

However, in the 'jargon' developed in the WASH sector in Jordan, especially in relation to sanitation in refugee camps, the term "septic tank" is commonly used to designate sealed underground tanks for wastewater collection, without any outlet pipe and any scum / sludge retention system. Those tanks are designed to be emptied often by wastewater trucks.

It was surprising to find during the assessment that the devices commonly called "septic tanks" in host communities do not correspond to any of the descriptions mentioned above. None of the numerous "septic tanks" surveyed are actually lined on all sides, none of them have an outlet pipe, and none of them are designed to retain sludge and scum. No maintenance is performed on such "septic tanks", only sporadic emptying by wastewater trucks. The most relevant feature of these "septic tanks" is that they are completely or partially unlined, allowing wastewater seepage into the ground. In several cases, "septic tanks" are in fact pits dug in the ground and covered by concrete slabs equipped with apertures for emptying. In a few cases, "septic tanks" are covered by corrugated iron sheets. Depending on the type of rock, seepage happens more or less effectively. As a result, "septic tanks" become full more or less frequently, and emptying operations are done accordingly.

Observation of the characteristics of septic tanks is obviously difficult, unless they are empty or under construction, so most of the information in the assessment was gathered by inquiring with household members. Of note is that in some cases, particularly in rural settings, respondents indicated that they do not empty their "septic tanks" at all. Once the tank (or pit) is full, they just dig a new one nearby.

For clarity, from now on the expression "improved pit" will be used instead of "septic tank".[33]

3.3.5. Access to sewerage and to improved pits

The findings reveal that access to toilets does not present a significant issue, with 99% of both rural and urban households (n=2137) equipped with private toilet access. Only three households — all in rural areas — use communal toilets or those located at the homes of neighbours / friends. However, given that women in the FGD highlighted issues in relation to the use of communal toilets, it might be that many respondents in the household survey considered toilets shared by families in a multi-family building as 'private'. The rest of respondents engage in open defection, the vast majority (nine of ten households) located in rural areas.

Although the household survey appears to find a low presence of communal toilets, the FGD discussions with women in both rural and urban areas reveal multiple and significant problems for families using these toilets. First, water supply constitutes a severe issue for users of communal toilets, especially ones unconnected to the sewer network. Intermittent water supply, coupled with frequent usage by multiple families, often results in water shortages for these toilets, negatively affecting personal hygiene practices and increasing infection levels (especially during women's menstrual cycles), exacerbating unsanitary toilet conditions and potentially contributing to blockages. However, many of the women, lacking sufficient income, are not able to afford water from private trucks to meet gaps in water supply for sanitation and hygiene purposes, although some women have had to resort to buying water during their menstrual periods.

Without sufficient financial resources, the majority of women also stressed the lack of hygiene materials – sanitary pads and personal care products — to adequately meet their personal hygiene needs. Insufficient sanitary pads, for instance, often cause women to wear the pads for far longer than recommended, resulting in vaginal infections and other health problems.

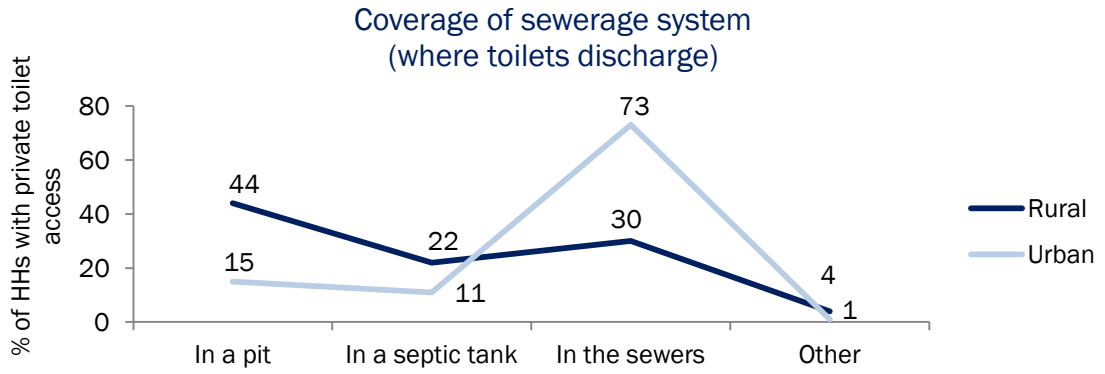
[33] The pit is defined as "improved" because it is closed and, in very general terms, does not seem to represent a health hazard for the users. In this case "improved" does not directly refer to the JMP's definitions.

Women also highlighted the generally low levels of safety and cleanliness found in communal toilets, as the presence of rodents and insects often dissuade children from using them out of fear. Indeed, women reported that children often had to be accompanied by their mothers to ensure their safety and privacy when using the toilets. Moreover, the potential security risk in accessing communal toilets, especially at night, often forced women to be accompanied by a male family member.

Finally, long queues and the lack of privacy of communal bathrooms — resulting from missing windows, doors and locks, for instance — were sources of discomfort for women in both rural and urban areas in all governorates. Moreover, a combination of overcrowding, water shortages, pests, and insufficient or lack of gas to heat water further meant that there was little time and few opportunities for women and their families to bathe on a regular basis (e.g. more than once a week), in both rural and urban areas.

Although toilet access is widespread, sewerage system coverage is more limited (46%), with a significant rural / urban divide. Only 35% of the rural BSUs had sewerage systems, compared to 82% of the urban ones. Conversely, improved pits were observed in 76% of the rural BSUs and in 55% of the urban ones. This suggests that most locations served by sewerage systems also have improved pits, particularly in urban settings. It was indeed common for assessment teams to report of urban centres where some areas were served by a sewerage system whilst other areas were not and were relying on improved pits.

Data from the households with private toilet access confirmed that sewerage connection is not extensive, not only in terms of locations served, but also in terms of households having access within the different locations. Only nearly half (49%) of the households with private toilets are connected to a sewerage network. Nearly two thirds (73%) of these are urban households, confirming the far wider availability of sewerage network coverage in these areas.



