Practical Paper

Developing water and sanitation services in refugee settings from emergency to sustainability – the case of Zaatari Camp in Jordan

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ABSTRACT

As of the beginning of 2017, more than four years after opening, Zaatari refugee camp in the Hashemite Kingdom of Jordan hosts around 80,000 Syrian refugees. Zaatari is one of the largest refugee camps in the world, in one of the most water scarce countries. Since its establishment, drinking water has been trucked to communal facilities. Wastewater has been trucked from these facilities and from self-constructed storages next to households. To improve future sustainability in equitable water and sanitation access, public health conditions, environmental conservation and operational costs, household connected water and sewage networks are implemented. This shift from emergency to sustainable phase benefitted from adaptation of urban infrastructure methods. Maximising such investment requires stakeholder and project management, throughout design and implementation, for quality control of all processes and outputs, asset management and administrative strategies. A shift is necessary from a humanitarian approach toward a structured master planning vision. The planning urban utility perspective is essential for ensuring operational sustainability in the conception of water and sanitation systems in Zaatari refugee camp.

Key words | drinking water, infrastructure, public health, refugee camp, sustainability, wastewater

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INTRODUCTION

Zaatari camp in the Hashemite Kingdom of Jordan opened on July 29th, 2012 to host approximately 22,000 Syrian refugees. The influx of refugees quickly exceeded the planned number. Zaatari refugee camp is one of the largest in the world hosting around 80,000 Syrian refugees (UNHCR 2017), with a maximum capacity of 100,000. The development of adequate water and sanitation systems that consider humanitarian needs and environmental concerns is crucial. UNICEF and humanitarian partners constructed 417 communal water, sanitation and hygiene (WASH) blocks distributed evenly across the camp as it grew. Design incorporated gender segregation, privacy, cultural practices and protection principles (Sphere 2011). Despite respecting minimum humanitarian standards, refugees' concerns around personal safety and privacy deterred the use of communal blocks. Camp residents demonstrated a strong preference for family facilities by constructing toilets and showers adjacent to their shelter, increasing the risk of disease proliferation and water contamination. Refugees repurposed materials from WASH blocks resulting in significant damage, loss and resources to continuously maintain WASH blocks for the most vulnerable families.

Inequity, health and environmental risks, and increasingly high operation and maintenance (O&M) needs

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resulted from a combination of rapid camp expansion, fast self-development by refugees, and high population density. These factors expedited the consideration of integrated approaches for service provision similar to urban utilities, however the institutional context differs greatly. No plan exists for infrastructure or resource management functions, administration, revenues, auditable financial systems, nor customer service contracts outlining service levels, rights and responsibilities. The fast conception of a refugee camp as an urban setting, with an integrated sustainable approach within two years after opening, is novel. The objective of this paper is to describe the development of water and sanitation infrastructures in Zaatari camp, from the emergency phase towards an integrated sustainable solution.

CAMP DEVELOPMENT

The United Nations High Commissioner for Refugees (UNHCR) is mandated to lead and co-ordinate the protection of refugees. To meet life-saving needs of refugees, UNHCR partners with other UN agencies, such as UNICEF for WASH, and non-governmental organisations (NGOs). UNHCR's policy is to avoid the establishment of refugee camps, wherever possible, while pursuing alternatives to camps that ensure refugees are protected and assisted effectively and enabled to achieve solutions (UNHCR 2014a). After a camp is established, in time, its development transitions from emergency to a post-emergency phase. The emergency phase is characterised by the continuous arrival of large groups of despairing people for as long as causal factors persist. Provision of essential services such as food, shelter, health care, water and sanitation needs to be timely and efficient. In protracted situations, refugees may establish their lives similar to settlements. As the average life of a refugee camp is 17 years, facilities and services have to be developed sustainably to serve the population for years ahead.

The size and density of a camp affect morbidity, resource competition, dignity and security. The highly variable camp population, resulting from Syrian refugee movements, made it difficult to plan evenly distributed facilities. Therefore, planning sustainable services required reference to variable density urban experiences.

