

Water and Sanitation services in UNRWA camps - Challenges, Issues and Way Forward

1 Introduction

The United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) is mandated to provide, assistance and protection, to some 5.9 million registered Palestine refugees across Jordan, Lebanon, Syria, the West Bank, and Gaza. Within its 58 recognized camps and other hosting areas, UNRWA delivers a range of water, sanitation, and hygiene (WASH) services, including safe water supply, sanitation infrastructure, solid waste management, hygiene promotion, and renewable energy solutions for essential facilities. These services are supported by dedicated WASH teams comprising both UNRWA staff and community-based workers, working to ensure safe living environments for camp residents. Through these interventions, UNRWA contributes to numerous Sustainable Development Goals including SDG 6 “Clean water and sanitation for all” and its interlinkages with other SDGs, emphasizing long-term, sustainable improvements to public health and environmental resilience, alongside emergency response capabilities where needed.

This paper examines the status of WASH and solid waste management across all five UNRWA fields of operation, with a primary focus on the 58 formal and eight informal Palestine refugee camps where a significant proportion of the Palestinian refugee population resides. It integrates field data and recent experiences, highlights emerging challenges since the 2023 UN Water Conference, and outlines actionable, scalable solutions. The aim is to provide evidence-based recommendations for UNRWA, host authorities, donors, and international partners to safeguard access to essential WASH and solid waste services while upholding the dignity and resilience of Palestine refugees.

Palestine refugees served by UNRWA continue to face severe, interrelated deficits in water, sanitation and solid waste services that undermine dignity, health and resilience. These are not only technical failures of pipes and trucks: they reflect political constraints on bulk supply, chronic under-investment in ageing networks, and fast-moving crises (conflict, climatic extremes and economic collapse) that together convert routine shortages into public-health emergencies. This paper draws on UNRWA field reporting, Inter-agency monitoring and UN assessments to provide an overview and identify suitable pragmatic, rights-based responses.

Across all UNRWA Fields of operations, the camp and shelter-level realities faced by Palestine refugees are stark and highly diverse. Many shelters across all UNRWA fields of operation report water being supplied once-per-week or less, forcing households to rely on small rooftop tanks and unregulated private tanker purchases. Typical household rooftop tanks are small (1-2 m³) and often poorly maintained; emergency central tanks are rare or absent in many sites. These constraints directly reduce hygiene practices and push families to buy water at prices that further strain livelihoods. Inter-agency monitoring in 2025 recorded rapidly worsening household water

security and widespread depletion of hygiene supplies, particularly for the people who have been displaced and living in displacement sites. In countering these challenges, UNRWA is providing services and places to stay for displaced refugees in UNRWA schools that have been converted into Designated Emergency Shelters (DES) specially in Gaza.

At the camp level, sanitation and solid-waste services face parallel collapses in some UNRWA fields. Sewer networks where present are often undersized, blocked, and vulnerable to winter storm surges, leading to recurrent sewage overflowing into streets and shelters. These systems in general are managed by respective host authorities. In Gaza the environmental consequences of the ongoing conflict are already severe: UN and UNEP assessments document extensive damage to water and wastewater infrastructure and large volumes of accumulated waste that present immediate disease and marine-pollution risks¹.

2 Status and Trends

UNRWA's environmental health and infrastructure programme across its five fields of operation (Jordan, Lebanon, Syria, West Bank, including East Jerusalem, and Gaza) continue to sustain essential WASH services under conditions of extreme strain. Chronic underfunding, infrastructure degradation, population growth, and recurrent crises both natural and man-made have combined to weaken service reliability and resilience. While national water stress affects all host countries and authorities, Palestine refugees in camps face disproportionately severe access constraints compared to surrounding populations².

While statutory responsibility for water and sewerage networks rests with host governments and authorities, UNRWA plays a vital complementary role within refugee camps. The Agency maintains internal distribution lines, wells, and sewerage systems in coordination with national and municipal utilities such as the Palestinian Water Authority (PWA) in the West Bank and Gaza, Water Establishments in Lebanon³, and local authorities in Jordan and Syria. This collaborative approach helps ensure daily services and rapid repair responses within camps, even during national crises, power shortages, or conflict-related disruptions.

UNRWA's operational capacity remains vital for Palestine refugees. Its efforts in maintaining water and sewerage systems, managing electricity-powered and renewable-energy pumping, sustaining solid waste collection, and implementing hygiene infrastructure and campaigns reflect a consistent commitment to environmental health and public safety across all Fields of operation.

¹ https://www.un.org/unispal/wp-content/uploads/2024/06/environmental_impact_conflict_Gaza.pdf

² El Kawak M, Al Hassanieh J, Berjawi M, Jurdi M, Abiad MG, Yassin N, et al. (2024) Cytotoxicity of water supply in a Palestinian refugee camp and a Syrian informal tented settlement in Lebanon. PLoS ONE 19(1): e0294679. <https://doi.org/10.1371/journal.pone.0294679>

³ Water Establishments in Lebanon refer to the public water and wastewater utility companies responsible for managing water supply, sanitation, and wastewater treatment services across various regions of Lebanon.

As of 31 December 2024, approximately 1.7 million registered Palestine refugees lived in the 58 formal UNRWA camps, while around 5.6 million registered persons resided outside the camps⁴.

2.1 Water Supply and Storage across UNRWA Fields

Access to safe and reliable water in Palestine refugee camps remains one of the most pressing environmental, developmental and humanitarian challenges across all UNRWA fields. Despite variations among its five fields of operation, a consistent pattern emerges: Water scarcity, irregular supply cycles, and aging infrastructure continue to undermine the resilience of camp populations. Most systems depend heavily on groundwater extraction, limited municipal allocations, or damaged networks, with service reliability determined largely by energy availability and maintenance capacity rather than system design.

2.1.1 Water Supply

Water availability varies widely across fields. In **Jordan**, approximately 2.3 million Palestine refugees are registered with UNRWA and approximately 577,000 Palestine refugees are living in the 13 camps (10 official + 3 unofficial camps). Nearly all camp shelters are connected to public networks; however, supply frequency ranges from weekly distribution in camps such as Husn and Marka camp to once every 21–25 days in Jerash and Souf camp. These prolonged intervals force reliance on private tankers. UNRWA ensures equitable internal distribution and community awareness campaigns to promote conservation and safe water storage practices.

In **Lebanon**, approximately 0.49 million Palestine refugees are registered with UNRWA and approximately 246,000 Palestine refugees are living in the 12 camps. UNRWA is delivering around 34,000 m³ of water daily through 76 wells and three reverse osmosis (RO) units. Frequent power cuts and saline intrusion in coastal camps (particularly in Rashidieh and El Buss, hosting an estimated 50,000–60,000 Palestine refugees) disrupt supply. UNRWA has expanded the use of solar pumping and routine well maintenance, reducing outage durations and increasing operational sustainability.

In **Syria** approximately 0.58 million Palestine refugees are registered with UNRWA and approximately 101,000 Palestine refugees are living in the 12 camps (9 camps + 3 unofficial camps). Water services in the camps depend on local governorate networks supported by UNRWA-managed wells and elevated tanks. Interruptions to supply remain common due to electricity shortages and damaged networks. Moreover, the return of refugees to their communities has increased overall water demand, putting additional pressure on already strained systems. The

⁴ As per UNRWA registration data: a total of 5,914,407 Palestine refugees (2,907,036 female and 3,007,371 male) and 815,159 other registered persons (470,927 female and 344,232 male) were registered with the Agency as of 31 December 2024 (UNRWA Registration Report 2025).

Agency conducts regular rehabilitation and hygiene promotion activities to mitigate associated health risks. UNRWA has strengthened system resilience by installing generators, rehabilitating well equipment, and upgrading pumping capacity to ensure minimum water continuity during extended power outages.