In the other half of households with private toilets, toilets are discharged to an improved pit (48%). As expected, households using an improved pit are predominantly located in rural areas (65% compared to 25% urban), where sewerage network coverage is not as widely prevalent. As mentioned above, the so-called "septic tanks" are simply pits with concrete covers and emptying apertures. For this reason, the findings concerning "pits" and "septic tanks" were presented above in an aggregated from, even if household questionnaires inquired about "pits" and "septic tanks" separately.

Most improved pits are private, i.e. they are used by one household only, although some are shared by different households. Improved pit sizes vary, ranging from 9m^3 to 70m^3 for the private ones and from 10m^3 to 80m^3 for the shared ones. However, data about size did not come from observation (only the top side can be actually measured), but from questions asked to household members, who on several occasions were not sure of the actual size of the tank. Therefore, this data needs to be taken cautiously.

The data suggest that sewerage, despite being the standard wastewater collection system in Jordan, does not seem to play a major role in sanitation in comparison to the improved pit system. The two systems seem to work in parallel in most cases. It must be kept in mind that detailed regulations cover wastewater disposal in Jordan (section 3.3.1). Based on these regulations, seepage of untreated wastewater into the ground would seem to be technically unauthorised.[34]

With regard to the actual environmental risk represented by such widespread practice, different interpretations can be given. This point was debated during the WASH Technical Workshop. On the one hand, ground seepage of untreated wastewater on a large scale might be seen as a risk factor in a country widely reliant on groundwater for drinking. On the other hand, most of the aquifers tapped for drinking water are deep (minus 100m to minus 500m), which reduces, to a great extent, the likelihood of groundwater contamination from wastewater seepage. A compromise approach would be to identify specific geographic areas considered 'at risk' based on hydrogeology and on the presence of improved pits.

3.3.6. Desludging

Similar to water supply, a private market in desludging is active, catering for a significant proportion of households lacking access to the sewerage network. For instance, more than three fourths of households (80%) with toilets that discharge to improved pits are heavily dependent on private desludging trucks, with a higher use of this service in rural areas (82%) than in urban ones (71%). Only 3% of households with toilets that discharge to

[34] WHO, 2006, *A compendium of standards for wastewater reuse in the Eastern Mediterranean Region*.

improved pits use public desludging trucks, with urban households using this service at four times the level (10%) seen in rural (2%) areas.

Overflowing improved pits can constitute a public health risk in terms of faecal-oral disease transmission route. The assessment found that nearly a third of households with toilets that discharge to improved pits (32%) have had overflowing pits in the past three months, with no significant difference between rural and urban households. To put this data in context, findings from observation reported only three instances of improved pits overflowing, leaking or surrounded by stagnant water throughout the assessment. This suggests that households with overflowing improved pits generally are able to quickly fix the issue, mainly by calling private pit emptying operators. This seems to minimise the health hazard associated with overflowing wastewater.

3.3.7. Informal wastewater disposal sites

As described above, WWTPs represent the standard for wastewater disposal and treatment in Jordan. Sewerage networks typically discharge to the closest WWTP.

As also mentioned previously, a parallel system based on improved pits and on private wastewater trucks is in place, serving nearly half of the population. As reported by key informants during the assessment and as reminded during the WASH Technical Workshop, public or private wastewater trucks are required by law to be easily identifiable (colour orange) and to dispose of their content in official WWTPs, with a fining system in place in case of non-compliance. At the same time, wastewater trucks — especially the private ones — can be difficult to control. Wastewater discharged from households into sewers reaches by default to the WWTPs, apart from leakages occurring on the way; on the contrary, wastewater collected by truck could be dumped in unauthorised informal sites in spite of existing regulations. Disposal of wastewater in informal sites near residential areas where wastewater is collected, rather than in authorised WWTPs, would guarantee quicker turnover, lower fuel consumption and therefore increased revenues to wastewater truck operators.

Based on this logic, the assessment teams inquired about informal wastewater disposal sites amongst key informants and occasionally amongst wastewater truck drivers. As expected, the former and the latter tended to be careful and hostile on the subject. As a result, it was not possible to get a comprehensive overview of the situation, much less to list and to map these informal sites. Only in two BSUs was it possible for the assessment teams to have explicit confirmation that wastewater trucks regularly dump their content in informal sites. Time constraints did not allow further investigations. In addition, caution and tact by the assessment teams were required due to the sensitivity of the issue.

The picture in figure 5 represents an informal wastewater disposal site. It is completely unfenced and unguarded, and it is located about 5 km away from the nearest village. It can be estimated to serve about 10,000 people.

Figure 5: An informal wastewater disposal site

This photo was not taken during the assessment but on a different occasion. The location where these photos were taken is in fact close to one of the BSUs covered in the assessment, but is not one of the two BSUs where the assessment teams received explicit confirmation of informal wastewater disposal sites. This suggests that further research could reveal more of these informal sites.

3.4. Solid Waste

3.4.1. Overview of solid waste system in Jordan

As with wastewater and sanitation, solid waste management in Jordan seems quite under-researched in comparison to water supply.[35]

Solid waste is managed by various institutions. Municipalities are in charge of solid waste collection and transport to disposal sites (with the exception of Aqaba City), whilst those sites are managed by Common Services Councils, i.e. consortia of local authorities.[36] Waste is mainly collected from communal waste bins by compactor trucks, which transport the waste to transfer stations or to final disposal sites. Overall, only 50% of the waste is disposed in sanitary landfills, whilst 35% is disposed in controlled dumps and 5% is openly dumped. More is added about solid waste disposal sites in section 3.4.5. Municipal Solid Waste collection is reported to cover 70% of rural population and 90% of urban population.[37] Solid waste disposal is centralised in two sanitary landfills and in 20 controlled dumps across the country. The Ministry of Health, the Ministry of Environment and the Ministry of Municipal Affairs are the organs in charge of policy and regulation in the sector. However, unlike the water and wastewater sectors, solid waste management seems to be loosely regulated in the country, and no specific legal framework is in place.[38]