WATER AND SANITATION SERVICES DEVELOPMENT

WASH minimum standards defined by the 'Sphere project' (Sphere 2016) for the emergency phase are adapted for location and cultural context. Service provision is influenced by physical constraints, funding, and the host country situation, especially the state of water and sanitation services. The drivers for integrated sustainable development of adapted water and sanitation services resulted from observing stakeholder's perspectives. The major drivers for Zaatari camp are as follows:

- Refugees: spontaneous coping mechanisms conflicting with humanitarian assistance resulting in inequity, unregulated wastewater disposal by 93% of households (REACH & UNICEF 2014), and unsustainable O&M costs. Figure 1 presents the extent of household toilets in February/March 2014.
- Humanitarian organisations: cross-cutting impacts on other sectors, e.g. health, and resource sustainability.
- Local authorities: risks to socioeconomic stability and sustainable national resource and infrastructure management. The Ministry of Water and Irrigation/Water Authority of Jordan (MWI/WAJ) have been involved and consulted in the refugee response from the earliest phases.
- Donors: risks to funding, uncertain budgets, and unaccountability.

From the start, humanitarian organisations delivered drinking quality water from boreholes to communal WASH blocks, communal water points and private tanks, with a set average standard of 35 L/p/d (UNHCR 2015). However, actual availability is most likely higher due to the proliferation of household water storages and vendors bringing water in the camp and selling it in cooperation with and to refugees. Discussions on possible options (centralised versus decentralised) for sustainable water supply solutions began in late 2012. A milestone was the decision in May 2014 for a camp-wide, household-level drinking water network. The decision was based on a feasibility study with detailed options analysis comparing different water access levels ranging from communal to household