In the **West Bank**, approximately 0.92 million Palestine refugees are registered with UNRWA and approximately 278,000 Palestine refugees are living in the 21 camps (19 official camps + 2 unofficial camps). The supply of municipal water that is managed by the PWA are frequently curtailed due to reductions in Mekorot's supply⁵, particularly in the southern governorates. As a result, many refugee camps now receive water only once weekly, and in some cases once every two weeks. These prolonged interruptions force residents to complement the limited municipal supply by purchasing water from private tankers, often at high cost and without guaranteed water quality. The heavy reliance on private trucking may contribute to increased contamination risks, especially where unregulated boreholes or tanker filling points are used. Access challenges in the northern West Bank have further compounded service gaps. Due to the current security situation and frequent movement restrictions, several northern camps, including Tulkarm Camp, Nour Shams Camp, and Jenin Camp continue to face prolonged disruptions in water supply and delays in network maintenance. Humanitarian access for water trucking and rehabilitation works has also been intermittently constrained, affecting the camp residents residing in these areas.

In **Gaza**, approximately 1.6 million Palestine refugees are registered with UNRWA and approximately 510,000 Palestine refugees are living in the 8 camps. The recent hostilities have caused widespread infrastructure damage, destroying most water and sewage facilities. The situation evolved during the war due to access constraints, security risks, and damage to infrastructure, reducing the number of operational UNRWA-managed water wells from seven (7) before the escalation to only three (3) currently. Despite these conditions, UNRWA continues to operate three (3) of remaining wells, rehabilitate the damaged ones as may be possible, coordinate emergency water trucking, and provide desalinated water to shelters. These emergency efforts prevent total service collapse and represent one of the most critical humanitarian operations in the Strip. Furthermore, due to security constraints and ceasefire agreement, the yellow line defines the inaccessible areas which include parts of Jabalia Camp, Burij Camp, Maghazi Camp and Beach Camp and entire Rafah Camp, limiting UNRWA's ability to deliver water and sanitation services in these locations.

2.1.2 Storage and Emergency Capacity

Water storage remains a key resilience factor across all fields. Most households rely on 1–2 m³ rooftop tanks, providing only short-term reserves.

⁵ Mekorot is Israel's national water company, which supplies water to parts of the West Bank under specific agreements.

In **Lebanon**, over 30 communal tanks exist across 12 camps, with several high-capacity assets such as the 1,500 m³ Deir El Quasi tank in Ein El Hilweh camp significantly enhancing resilience. New solar-powered pumping and water treatment installations, including solar pumps and control systems for communal tanks have improved operational continuity despite electricity shortages.

In **Jordan**, communal storage facilities are limited, and almost all camp shelters have water storage tanks, and many shelters have more than one tank. At the beginning of 2025, the Husn Camp Service Committee distributed 800 water tanks to most shelters strengthening local coping capacity. The Agency continues to advocate for integrating emergency storage into UNRWA's internal camp improvement plans (CIP) to ensure systematic upgrades within the camps. In **Syria**, emergency tanks exist in some camps, supplemented by awareness campaigns on safe water storage. UNRWA's regular inspections and cleaning campaigns reduce contamination risks. Additional elevated tanks have been rehabilitated to increase reserve capacity, particularly in camps where municipal supply is highly unreliable. UNRWA also optimizes well-pumping in critical situations to ensure that vulnerable households maintain access to safe drinking water. The Agency also deploys emergency water trucking in extreme cases, preventing service collapse for vulnerable households.

In the **West Bank**, most shelters rely on rooftop water tanks, many of which are old or poorly maintained and require repair or replacement to ensure safe storage and reduce water losses. UNRWA's engineering teams regularly inspect internal camp networks and implement rehabilitation works, as needed. At the same time, UNRWA's Environmental Health Teams conduct routine water-quality monitoring across multiple sampling points inside the camps, testing for residual chlorine and microbiological contaminants in UNRWA laboratories. By contrast, the Palestinian Ministry of Health conducts water testing primarily at main distribution points. When UNRWA's teams identify concerns or require additional confirmatory testing, they formally request specialized sampling and analysis from the relevant government authorities. These coordinated efforts help maintain basic water safety despite irregular municipal supply and increasing reliance on private trucking.

In **Gaza**, fuel and material shortages continue to limit water production and storage, but the Agency operates emergency trucking and mobile tank units to sustain basic access. The ongoing conflict and restrictions on UNRWA's operations⁶ have devastated UNRWA-managed water (water wells) and sanitation infrastructure. The destruction of UNRWA's Gaza City Water Laboratory in January 2025 further crippled water quality monitoring, leaving only partial testing capacity at Nuseirat camp. As a result, the spread of waterborne diseases including diarrhea, skin infections, and respiratory illnesses has sharply increased amid inadequate hygiene supplies and unsafe water storage conditions. **Table 1** shows an overview of Water Supply and Storage Conditions across UNRWA Fields.

⁶ Restrictions refer to limited access to certain areas, security risks, and constraints on importing fuel, materials, and equipment necessary for UNRWA operations in Gaza.

Table 1: Overview of Water Supply and Storage Conditions across UNRWA Fields (2025)

Field	Main Water Source	Average Distribution Frequency	Key Challenges	Primary Coping Mechanisms
Jordan	Public & groundwater	Weekly to every 25 days	Long supply cycles, tanker dependence	Rooftop tanks, private trucking
Lebanon	Groundwater + 3 RO units	Every 1–3 days (power dependent)	Saline intrusion, power cuts	Solar/diesel pumps, household storage
Syria	Public network & wells	Every 2–3 days	Power shortages, damaged lines	Tankers, hygiene campaigns
West Bank	PWA/Municipal allocations	Weekly or biweekly	Mekorot cuts, leakage	Trucking, small rooftop tanks
Gaza	Wells & emergency trucking	Irregular (hours/week)	Infrastructure destruction, fuel shortages	Temporary desalination, water trucking

2.2 Sanitation Across UNRWA Fields

Sanitation systems across UNRWA’s fields of operations form the backbone of environmental health protection for Palestine refugees, yet they remain deeply fragile. By the end of 2024, approximately 94.6 per cent of all shelters in camps in all Fields (excluding Gaza) were connected to official sewerage networks, indicating that only a small proportion remain unserved. However, many of these foul-water systems are decades old, undersized, and increasingly unable to cope with the rising population, resulting in increase in population density, stormwater, and limited maintenance resources. Persistent blockages, network collapses, and flooding during heavy rains have become recurrent issues in nearly all fields, illustrating the scale of deferred infrastructure renewal. These connectivity figures do not apply to Gaza, where extensive damage during the conflict has left large portions of sanitation infrastructure non-functional.

UNRWA sanitation systems constitute the first line of defense for public health in camps. While networks are aging and often undersized, daily maintenance, joint coordination with authorities, and rapid emergency responses sustain functionality even in the most complex settings.

In Lebanon, all twelve camps are connected to sewerage networks, though conditions differ. Chronic blockages and localized flooding persist in coastal camps such as Shatila and Burj Barajneh camp. Rehabilitation projects between 2023–2025 have improved drainage and replaced damaged lines, while new stormwater catch basins and solar-powered pumping stations have strengthened resilience.

In the West Bank, most camps are connected to municipal or joint sewer networks. UNRWA conducts annual winterization and preventive flushing to reduce blockages, but ongoing

incursions⁷ and frequent infrastructure damage particularly in northern camps such as Jenin, Tulkarem, and Nur Shams camps continue to disrupt sewer lines and increase the risk of overflows. Despite these challenges, coordinated pumping and rapid repair efforts help limit the severity of incidents when access is permitted, as security-related movement restrictions often delay maintenance and improvement works.

In Syria, the Agency manages daily maintenance campaigns in coordination with municipalities, replacing damaged segments and disinfecting networks. Enhanced coordination with local municipalities, rapid deployment of mobile repair units, and community hygiene awareness campaigns further strengthen network resilience. Despite limited spare parts and power shortages, these continuous interventions have contained public health risks and maintained minimum service functionality.