3.4.2. Solid waste communal storage

Communal storage of solid waste is mostly done in 1m^3 bins placed on the roadside and secondarily in 200L bins (oil drums with the top removed). Through observation and key informant interviews with mayors and area managers, it is possible to estimate the communal waste storage in the BSUs assessed. In rural settings, 1m^3 of waste storage is available every 434 inhabitants, whilst in urban settings, the ratio is 1/399. It must be noted that the data varied considerably, ranging from 9 to 2,000 people per cubic metre of available communal storage. This suggests not only a range of different service levels, but also, at times, lack of sound knowledge by key informants. That said, WASH sector standards in refugee camps in Jordan prescribe 1m^3 of solid waste storage for every 150 people. Assuming the average figures reported above are accurate, it would seem that refugee camps are provided with higher service levels than host communities. At the same time, refugee camps generally require special attention from the environmental health point of view due to their high population density, which could justify the higher ratio of waste storage per capita advised.

[35] Unfortunately no governmental agencies in charge of solid waste were represented at the WASH Technical Workshop, which could have helped to cast light on various aspects of the solid waste management system nation-wide.
[36] http://mirror.undp.org/magnet/Docs/dec/monograph/FiscalAdmin&CSR-JOR.htm.
[37] SWEEP-NET, 2012, *Country Profile on the Solid Waste Management Situation in Jordan.*
[38] Date in this section comes from SWEEP-NET, 2012.

Waste bins were more or less frequently observed according to the location within the BSU. More densely populated neighbourhoods tended to be equipped with more frequent waste bins, but there were cases in which this rationale was not so obvious. For instance, one of BSUs visited is a tourist destination. In this case, no waste bins were observed in the most touristic area. When asked about this observation, key informants responded that for reasons of decorum, it was decided not to place bins in the tourist area. It was preferable to have heaps of waste on the sidewalks which are collected by municipal workers, and dumped into communal waste bins located just outside the heart of the tourist area.

Use of the municipal waste collection system by the public appears to be widespread. Eighty-five per cent, in both rural (86%) and urban (83%) areas, are disposing their waste in municipal bins on the street. However, more than one in ten households (12%) do not use these bins, instead dropping their waste anywhere outside, perhaps in response to the lack of proximate bins given the low per capita presence of bins observed by the assessment team as described above. Less than two per cent dispose of their waste in informal dumping areas used by other people. The female FGDs corroborate these findings, suggesting that, in the absence of municipal waste collection bins, waste is being disposed in informal dumping areas, such as in valleys, potentially to be burnt later. Of note is the fact that many women reported discarding sanitary pads and diapers in separate bags and bins, perhaps in recognition of the unique health risks posed by these types of waste, although the disposal of pads and diapers outside windows was found to be happening to a lesser extent with some women.

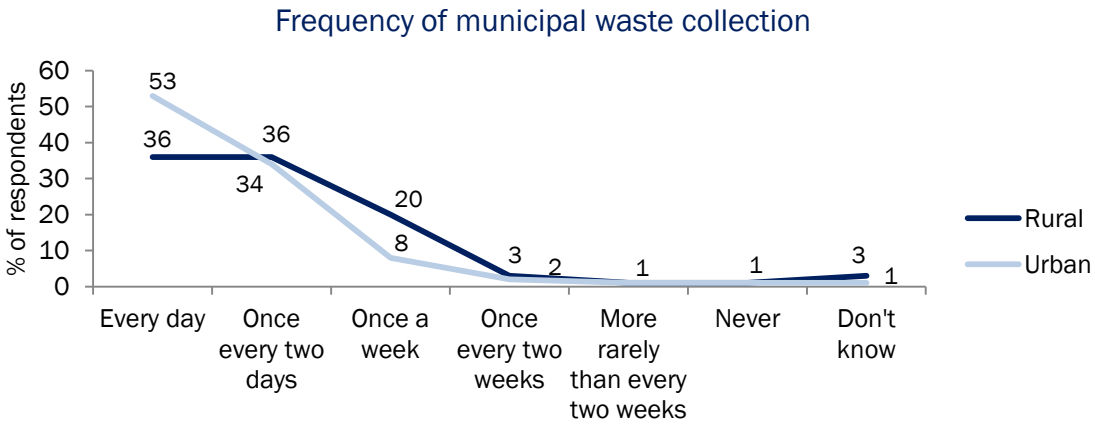
3.4.3. Solid waste generation and collection

Based on data from key informants, municipalities collect on average 0.76Kg of solid waste per person per day. This should be taken cautiously, since several key informants did not seem very confident about the quantity of waste collected, as well as on the population figures. In addition, waste collected daily per capita in rural settings would be 0.93Kg, almost twice the amount collected in urban centres, 0.48Kg, which seems unlikely. Secondary sources report municipal waste generation as 0.95Kg/p/d in urban settings and 0.85Kg/p/d in rural settings.[39]

Solid waste collection is usually done by compactor trucks, sometimes in conjunction with open trucks. In one case, donkeys were observed at work. Most of the key informants affirmed having garbage trucks at their disposal, but also generally lamented that the number they have is not adequate to meet existing needs.

[39] SWEEP-NET, 2012.

At the household level, municipal waste collection from communal bins is reported to take place frequently. According to 79% of households, waste collection occurs at least every couple of days by municipal sanitation workers, with 44% of them reporting daily waste collection. At the same time, 15% of households indicated that municipal waste collection occurs only once a week, with 3% reporting collection happening every two weeks and 1% reporting that it never occurs.