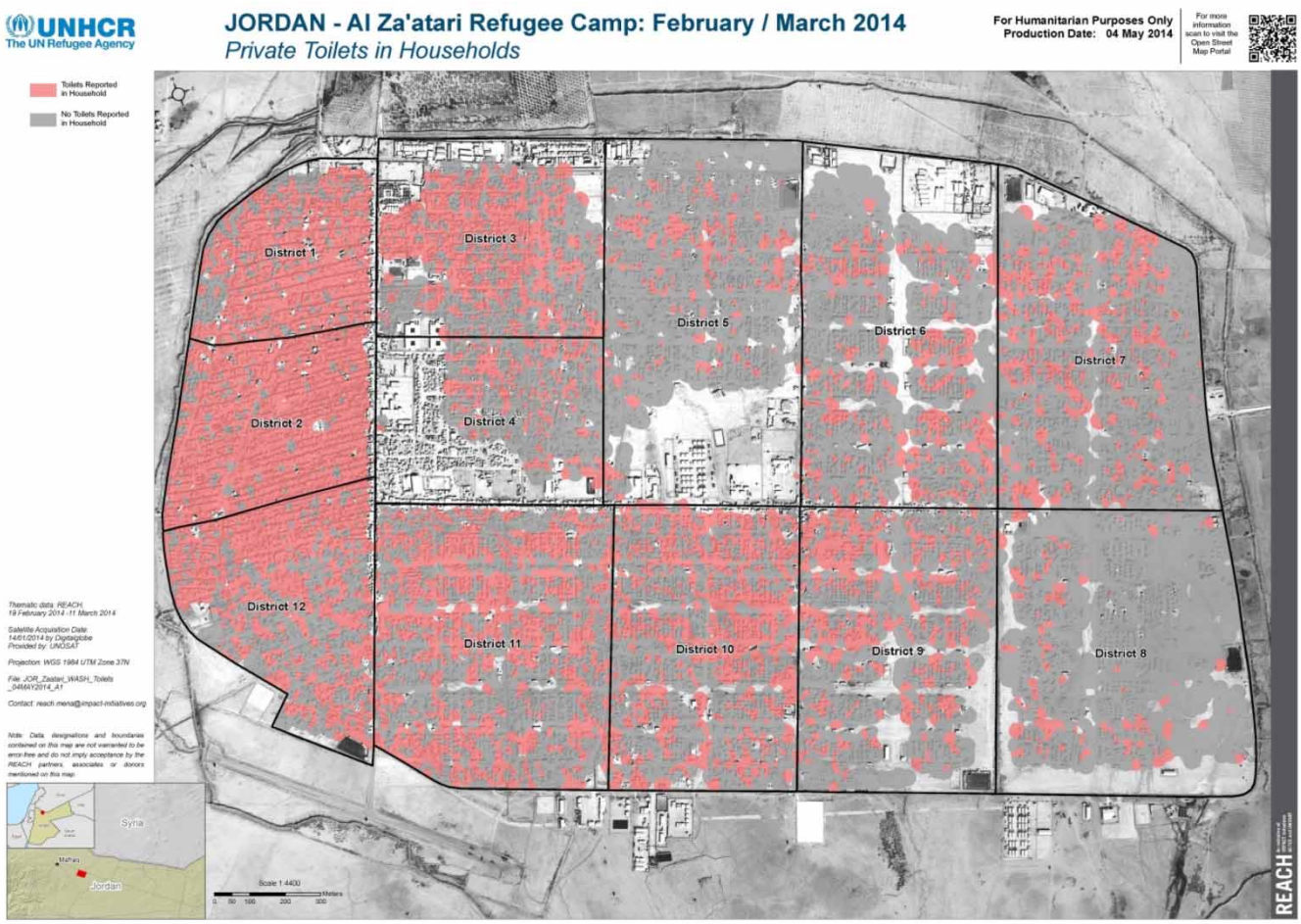

Figure 1 | Zaatari camp private toilets in households February/March 2014 (REACH & UNCHR 2014).

(UNHCR *et al.* 2014). To ensure the most sustainable infrastructure, a multi-criteria comparison was undertaken with participation/representation of all stakeholders. Net present cost analysis (including sensitivity analysis) was undertaken to present the financial value of each option.

From the start, humanitarian organisations provided refugees with communal WASH blocks including toilets, showers and laundries at the average ratio of 50 persons per communal toilet. However, 84.6% of the refugee households had installed toilets and showers in their shelters by late 2014 (UNICEF 2015). Household facilities were connected by refugees to either open pits, wastewater collection tanks of communal facilities or storm water drains with the risk of overflow in wet weather. Wastewater was tankered out from these temporary storages and initially disposed at a municipal wastewater treatment plant (WWTP).

The multi-criteria option analysis of wastewater systems began in early 2013 with a milestone in September 2014 when stakeholders agreed all household WASH facilities would be made safe and hygienic through a household-level wastewater network discharging to a containerised on-site WWTP. Based on the 'simplified sewer' (Bakalian *et al.* 1994), a 'solids-free sewer' was adopted for the camp network which commenced parallel to an interim household storage solution to be later integrated with the sewer. In 2016 all households were properly and safely connected to family-cluster wastewater storage tanks. The WWTP commenced operation in early 2015 with effluent quality permitted for reuse in animal crops irrigation. Funding for the Zaatari camp water infrastructure was achieved by UNICEF and WASH partners, through interagency humanitarian appeal mechanisms.

DISCUSSION

For truly sustainable infrastructure, all physical planning sectors would simultaneously and cooperatively develop integrated solutions and designs as would be undertaken in urban master planning, and as recommended in the UNHCR Global Strategy for Settlement and Shelter (UNHCR 2014b). Although some of these concepts were referenced during camp conception, the rapidly changing situation highlighted the difficulty of integrating all sector's technical design objectives and implementation schedules. Nonetheless, some agreed principles deemed indispensable provided the foundations for the technical design of water and wastewater infrastructure as part of an integrated camp water cycle. The Zaatari water cycle as of early 2015 and planned future are summarised in Figures 2 and 3.