In Jordan, sanitation systems are largely functional, maintained through regular preventive programmes. The completion of the Souf valley drainage project and coordination with government authorities have significantly reduced flood incidents. Persistent challenges such as debris accumulation and limited drainage capacity remain under active management. However, Jerash Camp lacks a stormwater drainage system altogether, making it highly prone to flooding during rainfall events. Poor road conditions further exacerbate the risk of overflow.

In Gaza, the sewerage system has suffered widespread destruction since 7 October 2023, with most treatment plants non-operational. UNRWA sanitation teams continue to clear blockages, operate mobile pumping units, and mitigate contamination in and around emergency shelters. Despite extremely limited access, these emergency measures prevent further deterioration of public health conditions. With extreme damage to the existing systems that, pre-conflict, were operating beyond capacity, Gaza’s WASH systems are facing total systemic collapse, placing already vulnerable communities at grave risk of disease and environmental contamination. **Table 2** shows the comparative Overview of Sanitation Systems Across UNRWA Fields.

Table 2: Comparative Overview of Sanitation Systems Across UNRWA Fields (Updated with 2024 Connection Rates)

Field	Network Coverage (% of shelters connected)	Average Reliability	Key Technical Issues	Operational Challenges
Jordan	99.99%	Generally functional but vulnerable during rainfall	Absence of stormwater drainage in some camps; aged pipelines	Limited maintenance capacity; drain blockages from debris and rubble

⁷ Incursions refer to Israeli military operations inside refugee camps, which often involve heavy equipment and result in damage to roads and underground utilities including sewer lines.

Field	Network Coverage (% of shelters connected)	Average Reliability	Key Technical Issues	Operational Challenges
Lebanon	98.23%	Moderate; affected by power cuts and saline intrusion	Undersized sewers; flooding during winter rains; partial septic use (~25% in Rashidieh)	Electricity shortages; outdated systems
West Bank	75.32%	Intermittent; prone to flooding during heavy rain	Combined sewer–stormwater networks; frequent backflows	Aging infrastructure; lack of network separation
Syria	80%	Low–moderate; frequent blockages and flooding	Damaged or obsolete sewer lines; poor drainage	Limited spare parts; electricity shortages
Gaza	<20% (functional portion post-conflict, 2025)	Critically low; widespread collapse	85% of facilities destroyed; 73 of 84 pumping stations non-functional	Fuel shortages; no spare parts; access restrictions

2.3 Solid Waste Management

Solid waste management across UNRWA's fields remains one of the most resource-intensive and operationally challenging components of WASH services. Despite near-daily collection in all camps, system reliability is highly uneven, shaped by workforce shortages, limited disposal options, and national-level waste crises in host countries.

In **Lebanon**, daily collection and disposal are sustained despite landfill closures and transportation disruptions. Donor-supported maintenance and awareness initiatives have improved cleanliness in high-density camps. The camps generate an estimated 159 tons of solid waste per day, collected by UNRWA's sanitation labourers. Despite daily operations, visible accumulation is common in the afternoons, particularly in dense markets such as Shatila and Burj Barajneh.

In the **West Bank**, despite the challenging situation, UNRWA continues to address environmental health concerns across all camps, including internally displaced person (IDP) collective centers in the north and nearby host communities in Jenin and Tulkarem camp. The camps generate an estimated 125 tons of solid waste per day, collected by UNRWA's sanitation labourers. The Agency also maintains agreements with Joint Service Councils to outsource services during emergencies such as when UNRWA vehicles are unavailable ensuring continuity of critical operations.

In **Syria**, solid waste management continues daily despite resource shortages and periodic access restrictions. UNRWA directly manages waste in several camps (e.g., Sbeineh), while in others such

as Dera'a and Latakia, private contractors are engaged. The camps generate an estimated 207 tons of solid waste per day, collected by UNRWA's sanitation labourers. Labour shortages, damaged vehicles, and rising waste volumes have led to intermittent accumulation, though localized community-led recycling efforts (such as sorting and resale of plastics) have shown promise. However, recycling coverage remains marginal, and the financial and energy constraints continue to limit service regularity. These measures aim to reduce health risks, prevent blockages in drainage systems, and strengthen resilience in camps facing chronic service disruptions.

In **Jordan**, solid waste management operates as a shared arrangement, where UNRWA carries out primary waste collection within camps due to narrow internal streets that prevent municipal access, while waste transport to official disposal sites is carried out by the municipal authorities, or by UNRWA in camps where municipalities cannot access the camp. Refugee camps collectively generate several hundred tons of solid waste per month. The camps generate an estimated 270 tons of solid waste per day, collected by UNRWA's sanitation labourers. For Talbieh Camp, which hosts approximately 10,000 registered Palestine refugees, generates around 700 tons monthly handled through the Madaba Services Council. Narrow streets, aging compactors, and a persistent shortage of sanitation labourers undermine collection efficiency. Accumulation of bulky and construction waste further obstructs service points. While localized awareness campaigns such as school-based and municipal recycling initiatives exist, there remains no structured recycling or waste segregation programme across camps.

In **Gaza**, the war has pushed the waste management system to near collapse. Approximately 260 tons of solid waste are generated daily, but only about 200 tons are collected and removed, leaving over 60 tons per day accumulating near shelters and residential areas. With formal landfills such as Johr El-Deek and Sofa inaccessible, UNRWA has resorted to temporary dumping sites (i.e. Firas Market at Gaza holding over 200,000 m³ of accumulated waste). The combination of destroyed and dilapidated vehicles, lack of fuel, and blocked access has created critical public health and environmental hazards.

Overall, solid waste management in Palestine refugee camps is sustained through UNRWA's exceptional operational commitment under severe financial and logistical constraints. Despite chronic underfunding, limited municipal cooperation, and the absence of modern waste infrastructure, UNRWA continues to ensure daily collection and disposal, preventing serious public health and environmental hazards. These sustained efforts, often implemented through local partnerships and community engagement, demonstrate the Agency's critical role in maintaining safe living conditions. Moving forward, expanding waste reduction, segregation, and recycling initiatives, alongside strengthening access to disposal facilities, remains a key priority for long-term sustainability.

Table 3: Comparative Overview of Solid Waste Management Across UNRWA Fields (2025)

Field	Estimated Waste Generation (tons/day)	Collection Frequency	Operational Capacity / Workforce	Main Constraints	Current Initiatives
Jordan	270	Daily	UNRWA sanitation labourers + contractors	Narrow streets; compactor breakdowns; debris accumulation	School recycling campaigns; coordination with local councils
Lebanon	159	Daily	UNRWA labourers + community-based cash-for-work (CfW)* support	Disposal site closures; landfill fees; bulky waste	Continuous collection; donor-funded equipment; limited segregation
West Bank	125	Daily	UNRWA sanitation labourers; municipal partners	Equipment damage; limited community awareness; debris overload	Youth-led recycling; winterization campaigns
Syria	207	Daily	UNRWA labourers + private contractors	Labour shortages; damaged vehicles; rising waste volumes	Hygiene promotion; small-scale plastic sorting/reuse
Gaza	~260 tons/day (≈115 tons uncollected)	Severely disrupted	50% of fleet destroyed; limited fuel	Access restrictions; landfill closures; fuel shortage	Temporary dumpsites; manual waste clearing near shelters

*CfW = Cash-for-Work, a programme where community members are temporarily employed to support camp services and receive cash compensation.

2.4 Comparative WASH Conditions: Camps vs Host Populations

While host countries such as Jordan, Lebanon, and Syria face national water scarcity and aging public infrastructure, Palestine refugees living in camps experience disproportionate challenges due to higher population density, limited space for infrastructure expansion, and restricted funding for network rehabilitation. The responsibility for infrastructure and service provision in the camps primarily rests with the host authorities, with UNRWA providing support through daily operations, maintenance, and emergency interventions that often compensate for broader national system gaps. Nevertheless, UNRWA continues to play a central role in sustaining service

delivery through daily operations, maintenance, and emergency interventions that often compensate for broader national system gaps.