The assessment teams had the opportunity to witness waste collection operations only eight times throughout the three weeks of assessment. As part of the observation protocols, the assessment teams ranked the general state of the waste bins at the time of observation. Overall, only 21% of the bins were found empty, whilst 79% were half-full, full or brimming over. Data were quite homogeneous, with a slightly higher presence of empty bins in rural setting: 24% compared to 17% in urban settings. It must be highlighted that the distance between BSUs and waste disposal sites tends to be significant: 40 km on average with no relevant difference between rural and urban, with a maximum of 85 km. This factor certainly plays a role in limiting waste collection efficiency.

An additional indicator of solid waste storage and collection service levels was represented by the presence of areas where waste was informally dumped — on the roadside, on street corners and in similar locations. Such areas were observed in 54% of the BSUs, with significant difference seen between rural BSUs (50%) and urban BSUs (64%). The vast majority of these areas had evidence of waste burning practices (67%), with a noteworthy prevalence in rural settings: 88% compared to 43% in urban centres.

Surprisingly, less than 0.25% of households reported burning their waste, with no large difference observed between rural and urban households. This seems at odds with the widespread presence of charred waste observed above. On the one hand, this might be

interpreted as reluctance on the respondents' side to recognise they actually burn their waste. On the other hand, it is possible that waste is mostly burned not by household users but by formal operators (municipal workers) and by informal operators (scavengers). This interpretation was confirmed in one occasion, when municipal workers explicitly affirmed habitually burning waste heaps as part of their working routine. This was documented by the picture in figure 6.

Figure 6: Waste burning by municipal workers

The number of street sweepers reported by key informants varied significantly, with estimates of sweepers / population ratios ranging from 1/175 to 1/13,750. Similar to the data provided on the number of waste bins, this variation might be due to inaccuracies with the information provided by the key informants. In addition, the distinction between street sweepers and general municipal waste collection workers (including sweepers, drivers and waste collectors) might have not been clear enough for key informants. At any rate, only 14 street sweepers were seen at work throughout the duration of the assessment, which suggests either understaffing or inadequate use of available staff.

The amount of litter observed on the streets and in communal areas, such as squares and markets, likely represents a more reliable indicator of collection service levels than the alleged number of street sweepers employed by the municipalities. The assessment teams were asked to rank the amount of litter on a scale from "no litter" to "a lot". Overall, 56% of the BSUs had "a lot" or "medium" litter, with a considerable gap seen between rural and urban environments: 70% of urban BSUs were ranked as "medium" or "a lot", compared to 47% of rural BSUs.

Despite reports that the municipalities collect waste from communal bins rather regularly, other data suggest that waste storage and waste collection services struggle to meet satisfactory levels. Solid waste clearance has emerged as an area of concern for residents

in Jordan, indicating growing public frustration with the timely clearance of solid waste by authorities.[40]

3.4.4. SOLID WASTE RESELLING AND RECYCLING

Less than 10% of the estimated 2.3 million tonnes of solid waste generated in Jordan is recycled.[41] The assessment also found low rates of recycling, with less than 1% of households reported reselling part of their solid waste, predominantly metal, despite the fact that 17% of waste composition in Jordan is comprised of plastics.[42] However, it must be kept in mind that the assessment only asked questions about the resale of materials, rather than about their reuse / redistribution, which are more commonly practiced.[43] Indeed, the UNOPS representative at the WASH Technical Workshop noted that Jordanians tend not to resell and recycle their solid waste, largely due to cultural factors and to the lack of established market value of recyclable materials. Instead, they are more likely to reuse and redistribute materials to friends or family if they do not dispose it as waste.

3.4.5. INFORMAL WASTE DISPOSAL SITES

The assessment teams inquired about the presence of informal solid waste disposal areas. As with wastewater disposal by trucking, it was interesting to investigate if and to what extent municipal trucks dispose of solid waste in informal / uncontrolled sites.

As mentioned in section 3.4.1, the regulatory framework on waste disposal sites does not seem to be very exhaustive. As a result, the boundary between formal sites and informal / uncontrolled sites is blurred, especially in the eyes of local municipalities, who have the task of waste collection without being in charge of the waste disposal sites. Most key informants seemed concerned about the low number of garbage vehicles and the distances they have to cover, but generally did not show particular concern about the *type* of waste disposal site. In most cases, key informants were able to indicate the final disposal site. Twelve 'official' destinations were mentioned, of which five were transfer stations. Due to time constraints, it was not possible to visit all official sites mentioned by the key informants. As with wastewater disposal, it was difficult to gather comprehensive data about any informal solid

[40] See: "Hashmiyeh residents protest against sanitation problems," *The Jordan Times*, 15 August 2013. Available at: http://jordantimes.com/hashmiyeh-residents-protest-against-sanitation-problems. See also: "Young volunteers urge motorists not to litter streets", *The Jordan Times*, 5 September 2013. Available at: http://m.jordantimes.com/young-volunteers-urge-motorists-not-to-litter-streets. See also Omar Obeidat, "Sahab mayor dons sanitation worker garb to clean town," *The Jordan Times*, 2 September 2013. Available at: http://jordantimes.com/sahab-mayor-dons-sanitation-worker-garb-to-clean-town

[41] Hana Namrouqa, "Less than 5% of Jordan's solid waste is recycled," *Jordan Times*, 16 May 2013. Available at: http://jordantimes.com/less-than-5-of-jordans-solid-waste-is-recycled---experts

[42] Sweepnet, p. 1.

[43] See USAID, *Solid waste behaviors within the formal and informal waste streams of Jordan*, June 2010, p. 3.

waste disposal site used by municipal trucks. Further research is needed to cast light on this aspect.

The picture in figure 7 shows an informal site. It is unfenced and used by scavengers to collect reusable-recyclable materials. The pictures in figures 8 and 9 show two official transfer stations, with quite visibly different sanitary conditions.

Figure 7: An informal waste disposal site

Figure 8: A waste transfer station in good condition

Figure 9: A transfer station under stress

As a general remark, defining sites used regularly by *formal* municipal trucks as "*informal* sites" might be improper, even if they do not respond to any specified sanitary criteria. It is probably more appropriate to define them as "substandard formal waste disposal sites."