The initial benefit-cost analysis was positive after five years for both water and wastewater infrastructure. For Zaatari, infrastructure life expectancy is at least 15–20 years (USEPA 2015) if designed to minimum standards. Therefore, regardless of whether refugees remain, the infrastructure delivers future benefits to local communities. The end value will be predominantly determined by the actual use post-refugees.

Jordanian standards and codes were considered for the design and construction of the camp infrastructure. Urban standards usually contain a high factor of safety to ensure meeting legal service level agreements. However, some deviations from these standards had to be applied due to specific constraints in Zaatari. For example, low water and high solids concentration in wastewater, space constraints, depth of bedrock, distances to span, lack of legal customer contracts or tariff system, and expected limited O&M resources, resulted in the adoption of 'simplified sewers' (Bakalian *et al.* 1994). Simplified sewers have been implemented in dense, low income areas around the world for greater design life and capacities than Zaatari. They provide more degrees of flexibility than conventional urban sewer design resulting in reduced capital costs, implementation time and O&M requirements.

The Zaatari design process stipulates the need to develop risk management strategies including O&M manuals with consideration of both technical and behavioural scenarios. The legal status of both refugees and humanitarian organisations in a hosting country means conventional contracts, including property and asset ownership rights, may not be applicable. This makes the need for community and stakeholder engagement to explore social contracts/agreements critical to minimise conflict, maximise reliability and predictability, and maintain asset value. Involvement of and consultation with refugees needs to commence in the options analysis stage. The critical component of this engagement will be scenario analysis and forecasting of various technical, social and financial aspects including needs/service level, awareness/knowledge/skills level, shared responsibilities, conflict minimisation and resolution mechanisms which are critical to establishing mutually beneficial agreements (Mara & Alabaster 2008).

Synchronising the construction of centralised water and sanitation infrastructures is important in densely populated areas such as Zaatari camp. The options for location of infrastructure horizontally and vertically are limited, with greater flexibility for the pressurised water network than the gravity wastewater networks. Footprint and ground constraints require water and wastewater systems to be laid in close proximity, especially at local street level, while considering other risks such as: wastewater contaminating intermittently-pressurised drinking water; reduced maintenance access; impact on inhabitants; restricting service delivery during construction, and construction inefficiencies. Pre-planning would ideally result in synchronised construction of both networks to minimise these risks, but will be difficult in Zaatari camp due to funding issues and different implementation schedules. Development towards urban infrastructure in refugee camps can be focused and optimised through a project management framework similar to that used in urban development.

The project management roles should include governance, stakeholder and information management and quality control of all phases from design through implementation, handover and development of an optimised operational strategy. Project management in rapidly evolving refugee camps is even more critical than in established urban settings, considering infrastructure implementation and performance standards need detailed, specific adaptation.