In **Jordan**, official figures show that the national per-capita domestic water supply hovers around 80–90 liters per person per day in many areas⁸. The disparity between camps and surrounding host communities is relatively narrow in terms of service access. Both refugees and non-refugees are affected by national water rationing policies, with average municipal supply in most cities occurring once per week. UNRWA's operational teams coordinate closely with the Water Authority of Jordan (WAJ) to ensure equitable water distribution, carry out winterization and sanitation campaigns, and provide targeted interventions.

In **Lebanon**, most urban residents access mixed public–private water sources, whereas camp residents rely heavily on overstretched groundwater systems operated by UNRWA and Popular Committees⁹. Field reports highlight significantly lower reliability of water supply in camps, due to frequent breakdowns, saline intrusion and power outages, even as nearby municipalities benefit from stronger infrastructure and regular service¹⁰. Electricity shortages and saline intrusion, especially in coastal areas, frequently interrupt service reliability. Despite these obstacles, UNRWA has implemented donor-funded rehabilitation projects such as solar-powered pumping units and stormwater drainage upgrades that have improved service continuity in several camps. However, disparities persist, with national systems benefiting from greater infrastructure investment and lower user density compared to congested camp settings.

In **Syria**, post-conflict reconstruction has partially restored municipal water networks in urban centers, yet many camps such as Khan Eshieh and Sbeineh remain dependent on emergency and temporary storage. Across Syria, Palestine refugee camps continue to face severe and protracted challenges in securing safe and reliable water supply and sanitation services. As many camps still rely on intermittent tanker deliveries and small rooftop tanks, damaged sewage networks increase health risks. According to UNRWA's 2025 Emergency Appeal and the 2024 Syria Field Update¹¹, most camp infrastructure remains partially functional, at best, following more than a decade of conflict and repeated localized damage. UNRWA focuses on emergency water trucking, hygiene promotion, and targeted rehabilitation to sustain minimal service levels.

In the **West Bank**, camp residents receive water only once every 7–14 days or longer, depending on municipal schedules and system pressure. As a result, families rely heavily on rooftop tank storage, which increases the risk of contamination and waterborne disease. Per capita water

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https://www.mwi.gov.jo/ebv4.0/root_storage/ar/eb_list_page/national_water_conservation_roadmap_english_2024-0.pdf

⁹ Popular Services Committees (PSC) in refugee camps are a liaison body between the camps and UNRWA and the Palestinian Authority (PA), and are responsible for security and governance in the camp

¹⁰ https://www.unrwa.org/sites/default/files/content/resources/lebanon_factsheet_2025.pdf

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https://www.unrwa.org/sites/default/files/content/resources/unrwa_2025_syria_lebanon_and_jordan_emergency_appeal_f.pdf

availability is often only around 60 lpcd (liters per capita per day) below the WHO/UNICEF¹² recommended minimum for basic human needs. The Palestinian Water Authority (PWA) has designated West Bank camps as intervention zones, and planned reconstruction aligns with its 2023–2027 strategy to improve water equity, reduce losses, and ensure safe access for vulnerable communities. However, the implementation of this plan has been constrained by limited financial and operational resources, particularly in light of the ongoing regional conflicts and budgetary pressures on the Palestinian Authority (PA).

The **Gaza Strip** shows clear, quantified deterioration of WASH services following intense hostilities and infrastructure damage. OCHA WASH snapshots and sector reporting from 2025 indicate that a large share of households are receiving well below humanitarian minimums: for example, as of early April 2025 roughly 35% of people in Gaza were estimated to receive less than 15 litres of water per person, per day for drinking, cooking and basic hygiene, and sector monitoring reported very high rates of damage to WASH assets across the Strip. UNRWA, UN and other humanitarian agencies appeal's describe severe destruction of wells, pumping stations and sanitation assets and record massive reliance on emergency water trucking, temporary desalination and ad hoc waste disposal arrangements; together these sources make clear that both quantity and quality of water reaching many IDPs and camp residents are critically impaired and require simultaneous emergency and recovery responses.¹³

The UN 2023 Water Conference reinforced the global commitment to ensuring equitable access to safe water and sanitation under the principle of “*Leaving No One Behind*” (**UN-Water, 2023**).¹⁴ For Palestine refugees, this translates into ensuring that water scarcity, aging infrastructure, and financial constraints do not translate into systemic exclusion. UNRWA's WASH interventions play a critical role in narrowing the equity gap between camps and surrounding host communities, particularly in contexts such as Jordan where service frequency and quality are comparable despite broader national water stress. By promoting inclusive and rights-based WASH delivery, UNRWA not only addresses immediate humanitarian needs but also upholds global principles of justice, dignity, and equality embedded within the Sustainable Development Goals (SDG) and the Water Action Agenda.

3 Challenges and Emerging Issues

Since the 2023 UN Water Conference, the context in which UNRWA delivers water, sanitation, and hygiene (WASH) services have deteriorated sharply. Refugee camps across Jordan, Lebanon, Syria, the West Bank, and Gaza face mounting pressures from conflict, climate-related stresses, aging

¹² “WHO/UNICEF recommend a minimum of 50–100 liters per person per day (L/c/d) for basic human needs under the SPHERE standards, including drinking, cooking, personal hygiene, and sanitation.”

¹³ https://www.ochaopt.org/sites/default/files/Gaza_Reported_Impact_Snapshot_03_April_2025.pdf
https://www.ochaopt.org/sites/default/files/Gaza_Reported_Impact_Snapshot_23_July_2025.pdf, and
https://www.ochaopt.org/sites/default/files/Gaza_Reported_Impact_Snapshot_23_July_2025.pdf

¹⁴ UN-Water. (2023). Key Outcomes of the UN 2023 Water Conference. Geneva: UN-Water Secretariat.

infrastructure, and chronic underfunding. The challenges identified go beyond technical service delivery: they reveal deep interlinkages with health, resilience, governance, and environmental sustainability. This section explores the key challenges and emerging issues that have become more urgent since 2023, analyzing their implications for Sustainable Development Goal (SDG) 6 on water and sanitation, and highlighting synergies with other SDGs.

3.1 Infrastructure Damage and Service Disruptions

Across UNRWA's five fields of operation, the fragility of WASH infrastructure at camp level is evident. Protracted displacement, demographic growth, and limited capital investment have left most systems overstretched.

In **Gaza**, the war has devastated WASH infrastructure. Around 85% of water and sewage facilities were destroyed, while 73 out of 84 sewage pumping stations ceased functioning. More than 175,000 linear meters of sewer lines were damaged, and at least 25,000 meters of these were in and around camps. Water wells have been destroyed or damaged, including four out of seven in Jabalia camp. The collapse of wastewater treatment means that tens of thousands of cubic meters of raw sewage flow daily into streets, open basins, and the Mediterranean Sea. Such destruction has created a humanitarian crisis, exposing internally IDPs to open sewage and accelerating outbreaks of diarrhea, skin diseases, and respiratory infections. The data is based on assessments conducted by UNRWA's Gaza Field Team in July 2025. UN agencies on the ground are struggling to mitigate the crisis. UNRWA is currently operating approximately 100 Designated Emergency Shelters (DESS) and hosting around 75,000 displaced people. Furthermore, together with other UN humanitarian partners, continues to truck water to communities and operating small desalination units where possible ¹⁵ as of 4–10 September 2025 ¹⁶. In January 2025, for example, aid groups like Médecins Sans Frontières (MSF)¹⁷ were distributing 500,000 liters of desalinated water per day at emergency water points across Gaza's refugee camps, despite ongoing hostilities. But these efforts can only meet a fraction of needs, and fuel and access restrictions cripple their operations¹⁸. Every day that critical supplies are denied and infrastructure remains under fire, the humanitarian situation worsens. For Gaza's population, over half of whom are children, the right to water and sanitation exists on paper but not in practice under these conditions.