3.5. Informal Settlements

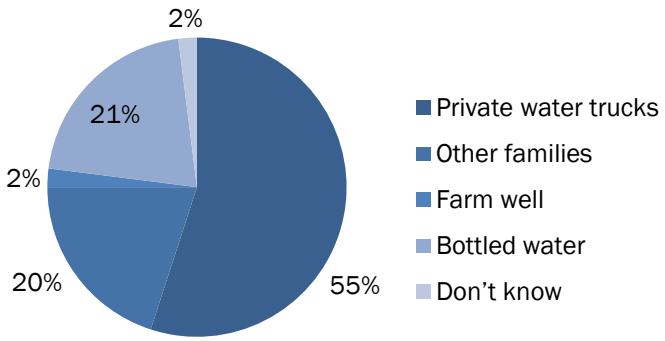
Households living in informal settlements, most often in tents or temporary structures, comprise some of the most vulnerable population, with correspondingly large needs. Informal settlements can range in size from small groups of a few households to communities of more than 50 tents / shelters. That said, households inhabiting tents / temporary structures might not be living in areas commonly considered as "informal settlements". For the purpose of identifying the specific needs unique to these households in the following sections, 113 households (111 of them Syrian) are identified as belonging to 'informal settlements' if they are living in tents / temporary structures.

3.5.1. Access to water

Public water coverage for households living in tents / temporary structures is unsurprisingly low. The assessment found that 72% of households do not have access either to an indoor or outdoor tap, but as found with the non-informal settlement population, access to taps does not correlate to pipe network connection. Instead, households with access to taps most likely have water access through communal tanks, which store water from private trucks and dispense it through taps. In fact, a higher percentage, 89%, of informal settlement households are not connected to the piped system.

For the majority of unconnected households, their drinking water is primarily sourced from private water trucks (55%), followed by bottled water (21%). The higher dependence on private water trucks might be a result of assistance provided through humanitarian organisations as well as the lower costs of purchasing bulk water from trucks rather than in bottled form. Interestingly, one in five (20%) unconnected households — a far higher percentage than the non-informal settlement population — is reliant on other families to secure drinking water. This is perhaps indicative of the important role that social networks in the settlement are playing in helping some refugee families meet their basic needs.

Drinking water sources for unnconnected households

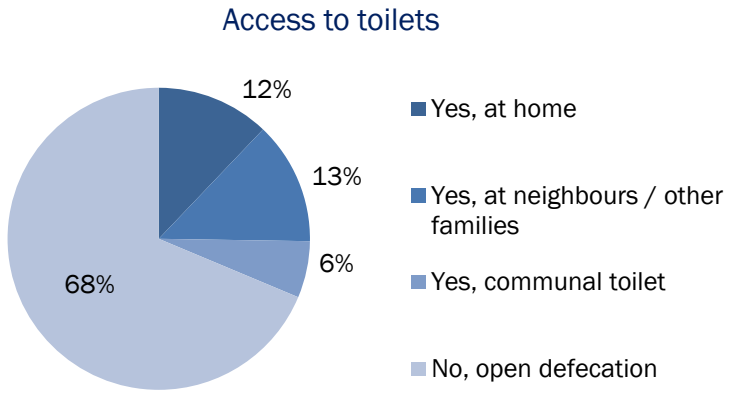


In light of the almost non-existent access to the piped network amongst informal settlement households, more than half (53%) of unconnected household water samples (n=55) revealed 0 mg/L levels of free residual chlorine, whilst nearly a third (29%) had levels at 0.1 mg/L. Given that nearly half of the samples came from households which use private water trucks as their primary source of drinking water, this could explain the low or non-existent levels of free residual chlorine. Only 15% of the total samples tested from unconnected households had free chlorine residual levels within the government standard, largely from households using water from other families as their primary source of drinking water.

3.5.2. Access to sanitation

Access to sanitation for informal settlement households remains poor, with the majority of households (68%) engaging in open defecation due to lack of access to any type of toilets. According to a FDG with community representatives in one settlement, open defecation might also entail people digging ad hoc, shallow spits, which poses problems for them to empty, given the lack of private desludging companies, and is raising fears of disease transmission amongst the community. Twelve per cent of households reported using private toilets, but this might actually refer to the practice of defecating in a plastic bag or container in the home and discarding the waste outside. Only a small proportion of households, 6%, have access to communal toilets, but these are generally considered unsafe and uncomfortable for women and children to use by more than two thirds of these households (86%). This is largely because the toilets might have long queues at times, might be located far from the tents, are not sex segregated and illuminated, generally lack privacy due to no doors and locks, forcing women to be accompanied by male family members, and might have rodents and insects. Female FGD participants confirmed that many of these toilets are simply pits dug in the ground, lacking connection to any water supply or sewage system, with only blankets or tents used as cover. Given the significant safety and privacy issues faced by women with communal pits, they stressed the need for private toilets that are connected to the sewer system and are not shared with men.

As with toilets, bathing for women and children involves similar issues of privacy and security. According to female FGD participants, women and children must resort to bathing in tents without doors or locks, which often requires a male relative to stand guard outside the tent. Furthermore, shortages in water availability often affect bathing frequency, as well as the ability of women to maintain adequate personal hygiene levels during their menstrual periods, contributing to vaginal infections and skin problems.



The assessment teams had the opportunity to visit three informal settlements throughout the assessment. One of them deserves to be described in relation to sanitation. The settlement was situated on a hilly area at the border between different municipalities. According to the inhabitants, two spots were mainly used as defecation fields. One of them was located some hundred metres from the settlement, whilst the other was located between two clusters of tents within the settlement. Both defecation fields were situated downhill for users, so as not to be easily noticed from the tents. The closer defecation field was visited by the assessment team. Numerous traces of faeces were found on the ground. One area in particular was protected by a rudimentary stone wall providing some privacy to users. However, defecation seemed to be equally practiced both inside and outside the area.