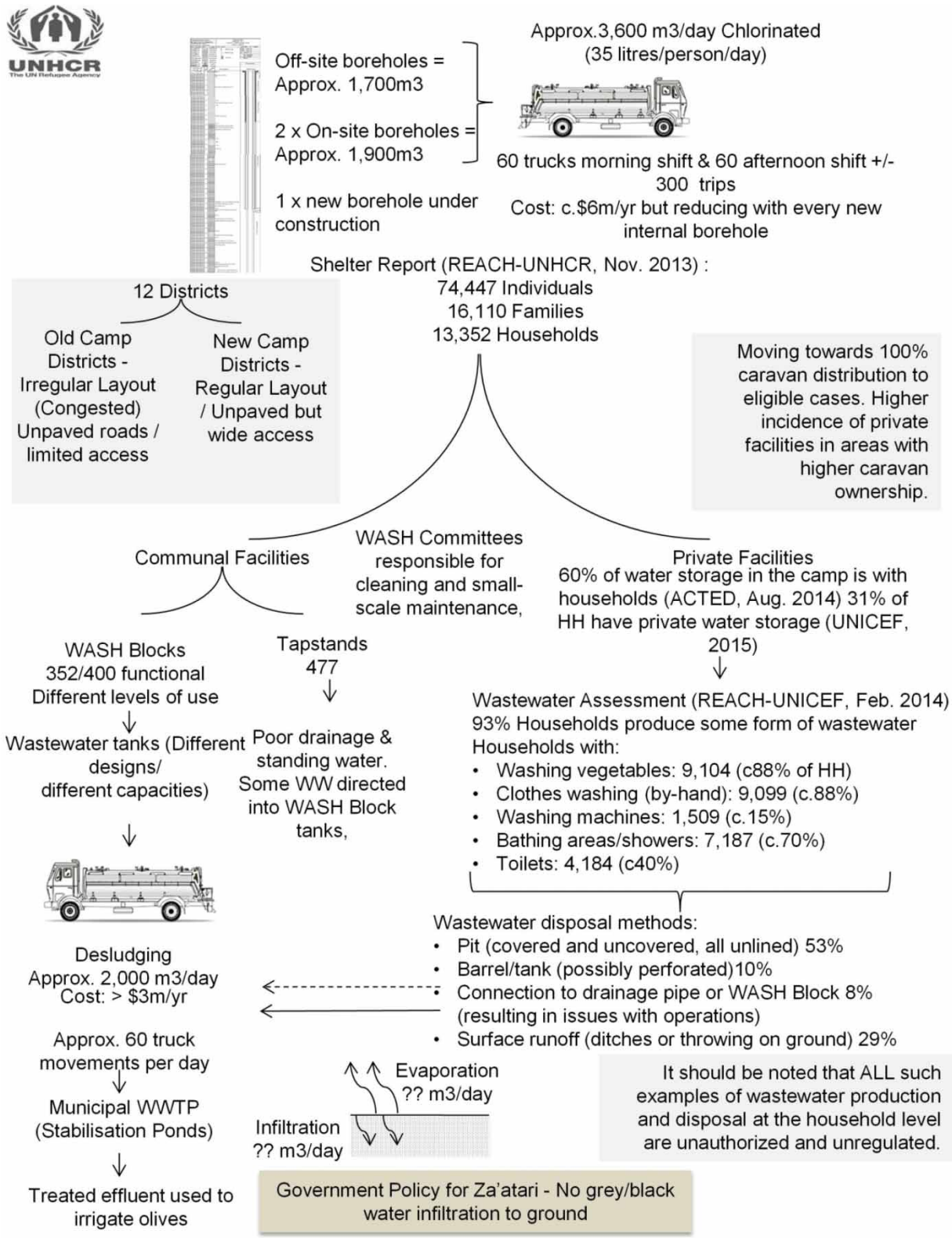

Figure 2 | Water cycle of Zaatari camp as of January 2015.