In **Syria**, while government networks provide water and sewage services, protracted conflict has eroded functionality. Frequent electricity cuts, damaged pipelines, and under-maintained storage facilities mean residents often face interruptions lasting up to 72 hours. Many camps rely on supplementary tanker deliveries, which increase costs and reduce reliability. Old sewage networks

¹⁵ <https://palestine.un.org/en/266262-28-billion-appeal-three-million-people-gaza-west-bank#:~:text=%E2%80%9Ctwo%20thirds%20of%20the%20population,vicinity%20of%20the%20UN%20agency>

¹⁶ <https://www.un.org/unispa/document/unrwa-situation-report-188-12sep25>

¹⁷ "Médecins Sans Frontières (MSF), also known as Doctors Without Borders, is an international humanitarian organization providing medical and emergency relief in conflict and disaster zones."

¹⁸ <https://www.unicef.org/mena/press-releases/gazas-taps-running-dry-fuel-crisis-deepens-daily-struggle-families#:~:text=%E2%80%9CSince%20all%20the%20electricity%20to,more%20than%20two%20million%20P> alestinians

in camps such as Khan Eshieh and Khan Dannoun camp frequently overflow during heavy rain, posing both environmental and health risks.

Lebanon faces similar structural destruction, though in a different context. Most camp water and sanitation systems date back decades, with many installed in the 1950s and 1960s. A 2016 assessment showed that numerous elevated tanks were already deteriorating, and current conditions reveal widespread non-functionality. In Burj Barajneh and Dbayeh camp, multiple tanks are no longer in use, while others operate with limited capacity. Maintenance is irregular due to funding gaps and reliance on community committees. The country's severe economic collapse since 2019 has further constrained resources for rehabilitation. Essential facilities, including schools and community spaces, often require prioritized WASH interventions to maintain safe and functional service delivery. UNRWA also implements rapid repair teams and mobile treatment units to address sudden service failures, while coordinating with local authorities to secure spare parts and fuel for pumps. Community engagement programmes educate residents on safe water use and hygiene practices, mitigating health risks during prolonged outages.

In the West Bank, while shelters are connected to municipal or camp wells, water supply remains highly irregular due to reliance on the Mekorot water company, which is based in Israel. Refugee households often receive water only once per week or bi-weekly, forcing them to rely on rooftop tanks that are frequently in poor condition and to purchase water from private tankers. The absence of emergency water tanks leaves residents particularly vulnerable in IDP collective centers housing displaced populations from Nur Shams, Tulkarem, and Jenin camps, where incursions that began in January 2025 have caused displacement and disrupted water supply. Combined with high losses from aging networks in other camps, these conditions raise additional public health concerns, including elevated nitrate levels in boreholes such as those in Fawwar Camp, which residents often rely on for drinking water. United Nations Operational Satellite Applications Programme (UNOSAT) damage assessments confirm extensive destruction across internal WASH and infrastructure systems in northern camps.¹⁹ Satellite imagery from UNOSAT's Comprehensive Damage Assessment (21 May 2025)²⁰ confirms extensive destruction across West Bank refugee camps, particularly in Jenin, Nur Shams, and Tulkarem. In **Jenin Camp**, 125 structures were destroyed, 101 severely damaged, and 322 moderately damaged, totaling 548 buildings (~43% of the camp). In **Nur Shams Camp**, 89 buildings were destroyed, 35 severely damaged, and 156 moderately damaged, totaling 280 buildings (~35% of the camp). In **Tulkarem Camp**, 157 structures were destroyed or damaged, with no new damage observed between March and May 2025. This widespread destruction has significantly disrupted water, sanitation, and solid waste services, increasing the vulnerability of both displaced and resident populations. This widespread

¹⁹ https://unosat.org/static/unosat_filesystem/4149/UN-OCHA_027_UNOSAT_CE20231007PSE_WestBank_RefugeeCamps_CDA_SA_20250519.pdf

²⁰ UNOSAT, *Comprehensive Damage Assessment – Jenin, Nur Shams, Tulkarem Camps*, UN Office for the Coordination of Humanitarian Affairs, 21 May 2025 (https://unosat.org/static/unosat_filesystem/4149/UN-OCHA_027_UNOSAT_CE20231007PSE_WestBank_RefugeeCamps_CDA_SA_20250519.pdf)

destruction has further disrupted water, sanitation, and solid waste services, significantly increasing the vulnerability of both displaced and resident populations.

In **Jordan**, although water supply networks cover nearly all shelters, pumping cycles are extremely infrequent in certain camps. Jerash and Souf camps receive water only once every 21–25 days, leaving residents dependent on private tankers and bottled water. Storage limitations are compounded by structural constraints such as zinc roofs that cannot support heavy tanks. In contrast, Husn camp benefits from weekly distribution and a recent distribution of 800 new household tanks, showing the unevenness of service levels. Sanitation systems are generally functional but face recurring overflows, while in Jerash camp the absence of stormwater drainage creates seasonal flooding risks.

The pattern across fields is clear: where conflict has destroyed assets (Gaza, Syria), or where infrastructure is aged and underfunded (Lebanon, West Bank, Jordan), service delivery is precarious. In all contexts, resilience is undermined by insufficient redundancy.

3.2 Resource Scarcity: Water, Energy, and Financial Gaps

Water scarcity is acute. In Gaza, as of 2024–2025 reporting, daily per capita water consumption has fallen to an average of just 15 liters²¹, well below the Sphere standard of 50 liters per person per day. In the West Bank, the field engineers' operational reporting for 2025 that the Israeli restrictions and Mekorot cuts mean residents in several camps often face week-long interruptions. In Jordan, Jerash and Souf camps rely on one distribution every three to four weeks, creating heavy reliance on costly private tankers. In Syria, interruptions lasting up to three days per week are common due to electricity cuts and network damage. These conditions compromise hygiene practices and increase the financial burden on families already living below the poverty line.

Energy scarcity compounds water challenges. Gaza exemplifies this, with the total collapse of its electricity grid and extreme fuel shortages. Generators in designated emergency shelters are unable to operate wells or sanitation trucks consistently. According to UNRWA field engineers' operational reporting (Gaza Field, 2025), reduced fuel allocations has resulted in reduced water production from an estimated 857 m³/day to approximately 600 m³/day, resulting in an operational shortfall of around 300 m³/day. In Syria, electricity blackouts frequently disable pumping stations, while in Lebanon, chronic power cuts hinder water sterilization and pumping.

Financial constraints form the third axis of scarcity. Chronic underfunding of UNRWA's core and emergency funding portals, combined with national economic crises in Lebanon and Syria, restricts investment in network rehabilitation, laboratory testing, and adequate staffing. In the occupied Palestinian territory (oPt), recurrent funding shortfalls limit the ability to replace

²¹ UNRWA, "Situation Report #188 on the Humanitarian Crisis in the Gaza Strip and the occupied West Bank," January 2025 ([UNRWA Situation Report #188 on the Humanitarian Crisis in the Gaza Strip and the occupied West Bank, including East Jerusalem | UNRWA](#)).

damaged WASH assets, rehabilitate aging networks, and sustain essential operations in West Bank and Gaza. For example, in Gaza, UNRWA's sanitation fleet has suffered severe losses, with approximately half of its vacuum trucks and service vehicles destroyed, yet replacement vehicles are impossible to procure under current restrictions and lack of funds. In Lebanon, community committees struggle to finance even basic water tank maintenance.

The interplay between scarce water, fuel, and funding creates a feedback loop: as systems falter, families turn to private markets (tankers, bottled water, informal disposal), driving up costs and inequalities while reducing resilience.