The defecation field was actually located in a *wadi*. The riverbed was dry at the time of observation (end of September 2013), but presented clear signs of erosion, meaning that water flows in the *wadi* during the winter months.[44]

Figure 10: A 'fenced' defecation field

[44] *Wadi* is an Arabic word to designate a valley with a stream or river that is dry except in specific times of the year, in relation to precipitation patterns.

Communal toilets are used in the informal settlements to the limited extent described above. Such toilets had very basic structure. The superstructure was usually made of materials like blankets or jute, even though more permanent structures made of concrete blocks were also found. Some toilets had no squatting slabs, with just large PVC drainpipes to collect the excreta. Other toilets were equipped with 'Turkish style' squatting slabs. Wastewater from the toilets was mostly collected through PVC drainpipes to small off-set pits covered in cheap materials, such as plastic sheeting or scrap wood. In the case of the settlement described above, some toilets were installed in close proximity to the bottom of the *wadi* and discharged directly to the *wadi* through PVC drainpipes. No handwashing facility was noticed in proximity of communal toilets.

Figure 11: A communal toilet in an informal settlement

The overall level of cleanliness of communal toilets was not particularly alarming. Not many overflowing pits were observed, and in the case of toilets discharging directly to the *wadi,* no stagnant wastewater was noticed. Very little traces of excreta were found on squatting slabs, suggesting that the toilets were habitually flushed after use. On the other hand, this might be read as an indicator of the low usage of these toilets in comparison with open defecation and defecation within tents.

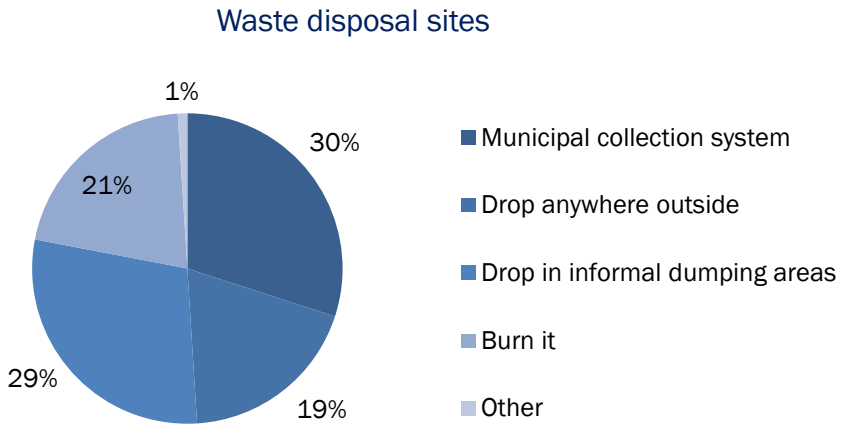
Figure 12: A communal toilet in a different settlement

For both defecation fields and communal toilets, their close proximity to *wadis* would constitute a risk in terms of faecal contamination of water once the *wadis* are flooded. At the

same time, water from the wadis is not commonly used for drinking, and the toilets can be easily moved uphill.

3.5.3. SOLID WASTE

Only about one in three informal settlement households (30%) reported using the municipal waste collection system, compared to a much higher proportion of households who forgo the municipal bins. Instead, these respondents drop their waste anywhere (19%) or at informal dumping sites (29%), largely due to necessity, as female FGD participants mentioned that they lack sufficient bins for waste disposal in the settlements. In particular, the women complained about not knowing how or where to dispose of sanitary pads in the absence of bins. As a result, some women are combining the pads along with other solid waste or putting it in separate bags for disposal in informal dumping areas. The assessment also found that a far higher proportion of informal settlements households (21%) burn their waste in comparison to the non-informal settlement population, as corroborated by community representatives in the FGD, most likely in response to the low coverage of municipal bins in these areas.



Given the low coverage of the municipal waste collection system in informal settlement areas, it is not surprising that more than half of these households (58%) reported that municipal waste collection 'never' occurs, whilst only 18% report waste collection occurring daily or every couple of days. Seven per cent report collection happening at least once a week.

4. CONCLUSION AND POTENTIAL RESPONSES

As described in section 2.3, a WASH Technical Workshop was held on October 8th with the aim to present the preliminary findings of the assessment, and to define potentially suitable responses to the needs identified, in the immediate term and medium-long term. This section presents the results from the debate that took place at the workshop and summarises the outputs. Outputs are divided into water supply, sanitation / wastewater, solid waste management, and informal settlements parts.

As a general strategy, it was agreed that household-based interventions are still necessary, but to a much lesser extent than interventions targeting communal services and infrastructure.

The participants in the workshop agreed on the following requirements to be met by any activity:

Cost: Capital costs are justified; capital costs are manageable; recurrent costs are justified; recurrent costs are manageable.

Social: It is compatible with existing local markets; it is compatible with users' preferences.

Legal and institutional: It is in line with the legal framework; it is feasible with few or no institutional arrangements; it is feasible with available O&M capacities.

Environmental: It is environmentally sustainable; it does not put natural resources under stress; it does not harm public health.

4.1. WATER – SUMMARY OF NEEDS

Jordan is a water-scarce country, and the difference between water demand and water resources is increasing. At the same time, water supply networks cover nearly the entire population, and nearly all households have access to piped water at home. Various rural and urban centres tend to be interconnected in comprehensive water supply networks — any village-based intervention on water supply systems should take this into account. Partly due to ageing infrastructure, O&M of water supply infrastructures was highlighted as a challenge, especially with regard to water sources and pumping stations. Water supply is intermittent, and this has an impact on water mains as well as on service levels. It is common for households to run out of water at least once a month, despite having water storage facilities at their disposal. The capacity of water utilities to provide supplementary water trucking services is limited. As a response to this service gap, the use of private water trucking is prevalent. Possibly as a result of this, the proportion of households having satisfactory free residual chlorine at tap level does not exceed two thirds. Balancing this data, less than half of the population uses tap water for drinking and largely relies on bottled water. The private sector plays a key role both in water quantity (trucking) and in water quality (water vendors),

suggesting an ongoing process of water "commoditisation". However, in the public sector side, NRW still amounts to nearly 50%, due both to physical and commercial losses.