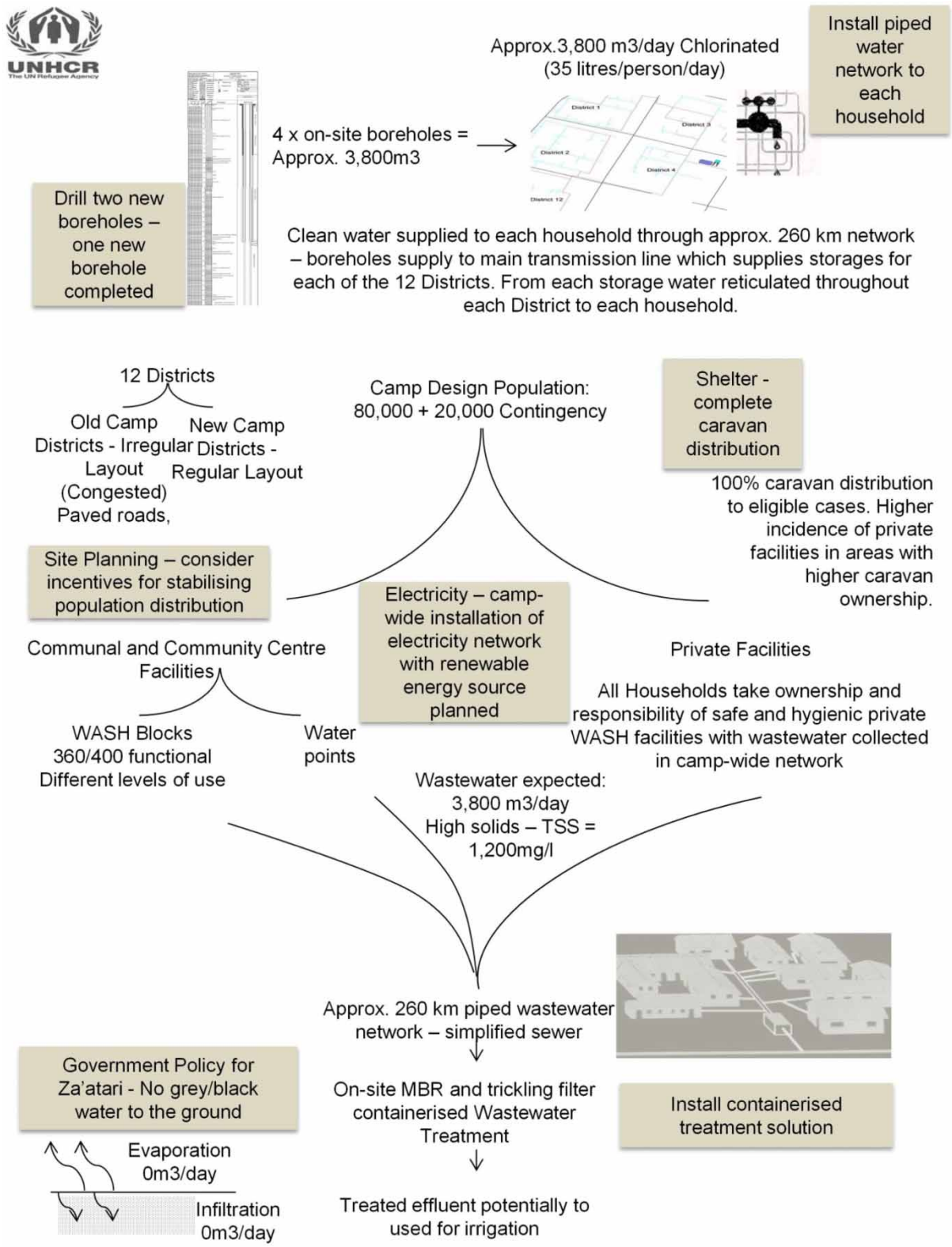

Figure 3 | Future planned water cycle of Zaatari camp.

Opportunities for further sustainability and integration

Increased operational, financial and environmental sustainability will add further value to the capital investment. A socioeconomic and financial analysis of the nexus between the camp water cycle and the surrounding Jordanian community could be undertaken to explore future impacts and potential integration with Jordan infrastructure master plans. For integrated development of water and sanitation services in refugee camps, the following roles have been proposed as essential from an early stage:

- development expert to further explore sustainability and integration options;
- expert on public engagement, social assessment, stakeholder management and communications to facilitate trust and goodwill in the process of developing service level and shared responsibility agreements;
- infrastructure finance analyst to formulate budget forecasts for water and sewerage system development and operations into the future.

CONCLUSIONS

The perspective of urban development for water and sanitation in Zaatari camp is essential for an integrated transition from emergency phase to sustainability, while mitigating potential health, environmental and financial risks. Therefore, situational factors should be closely monitored and humanitarian agencies should budget for technical studies to assess the opportunity for master planning. As refugees and humanitarian organisations suffer from limited and uncertain resources, timeframes and status, it is important that urban infrastructure planning tools are adapted for application to refugee settlements to ensure technically, socially, economically and financially optimised solutions. There are significant aspects of urban infrastructure selection, design, implementation and operation that can be adapted to post-emergency settings with long lifespans. Blending the experience, functions and organisational structures of humanitarian organisations with urban and governmental infrastructural organisations is an asset in transitioning from emergency phase toward sustainable solutions.

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