3.3 Environmental and Public Health Risks

Solid waste accumulation is one of the most pressing environmental issues in Gaza. Daily more than 260 tons of waste are generated, but with UNRWA's sanitation fleet halved and fuel scarce, only around 200 tons are collected. Due to restrictions on accessing official landfills located within military zones, the remaining waste accumulates in camps and is temporarily deposited at emergency sites such as Firas Market in Gaza, which spans 33 dunums and contains approximately 200,000 m³ of waste, posing risks to nearby residential areas. In Lebanon, the accumulation of construction debris regularly damages compactor trucks and obstructs waste collection. In Jordan, rubble at collection points in Jerash and Husn impedes services, while in Syria, population density and shortages of labourers cause frequent overflow. In the West Bank, restrictions resulting from the "no contact" policy, which affect licensing and coordination with local authorities, have limited UNRWA's ability to operate and maintain its solid waste management fleet effectively. The long distances to approved dumping sites, particularly from areas near Jerusalem, and the absence of nearby disposal facilities increase transport time, fuel consumption, and maintenance costs. These challenges are further compounded by the risks associated with navigating public roads outside the camps, often passing through checkpoints and areas under Israeli control. Water contamination is a second major threat. In Gaza, the destruction of the UNRWA water testing laboratory in 2025 has crippled water quality monitoring. With limited chlorine supplies and deteriorating infrastructure, risks of *E. coli* and other pathogens have increased. In Syria, reliance on insecure tanker supplies has heightened potential risk of diarrheal diseases, although no outbreaks were reported among Palestine refugees during the 2024 reporting period (UNRWA, 2024 Annual Operational Report). Across fields, storage tanks are often poorly maintained, leading to increased potential for bacterial growth. In West Bank, Fawwar Camp faces a significant public health concern due to dangerously high nitrate levels in its boreholes. All wells exhibit elevated concentrations, posing serious health risks, particularly for children.

Disease outbreaks are already widespread in Gaza. As of July 2025, the Gaza Health Ministry has reported one million cases of infectious diseases since the onset of the conflict, including 44,000 diarrheal infections, nearly 9,000 cases of lice and scabies, and thousands of respiratory illnesses. In the West Bank and Jordan, while outbreaks have been less severe, inadequate water cycles and poor drainage increase vulnerability. The potential of the risk of regional spread hepatitis A, cholera, and other waterborne diseases remains significant.

Flooding risks further exacerbate vulnerabilities. In Jerash camp (Jordan) and Khan Dannoun camp (Syria), inadequate stormwater systems cause sewage to mix with floodwaters, contaminating streets and shelters. In Lebanon, heavy rainfall overwhelms old sewer lines, particularly in Ein El Hilweh. The environmental consequences are transboundary: sewage discharge into the Mediterranean from Gaza threatens regional marine ecosystems and neighboring coastal communities.

In the West Bank, Arroub Camp faces serious concerns regarding potential flooding caused by a new road and drainage system constructed parallel to the camp, which directs runoff toward the area and worsens recurring winter floods. During construction of the Al Arroub bypass road, two culverts were installed near the college to channel runoff toward the Arroub culvert inlet, along with a parallel piping system on the opposite side. Water releases from agricultural ponds near Beit Al-Baraka or treated sewage sources have already caused severe flooding and property damage within the camp. This situation poses a significant public health risk, as residents may be exposed to pathogens in potentially contaminated floodwater.

3.4 Waterborne Disease Outbreaks and Health Implications

Palestine refugee camps across the five UNRWA fields face potential risks of waterborne and hygiene-related diseases due to the fragility of existing WASH systems and service interruptions, although no outbreaks were reported during the 2024 reporting period (UNRWA, 2024 Annual Operational Report). These risks underline the urgent need for sustained water quality monitoring, public health coordination, and infrastructure resilience.

Between 2019 and 2024, several notable outbreaks were recorded in specific UNRWA fields, while overall reporting in the 2019–2024 UNRWA Annual Operational Reports indicates that outbreaks were limited and contained. In Gaza (2024), a poliomyelitis outbreak highlighted vulnerabilities in immunization coverage under conditions of siege and infrastructure collapse. A joint campaign by UNRWA, WHO, UNICEF, and the Palestinian Ministry of Health vaccinated over 600,000 children under ten across two rounds, successfully containing the outbreak and preventing further transmission. Similarly, in Syria (2021), a sewage leak in Qaber Essit caused 419 diarrheal cases, all resolved without fatalities following coordination with governmental authorities. Earlier in 2019 in Jenin Camp (West Bank), 148 gastroenteritis cases were linked to the use of unsafe private wells, prompting joint UNRWA–MOH water testing, chlorination, and hygiene awareness drives.

A concise summary of major incidents is presented in the table below.

Table 4: Summary of Major Incidents for Waterborne Diseases*

Field	Year	Details
Syria	2022	28 cholera cases (polluted water, SFO).
Lebanon	2022	6 confirmed cholera cases at Naher El Bared Camp.
Gaza	2024	Poliomyelitis outbreak; >600,000 children vaccinated; outbreak contained.

Syria	2021	419 diarrhea cases, Qaber Essit; leak resolved.
Lebanon	2022	Cholera cases
West Bank	2019	148 gastroenteritis cases, Jenin Camp; linked to unsafe wells.

* *"Note: These incidents are localized and based on field reports. According to UNRWA Annual Operational Reports (2019–2024), overall outbreaks across the fields were limited and contained."*

3.5 Emerging Issues Post-2023

Since the 2023 UN Water Conference, a series of emerging issues have significantly reshaped the WASH landscape across UNRWA's fields of operation. These issues are not isolated but deeply interlinked, amplifying vulnerabilities and creating new dimensions of risk for refugee communities.

One of the most critical developments has been the escalation of conflict in Gaza, which has led to an unprecedented collapse of water, sanitation, and hygiene systems. As of July 2025, preliminary assessments by UNRWA field engineers in Gaza indicate that 85% of water and sewage facilities have been destroyed, and 73 out of 84 sewage pumping stations are non-operational. In Jabalia camp alone, four out of seven UNRWA water wells have been destroyed, leaving hundreds of thousands of refugees without access to safe water. All wastewater treatment plants have ceased operations, resulting in tens of thousands of cubic meters of untreated sewage being discharged daily into streets and the Mediterranean Sea. This breakdown is not only a humanitarian crisis within Gaza but also an environmental emergency with regional implications, threatening marine ecosystems and the health of coastal populations across borders.

At the same time, climate change impacts are becoming more visible and disruptive. In Jordan, water scarcity has worsened, with shelters in Jerash and Souf camps receiving water only once every 21–25 days, forcing families to rely on private tankers that charge up to 15–18 Jordanian Dinars per 3 m³ during peak summer months. In Syria, water supply interruptions last between 6 and 72 hours multiple times a week, primarily due to weak electrical supply to pumps. Conversely, intense and irregular winter storms are increasing flooding risks, particularly in camps like Jerash in Jordan, which still lacks a stormwater drainage system. These dual extremes of drought and flooding highlight the urgency of developing climate-resilient infrastructure within refugee settings.

Compounding these environmental pressures are the economic crises in Lebanon and Syria and the oPt, which undermine both household resilience and institutional capacity to deliver WASH services. In Lebanon, hyperinflation has made procurement of spare parts for water and sanitation infrastructure nearly impossible, while UNRWA pays approximately USD 2.9 million annually in transport and disposal fees to ensure the continuity of basic solid waste management services. In Gaza, average per capita water consumption in camps has dropped to 15 liters per day as of

September 2025, far below the humanitarian standard of 50 liters, reflecting the collapse of service provision amid budgetary and access constraints²².

A further emerging issue is the rise of regional environmental risks. Makeshift dumping sites in Gaza, such as Firas Market, are holding an estimated 200,000 m³ of accumulated waste as of July 2025, directly contaminating soil and threatening nearby communities. In Syria and Lebanon, unregulated disposal and the absence of recycling systems are exacerbating groundwater and air pollution. These environmental risks extend beyond refugee populations, creating spillover effects for host communities and ecosystems alike.

Taken together, these emerging issues demonstrate that WASH can no longer be regarded as a narrow humanitarian or technical sector. Instead, it has become a central concern for environmental security, climate resilience, and regional stability. Addressing them will require not only immediate humanitarian interventions but also long-term, multi-level strategies that integrate conflict sensitivity, climate adaptation, and environmental governance into WASH programming.