4.1.1. WATER – POTENTIAL RESPONSES

Short term / immediate need

Household-level rehabilitation for vulnerable Syrian and Jordanian families: Such type of intervention mainly replicates what has been done be several agencies in the last year in host communities. This mainly includes the installation of water storage tanks connected to household taps and general rehabilitation of water infrastructure in the home. That said, findings from the assessment point out that a large majority of households are already equipped with storage tanks and taps.

Water trucking for vulnerable households: Same as above, water trucking to vulnerable households has been extensively conducted in the last year. This activity can be continued and improved. Special attention should be given to the exit strategy, to avoid long-term reliance by households and by water utilities on aid agencies' water provision. In addition, any water supply activities should take into account local markets and should not disrupt existing systems.

Public buildings (schools, healthcare facilities): Due to the sensitivity of the services offered, schools and healthcare facilities should be targeted with water supply network rehabilitation, both at building level (i.e. inside the building) and at communal level, i.e. the networks supplying these buildings.

Rental of private boreholes: In the summer months, water utilities need to rent private boreholes to supplement the water sources used in public water trucking. It was reported during the workshop that this often becomes impossible for the water utilities to undertake for financial reasons. Borehole rental in summer can be subsidised by aid agencies.

O&M tools and equipment: As part of short term interventions, water utilities can be provided with tools and equipment, such as pumps, valves and fittings. These interventions should be targeted to specific areas and facilities, to ensure the tools and equipment provided actually 'fix' immediate critical problems. Special attention should be given to water sources and infrastructure needing maintenance.

Medium-longer term

Water quality monitoring: As highlighted by the assessment, achieving the right amount of free residual chlorine at tap level represents a challenge. Water quality monitoring can be reinforced with the provision of equipment and consumables, and through a wider monitoring programme at the various stages of the water supply chains — both piped network and private truck chains. This should be done in partnership with water utilities and with WAJ, and within the existing water quality regulatory regime.

NRW reduction: Focusing on non-revenue water is an overall approach that would benefit both water utilities (increased revenues) and end users (increased service levels). This approach needs to address both physical losses and commercial losses. Water utilities would be supported on the management side, including O&M management (preventative maintenance), asset management, HR capacity development, logistics and spare parts supply chain, leakage monitoring and management. At the same time, large-scale rehabilitation and restructuring of water networks would be needed, from water sources to distribution networks.

Prevent aquifer depletion: Water resource scarcity is a critical issue in Jordan. During the workshop, the MoWI representative emphasised that this is a priority for MoWI, which takes the lead in any plan to safeguard groundwater resources. Minimising physical water losses would certainly play a role in decreasing pressure on aquifers (see point above on NRW).

4.2. SANITATION – SUMMARY OF NEEDS

Access to sanitation does not represent an issue in Jordan, and nearly 100% of the population have access to toilets at home. In contrast to water supply networks, sewerage networks cover only half of the country, with a significant urban prevalence. O&M issues were often emphasised, in relation to lack of equipment and to ageing infrastructure. The half of the population un-served by sewerage collects wastewater in improperly defined "septic tanks". These are actually partially unlined pits allowing wastewater to seep into the ground. Such widespread practice does not comply in principle with existing regulations governing wastewater disposal. "Septic tanks" (better defined as "improved pits") tend to quite frequently overflow; however, households seem to be able to cope effectively. The private sector plays a central role in this regard: pit emptying is mostly done by private operators using wastewater trucks. The standard approach of wastewater treatment and disposal is through WWTPs. The effluent is reused in irrigation or discharged into surface water bodies. However, 'free' wastewater dumping by wastewater trucks in uncontrolled sites might represent an issue, given that half of the population is not served by sewerage networks. Likewise, the actual condition of WWTPs needs further research.

4.2.1. SANITATION – POTENTIAL RESPONSES

Short term / immediate needs

Household-level rehabilitation for vulnerable Syrian and Jordanian families: As with water, household level sanitation interventions should probably not be conducted on a large scale, since the assessment highlighted that nearly all households are already equipped with adequate sanitation facilities. Such activities could focus on improved pits when needs are identified, both on the structural side (rehabilitation) and on the desludging side (supporting tank emptying). As with water trucking, any support in

improved pit emptying should take into account local markets and should not disrupt existing systems.

Blocked sewers: As discussed during the WASH Technical Workshop, blocked sewers are an issue, especially in the rainy winter months from December - February, when manholes are opened to absorb surface water runoff. As a result, large amounts of street litter carried by water fall into the manholes, blocking sewers and causing sewage overflow. That said, blocked sewers in winter are not the only issue. Direct support to water utilities should be provided in terms of O&M tools and equipment to rapidly unblock sewers.

Wastewater from refugee camps: This is a concern, especially for governmental agencies. The MoWI has already established plans to install WWTPs in the main refugee camps in the country, Za'atari and — upon opening — Azraq. It was recommended during the workshop that wastewater management should be an essential part of any refugee camp planning in Jordan from now on.

Uncontrolled wastewater dumping: The issue of uncontrolled wastewater dumping by private trucks needs to be adequately addressed, by mapping them and by improving sites where the immediate environmental risk is high, such as where elevated amounts of untreated wastewater are dumped, and where sites are proximate to residential areas and to groundwater sources.

Medium-longer term

Bulk sewer network extension: Sewerage coverage in Jordan is still limited, especially in rural areas. A programme of sewerage extension could be done nationwide or in targeted areas, including design, funding and implementation. Any programme of this kind should incorporate capacity development and O&M follow-up as substantial components.

Wastewater treatment plants: In parallel to the point above, the WWTP system should be addressed. O&M and management support to existing plants could be provided, and new plants would be required to treat increasing quantities of wastewater.