4 Potential Solutions

The escalating WASH crisis among Palestine refugee camps demands not only reactive measures, but also long-term, resilient, and scalable solutions. While implementing sustainable development initiatives is challenging given UNRWA's operational constraints including recurrent conflict cycles, limited funding, and infrastructure vulnerabilities these potential solutions aim to combine emergency relief with targeted, context-sensitive interventions that can be realistically applied where feasible.

In line with the outcomes of the UN 2023 Water Conference, an integrated water–energy–food–waste management approach is essential to achieve sustainable WASH solutions. This Nexus Approach recognizes the interdependence between water availability, sanitation systems, energy access, and food security, particularly in resource-scarce refugee settings²³.

Strengthening climate resilience within WASH operations requires combining renewable energy technologies such as solar-powered pumping with adaptive storage, efficient network design, and decentralized treatment systems. Applying the 4Rs principle (Reduce, Reuse, Recycle, and Recover) within a circular economy approach ensures that water, energy, and waste resources are managed holistically. This integrated model not only enhances efficiency and cost-effectiveness

²² [UNRWA Situation Report #188 on the Humanitarian Crisis in the Gaza Strip and the occupied West Bank, including East Jerusalem | UNRWA](https://www.unrwa.org/resources/reports/unrwa-situation-report-188-situation-gaza-strip-and-west-bank-including-east-jerusalem) (<https://www.unrwa.org/resources/reports/unrwa-situation-report-188-situation-gaza-strip-and-west-bank-including-east-jerusalem>)

²³ <https://www.unwater.org/publications/un-world-water-development-report-2023>

but also reduces environmental impacts and strengthens community preparedness against climate-induced shocks²⁴.

4.1 Strengthening Emergency Water Storage and Buffer Capacity

Given that several camps as mentioned in Table-1 experience water supply only every 21–25 days, enhancing storage capacity is an urgent priority. There is a need to establish modular elevated emergency tanks in central, accessible locations within these camps, each capable of holding sufficient water to meet basic domestic needs during extended gaps in supply. Additionally, booster refilling stations serviced via wells or water trucking can reduce the cost burden on families forced to purchase water. This need is of prime importance, especially considering the severe interruptions in water supply and the lack of sufficient household storage in highly impacted areas²⁵.

4.2 Water Quality Monitoring and Hygiene Interventions

As infrastructure weakens, water quality becomes a significant public health risk. A recent WHO/UNICEF report ²⁶ highlights inequalities in access to safely managed drinking water and basic hygiene services. To remedy this, there is a need to restore destroyed water testing laboratories (notably Gaza's lab was destroyed in early 2025), deploy mobile water testing units, and distribute hygiene kits, chlorine tablets, and safe containers for water storage. Parallel community awareness campaigns, particularly in IDP shelters and camps, on disease prevention, hygiene practices, and safe storage are essential.

4.3 Financing, Institutional Partnerships and Governance

Meeting urgent needs and scaling up solutions requires sustainable funding and strong partnerships. UNRWA's humanitarian appeals (Situation Report #172) underline the shortfall between the resources required for emergency WASH services and the funding available. . UN member states, donors, private sector partners, NGOs, and local governments must coordinate to channel funds for emergency water trucking, energy for pumping, spare parts, and long-term infrastructure recovery. Institutional strengthening, particularly in maintenance, coordination between UNRWA and local water authorities, and community governance of local WASH projects is key to ensuring resilience. Advocacy for unhindered access to all camp areas, including those currently restricted under Israeli legislation affecting UNRWA operations, is critical to ensuring equitable and effective WASH service delivery in Occupied Palestine Territory (Opt)

²⁴ <https://sdgs.un.org/sites/default/files/2023-05/FINAL%20EDITED%20-%20PGA77%20Summary%20for%20Water%20Conference%202023.pdf>

²⁵ [UNRWA Situation Report #172 on the Humanitarian Crisis in the Gaza Strip and the West Bank, including East Jerusalem. All information updated for 15 - 22 May 2025 - occupied Palestinian territory | ReliefWeb](#)

²⁶ <https://cdn.who.int/media/docs/default-source/wash-documents/wash-coverage/jmp/jmp-2025-wash-households-lowres-launch.pdf>

4.4 Scaling Proven Pilots & Focusing on Climate-Resilience

Several pilot initiatives have already demonstrated that small, well-targeted investments can materially improve WASH access in fragile settings. Projects deploying solar-powered pumps, modular elevated storage, and neighborhood-level treatment units have reduced interruptions and improved service continuity where grid power and centralized systems fail. These pilots should therefore be deliberately scaled to reach underserved camps, prioritizing sites with the greatest exposure to supply shocks. Critically, scaling must go hand in hand with climate-proofing: infrastructure designs should be engineered to withstand extreme weather (floods, heatwaves), water sources must be protected from contamination and salinization, and energy systems should include redundancies (solar, battery storage, hybrid generators) so operations can continue during grid or fuel outages. The UNICEF framework on strengthening WASH climate resilience recommends exactly these measures: expansion of solar pumping pilots, flexible storage solutions, decentralized treatment, and integration of nature-based flood mitigation alongside community-led maintenance and context-specific risk assessments to ensure longevity and local ownership²⁷.

4.5 Integrating the 4Rs and Circular Economy Principles

Embedding sustainability within WASH operations requires a strategic shift toward circular water management models that maximize efficiency and minimize waste. The integration of the 4Rs principle, Reduce, Reuse, Recycle, and Recover offers a practical framework to achieve this transformation. By prioritizing reduction, water losses could be minimized through systematic leak detection, improved fixtures, and efficient use practices. The reuse of treated greywater for non-potable applications such as irrigation and cleaning can further extend available resources, while recycling initiatives, including waste segregation and material recovery, help reduce landfill dependency and environmental pollution. Finally, recovering energy from sludge or other organic waste streams presents an opportunity to close the resource loop, generating power that can support local operations.

Collectively, these measures reflect the essence of a circular economy approach, where water, waste, and energy are managed as interconnected systems rather than isolated sectors. Through such integration, dependency on external inputs is reduced while resource recovery and reuse within camps are maximized. By embedding these principles into future WASH programming, UNRWA can transition from reactive service delivery to a proactive, sustainable, and climate-resilient model, capable of meeting both urgent humanitarian needs and long-term environmental objectives.

²⁷ <https://www.unicef.org/indonesia/media/23816/file/framework-strengthening-wash-climate-resilience.pdf>

4.6 Opportunities and Pathways Forward

Despite the challenges facing WASH systems in UNRWA's areas, several opportunities exist to enhance resilience and service delivery. Rehabilitating infrastructure with resilient and decentralized designs such as neighborhood-level water distribution or modular wastewater units can prevent total system collapse during crises.

Renewable energy integration offers another pathway. Solar-powered pumps, hybrid sanitation vehicles, and renewable desalination units could stabilize services amid fuel and electricity shortages, reduce costs, and support climate goals. Successful pilots in Lebanon's camps demonstrate the feasibility of scaling such solutions.

Community participation can strengthen local resilience. Scaling up local recycling, hygiene promotion, and youth-led awareness campaigns could reduce environmental pressures, enhance ownership, and create livelihood opportunities.

Regional cooperation is essential to address transboundary risks. Untreated sewage and marine pollution in Gaza threaten neighboring ecosystems, and joint frameworks could facilitate monitoring and mitigation.

Finally, aligning WASH interventions with the Sustainable Development Goals (SDGs) beyond SDG 6, including health, climate action, sustainable cities, and governance support advocacy and funding, positioning WASH as both a humanitarian and development priority.

5 Recommendations and Conclusions

The escalating WASH crisis in Palestine refugee camps demands a multi-dimensional response that balances immediate humanitarian relief with long-term resilience-building strategies. Drawing on field observations, UNRWA operational reports, and global guidance, this paper presents a set of actionable recommendations to safeguard public health, enhance service reliability, and promote sustainable and climate-resilient systems.

1. Strengthening Emergency Water Supply and Storage

Emergency water storage remains a critical bottleneck across all UNRWA fields, particularly in camps experiencing extended supply interruptions such as Jerash, Souf, and West Bank camps. To mitigate these challenges, there is a need to prioritize the installation of modular elevated water tanks in strategic camp locations. Each tank should be sized to provide a minimum of 50 liters per person per day for at least 21–25 days, in line with Sphere humanitarian standards. In addition, booster stations fed by existing wells or water-trucking services can reduce dependence on private water markets, lowering costs for vulnerable households. Complementary interventions include regular inspection and maintenance of household rooftop tanks and community storage systems, ensuring they remain safe, functional, and free from contamination.

2. Water Quality Monitoring and Public Health Interventions

The destruction of water laboratories, particularly in Gaza, has severely impaired the monitoring of water quality, increasing vulnerability to waterborne diseases. Rapid deployment of mobile water testing units, combined with the restoration of fixed laboratory capacity, should be undertaken immediately. These should be coupled with targeted distribution of hygiene kits, chlorine tablets, and safe water containers. Community awareness campaigns are essential to reinforce safe water handling, personal hygiene, and disease prevention practices. Programmes must be context-specific, including considerations for IDPs living in temporary shelters and overcrowded camps. Integrating community health workers into these interventions can improve uptake and enhance monitoring of emerging health risks.

3. Infrastructure Rehabilitation and Climate-Resilient Design

Long-term solutions require a shift from reactive repairs to resilient infrastructure planning. Decentralized water distribution, modular wastewater treatment units, and solar-powered pumping systems should form the backbone of future WASH infrastructure. Modular designs allow systems to remain operational despite partial network damage, while decentralized treatment reduces dependency on central facilities vulnerable to conflict or extreme weather. Solar and hybrid energy systems enhance continuity, particularly where grid reliability is low or fuel is scarce, as demonstrated in pilot projects across Lebanon. Retrofitting existing networks to integrate climate-resilient elements, such as flood-proof drainage and corrosion-resistant materials, will reduce system failure during extreme events.

4. Renewable Energy Integration

Energy scarcity is a major constraint across UNRWA fields, particularly in Gaza, Lebanon, and Syria. Integrating renewable energy solutions into WASH operations is both feasible and cost-effective. Solar-powered pumps, hybrid desalination units, and energy-efficient vehicles for solid waste collection can stabilize service delivery and reduce operational costs. Piloting battery-backed solar systems ensures continuity during power outages, while also aligning with global climate mitigation objectives. Such investments not only provide immediate operational benefits but also contribute to longer-term environmental sustainability and carbon footprint reduction in densely populated camp settings.

5. Governance, Institutional Strengthening, and Financing

Effective WASH service delivery relies on strong institutional frameworks, robust coordination with local authorities, and sustainable financing mechanisms. UNRWA should continue strengthening partnerships with host-country and host-authority public water providers, municipal councils, and community-based committees to improve maintenance, oversight, and emergency response capacity. Multi-stakeholder funding mechanisms, involving donors, NGOs, private sector actors, and UN member states, are essential to bridge financial gaps and ensure timely procurement of spare parts, energy resources, and infrastructure upgrades. Transparency and accountability in fund allocation will enhance trust and facilitate long-term programme sustainability.

6. Community Participation and Capacity Building

Refugee communities have demonstrated resilience and ingenuity in managing WASH challenges. Scaling up community-led initiatives, such as youth awareness campaigns on water conservation, waste segregation, and hygiene promotion, can strengthen local ownership and reduce environmental pressures. Training programmes for community health workers, sanitation labourers, and local technical teams can enhance operational capacity and create livelihood opportunities. A structured approach to capacity building ensures continuity even amid crises and contributes to social cohesion within camps.

7. Circular Economy and the 4Rs Framework

Applying the 4Rs principle (Reduce, Reuse, Recycle, Recover) within WASH operations offers a pathway to sustainable resource management. Reducing water losses through leak detection, efficient distribution, and conservation campaigns can substantially increase system efficiency. Greywater reused for non-potable purposes, such as irrigation and cleaning, maximizes resource utilization, while structured recycling programmes for solid waste minimize landfill dependency and environmental pollution. A comprehensive adoption of these practices promotes environmental sustainability while enhancing resilience to supply and energy disruptions. Furthermore, Public-private partnerships in areas such as waste collection and recycling services can expand system efficiency, introduce innovative solutions, and support long-term cost reductions. Within solid waste management specifically, expanding collaboration with the private sector offers a pathway to strengthen local systems. Private operators can support improved waste collection, sorting, and recycling services, while corporate social responsibility (CSR) initiatives can introduce community-based recycling activities, awareness campaigns, and investment in small-scale waste processing facilities. Such partnerships not only improve service quality and reduce operational costs but also create livelihood opportunities within camps and reinforce a more sustainable community-driven approach.

8. Regional Collaboration and Transboundary Risk Management

Environmental risks associated with untreated wastewater, marine pollution, and unregulated solid waste extend beyond individual camps, threatening host communities and regional ecosystems. Coordinated monitoring and mitigation efforts with neighboring countries, international organizations, and regional environmental agencies can help manage transboundary risks. Collaborative frameworks should emphasize shared data systems, joint emergency planning, and cross-border capacity building. Such approaches transform environmental challenges into opportunities for regional cooperation and integrated resource management.

9. Data-Driven Decision Making and Technology Adoption

WASH programming must be informed by accurate, real-time data. Deploying digital monitoring systems for water supply, sanitation network performance, and waste collection enables timely detection of service disruptions and efficient resource allocation. Geographic Information Systems (GIS), remote sensing, and mobile data collection platforms can enhance situational awareness,

particularly in inaccessible or conflict-affected areas. Leveraging technology facilitates predictive maintenance, optimizes distribution schedules, and strengthens accountability.

The proposed WASH strategies align closely with the global priorities set out during the United Nations 2023 Water Conference and the resulting *Water Action Agenda*²⁸. The agenda emphasized the urgent need for integrated, climate-resilient, and equitable water management approaches that move beyond short-term interventions. UNRWA's proposed actions—ranging from enhanced emergency storage and solar-powered water systems to the application of circular economy principles, reflect this global vision of transforming WASH delivery into fragile and refugee contexts into more sustainable and self-reliant systems²⁹.

By aligning with international commitments on the human right to water and sanitation, the 4Rs principle (Reduce, Reuse, Recycle, and Recover), and the sustainable Development Goals (SDGs) (particularly SDG 6: Clean Water and Sanitation), UNRWA's interventions contribute directly to advancing the objectives of the *Water Action Agenda 2023–2030* and support the global call to “leave no one behind.”

6 Guiding Questions

To guide effective and sustainable WASH interventions across UNRWA fields, a comprehensive set of operational guiding questions to be answered to support planning, implementation, and evaluation. These questions address emergency water supply needs, optimal tank placement, and contingency planning; water quality monitoring and hygiene promotion to prevent disease; infrastructure vulnerabilities and climate-resilient design; governance coordination and sustainable financing; community engagement through inclusive participation and feedback systems; circular economy practices like greywater reuse and waste recovery; regional cooperation for managing transboundary environmental risks; integration of real-time data and technology for monitoring and decision-making; alignment with global policy frameworks and SDG targets; and mechanisms for learning and performance evaluation. Together, they form a strategic framework to ensure WASH services are context-sensitive, equitable, and resilient for Palestinian refugees.

²⁸ United Nations (2023). *UN 2023 Water Conference: Water Action Agenda Summary Report*. New York: United Nations Department of Economic and Social Affairs (UNDESA)

²⁹ [unece.org/sites/default/files/2023-05/UN Water Conference 2023-Booklet.pdf](https://unece.org/sites/default/files/2023-05/UN%20Water%20Conference%202023-Booklet.pdf)