Alternative wastewater treatment technologies: The subject of appropriate technology was discussed at the workshop. The suitability of conventional large and centralised WWTPs adapted to the local context was debated. Alternative options were proposed, in particular low-tech decentralised systems — e.g. constructed wetlands. Also, the reuse of sludge from WWTPs for biogas production was raised as a possible response. However, these approaches do not reflect current policies at the government level; therefore, advocacy to the MoWI, small-scale piloting and private sector involvement would be required.

Improved pits system: This issue would need to be addressed through a case-by-case approach. Mapping risk areas with high concentration of improved pits in the

presence of relatively shallow aquifers would be a first step toward addressing this issue. Putting in place improved sanitation systems in these areas (conventional sewers or alternative technology) would be a further step.

4.3. SOLID WASTE – SUMMARY OF NEEDS

In contrast to the water and wastewater sectors, solid waste management seems to be regulated by a loose legal framework. The involvement of the private sector is very limited, with municipalities and Common Services Councils in charge of the solid waste management chain from collection to disposal. Municipal solid waste departments are overstretched with staffing, vehicles and waste bins. As a result, informal dumping is frequent in residential areas, as well as the practice of burning waste, which seems to be practiced mostly by municipal workers and informal operators (scavengers). The situation is exacerbated by the low number of waste transfer stations and of disposal sites, which forces municipal trucks to transport waste for long distances. Informal door-to-door collectors of scrap materials are common in residential areas, but the value chain of recyclables is not easy to establish. Only two sanitary landfills are in place in the country, and the boundary between standard and substandard waste disposal sites is somewhat unclear. As with wastewater, the condition of both standard and substandard waste disposal sites requires further investigation.

4.3.1. SOLID WASTE – POTENTIAL RESPONSES

Short term / immediate needs

Immediate support to municipalities: Lack of means and resources at the municipal level was highlighted in the assessment. The provision of waste collection vehicles, waste bins and staffing to target municipalities would be a suitable response to the most immediate needs in terms of waste storage, waste collection and cleanliness of communal areas.

Uncontrolled solid waste dumping: The issue of uncontrolled waste dumping by garbage trucks needs to be adequately addressed, by mapping them and by improving sites where the immediate environmental risk is high, such as where high amounts of waste are dumped and sites are proximate to residential areas.

Medium-longer term

Management support to municipalities: Support to municipalities would be done not only through provision of vehicles, bins and staffing, but also through capacity development of solid waste general management and assistance to put in place efficient waste collection systems.

Awareness-raising: As the assessment found, the overall level of population use of communal solid waste services tends to be high despite the challenges and

deficiencies observed. However, issues remain with waste disposal in unofficial and informal areas. Awareness and behaviour change campaigns, concerning solid waste and cleanliness of communal spaces, could target specific populations.

The "4 R's"*:* Numerous informal operators are active in the country, collecting scrap materials from households and reselling it. In this sense, there is potential to build on these systems, with the involvement of multiple stakeholders (households, informal operators, municipalities, waste disposal sites), to improve good practices in waste management: Reduce, Repair, Reuse & Recycle — the so-called "4 R's".

Solid waste disposal: Only two sanitary landfills are in place in Jordan, and substantial amounts of waste are disposed in official or unofficial substandard sites. The improvement of these sites is crucial, with the aim to turn them into sanitary landfills when possible. In addition, extra sanitary landfills should be built, as well as extra transfer stations, to decentralise the system and minimise distances covered by municipal garbage trucks. The conditions of the existing transfer stations should be improved.

Hazardous waste: Hazardous waste management was highlighted as an issue during the workshop, especially in reference to medical waste. It was reported that hazardous waste, in many cases, ends up disposed along with general waste. Support to the various institutions in charge of hazardous waste management from generation to disposal would improve the situation.

Advocacy: Two advocacy points were raised during the workshop. First, advocacy is required at the sector-wide policy level to reinforce the legislation framework and to effectively enforce existing regulations. Secondly, aid agencies should incorporate waste generation aspects in their emergency interventions, namely by minimising packaging in distributions and taking responsibility for collecting and disposing it after distribution.

4.4. INFORMAL SETTLEMENTS – SUMMARY OF NEEDS

In the bigger picture of water supply, wastewater and solid waste services, informal settlements represent an exception. Informal settlements are small clusters of substandard shelters — mostly tents — inhabited primarily by Syrians and to a much lower extent by Jordanians. Some informal settlements are permanent, whilst others are used by migrant workers. Informal settlements represent an exception because they are not covered by public services. Only one fourth of informal settlement dwellers have access to indoor or outdoor taps, and nearly none of them have access to piped water. Informal dwellers have developed coping strategies, by obtaining water either from trucks or from farm wells. As a result, half of them were found without any free residual chlorine in water. The situation is not dissimilar with regard to sanitation. Two thirds of the population practice open defecation. The few communal toilets in place, commonly considered unsafe for women and

children, are used by only 6% of the population. Around one third of the population living in informal settlements uses municipal bins for waste collection, but waste is never collected in more than half of the cases, and 20% of the waste is burned. Compared with overall national data, informal settlements are characterised by much higher levels of need at a much smaller scale.

4.4.1. INFORMAL SETTLEMENTS – POTENTIAL RESPONSES

Due to time constraints, potential responses to address the needs in informal settlements were not discussed during the WASH Technical Workshop.

As a strategy, it was however agreed that assistance to informal settlements should not aim at medium-long term solutions, instead focusing on responses to immediate needs. This is due to the small scale nature of many informal settlements, and to the fact that these areas are not meant to be permanent and that their legal status is uncertain.

5. LIST OF ANNEXES

1. BSU list
2. Example of water network
3. HH questionnaire
4. FGD - women
5. FGD - community
6. Observation protocol – solid waste
7. Observation protocol – water supply
8. Observation protocol – sanitation / wastewater
9. Borehole survey form
10. KI interview – solid waste
11. KI interview – water and wastewater